

A Secured Data against Attacks in Intrusion Detection System with Dynamic Source Routing Protocol Using Counter Measure Selection Algorithm

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Abstract— In this work has been executed the Intrusion Detection System (IDS) technique dependent on the rule of system, hub, or data misuse location framework that can precisely think about the marks of known assaults and has a low pace of support disappointment alerts. Security is a significant worry in remote innovation, and this street numbers security in the remote portable Adhoc organize by utilizing Novel IDS in the Dynamic Source Routing (DSR) directing convention. We control remote versatile specially appointed system hubs to get refreshes from obscure or undesirable hubs in a similar system by means of directing table. We utilize a novel interruption recognition procedure utilizing steering conventions in MANET. It is a famous, productive, straightforward and secure method for imparting between at least two versatile clients, and we can securely send information, data, updates, and signals starting with one end then onto the next utilizing Novel IDS innovation and by hindering of obscure hubs in MANET. In this investigation work created by utilizing the reproduction device NS2 for playing out our strategy.

Keywords— EAIDC, Counter Measure Selection, DSR, IDS, MANET.

I. INTRODUCTION

MANETs have bound unmistakable qualities that assemble them defenseless to numerous styles of assaults. Since they are conveyed partner in nursing open environmental factors any place all hubs co-work in sending the bundles inside the system, malignant hubs are inconvenient to take note. Henceforth it's very inconvenient to style a safe convention contrasted with wired or framework based remote systems. This segment talks about some of the issues and difficulties that an originator of secure conventions faces. These issues are examined as to the principal objectives of a protected convention – classification, uprightness and handiness, believability and non-renouncement. The assaults and dangers permitted by existing Eduard MANET directing conventions are then referenced. The working of some safe directing conventions that address these dangers like SEAD, ARIADNE, ARAN and SRP is then outlining. Back to back segment talks about another essential issue in MANET declaration based validation. It reviews a few instruments arranged and investigates the necessities for compelling endorsement based verification in MANETs.

A. objectives

- ❖ Another Intrusion Detection System called Enhanced Adaptive Intrusion Detection and Countermeasure

determination (EAIDC) with Dynamic Source Routing (DSR) Protocol explicitly produced for MANETs.

- ❖ Compared to contemporary approaches, EAIDC, under certain circumstances, show higher levels of malfunctions, while network performance does not significantly affect them.
- ❖ EAIDC can identify vindictive hubs regardless of the presence of bogus bad conduct and contrast them and other famous components in various situations through recreation.
- ❖ EAIDC may show higher detection rates for malicious behavior in certain circumstances, while network performance will not be significant.

II. LITERATURE SURVEY

This segment speaks to the review of related paper dependent on the ebb and flows investigate. These papers are not totally identified with the proposed approach however certainly upgrade the presentation of system. NICE (Network Intrusion Detection and Countermeasure Selection), another multi-stage circulated organize interruption location and counteraction structure in a virtual systems administration condition. Decent catches and reviews dubious virtual system framework traffic without intruding on clients' applications and virtual system framework administrations. Through programmable system draws near, NICE can improve the

assault identification likelihood and improve the strength to VM abuse assault without hindering existing ordinary virtual system framework administrations. Pleasant utilizes a novel assault diagram approach for assault location and anticipation by connecting assault conduct and furthermore proposes successful countermeasures. Decent streamlines the usage on virtual system framework servers to limit asset utilization [1]. Versatile impromptu system is enduring with different assaults because of the foundation less system. Thus, MANET needs quite certain security techniques to identify bogus passage of the trouble making hubs. The systems function admirably if the hubs are trusty and act properly helpfully. In this paper, we are distinguishing and identifying bundle dropping hubs utilizing Support vector machine. Bolster vector machine is utilized responsively to group hubs in two unique classes either ordinary or malevolent hubs. SVM takes as info the neighbor trust esteem, determined with information bundles and control parcels. Our strategy is executed with AODV (Ad-hoc on request vector steering) convention. Our test results assessed utilizing parcel conveyance proportion (PDR), End-To-End delay, Average throughput, Normalized Routing Overhead, Average Energy Consumption [2]. We present another circulated directing convention for versatile, multihop, remote systems. The convention is one of a group of conventions which we term "connect inversion" calculations. The convention's response is organized as a transiently requested succession of diffusing calculations; every calculation comprising of a grouping of coordinated connection inversions. The convention is exceptionally versatile, proficient and adaptable; being most appropriate for use in enormous, thick, portable systems. In these systems, the convention's response to interface disappointments commonly includes just a limited "single go" of the circulated calculation. This capacity is interesting among conventions which are steady despite arrange parcels, and results in the convention's high level of adaptivity. This alluring conduct is accomplished through the novel utilization of a "physical or sensible clock" to set up the "worldly request" of topological change occasions which is utilized to structure (or request) the calculation's response to topological changes. We allude to the convention as the transiently requested steering calculation (TORA) [3]. Remote Sensor Networks (WSNs) comprise of sensor hubs conveyed in a way to gather data about general condition. Their appropriated nature, multihop information sending, and open remote medium are the elements that make WSNs exceptionally defenseless against security assaults at different levels. Interruption Detection Systems (IDSs) can assume a significant job in identifying and forestalling security assaults. This paper presents momentum Intrusion Detection Systems and some open research issues identified with WSN security [8].

EXISTING SCHEME

In existing strategy we have concentrated on Ad-hoc on request separation vector directing convention and TTL (Time To Leave) calculation, look at the mark of known

assaults and has a low pace of parcel dropout's cautions. AODV convention gives unidirectional correspondence. Obscure assaults can't distinguish this current plan.

A. Disadvantages

- Lack of Central Points
- Absence of a Clear Line of Defense and Secure Communication
- Limited Resources
- Mobility

III. PROPOSED SCHEME

MANET is comprises of portable hubs that are operational with a radio transmitter just as a collector which convey legitimately or in a roundabout way with one another by means of bidirectional remote associations. Another Intrusion Detection System called Enhanced Adaptive Intrusion Detection and Countermeasure determination (EAIDC) with Dynamic Source Routing (DSR) Protocol explicitly created for MANETs.

Contrasted with contemporary methodologies, EAIDC, in specific situations, show more elevated levels of breakdowns, while organize execution doesn't essentially influence them. By utilizing Misbehavior Report Authentication (MRA) conspires, EAIDC can identify malignant hubs in spite of the presence of bogus rowdiness and contrast them and other famous components in various situations through recreation. EAIDC may show higher discovery rates for noxious conduct in specific conditions, while organize execution won't be critical.

A. Advantages

- Strong identification and authentication
- Intrusion Detection Systems are not an answer for all security concerns
- Good security strategy
- Human intervention is required.

IV. METHODOLOGY

A. Intrusion Detection Techniques

An interruption is characterized as a progression of activities that bargain the privacy, accessibility, and trustworthiness of a framework. Interruption Detection is a security innovation that attempts to recognize the individuals who are attempting to break a framework without approval and misuse it, and the individuals who have a genuine access to the framework, however misuse their benefits. The framework might be a host PC, a system gadget, a firewall, a switch, a corporate system, or a data framework checked by an interruption location framework.

An IDS progressively screens a framework and the activities of clients in the framework to distinguish interruptions. Since a data framework can experience the ill effects of different sorts of security holes, it is both actually troublesome and expensive to assemble and keep

up a framework that isn't defenseless against assaults. Experience instructs us never to depend on a solitary cautious strategy. An IDS, through the investigation of framework and client tasks, in the quest for undesirable and dubious exercises, can adequately screen and ensure against dangers.

When all is said in done, there are two sorts of interruption recognition: misuse based identification and abnormality based location. An abuse based discovery procedure encodes known assault marks and framework disappointments and stores them in a database. On the off chance that IDS finds a match between current exercises and marks, an alarm is created. Misuse identification strategies are not viable to recognize new assaults because of the absence of fitting marks. An oddity based acknowledgment method makes ordinary profiles of framework states or client conduct and contrasts them and current exercises. On the off chance that a critical deviation is watched, the IDS will raise a caution. Peculiarity location can recognize obscure assaults. Nonetheless, ordinary profiles are typically exceptionally hard to assemble. For instance, in a MANET, the versatility actuated elements make it hard to recognize typicality and peculiarity. It is along these lines increasingly hard to recognize bogus alerts and genuine interruptions. The capacity to set up typical profiles is basic to the structure of an effective, peculiarity based IDS.

As a promising other option, determination based acknowledgment methods consolidate the upsides of abuse discovery and inconsistency recognition using physically created particulars to portray real framework conduct. Particular based recognition approaches are like the irregularity location techniques, perceiving the two assaults as deviations from a typical profile. Notwithstanding, particular put together acknowledgment approaches depend with respect to physically created determinations to dodge the high pace of bogus alerts. Notwithstanding, the impediment is that the advancement of nitty gritty particulars can be tedious.

Interruption identification frameworks expect to distinguish assaults on PC frameworks and systems, or for the most part against data frameworks. Actually, it is hard to give solid data frameworks and keep them in such a sheltered state during their lifetime and use. Now and then heritage or operational imperatives don't take into account the meaning of a totally secure data framework. Accordingly, interruption location frameworks have the undertaking of checking the utilization of such frameworks to recognize any marvel of perilous conditions. They perceive endeavors and dynamic maltreatment by either genuine clients of the data frameworks or by outside gatherings to mishandle their benefits or to misuse wellbeing holes.

An interruption recognition framework acquires data about a data framework to make a determination about the

security status of the last mentioned. The point is to recognize security infringement, endeavored infringement or open shortcomings, which can prompt potential infringement. A run of the mill interruption location framework is appeared in Figure 1.

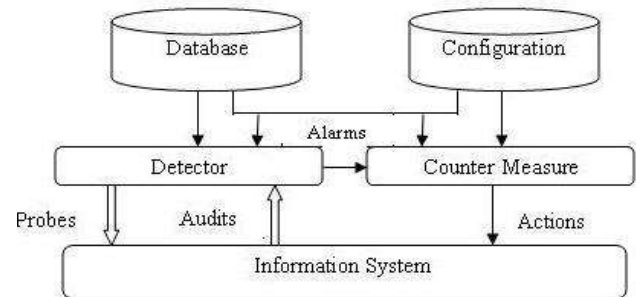


Figure 1. Simple IDS

An interruption location framework can be depicted at an exceptionally plainly visible level as an identifier which forms data from the framework to be ensured (Figure 1). This locator can likewise begin tests to start the review procedure, Such as mentioning rendition numbers for applications. It utilizes three sorts of data: long haul data identified with the procedure used to distinguish interruptions (e.g., an information base of assaults), arrangement data about the present condition of the framework, and review data portraying the occasions that happen framework.

The job of the identifier is to kill superfluous data from the review trail. It at that point presents either an engineered perspective on the security pertinent activities performed during typical utilization of the framework or a manufactured perspective on the present wellbeing state of the framework. A choice is then made to evaluate the probability that these activities or this state might be seen as indications of interruption or shortcomings. A countermeasure part would then be able to take remedial activities to either keep the activities from being performed or to change the condition of the framework to a protected state once more.

B. Implementation of EAIDC Scheme

In this segment we portray our proposed Enhanced Adaptive Intrusion Detection and Countermeasure choice (EAIDC) with Dynamic Source Routing (DSR) Protocol framework in detail. The methodology portrayed in this examination depends on our work to date, where the foundation of EAIDC has been proposed and assessed. In this work, we are growing it with the acquaintance of the advanced mark with keep the aggressor from making receipt bundles.

i. Basic Routing Module

In MANET if the source has no route to the goal, the source starts route disclosure on request. Subsequent to producing RREQ, the hub looks into its own neighbor table to discover in the event that it has a closer neighbor hub to the goal hub. On the off chance that a closer

neighbor is accessible, the RREQ parcel is directed to that hub. On the off chance that there is no more neighbors, the RREQ parcel is overwhelmed to all neighbors.

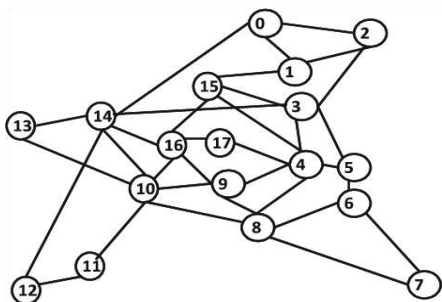


Figure 2. Basic Routing

ii. Secure Acknowledgement

In this module, we actualize a protected affirmation to recognize broken hubs in the steering condition. In this module, we guarantee that the acknowledgment is genuine and not accomplished by Digital Signature.

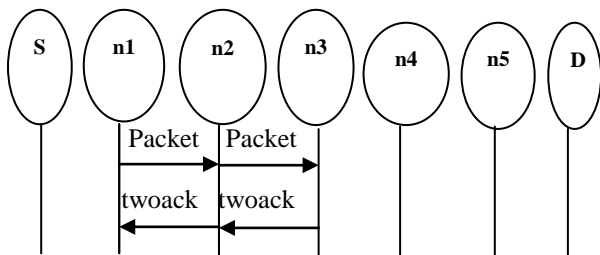


Figure 3. Acknowledgement Sharing

In Figure 3. shows the affirmation sharing at whatever point the source hub S is doesn't get the affirmation, it will begin a protected affirmation process inside three-three hubs. Here, n1, n2, n3 is the first gathering, which hub n1 sends a parcel to hub n2, it will advance it to hub n3 after the two hubs n2 and n1 need to send an affirmation to hub n1 inside time. In the event that the affirmation isn't gotten, it will report these hubs as inadequate hubs to the source hub. In any case, in this procedure there is an opportunity for bogus reports to evade that we execute MRA. Our essential model considering the advanced character creation just by the RSA plot, however in our all-inclusive framework the computerized marking with AES Encryption System made

iii. Misbehavior Report Authentication

In this module, we keep away from bogus reports created by the getting into mischief hubs. The primary objective of the MRA conspire is to confirm whether the objective hub has gotten the announced missing bundle over an alternate course. This technique is utilized in our fundamental model. This plan is intended to understand the shortcoming of bombs hub and to recognize broken hubs with the nearness of a bogus wrongdoing. The bogus unfortunate behavior report can be created by vindictive assailants to report blameless hubs as malignant. This assault can be deadly to the whole system if assailants break enough hubs, causing a system segment. The center of the MRA

plot is to validate whether the goal hub has gotten the detailed missing bundle over an alternate course.

To begin the MRA mode, the source hub turns out to be first search for your nearby information base and search for an elective course to the goal hub. In the event that there is no other existing, the source hub begins a DSR steering solicitation to locate an alternate course. Because of the idea of MANETs, it is entirely expected to discover a few courses between two hubs. By tolerating an elective way to the objective hub, we sidestep the jumble correspondent hub. On the off chance that the goal hub gets a MRA parcel, it look through its nearby information base and thinks about when the announced bundle is gotten. On the off chance that it is as of now got, at that point it is sure this is an erroneous maltreatment report and who made this report is set apart as malevolent. In any case the unfortunate behavior report is natural and acknowledged. By tolerating MRA plot, this can recognize threatening hubs notwithstanding the presence of bogus offense report.

Assault analyzer performs ready connection; ascertain seriousness of alarm and countermeasure choice. The ideal countermeasures are chosen from countermeasure pool utilizing the countermeasure determination calculation dependent on Return of Investment (ROI).

ROI [t,cm]= benefit t,cm cost .cm + intrusiveness .cm
The countermeasure which gives least estimation of ROI is chosen as ideal countermeasure.

Algorithm:

```

If node has to transfer to destination node
Check the routing table
if route found
    Send the data
    Start counting data
    At beginning of data count set the timer to check the counting
If route not found
    Generate the req as normal on routing protocol
    Broadcast to all neighbor to find destination
if Req received
    Checks req is new
    If not
        Ignore
    If yes
        Updates the reverses routes
        Send node to destination
    
```

iv. Counter Measure Selection

In this area, we portray the strategies for choosing countermeasures for a given assault situation. The countermeasure serves to:

- ❖ Protect the assurance of the objective VMs from trading off; and
- ❖ The assault conduct is with the goal that the activities of the assailant can be recognized.

For better assault location, Countermeasure incorporates assault discovery methods into the interruption counteraction forms. We should take note of that the plan of countermeasure doesn't expect to improve any of the current interruption discovery calculations; truth be told, countermeasure gives just programming system that is reasonable for assault location, fitting countermeasure determination, lastly countermeasure additionally gives security approaches that will help in making sure about the general condition.

Countermeasure used to reconfigure the virtual system based framework and screen, control plane over appropriated programmable virtual changes to altogether improve assault discovery. Countermeasure is a procedure, activity, framework or gadget that can forestall or diminish the impact of dangers to a PC server or system. Countermeasure are chosen by assault analyzer and executed by arrange controller. For instance, if the framework recognizes cradle flood, think about a notice for hub 16 (vAlert = 16), for instance, to check the determination of the framework. After the notice is produced, the combined likelihood of hub 16 becomes 1 since this aggressor has just influenced this hub. It will change in the aggregate probabilities of kid hubs of hub 16. Presently the following stage is to choose countermeasures from the pool of countermeasures CM.

v. Attack Analyzer

The primary elements of countermeasure Systems are completed by the analyzer assaults, including methodology, for example, illustrations assault Construction and redesign, alert connection and determination of countermeasures. The procedure of plan and utilization of Graphics assault situation (SAG) comprises of three stages: gathering data, assault diagram development and potential Exploit direction investigation. With this data, assault courses can be demonstrated utilizing SAG with. The analyzer likewise takes assaults Correlation and investigation tasks alerts. This part has two primary capacities:

- ❖ Create Picture Notification Correlation (ACG)
- ❖ Provide information about threats and corrective actions to the network controller for virtual networks

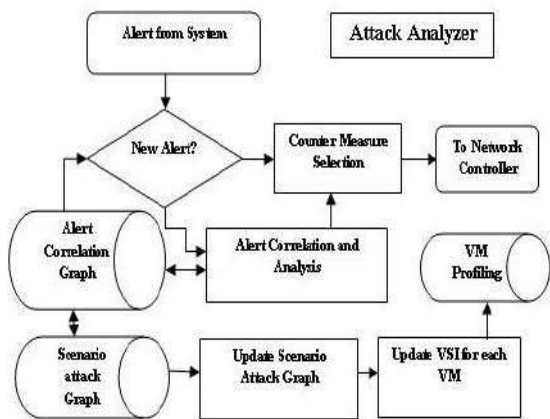


Figure 4 Workflow of Attack Analyzer

Figure 4 shows the work process in the assault examination part. Subsequent to getting a notice from the framework, the alert analyzer compares to the caution in the ACG. In the event that the alert as of now exists in the diagram and is a known assault (i.e., adjusts the assault signature), the assault analyzer plays out a countermeasure determination technique after the framework, and afterward quickly tells the system controller to utilize countermeasures or therapeutic measures. At the point when the admonition is new, the assault analyzer plays out a notice relationship and work process investigation, and updates ACG and SAG. This calculation associates each new admonition with a coordinating ready connection set (i.e., in a similar assault situation). A chose countermeasure is applied by the system controller dependent on the seriousness of the assessment results. On the off chance that the alarm is another blunder and is absent in the assault chart, the assault analyzer includes the assault diagram and afterward recreates it.

False Alarms

A virtual network system with hundreds of nodes will have a huge amount of warnings raised by Snort. Not all of these warnings can leave, and an effective mechanism is needed to check whether such warnings need to be addressed. Because Snort can be programmed to generate notifications via CVE, an approach that matches our work provides when the alarm is actually related to some weaknesses. If so, the existence of this weak spot in SAG means that the warning is rather a real attack. Thus, the false positive rate will be the common probability of the correlated warnings that will not increase the false positive rate in comparison to each individual false positive rate.

In addition, we cannot keep the case from zero-day attack aside, where the vulnerability is detected by the attacker but not detected by vulnerability scanner. In such a case, the warning is considered real because there is no corresponding node in SAG. Thus, current research does not focus on how to reduce the false negative rate. It is important to note that vulnerability scanning scanners are designed to capture the latest vulnerabilities and synchronize with the latest vulnerability database, be able to reduce the chance of zero-day attacks.

Algorithm

Calculation presents how to choose the ideal countermeasure for a given assault situation. Contribution to the calculation is an alarm, assault diagram G, and a pool of countermeasures CM. The calculation begins by choosing the hub vAlert that compares to the alarm produced by a NICE-A. Before choosing the countermeasure, we tally the separation of vAlert to the objective hub. In the event that the separation is more noteworthy than an edge esteem, we don't perform countermeasure determination however update the ACG to monitor alarms in the framework (line 3). For the source hub vAlert, all the reachable hubs (counting the source hub) are collected into a setT (line 6). Because the alarm is produced simply after the assailant

has played out the activity, we set the likelihood of vAlert to 1 and ascertain the new probabilities for the entirety of its youngster (downstream) hubs in the set T (lines 7 and 8). Presently, for all $t \in T$ the pertinent countermeasures in CM are chosen and new probabilities are determined by the adequacy of the chose countermeasures (lines 13 and 14).

The adjustment in likelihood of target hub gives the advantage for the applied counter-measure utilizing (7). In the following twofold for-circle, we process the Return of Investment (ROI) for each advantage of the applied countermeasure dependent on (8). The countermeasure which when applied on a hub gives minimal estimation of ROI, is viewed as the ideal countermeasure. At long last, SAG and ACG are additionally refreshed before ending the calculation. The multifaceted nature of Algorithm 2 is $(|V| \times |CM|)$, where $|V|$ is the quantity of vulnerabilities and $|CM|$ speaks to the quantity of countermeasures.

Performance analysis

The system execution alludes to the administration nature of a correspondence item as observed by the client. There are a wide range of approaches to live the exhibition of a system on the grounds that each system is totally unique in nature and style. The outcomes, we finish up, that affirmation based frameworks, including TWOACK, AACK, EAIDC are fit for identifying glitches with the nearness of beneficiary impact and constrained transmit power. In any case, if the quantity of pernicious hubs arrives at 40%, our proposed plot EAIDC execution is lower than that of TWOACK and AACK.

Table 1.1 Routing overhead of Best result in Performance Values of various techniques

Tech. / Scheme	0%	10%	20%	30%	40%
DSR	0.25	0.3	0.35	0.4	0.6
TWO ACK	0.2	0.03	0.3	0.35	0.45
AACK	0.1	0.2	0.25	0.22	0.37
EAIDC	0.001	0.1	0.2	0.21	0.3

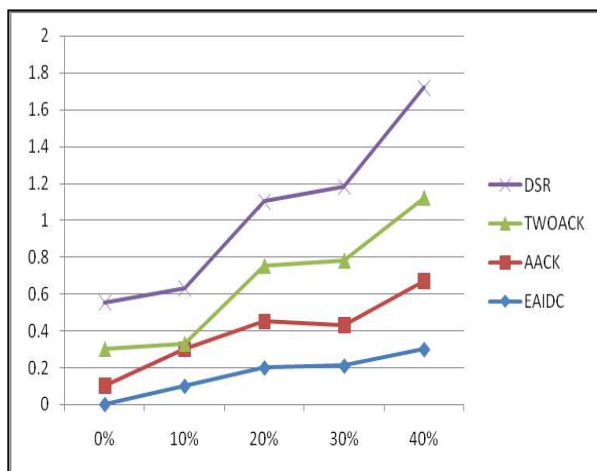


Chart 1.1: Performance Analyse in XGraph

V. RESULT AND DISCUSSION

We used Network test framework 2 (NS2) for execution of proposed work. The methodologies we acclimated are more noteworthy bracing fear change and use computation to strengthen the fulfillment of radio framework. In our exploration work we are utilizing the system recreation instrument for NS2.

Table 6.1 Simulation Parameters

Protocols	DSR
Simulation Time	100s
No. of Nodes	10
Dim. of simulated area	800x600
Speed	30ms
Traffic Type	Constant Bit Rate
Packet Size	1000 bytes
Pause Time	10-100s
No. of Constructions	10
Packet Delivery Ratio	90
Analyzing Rate	85
Throughput	96

We can calculate the following parameters:

1. PDR (Packet Delivery Ratio) - It is the quantity of conveyed information bundle to the hub. More prominent is the estimation of bundle conveyance proportion better is the exhibition of the hub.

$$PDR = \frac{\text{Number of Packet's Transmitted}}{\text{Total Number of Incoming Packets}}$$

2. CO (Control Overhead) - The proportion of the quantity of steering convention control parcels transmitted to the quantity of information bundles is known as Control overhead.

$$CO = \frac{\text{Number of Control Packet's Transmitted}}{\text{Total Number of Packets}}$$

3. PMIR (Packet Misroute Rate) - Node sends parcel to an inappropriate goal is called misroute information bundle. PMIR proportion is the quantity of misroute bundle is conveyed to the transmitted parcels.

$$PMIR = \frac{\text{Number of Packet's Misrouted}}{\text{Total Number of Incoming Packets}}$$

In the underneath screen shows that the correlation chart for Performance of existing and proposed framework.

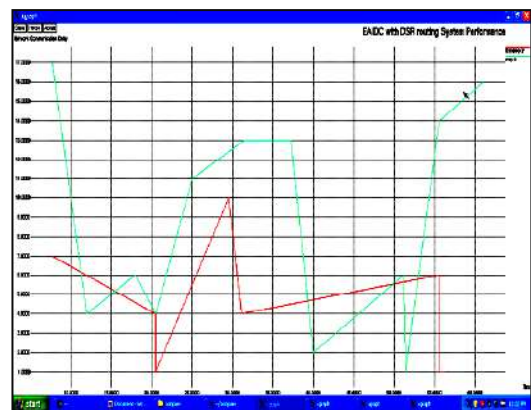


Figure 5 Comparison Graph for Performance Analysis

In the below screen shows that the comparison graph for analyzing rate of existing and proposed system.

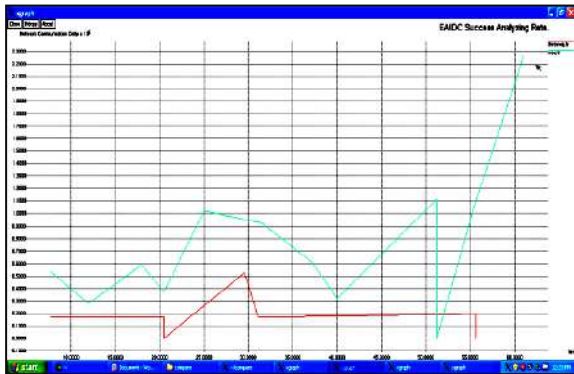


Figure 6 Analyzing Rate

In the below screen shows that the comparison graph for Packet Delivery Ratio (PDR) of existing and proposed system.

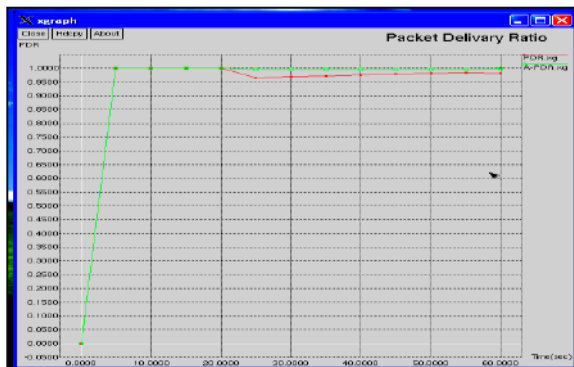


Figure 7 Packet Delivery Ratios

In the below screen shows that the comparison graph for Throughput of existing and proposed system.



Figure 8 Throughput

VI. CONCLUSION

Package dropping ambush has reliably been a noteworthy risk to security in MANETS. In this assessment, we have proposed novel IDS called EAIDC, which has been unequivocally made for MANETS and differentiated it and other standard instruments in different circumstances through propagations. Besides, we have stretched out our investigation to fuse the propelled mark into our proposed

plot with a ultimate objective to shield the aggressors from beginning phony affirmation. As we have showed up in our examination, it can basically improve the PDR of the framework if the aggressors are sufficiently keen to design confirmation packs. We acknowledge that this exchange off is valuable if sort out security is a top need.

FUTURE ENHANCEMENT

So as to expand the benefits of our exploration, we intend to investigate the accompanying themes in our future research:

- 1) approaches to embrace crossover cryptography strategies to additionally lessen the system trouble brought about by advanced mark;
- 2) inspect the conceivable outcomes of receiving a key trade instrument to expel the requirement for the recently appropriated keys.

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Synthesis and characterization of dysprosium (Dy^{3+}) doped titanium dioxide (TiO_2) as a potential material for photocatalytic activity

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ABSTRACT

Doping Dysprosium (Dy^{3+}) (2 wt%) by employing one step and one pot hydro thermal method with TiO_2 nano particles form a potential composition for photo catalysis. Dy^{3+} doped TiO_2 nano particles are obtained using the methodical synthesis and the resulted product is subjected to various studies like XRD, HR-TEM and UV to understand its structure, morphology and the bandgap. The narrower bandgap resulted by the doped nano material proves to be better than its purest form (TiO_2). It is acknowledged through UV analysis. The above synthesized material's photo catalytic degradation is carried out against the organic and inorganic contaminations present in waste water.

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1. Introduction

In nanotechnology, a particle is defined as a small object that behaves as the cutting edge of the scientific research world as a single unit with respect to its transport and properties. The particles whose size ranges between 1 and 100 nm are called as nano particles [1]. A photocatalyst is a material which absorbs light to bring it to a higher energy level and provides such energy to a reacting substance to make a chemical reaction occur. TiO_2 is the most widely used photocatalyst material due to its semiconductor characteristics and also used for the degradation and mineralization of many organic pollutants [2]. There are two types of catalyst. They are homogeneous and heterogeneous photocatalysis. In homogeneous photocatalysis, the reactants and the photocatalyst exist in the same phase whereas in heterogeneous photocatalysis, the catalyst has a different phase from the reactants. TiO_2 has been considered as a useful material for the treatment of wastewater due to its non-toxic character, chemical stability and excellent electrical and optical properties which contribute in its wide range of applications, particularly in environmental remediation technology [3].

2. Synthesis and characterization

Titanium (IV) Isopropoxide, acetic acid and distilled water were used in this preparation method. All these materials used in this synthesis procedure were of analytical grade of 99.99% purity and directly used without any future purification. Titanium (IV) Isopropoxide and acetic acid were taken in the molar ratio of 1:4. Acetic acid was added slowly in drops to the Titanium (IV) Isopropoxide under vigorous stirring. After which 70 ml of distilled water was added drop wise with stirring until the solution being transparent. The solution was transferred into the autoclave and it was kept in muffle furnace for half a day. The samples were cooled down to room temperature. The precipitate was separated through centrifuge and it was repeatedly rinsed with distilled water, and then washed five to six times with ethanol to remove the possible residues in the final product. Further, it was cooled down to room temperature at the natural cooling rate of the furnace followed by drying at 100 °C for 1 h. The obtained powder was ground in a mortar pestle.

The obtained product was calcined at 400 °C for 3 h using a heating rate of 5 °C/min. For atomic diffusion the slow heating rate allows longer time. This is an important sintering factor. This means that the more atoms are moving at higher points of temperature, to the points associated with the powder particles, which results in better sintering. However, the low heating rate is the face that the material is exposed to long periods of time; the resulting is

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the growth of their grains. The samples were allowed to cool to room temperature and then the resultant nano powders were used for characterization. Doping material (Dy^{3+}) is added with TiO_2 and the procedure is repeated to obtain the doped TiO_2 .

3. Results and discussion

3.1. XRD analysis

The crystallographic structure is characterized by XRD. The Fig. 1 shows the XRD pattern of Dy^{3+} doped TiO_2 sample. The XRD pattern of the sample shows good crystallinity and the peaks are indexed at $2\theta \approx 25.2^\circ, 37.9^\circ, 48.1^\circ, 54.1^\circ, 54.9^\circ, 62.7^\circ, 68.9^\circ, 70.1^\circ$ and 75.1° should be attributed to the reflections from (101), (004), (200), (105), (211), (204), (116), (220) and (215) planes of anatase phase of TiO_2 . The phases present were taken from the JCPDS card no. 21-1272 [4]. The size of the material is 10.38 nm for TiO_2 and 9.62 nm for Dy^{3+} doped TiO_2 respectively.

3.2. UV analysis (UV visible spectrometer)

The UV studies have been measured to examine the optical absorption assets of as synthesized samples. Fig. 2 (a) and (b) shows the UV absorption spectra of pure TiO_2 and Dy^{3+} doped TiO_2 samples. It is observed that the spectrum of Dy^{3+} doped TiO_2 shifted towards higher wavelengths and an enhancement of visible light absorption due to the doping of Dy^{3+} . The extension of light absorption shifted to visible-region compare to pure TiO_2 which indicates that narrowing band gap energy of TiO_2 , which is confirmed by Tauc-Plot function vs the energy of exciting light [5]. The calculated band gaps were 3.04 eV for TiO_2 and 2.95 eV for (Dy^{3+}) TiO_2 respectively. The narrowing band gap must be credited to the incorporation of Dy^{3+} ion into the TiO_2 surface. The extension of light absorption suggested that the Dy^{3+} doped TiO_2 could have higher optical activity.

3.3. HR – TEM analysis

Fig. 3 (a) and (b) display the typical High Resolution-Transmission Electron Microscope (HR-TEM) images of synthesis samples. This figure reveals that the nanoparticles are in spherical in shape.

Fig. 3 (b) indicates that the small amount of doping Dy^{3+} ions covers on the TiO_2 surface to form some uneven surface morphology. From HR-TEM results, the particle size is calculated as 12.62 nm for TiO_2 and 9.71 nm for Dy^{3+} doped TiO_2 which is in good agreement with XRD results.

3.4. Photoconductivity analysis

Photo conductivity is an essential study to determine the conducting nature and gain or loss of charge carriers within the sample under the presence of light with applied field [6]. The conductivity studies of the synthesized Dy^{3+} doped TiO_2 sample were carried out in the presence and absence of light respectively. Fig. 4 (a) and (b) shows the dark and photocurrent measurements of the Dy^{3+} doped TiO_2 samples. With an increasing electric field, both photo and dark current of the synthesized samples increase which confirmed the ohmic nature positive photoconductivity of the samples. This observed linear increase in current mainly due to photo generation of charge carriers within the sample.

The conductivity of the Dy^{3+} doped TiO_2 samples exhibits higher conductivity than pure TiO_2 which is due to the lower band gap of the material. Since, the lower band gap materials have the transfer of electron from the valence band to the conduction band easier. Therefore as synthesized Dy^{3+} doped TiO_2 would be a potential material for the Photocatalytic Activity.

3.5. Photocatalytic activity

The photocatalytic activity of the prepared sample was evaluation by the degradation of Rh B under visible light irradiation. The visible-light source under the operation conditions of 100 W. 0.002 g of the Rh B dye and 0.1 g of catalyst as-prepared powder were added into 50 ml of aqueous solution and the suspensions were stirred in dark for 1 h to achieve adsorption and desorption equilibrium before irradiation. During 75 min illumination, 2 ml homogeneous suspension was taken out at every 15 min of time intervals and filtered with a syringe filter. The concentrations of Rh B in solution were measured by employing an UV visible spectrophotometer at absorption wavelength of 270 nm. The photocatalytic activities of all the samples were assessed by measuring the photocatalytic degradation of Rh B under visible light irradiation. The Fig. 5 for 75 min showed the best catalytic performance in all different times of the samples (a), (b), (c), (d) and (e) respectively. Dy^{3+} doped TiO_2 0, 15, 30, 45 and 60 min showed evidently increased activity for 0, 7.40, 40.740, 59.55 and 75.1% respectively (Fig. 6). The comparison of efficiency between doped and undoped TiO_2 is tabulated in Table 1.

4. Conclusion

In this work, Dysprosium doped Titanium Dioxide were successfully synthesized by using a simple hydrothermal method and characterized. The synthesized nano particles were characterized by the following techniques. XRD analysis exhibits that syn-

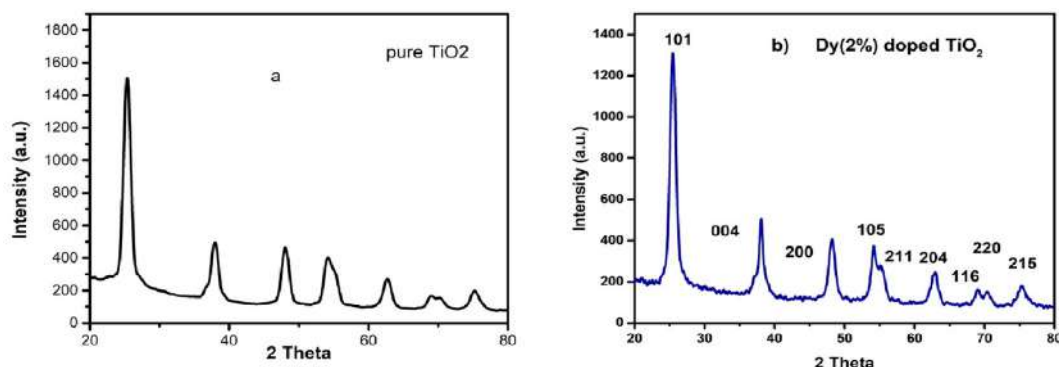


Fig. 1. XRD Patterns of TiO_2 (a) and (b) Dy^{3+} doped TiO_2 Nanoparticles.

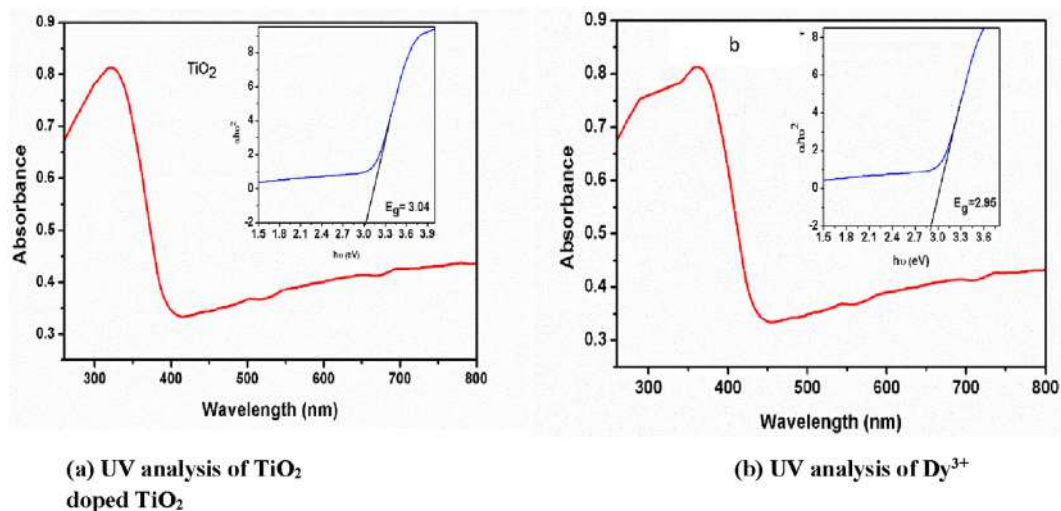


Fig. 2. UV Analysis.

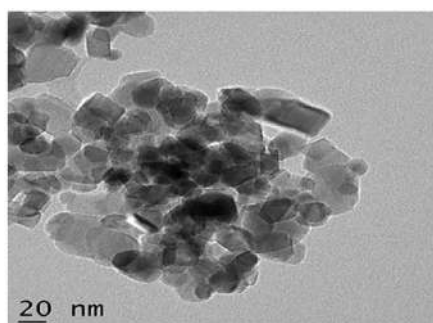
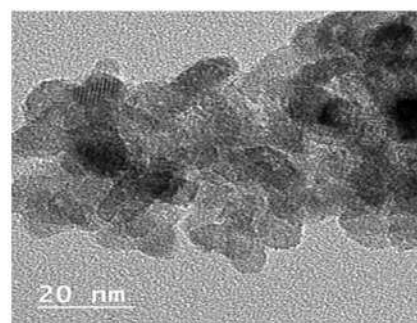
(a) HR-TEM image of TiO₂(b) HR-TEM image of Dy³⁺ doped TiO₂

Fig. 3. HR-TEM.

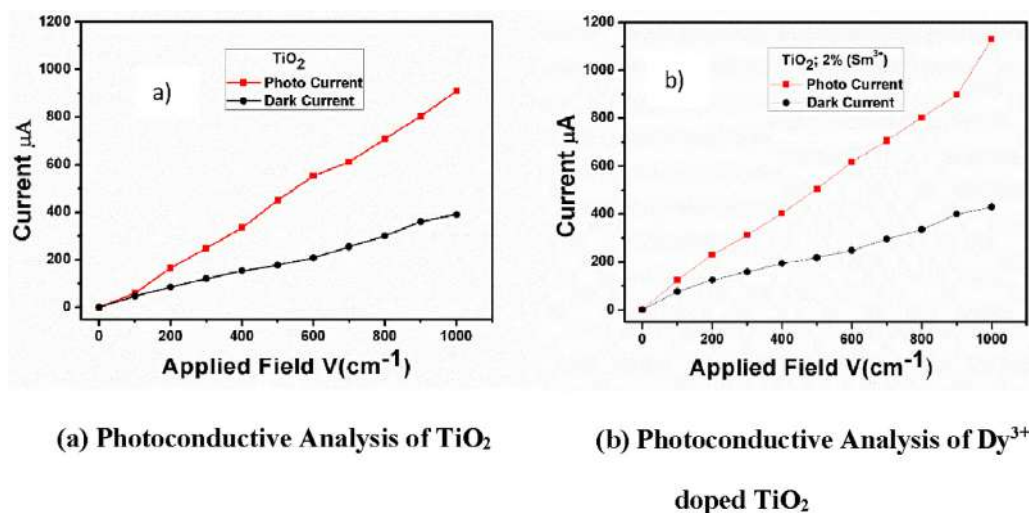
(a) Photoconductive Analysis of TiO₂(b) Photoconductive Analysis of Dy³⁺ doped TiO₂

Fig. 4. Photoconductivity Studies.

thesized nanoparticles are good in crystallinity and possess anatase structure. The HR-TEM images exhibit that the nanoparticles are spherical in size morphology and the results are in good agreement with XRD results. The extension of light absorption in the

higher wavelengths of Dy³⁺ doped TiO₂ indicates that the samples have higher optical activity. Linear increase in current vs applied field reveals that the sample hosts positive photoconductivity (positive shift of CB).

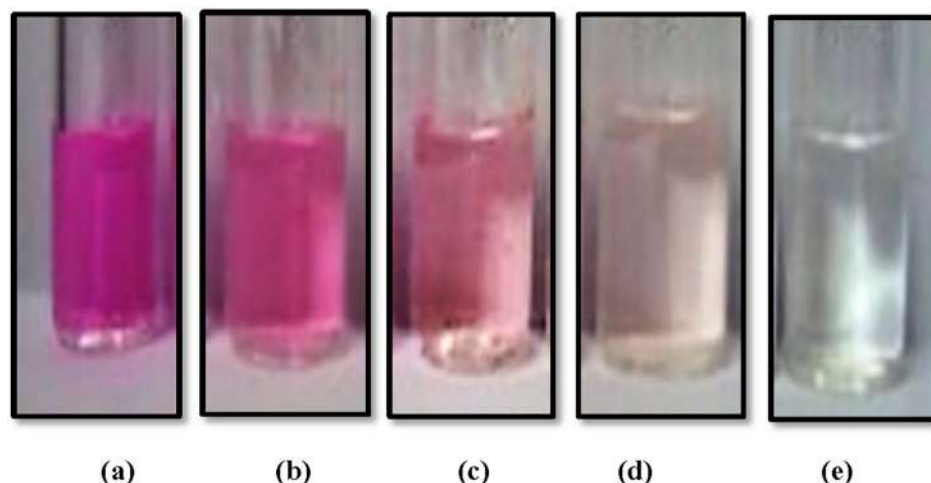


Fig. 5. Photocatalytic Degradation.

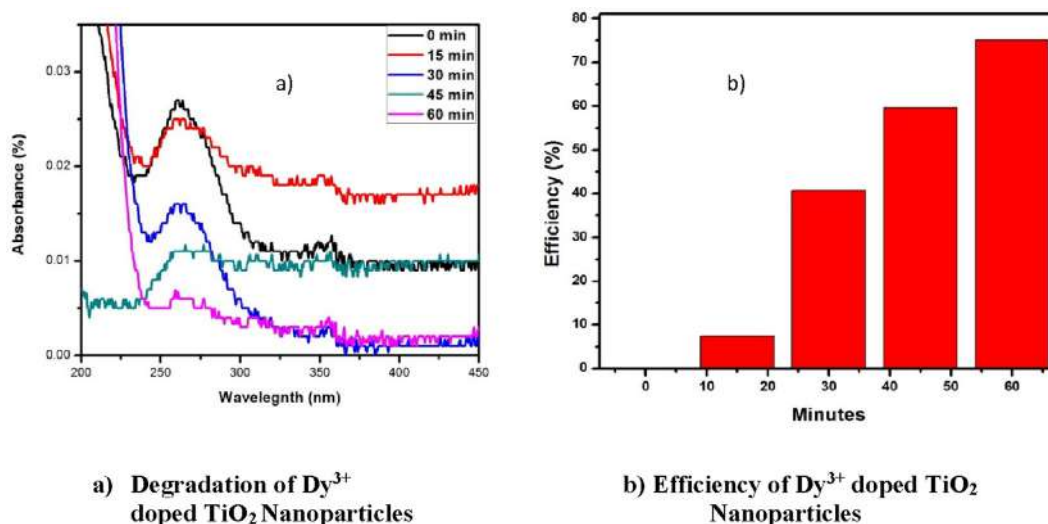


Fig. 6. Degradation and Efficiency.

Table 1
The Comparison of Degradation Efficiency between Doped and Undoped TiO₂.

Material	%	Time	Bandgap
Pure TiO ₂	96%	120 mins	3.04 eV
Dy ³⁺ doped TiO ₂	75.1%	60 mins	2.95 eV

CRediT authorship contribution statement

S. Bharathi Bernadsha: Conceptualization, Methodology, Investigation, Writing - review & editing, Writing - original draft.
J. Fennyl Britto: Software. **V. Anto Feradrick Samson:** Formal analysis, Writing - review & editing. **J. Madhavan:** Supervision.
M. Victor Antony Raj: Resources, Project administration.
M. Mahendiran: Software.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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A STUDY ON CUSTOMER PREFERENCE TOWARDS E-BANKING SERVICES WITH SPECIAL REFERENCE TO DHARMAPURI DISTRICT

Dr. M. Raja¹

Abstract

The purpose of this paper today every banking organization are using. e –banking for better customer services, banking industry has suddenly witnessed a major boom. Being a globalized market, the customer seeks and demand has world class products. Electronic banking is one of the emerging trends in the Indian banking. a interview schedule has been designed to collect the data from the respondents. the sample size 150. the random sampling used. the study makes use of statistical techniques such as percentage analysis, chi-square test, weighted average rank method in analyzing the data for finding the result. there is no significant association between age of the respondents and their aware about e-banking services and there is a significant difference between gender of the respondents and their recommend others to adopt e-banking services.

Keywords: e-banking, customer perception, security, usage, Technology.

Introduction

E- banking means any user with a personal computer and a browser can get connected to his bank-s website to perform any of the virtual banking functions, in internet banking system the bank has a centralized database that is web enabled. all the services that the bank has permitted on the internet are displayed in menu. any service can be selected and further interaction is dictated by the nature of service.

Electronic banking is one of the emerging trends in the Indian banking. it has been in the form of e-banking or net banking or online banking or internet banking which is now replacing the traditional banking mechanism. e-banking involves information technology based banking under this system the banking services are delivered by way of a computer controlled system this system does involve direct interface with the customers. the customers do not have to visit the banks premises.

e-banking is a product designed for the purpose of online banking that enables you to have easy and safe access to your bank account. E-banking is a safe, fast easy and efficient electronic service that enables you access to bank account and to carry out online banking. banking services, 24 hours a day and 7 days a week with this service you save your time by carrying out banking transactions at any time from your home or office all you need is internet access.

The government of India encourages people to move towards cashless economy. this can be achieved by use of debit and credit cards, electronic payment gateway system such as national electronic fund transfer (NEFT) and real-time gross settlement (RTGS) in India

Popular Services Covered Under E-Banking

The popular services covered under e-banking include

- Automated teller machines
- Credit cards
- Debit cards
- Smart cards
- Electronic fund transfer(EFT)system
- Cheques transaction payment system
- Mobile banking
- Internet banking
- Telephone banking

Advantages Of E-Banking

The main advantages of e-banking are:

1. The operating cost per unit services is lower for the banks
2. It offers convenience to customers as they are not required to go to the banks premises.
3. There is very low incidence of errors.

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- 4 The customer can obtain funds at any time ATM machines
- 5 The credit card and debit cards enables the customers to obtain discounts from retail outlets
- 6 The customer can easily transfer the funds from one place to another place electronically. It is updated online, real time, the system is updated immediately after every transaction automatically.

Services/Transactions

- Answering routine queries
- Bill payment service
- Electronic fund transfer
- Electronic clearing system
- Credit card customers
- Railway pass
- Investing through internet banking
- Recharging your prepaid phone
- Shopping

Review of literature

Gerrard and cunningham (2003) also identify of the factors of paramount importance in ensuring the success of e-banking, the ability of an innovation to meet users needs using different feature availability on the web site. for instance, the provision of interactive loan calculators, exchange rate converters, and mortgage calculators on the web sites draw the attention of both users and nonusers into the banks web site.

Boatenge and molla (2006) indicated that the operational constraints of internet banking is associated with the customer location, the need to maintain customer satisfaction and the capabilities of the banks main software to act as an influential factors in motivating the decision to enter electronic banking services and consequently influencing the usage experience and thus affecting the level of satisfaction.

Anita lifen zhao et al (2010) used empirical evidence to investigate the relationship between perceived risk and trust in adoption of internet banking services in china. the research was conducted on a sample of 432 young chines consumers who can be classified as internet banking service early adopters. the study results indicate that there is a significant relationship between trust and

that both are crucial in explaining the internet banking usage intention

Geetha k t & malarvizhi v (2011) investigates the factors which are affecting the acceptance of e-banking services among the customers and also indicates level of concern regarding security and privacy issues in Indian context. the finding depicts many factors like security and privacy and awareness level increased the acceptance of e-banking services among Indian customers

Objectives of the study

1. The study aims at identify the overall customer perception towards the e-banking services in Dharmapuri district.
2. The study also aims at know whether socio economic variables of the customer satisfaction in Dharmapuri district

Limitations of the study

1. There were several time constraints
2. The study is limited to areas of Dharmapuri only
3. The study is related to customers only
4. People were reluctant to go into details because of their busy schedules

Methodology and Sampling design

This present study will be used random to know the e-banking preference towards customers. It is planned to collect both primary and secondary data for analysis. The sample respondents cover Dharmapuri district. It is planned to collect data from the 150 respondents

Tools for data collection

Primary data and secondary data have been used. Primary data were collected through a structured questionnaire and the secondary data were collected from the books, journal, articles, newspapers magazines and websites. The primary data were collected was further analyzed by using various tools like 1. Percentage analysis 2. Chi-square independence test

Period of the study

The data were collected for the month of november 2018- January 2019.

Data analysis and interpretation:

Table - 1 : Demographic Profile of the Respondents

Category	Variable	Frequency	Percentage
1 Gender	Male	100	75
	Female	50	25
	Total	150	100.00
2 Age	21 – 30 years	80	53
	31 – 40 years	40	27
	41 – 50 years	25	17
	Above 50 years	05	03
	Total	150	100.00
3 Educational qualification	Illiterate	40	27
	School level	20	13
	Degree / Diploma level	55	37
	Professional level	35	23
	Total	150	100.00
4 Occupation	Government employee	30	20
	Private employee	52	34
	Profession	22	15
	Business	22	15
	Agriculture	24	16
	Total	150	100.00
5 Monthly family income	Below Rs.10000	33	68
	Rs.10001 – Rs.20000	41	42
	Rs.20001 – Rs.30000	22	25
	Above Rs.30000	8	15
	Total	150	100.00
6 Marital status	Married	18	12.00
	Unmarried	132	88.00
	Total	150	100.00
7 Name of the bank	State bank of India	62	41
	Indian overseas bank	34	23
	ICICI	34	23
	HDFC	20	13
	Total	150	100.00
8 E-banking service you think is more user friendly	Internet banking	40	27
	Telephone banking	10	06
	ATM	60	40
	Mobile banking	40	27
	Total	150	100.00

9 E-Banking services aware more	Internet banking	30	20
	Telephone banking	10	07
	ATM	80	53
	Mobile banking	30	20
	Total	150	100.00
10 Trust the security of e-banking services	Completely	54	36
	Somewhat	46	31
	Dubious	34	23
	Not at all	16	10
	Total	150	100.00

Table -7,8,9,10 analysis in e-banking services.

Table -7 relating to customer preference towards e-banking services

Table -8 relating to awareness of e-banking services, majority of 40% of respondents had awareness about e-banking services.

Table -9 relating to e-banking service you think is more user friendly, majority of the respondents think that ATM is more user friendly.

Table-10 relating to e-banking services aware more about ATM services

Chi-square test-association between age of the respondents and their aware about e-banking services

Research hypothesis: there is a significant association between age of the respondents and their aware about e-banking services

Null hypothesis: there is no significant association between age of the respondents and their aware about e-banking services

Table - 2

	Aware about e-banking services			Statistical inference
	Yes	No	Total	
Age	108	42	150	X ² = 2.072 df=3 558>0.05 not significant
21 to 30 yrs	61	20	81	
31-to 40 yrs	27	22	49	
41- to 50yrs	15	0	15	
51 yrs and above	05	0	05	

Findings : The above table reveals that there is no significant association between age of the respondents and their aware about e-banking services. hence, the calculated value greater than table value. so the research hypothesis is rejected and the null hypothesis accepted.

Summary of Findings :

1. Thus majority 55% of the respondents graduate only.
2. Thus majority 52% of the respondents are working in private concern
3. Thus the majority of the respondents annual income 10001-200000.
4. Thus majority 62 % of the respondents having an account state bank of india
5. Thus all the sample respondents have awareness about e-banking services

6. 88.3% of the respondents agree that their expectations are met through e-banking services 60% of the respondents opt that ATM service is more user friendly 7.78 % majority of the respondents agree that they definitely recommend others to adopt the e-banking services
7. majority of the respondents strongly agree that e-banking services provides
 - privacy of customer information

Suggestions:

The e-banking in india are using information technology not only to improve their own internal process but also to increases facilities and services to their customers. efficient use of technology of the increased transaction volume of banks of that comes with larger customer base. by designing and offering simple and, safe and secure technology, banks reach at doorstep of customer with delight customer satisfaction.

Conclusion

The usage of e-banking is all set to increase among the service class. the service class at the moment is not using the services thoroughly due to various hurdling factors like in security and fear of hidden costs. so banks should come forward with measures to reduce the apprehensions of their customers through awareness campaigns and more meaningful advertisements to make e-banking popular among all the age and income groups.

E -banking is an innovative tool that is fast becoming necessity it is a successful strategic weapon for banks to remain profitable in a volatile and competitive market place of today. in future, the availability of technology ensure safety and privacy of e-banking transactions and the RBI guidelines on various aspects of internet banking will definitely help in rapid growth of internet banking in India.

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A STUDY ON PROBLEMS FACED BY MSME ENTREPRENEURS IN KRISHNAGIRI DISTRICT (WITH SPECIAL REFERENCE TO HOSUR TALUK)

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Abstract: Micro, Small and Medium Enterprises sector has emerged as a highly vibrant and dynamic sector of the Indian economy. The Micro, Small and Medium level of company Development act for 2006. The Act has empowered the government to establish a National Board for Micro, Small and Medium Enterprises. Entrepreneurs are agents who perform a momentous role in the economic development of a country and are linked to the overall industrial development of a nation. Convenient sampling method was used to collect the data from the MSMEs entrepreneurs. Both primary and secondary data were used in this study. The secondary data was also obtained from website, books, leading journals and magazines for this study. The Primary data was collected through questionnaire. The research work was aimed at studying the problem faced by MSMEs Entrepreneurs. A sample of 150 respondents and data was collected in Hosur Taluk.

Key Words: MSME Entrepreneurs, Problems, MSME-Micro, Small and Medium Enterprises.

I. INTRODUCTION

Economic growth and development of the country is determined by human, physical and financial resources. The dynamic role of Micro, Small and Medium Enterprises in developing countries positions them as engines through which the growth objectives of developing countries can be archived-a role that has long been recognized. Micro, Small and Medium Enterprises are complementary to large industries as ancillary units and this sector contributes enormously to the socio-economic development of the country. This sector solves many problems viz. Poverty and unemployment through providing immediate large-scale employment, with lower investments and proves to be the second largest manpower employer after agriculture.

According to MSMEs Act 2006, the enterprises are broadly classified in terms of activity such as enterprises engaged in the manufacturing and enterprises engaged in services. The major advantages of the sector are its employment potential at low capital cost. They also play a key role in the development of the economy with their effective, efficient, flexible and innovative entrepreneurial spirit. It is the attitude of mind to seek opportunities, take calculated risks and derive benefits by setting up a venture.

II. OBJECTIVES OF THE STUDY

- To examine the socio-economic profile of MSMEs Entrepreneurs in Hosur Taluk.
- To study the association relationship between Problems faced by MSMEs Entrepreneurs with demographic and other variables of the MSMEs Entrepreneurs in Hosur Taluk.

III. RESEARCH METHODOLOGY

The present study is based on both primary and secondary data. A structured questionnaire is designed to collect the primary data. Secondary data sources have been collected from book, websites and journals.

IV. SAMPLE DESIGN

Convenient sampling techniques were adopted and 150 MSMEs Entrepreneurs were selected in Hosur Taluk.

V. STATISTICAL TOOLS

Appropriate statistical tools have been used to analyse the data. The researcher has applied the statistical tools such as Percentage analysis and Chi-square test are used to analyse the data.

VI. LIMITATION OF THE STUDY

The study is conducted only in Hosur Taluk and Sample size is only for 150 respondents. MSMEs Entrepreneurs.

VII. HYPOTHESIS

HYPOTHESES 1: Gender and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Gender and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Gender and Problems faced by MSMEs Entrepreneurs.

HYPOTHESES 2: Age and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Age and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Age and Problems faced by MSMEs Entrepreneurs.

HYPOTHESES 3: Education and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Education and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Education and Problems faced by MSMEs Entrepreneurs.

HYPOTHESES 4: Category of units and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Category of units and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Category of units and Problems faced by MSMEs Entrepreneurs.

HYPOTHESES 5: Experience and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Experience and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Experience and Problems faced by MSMEs Entrepreneurs.

HYPOTHESES 6: Nature of Activities and Problems faced by MSMEs Entrepreneurs.

Ho: There is no significance association between Nature of Activities and Problems faced by MSMEs Entrepreneurs.

H₁: There is significance association between Experience and Problems faced by MSMEs Entrepreneurs.

TABLE: 1

Number Of Male And Female Entrepreneurs

GENDER * CATEGORY Crosstabulation

		CATEGORY			Total	
		1	2	3		
GENDER	Male	Count	56	40	22	118
		% within GENDER	47.5%	33.9%	18.6%	100.0%
		% within CATEGORY OF UNITS	78.9%	75.5%	84.6%	78.7%
	Female	Count	15	13	4	32
		% within GENDER	46.9%	40.6%	12.5%	100.0%
		% within CATEGORY OF UNITS	21.1%	24.5%	15.4%	21.3%
Total	Count	71	53	26	150	
	% within GENDER	47.3%	35.3%	17.3%	100.0%	
	% within CATEGORY OF UNITS	100.0%	100.0%	100.0%	100.0%	

Sources: Field Survey

From the above table 1, among the total respondent, 78.7 percent of respondents are male and the remaining 21.3 percent are female. The male entrepreneurs are higher percentage in micro scale entrepreneurs (47.5%), small level (33.9%) and Medium level(18.6%). The Female entrepreneurs are higher percentage in micro scale industry (46.9%) followed by small(40.6%) and Medium (12.5%) scale entrepreneurs.

FIGURE 1.

Number Of Male And Female Entrepreneurs

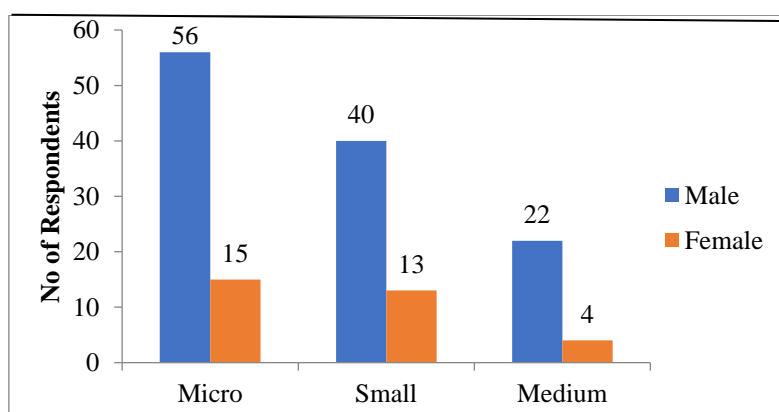


TABLE: 2
AGE OF THE ENTREPRENEURS

		Category of Units			Total	
		Micro	Small	Medium		
Age Groups	Below 27	Count	12	7	3	22
		% within Age	54.5%	31.8%	13.6%	100.0%
		% within Category of Units	16.9%	13.2%	11.5%	14.7%
	28-37	Count	16	8	3	27
	% within Age	59.3%	29.6%	11.1%	100.0%	
	% within Category of Units	22.5%	15.1%	11.5%	18.0%	
	38-47	Count	18	16	6	40
	% within Age	45.0%	40.0%	15.0%	100.0%	
	% within Category of Units	25.4%	30.2%	23.1%	26.7%	
	Above 47	Count	25	22	14	61
	% within Age	41.0%	36.1%	23.0%	100.0%	
	% within Category of Units	35.2%	41.5%	53.8%	40.7%	
Total	Total	Count	71	53	26	150
		% within Age	47.3%	35.3%	17.3%	100.0%
		% within Category of Units	100%	100%	100%	100%

Sources: Field Survey

Table 2 shows that the total sample of 150 MSMEs entrepreneurs in Hosur Taluk, 40.7 percent has above 47 years, 26.7 percent have betweenage group of 38-47 years, 18 percent have between age group of 28-37 years and 14.7 percent have between age group of Below 27 years. The tables reveal that 47.3 percent of respondents under micro scale entrepreneurs, 35.3 percent of respondents under small scale entrepreneurs and rest of respondents are Medium scale entrepreneurs.

FIGURES:2

AGE OF THE ENTREPRENEURS

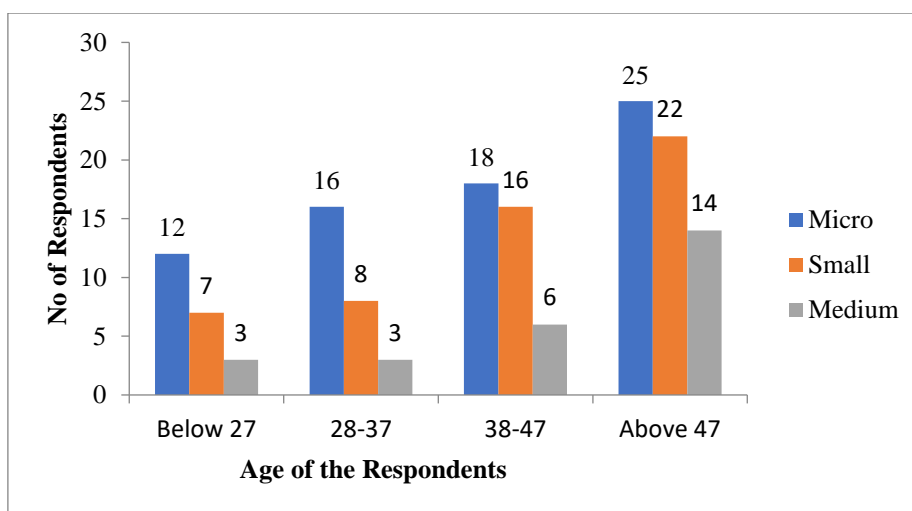


TABLE: 3

EDUCATIONAL QUALIFICATIONS OF ENTREPRENEURS

		Category of Units			Total
		Micro	Small	Medium	
Educational Qualifications	SSLC Count	10	12	1	9
	% within Education	40.0%	48.0%	12.0%	100.0%
	% within Category of Units	14.1%	22.6%	11.5%	16.7%
	Graduates Count	10	5	2	17
	% within Education	58.8%	29.4%	11.8%	100.0%
% within Category of Units	14.1%	9.4%	7.7%	11.3%	
Post Graduates	Count	5	4	1	10
	% within Education	50.0%	40.0%	10.0%	100.0%
	% within Category of Units	7.0%	7.5%	3.8%	6.7%
Diploma	Count	23	19	11	53
	% within Education	43.4%	35.8%	20.8%	100.0%
	% within Category of Units	32.4%	35.8%	42.3%	35.3%
Others	Count	23	13	9	45
	% within Education	51.1%	28.9%	20.0%	100.0%
	% within Category of Units	32.4%	24.5%	34.6%	30.0%
Total	Total Count	71	53	26	150
	% within Education	47.3%	35.3%	17.3%	100.0%
	% within Category of Units	100%	100%	100%	100%

SOURCES: FIELD SURVEY

The above table 3 shows the industry wise educational status of MSMEs Entrepreneurs in the study area. In the samples of 150 respondents 35.3 percent were diploma and others, 30 percent were others, 16.7 percent were SSLC and 6.7 percent comes under post graduates.

FIGURES 3

EDUCATIONAL QUALIFICATION OF ENTREPRENEURS

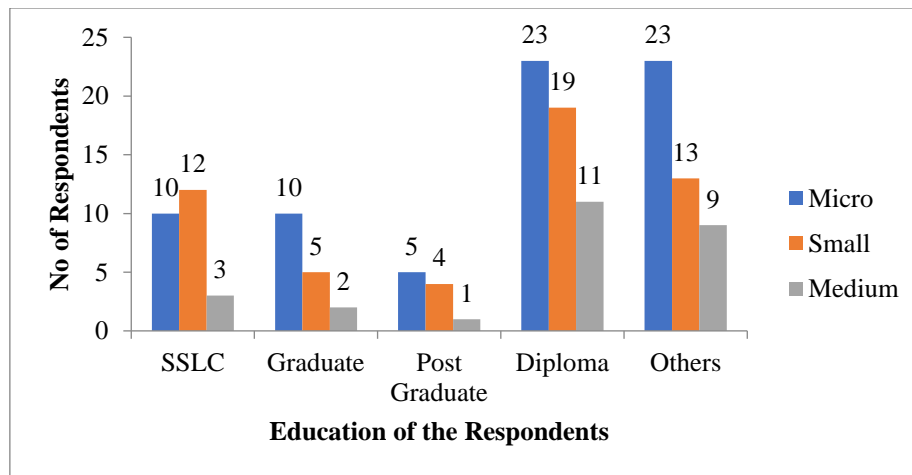


TABLE: 4
BUSINESS EXPERIENCES OF ENTREPRENEURS

		Category of Units			Total	
		Micro	Small	Medium		
Experience	Less than 5	Count	15	6	1	22
		% within Experience	68.2%	27.3%	4.5%	100.0%
		% within Category of Units	21.1%	11.3%	3.8%	14.7%
	5-10	Count	19	17	5	41
		% within Experience	46.3%	41.5%	12.2%	100.0%
		% within Category of Units	26.8%	32.1%	19.2%	27.3%
	11-15	Count	18	20	11	49
		% within Experience	36.7%	40.8%	22.4%	100.0%
		% within Category of Units	25.4%	37.7%	42.3%	32.7%
	Above 15	Count	19	10	9	38
		% within Experience	50.0%	26.3%	23.7%	100.0%
		% within Category of Units	26.8%	18.9%	34.6%	25.3%
Total	Total	71	53	26	150	
	% within Experience	47.3%	35.3%	17.3%	100.0%	
	% within Category of Units	100%	100%	100%	100%	

Sources: Field survey

Table-4 shows that, a maximum of 32.7 percent of the respondents who have experience in the range of 11-15 years of experience and out of which 42.3 percent belongs to small enterprises, 37.7 percent belongs to medium enterprises and 25.4 percent of them belong to micro enterprises. 25.3 percent of the respondents have experience of Above 15 years, out of which 33.3 percent belong to small enterprises, 25 percent of them belong to medium enterprises and 34.6 percent belongs to medium enterprises and so on. The least percentage relates to less than 14.7 percent of the respondents who have experience in the range of less than 5 years, out of which 21.1 percent of them belong to microenterprises and 11.3 percent belong to small and 3.5 percent of them belong to medium enterprises. This clearly shows that a sizable number of respondents in the study are very young and having experience i.e., those who have started the business recently.

TABLE: 5
CATEGORIES OF UNITS

		Frequency	Percent
Valid	Micro	71	47.3
	Small	53	35.3
	Medium	26	17.3
	Total	150	100.0

Sources: Field survey

From the above table 6, evidence that 47.3 percent of the respondents are Micro scale entrepreneurs, 35.3 percent of the respondents are Small scale entrepreneurs and rest of them medium scale entrepreneurs.

TABLE: 6 NATURE OF ACTIVITY OF ENTREPRENEURS

		Category of Units			Total	
		Micro	Small	Medium		
Nature of Activity	Manufacturing	Count	32	22	7	61
		% within Nature of Activity	52.5%	36.1%	11.5%	100.0%
		% within Category of Units	45.1%	41.5%	26.9%	40.7%
	Services	Count	22	19	10	51
		% within Nature of Activity	43.1%	37.3%	19.6%	100.0%
		% within Category of Units	31.0%	35.8%	38.5%	34.0%
	Both	Count	17	12	9	38
		% within Nature of Activity	44.7%	31.6%	23.7%	100.0%
		% within Category of Units	23.9%	22.6%	34.6%	25.3%
Total	Total	Count	71	53	26	150
		% within Education	47.3%	35.3%	17.3%	100.0%
		% within Category of Units	100%	100%	100%	100%

Sources: Field survey

The details relating to the nature of their products and services of the selected small scale units of the study are presented in table-6. The nature of the activities is classified into Manufacturing, Services and Both. The data reveal that in the total selected sample units 61 per cent are manufacturing, 51 percent are services and 38 percent are both.

The tables reveal that in the total sample units of manufacturing under 45.1 percent Micro, 41.5 percent Small and 26.9 percent Medium Scale.

CHI-SQUARE TEST FOR GENERAL PROBLEMS FACED BY MSMEs ENTREPRENEURS

TABLE: 7 BASED ON GENDER & GENERAL PROBLEMS
CHI-SQUARE TESTS

	Value	Df	P value
Pearson Chi-Square	.872 ^a	2	.646
Likelihood Ratio	.906	2	.636
Linear-by-Linear Association	.139	1	.709
N of Valid Cases	150		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.55.

The Chi-square table 7 reveals that the P value (0.646) is more than table value (0.05), the null hypothesis is accepted at 5% level of significance. Hence it's concluded that there is no significance association between gender and general problems faced by MSMEs entrepreneurs.

TABLE: 8 BASED ON AGE GROUPS & GENERAL PROBLEMS

CHI-SQUARE TESTS

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.286 ^a	3	.515
Likelihood Ratio	2.210	3	.530
Linear-by-Linear Association	.031	1	.860
N of Valid Cases	150		

0 cells (.0%) have expected count less than 5. The minimum expected count is 6.45.

Since p value (0.515) is more than 0.05, Null hypothesis is accepted at 5% level of significance. So, there is no significance difference between age and general problems faced by MSMEs entrepreneurs.

a.

TABLE: 9 BASED ON EDUCATIONAL QUALIFICATION & GENERAL PROBLEMS

CHI-SQUARE TESTS

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.919 ^a	4	.661
Likelihood Ratio	9.603	4	.671
Linear-by-Linear Association	3.027	1	.161
N of Valid Cases	50		

a. 2 cells (20.7%) have expected count less than 5. The minimum expected count is 2.93.

Table 9 states that at 5% level of significance the p value (0.441) is not significance. Therefore there is no relationship between Educational qualification and general problems by MSMEs entrepreneurs.

TABLE: 10 BASED ON CATEGORY OF UNITS & GENERAL PROBLEMS

CHI-SQUARE TESTS

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.085 ^a	2	.581
Likelihood Ratio	1.094	2	.579
Linear-by-Linear Association	.037	1	.848
N of Valid Cases	150		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.63.

This Chi-square test reveals that there is no association between category of unit and general problems faced by MSMEs entrepreneurs. The p-value of the test is not statistically significant. Therefore it can be concluded that null hypothesis is accepted.

TABLE: 11 BASED ON EXPERIENCE & GENERAL PROBLEMS

CHI-SQUARE TESTS

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.231 ^a	3	.972
Likelihood Ratio	.232	3	.972
Linear-by-Linear Association	.001	1	.970
N of Valid Cases	150		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is 1.82.

This Chi-square test reveals that there is no association between category of unit and general problems faced by MSMEs entrepreneurs. The p-value of the test is not statistically significant. Therefore it can be concluded that null hypothesis is accepted.

TABLE: 12 BASED ON NATURE OF ACTIVITY & GENERAL PROBLEMS

CHI-SQUARE TESTS

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.370 ^a	2	.048
Likelihood Ratio	5.265	2	.072
Linear-by-Linear Association	.003	1	.955
N of Valid Cases	150		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.15.

It is evident from the above table 12 the significance value is lesser than 0.05 the alternative hypothesis is accepted and null hypothesis is rejected and it is concluded that there is significance association between nature of activity and problems faced by MSMEs entrepreneurs.

VIII. FINDINGS OF THE STUDY

The study reveals that most of the respondents are Male (82%)

The age group of the respondents falls in above 47(40%)

The study found that majority of respondents is Diploma and others (34%)

From the analysis, 36 percent of the respondents are experience under 11-15 years.

It is revealed that 44 percent of respondents are in nature of manufacturing.

Majority (48%) of respondents are belongs to small scale entrepreneurs.

There is no significance difference between Gender and general problems faced by MSMEs entrepreneurs.

There is no significance difference between Age groups and general problems faced by MSMEs entrepreneurs.

There is no significance difference between educational qualification and general problems faced MSMEs entrepreneurs.

There is no significance difference between Category of units and general problems faced by MSMEs entrepreneurs.

There is no significance difference between experience and general problems faced by MSMEs entrepreneurs.

There is significance difference between nature of activity and problems faced by MSME entrepreneurs.

IX. CONCLUSION

It is well known that the socio-economic factors like gender, age, education starting before the enterprise, experience and nature of activities to start the industry. The analysis of the impact of socio-economic factors on entrepreneurship development in the district reveals that the growth of entrepreneurship has more influenced by the factors like previous experience.

The Government, by introducing the MSMED Act, has done a commendable job. The manner in which the whole segment is treated with such detail, touching the core areas of the segment is truly in the interest of the entrepreneurs. The Ministry of Micro, Small and Medium Enterprise has been continuously scrutinizing the policy framework. The various schemes introduced, the incentives, assistance and concessions given to the MSME sector in the country confirms this fact.

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AN ANALYSIS OF GROWTH AND PERFORMANCE OF MSMEs in TamilNadu

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ABSTRACT

Micro, Small and Medium Enterprises (MSMEs) have played an crucial role in the economic development of a country. MSMEs are the chief support of the country and provide a large number of employees to the youths. It support to the growth of Indian economy with the wide network of 36 million units as of today and it providing employment to 80 million people. The MSME's sector has consistently registered higher growth rate compare to the overall industrial sector. In the present year MSMEs is growing in the state and it had promoted the entrepreneurship development and startup schemes in the state. The objectives of the present study are to evaluate the growth and performance of MSMEs. In recent years MSME sector has registered higher growth rate than the overall industrial sector. The present study in empirical in nature and it is based on secondary data. The data collected from DIC, Annual reports of MSMEs, journals and periodicals.

Key Words: Growth and Performance of MSMEs

INTRODUCTION

The Micro, Small and Medium Enterprises (MSMEs) have been accepted as the engine of economic growth and for promoting equitable development. The MSME also play an important role in the development of the economy with their effective, efficient, flexible and innovative entrepreneurial spirit. If we go through the following tables, we would able to know that the number of MSMEs as well as its contribution is increasing day by day. MSMEs are the nursery where small existing businesses have the potential to become world beaters tomorrow.

Review of Literature

Dr. K. Kumaravel (2017)¹, evaluated the development of entrepreneurs through small and medium enterprises. The study concluded that there are various opportunities available for the growth of MSME, but entrepreneurship is very good platform to promote and growth of this industry.

Anis Ali, Firoz Husain(2014)² This study focuses upon the growth pattern of the MSMEs, number of units, investment, production and employment. The main objectives of this paper to study the present status of MSMEs in India. They researcher found that the MSMEs are providing more employment per unit.

Seena P.P., Dr.Swarupa.R.,(2018)³, they conducted a study to analyse the region wise growth and performance of MSME in Kerala. The study revealed that southern region good in industrialization and has showed a stable performance. Number of unit, employment generation production and investment are lowest in northern region but the compound growth rate is highest.

Objectives of the Study

- To evaluate the overall growth and performance of MSMEs Sector in Tamilnadu.

Research Methodology

The study is based on secondary data, which is collected from various issues of Annual Reports on MSMEs and Handbook of Statistics on the Indian Economy published by Ministry of MSMEs and various research articles. The study considers the time period from 2004-05 to 2017-18. To examine the performance of MSMEs in Tamilnadu, the available data have been processed and presented in suitable tables.

¹ *Dr. K. Kumaravel (2017), " Growth and Performance of MSME Sector in India", International Journal of Management and Humanities, Vol.No. 4 Issue No.2.*

² *Anis Ali, Firoz Husain(2014), Msme's In India: Problems, Solutions And Prospectus In Present Scenario", International Journal of Engineering and Management Sciences, Vol.No.5(2),2014 P-No. 109-115.*

³ *Seena P.P., Dr.Swarupa.R.,(2018)³, Growth and performance of Small Scale Industries/Micro Small and Medium Enterprises in Kerala-Region Wise Analysis, International Journal of Management Studies, Vol-V Issue No 2(1), April 2018, p-no. 117 -122*

Statistical Tools used:

The information gathered was tabulated and analyzed by using average and correlation.

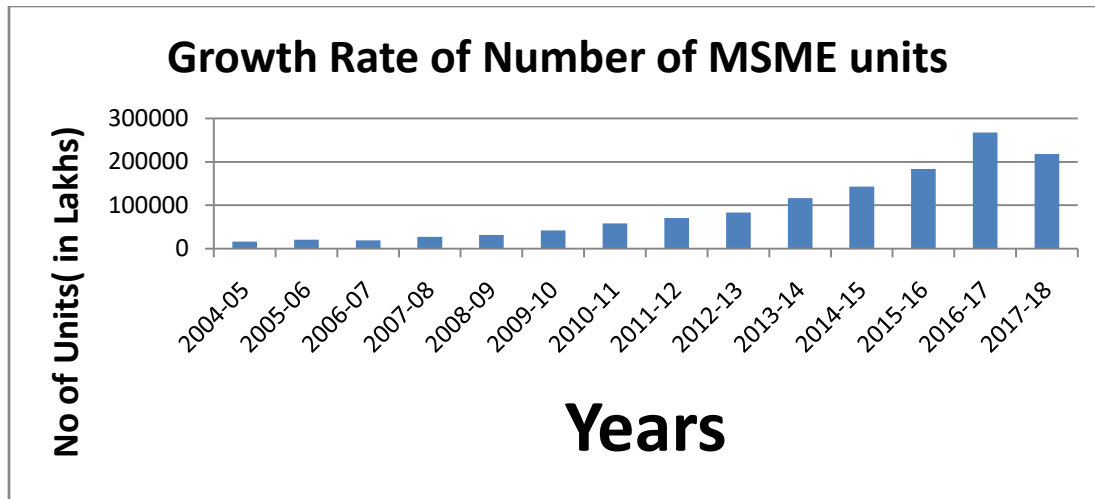
Table-1: Performance of MSMEs In TamilNadu

Year	No Of Units	Investment (Rs. Crore)	Production (Rs.in crore)	Employment (Rs. Lakhs)
2004-05	16253	1105.81	4556.97	60280
2005-06	20399	1705.20	4414.87	67800
2006-07	19201	714.41	2067.87	110026
2007-08	27209	2547.14	8739.95	242855
2008-09	32049	3557.89	13354.86	294255
2009-10	41799	3214.22	10880.01	151743
2010-11	57902	5872.37	12500.86	405233
2011-12	70758	7429.59	15496.00	502381
2012-13	83348	8751.57	17503.08	583436
2013-14	116393	18939.87	16832.25	494990
2014-15	143104	24349.65	59789.70	651180
2015-16	183792	40630.59	59332.19	1112002
2016-17	267310	36221.78	NA	1897619
2017-18	217981	25373.12	NA	1378544
Average	101894.3	12442.47	NA	546832.6

Sources: Annual Report2017-18, MSME in India.

The average growths of Micro, Small and Medium enterprises are 101897.3,12442.47 and 1378544 respectively with overall average growth rate of Unit, Investment, Production and Employment.

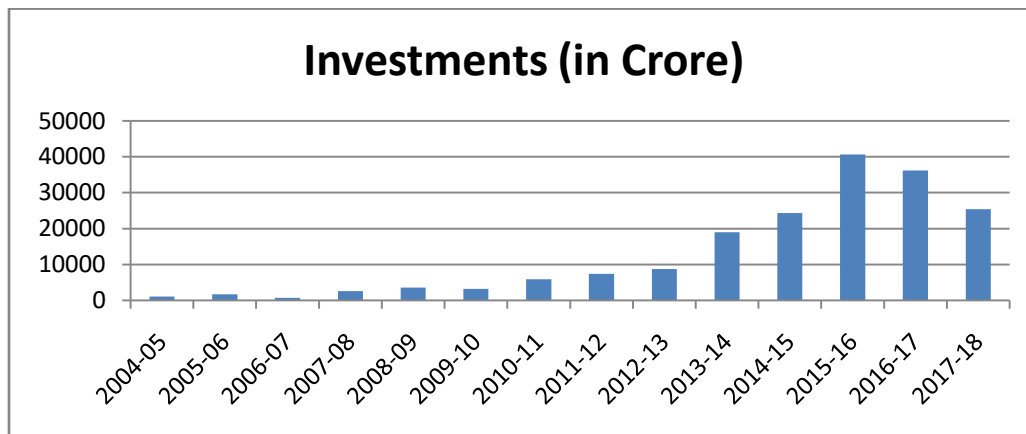
Figure-1: Growth Rate of Number of MSME units



Source : Annual Report MSME 2017-2018(Government of India)

According to Ministry of Micro, Small and Medium Enterprises, the number of MSME units are steadily increasing. The number of MSME units has increased from 16253 (lakhs) to 217981 (lakhs) from 2004-2005 to 2017-18period (see figure 1)

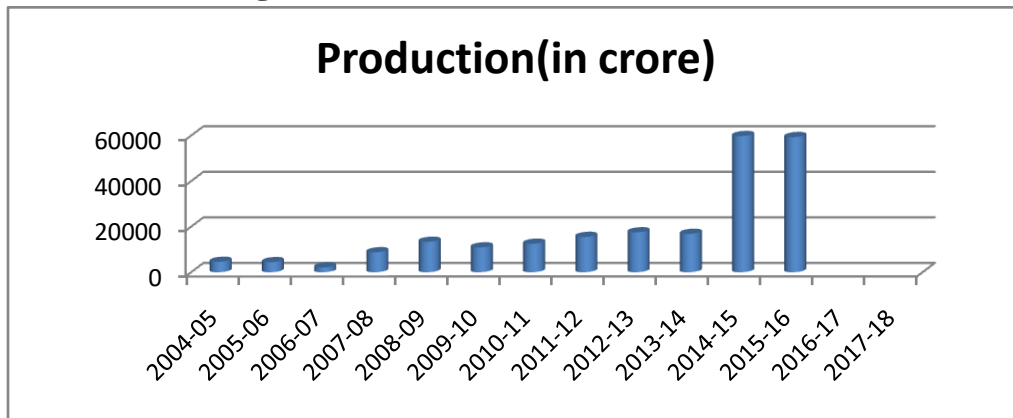
Figure-2: Growth Rate of Investment



Source : Annual Report MSME 2017-2018(Government of India)

The fixed investment (see figure 2) during the period of 2004-05 to 2017-2018 from Rs. 1105.81(crore) to Rs. 25373.12(crore).

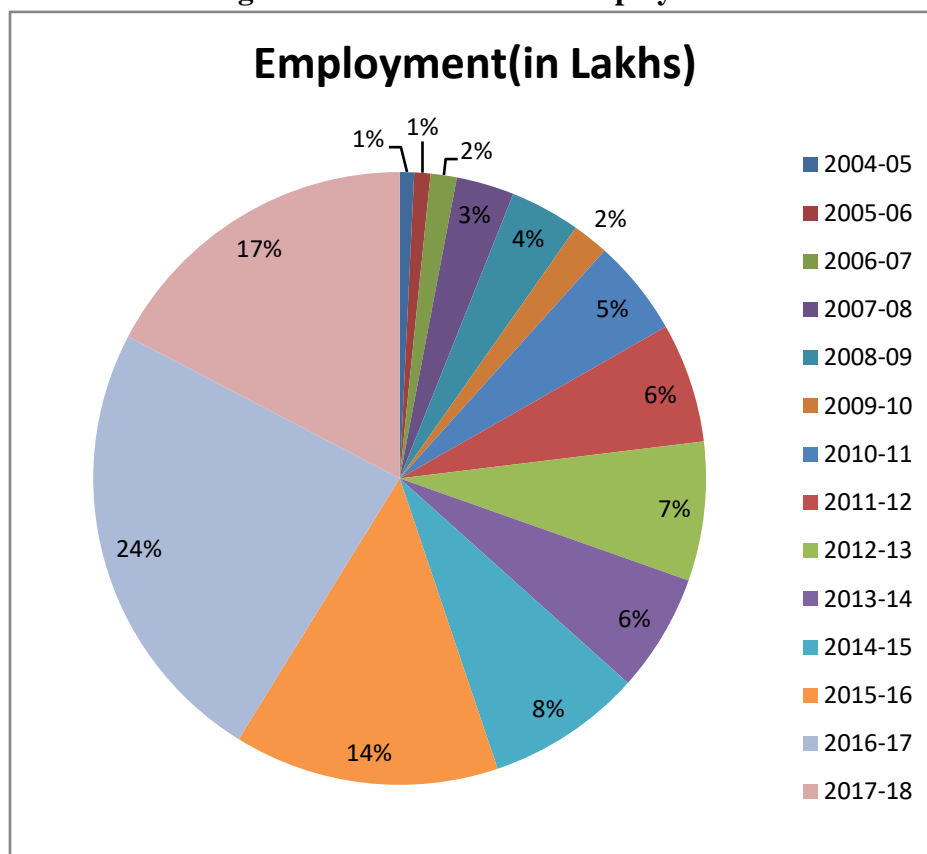
Figure-3: Growth Rate of Production



Source : Annual Report MSME 2017-2018(Government of India)

The total production in the MSMEs sector in the country as per the Final Report of the Fourth Census of MSMEs in 2004-2005 (Registered Sector) was 4556.97 crore persons and the same stands 59332.19 crore persons in the year 2015-2016 (see figure 3)

Figure-4: Growth Rate of Employment



Source : Annual Report MSME 2017-2018(Government of India)

The total employment in the MSMEs sector in the country as per the Final Report of the Fourth Census of MSMEs in 2004-2005 (Registered Sector) was 60280 crores persons and the same stands 1378544 crores persons in the year 2017-2018(see figure 4)

Table- 2:Results of Correlation for the growth of MSMEs in TamilNadu: Units, Investment, Production and Employment, 2004-2018

		Fixed Investment(Rs.in crore)	Production (in Crore)	Employment(in lakh)
Total No MSME(in lakh)	Pearson p-value	0.940** 0.000	0.912** 0.000	0.974** 0.000
Fixed Investment (Rs.in Crore)	Pearson p-value	1	0.917** 0.000	0.883** 0.000
Production (Rs. In Crore)	Pearson p-value		1	0.860** 0.000

** Correlation is significant at the 0.01 level(2-tailed)

The above results show that there exists the highest positive correlation between total MSMEs and fixed investment at 0.940 followed by total MSMEs and production at 0.912 and total MSMEs and employment at 0.974. Similarly, highest positive correlation at 0.917 is observed between fixed investment and production followed by fixed investment and employment at 0.883. The results also show that there is high positive correlation observed between production and employment at 0.860.

SUMMARY AND CONCLUSION

The summary of the study helped to conclude that the MSME sector plays a unique role in the socio-economic development of any country. A comparison of the growth rate of the MSME sector with that of the overall industrial sector in Tamilnadu indicated that MSMEs have registered a high growth rate which increased from 16253 to 217981 lakhs during the period 2004-2018.

Similarly highest positive correlation is observed in the case of fixed investment and production which stood at 0.917, employment stood at 0.883. It is also observed from the statistical analysis that a positive growth in production, investment and employment could be seen.

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Seena P.P., Dr.Swarupa.R.,(2018)¹, Growth and performance of Small Scale Industries/Micro Small and Medium Enterprises in Kerala-Region Wise Analysis, International Journal of Management Studies, Vol-V Issue No 2(1), April 2018, p-no. 117 -122

A STUDY ON IMPACT OF SOCIO-ECONOMIC PROFILE ON INVESTMENT PATTERN OF SALARIED & NON-SALARIED PEOPLE IN KRISHNAGIRI TOWN

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Dr. R. VENKATESH²

Investment is a commitment of funds for earning additional income. It is considered the sacrifice of certain present value of money in anticipation of a reward. The objectives of this study are Impact of Socio-Economic profile on investment pattern of salaried & non-salaried investors in Krishnagiri Town. Descriptive research design is used to describe the characteristic of group of target population such as age, gender, area of residence, Income etc., This study is conducted with convenience sampling and the data collected from 120 investors with help of interview schedule in the study area of Krishnagiri town. Secondary data are those that are collected from the reputed journals respective websites and text books. All the data codes are tabulated with using simple percentage analysis the study concluded that salaried investors preferred in Insurance and non-salaried investors preferred in Gold.

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Key Words: Investment, Salaried Investors, Non-Salaried Investors

A Study on Impact of Socio-Economic Profile on Investment Pattern of Salaried & Non-Salaried People in Krishnagiri Town

INTRODUCTION

Investments have become a basic necessity for everyone. In our country there is a rapid growth in Investment. The word 'Investment' means a person who has lent money to another. It may be an investment for a return and investment is a commitment of funds for earning additional income. Investment is also considered as the sacrifice of certain present value of money in anticipation of a reward.

Each investors is investing their funds in different investment alternatives, which depends upon their personal needs and goals. Each individual has different objectives that need to meet depending on age, income and expenditure etc., Now a days a salaried and non-salaried investors invest their money in financial investment as well as economic investment.

Financial investment means employment of funds in the form of assets with the objects of earning additional or appreciation in the value of investment in future. Ex: Bank deposits, Post Office Certificates, Company Deposits, shares and Securities listed on a recognised Stock exchanges and deposits in the Government Securities. These investments are safe, flexible and easily marketable.

Economic Investment is different from financial investment. Economic investment signifies net addition to the capital stock of the society. In turn means those goods and services are used in the production of other goods and services.

IMPACT OF SOCIO-ECONOMIC PROFILE ON INVESTMENT PATTERN.

Age: One of the most minutely researched demographic factor influencing the investment and there by risk attitude of the individual investors is his/her age.

Gender: Gender has a determinant of risk attitudes which remains a controversial factor. Many empirical studies (C Hanna and Lindamood, 2004; Al-Ajmi 2008; Olivaries Ct al, 2008; Gilliam et al 2010 a;) find that women investors are less risk tolerant and so more risk averse than their men counterparts.

Marital / Socio Status:

Marital / Social Status of individual investors is also considered to be an effective factor that affects investment decision.

In common the empirical studies show that married individuals are probably being less risk tolerant and more risk averse than single ones [Roszkowski et al 1993; Sunden and Surettle , 1998 :] However, on an overall basic it can be concluded that unmarried investors are found to have a slightly higher risk tolerance level and thereby risk prone attitude than all other demographics.

Number of Dependents: The General participation of number of dependents impact on the investment pattern is that individual investors with more dependents are less risk tolerant than the persons with less dependent.

Educational Qualification:

The level of education of individual investors is another critical factor in determining their investment pattern and risk attitudes.

It is observed that higher educational qualifications help to investors become capable of assessing the probable risks and benefits more carefully than those who have lower educational degrees.

Employment Status:

A clear distinction between the self-employed and business sector individuals and other entrepreneurs typically lead to higher level of risk-taking than employees who are on straight salary or wages.

Income Status:

Income status is the most impact of investment decisions. The investors can select the investment pattern depend upon their income status. It indicates that low income individual investors have lower risk tolerance which implies that they are risk adverse as because they have little flexibility with their regular budgets.

STATEMENT OF PROBLEM:

Any investment is made with the primary objectives of earning return on the invested sum. The investment pattern of salaried investors is differing from non-salaried investors because the income status of salaried are fixed. The non-salaried investors may earn income from various sources (not fixed).

There have been very little work on the impact of socio-economic profile of the investors because they are finding various problems in selecting their suitable investment pattern. It is identified that there is a need for research work in the field of impact of socio-economic profile on investment pattern of salaried and non-salaried investors in Krishnagiri Town of Tamil Nadu.

NEED FOR THE STUDY:

The study reveals the relationship between the socio-economic profile of the investors and their reference of investment pattern. This study may create the awareness to the people about the investors' investment behaviour based on their regularity of return. Day by day there is a growing demand for wealth management function. Hence it becomes behaviour and psychology.

OBJECTIVES AS THE STUDY:

- To study the impact of Socio-Economic profile on investment pattern of salaried and non-salaried investors.
- To Analyse the investment pattern among the salaried and non-salaried investors.

LIMITATIONS:

1. The present study is covered in and around the areas of Krishnagiri Town only.
2. The present study has covered only 120 respondents (Salaried and Non-salaried) only. It may not be able to match with the population.

LITERATURE REVIEW:

K. Chitra Devi (2012) studies on – The impact of socio economic variables on the attitude of investors towards investment. She found that the level of income also influences the investment decisions.

Fieldstein Martin S and Yitzhaki, (2011), in their study entitled, “ Are high Income individuals Better Stock Market Investors?” have presented evidence to suggest that the corporate stock owned by high-income investors appreciate substantially faster than stock owned by investors with lower incomes. They have indicated that high-income individuals have larger portfolios and can therefore devote more time or resources to their investments. Thus resulting in higher returns.

Rajarajan.V . (2003) studies brought out the existence of strong association between demographic characteristics and the risk bearing capacity of Indian investors, the relationship between age, income and risk bearing capacity of the investors are very high. The salaried members constituted the largest part of all categories.

D. Harikanth & B. Pragathi (2012) indicated that there is a significant role of income and occupation in investment avenue selection by the male and female investors. Geographical horizon of the investors, risks bearing capacity, education level, age, gender and risk tolerance capacity etc., also impacts their selection.

Giridhari Mohanta & Sathya Swaroop Debasish (2011) states that people were ready to invest for meeting their financial, social and psychological need. But the investor always had a mind set of safety and security, higher capital gain, secured future, tax benefit, getting periodic return or dividends, easy purchase and meeting future contingency.

METHODOLOGY:

The Present study is an impact of socio-economic profile and investment pattern of salaried and non-salaried in Krishnagiri Town. The study area is featured by a good number of salaried, professional & businessmen who have the ability to save & invest. Besides, the study area is featured with all the facilities that are needed for mobilizing & transmitting the idle savings. This research study is a descriptive study. In order to conduct this study, 120 investors in Krishnagiri Town have been surveyed and questionnaire is used for data collection.

Sources of Data: All the data required for this purpose has been obtained mainly from primary sources, and secondary sources.

Data Collection Methods : The data collection method is used to obtain the desired information from primary sources direct interview and questionnaire which has been used as an instrument.

Sampling Method: Convenient sampling.

Sample Size : 120

Area of Survey: Various localities in Krishnagiri Town.

Tools : Simple percentage.

DATA ANALYSIS AND INTERPRETATION

Table – 1
Gender of the Respondents

S.No.	Gender	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Male	38	46	84	70
2	Female	22	14	36	30
	Total	60	60	120	

Source: Primary Data

The above table shows the gender wise classification of the respondents, out of the total 120 respondents 70% were male, and it includes 38 investors from salaried and 46 investors from non-salaried. Out of the remaining 30% of the respondents were female , it includes 22 from salaried and 14 from non-salaried people.

Table-2
The Age of the Respondents

S.No.	Age (In Years)	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Below 30 Years	34	11	45	38
2	30 - 40	10	13	23	19
3	40 - 50	6	14	20	17
4	50 - 60	8	16	24	20
5	Above 60 Years	2	6	8	6
	Total	60	60	120	

Source: Primary Data

The above table shows the age wise classification of the respondents out of the total 120 respondents majority 38 % belongs to the age category of below 30 years that 34 respondents from salaried and 11 of the respondents non-salaried.

Table -3
Marital Status of the Respondents

S.No.	Marital Status	Number of Investors		Total	%
		Salaried	Non-Salaried		

Table-6

Annual Income of the Respondents

S.No.	Family annual Income	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Below 3 lakhs	30	27	57	48
2	3 - 6 lakhs	17	21	38	32
3	6 - 9 lakhs	10	7	17	14
4	Above 9 lakhs	3	5	8	6
	Total	60	60	120	

Source: Primary Data

The above table represents the annual income of the investors. 48% of the investors earn family annual income of Rs. below 3 lakhs it includes 30 investors from salaried and 27 investors from non-salaried. 32% of the investors comes under the category of 3 – 6 lakhs. 14% of the investors comes 6 – 9 lakhs of annual income and 6% of the respondents earn monthly income of above Rs. 9 lakhs it includes 3 of them salaried and 5 of them non-salaried investors.

Table-7

Monthly Expenditure of the Respondents

S.No.	Monthly Expenditure	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Below 12,000	16	17	33	28
2	12,000 to 24,000	27	30	57	47
3	24,000 to 36,000	11	7	18	15
4	Above 36,000	6	6	12	10
	Total	60	60	120	

Source: Primary Data

The above table shows the monthly expenditure of the investors. 28% of the investors have mentioned that they expend of below Rs.12000. 47% of the investors monthly expenditure is of Rs. 12000 to 24000, which includes 27 investors from salaried and 30 investors from non-salaried people.

Table – 8

Annual Savings of the Investors

S.No.	Annual Savings	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Below 50,000	29	33	62	52
2	50,000 to 1,50,000	20	16	36	30
3	1,50,000 to 3,00,000	7	5	12	10
4	Above 3,00,000	4	6	10	8
	Total	60	60	120	

Source: Primary Data

The above table indicates the annual savings of the investors 52% of the investors have savings below 50,000, which includes 29 investors from salaried and 33 investors from non-salaried people. 30% of the investors have save annual sum of Rs. 50,000 to 1,50,000, 10% of the investors save

Rs. 1,50,000 to 3,00,000 and 8 % of the investors save annual sum of as above 3 lakhs includes 4 of them salaried and 6 of them non-salaried people.

Table-9
Annual Investment of the Respondents

S.No.	Annual Investment	Number of Investors		Total	%
		Salaried	Non-Salaried		
1	Below 1 lakh	29	36	65	54
2	1 lakh to 2 lakhs	16	11	27	23
3	2 lakhs to 3 lakhs	9	6	15	13
4	Above 3 lakhs	6	7	13	10
	Total	60	60	120	

Source: Primary Data

The above table shows the annual investment of the investors in Krishnagiri Town. 54% of the investors have mentioned that they invest Annual sum of Rs. below 1 lakh, which includes 29 investors from salaried and 36 were non-salaried investors and 10% of the investors invest annual salary above 3 lakhs, which includes 6 investors from salaried and rest of 7 from non-salaried people.

Table – 10
Investment presently held by the Investors.

S.No	Investment Option	Number of Investments	
		Salaried(%)	Non-Salaried(%)
1	Bank Deposits	25 (14)	18 (11)
2	Insurance	52 (28)	40 (23)
3	Post Savings	43 (23)	11 (6)
4	Gold	37 (20)	42 (25)
5	Real Estate	15 (8)	35 (20)
6	Shares & Bonds	11 (6)	23 (13)
	Total	183	171

Source: Primary Data

The above table indicates the present investment pattern of the investors. Most of the salaried investors prefer to invest their money only in Insurance (28%) next preference goes to Post Office (23%), Gold (20%), Bank Deposits (14%), Real Estate (8%) and Shares & Bonds (6%) respectively.

Most of the Non-salaried investors most preferred to invest their money in Gold (25%). Next preference goes to Insurance (23%), Real Estate (20%), Shares & Bonds (13%), Bank Deposits (11%) and Post Office Savings (6%).

The above table concluded that salaried investors preferred in Insurance and non-salaried investors preferred in Gold.

FINDINGS OF THE STUDY :

- Out of the total 120 respondents 70% were male, and it includes 38 investors from salaried and 46 investors from non-salaried. Out of the remaining 30% of the respondents were female , it includes 22 from salaried and 14 from non-salaried people.
- Out of the total 120 respondents regarding age wise classification ,majority 38 % belongs to the age category of below 30 years that 34 respondents were from salaried and 11 of the respondents were non-salaried.
- Among the total investors 57% belongs to married, it includes 24 from salaried and 44 from non-salaried and 43% of the investors belongs to unmarried which includes 36 from salaried and 16 from non-salaried investors.
- Regarding the education classification of the investors, 38% of the investors had completed their post graduation, which includes 28 investors from salaried and 17 investors from non-salaried.
- The nature of family type of the investors, majority (97) of the investors lives in Nuclear family which includes 48 from salaried and 49 from non-salaried investors.
- Annual income of the investors , 48% of the investors earn family annual income of Rs. below 3 lakhs it includes 30 investors from salaried and 27 investors from non-salaried.
- 47% of the investors monthly expenditure is of Rs. 12000 to 24000, which includes 27 investors from salaried and 30 investors from non-salaried people.
- 52% of the investors have save below 50,000, which includes 29 investors from salaried and 33 investors from non-salaried people.
- The annual investment of the investors in Krishnagiri Town, 54% of the investors have mentioned that they invest Annual sum of Rs. below 1 lakh, which includes 29 investors from salaried and 36 non-salaried investors

- The study concluded that salaried investors preferred in Insurance and non-salaried investors preferred in Gold.

CONCLUSION:

Individuals avail economic security to continue their lives or incentive processing. While they put a certain amount of their income aside to meet their demands, they make saving to guarantee their future with the other part. Individual investors are affected by several factors while they direct their savings at investments. The studies specifically reveals the salaried and non-salaried people. The socio-economic variables helps the targeted respondents to make out the investment pattern. Moreover as far as the socio-economic variables are concerned age, gender, income, education and occupation have been found influencing the attitude of investors towards investment pattern.

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An Analysis of Factors Influencing E-Shopping In Dharmapuri District

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Abstract: Internet shopping is a phenomenon that is growing rapidly nowadays. A peep into the exponential growth of the main players in this industry indicates there is still a large reservoir of market potential for e-commerce. The frequency of online shopping has raised the interest of the retailers to focus on this area. Therefore, this study was determining the various factors influencing to the buyer for buying goods and services through E-Shopping. 150 out of 170 sets of questionnaires distributed were valid for coding, analyzing and testing the hypothesis. Collected data were then analyzed using SPSS version 22.0 and applied the statistical tools also.

Keywords: E-Shopping, Factors influencing, online Marketing

I. INTRODUCTION

In the past few years, e-commerce has increasingly become more and more important. The latest survey from shop.com and Boston Consulting Group on ecommerce indicated that on-line purchase has become stronger and more profitable. The evolution of the Internet, therefore, transforms and changes the way business transactions are conducted. Future business transactions were predicted to move from market place to market space (Kotler, 2000). Business transactions can easily be conducted on the Internet without the obstacles of international borders. Citizens living in one nation can purchase goods from corporations located in another nation with convenience and ease.

Generally speaking the trend of e-commerce has been increased rapidly in the recent years with the development of internet and due to the easy accessibility of internet usage. Easy access to internet has driven consumers to shop online in fact according to the University of California, Los Angeles (UCLA) communication policy (2001), online shopping is third most popular activity on the internet after email using and web browsing. Globally more than 627 million people have done online shopping so far, World's biggest online shoppers include Germans and British. Books, airline tickets/reservations, clothing/shoes videos/games and other electronic products are the most popular items purchased on the internet. (ACNielsen Report on Global Consumer Attitudes towards Online Shopping, 2007). Through electronic marketing and internet communication business firms are coordinating different marketing activities such as market research, product development, inform customers about product features, promotion, customer services, customer

feedback and so on. Online shopping is used as a medium for communication and electronic commerce, it is to increase or improve in value, quality and attractiveness of delivering customer benefits and better satisfaction, that is why online shopping is more convenience and day by day increasing its popularity. Not only benefits but also risk is associated with online shopping. Generally speaking internet users avert online shopping because of credit-card fraud, lack of privacy, non-delivery risk, lack of guarantee of quality of goods and services. Concerned authorities are devising policies to minimize the risk involved in e-business. In Liao and Cheung (2000) words: "Fraud-free electronic shopping" was introduced by UK in the early 1995 and after two years Europe and Singapore introduced secured electronic transaction (SET). On the other hand E-commerce has been grown very fast because of many advantages associated with buying on internet because of lower transaction and search cost as compared to other types of shopping. Through online shopping consumers can buy faster, more alternatives and can order product and services with comparative lowest price. (Cuneyt and Gautam 2004). Therefore Marketers have carefully analyzed the consumers' attitude and behavior towards the online shopping and spend billions of dollars to facilitate all the demographics of online shoppers.

II. REVIEW OF LITERATURE

The review of literature guides the researcher for getting better understanding of methodology used, limitation of various available estimation procedures, data base, lucid interpretation and reconciliation of the conflicting results. Besides this, the reviews of earlier studies explore the avenues for the present and future research related to the subject matter. A number of research studies have been carried out on different aspects of performance appraisal by the researchers, economists and academicians in the area of finance in India and abroad. A review if this analysis is important in order to develop an approach that can be employed in the context of the present study. Therefore, in this part, a review of earlier studies related to Online Trading has been made and rationale for the present study is given.

Goldsmith, 2002 in his study Nowadays, that e-commerce is necessary in various aspects of human life is undeniable. In addition, participating in global markets through efficient practices which reflect the country's economic empowerment

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urges organizations to adopt the current international system. In this context, online shopping and retailing is one of the e-commerce branches in which the internet is like a bridge between retailers and customers that helps customers buy their desirable goods every time and everywhere. Studies have shown that people who are shopping online increase every day.

Olfat et al., 2012 in their study Today, electronic commerce, i.e. exchanges between parties including organizations and individuals based on information technology, has become one of the most important issues in business. E-commerce leads to promoting communications and economic openness in national and international levels, changing business practices and converting traditional markets to modern markets. Online shopping is one of the new shopping practices which have wide advantages. Since there are a lot of online shopping throughout the whole world, identifying its influential factors can help its improvement.

Sinha, (2010) in her study, In the business to consumer (B2C) e-commerce cycle activity, consumers use Internet for many reasons and purposes such as: searching for product features, prices or reviews, selecting products and services through Internet, placing the order, making payments, or any other means which is then followed by delivery of the required products through Internet, or other means and last is sales service through Internet or other mean.

According to Ashcroft and Hoey (2001:68), the Internet has several advantages and unique characteristics. The communication processes on the Internet are swift and product delivery is almost immediate. The two-way communication process on the Internet allows the consumer and supplier/marketer/advertiser to communicate directly, which is in direct contrast to the familiar one-way business transactions conducted in traditional media. This two-way communication process demonstrates the interactive nature of this medium, which opens up the possibility for the supplier to get to know his customer and to tailor the product according to his/her specific needs.

Ashcroft and Hoey (2001:69) elaborate on the unique characteristics of the Internet by illustrating it as a medium which provides an ideal forum for group communication and interaction. This type of communication is possible because there is no need for physical presence and the normal restrictions of time and place are not prominent in web-based commercial communication.

According to Zinkhan (2000:4) academic advertising research concentrated on the audience's cognitive reactions to advertising during the 1970s. During the 1980s, this pattern changed to an increased interest in monitoring consumers' emotional reactions. Theorists thus consider different stages/phases of the consumer's response process important and also differ with regard to the sequence of these processes.

Kiani's (1998) study in which he addresses the opportunities offered by the Web to marketers, which

considers the Web as a two-way communication model in which four different communication stages can take place. Kiani's (1998) paper also suggests the necessity of the development of new concepts and models for marketers to manage their websites, due to the abilities of the new marketing medium. It is suggested that new marketing models should consider all opportunities which the interactive media can provide and that account should be taken of factors such as the attraction of users, the engagement of users' interest and participation, the detainment of users.

Scope and Importance of the Study

Dharmapuri district is a most famous district with high potential of steel products and mango. Online Purchasers who depend on government avenues to save their hard earned money. Hence this research was carried out with the Online Trading Bane or Boon in Dharmapuri District.

Statement of the Problem

Generally many companions are worn internet, but the maximum internet users are students. They use internet for reading, playing, chatting with their friends and making retail outlet etc. Hence it is inevitable to meditation the students' idea about online office. The respondents involved in this scrutiny contemplation were selected from Dharmapuri District with the arrangement of having had undergo in online buyers.

Objectives of the study

1. To analyze the Factors influencing on the Online-Trading in Dharmapuri District.
2. To analyze the Impact level of online-Trading in Dharmapuri District.
3. To suggest suitable measurements to be taken for the benefit of Online Purchaser and the Trading Company.

Hypotheses

The following hypotheses are framed and tested in this study;

1. There is no significant difference between male and female with regard to Factors influencing level.
2. There is no significant association between Educational Qualification and the Total Boon of Online Trading.

III. METHODOLOGY

i) Profile of the Study Area

Dharmapuri district is one of the southern districts of Tamil Nadu. The important towns of Dharmapuri district are Dharmapuri, Palacode and Pennagaram. The district is well connected to other districts of Tamil Nadu by established road and rail networks.

ii) Research Design

The research design is the basic framework or a plan for a study that guides the collection of data and analysis of data. In this market survey the design used is used Descriptive Research Design. It includes surveys and fact-finding enquiries of different kinds.

iii) Sample Size

The size of the sample is 150, and factors to be considered are time, cost and effectiveness. The study was conducted during the period 12th February 2nd April 2019. The respondents of the study are of Dharmapuri District.

iv) Data Collection

The collection of data is considered to be one of the most important aspects in the research methodology. Both primary

and secondary data are used in this study in order to meet the requirements of the purpose.

v) Primary Data

Under this study primary data was collected by using Structured Questionnaire. The structured questionnaire consists of both open-ended and closed-ended questions. The primary data has been collected through the questionnaire by means of personal interview. The questionnaire consists of a number of questions printed in a definite order on a form. The primary data was collected from individuals residing in Dharmapuri District.

vi) Secondary Data

The secondary data are sourced from various Life Insurance Companies, websites, Magazines, Books, Pamphlets, Periodical Surveys and Websites.

COMPONENTS OF THE RESPONDENTS BASED ON INFLUENCE YOU TO FOR THIS ONLINE TRADING

Factors Influence	Respondent	Percent	Valid Percent	Cumulative Percent
Friends	65	43.3	43.3	43.3
Own interest	44	29.3	29.3	72.7
Advertisement	25	16.7	16.7	89.3
Relative	10	6.7	6.7	96.0
Others	6	4.0	4.0	100.0
Total	150	100.0	100.0	

Sources: Primary Data

Inferences:

The above table show that 43.3 percent of the respondents are friends and 29.3 percent of the respondents are own interest and 16.7 percent of the respondents are advertisement

and 6.7 percent of the respondents are relative and 4.0 percent of the respondents are others. If clearly show that most of the respondents are friends (43.3 percent).

INDEPENDENT SAMPLE T- TEST

Gender	N	Mean	S.D	T-value	P-value
Male	94	1.90	1.068	0.466	0.241
Female	56	2.12	1.176		
Total	15				

Source: Primary Data

Inferences:

Since the P value is more than 0.05 (0.241) the null hypothesis is accepted at 5% level of significant. Hence it is concluded that there is no significant difference between male and female regard to Factors influencing level.

IV. FINDINGS, SUGGESTIONS AND CONCLUSIONS

Findings

43.3 percent of the respondents are friends and 29.3 percent of the respondents are own interest and 16.7 percent of the

respondents are advertisement and 6.7 percent of the respondents are relative and 4.0 percent of the respondents are others. It clearly shows that most of the respondents are friends (43.3 percent).

44.7 percent of the respondents are below 1 year and 35.3 percent of the respondents are 1-2 years and 13.3 percent of the respondents are 3-4 years and 6.7 percent of the respondents are above 4 years. It clearly shows that most of the respondents are below 1 year (44.7 percent).

42.0 percent of the respondents are occasionally and 24.0 percent of the respondents are others and 22.0 percent of the respondents are weekly and 12.0 percent of the respondents are daily. It clearly shows that most of the respondents are occasionally (42.0 percent).

Scope for further Research

Further research could be carried out focusing on the Consumer satisfaction level of Online Trading and the marketing level of Online Trading sector. A study could be made comparing Offline Trading and Online Trading.

Conclusion

The study has analyzed that the Online Trading Boon or bane in Dharmapuri District. This conclusion is based on Survey and its analysis. Most of the respondents are expect to

reduce the procedure for goods return time, Offer the rural area delivery facilities and State Languages. It has also offered suggestions that can be implemented for the benefit of the common public and the Online Trading Companies.

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Decision-Making Style of Purchasing Fashion Apparels among Rural Youth

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Abstract: *The purpose of this study is to examine and analyze the decision making styles of rural youth in Dharmapuri District towards fashion apparels and also tried to find out the factors influencing decision making styles. For this study the survey was conducted during 1st February to 31st March 2019. The data was collected from respondents through scheduled containing questions. The study result concluded that gender is not affecting the decision making styles. Six reliable factors of consumer decision-making styles on purchasing fashion apparels were identified in this study, which are quality, fashion, enjoyment and happiness, price, brand and familiarity. The findings in this study were useful in helping marketer to reallocate their marketing strategies and provide information to marketers about the consumer's decision-making profile of rural youth in Dharmapuri District.*

Keywords: Decision making styles, fashion apparels, buying behavior

1. Introduction

In today's society even the apparel customers like fashion trend seekers are influenced by journalists, celebrities, bloggers, magazines and brand advocates and they are regarded as “the most powerful force in the fashion marketplace.” They impact customers purchasing decisions based on their personal opinion, ability and position and are often considered experts in their field by consumers. Fashion is of great importance to many consumers, it is defined as “the process of social diffusion by which a new style is adopted by some group of consumers.” Fashion influences many aspects of our lives, it has both economic and social value and provides individuals with a tool to express themselves and create an identity. It is therefore important to understand the process of decision making within the fashion industry.

2. Scope of the Study

Philip Kotler's consumer decision making process is taken as a model. By collecting data from consumers' point of view, fresh insights can be gathered. The research also aims to serve as an indicator to potential readers of how they can tap into the decision making process influencers. Since it studies mainly the effect that blogs have on buying behaviour, which something all retailers should be aware of in order to be able to understand how behaviour patterns of modern buyers can be affected by other people's opinions.

3. Review of Literature

Fashion is one of the important factors in consumer decision-making (Gutman and Mills, 1982; Kim, 1988; King and Ring, 1980; Sproles, 1979; Sproles and Kendall, 1986). According to Kim (1988), fashion conscious consumers of the late of 20th century had strong fashion sense from the mass media and always considered before shopping. Fashion conscious consumers also tend to ignore about the quality, brand, and never compared the price.

McCracken's (1989), through his study observed that a celebrity endorser is an individual who enjoys public recognition and who uses this recognition on behalf of a consumer good by appearing with it in an advertisement.

Conner and Armitage (1998) observed that when a person decides his/her future purchase with the help of his/her past experiences of purchases, one can predict the intention of that person in the future too.

Muhammad Irfan Tariq et al. (2013) elucidated purchase intention concerning four behaviors of consumers comprising the absolute brand purchase the brand, thinking clearly to buy the brand, when someone considers to purchase the brand in the future, and to purchase the particular product absolutely.

Sedeke, (2013) explains fashion is a consistently changing industry with new products and trends being created and new designers itching to be publicized around the world at any given moment, making identification with loyal consumers and their preferences vital to any amount of success. As a low-cost form of distributing online media, specifically important to new designers whose budgets remain at lower capabilities, bloggers spend their time searching for high-quality information, including products and trends, to supplement a blog post to attract the largest audience possible.

Research Objectives

To achieve the goal of the study, the following research questions were addressed as research objectives.

- 1) To examine the association between gender and their decision making styles of buying fashion apparels in Dharmapuri District.
- 2) To analyze the decision making styles of rural youth in Dharmapuri District towards fashion apparels.

4. Research Methodology

Research methodology states what procedures were employed to carry out the research study. The technical facts about the study are given below.

This study focused on rural youth of Dharmapuri district's decision-making styles associated with fashion apparel purchases. The interview schedule was used and 114 consumers were selected from the three taluks namely Dharmapuri, Palacode and Pennagaram. A non-probability sample was used. In order to achieve the accuracy of result, a fair numbers of 65 male consumers and 49 female consumers were selected using the Quota sample based on the sex ratio. The consumer decision-making characteristic were measured by the variables are framed for this study.

Factor analysis was used to identify the highly influencing factors of decision making styles. According to Vogt (1999), factor analysis is often used in survey research questions or statements. An evidence of research in Huck (2000), he suggests that factor analysis also provides a measure of construct validity. For this purpose, factor analysis in this study was used to confirm the Consumer decision- making style and applied to convert the data into more manageable

factors about consumer decision-making styles relating to fashion apparels. In factor analysis, Varimax rotation and Kaiser-Meyer-Olkin (KMO) were used to summarize the items and to measure the sampling adequacy. KMO was extremely useful and assessed while the factor analysis was run. Generally, KMO varies from 0 to 1.0, but according to Hair et al (2006), the acceptable values of KMO statistics should higher or at least equal to 0.5 for a satisfactory factor analysis to proceed. In this study the KMO value is 0.891. At the same time, the use of varimax rotation was to achieve loadings of ones and zeros in the columns of the component matrix. Furthermore, to assess the internal consistency of each factor group, reliability test and Cronbach's alpha were used in this study. According to Sproles and Kendall (1986), the acceptable Cronbach's alpha coefficient was 0.4 or above. In our study Cronbach's alpha coefficient is 0.967.

5. Result and Discussion

This section deals with the testing of hypotheses by using appropriate statistical tools. SPSS 20 software has been used for the purpose of analyzing responses gathered.

H0: There is no significant association between gender and their decision making styles of buying fashion apparels

Gender and Decision Making Styles of Buying Fashion Apparels

Gender	Decision Making Styles				Chi-Square	p Value	H0 Accepted/ Rejected
	Decision Making under Certainty	Decision Making under Risk	Decision Making under Uncertainty	Total			
Male	15	30	20	65	1.090 ^a	0.580	Accepted
	23.1%	46.2%	30.8%	100.0%			
Female	14	24	11	49			
	28.6%	49.0%	22.4%	100.0%			
Total	29	54	31	114			
	25.4%	47.4%	27.2%	100.0%			

Source: Primary Data

Inference

The above table exhibit that the p value is higher than 0.05. So the null hypothesis is accepted at 5% level of significance. Hence it is concluded that there is no significant association among gender and their decision making styles of buying fashion apparels.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.891
Bartlett's Test of Sphericity	Approx. Chi-Square	3119.813
	df	630
	Sig.	.000

Source: Computed Data.

From the above table, it is known that Kaiser-Meyer-Olkin measure of sampling adequacy is 0.891 and Bartlett's Test of Sphericity's approximate Chi-Square value is 3119.813 which are statistically significant at 5% level.

Communalities

Factors influencing decision making style	Initial	Extraction
q6.1 I am an experienced user of fashion clothing	1.000	0.728
q6.2 Fashion clothing is a significant part of my life	1.000	0.724
q6.3 I usually dress for fashion	1.000	0.644
q6.4 I am interested in fashion clothing	1.000	0.659
q6.5 I go shopping to keep up with the trends	1.000	0.560
q6.6 I am very familiar with fashion clothing	1.000	0.666
q6.7I feel I know a lot about fashion clothing	1.000	0.728
q6.8 I would classify myself as an expert on fashion clothing	1.000	0.597
q6.9 For me fashion clothing is an important product	1.000	0.736
q6.10 Shopping for clothing is not a pleasant activity for me	1.000	0.701
q6.11 Going shopping for clothing is one of the enjoyable activities in my life	1.000	0.656
q6.12 I enjoy shopping just for the fun of it	1.000	0.669

q6.13 I do my shopping quickly	1.000	0.753
q6.17 Shopping for clothing satisfies my sense of curiosity	1.000	0.629
q6.18 The higher the price of clothing, the better the quality	1.000	0.621
q6.19 Nice departments and specialty stores offer me the best clothing	1.000	0.782
q6.20 The most advertised brands are usually very good choices	1.000	0.682
q6.21 The well-known brands of clothing are best for me	1.000	0.690
q6.22 The more expensive brands of clothing are usually purchased by choice	1.000	0.755
q6.23 I prefer buying the bestselling brands of clothing	1.000	0.652
q6.24 I keep my wardrobe up to date with the changing fashion	1.000	0.707
q6.25 Fashionable, attractive styling is very important for me	1.000	0.660
q6.26 To get variety, I shop at different stores and chose different brands	1.000	0.666
q6.27 It's fun to buy new and exciting clothing	1.000	0.746
q6.28 It's fun to buy new and exciting clothing	1.000	0.613
q6.29 Getting very good quality is important to me	1.000	0.750
q6.30 When it comes to purchasing clothing, I try to get the best or make the perfect choice	1.000	0.749
q6.31 In general, I try to buy the best overall quality in clothing	1.000	0.730
q6.32 I make a special effort to choose the very best quality clothing	1.000	0.702
q6.33 My standards and expectations for clothing I buy are very high here are so many brands to	1.000	0.715
q6.34 Choose from that I often feel confused	1.000	0.523
q6.36 The more I learn about clothing, the harder it seems to choose the best	1.000	0.576
q6.37 All the information I get on different products confuses me	1.000	0.649
q6.38 I have favorite brands I buy over and over	1.000	0.721
q6.39 Once I find a brand of clothing I like, I stick to it	1.000	0.722
q6.40 I go to the same stores each time I shop for clothing	1.000	0.538

Extraction Method: Principal Component Analysis.

The communalities in the column labeled extraction reflect the common variance in the data structure. For example, it can be said that, 72.8% of the variance associated with question 1 is common or shared variance. Another way to look at these communalities is in terms of the proportion of

variance explained by the underlying factors. After extraction some of the factors are discarded and so some information is lost. The amount of variance in each variable that can be explained by the retained factors is represented by the communalities after extraction.

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.490	45.805	45.805	16.490	45.805	45.805	6.306	17.517	17.517
2	2.659	7.387	53.192	2.659	7.387	53.192	5.767	16.020	33.537
3	1.470	4.085	57.277	1.470	4.085	57.277	3.543	9.842	43.379
4	1.346	3.739	61.016	1.346	3.739	61.016	3.300	9.168	52.547
5	1.248	3.466	64.482	1.248	3.466	64.482	3.123	8.676	61.223
6	1.187	3.296	67.778	1.187	3.296	67.778	2.360	6.555	67.778
7	.941	2.615	70.392						
8	.899	2.497	72.890						
9	.806	2.238	75.127						
10	.726	2.018	77.145						
11	.689	1.915	79.060						
12	.677	1.881	80.941						
13	.627	1.741	82.682						
14	.574	1.595	84.277						
15	.527	1.464	85.741						
16	.477	1.326	87.067						
17	.471	1.309	88.376						
18	.424	1.177	89.553						
19	.387	1.076	90.629						
20	.368	1.022	91.652						
21	.333	.924	92.575						
22	.307	.853	93.428						
23	.291	.809	94.238						
24	.276	.765	95.003						
25	.253	.703	95.706						
26	.218	.604	96.310						
27	.203	.565	96.875						
28	.199	.551	97.426						
29	.170	.471	97.897						
30	.145	.402	98.299						

31	.139	.387	98.685						
32	.122	.338	99.023						
33	.114	.318	99.341						
34	.096	.266	99.607						
35	.088	.246	99.853						
36	.053	.147	100.000						

Extraction Method: Principal Component Analysis.

In the above table, it can be noted that six factors have been extracted on the basis of prior knowledge to describe the relationship among the variables. Further, the scree plot associated with this analysis is given in Chart xxx in the scree plot, it can be noted that a distinct break occurs at six

factors. Finally, from the cumulative percentage of variance accounted for, it can be seen that 67.778 percent of variance, as contributed by first component (17.517 percent) followed by second component (16.020 percent) the third (9.842 percent) the fourth (9.168 percent) the fifth (8.676 percent) and sixth (6.555 percent) of total variance.

Rotated Component Matrix^a

Factors influencing decision making style	Component					
	1	2	3	4	5	6
Quality						
q6.31 In general, I try to buy the best overall quality in clothing	0.774					
q6.32 I make a special effort to choose the very best quality clothing	0.740					
q6.39 Once I find a brand of clothing I like, I stick to it	0.739					
q6.30 When it comes to purchasing clothing, I try to get the best or make the perfect choice	0.717					
q6.33 My standards and expectations for clothing I buy are very high here are so many brands to	0.684					
q6.38 I have favorite brands I buy over and over	0.626					
q6.36 The more I learn about clothing, the harder it seems to choose the best	0.559					
q6.40 I go to the same stores each time I shop for clothing	0.557					
q6.34 Choose from that I often feel confused	0.529					
Fashion						
q6.71 feel I know a lot about fashion clothing		0.773				
q6.2 Fashion clothing is a significant part of my life		0.739				
q6.3 I usually dress for fashion		0.692				
q6.1 I am an experienced user of fashion clothing		0.680				
q6.4 I am interested in fashion clothing		0.671				
q6.8 I would classify myself as an expert on fashion clothing		0.666				
q6.9 For me fashion clothing is an important product		0.656				
q6.10 Shopping for clothing is not a pleasant activity for me		0.606				
q6.5 I go shopping to keep up with the trends		0.588				
Enjoyment and Happiness						
q6.26 To get variety, I shop at different stores and chose different brands						
q6.13 I do my shopping quickly			0.797			
q6.17 Shopping for clothing satisfies my sense of curiosity			0.724			
q6.18 The higher the price of clothing, the better the quality			0.604			
q6.12 I enjoy shopping just for the fun of it			0.521			
q6.28 It's fun to buy new and exciting clothing			0.515			
Price						
q6.11 Going shopping for clothing is one of the enjoyable activities in my life				0.716		
q6.29 Getting very good quality is important to me				0.578		
q6.27 It's fun to buy new and exciting clothing				0.536		
q6.22 The more expensive brands of clothing are usually purchased by choice				0.529		
q6.23 I prefer buying the bestselling brands of clothing				0.516		
q6.24 I keep my wardrobe up to date with the changing fashion				0.498		
Brand						
q6.21 The well-known brands of clothing are best for me					0.711	
q6.37 All the information I get on different products confuses me					0.657	
q6.25 Fashionable, attractive styling is very important for me					0.578	
Familiarity						
q6.19 Nice departments and specialty stores offer me the best clothing						0.715
q6.20 The most advertised brands are usually very good choices						0.615
q6.6 I am very familiar with fashion clothing						0.569

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Inference

From the above table, it can be noted that nine variables are grouped under the first factor named as “Quality”. The second factor also consisting of nine variables is named as “Fashion”. The third factor named as “Enjoyment and Happiness” is formed with five variables. The fourth factor consisting of six variables is named as “Price”. The fifth factor named as “Brand” consisting of three variables. The last factor named as “Familiarity” consist of three variables. This table reveals that the factor analysis results in

six predominant factors. The entire variable in these six factors are compounded into the demographic profile of the respondents with the help of appropriate statistical tools.

Friedman Rank Correlation factors influencing decision making styles of buying fashion apparels

H₀: There is no significant relationship among factors influencing decision making styles of buying fashion apparels

Table: Factors for Decision Making Style

Factors	N	Mean	Std. Deviation	Mean Rank	Rank	Chi Squire	p Value	H0
Quality	114	29.63	8.231	5.55	1	494.632	<0.001	Rejected
Fashion	114	27.11	7.681	5.20	2			
Price	114	19.76	5.400	3.71	3			
Enjoyment & Happiness	114	18.74	5.388	3.48	4			
Familiarity	114	9.68	2.734	1.56	5			
Brand	114	9.56	2.704	1.50	6			

Source: Computed Data

Inference

The above table indicates that p value is less than 0.05, the null hypothesis is rejected at 5% level of significance. Hence it is concluded that there is significant relationship between among factors influencing decision making styles of buying fashion apparels. Based on mean rank 8.231 **quality** is the most important factor for among factors influencing decision making styles of buying fashion apparels followed by **fashion** with mean rank of 7.681, **price** with mean rank of 5.4, **enjoyment & happiness** mean rank with 5.366, **familiarity** with mean rank of 2.734 and brand mean rank of 2.704.

6. Conclusion

Retailers in emerging markets face a challenge of growing consumer preferences for international brands with strong brand images in developed countries. Intense competition in retailing industry urges retailers to find new ways how to increase their profits and returns of investment. To do so they need to know their consumers better.

Six reliable factors of consumer decision-making styles on purchasing fashion apparels were identified in this study, which are quality, fashion, enjoyment and happiness, price, brand and familiarity. The findings in this study were useful in helping marketer to reallocate their marketing strategies and provide information to marketers about the consumer’s decision-making profile of rural youth in Dharmapuri District.

7. Scope for Further Research

This research is limited to Dharmapuri district only which may not be applicable to entire nation. Further research may be conducted in the different parts of the country with same title.

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Students' Attitude towards Online Shopping in Dharmapuri District, Tamil Nadu.

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Abstract

The present study focuses on the attitude of online shopping among college students in Dharmapuri District. Students are one of the target markets towards the online retailer as they have money and interest. Most of these students are not working and most of them are getting financial assistants from their parents. The purpose of this study is to analyze factors that influence student's attitude towards online shopping. Descriptive study was conducted and well structured interview schedule was developed to collect data from college students through convenience sampling method. Collected data were analyzed and the Cronbach's Alpha is 0.842. Factor reduction technique, Friedman test, ANOVA and Correlation were used to assess the differences between independent variable such as gender, age and income dependant variable such as students' attitude towards online shopping. The findings revealed that there is no significant difference in attitude towards online shopping and socio-demographic variables.

Key words: Online shopping, Student Attitude, Buyer Behaviour

Introduction

In the digital era, shopping through internet is becoming progressively significant and several people prefer this channel, when they want to buy something. Online shopping is very common in developed countries, it is growing in Indian market, which is a large customer

market, is still not in line with the global market. According to India B2C E- Commerce Report 2013, e-tailing accounts for less than one percent of the overall retail market in India in 2012. While it accounts for over 5 percent if the total retail market in China and 10% in the UK and the US. It allows consumers to directly buy goods or services from a seller over the internet using a web browser and mobile apps. Online shopping offers a new atmosphere notable from the traditional ways of doing business. It is great because people are able to shop 24 hours a day without having to leave their home or anywhere. The development of smart phone technology and high speed internet services the youngsters' potential interest in the internet has enabled online shopping to acquire considerable interest in recent years. As the youngsters especially the college students would like to be more modern in every part of their life, the study on their attitude towards the modernized purchase namely 'online shopping' becomes essential in this digital era.

Scope of the Study

Although there has been much research about online shopping behaviors, most of it has focused on the entire population, including all age groups, and most of it does not have a specific group of people on which to do detailed analysis. Besides, most of the research does not include the effect of online shopping on the shopping habits of college students. Therefore, this study focuses on Online shopping attitude of one group of people, which is college students of Dharmapuri District, Tamil Nadu.

Review of Literature

Syuhaily Osman and et al., (2010) in their article, "Under graduates and Online Purchasing Behaviour", examined the attitude of University Putra Malaysia students towards online purchasing. They concluded that the purchase perception and website quality have

direct influence on the attitude towards online purchasing.

Ruvini & Weerasinghe (2014) were studied the online shopping behaviour of Sri Lankan young adults' of higher education sector. In their study they identified that the relationship between brand satisfaction and brand loyalty was established even in the online shopping environment. A clear relationship between the average price paid and the brand loyalty was not established and it could be concluded that the price may be one of the variables young shoppers looked at whilst many other variables, such as brand, design/features etc. may exist. In general, the effect of 'brand' plays a major role in online purchasing decisions.

Lim Yi Jin & et al (2015) identified in their study titled, Attitude towards Online Shopping Activities in Malaysia Public University that the university students are moving towards adopting online shopping as the shopping platform when they think positively on performing online purchases.

Yunxiao Diao (2015) in his study titled "Online shopping behavior among Chinese university students" he explains that, people can have a better understanding of online shopping customers' traits and even business experts can give more accurate advice to merchants and make more precise forecasts of the overall trend of online shopping. Students like to buy clothes and food through online shopping.

Lalitha & Chandra Sekhar (2016) They revealed in their research, the four important factors viz. perceived risk, perceived enjoyment, perceived ease of use and

perceived usefulness to be affecting the online shopping behavior of consumers in Delhi. Out of four, Perceived Risk is the most significant factor that may affect online shopping behavior of consumers in Delhi. Perceived risk indicates the lack of trust among consumers and many other reasons like that of chance of being cheated, inferior quality of products, non returnable policy etc.

Yi Jin Lim & et al (2016) conducted a study on “Factors Influencing Online Shopping Behavior: The Mediating Role of Purchase Intention” and they identified the relationship between subjective norms, perceived usefulness and online shopping behavior while mediate by purchase intention. 662 questionnaires were collected from the students of higher learning institution in Perlis, Malaysia. It concluded that subjective norms and perceived usefulness significantly influence online purchase intention. It also revealed that purchase intention significantly influence online shopping behavior.

Pawan Kumar (2017) explains clearly in his study that students are mostly go for online shopping. Factors such as quality of products, delivery time, products checking on the spot, return policy etc. which customer looks before online shopping. So the online websites must look after those factors to be successful and retain the customers. The online shopping is growing in bright mode among students of Ludhiana and decision of demonetization will help the online websites to attract more and more customers.

Guled Aden Farah & et al (2018) explains in their research the online web store functionality are the top most influencing factors followed by privacy, firm reputation, perceived value and low influencing factor trust. This study concluded that functionality is the most influencing factor which makes the online shopping easy and convenient to the

users.

Muralidharan & et al (2018) identified in their study that the men more interested in buying online than women. From the results of the study, it is arrived that the college students i.e. the people between the age group of 19-22 are the one who purchase through internet more often. They mostly use online shopping to buy electronic devices since there are various special offers and discounts for electronic gadgets in online sites which will not be available in any of the retail shops.

Thirupathi & James (2019) revealed that, majority of the people were induced by sales promotional activities, product delivery, convenience price, availability and mode of payment and these are important parameters which motivate the consumers to purchase online.

Research Objective

To achieve the goal of the study, the following research question was addressed as research objective is to analyze the factors influencing students' attitude towards online shopping in Dharmapuri District.

Research Methodology

Research methodology states what procedures were employed to carry out the research study. The technical facts about the study are given below. This study focused on students' attitude towards online shopping in Dharmapuri District. The interview schedule was used and 250 online shopping student buyers were selected from the District. A non-probability sample was used. In order to achieve the accuracy of result, a fair numbers of 130 male consumers and 120 female online buyers were selected using the convenient

sampling method. The purchase attitude of College students towards online shopping were measured by the variables are framed for this study.

Implications and Discussion

This section deals with the testing of hypotheses by using appropriate statistical tools.

SPSS 20 software has been used for the purpose of analyzing responses gathered.

Variables	Categories	Frequency	Percentage
Age	Upto 19 years	71	28.4
	20 - 25 years	80	32.0
	26 - 30 years	65	26.0
	31 and above	34	13.6
	Total	250	100.0
Education	Diploma	48	19.2
	Under Graduation	110	44.0
	Post Graduation	60	24.0
	Research Scholars	32	12.8
	Total	250	100.0
Family Monthly Income	Upto Rs. 10,000	69	27.6
	Rs. 10,001 to Rs. 15,000	54	21.6
	Rs. 15,001 to Rs. 20,000	45	18.0
	Above Rs. 20,000	82	32.8
	Total	250	100.0
Online Shopping Experience	Less than 1 year	120	48.0
	1 to 2 years	39	15.6
	2 to 3 years	59	23.6
	More than 3 years	32	12.8
	Total	250	100.0
Preference of Online Shopping Websites	Amazon	96	38.4
	Flipkart	61	24.4
	Seapdeal	47	18.8
	E Bay	30	12.0
	Jobang	16	6.4
	Total	250	100.0
Products mostly purchased online	Clothing	54	21.6
	Entertainment Tickets	13	5.2
	Books & Materials	70	28.0
	Electronics and Mobiles	52	20.8
	Travel Tickets	61	24.4
	Total	250	100.0
Made of Payment	Net Banking	79	31.6
	Credit Card	34	13.6

	Debit Card	62	24.8
	Cash on Delivery	75	30.0
	Total	250	100.0
Mode of Shopping	Websites	150	60.0
	Mobile Applications	100	40.0
	Total	250	100.0

Source: Primary Data

Inference

Demographic profile has been obtained from the responses and it was found that majority of the respondents are in the age group of 20-25 years of age, which is obvious since the target population are the students. Gender wise 52% of the respondents are male and the rest are female. Education levels of the respondents are 19.2% Diploma, 44% under graduate, 24% are graduate and 12.8 % are research scholars. Family monthly income wise, 32.8% above Rs. 20,000, 27.6% are in below Rs. 10,000 income group, 21% are in Rs. 10,001 to Rs. 15,000 and 18% are belongs to Rs. 15,001 to Rs. 20,000. Out of 250 respondents it was found that 48% of the student respondents have less than one year of online shopping experience. 23.6% of respondents have 2 – 3 years of online shopping experience. Majority of student respondents (38.4%) are prefer Amazon for online shopping. 28.4% prefers Flipkart, 18.8% are prefer snapdeal, 12% respondents shop through E Bay and 6.4% purchase through Jobang website. Mostly (28%) books and materials are purchased by students through online by college students. 21.6% are shops clothing; Travel tickets are purchased through online by 24.4% and 20.8% buy electronics and mobile through online. Online shopping provides different modes of payments. 31.6% are making payment through net banking system. 30% are paying cash on delivery and 24.8% are using debit card for online shopping payments. 60% of student respondents using shopping websites like Amazon, Flipkart etc. for purchasing products online and 40% using mobile apps for online shopping.

Hypothesis Testing

H₀: There is no significant association between Age and factors influencing students’ attitude towards online shopping

Age and factors influencing students’ attitude towards online shopping

Factors	Age	Sum of Squares	df	Mean Square	F	Sig.	H0 Accepted/Rejected
Convenience	Between Groups	267.016	3	89.005	1.914	0.128	Accepted
	Within Groups	11439.480	246	46.502			
	Total	11706.496	249				
Stress less Shopping	Between Groups	88.999	3	29.666	2.260	0.082	Accepted
	Within Groups	3229.037	246	13.126			
	Total	3318.036	249				
Quality Products	Between Groups	7.188	3	2.396	0.329	0.805	Accepted
	Within Groups	1792.816	246	7.288			
	Total	1800.004	249				
Availability of Product Offers	Between Groups	40.566	3	13.522	1.896	0.131	Accepted
	Within Groups	1754.458	246	7.132			
	Total	1795.024	249				
Financial Security	Between Groups	25.556	3	8.519	1.619	0.185	Accepted
	Within Groups	1294.140	246	5.261			
	Total	1319.696	249				

Source: Primary Data

Inference

The above one way ANOVA table exhibit that the p value is higher than 0.05. So the null hypothesis is accepted at 5% level of significance. Hence it is concluded that there is no significant association among age and factors influencing students’ attitude towards online shopping.

Factor Analysis

Factor analysis was used to identify the highly influencing factors of decision making styles. According to Vogt (1999), factor analysis is often used in survey research questions or statements. An evidence of research in Huck (2000), he suggests that factor analysis also provides a measure of construct validity. For this purpose, factor analysis in this study

was used to confirm the Consumer decision- making style and applied to convert the data into more manageable factors about consumer decision-making styles relating to fashion apparels.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.845
Bartlett's Test of Sphericity	Approx. Chi-Square	2082.858
	Df	210
	Sig.	<0.001

Varimax rotation and Kaiser-Meyer-Olkin (KMO) were used to summarize the items and to measure the sampling adequacy. KMO was extremely useful and assessed while the factor analysis was run. Generally, KMO varies from 0 to 1.0, but according to Hair et al (2006), the acceptable values of KMO statistics should higher or at least equal to 0.5 for a satisfactory factor analysis to proceed. In this study the KMO value is 0.845. At the same time, the use of Varimax rotation was to achieve loadings of ones and zeros in the columns of the component matrix. Furthermore, to assess the internal consistency of each factor group, reliability test and Cronbach’s Alpha were used in this study. According to Sproles and Kendall (1986), the acceptable Cronbach’s Alpha coefficient was 0.4 or above. In our study Cronbach’s Alpha coefficient is 0.842.

Communalities

Factors	Initial	Extraction
Q1 Online Shopping Saves Time	1.000	.506
Q2 Shopping Can be done any time at any ware	1.000	.636
Q3 Wide Varity of Products	1.000	.609
Q4 Accurate description about product	1.000	.561
Q5 Online shopping is as secure as traditional shopping	1.000	.637
Q6 Online shopping is risky	1.000	.644

Q7 Longtime is required for the delivery of product	1.000	.639
Q8 Necessity of having bank A/C or credit card create difficulty	1.000	.708
Q9 Risk of losing privacy	1.000	.574
Q10 Complex compared to traditional shopping	1.000	.623
Q11 Availability of products	1.000	.692
Q12 No need to travel to the shop	1.000	.698
Q13 Availability of payment options	1.000	.527
Q14 After Sales Service	1.000	.612
Q15 User friendly web page	1.000	.732
Q16 Comparison of Products	1.000	.682
Q17 Special Offers	1.000	.453
Q18 Quality of Products	1.000	.434
Q19 Delivery Performance	1.000	.611
Q20 Price consciousness	1.000	.482
Q21 Easy of online purchase procedure	1.000	.635

Extraction Method: Principal Component Analysis.

The communalities in the column labeled extraction reflect the common variance in the data structure. Communalities are in terms of the proportion of variance explained by the underlying factors. After extraction some of the factors are discarded and so some information is lost. The amount of variance in each variable that can be explained by the retained factors is represented by the communalities after extraction.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.537	31.129	31.129	6.537	31.129	31.129	4.868	23.183	23.183
2	2.397	11.414	42.542	2.397	11.414	42.542	2.715	12.929	36.112
3	1.470	6.998	49.541	1.470	6.998	49.541	1.896	9.027	45.139
4	1.290	6.143	55.684	1.290	6.143	55.684	1.746	8.316	53.454
5	1.004	4.783	60.467	1.004	4.783	60.467	1.473	7.013	60.467
6	.955	4.547	65.014						
7	.803	3.825	68.839						

8	.760	3.620	72.459					
9	.699	3.326	75.786					
10	.637	3.033	78.819					
11	.629	2.996	81.815					
12	.566	2.697	84.512					
13	.563	2.679	87.191					
14	.486	2.314	89.505					
15	.419	1.993	91.498					
16	.398	1.894	93.392					
17	.376	1.792	95.184					
18	.332	1.582	96.767					
19	.269	1.281	98.048					
20	.208	.989	99.036					
21	.202	.964	100.000					

Extraction Method: Principal Component Analysis.

From the above table, it can be noted that five factors have been extracted on the basis of prior knowledge to explain the correlation among the variables. From the cumulative percentage of variance accounted for, it can be seen that 60.467 percent of variance, as contributed by first component (23.183 percent) followed by second component (12.929 percent) the third (9.027 percent) the fourth (8.316percent) and the fifth (7.013 percent) of total variance.

Rotated Component Matrix^a

Factors	Component				
	1	2	3	4	5
Convenience					
Q8 Necessity of having bank A/C or credit card create difficulty	.795				
Q2 Shopping Can be done any time at any ware	.773				
Q7 Longtime is required for the delivery of product	.758				
Q6 Online shopping is risky	.745				
Q3 Wide Varity of Products	.741				
Q5 Online shopping is as secure as traditional shopping	.695				
Q4 Accurate description about product	.640				
Q1 Online Shopping Saves Time	.632				
Stress less Shopping					

Q12 No need to travel to the shop		.802			
Q11 Availability of products		.777			
Q10 Complex compared to traditional shopping		.660			
Q13 Availability of payment options		.634			
Quality Products					
Q19 Delivery Performance			.777		
Q21 Easy of online purchase procedure			.762		
Q18 Quality of Products			.560		
Availability of Product Offers					
Q15 User friendly web page				.846	
Q16 Comparison of Products				.812	
Q17 Special Offers				.450	
Financial Security					
Q9 Risk of losing privacy					.658
Q14 After Sales Service					.570
Q20 Price consciousness					.441

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 9 iterations .

Inference

From the above table, it can be noted that eight variables are clustered under the first factor named as “**Convenience**”. The second factor consists of four variables and it’s named as “**Stress less Shopping**”. The third factor named as “**Quality Products**” is formed with three variables. The fourth factor consisting of three variables is named as “**Availability of Product Offers**”. The fifth factor named as “**Financial Security**” includes three variables.

Component Transformation Matrix

Component	1	2	3	4	5
Convenience	.822	.520	.004	-.005	.232
Stress less Shopping	-.087	.000	.722	.613	.308
Quality Products	-.389	.551	-.530	.487	.163
Availability of Product Offers	.406	-.501	-.346	.614	-.296
Financial Security	-.023	.418	.279	.099	-.859

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

Component Transformation Matrix explains that the factor analysis results in five predominant factors. The entire variables in these five factors are compounded into the demographic profile of the respondents with the help of appropriate statistical tools.

Friedman Test for factors influencing students’ attitude towards online shopping

H₀: There is no significant relationship among factors influencing students’ attitude towards online shopping

Friedman Test

Factors	N	Mean	Std. Deviation	Mean Rank	Rank	Chi-Square	Asymp. Sig.
Convenience	250	24.50	6.857	4.93	1	564.715	0.000
Stress less Shopping	250	12.68	3.650	3.15	2		
Quality Products	250	11.23	2.689	2.69	3		
Availability of Product Offers	250	10.35	2.685	2.26	4		
Financial Security	250	9.90	2.302	1.97	5		

Source: Computed Data

Inference

The above table indicates that p value is less than 0.05; the null hypothesis is rejected at 5% level of significance. Hence it is concluded that there is significant relationship between among factors influencing students’ attitude towards online shopping. Based on mean rank 4.93 **Convenience** is the most important factor for among factors influencing students’ attitude towards online shopping followed by **Stress less Shopping** with mean rank of 3.15, **Quality Products** with mean rank of 2.69, **Availability of Product Offers** mean rank with 2.26 and **Financial Security** with mean rank of 1.97.

Correlation Analysis

In this study, correlation analysis was performed to study the relationship between conveniences, stress less shopping, quality products, availability of product offers and

financial security.

H₀: There is no significant correlation among convenience, stress less shopping, quality products, availability of product offers and financial security in online shopping.

Correlation Analysis

Factors		Convenience	Stress less Shopping	Quality Products	Availability of Product Offers	Financial Security
Convenience	Pearson Correlation	1	.609**	.015	.014	.418**
	Sig. (2-tailed)		.000	.810	.822	.000
	N	250	250	250	250	250
Stress less Shopping	Pearson Correlation	.609**	1	-.028	.038**	.459
	Sig. (2-tailed)	.000		.657	.545	.000
	N	250	250	250	250	250
Quality Products	Pearson Correlation	.015	-.028	1	.253	.221
	Sig. (2-tailed)	.810	.657		.000	.000
	N	250	250	250	250	250
Availability of Product Offers	Pearson Correlation	.014	.038	.253**	1	.228
	Sig. (2-tailed)	.822	.545	.000		.000
	N	250	250	250	250	250
Financial Security	Pearson Correlation	.418**	.459**	.221**	.228**	1**
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	250	250	250	250	250

** . Correlation is significant at the 0.01 level (2-tailed).

The above table shows that relationship between factors influencing students’ attitude towards online shopping (Convenience, Stress less Shopping, Quality Products, Availability of Product Offers and Financial Security) are significant at 1% level and shows positive relationship among factors. It also shows that higher positive relationship (0.609) exists between convenient shopping and Stress less Shopping. Therefore H₀₁ is rejected. There is a significant correlation among convenience, stress less shopping, quality products, availability of product offers and financial security in online shopping.

Conclusion

Online shopping is a borderless entity, which helps the consumers to buy directly from the seller. Factors such as gender, age, education, family monthly income, mode of

payment, mode of shop online, Products mostly purchased online shopping experience were considered as demographic factors. This paper examined the college students' attitude towards online shopping by using primary data collected from the respondents in Dharmapuri District.

First, the analysis in ANOVA test found that there is no significant association among different age group of the respondents and factors influencing students' attitude towards online shopping. Secondly, the factor analysis results in five predominant factors. It found that there are eight variables are clustered under the first factor named as "Convenience". The second factor consists of four variables and it's named as "Stress less Shopping". The third factor named as "Quality Products" is formed with three variables. The fourth factor consisting of three variables is named as "Availability of Product Offers". The fifth factor named as "Financial Security" includes three variables. The relationship between factors influencing students' attitude towards online shopping (Convenience, Stress less Shopping, Quality Products, Availability of Product Offers and Financial Security) are highly correlated and it shows positive relationship among factors. There is a significant correlation among convenience, stress less shopping, quality products, availability of product offers and financial security in online shopping. The findings in this study were useful to online sellers for change their marketing strategies and provide information regarding convenience, stress less shopping, quality products, availability of product offers and financial security and products and polices relating to rural youth in Dharmapuri District.

Scope for Further Research

This research is limited to College Students of Dharmapuri district only which may not be applicable to entire online shoppers in the nation. Further research may be conducted in the different income group of online buyers in different parts of the country.

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Working Class Awareness and Preference Towards High End Consumer Durables (Luxury Durables) with Special Reference Towards Dharmapuri District

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ABSTRACT

India is the fastest growing economy and second largest by population and it has the highest growth consumption, the per capita income has increased in this century. This has put more disposable cash in the pockets of consumers, besides this the growth of young urban consumers, nuclear families, growth in aspirations, digital influence and digital access becomes more and more affordable, along with increasing product awareness and a shift in lifestyle patterns, consumer spending on electronics and home appliances could see strong growth in next five years. The objectives of the study is to identify the working class awareness towards high end durables and the preference of consumers towards high end consumer durables. Non probability sampling method (convenience method) is adopted to in this study and questionnaire is used to collect data's from 250 respondents in Dharmapuri District

Key words: Consumer Durables, Increased Consumption, Disposable Income

INTRODCUTION

Indian consumer durable market has grown tremendously in the last few decades. The consumer electronic market has increased at 11 percent CAGR between fiscal year 2012-2017 and the industry is expected to grow at 13 percent by 2020 and India is the third largest consumer durable industry in the world This has driven by changed living standard (life style) of people, increased income (dual income), higher level of working women population, high spending power, increased electrification and drastic change/advancement in

technology with significant increase in discretionary income and easy finance schemes have led to shortened product replacement cycles and evolving life style where consumer durables TV's (OLED, LED, UHD, Smart), refrigerator (French door, side by side and top mounted) & washing machine (front loaded and top loaded) are perceived as utility items rather than luxury possessions. Besides this India has huge untapped market currently 29 percent of house hold in India own consumer durable items.

REVIEW OF LITERATURE

The literature of review is essential step in each and every research process. Besides, this review of earlier studies appraise the avenues of present and future research related to the subject matter. The various studies related to purchase behavior, product preference, decision making, attitudinal predictions was used. The present study covers working class awareness and preference towards high end (luxury) consumer durables.

Elizabeth (1958) investigation revealed that in the American family, economic decisions were most commonly made jointly by husband and wife. There also seemed to be an implicit division of responsibility, growingly more pronounced with increasing age and the length of marriage. The husband played a major role in planning car purchases and the wife in planning home appliances purchases.

Study done by **Daniel and staff (1958)** focused 12 products grouped into 8 categories which includes both durable and non-durables. Result showed that wives expressed few brand preferences for predominantly masculine non-durable products. They did most of the shopping with an awareness of the brands their husbands preferred. The influences the husband and wives varied by sub-divisions on the durables goods categories.

Kapoor (1960) in his study on the "Durable consumer goods"

revealed that the growth patterns in actual production and capacities of the consumer goods and concludes that rising income, urbanization and education are having a great impact on the Indian consumption pattern and the growing component of discretionary expenditure.

A survey conducted by **Subhas (1973)** during March-April 1972 shows that the upper income households those with income above ₹12,000 p.a possess a better ownership of consumer durables like scooter, furniture, electronic appliance etc. The study further stated that the companies have failed to exploit the market potential in rural areas.

George and Terry (1982) stated that it has been recognized for some time that brand attitudes can be useful predictors of subsequent brand choices when the proper measures are used and when few events intervene between attitude measurements and behaviour. A survey has been conducted on major appliances, purchasing behaviour and its relationship to pre search attitude and awareness data. The data relating to these aspects were obtained as a part of 2,350 U.S.A households. Results indicated that awareness of and attitudes towards major appliances brands were only weakly related to subsequent brand choices. Attitudes towards brands of major appliances seen to be formed primarily through a process of learning without involvement. Results suggested that attitudes derived from previous satisfactory experience with other products, in the line, which are reinforced with consistent brand advertising are more resistant to change.

An article by **Barry (1992)** revealed that replacement of durables account for a substantial position of sale of consumer durables in U.S.A. the study was conducted to develop a better understanding of the timing of durable goods replacement purchases. The characteristics of the consumer placing a product during the early and latter parts in the product's life time were compared. A cross sectional design was used to

investigate the degree to which consumer characteristics attitude, perceptions and search behaviour are associated with the timing of replacements. Result based on univariate and multivariate analysis of replacement buyers are more concerned with styling and image and less concerned with cost than “late” replacement buyers.

Jose and Pavles (1994) stated in their empirical study the impact of three socio economic factors- education, occupation and income ; and four attitudes –activism, low community stratification, mass media participation and consumer modernism on the acquisition of novel technological consumer durable goods. Path analysis is used to test the significance of these variables. The findings revealed that the impact of socio- economic factors such as education, occupation and income in developing countries are expected to be positively related to innovativeness.

In an article by **William et al (1998)** examined the impact of national identity, cultural values, country of origin effects and selected demographics can the intension to buy foreign made appliances. Specifically the study examines Japanese refrigerators versus U.S. refrigerators, although the Japanese have been in the market for the longest period and have similar cultural back grounds with Taiwanese, the study reveals that U.S. made refrigerators are held in higher esteem by younger, well-educated and high income consumers.

Suman and Shukla (2003) pointed out the survey conducted by NCAER about selected consumer durable products. The study was conducted in both rural and urban areas on the basis of multistage, stratified sampling techniques. The study concluded with the fact that between 1987-88 and 1988-99 the income distribution of households has undergone a significant change, which the share of low income households in the total population decreased sharply which in turn leads

to increase in consumer durable products in both urban and rural areas but the proportion of rural is increasing at an increasing rate when compared to urban.

The diffusion of innovation can be traced as by **Rogers E (1962)** , to the beginning of this century and has included investigations of the diffusion of new products, processes and organization practices. Towards the middle of this century, this body of work came to be dominated by the epidemic model of diffusion, represented by the logistic equation and now familiar S-curve. The S-shaped curve has remained one of the central 'stylized facts' of much of the subsequent work . Another characteristic of much of the innovation diffusion has been the attention paid to the adoption of technologies between firms, ignoring the diffusion of consumer goods. Companies are adopting emerging disruptive technologies like social media, mobility, cloud and data. Combination and convergence of these technologies is leading to the emergence of new products and solutions offering. With the multiplying smart devices, instant connectivity and massive growth of social media, customers today demand real time communication and consistent experience across channels. Companies are leveraging disruptive technologies to not just meet these changed expectations, but also to innovate and present cutting-edge products and solutions.

SCOPE OF THE STUDY

The study focuses on working class awareness and preference level towards selected consumer durables such as Television, Refrigerator and Washing machine. Hence, Dharmapuri District has 49.8 % of working class population and 68.54 % of literacy rate. In this context, the research is carried out to identify the working class awareness and preference towards high end (luxury) Consumer Durable in Dharmapuri District.

OBJECTIVES OF THE STUDY

- To identify the working class awareness level towards high end (luxury) durables in Dharmapuri District.
- To study working class preference towards high end (luxury) durables in Dharmapuri District.

RESEARCH HYPOTHESIS

H_0 : There is no significant relationship between demographic variable and awareness and preference factors of high end (luxury) consumer durables.

RESEARCH METHODOLOGY

The researcher has adopted descriptive research method to describe the characteristics of working class population. Non probability (convenient) sampling method is utilized to collect data from the respondents and the researcher has utilized both primary and secondary data. The primary data was collected by constructing questionnaire from working class consumers in Dharmapuri District. The data was collected from 250 respondents. Secondary data are collected from relevant journals and websites. 'Likert Five Point Scaling Technique' is applied to collect the data ranging from 'Strongly Agree (5), to 'Strongly Disagree' (1). The statistical tools namely percentage analysis, factor analysis, friedman test and T-test are used to analyze the primary data and to draw inferences.

DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Out of 250 respondents, 158 (63.2 %) respondents are male and 92 (36.8 %) of respondents are female. Among 250 respondents, 106 (42.4 %) of the respondents with the age of 31-40 years, 59 (23.6 %) of the respondents

with the age of 41-50 years, 55 (22 %) of the respondents with the age group of less than 30 years and 30 (12 %) of the respondents are with the age group of above 50 years. The study points out that among 250 respondents, 91 (36.4 %) of the respondents possess graduation, 72 (28.8 %) of the respondents completed post graduation, 56 (22.4 %) of the respondents possess school education and 31 (12.4 %) of the respondents having professional degree. The Study reveals that out of the 250 respondents, 62 (24.8 %) respondents are teachers, 61 (24.4 %) of the respondents are skilled, 57 (22.8 %) are involved in administrative activities 39 (15.6 %) are doing clerical jobs and 31 (12.4 %) of the respondents belongs to semi-skilled category. In the respect of Income the study exhibits that 110 (44 %) of the respondents have the monthly income of Rs. 20,001 to Rs. 40,000, 79 (31.6 %) of the respondents have earned the monthly income of Rs. 20,000 or less, 42 (16.8%) of the respondents have earned the monthly income of Rs. 40,001 to Rs. 60,000 and 19 (7.6 %) of the have earned the monthly income of Rs. 60,000 and above.

BRAND PREFERENCE OF THE RESPONDENTS

The study depicts that out of 250 respondents, majority of respondents 58 (23.2 %) prefer Sony brand, the Samsung brand secured second highest preference 47 (18.8 %), 39 (15.6 %) of the respondents prefer LG, 37 (14.8 %) of the respondents prefer Whirlpool, 35 (14.0 %) of the respondents prefer IFB, Onida brand is preferred by 14 (5.6 %) of the respondents, 12 (4.8 %) of the respondents prefer Videocon and Haier is preferred by 8 (3.2 %) of the respondents.

RESULTS

The factor analysis tries to find out and define the underlying aspects (factors) in the original variables. In this study 19 variables were find out to study the working class preference and awareness towards high end (luxury) consumer durables.

FACTOR ANALYSIS

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.911
Bartlett's Test of Sphericity	Approx. Chi-Square	2261.258
	df	171
	Sig.	.000

The Kaiser-Meyer-Olkin test is based on the correlations and partial correlations of the variables. If the test value of KMO measure is closer to one, its good to use factor analysis. (if it is closer to zero not good idea for analysis). In this study, KMO value of test statistics is 0.911 it means the that factor analysis for the 19 variables was appropriate to the study and the significant value of Bartlett’s test of Sphericity is (0.000). The measure of KMO test and value of Bartlett’s test shows that the sample taken for the study was useful for factor analysis procedure.

Communalities

Factors	Initial	Extraction
Q1 High Quality	1.000	.476
Q2 Image	1.000	.583
Q3 Availability of Service	1.000	.663
Q4 Performance	1.000	.656
Q5 Technology	1.000	.558
Q6 Durability	1.000	.570
Q7 Cost effectiveness	1.000	.586
Q8 Features	1.000	.619
Q9 Value offering	1.000	.612

Q10 Ease of use	1.000	.637
Q11 Packaging	1.000	.562
Q12 Power saving	1.000	.656
Q13 Best design & aesthetic	1.000	.675
Q14 Esteem of brand	1.000	.646
Q15 To fit in with friends	1.000	.546
Q16 Follow the trend	1.000	.602
Q17 Show off	1.000	.701
Q18 To differentiate myself from others	1.000	.653
Q19 Want others to view me as upper class	1.000	.671

Extraction Method: Principal Component Analysis.

The above table shows that the communalities of chosen 19 variables are having high reliability value of 0.911 good and properly verified and identified that none of the variables are having low loading. Therefore, all the measured variables are considered for further analysis. The appropriates of the data for the factor analysis is discussed in KMO and Barlett’s test.

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Total	% of Variance	Cumulative %	Cumulative %	Total	% of Variance	Cumulative %
1	7.958	41.886	5.350	28.159	28.159	41.886	5.350	28.159	28.159
2	1.464	7.707	3.453	18.174	46.332	49.592	3.453	18.174	46.332
3	1.217	6.403	1.716	9.030	55.363	55.995	1.716	9.030	55.363
4	1.034	5.444	1.155	6.077	61.439	61.439	1.155	6.077	61.439
5	.866	4.559							
6	.837	4.404							
7	.699	3.677							

8	.652	3.432						
9	.602	3.170						
10	.536	2.823						
11	.496	2.612						
12	.460	2.419						
13	.413	2.173						
14	.364	1.915						
15	.356	1.873						
16	.308	1.621						
17	.265	1.394						
18	.243	1.278						
19	.230	1.211						

Extraction Method : Principal Component Analysis

Exploratory Factor Analysis is applied in this study to examine the dimensions that created correlations among the observed variables which are stimulated the awareness and preference of working class consumer towards high end (luxury) consumer durables. The rule of thumb is applied to choose the number of factors for which “Eigen values” with greater utility is taken by using Principal Component Analysis method. The component matrix so framed is further rotated orthogonally using Varimax Rotation Algorithm. All the 19 variables utilized for the study and this variables is reduced into 4 important factors.

Rotated Component Matrix^a

Statements	Component			
	1	2	3	4
Advanced Technology & Reasonable price Q4 Performance	.796			

Q3 Availability of Service	.738		
Q10 Ease of use	.719		
Q9 Value offering	.705		
Q2 Image	.704		
Q8 Features	.680		
Q7 Cost effectiveness	.656		
Q5 Technology	.643		
Q11 Packaging	.579		
Q12 High Quality	.563		
Fashion			
Q13 Best design & aesthetic	.775		
Q16 Follow the trend	.707		
Q14 Esteem of brand	.665		
Q12 Power saving	.641		
Q15 To fit in with friends	.586		
Q6 Durability	.542		
Social Status			
Q17 Show off		.806	
Q18 To differentiate myself from others		.792	
Social Recognition			
Q19 Want others to view me as upper class			.813

Extraction Method : Principal Component Analysis

The above table shows that the output of rotated component matrix, in which the extort factors are a new labeling related together. As per the criteria it is acclaimed that the loaded factors are having less than 0.4 as loading values and single variable factors are rejected from the analysis. The above table exhibits that the ten variables grouped into “Advanced

Technology and Reasonable Price” factor, the second factor consist of six variables and labeled as “Fashion”, third factor “Social Status” covers two variables and last factor “Social Recognition” is framed with one variable. Above mentioned table reveals that the factor analysis result in four prominent factors. The whole variable in these four factors are grouped into the demographic profile of the respondents by using proper statistical tools.

T-TEST

H₀ : There is no significant relationship between marital status of working class and factors of awareness and preference towards high end (luxury) consumer durables.

Independent Sample t Test						
Factors	Marital Status	N	Mean	T	Sig. (2-tailed)	H₀
Advanced Technology with Reasonable Price	Married	194	31.04	0.252	0.802	Accepted
	Unmarried	56	30.71	0.277	0.783	
Fashion	Married	194	18.74	-1.207	0.229	
	Unmarried	56	19.70	-1.349	0.180	
Social Status	Married	194	6.07	-0.691	0.490	
	Unmarried	56	6.29	-0.683	0.496	
Social Recognition	Married	194	2.61	0.338	0.736	
	Unmarried	56	2.55	0.343	0.732	

The above reveals that the significant value (p) is above than 0.05 and the null hypothesis is accepted at 5% level of significance. It is noted that there is a no significant relationship between marital status of working class people and awareness and preference factors of high end consumer durables. T – test exhibits that there is no significant association of marital status of working class towards awareness and preference factors of high end consumer durables. It also indicates the significance is >0.000.

FRIEDMAN RANK CORRELATION TEST

H_0 : There is no significant relationship among factors creating awareness and preference of working class to buy high end (luxury) consumer durables.

Factors	N	Mean	Std. Deviation	Mean Rank	Rank	Chi-Square	Asym p Sig.	H_0
Advanced Technology with Reasonable Price	250	30.97	8.551	3.97	1	718.826	.000	Rejected
Fashion	250	18.96	5.218	3.02	2			
Social Status	250	6.12	2.034	1.92	3			
Social Recognition	250	2.60	1.165	1.09	4			

The above table reveals that the significant value (p) is less than 0.05 and hence the null hypothesis is rejected at 5% level of significance. It is observed that there is a significant relationship between factors creates influence on preferring high end consumer durables. Friedman test suggest that there is significant association of factors in preferring high end (luxury) consumer durables. It also indicates the significance value is <0.000. To conclude that Advanced Technology with Reasonable price (3.97) has highly preferred factors in choosing high end (luxury) consumer durables.

CONCLUSION

Based upon the research findings, it is suggested that the working class consumer having awareness and preference towards high end (luxury) consumer durables. Advanced Technology and Reasonable Price, Fashion, Social status and Social Recognition are important aspects in the concept of high end (luxury) consumer durables. The retailers of consumer durable should concentrate on the above mentioned factors to occupy the

opportunities and market share of high end (luxury) durable market.

SCOPE FOR FURTHER RESEARCH

There is a enormous opportunity exist for the researcher to undertake research activities in consumer durables segment with different groups of consumers. This paper has made an attempt to identify the working class awareness and preference towards high end consumer durables in Dharmapuri District, the research scope enlarged to all the groups in a larger geographical location.

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A STUDY ON CUSTOMER PREFERENCE TOWARDS E-BANKING SERVICES WITH SPECIAL REFERENCE TO DHARMAPURI DISTRICT

Dr. M. Raja¹

Abstract

The purpose of this paper today every banking organization are using. e –banking for better customer services, banking industry has suddenly witnessed a major boom. Being a globalized market, the customer seeks and demand has world class products. Electronic banking is one of the emerging trends in the Indian banking. a interview schedule has been designed to collect the data from the respondents. the sample size 150. the random sampling used. the study makes use of statistical techniques such as percentage analysis, chi-square test, weighted average rank method in analyzing the data for finding the result. there is no significant association between age of the respondents and their aware about e-banking services and there is a significant difference between gender of the respondents and their recommend others to adopt e-banking services.

Keywords: e-banking, customer perception, security, usage, Technology.

Introduction

E- banking means any user with a personal computer and a browser can get connected to his bank-s website to perform any of the virtual banking functions, in internet banking system the bank has a centralized database that is web enabled. all the services that the bank has permitted on the internet are displayed in menu. any service can be selected and further interaction is dictated by the nature of service.

Electronic banking is one of the emerging trends in the Indian banking. it has been in the form of e-banking or net banking or online banking or internet banking which is now replacing the traditional banking mechanism. e-banking involves information technology based banking under this system the banking services are delivered by way of a computer controlled system this system does involve direct interface with the customers. the customers do not have to visit the banks premises.

e-banking is a product designed for the purpose of online banking that enables you to have easy and safe access to your bank account. E-banking is a safe, fast easy and efficient electronic service that enables you access to bank account and to carry out online banking. banking services,24 hours a day and 7 days a week with this service you save your time by carrying out banking transactions at any time from your home or office all you need is internet access.

The government of India encourages people to move towards cashless economy. this can be achieved by use of debit and credit cards, electronic payment gateway system such as national electronic fund transfer (NEFT)and real-time gross settlement(RTGS) in India

Popular Services Covered Under E-Banking

The popular services covered under e-banking include

- Automated teller machines
- Credit cards
- Debit cards
- Smart cards
- Electronic fund transfer(EFT)system
- Cheques transaction payment system
- Mobile banking
- Internet banking
- Telephone banking

Advantages Of E-Banking

The main advantages of e-banking are:

1. The operating cost per unit services is lower for the banks
2. It offers convenience to customers as they are not required to go to the banks premises.
3. There is very low incidence of errors.

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4. The customer can obtain funds at any time ATM machines
5. The credit card and debit cards enables the customers to obtain discounts from retail outlets
6. The customer can easily transfer the funds from one place to another place electronically. It is updated online, real time, the system is updated immediately after every transaction automatically.

Services/Transactions

- Answering routine queries
- Bill payment service
- Electronic fund transfer
- Electronic clearing system
- Credit card customers
- Railway pass
- Investing through internet banking
- Recharging your prepaid phone
- Shopping

Review of literature

Gerrard and cunningham (2003) also identify of the factors of paramount importance in ensuring the success of e-banking, the ability of an innovation to meet users needs using different feature availability on the web site. for instance, the provision of interactive loan calculators, exchange rate converters, and mortgage calculators on the web sites draw the attention of both users and nonusers into the banks web site.

Boatenge and molla (2006) indicated that the operational constraints of internet banking is associated with the customer location, the need to maintain customer satisfaction and the capabilities of the banks main software to act as an influential factors in motivating the decision to enter electronic banking services and consequently influencing the usage experience and thus affecting the level of satisfaction.

Anita lifen zhao et al (2010) used empirical evidence to investigate the relationship between perceived risk and trust in adoption of internet banking services in china. the research was conducted on a sample of 432 young chines consumers who can be classified as internet banking service early adopters. the study results indicate that there is a significant relationship between trust and

that both are crucial in explaining the internet banking usage intention

Geetha k t & malarvizhi v (2011) investigates the factors which are affecting the acceptance of e-banking services among the customers and also indicates level of concern regarding security and privacy issues in Indian context. the finding depicts many factors like security and privacy and awareness level increased the acceptance of e-banking services among Indian customers

Objectives of the study

1. The study aims at identify the overall customer perception towards the e-banking services in Dharmapuri district.
2. The study also aims at know whether socio economic variables of the customer satisfaction in Dharmapuri district

Limitations of the study

1. There were several time constraints
2. The study is limited to areas of Dharmapuri only
3. The study is related to customers only
4. People were reluctant to go into details because of their busy schedules

Methodology and Sampling design

This present study will be used random to know the e-banking preference towards customers. It is planned to collect both primary and secondary data for analysis. The sample respondents cover Dharmapuri district. It is planned to collect data from the 150 respondents

Tools for data collection

Primary data and secondary data have been used. Primary data were collected through a structured questionnaire and the secondary data were collected from the books, journal, articles, newspapers magazines and websites. The primary data were collected was further analyzed by using various tools like 1. Percentage analysis 2. Chi-square independence test

Period of the study

The data were collected for the month of november 2018- January 2019.

Data analysis and interpretation:

Table - 1 : Demographic Profile of the Respondents

Category	Variable	Frequency	Percentage
1 Gender	Male	100	75
	Female	50	25
	Total	150	100.00
2 Age	21 – 30 years	80	53
	31 – 40 years	40	27
	41 – 50 years	25	17
	Above 50 years	05	03
	Total	150	100.00
3 Educational qualification	Illiterate	40	27
	School level	20	13
	Degree / Diploma level	55	37
	Professional level	35	23
	Total	150	100.00
4 Occupation	Government employee	30	20
	Private employee	52	34
	Profession	22	15
	Business	22	15
	Agriculture	24	16
	Total	150	100.00
5 Monthly family income	Below Rs.10000	33	68
	Rs.10001 – Rs.20000	41	42
	Rs.20001 – Rs.30000	22	25
	Above Rs.30000	8	15
	Total	150	100.00
6 Marital status	Married	18	12.00
	Unmarried	132	88.00
	Total	150	100.00
7 Name of the bank	State bank of India	62	41
	Indian overseas bank	34	23
	ICICI	34	23
	HDFC	20	13
	Total	150	100.00
8 E-banking service you think is more user friendly	Internet banking	40	27
	Telephone banking	10	06
	ATM	60	40
	Mobile banking	40	27
	Total	150	100.00

9 E-Banking services aware more	Internet banking	30	20
	Telephone banking	10	07
	ATM	80	53
	Mobile banking	30	20
	Total	150	100.00
10 Trust the security of e-banking services	Completely	54	36
	Somewhat	46	31
	Dubious	34	23
	Not at all	16	10
	Total	150	100.00

Table -7,8,9,10 analysis in e-banking services.

Table -7 relating to customer preference towards e-banking services

Table -8 relating to awareness of e-banking services, majority of 40% of respondents had awareness about e-banking services.

Table -9 relating to e-banking service you think is more user friendly, majority of the respondents think that ATM is more user friendly.

Table-10 relating to e-banking services aware more about ATM services

Chi-square test-association between age of the respondents and their aware about e-banking services

Research hypothesis: there is a significant association between age of the respondents and their aware about e-banking services

Null hypothesis: there is no significant association between age of the respondents and their aware about e-banking services

Table - 2

	Aware about e-banking services			Statistical inference
	Yes	No	Total	
Age	108	42	150	X ² = 2.072 df=3 558>0.05 not significant
21 to 30 yrs	61	20	81	
31-to 40 yrs	27	22	49	
41- to 50yrs	15	0	15	
51 yrs and above	05	0	05	

Findings : The above table reveals that there is no significant association between age of the respondents and their aware about e-banking services. hence, the calculated value greater than table value. so the research hypothesis is rejected and the null hypothesis accepted.

Summary of Findings :

1. Thus majority 55% of the respondents graduate only.
2. Thus majority 52% of the respondents are working in private concern
3. Thus the majority of the respondents annual income 10001-200000.
4. Thus majority 62 % of the respondents having an account state bank of india
5. Thus all the sample respondents have awareness about e-banking services

6. 88.3% of the respondents agree that their expectations are met through e-banking services 60% of the respondents opt that ATM service is more user friendly 7.78 % majority of the respondents agree that they definitely recommend others to adopt the e-banking services
7. majority of the respondents strongly agree that e-banking services provides
privacy of customer information

Suggestions:

The e-banking in india are using information technology not only to improve their own internal process but also to increases facilities and services to their customers. efficient use of technology of the increased transaction volume of banks of that comes with larger customer base. by designing and offering simple and, safe and secure technology, banks reach at doorstep of customer with delight customer satisfaction.

Conclusion

The usage of e-banking is all set to increase among the service class. the service class at the moment is not using the services thoroughly due to various hurdling factors like in security and fear of hidden costs. so banks should come forward with measures to reduce the apprehensions of their customers through awareness campaigns and more meaningful advertisements to make e-banking popular among all the age and income groups.

E -banking is an innovative tool that is fast becoming necessity it is a successful strategic weapon for banks to remain profitable in a volatile and competitive market place of today. in future, the availability of technology ensure safety and privacy of e-banking transactions and the RBI guidelines on various aspects of internet banking will definitely help in rapid growth of internet banking in India.

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**Services Marketing – A Study With Reference To Private Hospitals In
Dharmapuri District****Dr. M.RAJA.,**Assistant Professor in Commerce. DONBOSCO COLLEGE,
Dharmapuri ,636-809, Tamilnadu –India.**Introduction**

Services marketing are a sub field of marketing which covers the marketing of both goods and services. Goods include the marketing of fast moving consumer goods (FMCG) and durables. Services marketing typically refer to the marketing of both business to consumer (B2C) and business to business (B2B) services. Common examples of service marketing are found in telecommunications, air travel, health care, financial services, all types of hospitality services, car rental services, and professional services.

A service, according to Vargo and Lusch (2004), is ‘the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself. Services are economic activities, rather than tangible products, offered by one party to another. Rendering a service to recipients, objects, or other assets depends on a time-sensitive performance to bring about the desired result. In exchange for money, time, and effort, service customers expected value from access to goods, labor, professional skills, facilities, networks, and systems; but they did not normally take ownership of any of the physical elements involved.

Services Marketing

Services marketing were a relatively new phenomenon in the domain of marketing. It gained importance as a discipline towards the end of the 20th century. Services marketing first came into force in the 1980s when there was debate of whether the marketing of services was significantly different from that of products, and whether it should be classified as a separate discipline. Prior to this, services were considered as an aid to the production and

marketing of goods, and were not deemed as having separate relevance on their own.

The 1980s saw a shift in this thinking. As the service sector started to grow in importance in post-industrial societies and emerged as a significant employer and contributor to those nations' GDPs, academia and marketing practitioners began to look at the marketing of services in a new light. Empirical research was conducted which brought to light the specific distinguishing characteristics of services. By the mid 1990s, services marketing was firmly entrenched as a significant sub-discipline of marketing with its own empirical research and data, growing significance in the increasingly service sector dominated economies of the new millennium. New areas of study in the field opened up and were the subject of extensive empirical research. This gave rise to concepts such as the product-service spectrum, relationship marketing, franchising of services, customer retention, and others.

Product

In case of services, the 'product' is intangible, heterogeneous and perishable. Moreover, its production and consumption are inseparable. Hence, there is scope for customizing the offering as per customer requirements and the actual customer encounter therefore assumes particular significance. However, too much customization would compromise the standard delivery of the service and adversely affected its quality. Hence particular care had to be taken in designing the service offering.

Pricing

Pricing of services is tougher than pricing of goods. While the latter can be priced easily by taking into account the raw materials and labour. The final price for the service is then arrived at by including a mark up for an adequate profit margin.

Place

Hospitals are easily accessible to the patients and be adequately protected from pollution. Every hospital tried to make services available and accessible to its target consumers. While distributing health care accessibility with physicians, hospital administrators, donors, government, insurance companies, employers are needed. Thus hospitals had to take three major distribution decisions. They include physical access (channels, location, and facilities), time access and promotional access.

Promotion

Since a service offering could be easily replicated, promotion becomes crucial in differentiating a service offering in the mind of the consumer. Thus, service providers offered identical services such as airlines or banks and insurance companies invest heavily in advertising their services. This was crucial in attracting customers in a segment where the services providers have nearly identical offerings.

The final three elements of the services marketing mix - people, process and physical evidence - are unique to the marketing of services.

People

People are a defining factor in a service delivery process, since a service has inseparable from the person providing it. Thus, a restaurant is known as much for its food as for the service provided by its staff. The same is true of banks and department stores. Consequently, customer service training for staff had become a top priority for many organizations today.

Process

The process of service delivery was crucial since it ensured that the same standard of service is repeatedly delivered to the customers. Therefore, most companies had a service blueprint which provided the details of the service delivery process, often going down to even defining the service script and the greeting phrases to be used by the service staff.

Physical Evidence

Since services had been intangible in nature, most service providers strive to incorporate certain tangible elements into their offering to enhance customer experience. Many hair salons invested in comfortable and stylish sitting areas with magazines and plush sofas for patrons to read and relax while they wait. Similarly, many restaurants invest heavily in their interior design and decorations to offer a tangible and unique experience to their guests.

Statement of the problem

The services sector comprised a wide array of industries that sold to individual consumers and business customers, as well as to government agencies and nonprofit organizations. Services made up the bulk of the economy in post-industrial societies and account for most of the growth in new jobs. Unless a person is already predestined for a career in family manufacturing or agricultural business, the probability is high that they will spend their working life in service organizations. The size of service sector is increasing in almost all economies around the world. As national economy develops, the relative share of employment among the agricultural industry, and the service industry change dramatically. Even in emerging economies, service output is growing rapidly and often repress

1. **Ordering Ease:** Ordering ease refers to how easy it is for the customer to place an order with the company.
2. **Delivery Ease:** Delivery refers to how well the product or service is brought to the customer. It includes speed, accuracy, and care throughout the process.
3. **Installation:** It refers to the work done to make a product or service operational in its planned location. Ease of installation becomes a true selling point, especially when the target market is technology novice.
4. **Customer Training:** It refers to training the customer's employees to use the vendor's equipment properly and efficiently.

In the age of Patient Empowerment and the trend towards patient consumerism, it's important for doctors to market themselves to patients.

Patients were making informed decisions about who they see, and who they trust, which was a good thing for healthcare. Many physicians like do eschew the idea that they are actually conducting business, let alone try to market themselves. A number likes to pretend that medicine and business have nothing to do with each other, and that business pressures can only serve to pervert medicine. Medicine is big business, and natural market forces should create pressure to provide a better product. Patients wanted to a better product. Patients should be seen as customers. Most of the hospitals provided poor customer service like long wait times, short visits, repetitive questioning, lack of patient-centric care, etc. Moreover the opinion about the services marketing of the hospitals from the administrators, doctors and nurses point of view will not give the accurate result. The reason is that one who is not ready to give bad opinion about their organization. Hence the researcher has planned to gather opinion form the customers (patients) of hospitals. The study will cover the private hospitals functioning in the Dharmapuri District. In the study area there are 10 private hospitals are involved in health care services. This study will provide the better understanding of the level of services marketing of the private hospitals from the customers' point of view and the area need to be improved for the marketing the hospital services than the existing level.

Scope of the study

The present study will covered the private hospitals of Dharmapuri District. In Tamil Nadu Dharmapuri District is one of the major industrial Districts and it consists the more number of population. Moreover the private hospitals in the study area are more in numbers and increasing in nature. Further this district connects the nearby states namely Anthrapreadsh, kerala and karnataka. People from the nearby states are also availing the health care services from the hospitals of the study District. Hence the researcher found that there is a vast scope to made this study.

Objectives of the study

The following major objectives are framed for this proposed study.

1. To analyse the profile of patients availing services in the private hospitals of Dharmapuri District.
2. To examine the opinion of the patients about the marketing practices of private hospitals under 7 Ps.
3. To analyse the variables determining the opinion of the patients about the marketing practices of the selected private hospitals in the study area.

Hypotheses

To achieve the above objectives the study following null hypotheses have framed.

- a. Job profile variables of the employees of the hospitals and their opinion about various dimensions of services marketing of the hospital are independent in nature.
- b. The respondents and the employees of the hospitals do not differ in their opinion about various dimensions of services and services marketing of the hospitals.

Methodology and Sampling design

This present study will be both descriptive and analytical in nature. It is planned to collect both primary and secondary data for analysis. The sample respondents cover the both inpatients and outpatients of the selected 10 private hospitals. It is planned to collect data from the 500 patients.

Tools for analysis

The following tools will be used for analysis

1. Chi square independence test
2. Independent sample t test
3. ANOVA – One way and Two way

4. Correlation
5. Regression
6. MANOVA

REVIEW OF LITERATURE

This chapter is designed to present the past studies reviewed for the present study. Literature reviews are classified as argumentative review, integrative review, historical review, methodological review, systematic review and theoretical review. Methodological reviews are explaining about the substantive fields, research approaches and data collection, analysis techniques which enables the researcher to draw on a wide variety of knowledge ranging from the conceptual level to practical documents for use in fieldwork in the areas of ontological and epistemological consideration, quantitative and qualitative integration, sampling, interviewing, data collection and data analysis.

Kotler and Clarke., (1987)¹ made a study on the topic “Marketing for Health Care Organizations”. The authors noted that marketing is effective in the healthcare industry and found that a high marketing orientation in hospitals is positively related to the existence of a marketing department, bed size, and competition in the area. Furthermore, these researchers suggested that a professional marketing director be appointed to lead the marketing function.

Gronroos (1990)² in his book entitled “Service Management and Marketing”, focused on two major components of the service quality in the health care sector: one is technical or mechanical quality and another is serviceable or functional quality. In the health care industry technical equipments and other related medical diagnoses systems are core for patients checkup for their treatment and functional quality measured by the service offered by the health care center such as services of staffs, nurses, administrations and most importantly the doctors towards the patient and their assistants. It has been found from different health care research patients mostly give priority to the functional quality rather than the technical quality though the technical quality may not be satisfactory

Socio- Economic Profile of the Respondents

¹ Kotler, P and Clarke, R., “Marketing for Health Care Organizations”, Englewood Cliffs, NJ, Prentice-Hall, Inc, 1987, p.8.

² Gronroos, C., “Service Management and Marketing”, Lexington: Lexington Books, 1990, pp.23-26.

The following table shows the socio economic profile of the patients selected for the study and their opinion about the services of the hospitals where they are availing for their health purpose.

Table 5.1
Socio- Economic Profile of the Respondents

Category	Variable	Frequency	Percentage
Gender	Male	262	52.40
	Female	238	47.60
	Total	500	100.00
Age	Below 20 years	21	4.20
	21 - 30 years	285	57.00
	31 - 40 years	108	21.60
	41 - 50 years	75	15.00
	Above 50 years	11	2.20
	Total	500	100.0
Educational qualification	Illiterate	11	2.20
	School level	128	25.60
	Degree / Diploma level	32	6.40
	Professional level	329	65.80
	Total	500	100.00

Source: Primary Data

Category	Variable	Frequency	Percentage
Frequency of Admission	First time	226	45.20
	Second time	175	35.00
	Third time	55	11.00
	More than three times	44	8.80
	Total	500	100.00
Occupation	Government employee	44	8.80
	Private employee	350	70.00
	Profession	11	2.20
	Business	42	8.40
	Agriculture	53	10.60

	Total	500	100.00
Monthly family income	Below Rs.10000	170	34.00
	Rs.10001 - Rs.20000	275	55.00
	Rs.20001 - Rs.30000	22	4.40
	Above Rs.30000	33	6.60
	Total	500	100.00
Marital status	Married	347	69.40
	Unmarried	153	30.60
	Total	500	100.00
Number of family members	Two	55	11.00
	Three	87	17.40
	Four	207	41.40
	Above four members	151	30.20
	Total	500	100.00
Type of patient	In patient	43	8.60
	Out patient	457	91.40
	Total	500	100.00

Source: Primary Data

Category	Variable	Frequency	Percentage
Source of getting knowledge about this hospital	Advertisement	274	54.80
	Family members	194	38.80
	Friends and Relatives	10	2.00
	Colleague	11	2.20
	Other sources	11	2.20
	Total	500	100.00
Level of illness while admitting in this hospital	Very high	95	19.00
	High	384	76.80
	Medium	11	2.20
	Low	10	2.00
	Total	500	100.00

Reaction for getting appointment in this hospital	Preferring other hospital	11	2.20
	Waiting for this hospital	489	97.80
	Total	500	100.00
Satisfaction towards the services of this hospital	Very high	84	16.80
	High	416	83.20
	Total	500	100.00
Informed about the fees before the treatment	Yes	347	69.40
	No	153	30.60
	Total	500	100.00
Nature of residence	Rural	186	37.20
	Urban	248	49.60
	Semi urban	66	13.20
	Total	500	100.00
Comparison of fee with other hospital	Yes	261	52.20
	No	239	47.80
	Total	500	100.00

Source: Primary Data

Category	Variable	Frequency	Percentage
Mode of getting appointment	Over telephone	33	6.60
	Direct approach	467	93.40
	Total	500	100.00
Extra charges for getting appointment over phone	Yes	129	25.80
	No	371	74.20
	Total	500	100.00
Level of care taken by the nurses while waiting for treatment	Very high	95	19.00
	High	394	78.80
	Very low	11	2.20
	Total	500	100.00

Facilities available in the waiting hall	Very good	63	12.60
	Good	426	85.20
	Medium	11	2.20
	Total	500	100.00
Level of willingness to visit this hospital again	Very high	75	15.00
	High	414	82.80
	Medium	11	2.20
	Total	500	100.00
Price of the service relating to other private hospital	Very high	54	10.80
	High	414	82.80
	Medium	21	4.20
	Very low	11	2.20
	Total	500	100.00

Source: Primary Data

a. Socio- Economic Profile of the Patients

Gender wise classification of the respondents

It is found that majority of the respondents (52.40 %) selected for the study are male.

Age of the respondents

It is noted that majority of the respondents (57.00%) selected for the study are in the age between 21- 30 years.

Educational qualification of the respondents

It is found that majority of the respondents (65.80 %) have professional level of educational qualification.

Frequency of admission

It is divulged that most of the respondents (45.20 %) are admitted in the private hospitals for the first time.

Occupation of the respondents

It is a fact that majority of the respondents (70.00 %) admitted in the private hospitals in the study area are private employees.

Monthly family income of the respondents

It is illustrated that majority of the respondents' (55.00%) monthly family income is varied between Rs.10001 and Rs.20000.

Marital status of the respondents

It is striking that majority of the respondents (69.40%) are in the married category.

Number of family members

It is revealed that most of the respondents (41.40 %) have four members in their family.

Type of patient

It is discovered that majority of the respondents (91.40%) are in the out patient category.

Source of getting knowledge about the particular hospital

It is disclosed that majority of the respondents (54.80%) are knew about the particular hospital through advertisement in the study area.

Level of illness while admitting in this hospital

It is unveiled that majority of the respondents (76.80%) have high level of illness while admitted in the hospitals.

Reaction for getting appointment

It is exposed that majority of the respondents (97.80%) do not prefer other hospitals when there is a delay in getting appointment in their preferred hospitals in the study area.

Satisfaction towards the services of this hospital

It is extracted that majority of the respondents (83.20%) have high low level of satisfaction towards the services of the selected private hospitals functioning in the study area.

Fee information before treatment

It is unearth that majority of the respondents (69.40%) stated that they are informed about the fee before the treatment in the hospital.

Nature of residence

It is realised that most of the respondents (49.60 %) belong to the urban area.

Comparison of fee with other hospital

It is understood that majority of the respondents (52.20%) compare the fee with other hospitals in the study area.

Mode of getting appointment

It is noted that majority of the respondents (93.40 %) have got appointment for treatment through direct approach.

Extra charges for getting appointment over phone

It is found that majority of the respondents (74.20%) stated that there is no extra charge is collected for getting appointment by the patients over telephone in the private hospitals in the study area.

Level of care taken by the nurses while waiting for treatment

It is clear that majority of the respondents (78.80%) opined that the high level of care is taken by the nurses for the patients in the waiting hall in the hospitals.

Facilities available in the waiting hall

It is exemplified that majority of the respondents (85.200%) opined that the facilities available in the waiting hall is good in the private hospitals in the study area.

Level of willingness to visit the same hospital

It is represented that majority of the respondents (82.80%) have high level of willingness to visit the same hospital for getting treatment.

Opinion about price of the service relating to other private hospital

It is characterized that majority of the respondents (82.80%) felt that the charges of the private hospital is high when it is compared with the other private hospitals in the study area.

b. Dependency between the socio economic variables of the respondents and opinion about facilities available in the waiting hall**Gender of the respondents and opinion about facilities available in the waiting hall are independent in nature**

“Gender of the respondents and their opinion about facilities available in the waiting hall are independent in nature”.

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 17.037 is less than the acceptance level of 0.05 ($p= 0.000$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between gender of the respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Age of the respondents and opinion about facilities available in the waiting hall are independent in nature

“Age of the respondents and their opinion about facilities available in the waiting hall are independent in nature”.

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 27.369 is less than the acceptance level of 0.05 ($p= 0.001$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between age of the respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Educational qualification of the respondents and opinion about facilities available in the waiting hall are independent in nature

“Educational qualification of the respondents and their opinion about facilities available in the waiting hall are independent in nature”

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 157.196 is less than the acceptance level of 0.05 ($p= 0.000$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between educational qualification of the respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Occupation of the respondents and opinion about facilities available in the waiting hall are independent in nature

“Occupation of the respondents and their opinion about facilities available in the waiting hall are independent in nature”

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 159.175 is less than the acceptance level of 0.05 ($p= 0.000$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between occupation of the respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Monthly family income of the respondents and opinion about facilities available in the waiting hall are independent in nature

“Monthly family income of the respondents and their opinion about facilities available in the waiting hall are independent in nature”

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 103.147 is less than the acceptance level of 0.05 ($p= 0.000$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between monthly family income of the

respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Marital status of the respondents and opinion about facilities available in the waiting hall are independent in nature

“Marital status of the respondents and their opinion about facilities available in the waiting hall are independent in nature”

To test the above hypothesis Chi-square test is applied and it is found that the significance value for chi-square value of 30.074 is less than the acceptance level of 0.05 ($p= 0.000$). Hence it is possible to reject the null hypothesis and it is concluded that there is a significant association between marital status of the respondents of private hospitals and their opinion about facilities available in the waiting hall of the hospitals.

Association between intersections of gender, age, educational qualification and opinion about service quality of the private hospitals – MANOVA - Three way

“There is no association between the intersections gender, age, educational qualification and opinion about service quality of the private hospitals”

To test the above null hypothesis MANOVA – Three way test is applied and it is found that the opinion of the respondents about responsiveness, reliability and courtesy aspects of the service quality is varied when they are classified based on their gender, age and educational qualification i.e., the p value is less than the acceptance level of 0.05. Hence the null hypothesis is rejected and it is inferred that the opinion of the patients about the service quality of the private hospitals is varied on the three aspects namely responsiveness, reliability and courtesy when the respondents are classified by their gender, age and educational qualification.

Suggestions

The following are the suggestions made by the researcher based on the above findings to enhance the services marketing of the private hospitals.

1. It is recommended that the management authorities of the private hospitals which are functioning in the different locations may concentrate on all the seven P's of the services marketing namely Product, Price, Place, Promotional measures, People, Physical Evidence and Process aspects than the existing level.

2. It is suggested that the private hospitals both which classify and do not classify their patients may strengthen the Product, Price, Place and Promotional measures aspects of the services marketing in the study area.
3. The private hospitals may take necessary steps to offer free services to the poor people living with no hospital facility in the study area.
4. The authorities of the private hospitals may take necessary steps for maintaining up-to-date rapport with their patients which pave the way for retaining their existing health care to the needy people.
5. It is recommended that the management authorities of the private hospitals may organise periodical medical camps for school and college students and for the public in the study area.
6. The private hospitals in the study area may assist their patients for getting medical claim and offer free medical services to the poor patients who need major treatment.

Conclusion

Hospitality marketing is unique because it deals with the tangible products, like bed and food, but it also deals with the intangible aspects of the hospitality services. Hospitality marketing is very critical. Proper marketing effort promotes a product or service that fills the needs and wants of the consumers and at the same time, brings profits to the organization or country that features it. This present study identifies the existing marketing strategy of the private hospitals and their service quality from the points of view of employees and patients. The researcher has felt that the seven aspects of the services marketing and six dimensions of the service quality of the private hospitals have to be improved than the existing level.

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Best Feature Selection using Modified Whale Optimization Algorithm for Prediction of Heart Disease

M. Geethanjali, P. Madhubala

Abstract: *Coronary illness is the confusion of heart and blood veins. It is hard for restorative specialists and specialists to foresee precise about coronary illness determination. Information science is the major object in primary expectation and takes care of huge information issues nowadays. This examination paper portrays the expectation of coronary illness in restorative area by utilizing information science. The same number of inquiries about done research identified with that issue however the exactness of expectation is yet should have been improved. Thus, this exploration centers on highlight choice methods and calculations where numerous coronary illness datasets are utilized for experimentation investigation and to appearance the precision development. In this work Modified Whale Optimization (MWOA) is utilized for highlight determination reason. By utilizing the Rapid digger as apparatus; Random Forest, (ANN), Decision Tree(DT) and Naive Bayes(NB) calculations are utilized as highlight choice procedures and improvement is appeared in the outcomes by demonstrating the exactness. From the proposed investigation the Artificial Neural Network grouping system is document better outcomes regarding Accuracy, Recall, Precision and F-measure.*

Keywords: *Heart Disease Prediction, feature selection, Modified Whale Optimization (MWOA), Random Forest, Artificial Neural Network (ANN), Decision Tree (DT) and Naive Bayes (NB).*

I. INTRODUCTION

Coronary illness additionally named as cardiovascular infection is a significant basic state of the heart and blood veins in larger part of passing's. This is the reason for misfortune in view of stroke or coronary failure which is 20 percent of all passings [1]. Various side effects and reasons for coronary illness are chest torment, hurt consume and stomach torment, torment in the arms, weakness, and perspiring. An ongoing report done in 2018 by WHO shows the outcome that 56.9 million passings happened on the planet during the year 2016 is because of heart ailments [2]. In 2008 17.3 million individuals completed in view of heart sicknesses [3]. WHO perceived the capability of information mining that it can anticipate beginning period of coronary illness and can give exact arrangement of the infection. Information mining is fundamentally the revelation of information from colossal measure of crude information. Information mining is otherwise called sub field of information the board [4]. Information mining has classified in primary models named as prescient model and descriptive

Model. Prescient model is characterized as a model which is made to anticipate a specific result or result by utilizing prescient demonstrating systems [5]. While illustrative model is characterized as a model made to give a superior comprehend of information without focusing on a variable by utilizing investigation procedures like factor examination and bunch investigation and so on [6].

Information mining has many learning systems that can be helpful to watch gigantic prior accessible information new data. A few instances of the systems are: (DT), (MLP), (NB), K-closest neighbor (K-NN) and (SVM) [7]. Numerous information mining methods are applied on restorative information to find concealed certainties from a lot of information for example grouping, relapse, characterization, and exception and so on. A portion of the savvy models in social insurance things are (CSS) and (DSS). Clinical Decision emotionally supportive networks (CDSS) are use of DSS in medicinal services field which is intended to help specialists and other human services staff for developing and settling on medical choices. Choice emotionally supportive networks (DSS) are the data frameworks utilized in basic leadership exercises for different fields [8]. Computational insight has significant job in the forecast of coronary illness. Ideas that are utilized in calculation knowledge can find the connections between understanding characteristics and various sicknesses [9]. In the contemporary investigations, numerous scientists did their work by utilizing highlight choice method in expectation of coronary illness. Highlight determination is likewise named as factor choice or traits choice. Highlight determination is assorted from dimensionality decrease. Highlight determination centers around lessening the quantity of superfluous characteristics by certain procedures i.e trait subset choice while dimensionality decrease diminishes the quality set by creating new properties from given property set [10].

II. RELATED WORKS

Various creators have spoken to their exploration by investigating different systems which incorporate characterization, affiliation mining, grouping, and choice tress in various wellbeing fields. Different interminable illnesses like asthma, circulatory strain, diabetes cannot be relieved effectively, yet high danger of ailments can be controlled with precise and convenient update information of the patients.

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Isler [11] has dissected the pulse changeability to recognize injured person with systolic (CHF) from patients with diastolic CHF. Creators played out the characterization utilizing a multiple layer discernment and the closest relatives. The investigation was executed on a sum of 30 persons: 18 persons having systolic CHF and 12 having diastolic CHF. The most extreme precision is acquired as 96.43% with classifier named as MLF.

Sudhakar, K. what's more, Manimekalai, D.M. [12] has utilized both arrangement displaying strategies, and affiliation order method to anticipate the hazard to have a cardiovascular breakdown. For successful coronary illness forecast K-implies bunching with the choice tree strategy were placed. Another time the Cleveland Clinic Foundation Heart Infection dataset with 13 traits was utilized. The greatest expectation precision determined was 83.9% subsequent to testing various blends for the centroid.

Syedamin et al. [13]. Scientists deals with various AI method and thinks about their outcomes in term of precision. Different AI methods are utilized in this investigation on little informational collection and contrasted the outcome and one another. SVM is prepared on restorative coronary illness dataset bringing about a classifier. To improve precision previously mentioned methods are applied namely Bagging, Boosting and Stacking. Utilizing Stacking procedure SVM, MLP classifier has greatest exactness 84.15% higher than different methods.

S. Prakash et al. [14] has proposed a coronary illness forecast which presented Optimality Criterion highlight determination (OCFS) for the extrapolation and capably analyze the coronary illness. Scientist improves their technique for harsh set element determination on data entropy (RFSIE). In this examination they contrast the OCFS and RFS-IE in word of computational period, expectation worth, and mistake level utilizing distinctive kind of informational indexes. OCFS strategy be able to take least performance time when contrasted with another one technique.

III. PROPOSED SYSTEM

The future methodology used to finish this exploration is begun by taking an open source UCI informational index. Subsequent to checking the dataset, following stage is preprocessing and information discretization as Data cleaning, Data Alteration, Data Reduction, Binning and Select Attributes. Subsequent to applying every one of these systems on downloaded dataset, the principle procedure highlight determination is applied. Presently, the following calculations are applied on the information i.e Random Forest, ANN, Decision Tree (DT) and Naive Bayes (NB).

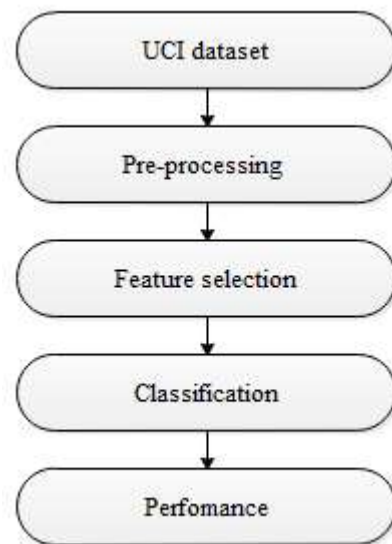


Fig.1.Flow chart of the proposed system.

A. UCI Dataset

The data of UCI archive is utilized in the database. There are complete 13 characteristics and 270 cases in this dataset. One of open online source dataset is UCI which is related with huge numbers of sicknesses and spreads a huge wellspring of databases, area speculations and information originators which are used by the specialists.

B. Preprocessing & Discretization

Future processing of information is displayed in a comprehensible introduction by transforming crude information into fathomable setting for intention.

C. Data Cleaning

Information cleaning is a procedure wherein information is cleaned by evacuating missing information, copy information and settling information irregularities. Therefore information quality is improved bringing about helpfulness of information.

D. Data Transformation

Change of information or data starting with one organization then onto the next arrangement is known as information change. It generally done when expected the source position to change over into needed organization for particular reason.

1. Data Reduction

Change of integer or string advanced data into a remedied arranged and disentangled structure tentatively or experimentally. The principle idea of information decrease is to diminish innumerable measures of information into valuable data.

2. Binning

Binning partitions gatherings and sum of nonstop qualities in toward little receptacles by utilizing equivalent recurrence or equivalent profundity binning procedures.

E. Feature selection

Highlight determination is additionally indicated as factor choice, Attribute choice or inconstant subset choice for typical development which hinders the way toward picking a subset of relevant highlights Feature choice. In this proposed framework (WOA) Algorithm is utilized for include determination.

1. Modified Whale Optimization Algorithm (MWOA) Feature Selection

In this segment, WOA is altered by modifying the control restriction and implanting other looking through techniques. In MWOA, three changes are projected and talked about in detail as pursues.

The significant issue of illuminating Large-scale worldwide enhancement (LSGO) with meta-heuristic calculations (Mas) is that most of them unite rashly toward neighborhood optima because of quick decrease of decent variety, and the first WOA is no special case. In the past investigations, the Lévy Flight (LF) process is broadly utilized in MAs to keep the arrangement from nearby optima and quicken the union speediness in light of its productive worldwide hunt capacity. Hence, a LF is utilized in MWOA to get away from the nearby optima by advancing the populace decent variety.

The LF is a sort of non-Gaussian arbitrary procedure with step length following a Lévy appropriation. A straightforward power-law vision of the Lévy conveyance is:

$$L(s) \sim |s|^{-1-\beta}, 0 < \beta \leq 2 \quad (1)$$

Where

β - Index,

s -Step distance of the LF. Using Mantegna's algorithm to determine

$$s = \mu / |\vartheta|^{1/\beta} \quad (2)$$

Where, μ and ϑ follow normal distribution, that is

$$\mu \sim N(0, \sigma_\mu^2), \vartheta \sim N(0, \sigma_\vartheta^2) \quad (3)$$

$$\sigma_\mu = \left[\frac{\tau(1+\beta) \cdot \sin(\pi\beta/2)}{\tau(1+\beta/2) \cdot \beta \cdot 2^{1/\beta}} \right]^{1/\beta} \quad (4)$$

$$\sigma_\vartheta = 1 \quad (5)$$

To avoiding the step size the Lévy flight jumping out of the scheme domain is accepted. It remains by:

$$Levy = random(size(D)) \oplus L(\beta) \sim \frac{0.01\mu}{|v|^{1/\beta} (X_i - X^*)} \quad (6)$$

Where the scale of the problem is $size(D)$ and \oplus means entry-wise multiplications, X_i is the i^{th} solution vector, Because of the limitless fluctuation of Lévy circulation, the LF implements the extended separation development sometimes for advancing the investigation capacity, while the short separation development is achieved for upgrading the misuse capacity. Clearly, this legitimacy can guarantee that MAs bounce out of nearby optima. In MWOA, the contracting encompassing instrument is supplanted by a Lévy trip so as to investigate the pursuit space all the more proficiently. The new location is refreshed by the accompanying principle.

$$Y(t+1) = Y(t) + \frac{1}{sqrt(t)} \cdot sign(rand - 0.5) \oplus Levy \quad (7)$$

Where $1/sqrt(t)$ a constraint is related to the present iteration number t and $sqrt()$ represents the square root task. In this regard, a huge range of finding movement can be performed during the initial level while a lesser one is employed in the later period. $Sign(rand - 0.5)$ signifies a sign function with values of (-1, 0, 1). Examination phase of MWOA is shortened.

$$Y(t+1) = \begin{cases} Y(t) + \frac{1}{sqrt(t)} \cdot sign(rand - 0.5) \oplus Levy & \text{if } p < 0.5 \\ D' \cdot e^{bl} \cos(2\pi l) + Y^*(t) & \text{if } p \geq 0.5 \end{cases} \quad (8)$$

F. Classification Algorithms

In preprocessed dataset the following grouping calculations are then applied

RF: Tree based technique is a RF that is utilized for together arrangement and relapse examination. Developed various trees and a mean forecast would be a yield for grouping.

ANN: A neural system depends on the possibility of organic neural systems; it is performed on the PC to carry out certain responsibilities like bunching, design rearrangement and characterization. ANN is a nonlinear measurable information model since complex connections among data sources and yields are demonstrated. The structure of ANN is influenced by the progression of data since this structure changes and learns dependent on the navigating information and yield in the neural system.

DT: DT is an approach to show the information. It utilizes a tree-like diagram as prescient model. The objective of DTs is to make a model to anticipate an outcome or a worth dependent on input factors. The outcomes are a significant order and broadly utilized for basic leadership. This method is a well-known instrument in AI that help to locate the proper procedure to arrive at the fantastic resolutions since it very well may be changed to a lot of significant standards by coordinating the root hubs to the leaf hubs.

NB: This procedure is a probabilistic classifier that utilizes Bayes hypothesis. The NB hypothesis is the accompanying

$$P(C|X) = P(X|C) \times \frac{P(C)}{P(X)}$$

Where

X -Information

C- Denote the class.

- Consistent or the equivalent for every one of the classes.

NB functions admirably on huge informational index, realizing that depends relying on the prerequisite that characteristics esteem are restrictively free which is unreasonable.

IV. RESULT AND DISCUSSION

The examinations are executed utilizing Python 3.7.3 idle on a computer with Intel Core i5 CPU 2.2 GHz with 8.00 GB RAM.

The content order network has generally utilized estimation exactness (the bit of records named positive that genuinely are certain), review (the segment of non-negative reports that are named positive). For a given class c_i , the general recipe for computing the exactness and review is given in the conditions (9) & (10).

$$Precision = \frac{|Documents\ correctly\ classified\ to\ the\ class\ c|}{|Total\ documents\ classified\ to\ class\ c|} \quad (9)$$

$$Recall = \frac{|Documents\ correctly\ classified\ to\ the\ class\ c|}{|Total\ documents\ in\ class\ c|} \quad (10)$$

Accuracy is the calculate of statistical variability and a description of random errors. The total accuracy of text grouping results for determining the intrusion is specified in the Eq. (11).

$$Accuracy = \frac{|Total\ correctly\ classified\ documents|}{|Total\ number\ of\ documents|} \quad (11)$$

F-measure is the measure of accuracy test and it considers each precision and recall of the test in order to evaluate the score. The common formula for F-measure is given in the Eq. (12).

$$F - Measure = \frac{2 * Precision * Recall}{Precision + Recall} \quad (12)$$

In this trial look into, reenacted UCI information is utilized for contrasting the exhibition assessment of existing philosophies and the proposed methodology as far as exactness, F-measure, accuracy, and review. The use of systems uncovers the aftereffects of every one of the four applying calculations NB, DT, ANN, and RF. By applying various information emulating learning methods and leading trials on the given dataset, we presume that the cross-breed determination model has the most elevated precision. It upgrades the presentation of coronary illness forecast model. The correlation of Accuracy, Recall, Precision and F-proportion of arrangement strategies is appeared in Table 1.

Table 1: Comparison of proposed results

Classification Technique	Accuracy (%)	Recall (%)	Precision (%)	F-measure (%)
WOA-NB	74.24	57.23	36.49	47.01
MWOA-NB	84	59.47	40.12	43.82
WOA-DT	67.4	58.13	47.51	47.49
MWOA-DT	87	60.25	45.85	49.07
WOA-ANN	75	65.82	65.24	65.17
MWOA-ANN	90.04	89.20	93.58	91.17
WOA-RF	74.24	74.74	74.20	74
MWOA-RF	84	81.16	80.85	80.83

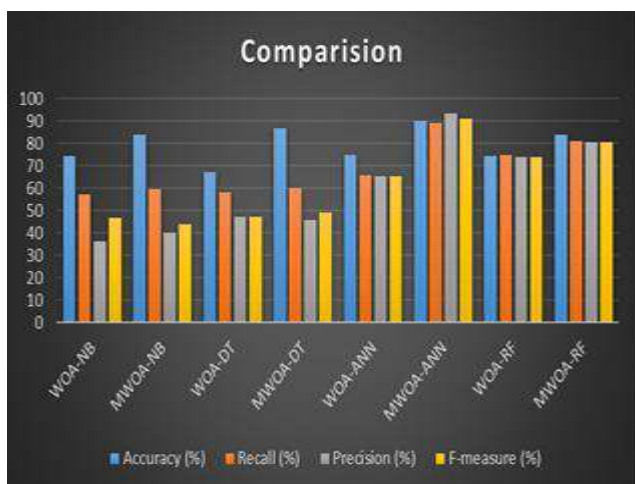


Fig.2. Comparison of proposed results.

From the table.1.And the Fig.2. Shows that the compared to WOA algorithm the proposed MWOA algorithm provides much better results for all classification techniques. In that specifically, compared to other classification algorithms the proposed MWOA technique is working better for ANN algorithm.

V. CONCLUSION

The primary aspiration of this paper is to improve exactness in forecast of coronary illness by utilizing highlight determination strategies. Various information mining systems for example NB, DT, ANN and RF. These are submitted independently in Rapid excavator on a UCI coronary illness date set and contrasted outputs and the previous inquires about. This examination accomplishes the objective which was according to desire and precision has been developed from past referenced qualities in writing audit. Exactness is significant for information mining in restorative industry. Various calculations can be applied for recognizing various kinds of maladies. This thusly makes the framework shrewd. Progressively combinational models are built to foresee the coronary illness which can help specialists in expectation of various kinds of heart ailments at a beginning time. The contrasted with WOA calculation the proposed MWOA calculation gives much better outcomes to all arrangement systems. In that explicitly, contrasted with other arrangement calculations the proposed MWOA strategy is working better for ANN calculation.

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Research Issues and Challenges for Multimedia Services in Cloud Environment

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Abstract— Foundation of many technologies gives the development of internet. For large scale data processing, cloud computing is the most modern trend and it provides shared resources for supporting to the distributed parallel processing. Though, the distributed system has given response time capable to handle the major challenging issues. The need of own device was eliminated by the cloud computing which supplies data and resources on the pay per use basis. More users are attracted by the cloud computing growth because it improves the response time using distributed computing and effective load balancing algorithms. The main requirement is to improve the performance of the cluster using load balancing algorithms and the security is the concern. The main objective of this paper is to bring out the research issues and challenges in cloud based multimedia systems.

Keywords— Multimedia, QoS, CDN, Storage, MSP, CMS

I. INTRODUCTION

The media-related businesses deliver their content to the end users with the benefit of internet facility. Rich internet applications like multimedia contents, web pages, interactive communications, and changing landscape of digital media demand a new method for content delivery networks by the providers. Volume, velocity and variety of multimedia content in information technology and digital world are increasing exponentially. More than 30 billion pieces of content such as news feeds and stories, links to websites, blog posts, text comments and photo albums, pictures are shared monthly on Facebook [Manyika et al., 2011]. An average of 55 million tweets a day on Twitter by several users containing photo-albums, tweets and web links. The demand on, these content-rich web pages, digital media, interactive communications and software downloads, required a new approach to content delivery to cater to the ever-growing data volume and its Quality of Service (QoS). A typical architecture for multimedia cloud computing is illustrated in the Figure 1.



Fig. 1 Multimedia Cloud computing

In recent years the increasing role of multimedia data such as graphics, audio, video and images, 3D models have led to

observations about activities, incidents and the digital environment. Multimedia contents present overwhelming research and technical challenges. To deal with online multimedia tasks like video processing, multimedia synchronization, and real-time transcoding for heterogeneous video sponsors and consumers, massive back-end server is essential. The highly dynamic and distributed sources of multimedia, significant multimedia QoS constraints, heterogeneity of the multimedia sources, makes it more challenging even with the support from powerful cloud computing technologies. It is expected to survey state-of-the-mi literature in cloud resource management and the multimedia processing and transmission, and formulate a joint optimization problem, or equivalently develop an algorithm to enhance the energy .efficiency of the multimedia cloud while also providing a rich multimedia experience to the users.

II. CLOUD COMPUTING FOR MULTIMEDIA

In order to meet the challenges of multimedia's huge data sizes, and to preserve the quality standards of streaming and caching HD videos, cloud computing as a data system is rapidly spreading over cyberspace. This model of multimedia Content Delivery Networks (CDN) comprises the streaming and storage of video content in the cloud [Ranjan et al., 2013]. Cloud computing has involved many big organizations and companies for use as a means of storage, for several reasons. Few of them involve the increasing need for bigger storage platforms where content can be stored and accessed at any time. The most evident advantages of multimedia cloud computing are

1) Ubiquitous data center [Zhu et al., 2011] - refers to the data which is being stored and retrieved at the same time, which makes the data center available and up-to-date at all times.

2) Distributed storage media -Search tools have preserved their speed and functionality through parallel processing rather than exploiting one centralized server to crawl data on the cloud.

3) Educational service tool -Cloud storage is broadly used by educational organizations for storing and retrieving data at any time. Lectures, documents, portals, videos etc, are easily retrieved from the cloud [Laisheng et al., 2011].

Armbrust et al. (2009) and Buyya et al. (2008) explores about the cloud computing which is used for data storage and processing in an effective manner. It has three different service models such as IaaS, PaaS and SaaS to deliver to the cloud users. Wen et al. (2011) presents the super computer and that provides different services from a cloud to internet users. By using cloud computing technology, we can store the

data in their own device as well as it provides the continual upgrade on their local devices.

Due to the development of web version, multimedia technology is the most demanding service in internet. Multimedia applications are image, video, audio, graphics and text etc. These applications are editable and viewable in cloud computing services. This multimedia application requires high storage space and computing, so here cloud computing plays a major role in multimedia technology and introduced a new multimedia computing paradigm. This technology helps the user store and computes the data in a distributed manner and also eases the process of media application installation. Maintenance of software will be very less and that leads to reduce the battery usage in mobile phone.

III. CHALLENGES OF MULTIMEDIA CLOUD STORAGE

There are certain limitations to cloud computing which are still being enhanced. Investigators are providing newer models on cloud computing multimedia framework for improved functionality. A couple of challenges that cloud computing is facing are

1) QoS variation against network band-width: Quality has to be met with quantity. As network bandwidth is broadly increasing in cloud storage, the service quality is being compromised. However, over a period, improvements have been made to eliminate this problem.

2) A disruptive technology for mobile computing: Cloud computing is generally observed as disruptive technology for mobile applications and services. This is because of the resultant power consumption in mobile phones for multimedia. Excessive data on the cloud makes batteries to drain rapidly.

3) Cloud-based multimedia system (CMS) generally combines software, platform and infrastructure to manage a vast number of customers concurrently. With the invention of CMS, multimedia application data can be stored and processed in a distributed manner and satisfy multimedia QoS requirements over internet.

IV. CHALLENGES IN CLOUD-BASED MULTIMEDIA SYSTEM

The challenges included in the cloud-based multimedia computing are listed below:

a) This multimedia technology supports variety of services include voice over IP, Photo Editing, Searching Images, Image Rendering, Image Sharing, Video Conferencing, Video Transcoding, Streaming Services, Delivery Services and Video Adoption Services.

b) The cloud-based multimedia should support the quality of services based on different requirements of multimedia services.

c) The characteristics of wireless networks such as bandwidth, latency, delay, jitter and throughput need to support the cloud-based multimedia services for optimal performance in cloud computing.

d) The different capability devices included television, computers, mobile phones, laptops and tablet requires cloud-based multimedia to store and adapt to the different parameters included in devices such-as CPU, display, GPU, memory and power. In cloud computing applied in multimedia, QoS provision is most needed because it uses

large number of users and the accessing of multimedia data. Normal cloud computing used only for storage purpose and it helps the users only for CPU storage services. But when it is applied in multimedia applications, the requirement of cloud has been extended. Cloud computing has to concentrate the quality of services for utilizing the large size of data. It should mainly concentrate on the parameters of delay, jitter and throughput. Kilkki (2018) deals the multimedia services for the unacceptable quality of services and quality of experience faced by the cloud computing.

V. MAJOR RESEARCH ISSUES IN MULTIMEDIA CLOUD COMPUTING

The rapid growth in the usage of multimedia applications (e.g., streaming, video conferencing and online gaming) on mobile devices has directed IT companies to develop their technologies to handle the multimedia requirements. Multimedia cloud computing is evolving as an emerging technology that enhances the capability of portable mobile devices to enable rich multimedia applications since mobile gadgets are fundamentally resource-limited. Irrespective of the challenges, cloud computing is here to stay and will continue to mature, in time eradicating the issues and overcoming these barriers. Few research challenges are enhanced QoS or Quality of Experience (QoE) for mobile multimedia, Cloud-based mobile multimedia streaming, Cloud-based mobile multimedia processing; Media cloud resource management, Content personalization and contextualization, Distributed caching of mobile media data, Performance prediction, analysis, models and results; Multimedia search on mobile devices, Multimedia service scheduling and Cloud-assisted media content recommendation.

VI. RESEARCH CHALLENGES IN MULTIMEDIA CLOUD COMPUTING

Multimedia technology has already diffused in our everyday life with the progress of interactive real-time multimedia applications and services. Mobile multimedia cloud computing is used for handling multimedia services in cloud environment. Multimedia cloud computing not only offers new opportunities to users and Multimedia Service Providers (MSPs), but also fetches new challenges. Despite the fact that great interests have been drawn from research societies, many challenges have not been completely addressed yet.

Firstly, it is challenging task to measure the relationship among the user demands, allocated resources, and response time. There is always a compromise between the resource cost and the response time in multimedia cloud. The under-provisioned resources would degrade services and weaken the QoS parameters, whereas the over-provisioned resources would reduce response time but result in high resource cost. Thus, it is a challenge for MSPs to exactly model the dynamic user demands and efficiently allocate resources. Many research studies [Minarolli et al., 2013; Calyam et al., 2011] take utility functions to formulate the allocated resources and the QoS performance. Besides, multimedia services often have diverse priorities. For illustration, the real-time health monitoring service needs a higher priority than the on-demand video service. However, existing resource management

systems are primarily designed based on first-come first-served (FCFS) service model [Rai et al., 2012; Nathani et al., 2012]. Therefore, an effective modelling method is needed to represent the cloud service process under different service disciplines.

Second challenge is to optimally schedule the workload among the assigned cloud resources. There are two stages of workload scheduling in multimedia cloud. The first stage is the user level scheduling, in which user's requests are disseminated to different VMs according to the current load intensity at each VM since different VMs have different rates for processing user requests. It is tedious to schedule workload to each VM to achieve the finest service performance. Whereas task level scheduling does it in a better granularity. A multimedia service can be observed as a work flow, composed of a set of tasks. The objective of task level scheduling is to minimize the complete execution time by optimally provisioning tasks to different VMs. Some earlier research works [Wu et al., 2013; Li et al., 2012; Khiyaita et al., 2011] apply the best scheduling schemes. Some researchers [Beloglazov et al., 2012; Srikantaiah et al., 2008] reviewed the scheduling issues by considering the CPU utilization at each cloud server to decrease the total power consumption. But these investigations do not consider the diverse resource demands.

Thirdly, it is a challenge to dynamically configure cloud resources to accommodate the changing workload. Most cloud computing providers suggest two different pricing strategies, the on-demand pricing plan and reservation plan based on reserved instances. In the reservation pricing strategy, MSPs charge for a onetime upfront payment for a virtual machine (VM) instance and in turn receive a discount on the hourly rate. Whereas, the on-demand strategy is more flexible. In this, a VM instance can be paid by usage without long-term assurance. MSPs need to identify the required number and class of VMs for individual service. But, it is problematic to reach an optimal VM allocation, since multimedia services demand diverse resources, while VMs are configured with heterogeneous dimensions. Presently, the state-of-the-art resource allocation method, used in Amazon Elastic Beanstalk, is designed based on the utilization. It handles the deployment, load balancing, capacity provisioning, auto-scaling to application health monitoring.

Next, it is a research challenge to guarantee the QoS for interactive multimedia services, like cloud gaming [OnLive; PlayStation; Vortex]. In cloud gaming technology, cloud servers have capability to render game scenes entirely or partly and encodes each frame instantly and stream game frames to clients, while user's control events are captured and communicated back to cloud servers. Most prevailing cloud gaming systems spread the encoded game frames using video streaming. But, video streaming demands a large bandwidth size to bring the high-definition game frames. Some researchers used the attention prototype [Hemmati et al., 2013; Ahmadi et al., 2013] to allocate diverse rates to each content in proportion to its importance. Hence, it is still a challenge to deliver users with a high-quality cloud gaming experience underneath bandwidth and delay limitations.

The requirement of cloud-based multimedia system which handles multimedia services has been increased due to the

higher demand of storage space [Zhu et al., 2011]. It supports a large number of clients concurrently. This approach helps the multimedia applications for storing process as well as it helps the QoS requirements satisfy in multimedia applications. Hence, multimedia applications are required to be handled on robust cloud servers, and the clients can pay only for the exploited resources by the time. To reply to the practical requirements stated above, load balancing in CMS is very important challenge to be considered [Wen et al., 2011]. The cost of deploying and operating multimedia networks can be reduced with new evolving cloud-based multimedia technology. Multimedia cloud still remains a major challenge due to massive volumes of data, strict real-time, high level concurrency, resource scheduling for multimedia content distribution. The objective of this problem is to decrease completion time of content dissemination and thereby increasing the user satisfaction. Multimedia applications and services certainly pose some new and unique challenges which demand new solutions that mutually consider resource allocation and management in multimedia cloud and the quality of service and quality of experience of the cloud computing end-users.

Multimedia processing imposes new challenges to cloud computing, due to the special characteristics, like delay sensitivity, high computation intensity, and large bandwidth demands. Compared to the general services, multimedia processing not only demands computation resources from cloud, but also requires QoS guarantees. Therefore, simply migrating multimedia services to cloud may degrade the experience of user without checking QoS requirements.

Ferretti et al. (2010) presents a cross-layer cloud architecture, which enabled wireless devices to seamlessly access multimedia services. During the communications a pair of proxies is used to identify the architecture and it enhances the network similarities and reduces the dissimilarities through interfaces. Based on the pay-as-u-go principle these cloud services are used to compute the infrastructure and a dynamic proxy is used to set the server-side dynamic environment.

Zhu et al. (2010) discusses about the multimedia data that can be adapted accordingly, to result in an acceptable quality of service level when delivered to a specific mobile device. Procedures for configuring and operating a multimedia aware cloud principally configured for mobile devices computing, are described herein. In some instances, clusters of servers are organized for general computing, graphic computing and data storage. A load balancing server may be configured to: identify multimedia types currently being processed within the multimedia edge cloud; determine desired quality of service levels for each identified multimedia type; evaluate individual abilities of devices communicating with the multimedia edge cloud; and assess bandwidth of each network over which the multimedia edge cloud communicates with mobile devices. In one example of the techniques, graphic computing server clusters may be configured to process workload using a configuration that includes elements of both parallel and serial computing.

For multimedia services, Zhu et al. (2011) proposes multimedia cloud computing concept is better utilize cloud computing, where the solution concern about the efficient

cloud which provides QoS-satisfied multimedia services for all users. Multimedia cloud computing is a new and open era, which attracts considerable attentions from researchers. Some researchers started from the architecture perspective to investigate how to support multimedia services on to minimize the overall transition delay in the entire architecture and at the edge of cloud physically computing servers is placed.

Nan et al. (2011) presents a queuing model which is used in the allocation of optimization for multimedia cloud was discussed by Multimedia cloud afford QoS provisioning for multimedia presentations as a non ambiguous cloud hypothesis, which reports how cloud can efficiently develop multimedia services. Multimedia cloud has two major challenges. The first challenge in the model is based on the service time and the cost for availing these network cloud services. Specifically, single-class service case and multiple-class service case together is used to improve the resource allocation policies. It is used to solve the issues in reducing the consumption time and reduce the cost based on the optimally exploit resources in the network to attain a minimum mean response time or a minimum resource cost was demonstrated in this simulation results.

Li et al. (2011) introduces the cloud computing to promote integration of Mobile Multimedia Broadcasting (MMB) chain. It is well known that cloud deals with sharing of services among a group of clients requiring access to a shared pool of resources with recent trends pointing to MMB being used as a hotspot of wireless application. Research has been carried out in investigating and analysing the merits and demerits observed in the MMB technology which internally is constituted of virtual computing, distributed processing of resources as well as services. Intelligent methods have also been researched in the literature which involves neural networks and ubiquitous and sustainable computing which is making inroads in recent times.

Literature expresses that Chang et al. (2012) has presented an architecture which is specially focused for streaming multimedia applications and delivery of services from cloud. The proposed architecture is found to be dynamically adaptable with varying features of the input multimedia stream. The features may include stream and bit rates, modulation techniques, required codes for coding and decoding the data and its compatibility to various stage of the art hand held as well as portable gadgets. The experimental works have also focused towards reducing the energy consumption which is incurred during the streaming process, limited number of nodes in the network for delivery of services from cloud, limited allocation of resources etc. But studies reveal that the compatibility of hand-held devices have not been considered in this research work which aggravated the bandwidth constraints. An extension of this work in the form of DAM algorithm also conventionally known as Dynamic Adjustable Multimedia Streaming (DAMS) algorithm is researched and implemented within portable and hand-held devices delivery of services through cloud network. This technique is found to reduce the loading constraints and unevenness in cloud as well as in individual nodes and thus consequently helps reduce the energy consumption.

Load balancing algorithms have also been proposed in the literature by Wen et al. (2012) known as CMLB which provides an optimized solution for handling, storage and processing of cloud-based services. This algorithm improves the overall system throughput, bandwidth, response time to client request for access of services. All these attributes collectively are found to improve the QoS of the proposed system. In spite of the fact that this method is found to improve the resource allocation, further improvements in resource allocation are quite necessary to improve the overall QoS. In addition, some extensions of the proposed algorithm are also required to improve the response time of the network towards the client requests to access information from the cloud. This could be found to be achieved through utilization of nature inspired or evolutionary algorithms as they best stimulate the real time conditions.

Hui et al. (2012) developed a layered media cloud architecture. The QoS control was implemented across three layers media overlay layer, resource management layer and namely media service layer. Specifically, the media service layer negotiated QoS requests with users; the media overlay layer ensured the security of data transmission, and the resource management layer adjusted resources to support QoS provision.

As the popularity of smart phones and tablets, multimedia cloud provides an idyllic platform for mobile services. Miao et al. (2011) proposes a combined rendering framework for cloud based Free Viewpoint Video (FVV). While the local rendering was applied when the switch viewing time in order to conceal the interaction delay in the structure of the stationary viewing time, the cloud rendering was conducted to attain a best visual quality. Cloud performs rendering for mobile devices in this framework, it proposes a novel resources allocation model for achieving the better quality of service for the mobile users. They are considered clients to the clouds and allocated by resource allocation models for performing the rounded optimization

A cloud-based collaborative mobile visual search framework was proposed by Zhang et al. (2012) for social activities. In their work to recognize the visual intent of user, mobile users captured a photo and circled the region-of-interest in the photo. Searching results were related entities would be suggested to users and mapped to the sensory context. Via circle-based sign, a mobile user can click a photo then within the photo obviously specify an object-of-interest is called as "O" gesture. By recovering related images relies on a large-scale of visual vocabulary tree, both the surrounding visual context as well as selected object-of-interest regions are considered to achieve the search-based recognition. These visual queries and location-based services are suggested to the users as local business Based on the projected method, assessment with a wide range of situations on million-scale images database is made on a typical real time application on windows devices. To assess the enhancement of the visual search model the content-based images retrieval is related as better state of art of algorithm.

Wang et al. (2013) recommends cloud computing for the multiplayer games on mobile devices. According to the workload and computation constraints, they proposed a rendering adaption technique to dynamically differ the

difficulty of graphics rendering. The use of mobile devices and network throughout the world is around 487.7 million which exceeds the PCs of 414.6 million comprising tablets in the year 2011 in the US alone, more users projected to process the Internet from mobile devices rather than from PCs by 2015. The requirement of multimedia applications and its capabilities are considered for all the multimedia-oriented applications and this process will continue for wide range of applications. The cloud servers and their benefits in using cloud services are computed in the connectivity factors of mobile devices. These factors can help connect this gap by giving mobile applications, possibly facilitating omnipresent multimedia applications on user friendly systems as Cloud Mobile Media (CMM) applications.

Multimedia cloud has also been generally used in social media field. A mobile social TV framework, which provided transcoding services for different platforms and supported co-viewing practices via chat interactions among viewing users, was presented by Wu et al. (2013). It engages a substitute user for the cloud using IaaS for better streaming of videos even in time varying connection for social exchanged and video downloading for the user. Proficient stream includes a transcoding model which is used to match the connectivity and obtain the results about the quality of connections accomplished by the substitute. It supports the use of burst transmission from the substitutes are considered by the users to obtain the burst size while considering the life of the energy efficient model in streaming process. Efficient designs of data storage help achieve social communications among the users with Big Table and dynamic handling of huge volumes of simultaneous messages in a distinctive PaaS cloud. Social interactivity, flexible transcoding proficiencies and battery effectiveness of mobile devices jointly present a suitable environment for social services as TV applications. It employs the superior based on the real time experimentations which is followed on Amazon EC2 and Google App Engine.

For handling multimedia assignments in the cloud, Li et al. (2013) characterizes a QoS-based resource allocation method. Firstly, the virtual resource distribution problem should be designed from three characteristics: completion time, cost and energy consumption with the introduction of the cloud service providers and various QoS requirements of the users is proposed for the various distribution methods. The best results are obtained using the utility function and the results are considered for initial allocation and others to the reallocation process. This optimum resource allocation outcomes into related with the essential distribution method was efficiently achieved by the proposed algorithm which is showed in this investigational result. In addition, both the task utility and resources utilization are considered into maximum to achieve the efficient algorithm.

Kim et al. (2014) offers a streaming model which uses cloud computing as mainstream. This includes all the major cloud computing services function with such as multimedia services, delivery scalable applications on the internet involve cultured technologies for distributing, transcoding and streaming content. Particular experiments still remain in the extents of load balancing, task management, fault tolerance and cloud computing offers an infrastructure for technologies. Cloud DMSS has further measurements for transcoding, task

distribution, load balancing and content duplication and distribution is highly adapted to the structure and policies of Hadoop. Four significant algorithms are proposed, namely Streaming Resource-Based Connection (SRC) for streaming job distribution, System Recovery for Hadoop Distributed Multimedia Streaming and Content replication and management for cloud multimedia management. Several different performance tests are conducted on an intra test bed to estimate the anticipated system as transcoding, streaming job distribution using SRC, robustness to data node, task failures and streaming service deployment.

Lu et al. (2015) submits an online algorithm which is used to accomplish the hybrid cloud was proposed by in the disseminated manner. With help of a hybrid cloud, Multimedia Cloud Service is used to extend the service up to the geographical locations along with the better quality of service. In the interim, the MCSP requires an online management concepts to maximize its profit which to function the hybrid cloud proficiently. It helps the users study how to exploit an MCSP's profit from provisioning multimedia services with a hybrid cloud to geographically distributed users. Private, public and hybrid clouds have different strategies to handle the resources in the service requests even in different time granularities and the resources reservations to increase the income of MCSP it leverages the Lyapunov optimization technique. Precisely, the algorithm governs routing of every multimedia service demand and the access control in which accordingly it allocates the resources in the hybrid cloud and to conform that the worst-case latency for the existing requests is circumscribed it also apply the ϵ -persistent technique. Lastly, wide-ranging imitations using synthetically and real traces together are evaluated by the proposed algorithm. The algorithm can accomplish and maximize the profit by utilizing the hybrid cloud efficiently using the specified simulation results.

For Virtual Machine (VM) placement, Han et al. (2016) suggest a Remaining Utilization-Aware (RUA) algorithm to discover appropriate hosts to halt for energy saving. In recent years, Power-Aware Algorithm in Cloud Computing has invented the IT industry so that the user has to pay as they use the service model and it can include in the subscriptions-based services. In the meantime, to deliver a diversity of media services on the internet, cloud computing-based multimedia is considered to contribute the greenhouse gas emissions in the admiration of cloud computing. It is also results in the increasing of cloud user's costs. While nourishing the resource requirements of consumer and promising quality of service, the multimedia cloud vendors should try to reduce its energy consumption as much as possible. For finishing the process of VM consolidation, these above-mentioned algorithms have been merged and implemented to cloud data centres. In this simulation process the relation between the trade off and the energy consumption of cloud data violations are considered and the similarities and differences are identified after the VM placement to minimize the SLA damages histrionically to prevent hosts.

ISS-MCCS addresses how a cloud can achieve distributed multimedia processing and storage and deliver QoS provisioning for multimedia services. Load balancing issues of multimedia cloud computing can be resolved in two ways.

The first method is to make use of a centralized approach, when every time the centralized resource manager receives the global multimedia service task, it determines how to distribute the load equally to the server clusters in terms of minimizing the transmission cost between the server clusters and the clients [Zhu et al., 2011]. The tasks delivery is dependent on the features of requested task services. On comparison, a decentralized approach offers more scalability for overheads. However, the centralized approach may present a possibility for failure of the resource manager. The multimedia cloud computing system consists of varying type multimedia files such as videos, audios, images in different format, contact details, documents of varying file formats and so on. To accomplish a high QoS for multimedia services is a must.

IV. APPROACHES FOR MULTIMEDIA CLOUD CONTENT HANDLING

Multimedia contents would take up more amount of storage that would be altered dynamically during run time. These problems are solved in research work by balancing the load level of resources during run time. The steps which are adopted for handling the multimedia contents efficiently are by enhancing the multidimensional server resource utilization using Fuzzy Neural Network (FNN) and by Hybrid Genetic-Cuckoo Search Algorithm.

V. CONCLUSIONS AND FUTURE WORK

This paper presented the fundamental concept of multimedia supported cloud computing environment. The paper also discussed the requirements and challenges of multimedia cloud computing for rich multimedia communication and computation as media is dominating the internet traffic in today's era. The survey on various architectures proposed for multimedia cloud computing are also dealt. Security is always taken as a barrier for cloud adoption as how one can trust a third party for their personal images, videos and other secret data. This paper also discussed various security and other issues discovered from different authors in order to handle rich multimedia data like images, videos etc. by the cloud and the solutions or possibilities proposed by them. Still there are many areas of research possible in multimedia cloud computing. For example QoS provisioning of media contents still needs more solutions. Besides to fulfil high demands of media contents, an advanced transport protocol, P2P cloud for fast access of media contents, media cloud security and dynamic load balancing algorithms also needs more investigation. Apart from all these an advanced encryption algorithm and authentication framework is most required for multimedia cloud computing. In our future work we will try to implement an advanced hybrid cryptographic algorithm at client end that can enhance security of multimedia data in cloud environment. Beside this we will also try to propose an authentication framework that can protect user's data from unauthorized accesses.

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Level of Mental Health among the Adolescents of Dharmapuri

P. Robert Ramesh Babu*

S. Nemira Vinnarasi**

Abstract

Health is defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. A sound mind in a sound body has been recognized as a social ideal for many centuries. Mental health is an important aspect of one's total health status; it is a basic factor that maintains physical health as well as social effectiveness. WHO defines mental health as, "A state of well-being which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community". Adolescence and the early years of adulthood are a time of life when many changes occur, for example changing schools, leaving home, and starting university or a new job. For many, these are exciting times. They can also be times of stress and apprehension however. In some cases, if not recognized and managed, these feelings can lead to mental illness. Half of all mental illness begins by the age of 14, but most cases go undetected and untreated. In terms of the burden of the disease among adolescents, depression is the third leading cause. Suicide is the second leading cause of death among 15-29-year-olds. Harmful use of alcohol and illicit drugs among adolescents is a major issue in many countries and can lead to risky behaviours such as unsafe sex or dangerous driving. Eating disorders are also of concern. Much can be done to help build mental resilience from an early age to help prevent mental distress and illness among adolescents and young adults, and to manage and recover from mental illness. Prevention begins with being aware of and understanding the early warning signs and symptoms of mental illness. Based on this, the present study focused on the level of mental health among the adolescents of Dharmapuri. In this study, For the purpose of data collection the standardized questionnaire was used to collect the data from the respondents. Mental health matters by Dr. Arun Kumar Singh was used for data collection. It has five dimensions like emotional stability, over all adjustment, autonomy, security – insecurity and self-concept.

KeyWords: Mental Health; Adolescents; Emotional Stability; Security

1. Introduction

Mental health is a fundamental indicator of quality of life. It is a positive sense of wellbeing that helps an individual realize his/her own capabilities, can cope with the normal stressors of life, can work productively and fruitfully, and is able to make a contribution to his/her community (World Health Organization, 2004). The primary aim of mental health activity is to enhance people's wellbeing and functioning by focusing on their strengths and resources, reinforcing resilience and enhancing protective external factors (WHO Europe Declaration, 2006). The WHO-World Health Organisation (2009) defined Mental Health as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community. Mental health is concern with the process of adjustment of a person's potential in an expressed in a balanced way and motivation towards the goal. Hadfield considers that "In general terms we may say that mental health is the full harmonious functioning of the whole personality." (Hadfield: mental and psychoneurosis, p-1).

Mental health is the springboard of thinking and communication skills, learning, emotional growth, resilience and self-esteem. It is how people think, feel, and act as they face life's situations. It affects how people handle stress, relate to one another, and make decisions. Mental health influences the way individuals look at themselves, their lives, and others in their lives. Like physical health, mental health is important at every stage of life. Adolescence is a wonderful time of life, filled with new feelings, a higher level of self-awareness and a sense of almost unlimited horizons to explore. It is a time of paradox. Adolescence can be defined as a transitional stage in human development during which the individual undergoes marked physiological, psychological and social changes in the process of growing from a child into an adult. Adolescence is commonly divided into three periods: early adolescence (11 – 14years); middle adolescence (14 – 17 years) and late adolescence (17 – 20 years). Their mental health is really important and we need to help them to have good mental health.

Dr Margaret Chan, the WHO Director-General, described the new Comprehensive Mental Health Action Plan 2013–2020 as a landmark achievement: it focuses international attention on a long-neglected problem and is firmly rooted in the principles of human rights. The action plan calls for changes. It calls for a

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change in the attitudes that perpetuate stigma and discrimination that have isolated people since ancient times, and it calls for an expansion of services in order to promote greater efficiency in the use of resources.

The four major objectives of the action plan are to:

- Strengthen effective leadership and governance for mental health.
- Provide comprehensive, integrated and responsive mental health and social care services in community-based settings.
- Implement strategies for promotion and prevention in mental health.
- strengthen information systems, evidence and research for mental health

For the first time, world leaders are recognizing the promotion of mental health and well-being, and the prevention and treatment of substance abuse, as health priorities within the global development agenda.

Within the health goal, two targets are directly related to mental health and substance abuse. Target 3.4 requests that countries: "By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.

Review of literature

Srinivas (1999) indicate that in adequate study facilities, fear of failure, teacher pupil relationship, inter personal inadequacy are the reasons for academic stress in the students. Sood. P (1998) concluded that, students low on stress used more direct coping strategies. Girls more often used direct coping and suppression as coping strategies when compared to Boys. Biswas et al (1995) concluded that the disturbed group children experienced more adjustment problems in area of health, school and home with higher number stressful life events. K. Dubat & others (2007) stated that the adolescents experienced stress in the categories of family stress, ego threat, bereavement, personal set back, health and other issues. Dr. V. Srikanth Reddy & others (2005) highlighted that adolescent girls experienced less stress when compared to adolescent boys.

2. Research Methodology

Objectives of the study

The present study has been undertaken having the following objectives in mind.

1. To study the level of mental health of higher secondary school students.
2. To find out the difference between Gender and level of mental health
3. To find out the difference between family type and level of mental health

Hypotheses of the study

Based on the above objectives the following hypotheses have been framed.

1. The level of mental health of high school students is moderate.
2. There is no significant difference between gender in their level of mental health.
3. There is no significant difference between family type of the respondents and their level of mental

health.

Methodology

In order to achieve the objectives of the present investigation, survey method was employed. The researcher has adopted descriptive research design.

Sample

For the study, respondents were selected randomly from one of the private hr. sec. school, in Dharmapuri. The data was collected from 100 adolescents of both sexes (Male & Female) of 11th & 12th std students.

Tools of data collection

In this study, For the purpose of data collection the standardized questionnaire was used to collect the data from the respondents. Mental health battery by Dr. Arun Kumar Singh scale was used for data collection. In the present study the variable of mental health has been analyzed through five health indices – emotional stability, over all adjustment, autonomy, security – insecurity and self-concept.

Statistical techniques used

To analyse and interpret data, the statistical techniques such as mean, standard deviation and 'z' – test were used.

Analysis and interpretation of data

For analysis and interpretation of data, the relevant input and analytical findings and inference derived have been presented in different tables and diagrams.

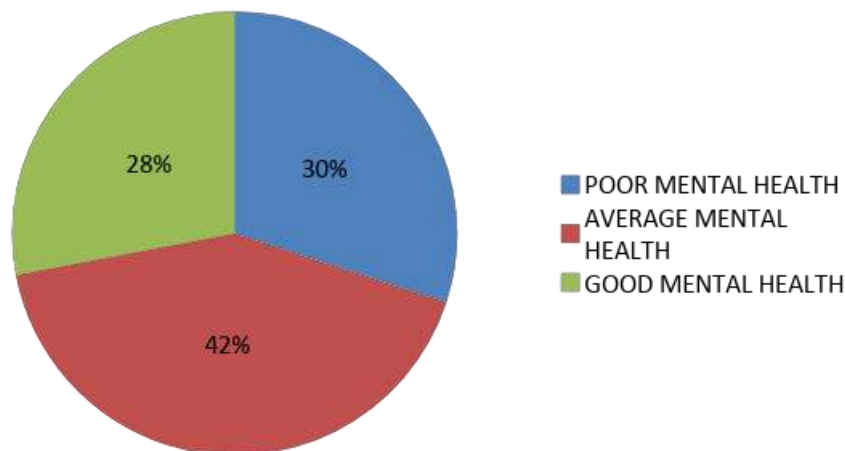


Figure 1. Distribution of the respondents' level of mental health

It is observed from the figure 1 that 42 percent of the respondents have moderate level of mental health. Therefore hypothesis – 1 that “the level of mental health of respondents is moderate” is accepted.

Table 1. 'Z' test between the gender and level of mental health

Particulars	Gender	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Mental Health	Male	50	61.78	4.67	0.661	Z= 0.626 Df= 98
	Female	50	61.16	5.21	0.736	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the gender with the level of mental health of the respondents. Hence hypothesis 2 is proved that gender has no significant difference in the level of the mental health of the respondents.

Table 2. 'Z' test between the family type and level of mental health

Particulars	Family Type	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Mental Health	Joint family	21	61.19	4.72	1.03	Z= 0.291 Df= 98
	Nuclear family	79	61.54	5.01	0.564	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the family type with the level of mental health of the respondents. Hence hypothesis 3 is proved that family type has no significant difference in the level of the mental health of the respondents.

Findings of the study

- 84 percent of the respondents were age group between 15- 16 years.
- 67 percent of the respondent's family has their own business.
- 43 percent of the respondent's mothers were illiterate.

- 65 percent of the respondents' mothers are house wives.
- 79 percent of the respondents are from nuclear family.
- 42 percent of the respondents have moderate level of mental health
- There is no significant difference between the gender with the level of mental health of the respondents.
- There is no significant difference between the family type with the level of mental health of the respondents.

4. Discussion and Conclusion

Discussion

While analyzing the mean scores, it is found that male respondents have little more level of mental health in the dimensions of emotional stability and overall adjustment than female respondents. It's found that female respondents have little more level of mental health in the dimension of autonomy and security – insecurity than male respondents. It is found that the both male respondents and female respondents have equal level of mental health in the dimension of self- concept. Based on the mean score it is identified that in the dimension of overall mental health, respondents from male and female seems to have almost equal amount of mental health level.

While analyzing the mean scores, it is found that in the dimensions of emotional stability, autonomy and self-concept mental health level of respondents who are from joint family and nuclear family has equal level of mental health. In the dimensions of overall adjustment respondents who are from nuclear family have more mental health level. In the dimensions of security – insecurity respondents who are from joint family have more mental health level. Based on the mean score it is identified that in the dimension of overall mental health respondents from joint family and nuclear family seems to have almost equal amount of mental health level.

Conclusion

Mental health is very important factor for higher secondary school students as they are in the turning point of their life in academic aspect and personal aspect. This study reveals that the higher secondary school students have moderate level of mental health. The educational institution can device certain programs to enhance the level of mental health of the students.

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resulted in nurturing hundreds of eminent
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“Once an Osmanian Always an Osmanian”

University College of Engineering, Osmania University, Hyderabad, India

University College of Engineering (UCE) has the distinction of being the oldest and the biggest among the engineering colleges of the State of Telangana, India. It was established in the year 1929, eleven years after the formation of Osmania University. The college was the sixth engineering college to be established in the whole of British India. The college moved to its present permanent building in the year 1947. Today, it is the biggest among the campus colleges of Osmania University. The golden jubilee of the college was celebrated in 1979, the diamond jubilee in 1989 and the platinum jubilee in 2004. The college was made autonomous in 1994. University Grants Commission of India conferred autonomy status to the college for a period of 6 years (2016–2017 to 2021–2022). The college offers four-year engineering degree courses leading to the award of Bachelor of Engineering (B.E.) in biomedical engineering, civil engineering, computer science and engineering, electrical and electronics engineering, electronics and communications engineering and mechanical engineering. The college also offers graduate programs and Ph.D. in the various branches of engineering. As of today, there is a yearly intake of 320 undergraduate students (full-time) and 290 postgraduate students (full-time and part-time). There are 143 teaching staff members, including 40 professors.

The UG programs offered have been accredited by the National Board of Accreditation, New Delhi. Osmania University is accredited by NAAC with “A+” Grade. UCE, OU, is the first engineering college to get ISO 9001 Certification in Telangana State. University College of Engineering was awarded the Best Engineering College by Indian Society for Technical Education (Telangana) in the year 2010. UCE, OU, was adjudged as the Best Engineering College in the country for the academic year 2003–2004 by Indian Society for Technical Education, New Delhi, and by Star News for the years 2010–2011 and 2011–2012.

The college has successfully completed the Technical Education Quality Improvement Programme (TEQIP-I) under the World Bank financial assistance of Rs. 15.48 crores during the period 2003–2008. The outcome of the project has resulted in: (i) increase in pass percentage of UG/PG students, (ii) enhancement of research publications of staff by threefolds, (iii) introduction of six PG programs in

niche areas, (iv) introduction of credit-based system and (v) substantial increase in internal revenue generation.

The college has successfully completed Phase II of TEQIP program with a financial assistance of Rs. 12.5 crores and additional grant of 5 crores under the best-performing institution category. Recently, the college has been approved as a minor center under QIP for full-time Ph.D. programs. The college has been selected for TEQIP Phase III twinning program with a financial assistance Rs. 7 crores. The college has been granted “Visvesvaraya Ph.D. Scheme for Electronics and IT” for full-time Ph.D. program. The GIAN program of MHRD has sanctioned 7 programs in specialized research area to the college. The college has been ranked 80 in NIRF Engineering College Ranking Survey by MHRD Survey, New Delhi, India, for the year 2017–2018.

Alumni Association University College of Engineering, Osmania University, Hyderabad, India

Once, University College of Engineering was declared autonomous, the idea of having Alumni Association, whose membership would include all past students of the college and present or past faculty members of the college, gained momentum. Under the dynamic leadership of then Principal, Prof. D. C. Reddy, the first get-together was held on Saturday the July 3, 1996. After the revival of the Association in 2015, the two subsequent Executive Committees under the leadership of Er. Rammohan Rao, Er. P. Ram Reddy and Dr. D. Vijay Kumar with the support of patrons, fellow members, learned faculty and students have been set out to fulfill the objectives of Alumni Association.

The Association is a not-for-profit organization and works with the staff and students of University College of Engineering, and the objectives are:

- Provide a platform for the alumni to connect with each other for the exchange of information and ideas and communicate their accomplishments, interests and concerns.
- Foster alumni pride and enhance the reputation of the university and OUCE in particular.
- Enrich the emotional bondage among the students, alumni and faculty.
- Extend maximum help to the college in the placement and internship of students in reputed organizations.
- Recognize alumni for their significant contributions to education.
- Propose and execute special projects: buildings, technical projects, seminars, conferences, etc.
- Support poor/economically backward students financially by floating scholarships.
- Institute awards for meritorious performance for students.
- Institute awards for the alumni for their contribution to the college and the society.
- Inspire and invoke the spirit of innovation among the students leading to finding technical solutions to the problems of the society leading to patents to students and the college.

In the past four years, the Executive Body set out to execute the above objectives by taking up many initiatives like conducting global alumni meets, alumni talks, funding student innovation, patent and research, facilitating student internships, industry interactions and career development programs, support for student clubs and other activities, facilitating in setting up the technology business incubator, etc.

To further the objectives of the Association to support the faculty and research scholars, the Association has organized the First International Conference on Emerging Trends in Engineering under its aegis.

Foreword

Alumni Association is constantly setting up new benchmarks with every passing year with a lot of good work done toward furthering the Association goals and giving back to the alma mater. One of the key focus areas has been to bridge the industry academia gap, thereby promoting cutting-edge skill development and research, thereby enabling the university to be a hub of innovation.

This publication is an outcome of the First International Conference on Emerging Trends in Engineering (ICETE). As part of the initiatives of Alumni Association, the conference was organized to enhance the information exchange of theoretical research/practical advancements at national and international levels in key fields of engineering and to promote professional interaction among students, scholars, researchers, educators, professionals from industries and other groups to share latest findings in their respective fields toward sustainable developments.

The entire organizing team has worked hard over the last few months in putting together the complete structure for the event and coordinating with all the eminent speakers across the globe to ensure that the 2-day conference brings together the best minds in the industry to come together and share their valuable insights with the entire fraternity. We are honored to have eminent speakers grace the conference this year.

We received 619 papers from about more than 100 institutions/organizations in 14 countries. The papers have gone through a rigorous evaluation process, and the best papers have been selected for presenting on the days of the conference. Only, the presented and approved papers have come for publishing. I want to thank the Technical Program Committee for bringing together research scholars from diverse background and working tirelessly in picking the final list and bringing out this publication.

With a rich history of over 100 years producing world-class students and alumni who have made a mark all over the world, we aim to continue the tradition by hosting such world-class conferences and live up to the expectations of our alma mater.

April 2019

D. Vijay Kumar

Preface

This book constitutes the thoroughly refereed post-conference proceedings of the First International Conference on Emerging Trends in Engineering (ICETE), held at University College of Engineering and organized by Alumni Association, University College of Engineering, Osmania University, Hyderabad, India, on March 22–23, 2019. The aim of this conference is to enhance the information exchange of theoretical research/practical advancements at national and international levels in the fields of biomedical engineering, civil engineering, computer science engineering, electrical engineering, electronics and communication engineering, mechanical engineering and mining engineering. This encourages and promotes professional interaction among students, scholars, researchers, educators, professionals from industries and other groups to share latest findings in their respective fields toward sustainable developments.

The refereed conference proceedings of the ICETE are published in three volumes covering seven streams, i.e. biomedical engineering, civil engineering, computer science engineering, electrical and electronics engineering, electronics and communication engineering, mechanical engineering and mining engineering. Out of 619 paper submissions from about 14 countries in seven streams of engineering, only 214 papers are being published after reviewing thoroughly; this first volume under the theme “Advances in Decision Sciences, Image Processing, Security and Computer Vision - International Conference on Emerging Trends in Engineering (ICETE)” comprises the comprehensive state-of-the-art technical contributions in the areas of biomedical and computer science engineering streams. Major topics of these research papers include latest findings in the respective fields toward sustainable developments include instrumentation and innovation, signal and image processing, Internet of things, cryptography and network security, data mining and machine learning.

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A Review on Impact Application of Heart Rate Variability (HRV)

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Abstract. The heart is the principal element of the physical structure because it transfers deoxygenated and oxygenated blood within the body. Heart rate variation gives the idea about many physiological and pathological parameter that lead to the change in normal to normal synchronous of the heart rate. HRV could be an essential tool within the department of cardiology, used as a non-invasive measurement technique to get the pathological information of a patient who has changed to suffer from cardiac diseases. Analysis of HRV can facilitate grasping the understanding of the autonomous nervous system (ANS) and can predict cardiac health. HRV shows the variation in the time interval between heartbeats and it is a reliable indicator of current disease, or a person may get suffer from some cardiac diseases. We gave a brief in this paper review of the clinical application of HRV and differential measurement technique such as Time domain, Frequency domain, and Non-linear technique for analysis of HRV.

Keywords: Heart rate variability (HRV) ·
Autonomous nervous system (ANS) · Heart beat ·
Cardiac disease · Time domain · Frequency domain · Non-linear technique

1 Introduction

Electrocardiography is the electrical activity generated by cardiac muscle during a cardiac cycle. ECG is due to the pacemaker of the heart. The Pacemaker of the heart is the Sinuatrial node (SA). This SA node maintains the rhythmic activity of a heart. HRV is the normal to normal interval between hearts beats [1] (Fig. 1).

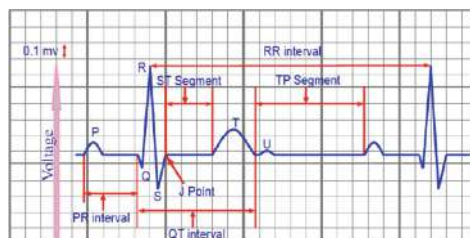


Fig. 1. RR interval

HRV is a noninvasive technique, pre marker technique to know the health status of the autonomic nervous system (ANS) which maintain the normal rhythm of a heartbeat. Regular rhythm is the interval between consecutive heartbeats known as RR interval [2]. HRV reflects the normal to normal interval between the hearts beat corresponding to changes in Heart rate (HR). The normal physiological fluctuation in Heart rate (HR) is because of the Autonomous sensory system (ANS). ANS additionally influences the working of inner body organs.

1.1 Autonomous Nervous System (ANS)

The variation in physiological parameters is a result of control of the body function by several mechanisms. Thermoregulation, sleep, stress, baroreceptor reflex, and ANS is a few of the causes [3]. The factor such as Respiration rate and Heart rate are processed and regulated by an autonomous nervous system (ANS) [1, 4]. The HRV is strongly correlated with the activity of the ANS. The Heart rate (HR) and rhythm are under the control of ANS. The ANS maintained physiological homeostasis in a body and divided into two cords namely Sympathetic nervous system (SNS) and parasympathetic nervous system (PSNS) which begin from Central Nervous System and connected to the different part/organ of the body [5]. Sympathetic and Parasympathetic framework oppositely affect a specific structure, the significance of that; on the off chance that sympathetic structure expands the movement of a particular organ, parasympathetic structure diminishes the equivalent and the other way around [6]. Sympathetic nervous system (SNS) stimulates body for fight or flight in response to dangers and increases the rate of heart, blood pressure, and breathing, whereas the parasympathetic nervous system (PSNS), is involved during relaxation, responsible for preparing the body for rest and for bringing the body at normal state [7], Thus Parasympathetic nervous system (PSNS) increase the time interval between the Heart rate, decreases Blood Pressure and Respiration rate. The Sympathetic nervous system (SNS) and parasympathetic nervous system (PSNS) are directly connected to Sinuatrial (SA) node, found in the right atrium of a human heart, which generates the electrical impulse to regulate the normal rhythm, i.e., depolarization and repolarization of the heart. Hence we can use HRV to analyze the ANS function HRV. By measuring HRV, the human body parameter can be monitored much more efficiently and accurately [1].

2 Literature Review

A brief review of Heart rate variability (HRV) was given by Acharya et al. [8]. He stated that HRV is a very vital and powerful tool to know the imbalance of the ANS. He has mentioned the different physiological factor that can influence the regular beat of Heart Rate (HR). Variation in HR is an indicator of current and warning about a future cardiac disorder. The author also presented the different clinical application of HRV.

Melillo et al. [9] developed a novel predictive model using a data mining algorithm to provide information about the risk of the hypertensive patient using HRV. In this paper, the author expresses, the prescient model dependent on random forest method, technique, and accuracy of this method is up to 87.8% and concluded that the HRV

could be used to detect the different cardiac event and hypertensive patients. Lin et al. [10] have derived the features of HRV based on long-term monitoring. He proposed two best strategies to know the physiological state of an individual from HRV; the technique is; hybrid learning and decision tree learning strategy. These techniques include extraction strategy gives precision up to 90.1%. Kim et al. [11] have built up a feeling acknowledgment framework depends on the physiological signal, for example, body temperature, skin, ECG as this parameter influences ANS. The feature can be extracted using the support vector machine (SVM) classifier.

Researchers of BARC- Bhabha Atomic Research Center and Doctors of AIIMS-All India Institute of Medical Science introduced the distinctive sections about the innovations and a new method for investigation of physiological variation in Advanced Applications of Physiological Variability (AAPV) handbook by Dr. Jindal et al. [3]. The handbook gives a clear idea about the new measurement technique, clinical application, a different protocol for a long term and short term recording of a physiological signal. Bravi et al. [12] presented more than 70 variability technique in his article and discussed the importance, limitation and positive reference related to the clinical application of HRV. The author has given an idea about the different feature extraction technique. The paper further discusses the complexity of the different technique to get the accurate possible way of study. Verlinde et al. [13] presented the case study of athletes and compared result with a healthy subject. The HRV of oxygen-consuming athletes have expanded power in all frequency groups, and the outcomes are gotten by spectral investigation utilizing wavelets transform. Wavelets could be an accurate tool for evaluating the performance of HRV because wavelet can evaluate the oscillating component.

Mager et al. [14] built up a calculation utilizing continuous wavelet change used for power spectral analysis of HRV, which state the co-relation between autonomic and cardiovascular function. Bračić and Stefanovska [15] have examined the human bloodstream in time and frequency domain utilizing a wavelet transform for a different state of cardiac arrhythmia and fibrillation. Panerai et al. [16] has described the relationship between HRV and Blood Pressure (BP) fluctuations in the frequency domain, which demonstrates 10-s fluctuation among time interval and pressure variability. Nagy et al. [17] found that an infant has a lower HR variation in the baby boy than a baby girl. HR variances in the healthy subject have a place by age 20 to 80 were examined, mentioned that HRV decline with age in female than male. Guzzetti et al. [18] has studied the effect of a drug on HRV and found that High frequency (HF) fluctuation increases and Low frequency (LF) fluctuation decreases in the sympathetic activity, these fluctuations in sympathetic activity may lead to heart attack. Luchini et al. [19] found that smokers have increased sympathetic activity during HRV analysis. HRV gets reduced during smoking. Smoking effects on HRV which will harm the ANS. Malpas et al. [20] have demonstrated that HRV will get reduced with the consumption of alcohol. Togo and Yamamoto [21] the author suggested that the conscious state of the brain is reflected in HRV.

Jang et al. [22] expressed in his article that, a confusion of fringe and the focal sensory system will affect HRV. The significance of the HRV investigation in mental illness emerges because of a lopsidedness of sympathetic and parasympathetic action. Wheeler and Watkins [23] confirmed that in the case of diabetic neuropathy there is a

decrease in normal to normal variability. The experiment was performed on 40 subjects who suffered from diabetes and result were concluded that diabetic patient had lowered HRV.

3 HRV Analysis Method

HRV is not a surgical method to examine the condition of the heart; HRV is only used for analysis of heart rhythm. Various procedures currently have been created to evaluate this beat to beat fluctuation to give records of autonomic direction in both healthy and unhealthy conditions. There are two essential methodologies for the investigation of HRV: Linear and Non-linear measurement technique. The most often utilized methods of HRV is the linear method, i.e., Time and frequency domain which gives the spectral data about HRV [3]. In the spectrum of the heart fluctuation, there are four dominant ranges such as Very low frequency (VLF-0.03 to 0.04 Hz), Low frequency (0.04 to 0.15 Hz) and High frequency (HF-0.15 to 0.40 Hz) which reflects sympathetic and parasympathetic action individually. Analysis of HRV will help us for mass screening, post-intervention analysis, and disease characterization.

4 Clinical Application

4.1 HRV as an Indicator of Health

The amount of HRV represents psychological and physiological health. A large number of studies found that autonomic parameter serves as a marker for prediction of disease.

A natural derivation of Heart rate variability (HRV) will help cardiologists to utilize it as a straightforward non-obtrusive tool for clinical research. HRV has been demonstrated in essential in regards the heartsickness too in a condition such as Alzheimer's, renal failure, epilepsy, diabetic neuropathy, thrombolysis, strokes and sleep disorder. Since every part of the body is dependent on blood, so any cardiac abnormalities will affect the functions of all organs, hence most doctors confirmed that HRV affect on every part of the body, Autonomous nervous system (ANS) dysfunction is a vital characteristic of the heart and HRV decreases in disease such as myocardial infarction, arrhythmia, ventricular fibrillation, brain trauma, sepsis, vital organ failure, diabetic neuropathy. In these conditions, there is a prevalence of intellectual movement and a massive decrease in parasympathetic action. There is a drastic reduction in time domain parameter and low frequency (LF) component of HRV. This is due to unopposed sympathetic excitation, attenuation in the activity of the SA node. Sick sinus syndrome (SS), Left branch bundle block (LBBB), and Congestive heart block (CHB) in such condition HRV increases [1].

The HRV measurement technique can provide information about the dysfunction in ANS, a psychiatric disorder such as schizophrenia and depression. The scientist gave the outcomes from a few examinations that ANS brokenness is one of the pre-marked for discouragement. In such cases parasympathetic activity gets reduced which would

lead in a variation of heartbeats, frequency domain technique provides noticeable results in depression.

In the case of arrhythmia and ventricular fibrillation, the medical practitioner has observed that rapid fluctuation in sympathetic and parasympathetic activity occurs. Though the autonomous nervous system (ANS) affects the HRV Central nervous system (CNS) and the Peripheral nervous system (PNS) will also play a significant role [1].

4.2 Alteration in HRV in Various Disease

Chronic diseases such as functional somatic disorders, cardiovascular diseases, neurological disorders, respiratory diseases, immunologic diseases, hematologic disease, and renal disease show abnormalities in the autonomic nervous system. It is not only a chronic disorder but also the unstable state situation such as trauma, stress, etc. [1]. Based on Indian study and literature survey following conclusion can be drawn HRV as a predictor and a marker.

HRV as a Marker for Arrhythmia

Arrhythmia is a potential threat to life. They may occur in the form of myocardial damage. Autonomic patient profile estimated by the standard deviation of normal to the normal interim (SDNN) was observed to be correlated with arrhythmia. HRV analysis is found to be a useful method for identification of arrhythmic patients [24].

HRV as a tool for classification of Heart disease

By utilizing a computational methodology, such as neural network, random forest, support vector machine (SVM) and fuzzy logic, a researcher has attempted to classify ECG abnormalities using HRV parameters [25].

HRV as Risk Marker for Epilepsy

Sudden unexpected death in epilepsy can be investigated using the HRV parameter. The root means square standard deviation (RMSSD) is strongly related to epilepsy [26].

HRV as a predictor of Myocardial Infarction

The clinical value of HRV parameters is in its predictive ability of sudden cardiac death due to myocardial infarction. Several long-term trial studies found that HRV parameter has definite potential to predict the myocardial event [5].

HRV as a useful parameter for Biofeedback

Biofeedback uses a physiological parameter which serves as monitoring parameters. This monitoring parameter is also the parameter which can be controlled by the individual. Several diseases which show reduced HRV are likely to get information from biofeedback using HRV [27].

HRV as a predictive tool for monitoring ANS

Autonomous nervous system (ANS) plays a vital role in maintaining blood pressure (BP) in physiologic situations like anesthetic sedation. If there is a problem with ANS, then there will be a change in blood pressure, which will affect HRV [28].

HRV as an indicator of hemodynamic crises

Alteration in HRV has been documented in several severe hemodynamic crises in operation theatres and emergency rooms. The HRV has the potential to serve as a predictor of hemodynamic crises, and there is a need to carry out studies during potential crises. It also can predict the severity of prognosis for recovery in children and adults in traumatic injury [3, 28].

HRV as a parameter to predict Time to Death

At the end of life care, it is essential to be able to predict the time of death. Since the ANS determines the life processes, the deterioration of ANS activity can be utilized to predict the time to death. In a case series study of hepatocellular carcinoma, found that the time to death was significantly associated with total power and high frequency of HRV. Therefore the inclusion of HRV measurement in prognostic models may improve the predictive ability concerning time to death [3].

5 Conclusion

In this paper, we have seen the research done on HRV by various researchers and cardiologist, to improve the medical facilities for disease diagnosis and patient monitoring. Heart rate variability (HRV) becomes an essential noninvasive tool, and it is easy to perform. HRV technique not only used in case of cardiac disease but also used in other pathological conditions. The present review proposes that Heart rate variability investigation utilizing ECG recording could be successful in the case of addiction, stress, obesity, etc. It can be concluded that shortly we can get a more accurate result by developing different Machine Learning algorithms for analysis of HRV.

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Assessment of ECG Signal Quality

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Abstract. Background: Standard clinical parameter for monitoring and diagnosis of cardiovascular function is the electrocardiogram (ECG). It is an electrical activity of a heart generated by the cardiac muscle, measured using lead configuration placed on the body. **Objective:** Main objective is to design and validate the ECG signal acquisition module and its signal quality. **Method:** A simple 3-lead ECG acquisition module is created using Instrumentation amplifier and filter circuit. A different method like Template matching-Pearson Correlation, Skewness, Kurtosis, Statistical Test, Comparison of Error Bar, and Machine signal quality classifier is proposed to assess its signal quality. **Result:** In this paper, we have given the information about the statistical and machine learning method to estimate ECG signal quality acquired from the designed module. **Conclusion:** The result of the article concludes that the developed module produces a quality signal that can be used for clinical application.

Keywords: Electrocardiogram · ECG acquisition system
Signal quality estimation · Machine learning · Instrumentation amplifier

1 Introduction

It is tough to purchase the ECG machine only for experimentation and analysis purpose for the researcher. To perform experiments, we require a database of ECG signal. Although many databases of real and synthetic ECG signal are available on a different website. We aim to generate a database of Heart rate variability (HRV) signal. For analysis of HRV, we require a real-time signal that can be acquired from various acquisition machine like BIOPAC, but it is too costly. We have designed a small 3-lead ECG acquisition module having sampling frequency 100 Hz which will help to acquire a signal from the patient body. While developing a module, we must get a good quality signal, so that no significant information is lost. The acquired signal may suffer from disturbances like motion artifacts, which deteriorate the quality and make it impossible to analyze and diagnose. During designing of module proper filtering action must be considered to reduce artifacts. Acquisition system must have high Common Mode Rejection Ratio (CMRR) and signal to noise (SNR). The spectra of the ECG signal is 0.05–100 Hz. This spectra get altered when noise present in ECG signal which affects signal quality. So robustness of module is required.

We will discuss the development of ECG acquisition module and a different method for quality estimation of the ECG signal. Quality estimation of ECG signal can

be done by acquiring the signal from a healthy subject (subject signal) and comparing that with a standard signal. For experimentation purpose, standard ECG signal collected from the 12-channel a Tele ECG module for 10 min at a 100 Hz sampling frequency. The subject signal is received from the designed module for 10 min at 100 Hz. The standard and subject database contain 9000 samples. The module has a small size, not too costly, and signal quality is significant. Several methods exist to measure the quality of the signal. Our proposed method is based on statistical and machine learning parameter [5].

2 Materials and Methods

For this study 20 healthy male subject with age 20–28 were enrolled. First, 10 min ECG recording of 20 healthy subjects are taken using a Tele ECG module and the same latter procedure was done using designed ECG module. For simplicity purpose let us say, a signal acquired from the Tele ECG module is a standard signal, and a signal received from the developed module is a subject signal. These two signals were compared to estimate the signal quality of a developed module.

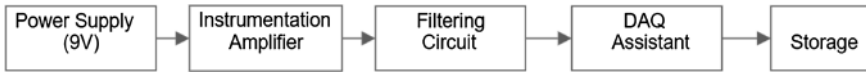


Fig. 1. Block diagram

Figure 1 gives the detailed block diagram of a simple ECG module that can be quickly assembled and experimented in the laboratories. A 9 V rechargeable battery powers the entire circuit. The purpose to use a battery as a power source is to eliminate power line interference 50 Hz noise. The output of the 9 V battery is connected to a low voltage drop three terminal voltage regulator 7805 to obtain +5 V regulated power supply. The advantage of using low voltage drop regulator to supply continues +5 V output voltage, even if the battery discharges up to 7 V by maintaining dropout voltage. Regulated +5 V is given to DC to DC converter (IN0505D) which gives ± 5 V supply to the amplifier circuit.

The amplifier circuit made up of a low power Instrumentation amplifier (INA129). The gain resistance is taken as 10 k Ω to get a gain of 5 from the amplifier. Gain 5 is kept given the electrode potential of the order 450 mV. The output of INA129 is further amplified for a gain of 450 with the help of quad op-amp LMC6044 [2]. The amplified output is connected with Integrated circuit (Low Pass Filter) with a time constant of 3.4 s which gives a lower 3 dB response of 0.05 Hz for baseline restoration to have clinical quality ECG output. The differentiator circuit (High Pass Filter) is used to obtain upper 3 dB cutoff frequency at 150 Hz. The cascaded HPF and LPF formed the Band Pass Filter, which is considered for removal of artifacts. The output of Instrumentation amplifier is DC translated to an appropriate level with the help of LMC6044 [2].

Positive input from the left leg (LL) or Left arm (LA) electrode is connected to inverting input and Negative input from Right arm (RA) electrode is connected to the

non-inverting terminal of INA129. The output from quad opamp LMC6044 can be observed on Digital storage oscilloscope (DSO). We can store the data/signal using NI DAQ assistant card, and further processing can perform on Lab VIEW or MATLAB software. We can store data in .dat, .mat, .csv format.

After acquiring the signal, we have to estimate its quality. Estimation of quality is essential to know because a signal is used for clinical application. We can define the signal quality of ECG with two parameters, i.e., Fundamental quality and vital quality. Fundamental quality is related with Heart rate (HR), Arrhythmia, Atrial fibrillation, HRV and it usually defines P, QRS, and T wave in a condition like myocardial ischemia and coronary heart disease. More information can be extracted from Heart rate (HR) hence more focus on the fundamental quality of ECG signal is given [1]. Comparison between standard and subject signal was performed by 'Unpaired t' test. $P\text{-value} < 0.05$ was accepted as the level of significance.

3 Result and Discussion

There are several signal quality index parameter which estimates the quality of signals such as RR Interval variability, Template matching- Pearson correlation, skewness and kurtosis, statistical test, comparison of Error Bar and Machine learning signal quality classifier. We will implement all these signal quality indices on standard and subject signal.

3.1 RR Interval Variability

RR Interval is the successive interval between two R-peaks. In ECG QRS complex gives vital information about heart disease. The regularity in RR interval and R peak detection is an indicator of ECG signal quality. R peak detection algorithm applied using MATLAB. A total number of R peak detected are 450, 441 in standard and subject signal respectively. The quantity of R peak obtained through Tele ECG and designed module are very near.

3.2 Template Matching-Pearson Correlation

Another critical approach to measuring the regularity in the ECG signal is Template Matching. Quality of signal can be provided based on the shape of standard signal and subject signal for that template matching approach is used [4]. The correlation coefficient of the template is calculated. Correlation shows the strong relationship between two signals, which is denoted as r_{xy} .

$$r_{xy} = \frac{\sum_i (x - \bar{x})(y - \bar{y})}{\sqrt{\sum_i (x - \bar{x})^2} \sqrt{\sum_i (y - \bar{y})^2}}$$

Where x y is the data sample and \bar{x} , \bar{y} are the arithmetic mean of the data sample while the denominator is the standard deviation of two data sample. This is also known as the Pearson product correlation coefficient, usually the value of r_{xy} ranges between

-1 to +1. -1 represents the negative correlation whereas +1 represent positive correlation. The correlation between the standard signal and subject signal that we got is 0.816. The template matching approach based on correlation, with average correlation ≥ 0.70 is desirable, and a value of average correlation ≤ 0.70 is undesirable [1].

3.3 Skewness and Kurtosis

The third and fourth moment is skewness and kurtosis of a probability distribution. The third moment about the mean is

$$\frac{\sum_{i=1} (x_i - \mu)^3}{N}$$

Which tells us about the symmetry of the distribution. Skewness measure symmetry of the normal distribution and can take negative or positive value depending on the skew on the left or right tail of the normal distribution. The skewness can be as

$$S = \frac{\frac{1}{N} \sum_{i=1} (x_i - \mu)^3}{\sigma^3}$$

On the other hand, kurtosis measures a sharp peak of the distribution, the fourth moment about the mean is

$$\frac{\sum_{i=1} (x_i - \mu)^4}{N}$$

Which tells us about the shape of a distribution. Kurtosis of a population is characterized in terms of peak and tail, but it is described around the value of $\mu \pm \sigma$. The kurtosis can be calculated as

$$K = \frac{\frac{1}{N} \sum_{i=1} (x_i - \mu)^4}{\sigma^4}$$

In distribution, skewness also depends upon outlier, a distribution with any number of outliers has high skewness which results in an asymmetric distribution. Presence of outlier in data sample is an indication of noise which could effect on a signal. The normal distribution has skewness, kurtosis equal to 0 and 3 respectively. The kurtosis value of 2.8 to 3.5 is desirable. The following observation is drawn from the standard signal and subject signal.

	Standard Signal	Subject signal
Skewness	0.21	0.27
Kurtosis	3.1	3.3

Statistical Analysis

A statistical test is used to provide the probability of occurrence. The two tail ‘unpaired t’ test is used for analysis purpose. A statistical test is conducted by considering the Null Hypothesis (H_0) and Alternative Hypothesis (H_a). As the value of skewness and kurtosis is desirable, we can assume that the data follow a normal distribution. The objective of the statistical test is to find out any significant difference between the standard signal and the subject signal [3].

Null Hypothesis (H_0)

(H_0) = There is no significant difference between two data sample of the signal.

Alternative Hypothesis (H_a)

(H_a) = There is a significant difference between two data sample of the signal.

The level of significance is selected as 5% that gives a level of confidence 95%. If $p\text{-value} < \alpha$ then Reject null hypothesis; if $p\text{-value} > \alpha$ then Fail to reject the null hypothesis. $p\text{-value} (0.72) > 0.05$ is obtained using ‘unpaired t’ test, which indicates that there is no significant difference between the two data sample. Data sample belongs to the same population.

3.4 Machine Learning Signal Quality Classifier

The k - nearest neighbor, the non-parametric test is used to study for signal quality classification. To build classifier we have used the value of $k = 1$ and 3 for identifying the eigenvalue of k for classification of signal quality. To measure the classification model’s performance, three statistical measure called accuracy, sensitivity, and specificity were calculated. Their equation is

$$Accuracy = \frac{(TP + TN)}{(TP + FP + TN + FN)}$$

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Specificity = \frac{TN}{TN + FP}$$

T , F , P , and N are represented as *True*, *False*, *Positive* and *Negative* respectively. *True Positive (TP)* and *False Positive (FP)* are indicated as ‘*bad-quality signal*’ whereas *True Negative (TN)* and *False Negative (FN)* are indicated as ‘*good-quality signal*.’ Experimentation was done in MATLAB. By using 10 fold cross validation following are the result we will get

k -NN Classifier	Accuracy	Sensitivity	Specificity
$k = 1$	96.39%	97.92%	97.02%
$k = 3$	96.89%	84.06%	98.10%

The average accuracy, sensitivity, and specificity using $k = 1$ and 3 were 96.64% , 90.99% , and 97.56% respectively. The above result shows that k -NN can be effectively used for signal quality classification [4].

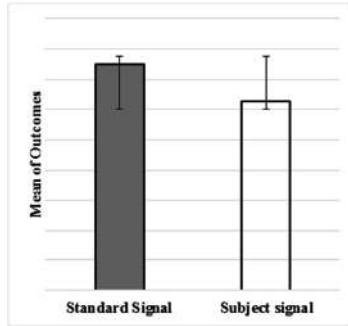


Fig. 2. Error Bar: Standard deviation

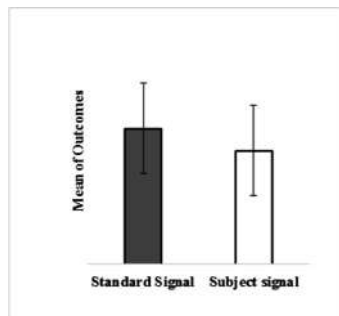


Fig. 3. Error Bar: Standard error

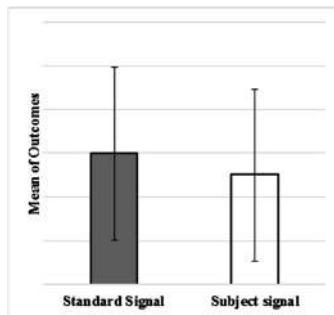


Fig. 4. Error Bar: 95% confidence interval

3.5 Comparison of Error Bar with Statistical Significance

Another way to analyze the significant difference between the standard signal and the subject signal is Error Bars. We have given a comparison between standard deviation error bars, Standard Error bars and 95% confidence interval error bars. If the error bar between groups of data does not overlap, then the data may be significantly different, and if it is overlap, then data is not significantly different. Below a comparison between error bars conclude that there is substantial overlap between the subject signal and standard signal, indicate no significant difference between the signals.

4 Conclusion

For the purpose of creating an ECG signal database, we have designed an ECG acquisition module for HRV analysis. Various signal quality index parameters such as, mean, standard deviation, Pearson's correlation, Normality test, Machine Learning signal quality classifier check the performance and quality of the signal acquired from the designed module. The outcome of all the methods shows clearly that there is no significant difference between the standard signal and the subject signal. This means that the designed module produces an ECG signal of quality, which can also be useful for clinical analysis and experimentation.

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Identifying Obstructive, Central and Mixed Apnea Syndrome Using Discrete Wavelet Transform

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Abstract. This paper presents feature extraction of Electroencephalogram (EEG) signal and identifying the Obstructive Sleep Syndrome (OSS), Central Sleep Syndrome (CSS) and Mixed Sleep Syndrome (MSS) using Daubechies order 2 wavelet transform. Wavelet transform is the powerful tool for feature extraction and classification. The EEG signal is decomposed into sub-bands and features are extracted. Based on the features the EEG signal is correlated with subjects abdomen movements, nasal air flow and ribcage movements. Then OSS, CSS and MSS are identified. The frequency of EEG signals goes high to low when event occurs. The signal amplitude of abdomen movements, nasal air flow and ribcage movements reduces and reaches zero level when event occurs. Recognizing the thresholds of all the artifacts leading to OSS, CSS, and MSS reduces the diagnosis time and saves life.

Keywords: Obstructive Sleep Syndrome (OSS) · Central Sleep Syndrome (CSS) · Mixed Sleep Syndrome (MSS)

1 Introduction

Adequate sleep is primary requirement for proper functioning of nervous system. Improper sleep effects immune system, leads to chronic conditions and there by serious health disorders. Sleep Apnea is one of the serious sleep disorder seen in 75% of human population. There are two stages of sleep: Non rapid eye movement (NREM), rapid eye movement (REM). NREM is further classified into three stages [1, 2].

- Stage one is the beginning of sleep with slow eye movements and muscles start relaxing, lasts for 5 to 10 min. This is the transition stage when person is moving from awake to sleep state.
- Stage two means the person enters to second stage of sleep where he stops eye movement. In this stage heart rate slows, muscles relax further. This stage lasts for 10 to 25 min.
- Stage three is considered as deep sleep stage, it is difficult to awake a person in this stage. Brain waves are less responsive in this stage. Breathing falls to low level, blood pressure falls and body temperature also falls. Dreaming happens in this stage. This stage lasts for 30 min or more [3, 4].

A person enters to REM stage after completing all the three stages of NREM. REM stage lasts longer during night time. In REM stage eye moves rapidly [11]. All these sleep stages are diagnosed for sleep apnea patients through polysomnography test. This test includes electroencephalogram (EEG), electrocardiography (ECG), electrooculogram EOG, electromyogram EMG, Oxygen saturation SpO₂ and so on [5, 10].

Sleep Apnea is commonly seen in men and women due to lifestyle changes. Now a days it is very common like type 2 diabetes. If it is undiagnosed and untreated then it leads to serious consequences like death [6, 9]. There are three types of sleep apnea: Obstructive Sleep Syndrome (OSS), Central Sleep Syndrome (CSS) and Mixed sleep Syndrome (MSS). OSS is caused by blockage of upper airway or due to the pauses in air flow for a few seconds. This is commonly seen in snoring subjects [7, 8]. The obstructive air flow leads to reduced oxygen saturation. The difference between normal breathing, partial obstruction and complete obstruction in breathing is shown in Fig. 1.

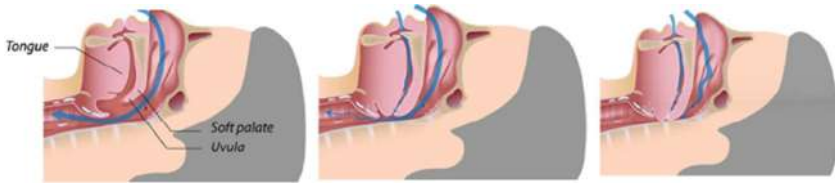


Fig. 1. Normal, partial obstruction and complete obstruction in breathing

2 Methodology

The subjects having Obstructive Sleep Syndrome (OSS), Central Sleep Syndrome (CSS) and Mixed sleep Syndrome (MSS) are taken from <https://physionet.org> and signals are decomposed into sub-bands to extract the detailed and approximate coefficients. The decomposition and feature extraction is done using discrete wavelet transform with Daubechies order 2. In this paper 25 subjects data suffering from Obstructive Sleep Syndrome (OSS), Central Sleep Syndrome (CSS), Mixed sleep Syndrome (MSS) are taken. Out of these 25 subjects 21 are male and 4 are female with age 50 ± 10 years. Table 1 show the sample of 10 subjects considered.

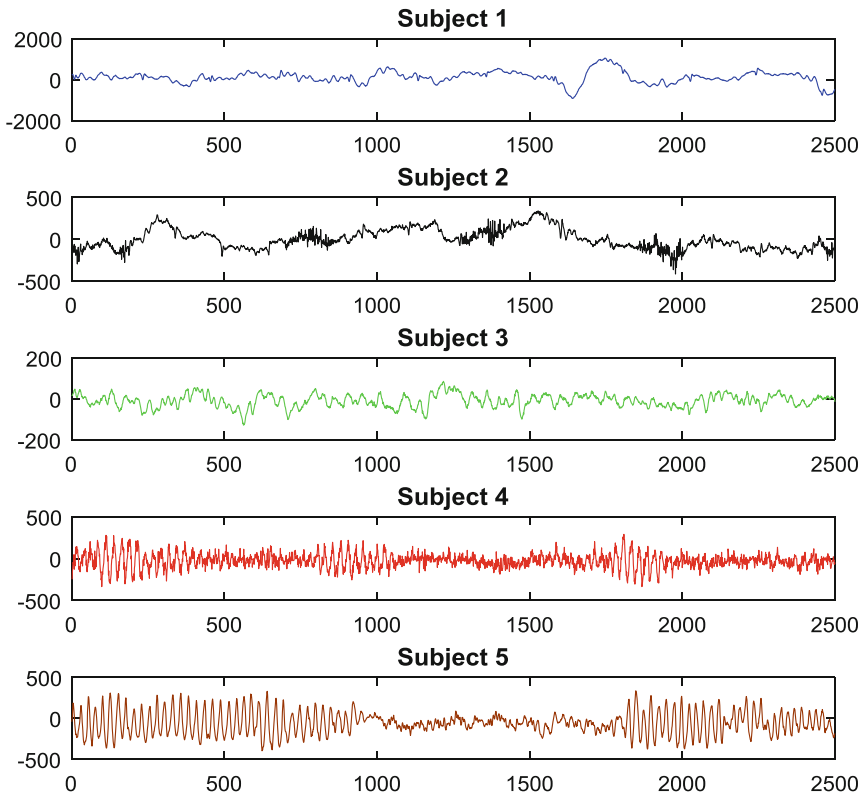
Figure 2 show the abnormal EEG for multiple subjects and data is taken at standard terminal C4–A1. These EEG signals are said to be abnormal since they include sleep apnea syndrome. Wavelet transform is used for decomposing the EEG signal in to sub-bands (alpha, beta, theta, delta and gamma). The sampling frequency is 250 Hz, eight decomposition levels are done for extracting detailed and approximate coefficients.

For decomposing of EEG signal Daubechies order 2 discrete wavelet transform is used. From these coefficients the features are extracted to identify the obstructive sleep apnea, central sleep apnea and mixed sleep apnea.

The features considered for extracting OSS, CSS and MSS are energy, variance, mean, median, maximum and minimum. Later in the next stage for OSS, CSS and MSS subjects the abdomen movements, nasal flow, ribcage movements and snoring are identified.

Table 1. Sample of subjects considered

Subjects	Weight	Gender	Age
Subject 1	100.3	M	54
Subject 2	102	M	48
Subject 3	80	F	62
Subject 4	103.5	M	52
Subject 5	87	F	41
Subject 6	119	M	38
Subject 7	89	F	68
Subject 8	117	M	53
Subject 9	83.9	F	28
Subject 10	108.8	M	52

**Fig. 2.** Abnormal EEG from multiple subjects

3 Results and Discussions

In this study the obstructive sleep syndrome, central sleep syndrome and mixed sleep syndrome are identified using discrete wavelet transform with Daubechies order 2. Five recordings EEG, abdomen movements, nasal flow, ribcage movements and snoring are extracted from each subject to identify the severity of apnea shown in Figs. 4, 5 and 6. The EEG signal is decomposed into five sub-bands alpha (α), beta (β), theta (θ), delta (δ) and gamma(γ) shown in Fig. 3.

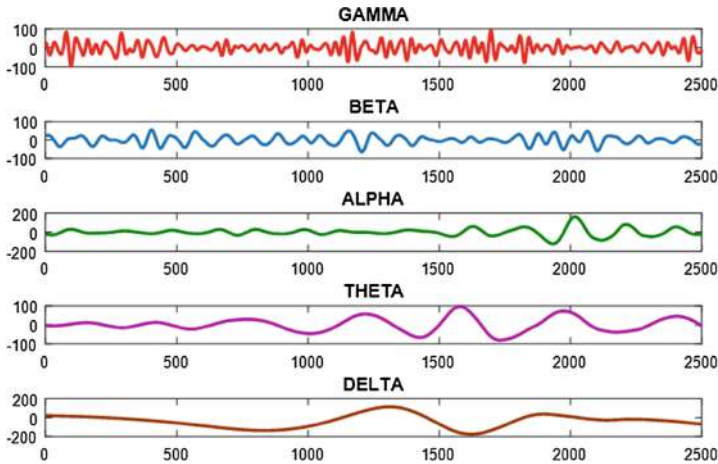


Fig. 3. Decomposed EEG signal

Then set of features mean, absolute mean, standard deviation, median, variance, maximum, minimum are extracted shown in Table 2. These features demonstrates the apnea type (OSS, CSS or MSS) along with the four artifacts (abdomen movements, nasal air flow, ribcage movements and snoring) taken from the subjects.

Table 2. Features extracted from a subject

Features	Gamma	Beta	Alpha	Theta	Delta
Mean	-0.0152	0.04217	0.1847	0.7789	15.26
Energy	17.741	4.572	8.888	8.675	10.953
Maximum	122.7	57.85	75.47	65.68	76.76
Minimum	-96.34	-61.55	-66.07	-46.4	-24.47
Standard deviation	32.58	23.06	28.66	23.76	25.12
Variance	5.707	4.802	5.353	4.874	5.012

Figure 4 shows the occurrence of obstructive sleep apnea during REM sleep. It is observed the abdomen movements, nasal and ribcage signals are completely reduced to nearly zero level at 2000 to 4000 m sec range when OSS episode occurs.

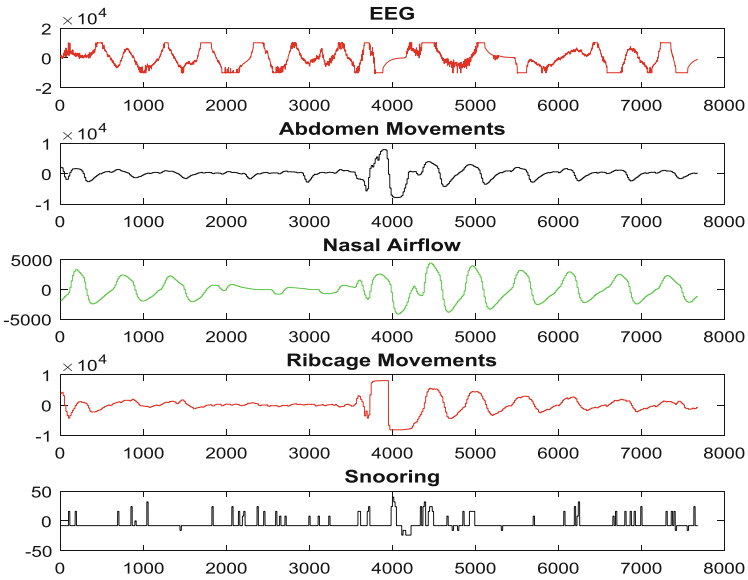


Fig. 4. Obstructive sleep apnea

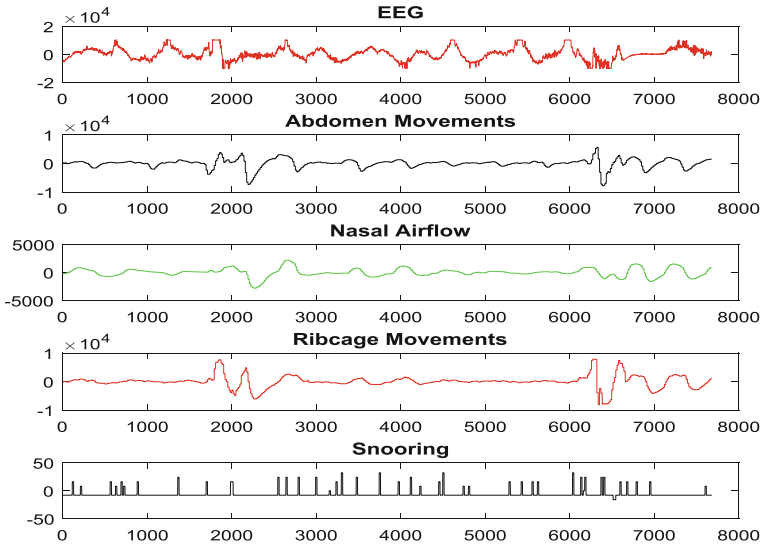


Fig. 5. Central sleep apnea

Figure 5 shows the occurrence of Central sleep apnea during REM sleep. It is observed the ribcage movements is reduced to zero level. The airflow and abdomen signals are reduced at 4000 ms to 6000 ms range when CSA event occurred. Figure 6

shows the occurrence of Mixed sleep apnea. When EEG signal is compared with abdomen movements and ribcage movements these signals reached to zero level. In EEG signal the spike is seen at 1800 ms when the episode occurs and similarly at the ribcage movement the event occurrence is seen at 0 to 2000 ms and again at 3000 ms to 4800 ms.

The subjects abdomen movements, nasal and ribcage movements are analysed for 30 s duration for sleep apnea patients. Snoring of each subject is also analysed for identifying apnea events.

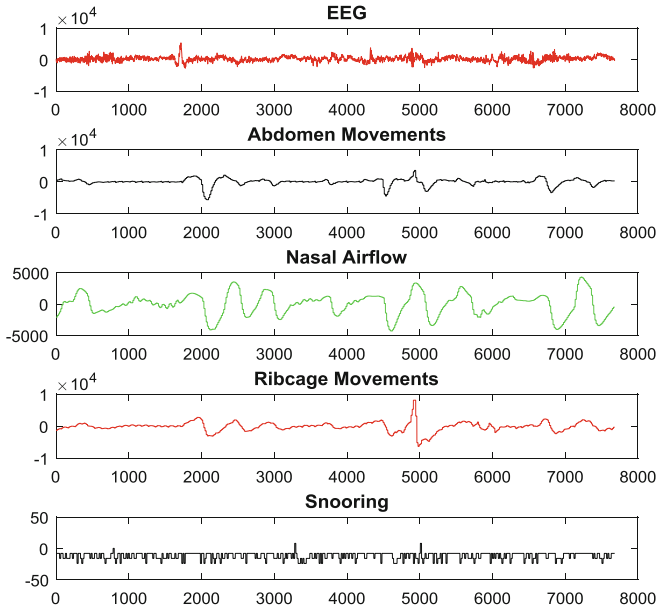


Fig. 6. Mixed sleep apnea

4 Conclusions

In this paper identifies all three types of apnea events-Obstructive Sleep Syndrome (OSS), Central Sleep Syndrome (CSS) and Mixed sleep Syndrome (MSS). The EEG signal characteristics are analyzed with the help of wavelet decomposition techniques. After identification of OSS, CSS and MSS these artifacts abdomen movements, nasal airflow and ribcage movements and snoring of all 25 subjects are analyzed. The EEG signal is decomposed into 8 sub-bands and coefficients are extracted as features. The features of EEG signal-mean, standard deviation, median, variance and generated are extracted using Daubechies order 2 wavelet transform. Daubechies wavelet gives better efficiency than other wavelets. It is observed the EEG signal, abdomen movements, nasal, ribcage movements and snoring signal amplitudes goes high to low when event occurs.

Acknowledgments. The authors wish to thank the publicly available physio bank database <https://physionet.org/physiobank/>

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Fractal Dimension of Fundoscopic Retinal Images for Diagnosing of Diabetic Retinopathy

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Abstract. The present work applied different image processing techniques like green component image, background estimation and image skeletonization on the subject's fundus images. Statistical methods like fractal dimensions, neighbourhood concept was used to distinguish between normal and abnormal fundus images in subjects ($n = 45$). The results show that, in normal fundus images the vein structures were clearly visible, while in the fundoscopic positive images, the vein structures were totally absent. In fundoscopic negative images the visible vein structures are observed to be thick and coiled up. No significant changes were found in Fractal Dimension (FD) values among the subjects. Neighbourhood pixels (NP) values were found to be 45 ± 0.74 (mean \pm S.D.) for normal subjects, 34 ± 1.01 for fundoscopic positive subjects, 20.47 ± 0.49 for fundoscopic negative subjects. The results of this work validated the skeletonized images and support the strength of diagnosis with the help of accurate figures.

Keywords: Fractal dimensions · Fundoscopy · Fundus image · Neighbourhood concept · Skeletonised images

1 Introduction

According to World Health Organization (WHO) survey conducted in 2016, it is stated that about 422 million adults are affected with diabetes mellitus and there are about 30 million people diagnosed with diabetes in India [1]. Diabetic Retinopathy (DR) damages the retina of the eye and is a serious sight-threatening complication of diabetes. DR is divided into two types Non-proliferative diabetic retinopathy (fundoscopic Negative) and Proliferative diabetic retinopathy (fundoscopic Positive). The approximate field of view of an individual human eye varies due to facial anatomy, but is typically 30° upwards until the eye brow, 45° towards the nose, 70° downward, and 100° front view. Combining both the eyes the photographic view is 135° upwards and 200° parallel [2].

Figure 1 shows the front view of the human eye and Fig. 2 shows the fundus image of the eye captured by a fundus camera [3–5]. The fundus camera has two modes, one which captures the back part of the eye and the other which captures front part of the

eye [6–9]. The blood vessel structures are visible [10–13] in the back part of eye as shown in Fig. 2. The disadvantage of the fundus camera is that, it lacks the in-depth and accurate information regarding each disease.

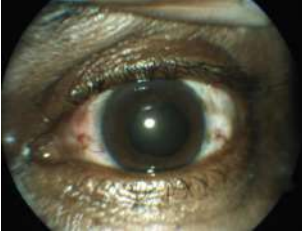


Fig. 1. Funduscopy camera capturing front part of eye

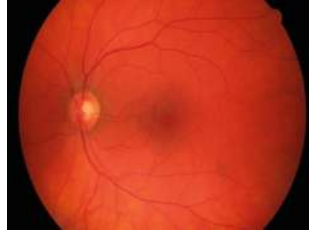


Fig. 2. Fundus image of eye

The previously reported literature [1] shows that damage to the vessels of the eye depends on the time of exposure to graphene oxide. [14] summarises the skeletonization of the fundus images using various image processing techniques. However, the results were not supported by the mathematical justification. [15], reports the use of fractal dimensions in images of high ocular patients. But the paper had limited scope as they used only one mathematical concept.

2 Methodology

Data Collection: Forty-five subjects (12 females) of mean age (55 ± 5) were included in this study. The subjects were divided into Healthy ($n = 15$), fundoscopic positive ($n = 15$), fundoscopic negative ($n = 15$). All the subjects were recruited into the study from Apollo Institute of Medical Sciences and Research. All subjects gave informed consent for participation in the study. The Fundus CANON CF-1 retinal camera was used in this study to record the data.

Feature Extraction: Feature Extraction is divided into two: Fractal Dimensions, Neighbourhood Concept.

Fractal dimensions: Fractal dimension is a part of Fractal geometry, which defines the ratio which provides a statistical index of complexity in a pattern or design which changes with the scale that is being measured. It can also be characterized as a measure to fill the space capacity of a pattern, it necessarily need not to be a fraction. There are two types of fractal dimensions they are: self-similarity dimension and box counting dimension.

Self- Similarity Dimension: This type of dimension can only be used when the input image is self-similar. The equation for this type of dimension is given below:

$$a = 1/(s^D) \text{ where } "a" = \text{number of pieces}, "s" = \text{reduction factor and } "D" = \text{self-similar pieces.} \quad (1)$$

Box- Counting Dimension: This dimension is calculated by placing a grid or 1 mm square boxes on the input image. After placing the boxes on the input image, calculate the width of the grid and find the inverse of it that is represented as “s”. Now count the total number of boxes the input image touches, name it as “N”, then

$$x\text{-axis of the graph} = \log(s) \quad (2)$$

$$y\text{-axis of the graph} = \log(N(s)) \quad (3)$$

After taking the values of the x-axis and y-axis plot the graph and find the best fit line. In this work Box-Counting dimension has been used to find out the fractal dimension of the input image as it does not have a limiting factor called self-similarity.

Neighbourhood Concept: The output of applying the neighbourhood operation on an image which is considered to be an input, the output will also be an image format. Normally the size of the neighbourhood is fixed, either it will be square matrix or a cube matrix. The matrix will have a centre point “p”. The main work of the Neighbourhood concept is that to calculate object properties. To calculate object properties means it finds the centre pixel of the image which has high intensity. The reason for finding the centre pixel is due to locate the initial point where light enters into the eye. The initial point which allows the light into the eye will have a high intensity. After capturing the high intensity pixel, the mask (size of the neighbourhood) then finds the standard deviation among the pixels and then it displays it on the image.

Figure 3 shows the overall block diagram of image processing approach using neighbourhood concept and fractal dimension. The fundus image is first resized to display the image on the screen. Then the given image is converted to the greyscale image for binarization to calculate fractal dimension, object properties using the pixel values and custom pixel value-based properties, to plot the bar graph.

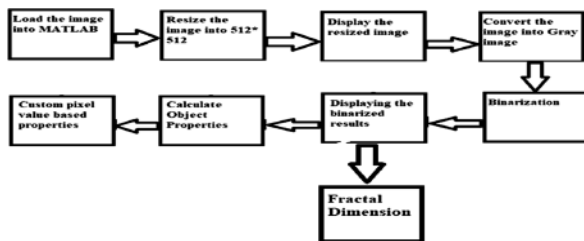


Fig. 3. Block diagram of unified image processing approach using neighbourhood concept and fractal dimension

3 Results

3.1 Results of Different Image Processing Tools Applied on Normal Fundus Images

Figure 4 represents the Normal fundus image results. Figure (4a) talks about reading the original fundus image of a normal patient, (4b) shows the green component of the image to put all the pixel value intensity of the image in a nearby intensity. (4c) Shows the background of the green component image which was estimated using morphological opening. (4d) shows the result of subtraction of background image with the original image. (4e) Increase the contrast of the image in step 4 (4d). (4f) Creating a new binary image by thresholding the adjusted image. (4g) Removing the unwanted noise. (4h) Skeletonising the image.

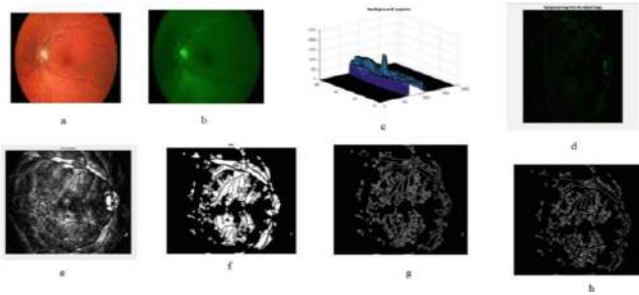


Fig. 4. Pre-processing of normal fundus images of a healthy subject

3.2 Results of Different Image Processing Techniques Applied on Fundoscopic Positive Image

Figure 5 shows the Fundoscopic Positive fundus image results. Figure (5a) talks about reading the original fundus image of a normal patient, (5b) shows the green component of the image to put all the pixel value intensity of the image in a nearby intensity. (5c) shows the background of the green component image which was estimated using

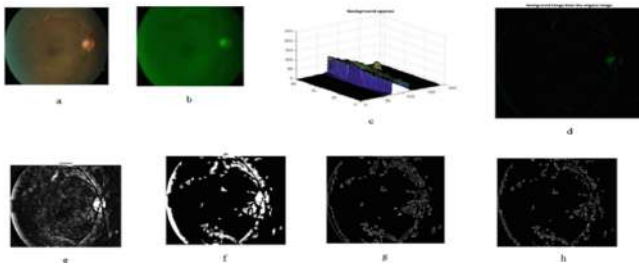


Fig. 5. Pre-processing of Fundoscopic positive images of a patient

morphological opening. (5d) shows the result of subtraction of background image with the original image. (5e) Increase the contrast of the image in step 4 (5d). (5f) Creating a new binary image by thresholding the adjusted image. (5g) Removing the unwanted noise. (5h) Skeletonising the image.

3.3 Results of Different Image Processing Tools Applied on Fundoscopic Negative Images

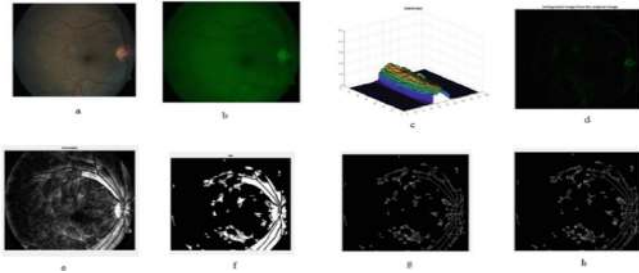


Fig. 6. Pre-processing of Fundoscopic negative images of a patient

Figure 6 shows the Fundoscopic Negative fundus images result. Figure (6a) talks about reading the original fundus image of a normal patient, (6b) shows the green component of the image to put all the pixel value intensity of the image in a nearby intensity. (6c) shows the background of the green component image which was estimated using morphological opening. (6d) shows the result of subtraction of background image with the original image. (6e) Increase the contrast of the image in step 4 (6d). (6f) Creating a new binary image by thresholding the adjusted image. (6g) Removing the unwanted noise. (6h) Skeletonising the image.

3.4 Mathematical Calculations Using Fractal Dimensions

Figure 7 shows the results of normal fundus images. Figure (7a) represents a healthy subject input data on the axis. Figure (7b) shows the resized image, binarizing and displaying the scaled results. Similarly, the same procedure was followed for the fundoscopic positive and negative patients. All images of the patients are shown in Fig. 8a–b, Fig. 9a–b respectively.

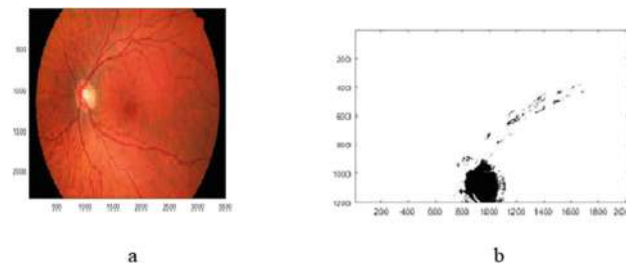


Fig. 7. Fractal Dimensions of normal fundus images of a healthy subject

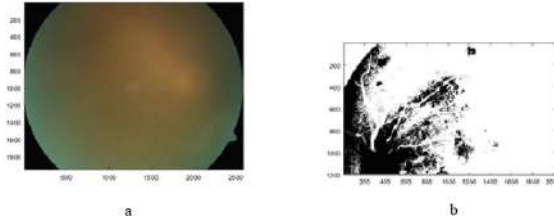


Fig. 8. Fractal Dimensions of Fundoscopic positive images of a patient

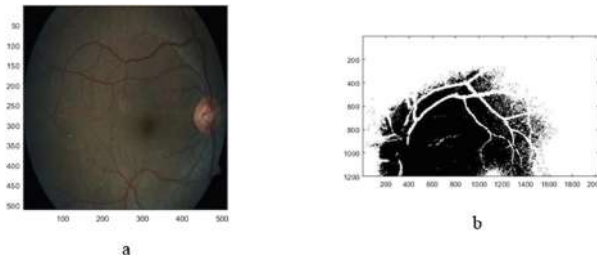


Fig. 9. Fractal Dimensions of fundoscopic negative images of a patient

3.5 Mathematical Calculation Using Neighbourhood Concept

Figure 10 represents the normal fundus image results. The original fundus image of a normal subject is shown in Fig. 10a. Figure 10b shows binary image of the healthy subject.

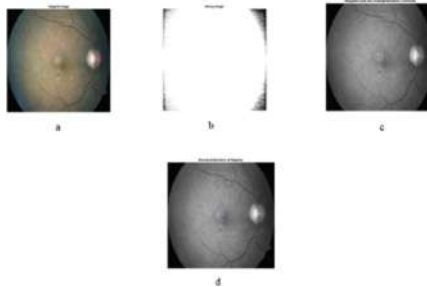


Fig. 10. Neighbourhood concept of healthy subject

Figure 10c shows the calculation of object properties using pixel value of grayscale. The calculation of custom pixel value-based properties is shown in Fig. 10d. Similarly, the same procedure was followed for the fundoscopic positive and negative patients. All images of the patients are shown in Fig. 11a–d, Fig. 12a–d respectively (Table 1).

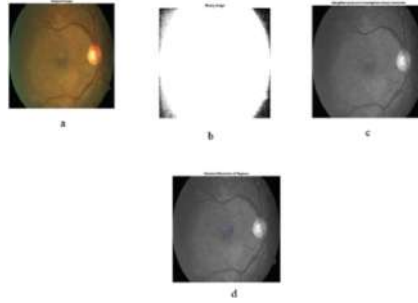


Fig. 11. Neighbourhood concept of Fundoscopic positive image

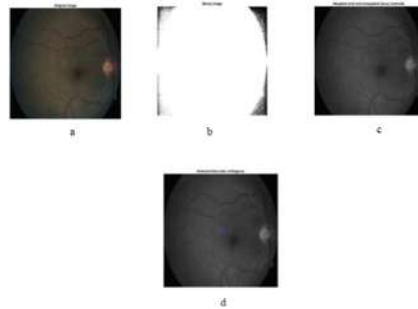


Fig. 12. Neighbourhood concept of Fundoscopic negative image

Table 1. The fractal dimension and neighbourhood concept values of study population

Subjects	Fractal dimension		Neighbourhood concept	
	Mean	SD	Mean	SD
Healthy subjects	0.039953	0.000175	44.94	0.72
Fundoscopy positive	0.000872398	1.04563×10^{-8}	34.12667	0.980793
Fundoscopy negative	0.007087	0.00015	20.47333	0.479537

4 Conclusion

The work done in this paper clearly distinguishes the normal, Fundoscopic positive, negative fundus images using the proposed fractal dimension and neighbourhood concept to a great extent. The statistical data given in Fractal dimension concept and Neighbourhood pixel concept widely shows the difference among the normal fundus images and abnormal fundus images (Fundoscopic positive, Fundoscopic negative). It is warranted that if the proposed algorithm incorporated in the fundus camera, it is certain that it improves the efficiency of the fundus images.

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Photosweep: An Engineering Approach to Develop Cost Effective Sterilization System for Hospitals

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Abstract. This study represents an engineering approach for the development of a cost effective sterilization device called “Photosweep”. It takes the present sterilization condition one step ahead by using heat generated from the solar energy and germicidal property of UV ray instead of electricity. Photosweep is a dual chamber machine where the first chamber uses the heat from sun, to turn water into high temperature and pressure steam for sterilization of glassware and metallic tools and accessories. In the second chamber, UV ray is extracted from the sun to sterilize plastics (ventilation tube, bio-bags, media solution, etc.) that would usually melt at high pressure and temperature steam. The developed low cost dual function Photosweep can reduce the operation cost for sterilization in small to medium capacity hospitals in low to middle income countries. Further improvement to this technology may augment potential benefits in all level hospitals of various countries having enough day light.

Keywords: Sterilization · Solar panel · Steam · UV ray · Resonance intensifier · Transmission filter · Autoclave

1 Introduction

Surgical Site Infection (SSI) comprise more than one-third of all hospital-acquired infections. It is observed that around 300,000 patients per year in the USA had a post-operative SSI [1]. Re-usable surgical instruments also can cause cross-contamination of serious life threatening diseases. Hospitals are not the only place affected by filthy medical tools, but even research labs, privatized medical chambers are victims and its proficiency, patients and worker health, are at stake. We know already that autoclave machines are the master sterilizers, being used in these places but autoclave machines are expensive. In developing countries the use of autoclaves machine is less because of affordability, also they don't have any or there is a lack of local manufacturers. So, they need to import which increases the cost even more, but Photosweep uses sustainable solar energy, not electricity, while providing similar working function of autoclaves.

2 Structure & Process

See Fig 1.

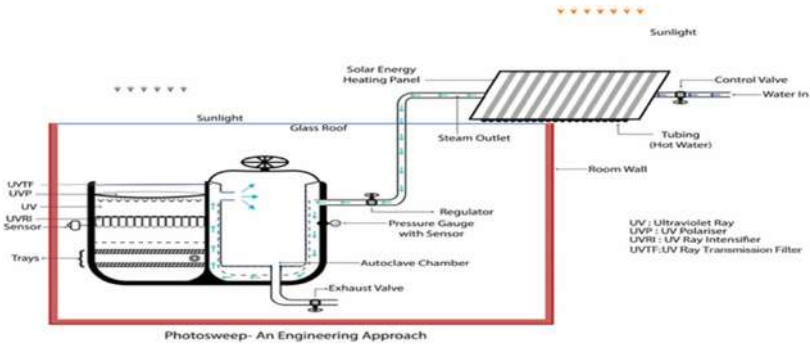


Fig. 1. Proposed design of a PHOTOSWEEP machine.

2.1 Structure of Water Heating Panel

See Tables 1 and 2, Fig. 2.

Table 1. Parts and their functions of water heating panel and pipeline

Name of the parts	Function
1. Pipeline for water supply	Supplies required water
2. Steam generating heating panel	Turns water into steam [123 °C]
3. Pipeline for steam supply	Supplies the steam to chamber I
4. Valves	Control supply of water and steam
5. Temperature sensor	Control the opening of valves

Table 2. Parts and dimensions of solar steam generating heating panel

Parts	Dimensions
1. Parabolic Trough	Length: 1 m, Aperture: 1.5 m
2. Evacuated Tubes	Length: 1 m, Diameter: 0.005 m Steel for inner tube material and evacuated glass for outer tube material
3. Flow rate of water inside the tubes	2.5 to 3.5 kg/h

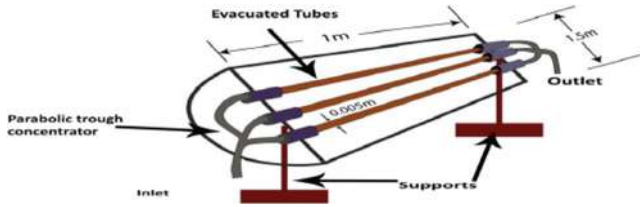


Fig. 2. Dimension of solar steam generating heating panel with parabolic trough

2.2 Process

- Clean water is supplied through the pipeline in a controlled way using one way valve to the solar water heating panel. The solar steam generating heating panel, as shown above, collects and stores the heat from solar energy, which is then absorbed by running water through the evacuated tube. A set of evacuated tubes is situated under the parabolic trough concentrator which can reach a temperature of 250 °C or even more [2].
- Temperature sensor simultaneously controls two valves. When temperature reaches at around 123 °C, temperature sensor opens the steam exit valve which allows passing of the steam only into the jacket of chamber (I) through the pipeline and the water supply valve permits water to enter evacuated tube. The incoming water into the evacuated tube will decrease the tube temperature. When temperature reaches at 121 °C, temperature sensor closes the steam exit valve.
- Chamber material and pipeline will receive some heat to reach temperature of 121 °C. Considering this heat loss in the chamber, higher temperature [123 °C] steam is supplied than required [121 °C] (Calculation is given below). When the evacuated tube is filled with water, the water supply valve will be closed.

2.3 Structure of Chamber (I)

See Table 3.

Table 3. Parts and their functions of chamber (I)

Name of the parts	Functions
1. Stainless steel cylinder	A double layered cylinder assembles the whole chamber containing a vacuum space in between the two layers, which provides heat insulation and the stainless steel provides heat resistance
2. Jacket	Made of Polypropylene that uniformly distributes steam inside the chamber
3. Trays	Hold the tools and glass wares
4. Airtight lid	Heavy and strong enough for holding a pressure of around 15 atm
5. Pressure gauge & sensor, Temperature sensor, Exhaust valve	Controls pressure, temperature, ejection of used steam respectively

2.4 Process

- At first, jacket gets filled by the steam coming from pipeline and it ensures uniform distribution of steam inside the chamber. After filling the whole jacket properly, steam enters inside the chamber through an opening (controlled by valves) which is situated exactly opposite of the exit of the steam pipeline.
- Inside the chamber the steam needed for sterilization should be at 121 °C temperature and 15 atm pressure. When pressure value reads 15 atm in pressure gauge, sensor will close all three valves and thus stops the entrance of water & steam and exhaustion of air. After 20–45 min sterilization is complete and the sensor opens the exhaust valve.

2.5 Structure of Chamber (II)

See Table 4.

Table 4. Parts and their functions of chamber (II)

Name of the parts	Functions
1. Stainless steel cylinder	Assemble the whole chamber
2. UV transmission filter	Transmit only the UV rays
3. UV Polarizer	Aligns the UV rays in one direction
4. UV resonance intensifier (UVRI)	Amplify the amplitude of polarized rays
5. Wooden lid	For closing and opening of UV ray chamber
6. UVRI sensor	Ensures the required intensity of UV ray

2.6 Process

- In second chamber Ultraviolet A (320–395 nm) and Ultraviolet B (280–320 nm) is used to sterilize the plastic tools that have low melting point. UVA is now known to cause significant damage to DNA via indirect routes (formation of free radicals and reactive oxygen species). UVB radiation excites DNA molecules, causing aberrant covalent bonds to form between adjacent pyrimidine bases, producing a dimer, that induces a form of programmed cell death (apoptosis) or can cause DNA replication errors leading to mutation.
- By opening the wooden lid sunlight is permitted to transmit through the UV transmission filter. Transmission filters are dark glass filters which absorb the visible region of light and transmit ultraviolet region and a negligible amount of near-infrared region.
- The transmitted UV ray are passed through the UV polarizer, where scattered UV ray are aligned in one direction.
- Polarized UV rays are intensified to 40 W/cm² approximately by the intensifier following the resonance principle and amplitude of the UV ray depends on the duration in UVRI which takes 25–30 min.

3 Related Calculations

Estimated dimensions of both chambers, required water supply, heat and temperature of supplied steam for chamber I of this model are calculated below (Fig. 3).

Dimension of Outer Chamber:

Taking, Pressure, $p = 1.05 \text{ bar} = 0.103 \text{ MPa}$ at 121°C

Radius of inner chamber, $r = 0.15 \text{ m}$

Working stress for thin chamber, $\sigma = 5 \text{ MN/m}^2 \sim 30 \text{ MN/m}^2$ [4]

Outer diameter = 0.30 m so, outer radius, $r = 0.15 \text{ m}$

Inner Radius, $r = 0.15 \text{ m} - .0031 = 0.147 \text{ m}$

Height, $h = 0.60 \text{ m}$

Density of stainless steel used for chamber = 7930 kg/m^3

Wall thickness of the chamber $t = \frac{pr}{\sigma} = 0.00309 \text{ m} = .0031 \text{ m}$

Volume of chamber $V = \pi r^2 h = \pi(0.15^2 - 0.147^2) \times 0.60 = 1.679 \times 10^{-3} \text{ m}^3$

Mass of the chamber $m = \rho V = 7930 \times 1.679 \times 10^{-3} = 13.314 \text{ kg}$

Weight of the chamber $W = mg = 13.481 \times 9.81 = 130.610 \text{ N}$

Dimension of inner chamber:

Taking, Pressure, $p = 0.103 \text{ MPa}$ at 121°C , Radius of inner chamber, $r = 0.13 \text{ m}$

Working stress for thin chamber, $\sigma = 5 \text{ MN/m}^2 \sim 30 \text{ MN/m}^2$ [4]

Outer diameter = 0.26 m so, outer radius, $r = 0.13 \text{ m}$

Inner Radius, $r = 0.13 \text{ m} - .003 = 0.127 \text{ m}$

Height, $h = 0.58 \text{ m}$ & Density of stainless steel used for chamber = 7930 kg/m^3

Wall thickness of the chamber, $t = \frac{pr}{\sigma} = 0.00309 \text{ m} = .003 \text{ m}$

Volume of chamber, $V = \pi r^2 h = \pi(0.13^2 - 0.127^2) \times 0.58 = 1.404 \times 10^{-3} \text{ m}^3$

Mass of the chamber, $m = \rho V = 7930 \times 1.404 \times 10^{-3} = 11.134 \text{ kg}$

Weight of the chamber, $W = mg = 11.134 \times 9.81 = 109.225 \text{ N}$

Dimension of jacket,

Taking, pressure, $p = 1.05 \text{ bar} = 0.103 \text{ MPa}$ at 121°C

Radius of inner chamber, $r = 0.125 \text{ m}$

Working stress for thin chamber, $\sigma = 5 \text{ MN/m}^2 \sim 30 \text{ MN/m}^2$ [4]

Outer diameter = 0.25 m so, outer radius, $r = 0.125 \text{ m}$

Inner radius = $0.125 - 2.575 \times 10^{-3} = 0.122 \text{ m}$

Height, $h = 0.55 \text{ m}$ & Density of Polypropylene = 946 kg/m^3

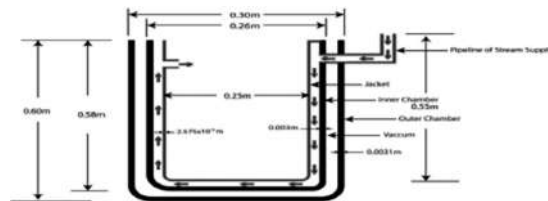


Fig. 3. Dimension of outer chamber, inner chamber and jacket of chamber (I); Dimension of chamber (II) will be the same excluding jacket.

Wall thickness of the chamber, $t = \frac{Pr}{\sigma} = 2.575 \times 10^{-3}$ m

Volume, $V = \pi r^2 h = \pi(0.125^2 - 0.122^2) \times 0.55 = 1.280 \times 10^{-3}$ m³

Mass of the chamber, $m = \rho V = 946 \times 1.280 \times 10^{-3} = 1.210$ kg

Weight of the chamber. $W = mg = 975.39 \times 9.81 = 9568.5759$ N

Water supply in chamber (I):

The volume of water supplied $V = \pi r^2 h = \pi(0.13)^2 \times 0.058 = 0.003$ m³

Where, $r = 0.13$ m, $h = 0.058$ m

Mass of the water supplied $m = \rho V = 1000 \times 0.003 = 3$ kg

Weight of water supplied $W = mg = 3 \times 9.81 = 29.43$ N

Heat calculation of chamber (I):

Heat $\Delta = mS\Delta\theta = 3 \text{ kg} \times 4185.5 \text{ jkg}^{-1}\text{k}^{-1} \times 96 \text{ k} = 1205.424$ kJ

Where, $121^\circ\text{C} - 25^\circ\text{C} = 96^\circ\text{C} = 96 \text{ k}$ [25°C is taken as room temperature]

Temperature of supplied steam in chamber (I):

$$m_1 s_1 (T_2 - T_1) = (m_2 s_2 + m_3 s_3) \Delta\theta$$

Where, m_1 = mass of steam

s_1 = specific heat of steam = $1.99 \times 10^3 \text{ jkg}^{-1}\text{k}^{-1}$

T_2 = supply temperature = ?

T_1 = final temperature = $121^\circ\text{C} = (121 + 273) = 394 \text{ k}$

m_2 = mass of inner chamber = 11.522 kg

s_2 = specific heat of stainless steel = $502.416 \text{ jkg}^{-1}\text{k}^{-1}$

m_3 = mass of jacket = 1.210 kg

s_3 = specific heat of polypropylene = $1920 \text{ jkg}^{-1}\text{k}^{-1}$

$\Delta\theta = (121^\circ\text{C} - 25^\circ\text{C}) = 96 \text{ k}$, [25°C is taken as room temperature]

Therefore, $T_2 = \frac{(m_2 s_2 + m_3 s_3) \Delta\theta}{m_1 s_1} + T_1 = 122.359^\circ\text{C}$

4 Result and Discussion

4.1 Required Time and Efficiency

In chamber (I), solar radiation is trapped by parabolic trough where high temperature [123°C] is obtained in the evacuated tubes to generate steam from approximately 3 kg of water flow through the inlet. Considering heat loss, the stable steam is produced in between 1.5 to 2 h with 1205.424 kJ heat, to perform sterilization of metallic tools in 20–45 min in chamber (I). In intensified UV ray chamber (II) 25–30 min is recommended for sterilization [5] and obtained result clearly indicates that “Photosweep” has the capability of making available a *cost efficient* sterilization process. The solar heating panels with the solar tracker can be used with the parabolic trough, to move it, following suns position. To get the best result, “Photosweep” should be run in between 9:00 am to 16:00 pm because solar irradiance is larger at that time to establish a higher steam generation rate [6] (Fig. 4).

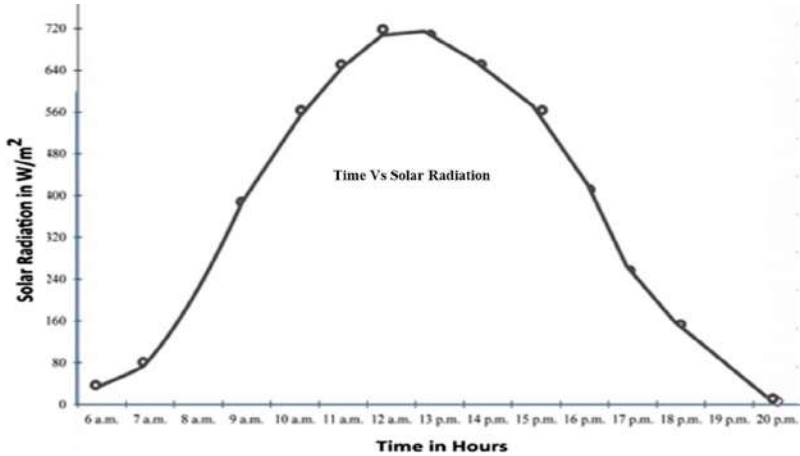


Fig. 4. Representation of solar energy at different day-time [7]

Again, when the sun intensity will be lower (during winter and cloudy nights), *molten salt*, a mixture of *sodium nitrate* (NaNO_3) 60% and *potassium nitrate* (KNO_3) 40%, can be used as a storage medium of thermal energy because of its superior heat capacity [8].

4.2 Comparison

The present condition of sterilization in a third world country is absolutely pitiful owing to the fact of technological gap and huge expenses.

- Sterilization of both the metallic and plastic tools can be done in one single device unlike autoclave using heating and germicidal properties of sunlight respectively.
- “Photosweep” can be manufactured locally as all the components are available in the market which reduces the price, whereas other sterilizing devices are manufactured by only a few specific companies that needs to be imported.
- Autoclave machines are costing around \$11,000 to \$12,000 where “Photosweep” cost around \$691 [Parabolic trough \$300, pipe and double metal chamber \$125, pressure temperature gauges & sensors \$200, UV transmission filter \$6, Polarizer \$45 and resonance tube \$15].
- Conventional sterilization devices use electricity where they have to bear the electricity bill. There is no such billing process in this model.

5 Conclusion

Using solar energy from Sun, the development of Photosweep sterilization system was done. It uses two properties of sunlight, one for heating water and producing steam using solar heating property and another utilizes germicidal property of UV ray. Even

though UVC is most effective in sterilization, it is absorbed by the oxygen in the atmosphere and it doesn't reach the earth naturally (unless ozone depletion is considered). In the future, hopefully the technology will be improved for utilizing UVA and UVB more efficiently. Overall the concept, resulted in a new sterilization system that can be implemented in healthcare facilities. As a result Photosweep system is drawing the attention of the experts from government and private sector, especially from healthcare industries. Being low cost and an eco-friendly technology, this system also attracted the environment specialists of our country. Thus use of renewable energy from sun in Photosweep has promises to become efficient biomedical modalities for the medical field sterilization system. It brings new hope for hospitals of low to middle income countries, which are currently lacking such facilities, to attain a sustainable and maintainable sterilization system.

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Conflict of interest. The Authors declare that they have no conflict of interest.

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Splice Junction Prediction in DNA Sequence Using Multilayered RNN Model

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Abstract. Genes are parts of a DNA sequence responsible for protein synthesis. Splicing more specifically refers to a post-transcriptional modification that is responsible for multiple protein synthesis from a single gene. The classification of the splice junction has remained quite a challenging task in the field of bioinformatics and is equally important as the synthesized proteins are responsible for the unique characteristics observed in different living organisms. In this study, we propose a state of the art algorithm in splice junction prediction from DNA sequence using a multilayered stacked RNN model, which achieves an overall accuracy of 99.95% and an AUROC score of 1.0 for exon-intron, intron-exon as well as no-junction classification.

Keywords: Codon · Exon · Intron · mRNA · Nucleotide · Splice junction · Transcription

1 Introduction

Splicing is one of the post-transcriptional modifications which prepares the mature m-RNA molecules to enter the protein synthesis phase. For successful splicing, it is essential to identify the amino acid-coding regions or exons from the non-coding regions or introns in the DNA sequences. During the splicing mechanism pre-mRNA transcribed from a particular gene may result in multiple mature-mRNA molecules which in turn result in the synthesis of unique functional proteins [1]. Thus, accurate detection of the splice junctions helps in understanding the nature of the synthesized proteins and their resulting characteristics. This can result in the development of new methodologies in the field of gene therapy in order to introduce new ways to resist genetic diseases. A simple splicing operation has been shown in Fig. 1.

We propose a versatile algorithm, based on the mechanism of protein synthesis from DNA sequences. The encoded sequences thus obtained are invariant of the type of RNN cell used. Classification is performed by the multilayered stacked recurrent neural network. Comparison of the performances of the network while using basic RNN, GRU and LSTM cells respectively have been shown in this study.

A faulty splicing operation can cause lethal side effects such as mutations in genes BRCA1 and BRCA2, which increase a female’s risk of developing breast and ovarian cancer [2]. Also, a change at an exon-intron junction results in β -Thalassemia [3]. The proposed methodology thus explores means to reach optimal performance with near-ideal accuracy of 99.95% with optimal precision-recall trade-off. The model in its entirety can be found at: <https://github.com/RahulSkr/junctionPredictionFromGeneSequence>. Optimal parameter settings for this architecture have been obtained through extensive fine tuning, which has been discussed in details in the sections below.

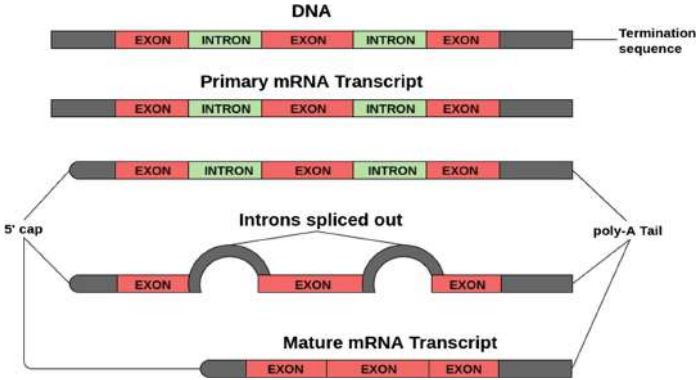


Fig. 1. Gene splicing

The rest of the paper has been organized as follows: Sect. 2 discusses the various existing statistical models designed for same/similar classification tasks; Sect. 3 explains in details all the sequence encoding stages followed by the model development; Sect. 4 shows the various performance statistics and curves obtained by the model on the given dataset and finally Sect. 5 discusses the importance of the proposed methodology and touches upon its possible future scope.

2 Related Works

In this section, we briefly summarize the various algorithms involved in DNA sequence encoding and splice junction classification. A comparison of the performance of the proposed model with the existing relevant algorithms is provided in Sect. 4.2.

Salzberg [4] explained a machine learning system based on decision trees combining 21 coding measures such as dicodon frequency, hexamer frequency and etc., to produce classifiers on DNA sequence with lengths 54, 108 and 162 base pairs. Nguyen et al. [5] in 2016, introduced an innovative method to classify DNA sequences using CNN. A sequence encoding approach was devised similar to ours where one hot encoding was performed on a group of 3 consecutive nucleotide bases and 2 such groups were concatenated together to obtain a 2D matrix from the sequence. This matrix was then processed by the CNN model.

Works based on splice junction prediction include: SVM power series kernels for classification with 4-position independent K-mer frequency based methods for mapping DNA sequences into SVM feature spaces, as described by Damaševicius [6]. Cervantes et al. [7] explained a sequence classification performed by using SVM and Bayesian classifiers. Kerdprasop et al. [8] described a splice site prediction algorithm based on association analysis: the frequent DNA patterns were combined and prioritized with respect to their annotations and support values based on which several rules were generated for classification operation. A hybrid machine learning ensemble model employing an AdaBoost AIDE and a bagging random forest classifier, was explained by Mandal [9]. A supervised feature reduction technique was developed using entropy-based fuzzy rough-set theory and was optimized using greedy hill climbing algorithm.

In the year 2015, Lee et al. [10] described a RNN architecture consisting of stacked RNN layers followed by FC layers. Zhang et al. [11] proposed a methodology involving deep CNN consisting of 2 layers. Encoding was performed for each sequence using one hot encoding of the nucleotide bases: A, C, G, T, N (either of the bases).

A comparison of the performance of the proposed methodology with the aforementioned relevant splice junction prediction algorithms is provided in Table 2.

3 Proposed Methodology

Our proposed recurrent neural network has a 3 layer deep architecture which is built using multiple recurrent units at each layer. In this study, we showcase the performance of the architecture with GRU, LSTM and basic RNN cells. The encoding process has also been discussed along with related theories to ensure its reliability. A pictorial run-down of the proposed methodology is shown in Fig. 2.

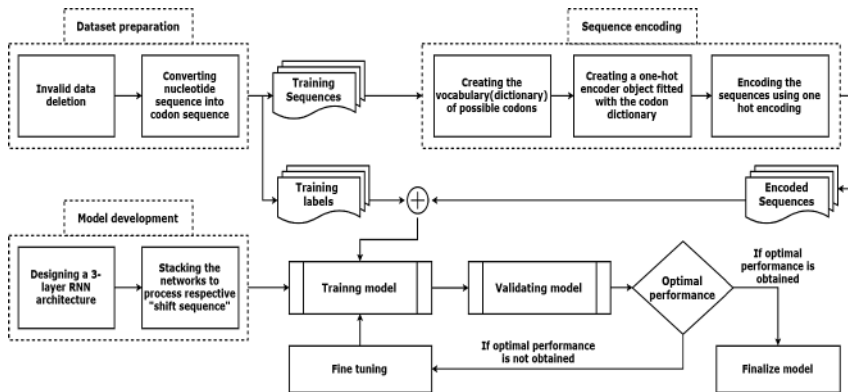


Fig. 2. Flow diagram of our approach

3.1 Dataset Preparation

We use the Molecular Biology (Splice-junction Gene Sequences) data set assembled by Murray et al., which consists of 3190 sequences taken from the Genbank database [12]. The sequences are labeled as “IE” or “EI” to signify intron-exon and exon-intron boundaries respectively. Sequences not containing a splice junction have also been included in the data set. The sequences have 62 attributes defining them, namely, the junction type (if any), the instance name and the sequence of 60 nucleotide bases. Sequences with uncertain nucleotide bases in them were eliminated, resulting in a downsized dataset of 3175 instances. Five-fold cross validation is used to train and validate the model performance, with each fold containing 635 instances. The section below describes the encoding of the sequences in details.

3.2 Sequence Encoding

The encoding algorithm requires the nucleotide bases to be grouped in batches of 3, where a batch represents a unique codon. A sequence of three consecutive DNA or RNA nucleotide bases is called a codon. And, these codons or rather the sequence of these codons are responsible for the synthesis of particular proteins from t-RNA molecules. As seen in Fig. 3, we can obtain 3 codon sequences from a single nucleotide sequence, with the unshifted sequence having length n , and the shifted ones with length $n - 1$ (where n appears in multiples of 3). A 3-shift will result in the same codon sequence as the 0-shift, hence, shifting beyond 2 characters is halted.

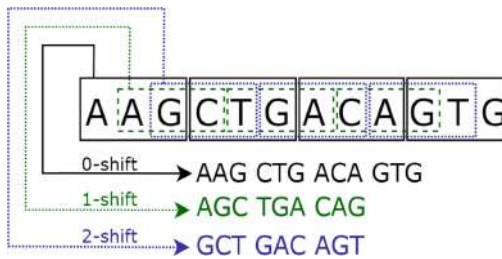


Fig. 3. Nucleotide sequence to codon sequence conversion

It is clear that for the dataset in question we obtain 3 sets of 3175 codon sequences. The shifting is performed in order to obtain all the possible sequences of codon. The ignored nucleotide bases in the shifted sequences can be considered to be a part of the codon preceding or following the given sequence. Custom encoding is then performed on these sets.

Each codon from the sequences is labelled with respect to its position in the DNA codon table [13]. Thus, a numeric labelled sequence is obtained from the codon sequences. This sequence is then converted to a sparse one-hot encoded matrix. The codons are responsible for protein synthesis and hence are responsible for coding of genetic characteristics. This theoretically justifies the effectiveness of our encoding algorithm. In the following sections we describe the model architecture in details.

3.3 Model Development

Recurrent neural networks, more commonly known as RNN are known to perform extremely well on sequence data. To be processed by RNN, the sequence data are required to be fed in form of discrete ordered states. Here, each sequence has a length of 20 states, where each state is a vector of 64 values. Each value in the vector represents a particular codon, as already mentioned. Figure 4 provides a brief insight into the architecture of the proposed network. The section below discusses the working of the stacked multilayered model.

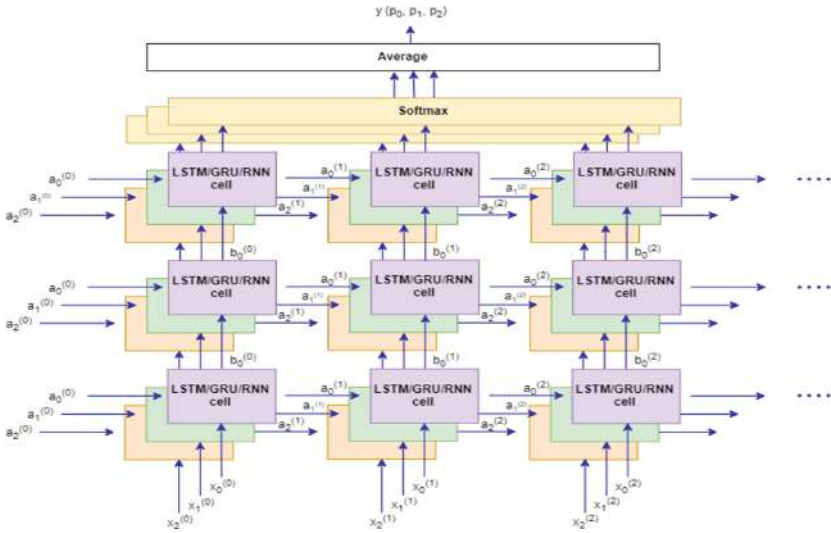


Fig. 4. Overview of the model architecture

Data flow within the model. The model consists of 3 stacks, where each stack consists of 3 layers. Each layer is made up of 90 basic RNN, GRU or LSTM cells. Each stack i , is made to train on a particular shift-sequence x_i , i.e., the 0-shift sequence is processed by the first stack, the 1-shift sequence is processed by the second and so on. At a given state, the first layer in a stack receives a one-hot encoded vector of 64 values representing the presence of a particular codon. The 90 hidden units in this layer process the data and, the output of this layer b_i , is forwarded to the next layer. The cell state (along with the cell output in case of LSTM), a_i is forwarded to the next state. Finally, the output from the ultimate RNN cell layer of each stack is multiplied to a weight vector and Softmax activation is applied in order to obtain the classification probabilities. Now, the mean of the probability values, y is obtained from each stack and classification is performed. The performance of the aforementioned model while using LSTM, GRU and basic RNN cells have been discussed in details in the sections below.

4 Result and Discussions

Verification of the model performance is done by monitoring the AUROC score along with its accuracy and loss. In this section, we compare these performance metrics of the 3 variants of our model and show how our custom embedding is able to optimize the classification ability of these variants.

4.1 Experimental Setup

The proposed model has been built using the Tensorflow API on Python 3.5. Validation of the model performance is done using 5-fold cross validation(CV). RMSprop algorithm is used to optimize the model performance. To avoid stagnation at training phase we apply a learning rate decay factor as an extra safety measure besides using RMSprop (which can alter learning rate accordingly). Checkpoints have been included in order to save the best weights of the model prior to overfitting. Finally, early stopping mechanism is used to halt training on loss stagnation. As already mentioned we use 5-fold CV, where each fold consists of 635 instances.

4.2 Performance Comparison

The normalized confusion matrix obtained on the best weights of the model is shown in Fig. 5. It should be mentioned that the 3 variants of our model achieved the same prediction scores and hence the identical confusion matrix as well as ROC curve. From the confusion matrix and the ROC curves (see Fig. 6) we can derive various performance metrics as shown in Table 1. ROC curves along with the respective AUC scores for each class has been shown in Fig. 6. These curves are obtained on a random test set of 935 sequences. It can be observed that the model has achieved a near perfect score for all the classes (AUC scores shown up to 6 places after decimal).

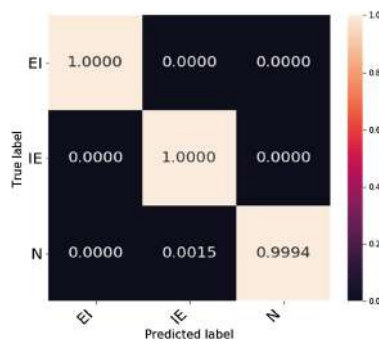
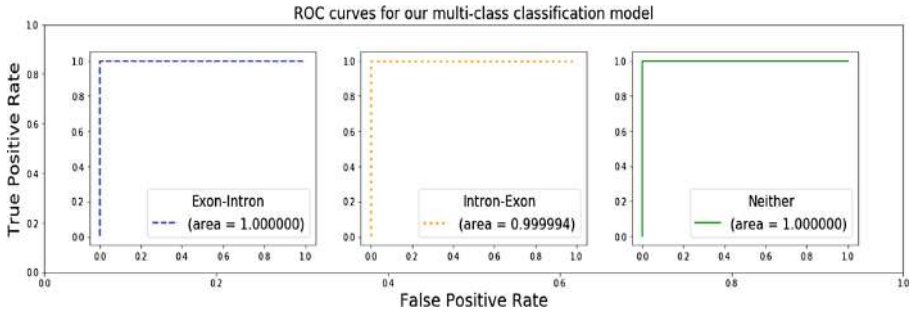
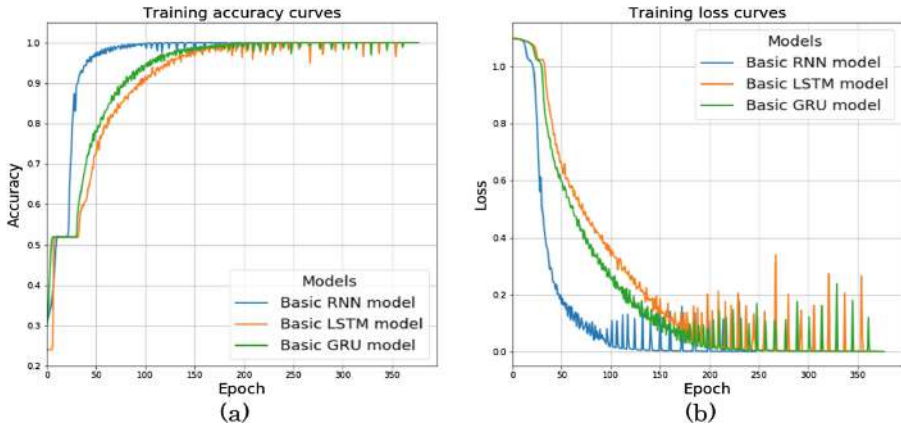


Fig. 5. Confusion matrix obtained by the different variants of the model

Table 1. Various performance metrics for the 3 variants of our model

Class	Accuracy	Precision	Sensitivity	Specificity	F1 Score	AUC score
Exon-Intron	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Intron-Exon	0.9995	0.9985	1.0000	0.9993	0.9993	1.0000
Neither	0.9995	1.0000	0.9985	1.0000	0.9993	1.0000

**Fig. 6.** ROC curves for the respective classes**Fig. 7.** (a) Shows the training accuracy curve (b) Shows the training loss curve

The training accuracy and loss curves are shown in Fig. 7. It is clear that the basic RNN variant of the network is the most efficient. However, this is subject to the condition that the sequences are of limited lengths. With increase in length of the sequence, the basic RNN variant will become prone to the problem of *vanishing gradient* and hence, the LSTM/GRU variants are recommended instead.

Finally, a comparison of our proposed methodology with the existing statistical models with respect to accuracy, for the classification task in question has been shown in Table 2.

Table 2. Summary of some of the existing statistical models used for splice junction prediction

Author	Year	Employed methodology	Accuracy
Cervantes et al. [7]	2009	Sparse encoding with SVM and Bayesian classifier	98.2%
Kerdprasop et al. [8]	2010	Association analysis over frequent DNA patterns	96.1%
Mandal [9]	2014	Ensemble model using AdaBoost and Random forest classifier	99.67%
Lee et al. [10]	2015	RNN model with RELU, LSTM and GRU	94.3%
Zhang et al. [11]	2016	Multilayered convolutional neural network	96.1%
Proposed methodology	–	Multilayered RNN model	99.95%

5 Conclusion and Future Scope

In this study, we explored the concepts of our versatile DNA sequence encoding algorithm along with a state of the art model for classification of splice junctions in DNA sequences. The encoding algorithm introduced by us could be used to obtain consistent and better performance from existing DNA sequence analysis models for tasks other than the one performed in this study. The consistency of the performance of the variants of the proposed model justifies the validity of our proposed encoding procedure. The proposed network architecture introduced here, shows ideal compatibility with the aforementioned encoding process and achieves ideal performance scores.

This study can be further extended to implement the aforementioned encoding algorithm in order to accurately predict nucleosome occupancy, acetylation and methylation regions in yeast genome sequence data [14], as these factors have a major impact on nuclear processes involving DNA. This would immensely help to automate the process of DNA sequence analysis using machine intelligence.

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Development of an Inexpensive Proficient Smart Walking Stick for Visually Impaired Peoples

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Abstract. This study represents a medical engineering technology to develop an extremely low cost & smart walking stick as assistance for visually impaired people. To assist those people, a smart model of stick has been designed and developed having production cost lesser than others. As a result, it will be much more affordable for people in developing countries. In such way, this smart walking stick can reduce the disability of blind people and make them less dependent by improving quality of life.

Keywords: Smart walking stick · Visually impaired peoples · Programmable interrupt controller · Ultrasound · Nickel metal hydride

1 Introduction

According to WHO (2018), In present world around 1.3 billion people live with vision impairment where 188.5 million people have a trivial level of visual impairment and 217 million people have moderate to extreme vision impairment. Shockingly, all but 36 million are blind among them [1]. Blind or severely vision impaired people are treated like a burden to their family as well as the country. They face problems, mainly outside the home because of having a lack of foresight. So, they always require someone to move. Unfortunately, this condition is more pitiful in developing countries which bind them to lead a miserable life. Where they are using very simple cane, which can't assist them properly. Consequently, they face accidents frequently. Moreover, because of financial condition they can't afford high technological & expensive sticks. But this model of blind stick with very nifty design and intelligence will be reasonable for all. It is far more handy and low cost than other developed sticks. Which is not only

detects the obstacle rather direct them in the path by measuring distances. Moreover, it also senses the water areas which is a huge advantage for the user to avoid mud and water sources. Whenever difficulties are found by the sensors, by producing respective vibration and different beep sounds it will direct people to the right path.

2 Related Works

There are some existing systems that can be used, but those systems have some drawbacks. Several works have been done about the smart walking stick using different types of components and module. Some of them are very shrewd, but costly and some of them have complex structure. This model has a very simple design with intelligence and most significant thing is that it is reasonable to all.

Microcontroller, three IR sensor for three sides and two speakers have been used in a model which doesn't detect water so there is a risk with water [2]. Where in another work ultrasonic sensor, water sensor, Arduino and Bluetooth module with android device application have been used to send voice messages. They have also used GPS system for safe migration of blind people to reach destination. All those things made it smart, but overpriced [3]. Again, another model was proposed which involve IR sensor and earphone to deliver a speech and authors demanded that it is cheap and user friendly, where the estimated cost is around \$120 does not seem so cheap [4]. Another group designed a shrewd android based cane, which consists of two parts. Those are Android application to get information from phone about location, longitude, etc. and the hardware part include Arduino and sensors (ultrasonic and IR). It is an eminent design and mostly applicable for migration, but expensive [5]. An expensive but smart cane using Microcontroller, GPS-GSM module, RF module, sensors (water, ultrasonic) etc. was proposed [6]. Finally, a good model of cane was proposed which provide communication through call by using a system called "e-SOS (electronic save our soul)". They have used Raspberry Pi 3, Raspberry Pi camera, ultrasonic sensor. Their approached model is appreciable but using those costly components it became expensive [7]. All those designed sticks have very well structure and functional capability. But not affordable to all because of their components and technology have been used. So our aim is to provide smart stick at low cost.

3 Tools

Basically, we have used several basic components to develop the circuitry of this smart cane. Such as, Microcontroller, Ultrasonic sensors, push button, battery (9 V), voltage regulator, ADC, resistors, capacitors, buzzer, vibration motor, connecting wire, etc. Here, describing about the major components in Table 1 and showing the block diagram of the system in Fig. 1.

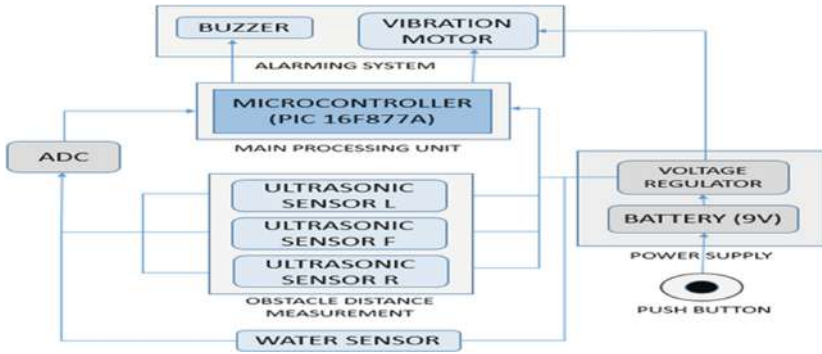

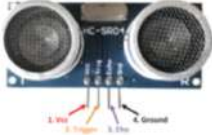




Fig. 1. Block diagram of total circuit.

Table 1. Some basic components with their functions & figure.

Name of the parts	Function	Figure
Microcontroller (PIC 16F877A)	It is the main controlling part and decision maker. It can be considered as the brain of the system. Used one is given in Fig. 2.	 <p>Fig. 2. Microcontroller</p>
Ultrasonic Sensor	It is a transducer which uses ultrasound wave to sense the presence of obstacle [9]. These portable sensors produce wave and receive the reflected echo to measure the distance. Used one is given in Fig. 3.	 <p>Fig. 3. Ultrasonic Sensor [7]</p>
Battery (9 V NI-MH)	Supplies power to the system. It is rechargeable and able to deliver 200mAh. Used one is given in Fig. 4.	 <p>Fig. 4. Battery</p>

(continued)

Table 1. (continued)

Name of the parts	Function	Figure
Water Sensor	It is mainly used to detect the presence of water to keep safe the person from mud to get rid of slippery. Used one is given in Fig. 5.	 <p>Fig. 5. Water Sensor [6]</p>

4 Techniques

4.1 Obstacle Detection

Detection of obstacle is done by using ultrasonic (HC-SR04) sensors. It is a transducer whose job is to send and receive echoes continuously while it is active. Here, in this model three sensors are used in three sides (right, front and left) of the stick. These sensors produce ultrasound waves which get reflected if there is any obstacle in range (2.5 m). That means if there is any obstacle within 2.5 m distance from the stick the sensor will receive the reflected echo. Then sensors automatically measure the distance of the obstacle using the time lapses between sending and receiving echoes following these equations,

It is said by Laplace, that longitudinal wave speed is determined by the equation-

$$u = \frac{\sqrt{P\gamma}}{\rho}$$

$$S = ut$$

$$\text{So, } S = \frac{\sqrt{P\gamma}}{\rho} t$$

Where, t = time lapses, P = pressure, ρ = density & γ is a dimensionless quantity [7, 8].

But, according to law of motion, $S = ut + \frac{1}{2}at^2$.

Here, acceleration $a = 0$

$$\text{So, } S = ut$$

Considering sending and receiving time, here distance of the obstacle from the stick will be determined by,

$$S = \frac{ut}{2} = \frac{\sqrt{P\gamma}}{2\rho} t$$

The output of an ultrasonic sensor is analog. So, these information of sensors are converted to digital by using an ADC (Analog to Digital Converter) then delivered to the microcontroller to process further (Fig. 6).

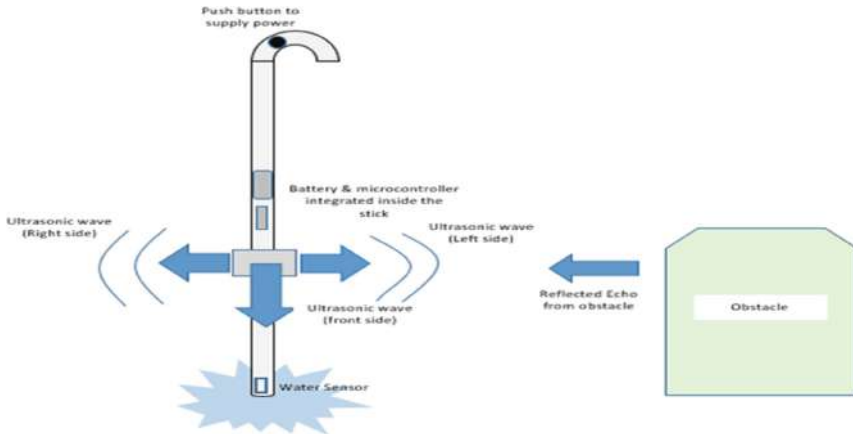


Fig. 6. Schematic diagram about functionality of stick.

4.2 Processing

Main processing of the collected data from the sensors is done by a microcontroller of PIC family. When the information is conveyed to microcontroller it process them following an algorithm to generate a decision. A micro C program is developed in its programming IDE called “MikroC PRO” of version 7.1. The working procedure of this program follows the flow chart given in Fig. 7.

4.3 Decision Making

Two different components (vibration motor and buzzer) have been used in this project to produce a reaction (beep sound and vibration respectively) depending on the data received from the sensors. Then processor generates a decision that where to move.

As, In case of buzzer two values are considered, those are coming from left and right ultrasonic sensors. If there is an obstacle in one side, then it will generate respective action as per the flow chart given in Fig. 7. Like if there is obstacle in right or left side it allows the buzzer to beeps two or three times respectively. But in case of obstacles on both sides it will compare the distances. And produce response following the same flow chart according to the comparison.

Here and now, vibration motor is used for two different purposes. First one is to notify about the obstacle in front of the person or stick within range. Whenever that will happens the motor will spin so fast which will create a strong vibration in the stick. And second job is updating about the presence of water beneath the stick. If that happen, the motor will spin slowly to create a feeble but observable vibration. But if there is any situation both happening at the same time, then the motor will vibrate with an interval of 500 ms.

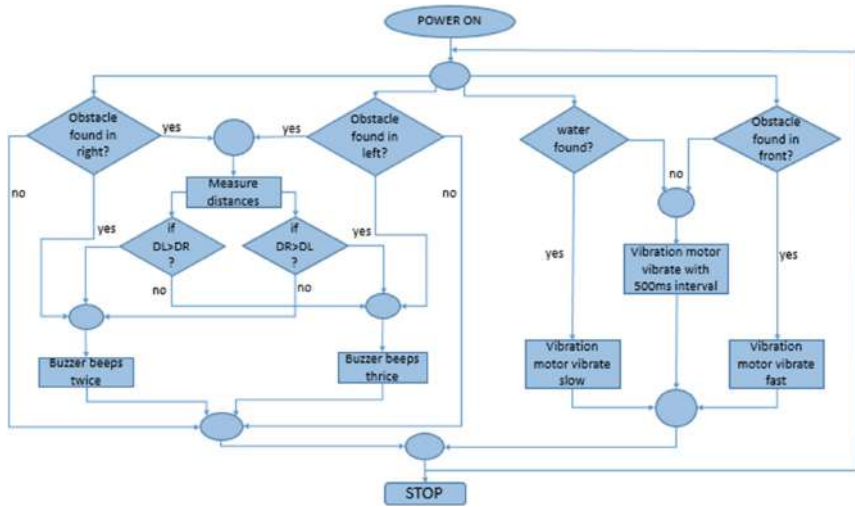


Fig. 7. Flow chart of operating system.

For instance, if there are obstacles in right & front sides, it will allow buzzer to beep twice and vibrate the motor faster. Then the person will understand that there are obstacle in right and front side. So he/she must go in the left side. The whole process follows the flow chart to generate different decision depending on different situation (Fig. 8).



Fig. 8. Real time model

4.4 Calculation of Error

To specify the efficiency of this model, sensitivity was determined by taking some trial using different types of obstacles. Where,

$$\text{Sensitivity } S_n = \frac{\text{TruePositive}}{\text{TruePositive} + \text{FalseNegative}}$$

To check the accuracy of this model, it has been tested in different situation using different obstacles. Obtained result & following bar diagram are given in Table 2 and Fig. 9 respectively.

Table 2. Response considering different obstacle.

Different obstacles	Tasted times	True positive	False negative	Sensitivity	Error (%)
1. Chair	15	14	1	0.93	7%
2. Bed	15	14	1	0.93	7%
3. Stairs	15	13	2	0.87	13%
4. Pipes	15	11	4	0.73	27%
5. Bottle	15	12	3	0.80	20%
6. Slow running car	15	10	5	0.67	33%
7. Slow running cycle	15	11	4	0.73	27%

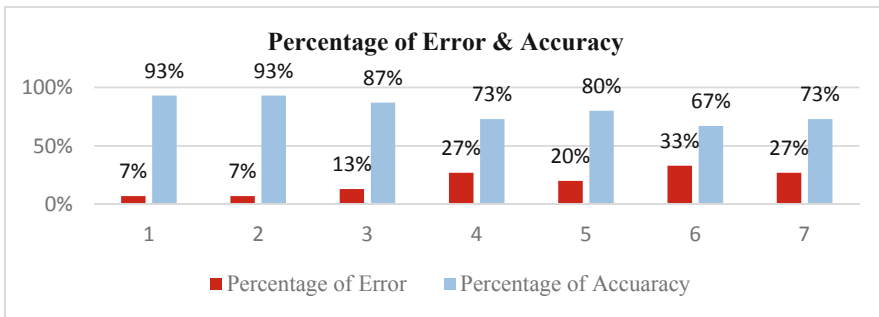


Fig. 9. Bar diagram showing the percentages of error & accuracy

5 Result and Discussion

This is a very practical design having fairly fast response. Measured time to response in different situations given in Table 3.

5.1 Required Time

Table 3. Response according to different situation.

Different situations	Time to response (ms)
Obstacle in left or right side	0.43
Obstacle in left & front sides	0.68
Obstacle in right & front sides	0.64
Obstacle in right side & water	0.71
Obstacle in left side & water	0.65
Obstacle in front side & water	0.73
Obstacle in three sides	0.81
Obstacle in three sides & water	0.87

There is nothing only having pros, there will be always some cons in everything in the world. In case of this model of stick, the average percentage of the error (19%) in detecting several obstacles was not so high. However, it can be reduced with the proper construction of the system. It always needs some time to detect anything but ranging in millisecond with some exceptions.

6 Conclusion

With the rapid growth of technology people facilitating their regular daily life with many kinds of smart electronic devices. Progressively, responsibility for the impaired population of the world is also aggregating. In some cases, dependency on such technologies is praiseworthy and assisting us in many ways. Learning all these, this low cost and smart walking stick has developed for the visually impaired peoples and tested with real impaired people. Though several designs of smart stick for the blind peoples are available, but affordability for all is yet to achieve. Keeping that in mind this design of the stick has developed. Which is very simple structured, inexpensive, feasible and user friendly as well. It can be affordable for mass peoples who are visually impaired. This stick has given the faster detection of the objects in a very effective manner. Thus, this designed and developed smart walking stick is practical and obviously such stick will improve the quality of the daily life of the visually impaired people worldwide in the near future.

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Conflict of interest. The Authors declare that they have no conflict of interest.

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A Continuum Model and Numerical Simulation for Avascular Tumor Growth

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Abstract. A spatio-temporal continuum model is developed for avascular tumor growth in two dimensions using fractional advection-diffusion equation as the transportation in biological systems is heterogeneous and anomalous in nature (non-Fickian). The model handles skewness with a suitable parameter. We study the behavior of this model with a set of parameters, and suitable initial and boundary conditions. It is found that the fractional advection-diffusion equation based model is more realistic as it provides more insightful information for tumor growth at the macroscopic level.

Keywords: Avascular tumor growth · Anomalous diffusion · Fractional advection-diffusion equation

1 Introduction

Initially, tumor growth does not have any direct vascular support. It takes necessary oxygen and nutrients for sustainable unbounded growth from the surrounding micro-environment through passive diffusion [1, 2]. The metabolic consumption of an avascular tumor nodule also grows with its volume proportionally, but actually it absorbs oxygen and nutrients proportionate to its surface area [3]. So, after a certain time, due to the deprivation of oxygen and nutrients tumor growth will be stagnant (1–2 mm in radius approx.).

Oxygen and nutrients deficiency gradually increase among the tumor cells with distance from the outer layer of the tumor towards its center. At the center of the tumor deficiency level will be the maximum. The deficiency of oxygen and nutrient within tumor cells divides the tumor into three different layers; though these layers are not clearly separated [4]. The outer layer mostly consists of proliferative cells and the inner most contains only the dead cells (necrotic core). The layer in between them is called the quiescent layer (collection of hypoxic cells) which are alive but do not divide. In this study, we consider quiescent cells consume less oxygen and nutrients compared to the proliferative cells.

Mathematicians have immensely studied avascular tumor growth since 1950's and developed various models from different perspectives. Greenspan [5] developed first

ever tumor growth model with proliferative, quiescent, and necrotic cell zones. Later researchers have adapted this framework and tried different modifications, like Ward and King [6] have developed tumor growth models in terms of dead and live cells densities and also considered that the cell population is space filling with new cells through cell divisions. Later, they [7] have extended their work and included cell motility into tumor spheroid. Sherratt and Chaplain [8] have developed a spatio-temporal model which considered different types of cells in tumor spheroid (which are not sharply divided into layers) and the tumor growth is driven by the cell movements under the influence of nutrients concentration.

In this study, we consider that the avascular tumor (only for epithelium tissue) is *in vivo* and disk shaped. Oxygen and nutrients synthesize the structural support of the tumor cells. Diffusion and convection processes in biological systems are very complex as most of the transportations pass through cellular membranes which are nonhomogeneous in nature. From the studies of the past few decades, it has been shown that entity concentrations passing through heterogeneous media are anomalous or non-Fickian in nature with a long leading or trailing edges [9, 10]. Within the cellular membrane, diffusion coefficient (constant) alone cannot describe the diffusion process. It changes with the spatial coordinates as the structural complexity varies close to the membrane surface [10].

The aim of this research work is to develop a mathematical model based on coupled fractional advection-diffusion equations (FADE) from phenomenological point of view. Initially, we develop a two dimensional (in Polar coordinate system) spatio-temporal model based on simple advection-diffusion equation, assuming less sharp demarcations between different cell layers. Afterwards we modify the basic model based on FADE. We include memory based diffusion process [10] to handle the non-Fickian nature of the process and also include a suitable parameter to express skewness in diffusion. Though, memory formalism in FADE is not adequate enough to model such a complex system like tumor microenvironment in the microscopic level, as several molecular activities are involved. But at the macroscopic level, FADE based model offers more realistic description of the overall system.

This paper is organized as follows: Sect. 2 describes the two dimensional model based on simple advection-diffusion equation in polar coordinate system; modification of the model with respect to anomalous diffusion is presented in Sect. 3, Sect. 4 is concerned with parameter estimation and model evaluation, and Sect. 5 concludes the paper.

2 Simple Advection-Diffusion Based Model

We consider that the tumor is disk shaped. Considering the radial symmetry, we assume that $p(r, t)$, $q(r, t)$, and $n(r, t)$ denote proliferative, quiescent, and necrotic cell concentrations respectively. Here, r denotes the spatial domain in polar coordinate system, and t indicates time. The tumor grows due to diffusive and convective force. The movement of extracellular matrix (ECM) surrounding the tumor is responsible for convection. In this model v_e denotes the velocity of ECM. While, the distinctions between these three layers are not sharp, but the presence of one layer restricts the

movement of the other layers. We assume that necrotic cells cannot migrate, divide or do not consume oxygen or nutrients. Hence, no cell flux is required for necrotic core as they are collection of dead cells. In this study we also include parameters (a_p, a_q) to handle the death rates due to apoptosis in the proliferative as well as quiescent cells. We assume that the values of a_p and a_q are the same.

We further assume that oxygen ($c_o(r, t)$) and nutrient ($c_n(r, t)$) concentrations are different entities. The tumor cell divisions, proliferation, transformation into quiescent or necrotic cells are controlled by concentration levels of oxygen and nutrients. Hence, all the parameters: proliferation rate, proliferative to quiescent and quiescent to necrotic transformation rates should be accompanied by c_o and c_n or some function of c_o and c_n . Under these assumptions we develop the following system Eq. (1),

$$\begin{aligned}
 \frac{\partial p}{\partial t} &= \frac{\partial}{\partial r} \left(D_p \frac{\partial p}{\partial r} - v_e p \right) + \frac{1}{r} \left(D_p \frac{\partial p}{\partial r} - v_e p \right) + \alpha h_1(c_o, c_n) p - \beta h_2(c_o, c_n) p - a_p p \\
 \frac{\partial q}{\partial t} &= \frac{\partial}{\partial r} \left(D_q \frac{\partial q}{\partial r} - v_e q \right) + \frac{1}{r} \left(D_q \frac{\partial q}{\partial r} - v_e q \right) + \beta h_2(c_o, c_n) p - \gamma h_3(c_o, c_n) q - a_q q \\
 \frac{\partial n}{\partial t} &= \gamma h_3(c_o, c_n) q \\
 \frac{\partial c_o}{\partial t} &= \frac{\partial}{\partial r} \left(D_o \frac{\partial c_o}{\partial r} - v_e c_o \right) + \frac{1}{r} \left(D_o \frac{\partial c_o}{\partial r} - v_e c_o \right) + \mu_o c_o - k_1 c_o - k_2 p c_o - k_3 q c_o \\
 \frac{\partial c_n}{\partial t} &= \frac{\partial}{\partial r} \left(D_n \frac{\partial c_n}{\partial r} - v_e c_n \right) + \frac{1}{r} \left(D_n \frac{\partial c_n}{\partial r} - v_e c_n \right) + \mu_n c_n - w_1 c_n - w_2 p c_n - w_3 q c_n
 \end{aligned} \tag{1}$$

Where, $D_p, D_q, D_o,$ and D_n are the diffusion coefficients of proliferative, quiescent, oxygen, and nutrients concentrations respectively; $\alpha, \beta,$ and γ are the rates of proliferations, proliferative to quiescent, and quiescent to necrotic transformations; μ_o and μ_n are scalars controlling the levels of oxygen and nutrients at any point in the domain of interest; whereas, k_1, k_2, k_3 and w_1, w_2, w_3 express the losses due to consumption by proliferative and quiescent cells. The system of Eq. (1) contains three functions $h_1, h_2,$ and h_3 . We consider,

$$\begin{aligned}
 h_1(c_o, c_n) &= 1 + 0.1(c_o, c_n); \quad h_2(c_o, c_n) = \exp(-c_o/s_1)/(1 + \exp(-c_n/s_1)); \\
 h_3(c_o, c_n) &= \exp(-c_o/s_2)/(1 + \exp(-c_n/s_2)), \text{ where } 0 < s_1, s_2 < 1.
 \end{aligned} \tag{2}$$

3 Model Based on Fractional Advection Diffusion

Generally, biological processes pass through cell membranes which are porous media and heterogeneous in nature. In this work, the profile concentration of the diffusing tumor cells, oxygen and nutrients inside an organ/tissue has been calculated on the basis of the FADE by introducing memory formalism (diffusion with memory). Diffusion with memory indicates the past behaviour of the function itself [10]. This approach generalizes the classical diffusion models to more complex systems, where diffusion coefficients are the function of c_o, c_n as both of them are varied with spatial domain. Skewness in diffusion may also be considered through a suitable parameter (φ). FADE with fixed order have shown certain advantages to model anomalous (non-Fickian) diffusion to some extent [11, 12]. In this phase, we modify model (1) and

include FADE based model using the Caputo definition of fractional derivative. We use an unconditionally stable finite element method (FEM) [13] to solve FADE.

As the medium of convection-diffusion in biological system is porous, it is also assumed that diffusion coefficient and convective velocity are related as:

$$(Diffusion\ coefficients) \propto (convection\ velocity)^\rho, \text{ where, } 1 \leq \rho \leq 2. \tag{3}$$

We consider, $v_e(c_o, c_n) = v_{e0}h(c_o, c_n)$. According to (3),

$$D_p(c_o, c_n) = D_{p0}h^\rho(c_o, c_n); D_q(c_o, c_n) = D_{q0}h^\rho(c_o, c_n); D_o(c_o, c_n) = D_{o0}h^\rho(c_o, c_n); \\ D_n(c_o, c_n) = D_{n0}h^\rho(c_o, c_n), \text{ where, } v_{e0}, D_{p0}, D_{q0}, D_{o0}, \text{ and } D_{n0} \text{ are the diffusivity constants.} \tag{4}$$

By combining (1) and (4), we get the following,

$$\frac{\partial p}{\partial t} = D_{p0}h^\rho \frac{\partial^2 p}{\partial r^2} - v_{e0}h \frac{\partial p}{\partial r} + \frac{1}{r} \left(D_{p0}h^\rho \frac{\partial p}{\partial r} - v_{e0}hp \right) + D_{p0} \left(\frac{\partial h^\rho}{\partial c_o} \frac{\partial c_o}{\partial r} + \frac{\partial h^\rho}{\partial c_n} \frac{\partial c_n}{\partial r} \right) \frac{\partial p}{\partial r} \\ - v_{e0} \left(\frac{\partial h}{\partial c_o} \frac{\partial c_o}{\partial r} + \frac{\partial h}{\partial c_n} \frac{\partial c_n}{\partial r} \right) p + \alpha h_1(c_o, c_n)p - \beta h_2(c_o, c_n)p - a_p p \tag{5}$$

Here, we have used h instead of $h(c_o, c_n)$, and h^ρ instead of $h^\rho(c_o, c_n)$ for the purpose of clarity. $\partial q/\partial t$, $\partial n/\partial t$, $\partial c_o/\partial t$, and $\partial c_n/\partial t$ also look similar to $\partial p/\partial t$.

We consider,

$$h(c_o, c_n) = \exp(\theta - c_o c_n), \theta \text{ is a constant, } \theta > 0 \tag{6}$$

We assume that the minimum distance from the tumor center ($r = 0$) to its nearest blood vessel is d . Therefore, we consider a circular domain of radius d in which the tumor has grown. Here, r is the radial direction from the center ($r = 0$) towards the boundary ($r = d$) of the disk shaped domain. Now, we non-dimensionalize the system of Eq. (5) by rescaling distance d with time $\tau = d^2/D_{o0}$. Proliferative cell, quiescent cell, necrotic cell, oxygen, and nutrients concentrations are also rescaled with p_0, q_0, n_0, c_1 , and c_2 respectively (where p_0, q_0, n_0, c_1 , and c_2 are the appropriate reference variables). Therefore, $p^* = p/p_0; q^* = q/q_0; n^* = n/n_0; c_o^* = c_o/c_1; c_n^* = c_n/c_2; t^* = t/\tau$. The new system of equations becomes (by dropping the stars),

$$\frac{\partial p}{\partial t} = D_1 h^\rho \frac{\partial^2 p}{\partial r^2} - v h \frac{\partial p}{\partial r} + \frac{1}{r} D_1 h^\rho \frac{\partial p}{\partial r} - \frac{1}{r} v h p + D_1 \left(\frac{\partial h^\rho}{\partial c_o} \frac{\partial c_o}{\partial r} + \frac{\partial h^\rho}{\partial c_n} \frac{\partial c_n}{\partial r} \right) \frac{\partial p}{\partial r} \\ - v \left(\frac{\partial h}{\partial c_o} \frac{\partial c_o}{\partial r} + \frac{\partial h}{\partial c_n} \frac{\partial c_n}{\partial r} \right) p + \alpha h_1(c_o, c_n)p - \beta h_2(c_o, c_n)p - a_p p \tag{7}$$

The rest of the equations ($\partial q/\partial t$, $\partial n/\partial t$, $\partial c_o/\partial t$, and $\partial c_n/\partial t$) also look similar to $\partial p/\partial t$ where, $\alpha^* = \alpha d^2/D_{o0}; \beta^* = \beta d^2/D_{o0}; a_p^* = a_p d^2/D_{o0}; \eta^* = \beta d^2/D_{o0}q_0; a_q^* = a_q d^2/D_{o0};$

$\gamma^* = \gamma d^2/D_{o0}$; $\omega^* = \gamma d^2/D_{o0}n_0$; $\mu_o^* = \mu_o d^2/D_{o0}$; $\mu_n^* = \mu_n d^2/D_{o0}$; $k_1^* = k_1 d^2/D_{o0}$; $k_2^* = k_2 d^2/D_{o0}$; $k_3^* = k_3 d^2/D_{o0}$; $w_1^* = w_1 d^2/D_{o0}$; $w_2^* = w_2 d^2/D_{o0}$; $w_3^* = w_3 d^2/D_{o0}$; $v^* = v_e d/D_{o0}$; $D_1^* = D_{p0}/D_{o0}$; $D_2^* = D_{q0}/D_{o0}$; $D_3^* = D_{n0}/D_{o0}$.

Now, the space fractional derivative is included in the model. From [14], we have,

$$\frac{\partial^\phi p}{\partial r^\phi} \approx \left(\left(\frac{1+\varphi}{2} \right) \mathcal{D}_L^\phi(p) + \left(\frac{1-\varphi}{2} \right) \mathcal{D}_R^\phi(p) \right), 1 < \Phi \leq 2 \tag{8}$$

where, ϕ is the fractional order, and φ ($-1 \leq \varphi \leq 1$) is the skewness parameter. \mathcal{D}_L^ϕ and \mathcal{D}_R^ϕ are the left- and right-handed fractional derivatives respectively. L ($L = 1$) and R ($R = 2$) are the corresponding lower and upper bounds of ϕ . The definitions of left- and right-hand derivatives are,

$$\mathcal{D}_L^\phi = \frac{\partial^\phi}{\partial(r)^\phi} \quad \text{and} \quad \mathcal{D}_R^\phi = \frac{\partial^\phi}{\partial(-r)^\phi} \tag{9}$$

and

$$\frac{\partial^\zeta p}{\partial r^\zeta} \approx \left(\left(\frac{1+\psi}{2} \right) \mathcal{D}_L^\zeta(p) - \left(\frac{1-\psi}{2} \right) \mathcal{D}_R^\zeta(p) \right), 0 < \zeta \leq 1 \tag{10}$$

where, ζ ($= \Phi - 1$) is the fractional order. \mathcal{D}_L^ζ and \mathcal{D}_R^ζ are the left- and right-handed fractional derivative respectively. L ($L = 0$) and R ($R = 1$) are the corresponding lower and upper bounds of ζ . The definitions of left- and right-hand limits are,

$$\mathcal{D}_L^\zeta = \frac{\partial^\zeta}{\partial(r)^\zeta} \quad \text{and} \quad \mathcal{D}_R^\zeta = \frac{\partial^\zeta}{\partial(-r)^\zeta} \tag{11}$$

For $\phi = 2$ and $\varphi = 0$, it indicates no skewness in the diffusion (Fick’s diffusion). Approximation sign (\approx) may be replaced by equality ($=$) sign. If $\varphi < 0$, the dispersion is skewed backward: a slow evolving contaminant plume followed by a heavy tail. For $\varphi > 0$, it shows a forward dispersion: a fast evolving contaminant plume followed by a light tail. We replace all the second-order derivatives with (8) and first-order derivatives with (10) in (7), except the derivatives with respect to time. We assume, $t_k = k \times \Delta t$, $0 \leq t_k \leq T$, where $k = 0, 1, 2, \dots, n_t$ and $r_i = i\Delta r$, $0 \leq r_i \leq d$, where $i = 0, 1, 2, \dots, n_r$.

The FEM of the fractional order derivatives according to Grünwald definition for the left-handed as well as the right-handed derivatives [15] are,

$$\frac{\partial^\phi p}{\partial r^\phi} = \frac{1}{\kappa^\phi} \sum_{\chi=0}^{i+1} g_\chi p_{i-\chi+1} \quad \text{and} \quad \frac{\partial^\phi p}{\partial(-r)^\phi} = \frac{1}{\kappa^\phi} \sum_{\chi=0}^{\chi-i+1} g_\chi p_{i+\chi-1} \tag{12}$$

$$\frac{\partial^\zeta p}{\partial r^\zeta} = \frac{1}{\kappa^\zeta} \sum_{\chi=0}^{i+1} g_\chi p_{i-\chi+1} \quad \text{and} \quad \frac{\partial^\zeta p}{\partial(-r)^\zeta} = \frac{1}{\kappa^\zeta} \sum_{\chi=0}^{\chi-i+1} g_\chi p_{i+\chi-1} \tag{13}$$

where, $g_\chi = \frac{\Gamma(\phi+1)}{\Gamma(\chi+1)\Gamma(\phi-\chi+1)}$.

$\Gamma(\cdot)$ is the Euler gamma function, and x is the uniform size of the intervals into which the spatial axis is divided. We have applied the fractional derivative on spatial domain only. Now, the system of Eq. (7) is solved by combining (8), (9), (10), (11), (12), and (13) with the following initial condition and boundary conditions.

Initial conditions: $p(r, 0) = 0.01 * \exp(-0.1 * r)$, $q(r, 0) = 0$, $n(r, 0) = 0$, $c_o(r, 0) = 1$, and $c_n(r, 0) = 1$ and the boundary conditions: $p(0, t) = p(d, t) = 0$, $q(0, t) = q(d, t) = 0$, $c_o(0, t) = c_o(d, t) = 1$, and $c_n(0, t) = c_n(d, t) = 1$ (no boundary condition is needed for n).

4 Parameter Estimation and Simulation

In this study we have used referred or previously estimated values from the experimental data, if possible. All the experiments are done in 10^{-2} mm scale. As we have mentioned before that at the avascular stage a tumor can grow at most 1–2 mm in radius, so, we consider the value of $d = 2.50$ mm (250 mm^2). As, our study is concentrated on the tumor in epithelium tissue, it is considered that the diffusivity constants of proliferative and quiescent cells are the same as the epithelium cells. For this study we have taken $D_{p0} = D_{q0} = 3.5 \times 10^{-11} \text{ cm}^2\text{s}^{-1}$ [16]. We further consider that the diffusivity of nutrients (D_{n0}) is $1.1 \times 10^{-6} \text{ cm}^2\text{s}^{-1}$ [17] and oxygen (D_{o0}) as $1.82 \times 10^{-6} \text{ cm}^2\text{s}^{-1}$ (estimated).

For simulation purpose we use proliferation rate (α) = 1.1 d^{-1} [18], $\gamma = 3.8 \times 10^{-6} \text{ s}^{-1}$ [19], and apoptosis rates $a_p = a_q = 4 \times 10^{-10} \text{ s}^{-1}$ [19]. We could not find any reference for β , hence, the value is taken ($1.7 \times 10^{-4} \text{ s}^{-1}$). We also use $v_{e0} = 2.4 \times 10^{-10} \text{ cms}^{-1}$, $s_1 = 0.25$, $s_2 = 0.30$; $\mu_o = \mu_n = 1.0 \text{ d}^{-1}$, and the consumption rates $k_1 = w_1 = 1.0 \text{ d}^{-1}$, $k_2 = w_2 = 0.8 \text{ d}^{-1}$, and $k_3 = w_3 = 0.3 \text{ d}^{-1}$. It is considered that the temporal as well as the spatial step sizes for our simulation are $\Delta t = 0.004$ and $\Delta r = 1$ respectively. We simulate our model with $p_0 = 1$, $q_0 = 2.25$, $n_0 = 1.5$, $c_1 = 1$, $c_2 = 1$. We assume $\theta = 1$, and $\varphi = 0.5$ in this study.

4.1 Simulation and Discussion

According to [20], an avascular tumor in epithelial tissue takes approximately 10 years to grow 1–2 mm in radius. In this experiment, we assume that an iteration of the simulation represents one day. So we have iterated the simulation process for 3500 times (3500 days \approx 10 years) collected the result at the interval of 500 days. All the simulation is done in MATLAB R2017a for this study.

Initially, the microenvironment is full of nutrients and oxygen. So tumor cell absorb these nutrients and oxygen and proliferate. Proliferative cells are concentrated near the tumor centre up to 500 days (Fig. 1 (a)). After that it gradually move forward and at the end of the simulation it reaches 2 mm (approx.). Figure 1(b) shows that after 1000 days the hypoxic cells gradually increase due to the steady fall of oxygen (Fig. 2(b)) and nutrient (Fig. 2(c)) concentrations within the tumor cells nearer to the centre. After 1500 days, oxygen and nutrients levels decrease further near to the centre of the tumor

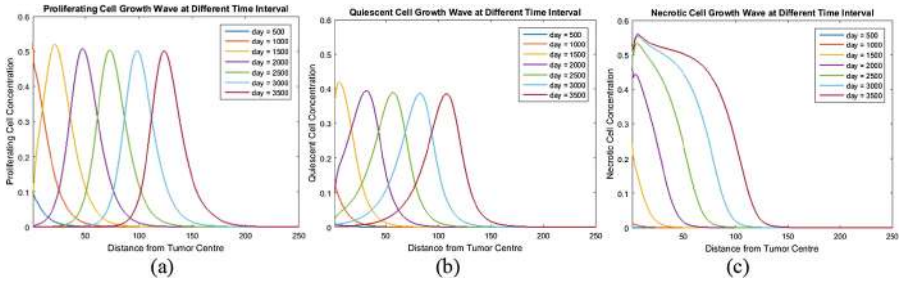


Fig. 1. (a) Proliferative (p/p_0), (b) quiescent (q/q_0), and (c) necrotic (n/n_0) cell concentration waves at different time intervals with respect to the distance (d) from tumor center.

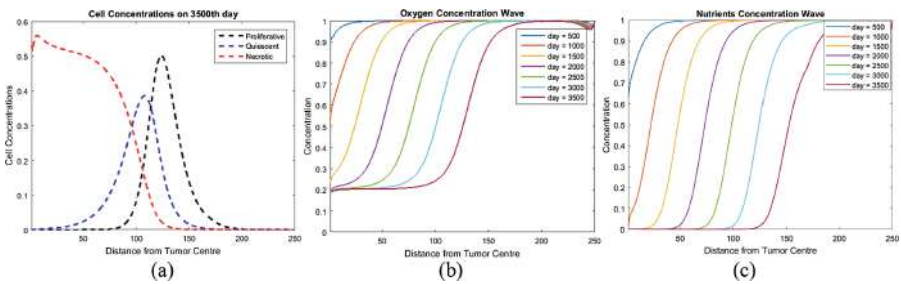


Fig. 2. (a) Represents proliferative, quiescent, and necrotic cell concentrations at 3500th day; (b) oxygen (c_o/c_1), and (c) nutrients (c_n/c_2) concentrations in different time intervals.

and quiescent cells (hypoxic) residing at that place are transformed into necrotic cells. With time the necrotic core increases rapidly and reaches approximately 1.4 mm (Fig. 1(c)) in radius, whereas hypoxic cells grow approximately 1.65 mm from the tumor center (Fig. 1(b)). This means that necrotic core acquires approximately more than 70 percent area whereas, proliferative cells contain 17.5% and quiescent cells contain only 12.5% area in an avascular tumor. The outer surface of the tumor always contains proliferative cells with higher concentration. The overlapping areas between the proliferative and quiescent, and quiescent and necrotic cells in Fig. 2(a) indicate

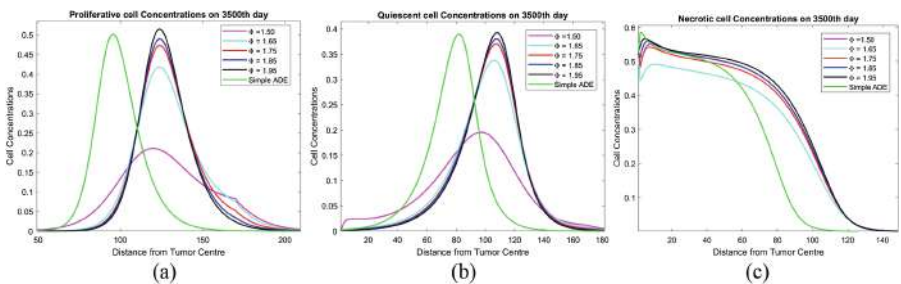


Fig. 3. (a) Proliferative (p/p_0), (b) quiescent (q/q_0) and (c) necrotic (n/n_0) cell concentration waves at different order FADE for 3500th day ($\varphi = 0.5$ and ϕ varying from 1.5 to 1.95).

that at any time, boundary between the two layers is not clear. Tumor regression cannot be seen in its life time. The above simulation has done with $\phi = 1.85$.

FADE model is also tested with different orders $\phi = 1.5, 1.65, 1.75, 1.85, \text{ and } 1.95$. It can be seen (Fig. 3(a)–(c)) that varying order does not affect proliferative, quiescent, and necrotic cell concentrations much excepting when $\phi = 1.5$ in terms of intensity. It is also clear that simple ADE always underestimate the radius of tumor than FADE based model with the same set of parameters. This means that tumor grows faster in FADE based model than in simple ADE based model. Not only tumor radius but also the quiescent and necrotic cell concentrations increase and the necrotic cells acquire almost $3/5$ portion of the tumor spheroid. In FADE we have also considered porosity and dynamic behaviour of cell membranes. FADE-based model tries to represent tumor growth more realistically than the simple ADE based model.

5 Conclusion

Transport processes through cell membranes are anomalous; hence we propose a memory based FADE model to explain avascular tumor growth *in vivo*. We solve the models numerically with a set of parameters with suitable initial and boundary conditions using FEM. We also compute the result with different values of ϕ . It is found that changing the order (ϕ) results in very small changes in the variables: proliferative, quiescent, and necrotic concentrations. But simple ADE based model always underestimate tumor growth than the FADE-based model. From the phenomenological point of view, FADE-based model provides more realistic description at the macroscopic level.

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A Review on Methods of Treatment for Diabetic Foot Ulcer

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Abstract. Diabetic Foot Ulcer (DFU) is a major complication in people suffering from diabetes mellitus. Diabetes is a metabolic disorder, in which the normal rate of healing decreases. As a result, DFU may take a longer time to heal only when proper wound care is taken. Improper management of DFU may lead to several other complications like infections, amputation of the patient's foot or sometimes even death of the patient. Several methods such as Pressure off-loading techniques, Wound debridement, Skin grafting, Antibiotic therapy, Negative pressure wound Therapy (NPWT), Hyper-Baric oxygen therapy (HBOT) were developed to enhance the impaired healing mechanism in diabetic patients but various factors like patient's physical characteristics, size, shape and stage of the wound influence the effectiveness of these methods. Electrical Stimulation (ES), on the other hand, seems to give better results compared to other methods. Electrical Stimulation improves blood flow and promotes cell growth which in turn enhances wound healing. ES when applied together with local or global heat, healing can be achieved at a higher rate.

Keywords: Diabetic Foot Ulcer · Electrical Stimulation · Wound healing · High voltage pulsed current

1 Introduction

Diabetes is one of the most widespread chronic diseases around the world. India is termed as Diabetes capital of the world as it ranks second in diabetic cases globally. This is due to the changing lifestyle, lack of physical work, unbalanced diet, i.e., intake of food that is rich in energy (sugar and unsaturated fat) and poor in nutrients. Approximately 425 million people suffer from diabetes worldwide in 2016, and among these, around 73 million people belong to India. According to the World Health Organization (WHO), it is estimated that this number rises to 87 million people by 2030. Almost 15% of patients suffering from diabetes are prone to develop a foot ulcer in their lifetime. Normal foot ulcers can be healed, but DFU remains unable to heal due to poor circulation and damage to peripheral nerve endings. Patients suffering from diabetes experience metabolic disorders that disturb the normal wound healing process. As a result, Diabetic foot ulcers may take a longer time to heal (only when proper wound care is taken) or sometimes lead to amputation of the damaged part. Various

statistics show that 84% of the DFU cases result in amputation of the leg of the patient. Hence this indicates the emergency of healing DFU. Most studies [1] suggest that DFU are common in people with ischemic, neuropathic or combined neuro ischemic abnormalities. Among these, only 10% of the DFU is pure ischemic ulcers and 90% are caused either by neuropathy, alone or along with ischemia. Diabetic patients with peripheral sensorimotor and autonomic neuropathy are at high risk of developing foot ulcers, as they experience high foot pressure, deformities in the foot, and gait instability.

Yazdanpanah [1] and Alavi [2] in their studies, suggested that healing rate could be increased by proper management of DFU which helps in a significant reduction, or prevention of complications like infection, amputation, and sometimes even death of the patient.

Various studies [1–9] reported that healing of DFU could be improved by *Controlling blood sugar levels, proper wound care and dead tissue removal, pressure offloading techniques, Wound debridement, Skin grafting, Anti biotic therapy, HBOT, NPWT, Electrical stimulation(alone) or along with local or global heating.*

2 Different Methods to Treat Diabetic Foot Ulcers

2.1 Blood Sugar Control

Glucose control is the most significant metabolic factor in people suffering from DFU [3]. Statistics reported that the prime basis of DFU is improper control of blood sugar. The probability of Inflammatory responses getting suppressed increases significantly with the increase in blood sugar levels. Hence regulating blood sugar levels might improve healing of DFU. However, up to date, no Randomized Control Trials (RCT) have been performed to determine whether control of blood sugar level has benefits after the development of DFU [1].

2.2 Off-Loading

The off-loading technique is also known as pressure modulation [1], is mostly used for the management of neuropathic ulcer in diabetic patients. Though many other techniques are used currently, only a few studies describe the frequency and rate of wound healing associated with them [4]. Physical characteristics of the patient and the ability to fulfil with the treatment along with location and extremity of ulcer determine the choice of the method to be used.

2.3 Wound Debridement

Wound Debridement helps in improving wound healing [4–6]. It converts chronic non-healing wounds into acute healing wounds by removing dead cells or non-responsive cells which increases the response of the wounds to standard treatment thus contributing to faster healing rates [5]. Cells present at the edges of non-healing chronic wounds exhibit pathogenic properties which obstruct the wound healing which we can

overcome in debridement. However, there is no practical evidence which prove complete wound healing through debridement but it is considered as a part of standard wound care.

2.4 Skin Grafting

Skin grafting helps in healing ulcers by replacing functions of skin temporarily [7]. It involves replacing lost skin functions through skin substitutes or grafts. This enhances the ulcers closure by adding extracellular matrices which induce growth factors. This skin grafts may be autografts, allografts or bio engineered skin. Some complications like infections, skin discoloration may result during treatment.

2.5 HyperBaric Oxygen Therapy (HBOT)

HBOT is a technique in which the amount of oxygen in the blood is increased using a special pressure chamber. The chamber pressure is three times higher than the normal atmospheric pressure which helps to increase tissue oxygen levels, thus contributes to quick healing [9]. HBOT can help especially infected wounds and DFUs to heal more quickly, but almost 20–40 sessions are required to achieve satisfying results. Many risks like injuries to the ear drum, myopia, seizures are associated with this treatment [1].

2.6 Negative Pressure Wound Therapy (NPWT)

NPWT is a wound healing technique in which controlled and localized negative pressure is applied. It is a non-invasive technique. It is stated that negative pressure helps in removing chronic exudates, edema, in reducing bacterial colonization. It also assists in the formation of new blood vessels and improves cellular proliferation and tissue oxygen levels thus contributing to faster healing rates [10]. Numerous RCTs have proved that this method is safe and effective in healing chronic wounds [1]. However, this method has the limitations of expensive materials and may not show much impact on infected wounds when compared to other methods.

2.7 Electrical Stimulation (ES)

Various studies have reported that Electric stimulation accelerates wound healing. On application of electrical stimulus to wound, positive effects are produced during all the three phases of wound healing: inflammation, proliferation and remodeling phases [18]. Vital factors which contribute to the formation of ulcers and result in amputations are found to be hypoxia in localized tissue and deficiency in local tissue perfusion. Electric stimulation has shown a significant increase in tissue perfusion. In a study [11], transcutaneous oxygen pressure was significantly increased in diabetic patients with the peripheral vascular disease during the first 5 min of stimulation. It is suggested that ES can improve poor blood flow, and even promote cell growth which are the common deficiencies associated with faulty wound healing in patients with DFU [11, 12]. It is also suggested that ES when used with proper wound care and off-loading techniques might enhance wound healing. It may, therefore, help in minimizing the need for lower extremity amputation as well contribute to regaining its original function.

2.8 Electrical Stimulation with Local /Global Heating

Few studies have reported little healing with ES alone [13]. But, when ES is applied along with global or local heat to reduce vasoconstriction, an increase in blood flow was observed. It proves that there was a significant increase in the rate of wound healing when ES is applied along with local or global heat [13–15]. Increase in the release of the vasodilator Nitric Oxide (NO), increases the blood supply to the affected area. Increase in temperature of the tissue activates the synthesis of NO. Hence ES shows better results along with local heating when compared to ES on cool tissue. It is reported that NO plays a vital role in the inflammatory phase. It has cytotoxic properties and also functions as a regulatory mechanism which mediates angiogenesis, collagen deposition and epithelialization crucial to proliferative phase. These properties collectively enhance the chances of healing the wounds.

3 Discussion

In a randomized control study by Peters et al. [11] two groups of 20 patients with diabetic foot ulcers were considered. Subjects were excluded if they have cardiac conductivity disorder or malignancy, pregnancy, implants or suffered from any soft tissue or bone infection. To one of the groups, a dosage of 50 V with 80 twin-peak monophasic pulses per second was delivered for 10 min, followed by 10 min of 8 pulses per second of current with a pulse width of 100 μ s at a gap of 40 min. Another group has undergone placebo treatment in which ES units that resembled and acted like active ES unit but did not deliver any current. Both the placebo and treatment groups received traditional wound care. The wound healing process in patients was evaluated every week. Among treatment and placebo groups, no significant differences were observed in the rate of wound healing and the average healing time. Over the 12-weeks study period, the total change in the cross-sectional area of the ulcer among treatment and placebo groups was 86.2% versus 71.4% respectively.

In a randomised study performed by Petrofsky et al. [13] on DFU, they aimed at comparing the rate of wound healing when ES is applied along with local or global heat and heat alone. In this, 20 subjects with single chronic and non-healing DFU (grade 2) were considered. Subjects randomly received local dry heat (37 °C) or local dry heat plus ES equally, 3 times a week for 4 weeks. ES used here was biphasic sine wave stimulation with a pulse width 250 μ s at a frequency of 30 Hz and current 20 mA. Laser Doppler imager was used to measure the skin blood flow in and around the wound. There was a significant decrease in volume and area of the wounds by $69.3 \pm 27.1\%$ and $68.4 \pm 28.6\%$ respectively in the group receiving Local heat + ES over a duration of 1 month. Only $30.1 \pm 22.6\%$ decrease in the area of the wound was observed in the group receiving just local heat, and at least for 2 months, wounds were not completely healed. Though this rate of healing was significant, it was not as much compared to that of the rate of healing in ES + local heat group. Hence local heat when applied along with ES has shown better results in healing DFUs compared to local heat or ES alone.

Wireless micro-current stimulation (WMCS) is a technology developed by Wirsing et al. [16] to treat DFU. They experimented on 47 subjects. Subjects with arterial, venous and mixed leg ulcers were considered mainly and those with DFU, pressure ulcers were also included. WMCS device uses the principle of transferring low-intensity current ranging from 1.5 μA to 4.0 μA to the patient at a certain distance. Complete healing was achieved within three months for the majority of cases. In some of the cases, light redness is seen. This method was used to treat only chronic wounds and did not respond to standard wounds. For evident progress of healing, this chronic wounds further testing and controlled studies are necessary.

Burdge et al. in their retrospective study [17] had evaluated the effect of high voltage pulsed current (HPVC) on DFU. They used biphasic, symmetric square wave, with a maximum voltage of 140 v and a pulse width 90–100 m sec at 55.19 Hz with a cycle width of 18 m sec is applied for 1.5 s followed by a rest period of 1.5 s at a room temperature of 74 °F. 30 patients with a total of 45 wounds were considered. The session is applied for 45 min, thrice a week for 16 weeks or till wounds healed completely. Improved healing rate was observed.

In the study conducted by Houghton et al. [19], 27 patients with 42 chronic leg ulcers (diabetic ulcers, venous and vascular ulcers) were considered. They divided patients into two groups based on the primary etiology of the wound, and treated them with HPVC on one group and sham on the other randomly. 45-min sessions were given thrice a week for 4 weeks. During primary evaluation of subjects, wound size and surface area were measured and given a conventional wound therapy for about 2 weeks prior to this treatment. A significant increase in wound healing was observed at the end of the treatment. The wound surface area decreased by half of the actual size in the HPVC group which was 2 times greater compared to that in the sham group.

Petrofsky et al. [14] conducted a study in which 29 patients with diabetic foot ulcers were considered. Subjects were divided randomly into three groups. One group of 10 subjects in the age of 52–82 range received ES along with global heat in which temperature of the room is maintained at 32 °C. Another group of 9 subjects with age of 53–68 range were given ES along with localized heat with infrared lamp placed near the wound. Another control group of 10 subjects received only wound treatment (no ES). Increase in blood flow was greater in the case of global heating compared to that of local heating. The global heat group showed an average healing rate of $74.5 \pm 23.4\%$ while that of local heat group was $55.3 \pm 31.1\%$ and the control group did not show any significant healing.

In a study done by Klothe et al. [20], a total of 16 patients suffering from stage IV decubitus ulcers with age ranging 20–89 years were taken into consideration. Subjects were randomly divided into treatment and control group. In the treatment group, 9 patients were given ES with a high voltage, monophasic, twin peak generator. In the control group, 7 patients were connected with electrodes but were not treated with ES. An average healing rate of 44.8% was observed in the treatment group over a 1 week period and almost healed over a period of 7.3 weeks while no healing was seen in the control group.

In a study by Jancovic et al. [21], 35 patients with 43 chronic (venous, diabetic and vascular) and painful leg ulcers were included and they were divided into two groups randomly. One group consisting of 20 subjects were treated with Frequency Rhythmic

Electrical Modulation System (FREMS), and another group of 15 patients were in the control group who were treated with conventional treatment. Wound surface area, wound surroundings, symptoms like pain were evaluated during the study. A significant increase in healing rate was observed and a decrease in pain was also seen in the treatment group while compared to that of the control group.

In the study performed by Lundeberg et al. [22], they used Electrical Nerve Stimulation (ENS) to treat 64 patients with diabetic leg ulcer. Patients with rheumatoid arthritis, osteomyelitis and ankle pressure below 75 mm Hg were excluded. The 64 patients were divided into two groups, each of 32. One group was treated with ENS and other is placebo ENS. In 12 weeks of study, the rate of wound healing is 61% among ENS group and 41% with placebo ENS. It also suggests that to enhance healing, stimulation of 40–60 min for 5–7 days a week is sufficient. Summary of clinical studies to heal DFU using various types of ES is shown in Table 1.

Table 1. Summary of clinical studies to heal DFU using various types of ES

S. No	Author	Type of wounds	Type of ES	No. of patients	Parameters of ES	Duration of ES	Results
1.	Peters et al. [2]	Diabetic foot ulcers	HPVC	40	50 V, 100 μ s	8 h, daily for 12 weeks	Wound healing improved when with standard wound care
2.	Petrofsky et al. [3]	Chronic diabetic ulcers	Local dry heating +ES vs heat alone	20	30 Hz, 250 μ s, 20 mA	30 min 3 times a week for 4-weeks	Significant increase in rate of healing in ES + local heat compared to ES alone
3.	Wirsing et al. [4]	Diabetic foot ulcers	Wireless LIDC	47	1.5 μ A	45–60 min, 2–3 times a week, for 8 weeks	Healing rate increased
4.	Burdge et al. [5]	Chronic diabetic wounds	HPVC	30	<140 V, 90–100 μ s, 55.19 Hz	45 min, 3 times in a week	Improved healing rate
5.	Baker et al. [9]	Open diabetic ulcers	Asymmetric biphasic pulsed current	80	Not mentioned	Until ulcers healed	60% enhanced healing rate

(continued)

Table 1. (continued)

S. No	Author	Type of wounds	Type of ES	No. of patients	Parameters of ES	Duration of ES	Results
6.	Houghton et al. [16]	Chronic leg ulcers	HPVC	27	150 V, 100 Hz, 100 μ s	45 min, 3 times a week for 4 weeks	Wounds size decreased by half of initial size approximately
7.	Petrofsky et al. [17]	Diabetic foot ulcers	ES + local heat vs ES + global heat	29	20 mA, 30 Hz	30 min, 3 times a week for 4 weeks	Healing rate is little more in case of global heat
8.	Kloth et al. [15]	Stage IV decubitus ulcers	HPVC	16	100 V, 105 Hz, 50 μ s	45 min, 5 days a week	44.8% of healing rate was seen in a week
9.	Jancovic et al. [19]	Chronic leg ulcers	FREMS	35	100 V, 10–40 μ s, 1000 Hz	40 min, 5 times a week for 3 weeks	Decrease in pain and improved healing rate
10.	Lundeberg et al.	Diabetic leg ulcers	ENS vs Placebo	64	Not mentioned	40–60 min, 5 times a week, for 12 weeks	Enhanced healing in case of ENS

4 Conclusion

Conventional methods used for treating DFUs like blood sugar control, pressure offloading have shown little results as they are dependent on the severity of the wounds and individual characteristics of the patient. HBOT technique can give potential results as it aims at improving tissue oxygen level at the site of the wound, but risks such as injuries to the middle ear, myopia, seizures are associated with it. NPWT has been proven to be effective on normal wounds, but this method does not show significant results when applied to infected wounds, and it is also expensive when compared to other methods. ES accelerates wound healing by improving blood flow and promoting cell growth at the site. On whole ES gives better results in healing DFU. ES when applied along with local or global heat significantly improves the rate of healing of DFU when compared to Electrical Stimulation or local heat alone.

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Feature Extraction of Cardiotocography Signal

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Abstract. Fetal heart activity is a vital measurement to assess the well-being of fetus throughout its intrauterine lifetime and mostly at the time of delivery. As it is a fact that the fetal heart rate interpretations are done manually, the readings are highly inaccurate and found to be subjective. Automated CTG analysis has been adopted as the most capable way to handle these problems of CTG. In this scope, CTG-OAS, an open software is used for fetal heart rate analysis. This software analyses the fetal heart rate and extracts the features of heart rate variability for further analysis. The results obtained are validated with those derived from the pH values of the cortical blood samples of delivered babies. The sympathetic and parasympathetic control on fetal heart rate and its relation with the fetal oxygenation is studied and analyzed for early detection of fetal distress.

Keywords: Fetal Heart Rate (FHR) · Cardiotocography · CTG-OAS software · CTU-UHB database

1 Introduction

During gestation, fetal heart rate is controlled by the autonomic nervous system and chemoreceptors present in umbilical artery. The pH of the blood indicates the amount of oxygen supplied to the fetus. The changes in the blood pH are detected by the chemoreceptors and the fetal heart rate is regulated by the necessary sympathetic and parasympathetic stimulation [1]. As the fetus matures its heart rate varies with respect to the growth of parasympathetic nervous system. Also, fetal heart rate variability becomes more pronounced. Sympathetic and parasympathetic nervous systems play an important role in controlling acceleration and deceleration patterns of fetal heart rate variability. Cerebral cortex, sympathetic ganglia, medulla oblongata and the vagus nerve are the centres responsible for the regulating fetal heart rate [2].

The fetal health assessment by auscultation of the fetal heart was initially described more than 300 years ago [3]. The information that can be picked up from the maternal abdominal wall is the electrical potential of the fetal heart activity and fetal heart sounds. With the fetoscope and stethoscope, listener can clearly hear and count the fetal heart rate. Electronic fetal monitoring is more sensitive than stethoscopic auscultation in predicting fetal distress. Fetal distress is the problem frequently encountered during the labour due to oxygen insufficiency of the fetus. The Fetal Heart Rate (FHR) monitoring using Cardiotocography is used as a screening tool to identify possible reasons for fetal distress during labour. In modern obstetrics, FHR variability

analysis is used to identify the risk factors, diagnose possible abnormalities and thereby help in executing safe labour.

The equipment which simultaneously records the instantaneous fetal heart rate and the uterine activity is called Cardiotocography (CTG) machine. There are two measuring electrodes used to record fetal electrocardiogram. Maternal abdomen skin electrode is used non-invasively and fetal scalp electrode is an invasive approach of CTG recording. The cardiotocograph is used to assess the electrical activity from the fetal heart. Fetal heart rate (110–160 bpm) is much higher than the maternal heart rate (70–80 bpm). The amplitude of fetal heart rate signal is very weak and is affected by various noises and interferences. Various noises are power line interference, random electronic noise, maternal interference and baseline wander among which maternal ECG is the most prominent interference.

2 Methodology

In invasive method, a scalp electrode is placed on the fetus head which passes through the mother's womb. Though it identifies morphological features with great success, this technique is harmful to the mother as it rips the womb and also causes undue pressure on the head of the fetus. Another major drawback is that this method is applicable only during labour after rupture of the membranes and hence there is a chance of infection to the mother.

Cardiotocography is a non-invasive fetal monitoring method performed by using ultrasonic transducers to record the fetal heart rate and pressure transducers to record the uterine contractions. These electrodes are tied onto the mother's abdomen using elastic straps. This non-invasive approach is easy to use during labour and non-hazardous to the mother and the fetus. The transducer directs the ultrasonic waves towards the fetal heart and the reflected waves are processed to determine heart rate of fetus. Hence short term variability in FHR and its beat to beat traces cannot be assessed accurately by this method. The fetal and maternal movements result in artefacts and hence continuous and precise record of the FHR is difficult. In order to perform automated analysis of FHR, we used CTGOAS software which is explained in the following section.

2.1 CTGOAS Software

CTG-OAS, open-access software is used to analyse cardiotocography (CTG) data. This software provides a computational platform for research purpose. Preprocessing, feature extraction and classification are the basic steps in automation of CTG analysis. These processes are embedded into the software to develop new algorithms. The software provides many tools to analyze fetal heart rate signals. FHR signals retrieved from CTUUBH database are analyzed using morphological features, linear and non-linear time-frequency features and image-based time-frequency features. CTG-OAS software is developed using MATLAB® GUI.

2.2 CTU-UHB Database

Physionet provides an openly available intrapartum database called CTU-UHB Database. Czech Technical University (CTU) and the University Hospital in Brno (UHB) give this database. 552 CTG recordings are chosen from 9164 recordings collected between 2010 and 2012 at UHB. This database provides all these recordings. CTG records fetal heart rate and uterine contraction signal, each sampled at 4 Hz. Each signal is segmented into four parts by experienced professionals. First three parts evaluate changes of FHR patterns depending on the shapes whereas the last part represents the parameters of delivery outcome quantitatively.

2.3 Preprocessing

Preprocessing is an important step in all biomedical signal applications. The values of feature extraction and classification performance are affected by this process. The steps in preprocessing are segment selection, artifacts rejection, interpolation, and detrend. These steps help in removing and replacing all unexpected changes in FHR. These changes are mainly due to the displacement of the transducer, movements of mother/fetus or both and stress during labour [4]. Some amount of entire data is removed as artifacts or missing values. Artifact rejection scheme is employed to interpolate the values and to fill up the missing beats [5]. This interpolation method introduces nonlinearity which is approximately same for both normal and abnormal FHR. After the preprocessing stage, the signals are ready to be analyzed.

2.4 Signal Characterization

The preprocessed signals are described by morphological features, linear and nonlinear time-frequency features and image-based time-frequency features. These features are compared before and after the preprocessing steps by visualizing all the changes done under preprocessing. In the present software baseline heart rate, number of acceleration (ACC), and number of deceleration (DCC) patterns are named as morphological features. These features are explained in terms of linear or time-domain features such as Mean (μ), Mean absolute deviation (Mean AD), Median absolute deviation (Median AD), Standard deviation (σ), Long-term irregularity (LTI), Delta (Δ), Short-term variability (STV), and Interval index (II). The time domain linear features are calculated by the following equations. FHR signal is denoted as $x(i)$ where $i = 1, 2, \dots, N$. The linear features are:

$$FHR_{mean} = \bar{x} = \frac{1}{N} \sum_{i=1}^N x(i)$$

$$FHR_{std} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x(i) - \bar{x})^2}$$

$$\Delta = \frac{1}{M} \sum_{i=1}^M [\max(x(i)) - \min(x(i))]$$

$$STV = \frac{1}{24M} \sum_{i=1}^{24M} |sm(i+1) - sm(i)|$$

$$\Pi = \frac{STV}{std[sm(i)]}$$

FHR Mean (μ) represents the mean value of FHR, and FHR std (σ) is the standard deviation of FHR. Variability for each minute is considered as delta (Δ), and M is the total number of minutes. sm is a vector obtained by collecting one sample per 2.5 s from FHR signals. STV is the short-term variability, calculated based on the creation interval of sm vector [6]. Π is the interval index that shows the gross change in the FHR.

Non-linear diagnostic parameters such as Approximation Entropy (ApEn), Sample Entropy (SampEn) and Lempel Ziv Complexity (LZC) are calculated by this software. These indices are very important in FHR signal analysis. Here, entropy is defined as the response of a system in terms of randomness. These non-linear parameters are expressed in terms of two values m (embedding dimension) and r (threshold) respectively.

$$ApEn(m, r, N) = \frac{1}{N - m + 1} \sum_{i=1}^{N-m+1} \ln(C_r^m(i)) - \frac{1}{N - m} \sum_{i=1}^{N-m} \ln(C_r^{m+1}(i))$$

$$(m, r) = \lim_{N \rightarrow \infty} -\ln \frac{C_r^{m+1}(i)}{C_r^m(i)}$$

LZC estimates a periodic signal that has same repeating pattern associated with low complexity in time-series irrespective of time [7].

3 Results and Discussions

This section discusses the results obtained by analyzing CTG signal of 552 subjects. CTG signal from CTU-UHB database is plotted using CTG OAS software as shown in Fig. 1. The raw CTG signal is denoised and is shown in Fig. 2. The signals shown in these figures are for 10 min window.

Eighteen features obtained from four different domains can be extracted and analyzed individually or collectively by using Feature Extraction menu. Morphological parameters (baseline, the number of acceleration and deceleration patterns) are colour coded and displayed. Mean, variance, and other linear indices of correlation structure of CTG signal are calculated as time domain features. Non-linear indices such as ApEn

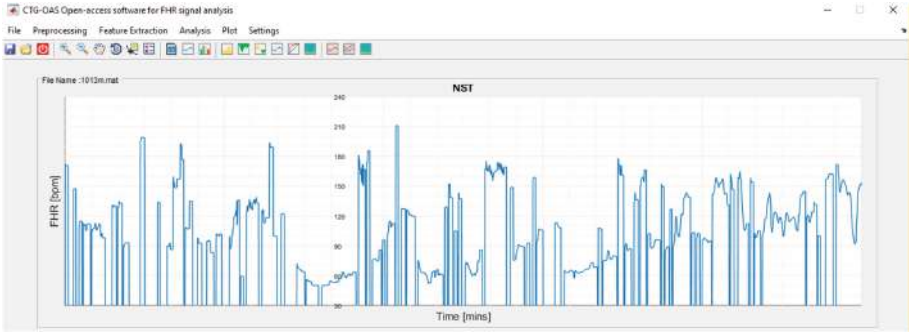


Fig. 1. CTG recording from CTU-UHB database plotted using CTGOAS software

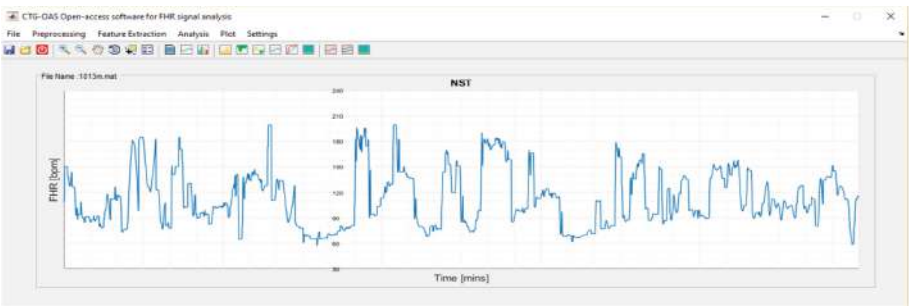


Fig. 2. The preprocessed cardiocardiographic signal

(m,r), SampEn(m,r) and LZC are calculated as frequency domain features [8]. These morphological, linear, non-linear indices and IBTF domains are displayed as shown in Fig. 3.

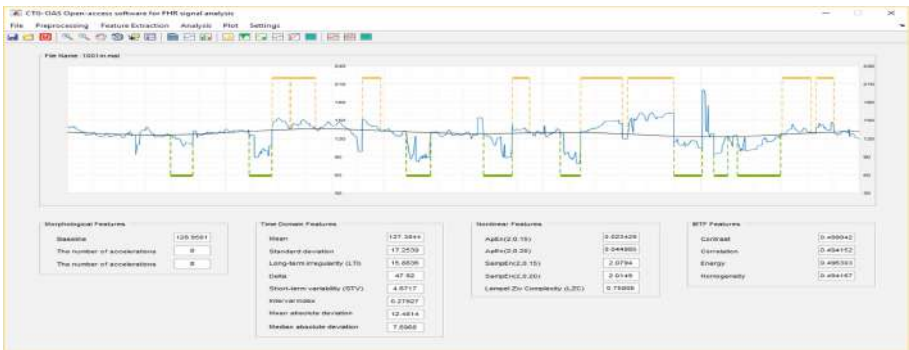


Fig. 3. Feature extraction of CTG recording.

FHR variability can be measured with these indices and is useful in the final stage of the delivery to clinically interpret the fetal well-being. As the labour proceeds, it is observed that there is a significant increase in linear domain indices and significant decrease in the nonlinear indices. Non-linear indices (ApEn(m,r), SampEn(m,r) and LZC) are derived by direct estimation of the CTG signal and quantify the signal complexity [9]. Entropy indices are calculated with 0.15 STD and 0.2 STD as the values set for r, while the value for m is set as 2. These indices are tested in the antepartum (before labour) period in order to study growth-retarded fetuses in the uterus and detect variability in the FHR patterns [10, 11]. Thus overall growth of the fetus can be assessed by using these parameters throughout the gestation period.

Fetus in the womb is supplied with oxygen by means of umbilical cord of the mother. If there is any interruption in the oxygen supply, the fetus blood turns abnormally acidic. This state of high acidity or low pH is defined as acidemia. This change in fetal blood pH results in the parasympathetic stimulation and increases the fetal heart rate. The relationship between fetal blood pH and the sympathetic and parasympathetic activation is discussed in detail in “*The Porto system for automated cardiocographic signal analysis*” [12]. In case of fetal distress, fetus suffers from oxygen insufficiency and this condition results in abnormal heart rate patterns. Thus fetal blood pH values can be considered as tool to predict fetal oxygenation and fetal heart rate variability. Based upon the values of arterial pH, CTU-UHB database categorized delivery outcome into three types of acidemia. They are normal ($\text{pH} \geq 7.20$), mildly acidemic (MA) ($7:10 > \text{pH} < 7:20$) and mildly to severe acidemic (MSA) ($\text{pH} \leq 7.10$) [13]. Table 1 shows the perinatal (after labour) features of different categories of acidemia. The data in the table are the mean values of these sixty subjects.

Table 1. Patient and delivery outcome statistics of sixty subjects.

Perinatal features	MSA (n = 7)	MA (n = 15)	Normal (n = 38)
Gestational age (weeks)	39.85	40.06	39.89
Apgar score at 1 min	7.71	7.73	8.26
Apgar score at 5 min	8.28	8.53	9.13
Umbilical arterial pH	7.015	7.1527.06	7.29
Maternal age (years)	31.14	27.06	28.68
Neonate's Weight (g)	3324.2	3388.6	3342.3

The arterial pH data and CTG recordings of these sixty subjects is compared to study the change in fetal heart rate variability. Table 2 shows the linear and non-linear parameters calculated from feature extraction and correlated with respect to the above mentioned three categories of the fetuses.

From the above analysis it is observed that in case of severe fetal acidemia, there is a decrease in the linear indices and increase in the non-linear indices. Moderate-to-severe acidemia reflects fetal hypoxia and shows a continuous change in entropy indices. In mildly acidemic and normal fetuses, linear indices are significantly increased and nonlinear indices show a significant decrease.

Table 2. Linear and nonlinear parameters calculated for three categories of acidemia.

Parameters	MSA	MA	Normal
Linear parameters:			
Mean	127	127.3	129.2
SD	17.9	17.3	17.1
Delta	47.7	49.6	47.5
STV	3.7	5.52	4.56
Interval index	0.25	0.32	0.36
Mean AD	14.04	12.7	10.4
Median AD	11.4	7.9	5.8
Non-linear parameters:			
ApEn(2,0.15)	0.036	0.0256	0.209
SampEn(2,0.15)	2.37	2.18	2.14
ApEn(2,0.20)	0.058	0.057	0.048
SampEn(2,0.20)	2.63	2.48	2.39

4 Conclusion

In this work an attempt has been made to detect the fetal distress prior to the labour period. The cortical pH values of the fetuses already given in the database are compared with the above calculated indices of fetal heart rate variability. The changes in pH values are found to be correlated with the variations in the FHR patterns. The present work mainly focuses on the early assessment of the autonomic nervous system response to the fetal oxygenation in regulating fetal heart rate. This work can further be improved by selecting a suitable signal processing technique to assist the clinicians in decision making. This can help prevention of fetal deaths due to misinterpretation of FHR variability.

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IoT Aided Non-invasive NIR Blood Glucose Monitoring Device

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Abstract. This paper demonstrates the measurement of human blood glucose concentration level non-invasively. Existing methods involve invasive monitoring that is painful, cause discomfort and damage to the tissue. Our project aims at developing a non-invasive glucose monitor. This monitor helps to reduce the agony of diabetic patients who require continuous monitoring of glucose and also reduce the spread of infectious diseases caused due to the repeated puncturing on the skin. The device works using Near Infra-Red (NIR) rays that are transmitted and received across the finger. The varying voltages taken at the receiver end are further processed and correlated with the glucose concentration levels, and thus the blood glucose concentration is estimated. The glucose levels obtained are displayed on smartphones through the Internet of Things (IoT). The efficiency and sensitivity of this method make this technique convenient to use.

Keywords: Glucose · Diabetes · NIR rays · IoT

1 Introduction

Diabetes Mellitus commonly known as diabetes is one of the deadliest and chronic diseases known. It is a metabolic disease which causes high blood sugar levels in the body. Insulin is a hormone that transports sugar from the body into cells, and these sugars are stored or used for energy generation. A person with diabetes cannot produce insulin or cannot effectively use the insulin produced. According to the World Health Organisation (WHO), the number of people suffering from diabetes is nearly 425 million. In 2012, 1.5 million people died of diabetes. Currently, around 73 million Indians are affected by diabetes, which is almost 7.1% of the population in India. Approximately 1 million deaths occur in India due to type 2 diabetes. If diabetes remains untreated, it can damage nerves, eyes, kidneys and other organs. Chronic diabetes may also result in diabetic ulcers and may lead to amputation of legs and hands of the patients in the later stages. Therefore, there is a need to continuously track the glucose at every stage as a preventive step against the disease getting worse. The condition of the subject based on the blood glucose concentration is illustrated in Table 1. The glucose concentration level in every human depends on different

parameters like physiology, age, sex and so on. The target glucose concentration levels of different age groups for diabetic patients are given in Table 2.

Table 1. Glucose concentration of the normal and diabetic subject

Condition	Concentration (mg/dl)
Normal	70–80
Hypoglycaemia (low blood sugar level)	<70
Hyperglycaemia (high blood sugar level)	180–200

Table 2. Target blood glucose levels for diabetic patients of different age groups

Age	Glucose level in diabetic patients (mg/dl)		
	Fasting	Before meal	After meal
Below 6 years	80–180	100–180	Around 180
6–12 years	80–180	90–180	180
12–19 years	70–150	90–130	150
Above 20 years	<100	70–130	<180

There are different types of diabetes.

- Type 1 diabetes: The cells in the pancreas that produce insulin get attacked and destroyed by the immune system and thereby no insulin is produced.
- Type 2 diabetes: It is a condition where sugar gets build up in the blood as the body cannot use insulin secreted because the body becomes resistant to insulin.
- Prediabetes: It is the condition where the blood sugar is slightly higher than the normal range, but the subject is not considered diabetic.
- Gestation diabetes: It is a type of diabetes which is caused by insulin-blocking hormones produced by the placenta. It is referred as high blood sugar during pregnancy.

The ratio of people with type 1 and type 2 diabetes is 5:95 percent. Haemoglobin is a protein attached to Red Blood Cells (RBC) in the bloodstream, and it carries oxygen to various tissues in the body. Few of the glucose molecules get attached to the haemoglobin forming glycated Haemoglobin (HbA1c). A HbA1c test determines the status of how well the subject is managing diabetes over a sustained period. The test is an average of blood sugar concentration levels taken over a 2–3 month period. The condition of the subject with respect to HbA1c value is explained in Table 3.

Table 3. Relation of the diabetic condition with HbA1c value

HbA1c value	Condition
<5.6%	Normal
5.6–6.4%	Impaired glucose tolerance
≥ 6.5%	Diabetic

The concentration levels of glucose in the blood (glycaemia) can be measured by blood glucose monitoring. It is essential for patients with diabetes mellitus to monitor glucose levels in the blood continuously for effective treatment. Currently, existing methods measure blood glucose levels invasively using Glucometer. Glucometer, also known as a glucose meter, is a medical device used to determine the glucose concentration in the blood. Blood sugar levels monitoring can be painful for diabetic patients. The finger of the subject is pricked several times a day to obtain blood sample every time, the blood droplet is applied onto a plastic strip and is inserted into a glucometer (a handheld device that tells whether the glucose level is high, low or normal on target). Current glucometers use test strips containing glucose oxidase, an enzyme where the glucose in the blood sample reacts as an interface to an electrode inside the meter. When the strip is inserted into the meter, the flux of the glucose reaction generates an electrical signal. The more the glucose in the sample, the higher the number. The main disadvantage of this method is the pain and discomfort caused to the subject due to its invasive nature. Non-invasive techniques are more useful and user-friendly as they resolve blood requirement issues. In comparison with the invasive method, the non-invasive method reduces healthcare cost, other complications like irritation, haemorrhages and frequent pricking. A non-invasive blood glucose monitoring can be carried out using several methods like Raman Spectroscopy, Light absorption spectroscopy, Polarimetry, Photoacoustic. This project aims to design a non-invasive glucometer by implementing NIR optical technique and IoT. The NIR technique is followed due to its sensitivity and selectivity.

2 Literature Survey

A paper on NIR Spectroscopy by Narkhede et al. [1] proposes that spectroscopy works on the principle of light absorption and the interaction of electromagnetic radiation with matter. A white light source with different wavelengths is focussed on a specimen. Upon focussing light onto the specimen, the particles (photons) present in the specimen excite. The attenuation of the transmitted light is compared with that of incident light and an absorption spectrum is acquired. Spectroscopic studies are mainly done in the region of NIR and visible range i.e., 400–1190 nm. NIR rays propagate more into the blood sample than visible or other rays. NIR can penetrate to a depth of 1–10 mm into the tissue. The penetration value decreases with an increase in wavelength value [11].

Pandey et al. [2] suggests the Raman spectroscopy method can be used as it allowed higher depths of penetration inside the tissue with great chemical stability. Using a laser, the sample was irradiated, and hence the spectrum consisting of varying molecular energies was formed. The scattered light from the specimen at varying wavelengths and intensities are detected.

Researchers also proposed that Fluorescence can also be correlated to the glucose levels. Biological tissues in the body exhibit fluorescence at specific frequencies. When glucose solution is made to excite by laser light at 350 nm, fluorescence is detected. The intensity of fluorescence depends on the concentration of glucose in the solution.

Pai et al. [9] and Sim et al. [10] proposed papers on photoacoustic spectroscopy which works on the principle of photoacoustic effect wherein the periodic temperature

variations happening in the sample when an IR light falls on it are measured as pressure fluctuations using a microphone. The processed pressure fluctuations/acoustic waves produce a spectrum similar to the absorption spectrum. These variations in pressure happen when light falls on biological tissues.

Cote et al. [8] suggested in his paper on polarimetry, where the polarized light falling on an optically active sample changes the rotation of the polarized light. The concentration of the sample/biological tissue was calculated using the values of the rotation angle.

3 Methodology

3.1 Principle

The device works on the principles of spectrophotometry and Beer–Lamberts law to analyse the absorbance of light. Beer–Lambert law states that the absorbance is directly proportional to its concentration and path length of the light through the sample. The principle of Beer–Lamberts law is explained in Eq. 1 and Fig. 1.

$$A = Ecl. \quad (1)$$

A = Absorbance, c = Concentration, l = Pathlength, E = Attenuation coefficient

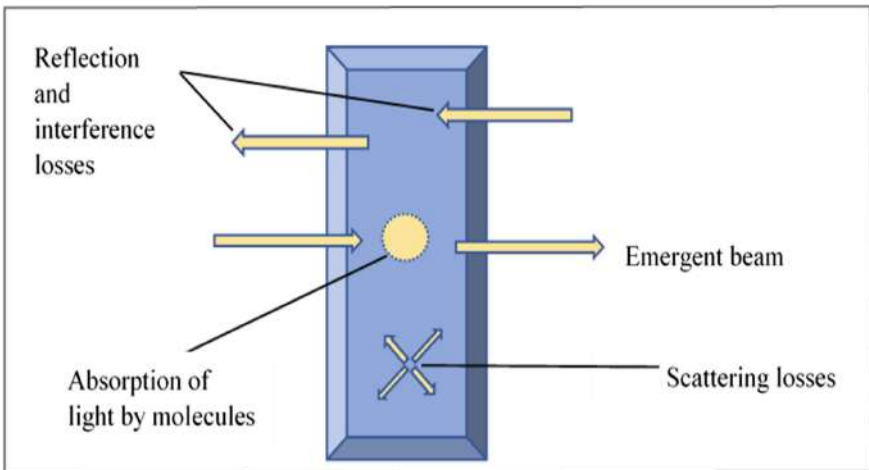


Fig. 1. Beer–Lamberts law

The response of light on the biological cells and fluids at a wavelength of range 590–1180 nm helps in estimating the concentration of glucose molecules. The C–H, O–H, C=O bonds in glucose ($C_6H_{12}O_6$) molecules undergo transitions when incident with IR light [6]. These transitions cause the transmitted light to get partially absorbed and scattered. Less glucose leads to weak NIR absorption and more scattering while

more glucose leads to higher NIR absorption and less scattering [5]. This attenuation of light due to absorption and scattering is calculated using Eq. 2.

$$I = I_0 e^{-\mu_e L} \tag{2}$$

I is the reflected light intensity, I_0 is the incident light intensity, L is the optical path length in the biological tissue.

μ_e is defined in Eq. 3 using the absorption coefficient μ_a and scattering coefficient μ'_s in Eqs. 4 and 5.

$$\mu_e = [3\mu_a(\mu_a + \mu'_s)]^{1/2} \tag{3}$$

$$\mu_a = 2.303\epsilon Ccm^{-1} \tag{4}$$

$$\mu'_s = \mu_s[1 - g] \tag{5}$$

The absorption coefficient (μ_a) can be derived from the chromophore concentration (C), molar extinction coefficient (ϵ) and the glucose concentration (g).

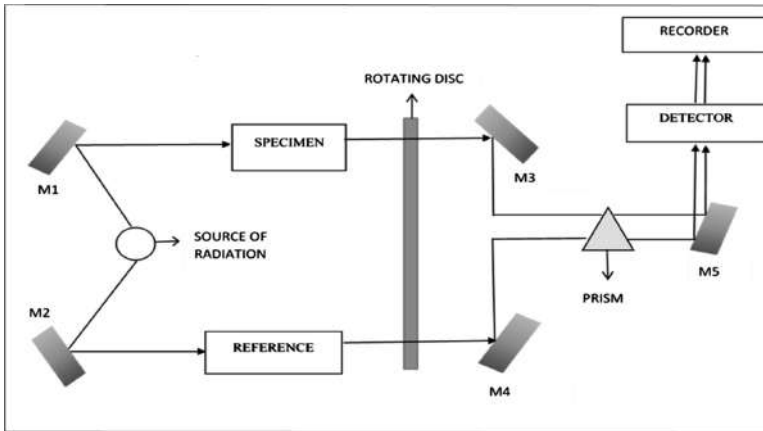


Fig. 2. Principle of NIR spectroscopy

The principle of Spectroscopy is portrayed in Fig. 2. It describes that when the sample is irradiated with IR source the atoms in the specimen excites from one state to another state. The concentration of the specimen is obtained through a relative difference in intensities of light reflected from the specimen through the mirrors (M1–M5) concerning the reference. NIR spectroscopy is in the range of 750–2500 nm as most of the biological cells and fluids are transparent in this range. The depth of penetration of the signal varies inversely with the wavelength. The range of penetration is 1–10 mm. Spectroscopy is the interaction of molecules with light energy. In IR spectroscopy, the IR rays where the bond of glucose vibrating at a frequency equal to the frequency of IR light is absorbed and thus transmittance decreases for that particular frequency.

3.2 Block Description

The series of blocks involved in the project are outlined in Fig. 3.

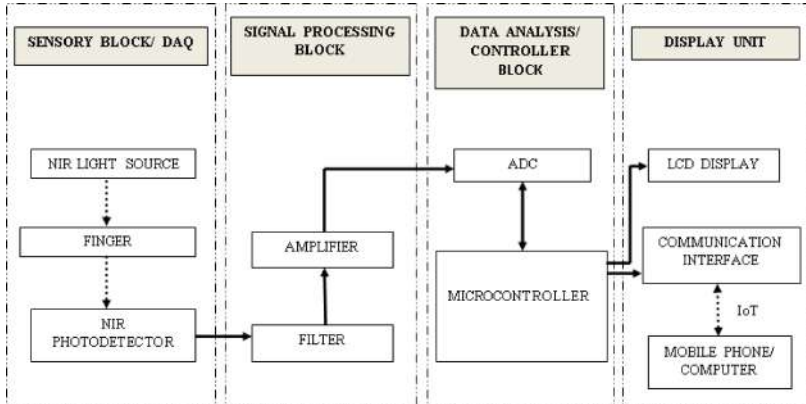


Fig. 3. Block diagram

Sensory Block

- DAQ (Data Acquisition) System: This block helps in acquiring the signal from the subject.
- NIR Light Source: Light absorption capacity of glucose is maximum at the wavelengths of 940 nm, 970 nm, 1408 nm, 2100 nm and 2306 nm. The attenuation of optical signals by other blood components like water, platelet, RBCs so on is minimum at 940 nm. This helps in achieving the desired depth of penetration and predict glucose concentration. A NIR LED is chosen as it emits optical signals at 940 nm.
- Photodetector: A Phototransistor acts as a photodetector which detects light emitted by the NIR LED and converts the optical signals into an electrical output signal, i.e., voltage.

Signal Processing Block

- Filter: The signal consists of noise due to artifacts while acquiring voltage from the photodetector. The purpose of a filter in a circuit is to eliminate the noise from the signal. A low pass filter with a cut off frequency of 10 Hz is used to remove high-frequency components and power line interference while a high pass filter with a cut off frequency of 0.5 Hz is used to remove low-frequency components or baseline drift [5].
- Amplifier: An amplifier is used to improve the quality of weaker signals. Instrumentation amplifier with a suitable gain is preferred in order to increase the output signal strength.

Data Analysis Block

ADC is used to convert the analog signal into a digital signal before feeding the signal into the microcontroller. A microcontroller is programmed to perform regression analysis.

Display Unit

- LCD (Liquid Crystal Display): The monitored glucose levels are displayed on LCD which has a direct connection with the rest of the unit.
- Display through IoT: IoT is a way of expanding internet connectivity wirelessly to a wide range of devices beyond existing standard devices like desktops, laptops, smartphones and tablets. IoT technology is implemented as communication gateways to display the readings. It provides remote and real-time notifications to the patients, their attendants and physician. The communication interface between the device and the display unit can be done through GSM, Wi-Fi, Bluetooth and many others [4].

3.3 Working

The project design includes hardware and software parts. The hardware part comprises of a transmitter and detector which are mounted on the finger. The analysis can also be done on ear lobe as these locations have less bony prominence. The transmitter consists of a near-infrared (NIR) LED which transmits light and the reflected light is received by a phototransistor which is a detector. NIR waves at a wavelength of 940 nm are used, as glucose is absorbed largely at this wavelength. IR 333A LED [4] is chosen as it emits signals at 940 nm wavelength. One can also choose Laser as a transmitter, but it is preferred less because of its cost and its effects on some tissues within the body. Hence the use of LED as a transmitter is one of the best options. The transmitter is connected to a constant power supply. The detector circuit consists of a phototransistor BPW34 which absorbs wavelength at 940 nm [5]. The detector circuit is connected to the signal processing unit which includes a filter and amplifier. Further data analysis involves Embedded C programming in a microcontroller. The blood glucose concentration level will be displayed on the smartphone using IoT or on the LCD.

4 Results

A working prototype of the project has been designed using an IR LED, phototransistor, signal processing unit and a display system wherein the blood glucose concentration levels of the subject were fed into the mobile phone or computer wirelessly using IoT. As mentioned in Table 1 & 2, factors like age, sex and health condition of the subject determine whether the subject is diabetic or not. So, the predefined ranges of those conditions are added through IoT, and the obtained values are compared with those preset values [3]. Thus, the diabetic status of the subject can be estimated precisely.

Data is acquired from 3 normal subjects and 4 diabetic patients of different age groups. All the subjects were asked to come fasting overnight. The values of voltage at the receiver end of the phototransistor are correlated with their corresponding glucose concentration levels [5, 7] as shown in Table 4.

Table 4. Estimated glucose concentration levels

Receiver voltage (V)	Glucose concentration (mg/dl)
2.21	94.4
1.732	128.3
1.946	111.9
2.894	63.3
2.574	75.3
2.148	98.2
2.759	67.8

5 Conclusion

A prototype has been developed, and the output of the system is correlated with the glucose concentration levels. Thus, non-invasively the glucose concentration levels are obtained without any discomfort to the subject. The results are notified to the subject and physician using IoT. These advantages depict the flexibility of using this technique. This project can be further extended to monitor the blood haemoglobin along with the blood glucose as it involves the similar principle.

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Correlation Between Serum Levels of p53 During Radiotherapy in Cervical Cancer Patients

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Abstract. Cervical cancer is the fourth largest for both incidence and mortality in females due to lack of proper diagnosis in early stages of cancer. Therefore, identification of serum biomarkers could help in earlier diagnosis and chances to improve the survival of cervical cancer patients. In this regard, we studied the levels of circulating p53 protein in cancer patients' serum during the radiation therapy which is widely used method to treat cervical cancer. p53 is a tumor suppressor protein and is associated with genetic changes of the cell. It has a vital role in cell cycle and apoptosis during cell mutations. We examined the relationship between the levels of circulating p53 protein and radiotherapy. Our hypothesis was to prove p53 protein as a biomarker for clinical response to radiotherapy of cervical cancer patients'. Five cervical cancer patients' were enrolled for the study and blood samples were collected from them before, during and after the radiation treatment. Post-radiotherapy, patients' clinical response to radiotherapy was determined from the expression of p53 protein using Western blot method. For all the samples, the elevation of p53 protein was not observed in serum. As a preliminary study our results revealed that there was no correlation between serum levels of p53 protein and radiotherapy clinical response, as no band was observed on the transfer membrane after blotting.

Keywords: P53 protein · Cervical cancer · Radiation response · Biomarker · Western blot

1 Introduction

Cancer is the leading cause of death decreasing the life expectancy in every country of the world in the 21st century. Cervical cancer is the fourth largest and most common types of cancer for both incidence and mortality in females [1]. In cervical cancer the cells of the cervix are mutated. One of the causes of cervical cancer is by Human papillomavirus (HPV), a sexually transmitted infection. There are over 100 types of HPV virus. Among them, HPV16 and HPV18 are high risk oncogenic types [2]. The discovery of p53 protein with molecular weight of 53 K Dalton showed its function as an oncogenic protein. p53 is tumor suppression protein [3, 4]. The location of p53 gene is on chromosome 17 short arm (17p13) Fig. 1 [5].

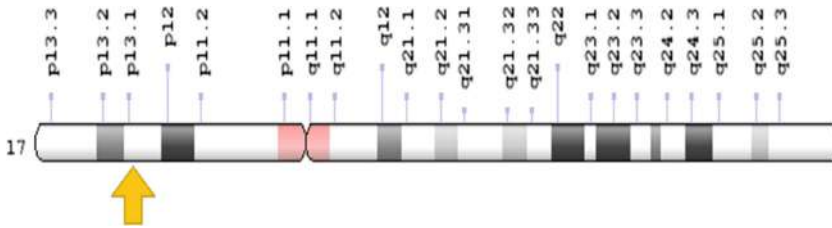


Fig. 1. Chromosome position of human p53 (NCBI)

The main function of p53 protein is to maintain cellular genomic integrity and controlled cell growth. So, it is triggered during cell stress [6–8]. The genetic change will trigger p53 gene to produce protein to repair the damage. If the damage is beyond repair the inhibition of the cell cycle progression takes place leading to cell apoptosis Fig. 2 [9].

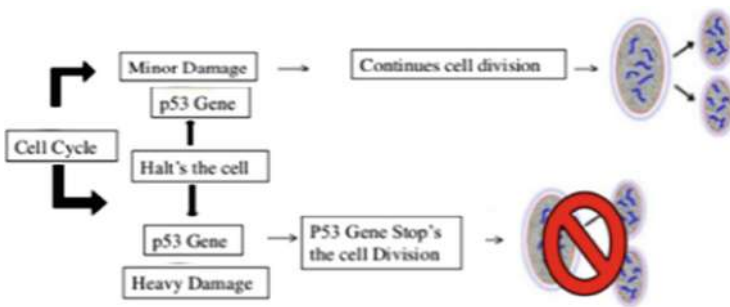


Fig. 2. Role of p53 gene in cell regulation

Radiotherapy is one of the promising treatments to treat cancer in the present times. It is recommended for 40–50% of all cases of cervical cancer [10]. In radiotherapy, DNA damage is induced in the cell leading to cell death. So as the cell is under stress our immune system triggers the release of p53 protein to repair the cell.

2 Methodology

2.1 Patients

Cervix patients' with Squamous cell carcinoma are enrolled at Department of Radiation Oncology, Basavatarakam Indo-American Cancer Hospital and Research Centre. All patients provided oral and written informed consent for the collection of blood which was approved by the Ethics Committee of Basavatarakam Indo-American Cancer Hospital and Research Centre, Hyderabad (EC Ref. IECR/2018/124, 21st June 2018). In total, five patients' were enrolled for the study. The treatment was planned for 5 weeks for all the patients. Blood was collected from untreated tumor patients' before, during and after radiation treatment. Three samples were collected from each patient. First sample was collected a day before the treatment started. Second sample was collected in the third week and third was collected after the completion of 5 weeks of the treatment. In total, fifteen blood samples were collected. Serum was extracted from the blood sample and stored in -80°C . Fifteen samples were blotted using western blot method the detection of p53 protein.

Inclusion criteria: (i) Patients' with histopathologically diagnosed cervical carcinoma (ii) No prior treatment (iii) tumor size was medium (iv) Treatment sittings 25.

Exclusion criteria: Patients' with HIV infection.

2.2 Method

Venous blood (5 ml) was collected in a sterile serum separation vacutiner and centrifuged within 2 h after collection at 3000 rpm for 5 min at room temperature. Supernatant containing serum was transferred into another polypropylene tube and stored at -80°C until further study. Serum was used for experiment after thawing once.

The aim of the study is to detect the expression levels of circulating p53 protein as an immune response to radiotherapy in serum of patients' suffering from cervical cancer. Serum levels of p53 were assessed in patients' before, during and after radiotherapy and compared. Circulating p53 protein was detected using western blotting.

Western blotting is a gold standard method to identify specific proteins from the sample. Firstly, SDS- polyacrylamide gel electrophoresis will be done to separate all the proteins in the samples according to their molecular weight. The separated proteins are then transferred to a transfer membrane mostly made up of Polyvinylidene difluoride (PVDF) or nitrocellulose. The membrane with total proteins is then labelled and incubated with antibodies specific to the protein of interest. Leaving the protein bound antibodies on the membrane the unbound primary and secondary antibodies are washed off. The membrane is then developed forming a band indicating the amount of protein bound to antibodies. The thickness of the band corresponds to the amount of protein present.

After separating the serum, the expression of p53 protein levels was observed using Western blotting method. Serum samples were analysed for total protein concentration using Bradford method. Samples were heated for 5 min at 100°C . Then lysed samples were subjected to 12% SDS- polyacrylamide gel electrophoresis to separate the proteins according to their molecular weight (Fig. 3).



Fig. 3. Buffer tank with gel loaded with samples

Proteins were transferred on to transfer membrane. To transfer the proteins on to Polyvinylidene difluoride (PVDF) membrane a sandwich of sponge, filter paper, gel and PDVF membrane was prepared and placed in the buffer tank filled with transfer buffer. Electrodes were placed on top of the sandwich and connected to power supply for 90 min. The membrane was removed and blocked with 5% skim milk in TBST for 1 h. Mouse- anti p53 primary antibody was added and incubated overnight in refrigerator at 4 °C. HRP conjugated secondary antibody was added and incubated for 1 h and band was observed. The membrane was developed by chemiluminescent method using ECL kit. All the fifteen samples were blotted using the same protocol.

3 Results

Western blot was performed for all the fifteen patient samples. The developed gels (shown in Figs. 4 and 5) were observed for p53 protein. No p53 protein bands were observed on the membrane for any of the fifteen samples.

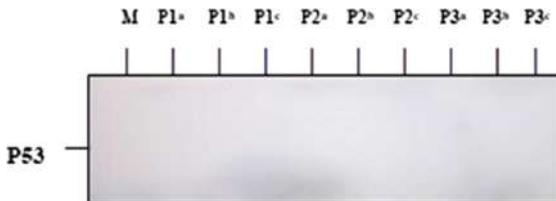


Fig. 4. Western blot analysis of p53 with Mouse- anti p53 primary antibody and HRP conjugated secondary antibody where M – Marker, P1^a, P1^b, P1^c- Patient 1 before, during and after radiation samples, P2^a, P2^b, P2^c- Patient 2 before, during and after radiation samples, P3^a, P3^b, P3^c- Patient 3 before, during and after radiation samples

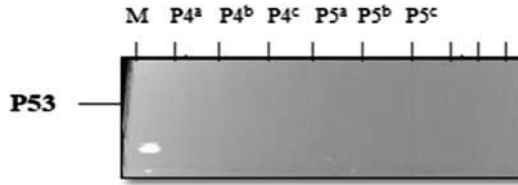


Fig. 5. Western blot analysis of p53 with Mouse- anti p53 primary antibody and HRP conjugated secondary antibody where M – Marker, P4^a, P4^b, P4^c- Patient 4 before, during and after radiation samples, P5^a, P5^b, P5^c- Patient 5 before, during and after radiation samples.

Table 1. Protein expression at the three time points i.e. before, during and after radiation samples

Patient	Before radiation (Expression of protein) ^a	During radiation (Expression of protein) ^b	After radiation (Expression of protein) ^c
P1	No expression	No expression	No expression
P2	No expression	No expression	No expression
P3	No expression	No expression	No expression
P4	No expression	No expression	No expression
P5	No expression	No expression	No expression

The protein expression at the three time points i.e. before, during and after radiation samples were compared shown in Table 1. Superfix a, b, c refer to before, during and after samples respectively. The results demonstrate that there is no detectable p53 protein as a response to radiation therapy. The results also demonstrated that there is no elevation of protein during radiation.

4 Conclusion

The major finding in this study is that there was no close correlation between serum p53 expression and radiotherapy process. There might be a possibility that synthesized p53 protein in serum gets very rapidly degraded. This study was conducted as a preliminary study. Further, the study will be done by increasing the sample size to standardize the results. Also, by comparing the tumor p53 levels could give more appropriate information to understand its correlation with radiation therapy. Additionally, the exact circulation time of the protein in serum is needed to be studied at varying time intervals. This reveals the correlation between protein levels before during and after radiation therapy.

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A Comparison of Morphological Features Between Normal and Abnormal Left Ventricle in One Cardiac Cycle

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Abstract. Echocardiographic images are widely used in the diagnostic procedure of the cardiac function. Left ventricle plays a vital role in pumping the oxygenated blood to the complete body and maintain systematic circulation. In this study, the echocardiogram data of a normal and abnormal subject were collected. The frames were extracted from the video for one cardiac cycle. The left ventricle from each frame was segmented using image processing techniques. The parameters such as area, perimeter, and the centroid of the left ventricle were determined. These parameters were used to estimate the movement of the LV and measure the contraction and expansion of the chamber while pumping the blood out in one cardiac cycle. The comparison of these parameters in normal and abnormal LV show that the cardiac motion varies significantly. ECG signal was used as the biomarker for this estimation.

Keywords: Left ventricle · Cardiac motion · LV segmentation · Regional properties

1 Introduction

In recent years the usage of medical image processing has become a necessity to extract relevant information, compression and image reconstruction. There are many modern imaging techniques which uses image processing are Radiography, Magnetic Image Resonance, Ultrasound and Echocardiography. These are used to access problems that occur in our body by the physician.

The human heart is four chambered and is divided into right and left side with each atrium and ventricle. The atria acts as reservoirs which does the receiving of the blood with a little pumping action to assist ventricular filling. The ventricles are the major pumping chambers for delivering blood to the body. The importance is given to the left ventricle (LV) when compared to others is as it performs more than 80% of the cardiac function.

Coronary artery disease which causes heart muscles to thicken leads to disrupting of heart function or even myocardial infarction. The abnormal contraction mechanisms of the left ventricle leads to decrease in the stroke volume which further decreases the cardiac output. Due to these reasons if muscles of the heart are affected it results in

circumferential fiber shortening, improper pumping of blood thus leading to reduction of stroke volume [1].

Left ventricular dilation is an abnormal condition of the heart where the left ventricle chamber of the heart dilates and weakens thus the amount of pumping is reduced comparatively. These abnormalities can be detected using various techniques such as MRI, CT and Echocardiography [2]. Even though this can be found using various scans like MRI and CT it has the drawback of being expensive and radiation effects respectively [3]. Echocardiography is one such technique which is non-invasive, low cost, less time consuming and radiation free. It is used for visualizing the heart and to diagnose its physiological conditions in real time.

Ultrasound is safer when compared to other techniques as it is non-invasive and has no side effects. It uses standard two-dimensional or three-dimensional technique and uses Doppler Effect to create images of the heart. Various information about the size, shape, location, movement and pumping capacity of the heart can be determined from the images [4, 5]. It is possible to determine volume along with the dynamic information which includes motion, deformation and speed.

To determine the above parameters, it is essential to trace the contour of the LV cavity. In order to achieve this it is required to trace the border of the left ventricle. There are different methods are used to find the border [6–8].

In this paper we propose an algorithm which area, perimeter and centroid during one complete cardiac cycle. These values were used to compare the test data and determine whether the cardiac motion is normal or abnormal. Experimental results show that these parameters of the normal heart vary significantly compared to the diseased heart.

2 Methodology

2.1 Data Collection

The data was collected from The New England Journal of Medicine. The echocardiogram was recorded for one cardiac cycle i.e., one R-R interval. The data was collected for one subject with normal heart and one other subject with abnormal heart. The two dimensional Echocardiography images of the heart are extracted from this video with ECG as a bio-marker of cardiac functioning.

2.2 Image Processing

The region of interest which is the left ventricle was chosen and was extracted into 16 different frames. The images were and the parameters were calculated. All the procedures were done using code written in MATLAB software as shown in Fig. 1

2.2.1 Image Pre-processing

In the pre-processing of the image, first the image is converted to gray scale. One of the commonly used nonlinear operation in image processing is the median filter which reduces the noisy pixels present in the image. In order to remove the noisy pixels, the image is filtered and smoothed using a median filter of [3 3] sub-matrix shown in

Eq. 1. Median filtering is more effective compared to other low pass filters when the main aim is to reduce speckle noise in the image and also simultaneously preserve the edges of the image.

$$F(x,y) = \text{median}\{g(s,t)\}, (s,t) \in S_{xy} \quad (1)$$

where $g(s,t)$ is the input image and S_{xy} is the subimage area used for filtering.

In-order to enhance the pixel intensity the histogram of the image was equalized which is needed for the segmentation procedure. Histogram equalization chooses the grayscale transformation T to minimize

$$|c_1(T(k)) - c_0(k)| \quad (2)$$

where c_0 is the cumulative histogram of the input image and c_1 is the cumulative sum of histogram for all intensities k .

2.2.2 Left Ventricular Contour Extraction

The procedure of the contour detection is shown below in Fig. 1.

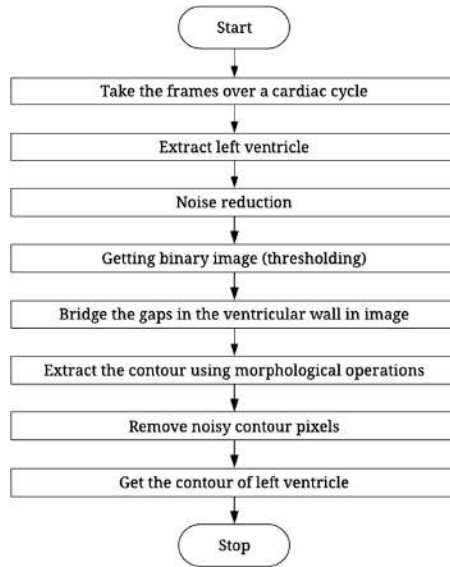


Fig. 1. Flow Chart of Contour extraction

To segment the LV in the filtered image, intensity based segmentation technique was used. The threshold value for segmentation was chosen from the histogram of the image. The segmented image is now converted into zeros and ones. Different thresholds were used for each frame based on the histogram of the image.

There were few gaps in the ventricular wall in the segmented image. To bridge these gaps in the segmented image few morphological operations were used. One such is closing operation which is dilation (Eq. 3) followed by erosion (Eq. 4) which was performed using a rectangular structuring element.

$$A \ominus B = \{z | (B_z \subseteq A)\} \tag{3}$$

$$A \oplus B = \{z | (B)_z \cap A \neq \emptyset\} \tag{4}$$

where A is the input image, B is the structuring element and z is the pixel location in the image.

After morphological operations there were some unwanted spots around the edges of the image. They were removed based on the 8-connected area ‘p’ determined for each image. Pixels of the unwanted spots are considered to be connected if their corners or edges touch with the region of interest (ROI) [9, 10].

Successive deletion of outer layer and inner layer gives the left ventricular contour. To get the contour of one pixel thickness the morphological operation, thinning is used. Thus, we get the binary image that contains the contour of left ventricle with one pixel thickness. The same process was used to extract the contour for all the frames.

2.3 Parametric Calculations

After the contour of the left ventricle was detected, the calculation of parameters such as area, perimeter and centroid of the left ventricle were performed. The pixels on the contour and the pixels inside the contour are considered. These parameters are generally denoted as the regional properties of the object in an image. The code for these calculations are written using the image processing toolbox of MATLAB software.

Area is calculated by counting the number of pixels present inside the ROI of segmented image which is returned as scalar. Perimeter is calculated by counting the number of pixels on the contour or the boundary of the ROI of segmented image which is also returned as scalar. Centroid is the average the average location of the pixels in the ROI which is returned as a 1-by-Q vector. The first element is the horizontal coordinate (x) and the second element is the vertical coordinate (y) [11]. The work flow of the calculation is shown below in Fig. 2.

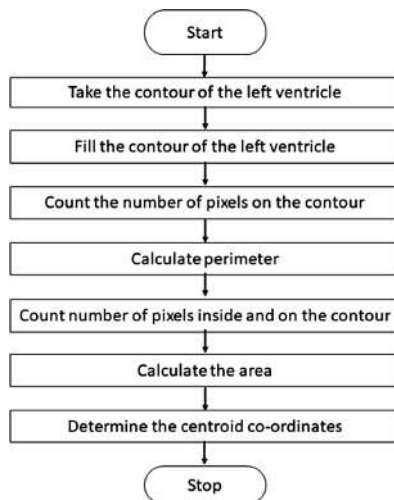


Fig. 2. Flow Chart of Parametric Calculations

The cardiac parameters such as area, perimeter and centroid of the left ventricle were calculated automatically for each frame during one cardiac cycle.

3 Results

From the echocardiogram images, contour of the left ventricle is extracted. By using this left ventricular contour, the parameters such as area, perimeter and centroid of the left ventricle are calculated. The processing is done for normal heart and abnormal heart.

3.1 Extraction of the Left Ventricular Contour

A 2D echocardiographic video is taken in apical four chamber view that gives the best view of left ventricle. The video was processed and few frames were extracted from the video which have been used for the analysis. Figure 3 shows one such extracted frame of the left ventricle.

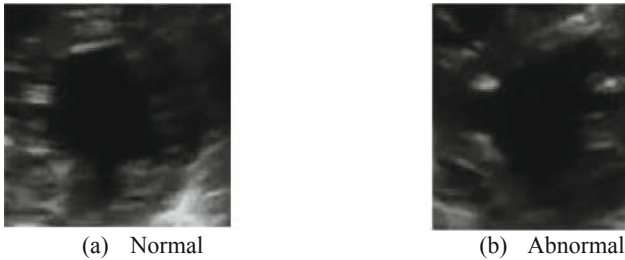


Fig. 3. Extracted frame of Left ventricle

The extracted frame contains noise, this noise was removed using a median filter. The image after median filtering and contrast enhancement using histogram equalization is shown in Fig. 4.

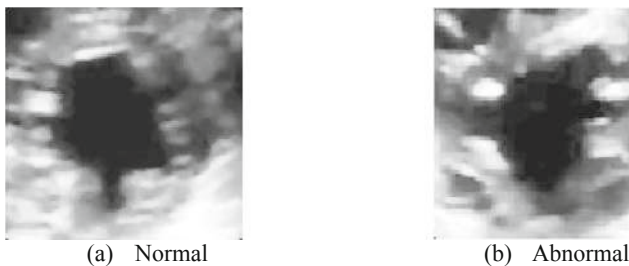


Fig. 4. Contrast enhanced image of the left ventricle

The segmented image using the intensity based thresholding where the ROI that is the left Ventricle is assigned a value of 1 and the rest with a value of 0. The resultant image is a segmented binary image shown in Fig. 5.



Fig. 5. Intensity based segmented image of the left ventricle

The contour of one pixel thickness is obtained by using the mathematical morphological operations and the output is shown in Fig. 6. The image contained the noisy pixel branches inside and outside the ROI. A program is developed to form a neat region for the segmented left ventricle which is used to find the regional properties as shown in Fig. 7.



Fig. 6. Left ventricular contour

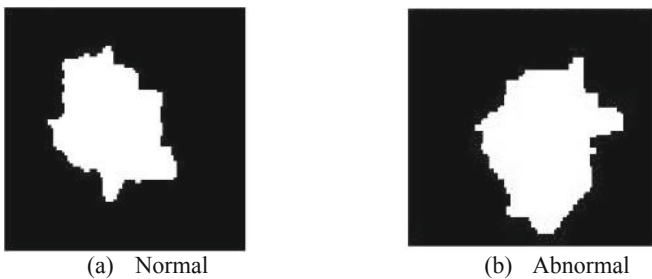


Fig. 7. Segmented left ventricular

Hence the left ventricular contour was extracted. The contour was extracted in all the frames in a similar way. The change in the shape of the left ventricle in normal heart and the abnormal heart can be differentiated accordingly.

3.2 Calculation of Parameters

The parameters such as area, perimeter and centroid of the left ventricle were calculated based on the number of pixels present inside the contour and on the contour. The area and the perimeter of the left ventricular contour is calculated for all the frames of one cardiac cycle for both normal and abnormal case and are shown in Table 1.

Table 1. Calculated values of area and perimeter for one cardiac cycle.

Frame	Area normal	Area abnormal	Perimeter normal	Perimeter abnormal
1	2896	1918	309.1787	239.0955
2	2746	1886	261.2792	238.6518
3	2496	1766	260.066	231.0955
4	1726	1584	193.196	226.8528
5	1574	1524	190.1249	225.1960
6	1194	1107	153.1543	196.1249
7	1093	952	140.8112	168.2254
8	1073	895	142.3259	160.1249
9	1262	913	176.9533	162.9533
10	1897	1006	197.0955	146.1249
11	2017	942	215.4386	138.1249
12	2255	1015	257.8234	144.129
13	2282	1232	222.0244	179.0538
14	2390	1403	263.4802	190.4680
15	2361	1554	254.1665	197.539
16	2496	2267	260.066	255.2376

A graph was drawn to show the variation in area over one cardiac cycle and shown in Fig. 8. It can be observed that the change in area during one cardiac cycle of a normal heart vary significantly when compared with the abnormal one. Figure 9 shows the graph of change in perimeters during one cardiac cycle.

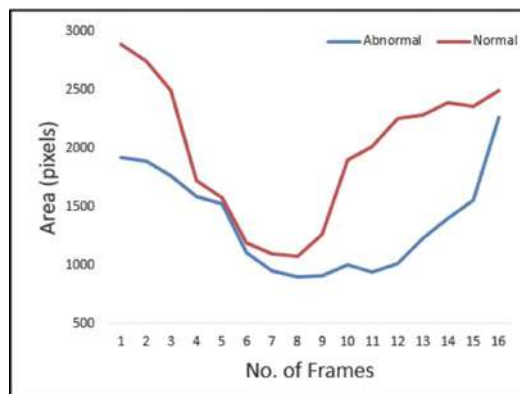


Fig. 8. Comparison plot for change in area corresponding to each frame.

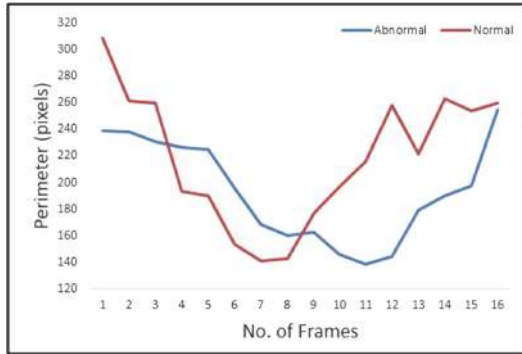


Fig. 9. Comparison plot for change in parameter corresponding to each frame.

The graphs drawn in Figs. 10, 11 and 12 shows the changes in the motion with respect to the coordinates of the centroid. The graphs obtained clearly explain the motion of the LV i.e., the systolic and diastolic movement.

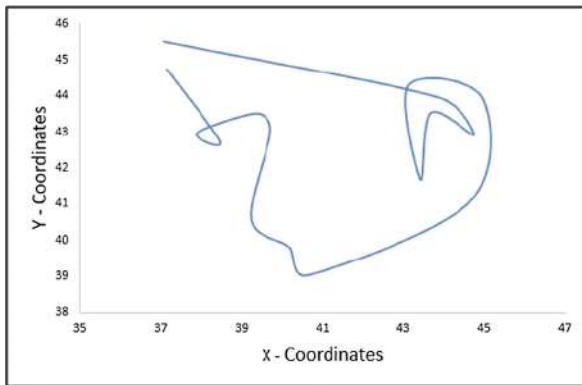


Fig. 10. Plot of the centroid's movement in normal LV.

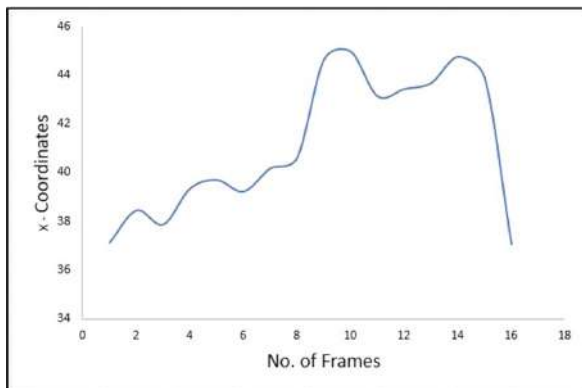


Fig. 11. Plot of the normal LV centroid X-coordinates w.r.t to the frames.

The location of the centroid is significantly different both in healthy and diseased heart. Figure 12 shows the movement of the x coordinate of the centroid during one cardiac cycle. The locations during the beginning and end are not close to each other.

The contraction and expansion of the LV's can be estimated thus inferring the amount of the blood and the pressure with which it is pumped can be analyzed by the health professionals.

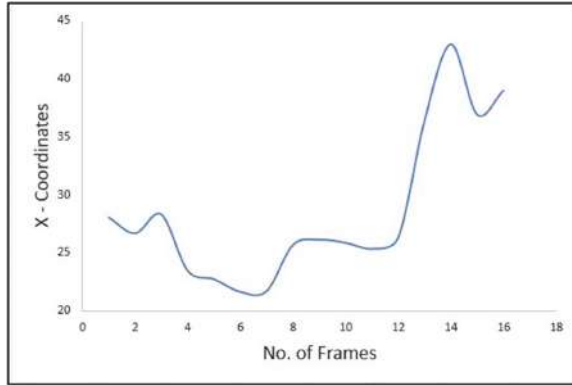


Fig. 12. Plot of the abnormal LV centroid X-coordinates w.r.t to the frames.

4 Conclusion and Future Scope

The area, perimeter and centroid of the left ventricle for normal and abnormal subjects were calculated for one cardiac cycle in 16 different frames. The changes in the parameters frame to frame were observed to learn the systolic and diastolic movement of the heart.

The area and perimeter of both normal and abnormal LV are compared. The Perimeter of the abnormal LV is comparatively greater than the normal because of the irregular shape of the LV. The area infers the change in contraction and expansion of the LV. The centroid of the LV is used to study the irregular motion of the abnormal LV comparing it with the normal LV. Thus, these results show that the contraction of the abnormal LV is lesser compared to normal.

This work can be further extended for calculation of the volume of the heart's left ventricle for diagnostic purposes.

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Localization of ECG QRS Waves Through Spectral Estimation of Heart Rate

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Abstract. An Electrocardiogram (ECG) is a biomedical signal that contains information about the functioning of the heart which is extracted by means of signal processing to assess cardiac functions.

The main feature of the ECG is the R wave in the QRS complex which defines the basic physiological finding in the heart (i.e.) heart rate. The crucial work in ECG analysis is to detect the R waves which are variant in amplitudes and locations throughout the rhythm strip making it difficult to set an amplitude threshold in priori to detect them. Most of ECG analysis methods rely on the detection of the R waves basically for primary as well as secondary analysis.

In this paper we propose a method to localize the R waves without setting a threshold in priori, nether static nor dynamic. The proposed method firstly achieves an estimate of the heart rate by analyzing the spectrum of the ECG signal in order to determine the set of points that includes the R waves and consequently localize the R waves in the time domain representation of the ECG signal. We estimate the heart rate by detecting the most significant energy frequency component in the spectrum that is in the range 0.5 Hz to 6 Hz and the corresponding time period (i.e. reciprocal of frequency component), then we find the maximum amplitude point in the ECG signal which definitely corresponds to an R wave. Starting from that point we go in both directions till the beginning and the end of the signal at a step size equal to the fundamental period aforementioned (i.e.) estimated heart rate component. As a result, the set that contains expected locations of all R waves is obtained. Finally a symmetrical time domain unity amplitude window is designed which is centered at every expected location found earlier and then the maximum amplitude points' within the window area are found which are going to represent the exact the R wave locations.

Keywords: ECG · Detection · Heart · QRS · Rate

1 Introduction

ECG is a recording of the heart's electrical activity as shown in Fig. 1. It is a vital tool in cardiology as it helps in detecting many heart diseases. The basic finding in an ECG is the heart rate which is determined from the count of the QRS complexes in the 10-s ECG strip as shown in Fig. 2. The first step in ECG processing is always the detection of R waves after which the detection of other waves are carried out. The detection of the R waves might be done in processing the time domain or the frequency domain

representations of the ECG. Lots of algorithms had been developed to process the ECG in the time domain in order to detect the R waves, in this paper we introduce a method to find the heart rate by processing the spectrum only; then the R waves' locations are discovered retrospectively (i.e.) using the information deduced from the spectrum processing. Finding the heart rate is a requirement in itself but we go beyond that to localize the R waves by using the heart rate piece of information. Most time domain algorithms-if not all-which aim to detect the QRS complexes need to set a threshold (whether static or dynamic) above which a peak point is considered a valid R wave and below which a peak point is neglected whatsoever. Verily a dynamic threshold is far more practical and reliable than a static one as it adapts with ECG parameters. In our proposed method we neither use a static threshold nor a dynamic one, but rather we find expected locations of the R waves using the heart rate piece of information and then design a window of a certain length to cover the vicinity area of every expected location, finally the maximum amplitude point within the limits of the window is found and verified to be the R wave.



Fig. 1. ECG signal waveform. Note the R wave peaks occurring periodically which represent the depolarization of ventricles.

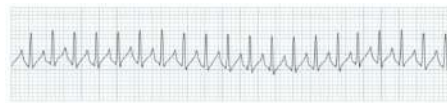


Fig. 2. ECG signal rhythm strip. Usually it is of 10 s duration in the ECG graph sheet.

Section 2 presents the algorithm in its two stages of processing; time and frequency domains, Sect. 3 details the results of the proposed method applied to 50 ECG records and finally Sect. 4 highlights some types of ECGs where this method fails to process and concludes with future improvements to the method.

2 Algorithm

The algorithm is based on the frequency component that represents the heart rate which typically lies in the range (0.5 Hz–6 Hz) which corresponds to heart rate range (30 beats per minute–360 beats per minute). Detecting this frequency component reveals the key piece of information because it represents the QRS complex rate of repetition which makes the estimation of R wave locations possible. After this primary estimation is attained, the certain locations are detected by processing the parts of the signal around the approximate locations.

2.1 Pre-processing

The preprocessing stage applied includes removing the DC voltage from the ECG signal by subtracting the mean of the signal from it which is followed by substituting the first and last 5% samples of the ECG signal by the mean to eliminate any unwanted distortions due signal acquisition or digitization processes, then the signal is multiplied by negative unity if the QRS complexes morphology is a deep S wave followed by a low amplitude R wave. Finally differentiating the signal to enhance high slope parts and squaring to remove negative amplitudes. There is no band pass filtering stage in this proposed method because the algorithm works on the spectrum and hence it initially excludes the unwanted regions (regions of noise and interference) of the spectrum from being involved while extracting the piece of information the whole algorithm is dependent on, unlike the other algorithms which deal with time domain representations of the ECG signal which represent all frequency components.

2.2 Spectrum Processing

The ECG is a periodic signal that contains different frequency components, the active bandwidth of the ECG signal is (0.05–150) Hz [1, 2], (0.05–100) Hz [3] and (0.5–30) Hz [4]. Typically the higher and lower components in the spectrum are associated to QRS complexes and T waves respectively. However baseline wandering and spurious spikes are in fact the lowest and highest components in the ECG signal respectively but theoretically they are not natural components of an ECG, they are considered to be noise interference. The application of fast Fourier transform (FFT) to the ECG signal reveals the spectral composition, we limited our analysis in the spectrum to frequencies that range from 0.5 Hz to 6 Hz as this is the practical range of all healthy and non healthy subjects. Then we find the highest energy frequency component in the defined range which represents the heart rate component as illustrated in Fig. 3. The heart rate frequency component that this proposed method relies on entirely as mentioned above is not that which makes up the QRS complex as the QRS complex's frequency composition is much higher due to its sharply slopping morphology; rather it is the fundamental component which synthesizes the QRS component as per Fourier theory. Thus excluding all frequencies above 6 Hz at spectral component energy analysis will affect the shape of QRS waves at wave reconstruction (synthesis) stage but does not have an effect on the pattern of the ECG as a whole.

2.3 Time Domain Processing

The reciprocal of the maximum energy frequency component found in the previous section is found to represent the corresponding period of repetition (N) of the QRS complex for the ECG signal. This period is the period separating every ECG cycle from the succeeding and preceding ones in the ECG rhythm strip. In order to have an initial location to start with and from which other possible locations of R waves are estimated by using the R wave period, the first location is needed to be correct. We made use of the fact that the highest amplitude point in the ECG signal with positive R waves (see lead I in Fig. 1) always belongs to one of the R waves, whereas in the deep S wave

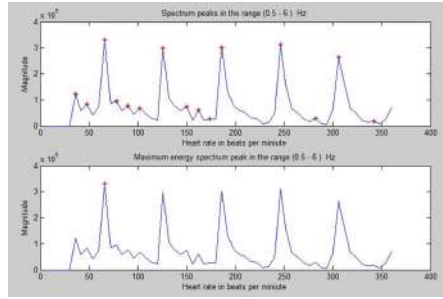


Fig. 3. ECG signal spectrum zoomed in to focus on the first quadrant of the spectrum. The horizontal axis represents the heart rate instead of frequency (1 Hz corresponds to a heart rate of 60 bpm) and the vertical axis indicates the energy. (a) all spectrum peaks. (b) maximum energy peak in (a).

followed by R wave (the term negative R wave can be used loosely) scenario ECGs (see lead aVR in Fig. 1) the minimum point always corresponds to an R wave. Having an R wave detected in the aforementioned mechanism (marked in blue in Fig. 4) paves the way to find all points that are N unit time away from the first R wave in both directions. At the end of this stage, a number of possible locations for the R waves are found (marked in green in Fig. 4) which are going to be not correct for the reason that the ECG signal is not periodic in the literal meaning of the word because it is a physiological signal (technically, strict periodicity is observed only in mathematical functions), some patterns of the cyclic ECG signal may come earlier or later than the fundamental period. For finding the correct locations of the R waves; a window of certain size (sizes are discussed in the next section) centered at the obtained expected locations is applied on the signal which covers the vicinity of the expected locations. Subsequently the highest amplitude point within the window limits is detected which determines the correct R wave peak (marked in black in Fig. 4). Finally; minor location offsets in R wave localizations which are due to preprocessing are corrected.

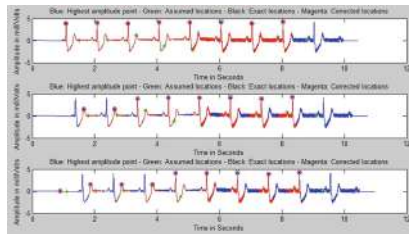


Fig. 4. ECG signal peak finding while (a) window size $L = N$, (b) window size $L = \frac{2}{3}N$ and (c) window size $L = \frac{1}{2}N$. Red delineation represents the parts processed by the successive windows in the peak detection process.

2.3.1 Size of the Window

The size (L) of the unity amplitude square window might be as big as half a period (i.e.) $\frac{1}{2}N$ on each side of the expected R wave locations and might be less than that. Shorter lengths are one third time period (i.e.) $\frac{1}{3}N$ on each side of the expected R wave location or one fourth time period (i.e.) $\frac{1}{4}N$ on each side of the expected R wave location. Applying shorter lengths reduces the number of samples processed in the time domain processing stage but increases the chances that a certain peak location in the vicinity of an expected location is missed due to the insufficiency of the number of processed samples, whereas applying longer lengths have the effect of increasing the accuracy of detection at the cost of increased processing burden and multiple segment (window area) overlap resulting in repeated detection of the same R wave peak as illustrated in Fig. 4. All the three length options are applied in three trials for every ECG signal and different levels of success in localizing the R waves are achieved. Results section shows the success rates of each length trial in detail.

Point in blue refer to the highest amplitude point in the signal, points in green indicate the assumed locations of R waves, points in black represent the correct locations of R waves and the points in magenta are the corrected R wave locations.

3 Results

The proposed method is applied on 50 ECGs of which 11 cases are digitized by us using a scanner, we captured the ECG graph sheets using a scanner to access them as digital images, then we converted lead II rhythm strip into a digital signal by using a code we developed earlier, the remaining 39 cases are digital ECGs obtained from MIT-BIH arrhythmia database [5]. There are 4 cases included in the experiment set in which the R wave is inverted (a deep S wave followed by a low amplitude R wave), the proposed method localizes the R waves in such cases also accurately. Table 1 shows 50 lead II rhythm strips each of 10-s duration obtained from two sources; MIT-BIH arrhythmia database (Challenge 2010 Test Set C and Challenge 2011 Pilot Set C) and a personal library of digitized ECG graph sheets. Record numbers in Table 1 are as designated in MIT-BIH database and the processed durations are shown to be 10-s for each recording. Total beats are counted visually and are all positive in all the records except the five records in Table 1 denoted as: 31, 2, 32, 37 and 38. The fifth column in the table illustrates the 3 trials, first trial is when size of the window L is equal to the R wave period N , second is when L is equal to two thirds the R wave period N and the third is when L is equal to one half the R wave period N . The column specifies clearly how many R waves are detected correctly, how many wrong points are detected as R wave peaks (false R waves) and finally how many R waves are missed for either being detected wrongly or totally missed. If the accuracy criterion is defined to be the minimum detection error (i.e.) minimum wrongness followed by minimum detection missing; then the most accurate trial is going to be trial 1 at a success rate of 94% followed by trial 2 at a success rate of 16% and lastly trial 3 at a success rate of 4%.

The most accurate trial’s particulars based on this criterion are written in *italic* in Table 1. Other criteria may be the basis to quantify the most reliable trial. Figure 5 shows an ECG signal contaminated partially with 50 Hz power signal interference with R waves detected.

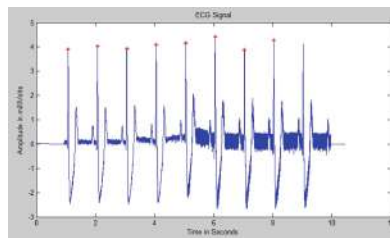
Table 1. Results of applying proposed method on 50 ECG records

Rec. No.	Total beats	R wave locations detected (correct, wrong, missed)			
Physionet MIT-BIT Arrhythmia Database Challenge 2010 Test Set C (Duration is 10 s and Sampling Rate is 124 samples per sec)		Percentage of samples processed in trials 1, 2 and 3	Window size L = 1 N	Window size L = 2/3 N	Window size L = 1/2 N
		C00	13	94,65,48	<i>13,13,0</i>
C13	11	88,59,45	<i>10,1,1</i>	<i>10,1,1</i>	10,11,1
C29	10	77,52,43	<i>9,1,1</i>	<i>9,1,1</i>	6,4,4
C32	10	79,58,43	<i>10,1,0</i>	7,5,3	6,6,4
C39	14	83,60,44	<i>13,0,1</i>	13,1,1	10,4,4
C53	16	93,61,45	<i>16,16,0</i>	11,22,5	8,24,8
C55	11	81,59,43	<i>10,0,1</i>	7,5,4	4,7,6
C22	12	94,65,48	<i>12,14,0</i>	10,16,2	7,23,3
C07	13	89,60,44	<i>12,1,1</i>	6,8,7	5,8,8
C09	11	79,58,43	<i>9,0,2</i>	6,5,5	4,7,7
C11	15	91,60,45	<i>15,1,0</i>	14,2,1	12,4,3
C14	13	89,60,45	<i>12,0,1</i>	8,5,5	8,5,5
C15	12	90,65,48	<i>12,12,0</i>	9,17,3	4,22,8
C21	18	88,59,47	<i>18,0,0</i>	13,6,5	10,10,8
C37	13	83,55,45	<i>12,0,1</i>	<i>12,0,1</i>	11,1,2
C45	9	72,54,41	<i>8,1,1</i>	5,5,4	4,6,5
C47	10	58,57,43	<i>10,1,0</i>	6,6,4	4,6,5
C41	10	87,63,46	<i>10,8,0</i>	6,15,4	5,16,5
C35	15	86,60,45	<i>14,1,1</i>	10,6,5	8,2,7
C03	14	86,60,45	<i>12,2,2</i>	10,6,4	10,6,4
C60	10	79,58,43	<i>9,1,1</i>	8,3,2	7,4,3
C01	12	90,62,48	<i>12,8,0</i>	10,14,2	7,19,5
C12	11	79,58,43	<i>10,0,1</i>	8,3,3	6,5,5
C40	15	85,55,45	<i>13,0,2</i>	10,4,5	8,7,7
C58	8	81,54,41	<i>8,0,0</i>	7,2,1	6,3,2
C51	14	85,59,45	<i>13,0,1</i>	10,5,4	8,7,6
C36	10	79,58,43	8,2,2	7,3,3	4,7,6
C18	12	88,59,43	<i>11,1,1</i>	<i>11,1,1</i>	10,2,2
Physionet MIT-BIT Arrhythmia Database Challenge 2011 Pilot Set C (Duration is 10 s and Sampling Rate is 500 samples per sec)					
ecg_38	12	94,63,48	<i>12,22,0</i>	10,29,2	7,30,4
ecg_33	12	96,63,49	<i>12,23,0</i>	12,27,0	11,27,1
ecg_31	11	96,63,49	<i>11,26,0</i>	11,28,0	10,30,1
ecg_20	11	92,63,47	<i>11,21,0</i>	8,26,3	6,28,8
ecg_2	12	94,62,48	<i>12,33,0</i>	10,28,2	7,23,5

(continued)

Table 1. (continued)

Rec. No.	Total beats	R wave locations detected (correct, wrong, missed)			
ecg_14	13	88,59,44	10,4,3	7,7,6	4,10,9
ecg_1	4	92,63,47	4,29,0	3,31,1	2,32,2
ecg_10	28	91,63,47	27,1,1	19,11,9	16,14,12
ecg_36	12	94,62,48	12,26,0	11,27,1	10,29,2
ecg_3	33	96,64,48	33,2,0	25,11,8	20,14,13
ecg_28	9	75,50,41	8,0,1	6,2,3	5,4,4
Personal Library of Digitized ECGs					
ecg6	11	79,57,44	10,11,1	8,3,3	7,4,4
ecg8	14	90,50,45	13,1,1	10,5,4	8,7,6
ecg13	12	87,57,44	12,1,0	7,6,5	5,8,7
ecg14	13	94,63,47	13,14,0	8,20,5	5,23,8
ecg25	13	88,58,47	13,1,0	8,6,5	6,9,7
ecg33	16	92,62,45	15,12,1	10,22,6	9,22,7
31	13	82,55,44	13,1,1	11,3,3	9,6,5
2	10	93,92,47	10,7,0	10,2,0	8,13,2
32	23	91,61,48	22,1,1	22,2,1	22,2,1
37	29	96,62,49	29,1,0	29,1,0	29,1,0
38	9	75,51,42	8,0,1	6,2,3	5,4,4

**Fig. 5.** ECG signal with peaks found.

4 Conclusion Remarks

The proposed method processes ECG signals in which the T wave height is lower in amplitude than the R wave (whether R wave is positive or negative) as discussed in Sect. 2, however in certain pathological cases the T waves are higher in amplitude than the R waves, the algorithm must be developed further to deal with such cases as well. The method is applied to the ECG signals in three trials at the stage of time domain processing as discussed. In most of the cases at least one trial achieves the detection of all R waves successfully. In future we shall develop a method in which the heart rate is estimated more accurately either in time or frequency domain. Also a mechanism that enables the artificial intelligence to choose the right trial among the three trials that represents the correct size of the window must be developed. One of the suggested methods for the automatic selection of the best window length among the three trials is the standard deviation analysis on basis of beat to beat time duration differences and peak to peak amplitude verification. Further, the false R waves (additional non true

waves detected) should be managed by the algorithm so that they are dropped from the final R wave locations vector in order to detect the correct heart rate and exact R wave locations.

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Early Stage Squamous Cell Lung Cancer Detection

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Abstract. Smoking and consuming alcohol leads to dangerous disease Squamous cell Lung Cancer (SqCLC). It is widespread all over the world today. The mortality rate of this cancer is on the higher side as it is diagnosed in stage III or IV. Small nodules are formed in the lungs in the starting stage, and gradually spreads in and around lung regions by a process of metastasis. Only few symptoms are seen in early stages of Cancer. Diagnosing Lung Cancer in the early stage is essential. The paper attempts to diagnose Lung Cancer in early stages by processing the Chest Computed Tomography (CT) image and segment the small lung nodules. The method uses the median filter to filter the noise and Watershed transform in combination with Morphology-based region of interest segmentation to fragment the nodules. Various metrics of the nodules in the image are calculated and the stage of Lung Cancer is determined.

Keywords: Lung cancer · Lung nodule · Watershed segmentation

1 Introduction

Cancer has become a common and life-threatening disease nowadays. Among various cancers, Lung cancer has more prevalence. Lung cancer is divided into non-small cell lung cancer and small cell lung cancer. Non-small cell lung cancer is categorized as Adenocarcinoma, Large cell carcinoma and Squamous cell carcinoma of the lung or squamous cell lung cancer (SqCLC). The cancer cells and their arrangements look different under a microscope for each type of lung cancer. Non-small cell lung carcinoma is spread at an average of 85% and Small cell lung cancer is about 15%. SqCLC is a common type of lung cancer. Around 25–30% of people with lung cancer will have SqCLC. Major risk factors like smoking, exposure to radon, secondhand smoke, air pollution causes this type of lung cancer. If such factors are kept in control, the risk of getting cancer can be lowered.

In the early stage of cancer, no specific symptoms are observed. The long-lasting cough is always a prior symptom to be considered. Chest X-Ray Radiography is screened to observe lung disorders. If the subject is suspicious of cancer, Chest CT is preferred to analyse lung cancer. The stage of lung cancer is determined with the size

and position of the tumor and its widespread. Four significant stages and indications of Lung cancer are shown in Table 1.

Table 1. Stages of lung cancer

Stage	Description
I stage	Localized small nodules (around 3 mm) are formed in lung
II stage	Size of nodule increases (>3 mm)
III stage	Spreads into surrounding tissues and nearby lymph nodes inside the chest
IV stage	Spreads outside the chest or another part of the body (metastasized)

In the primary stage, small nodules (<3 mm size) are formed in either lung and proliferates in a few months. It is essential to detect such nodules in early stages of cancer and can expect a five-year survival rate closer to 53%. Usually, symptoms appear clearly when the disease is at an advanced stage (stage III or IV). Thus the mortality rate is very high because of the same fact that it is diagnosed in later stages. So, the paper attempts to automatically detect lung nodules to diagnose lung cancer in early stages.

Generally, Computed Tomography (CT) is performed to diagnose lung cancer, which shows additional information than plain radiography does. However, CT requires additional techniques for the interpretation and extraction of pathological information [1]. A number of Computer-Aided Diagnosis (CAD) systems were developed to help radiologists to characterize the spread of disease in and around lung regions. In CAD systems, separation of Lung regions from chest CT is the crucial step. This is carried out by a segmentation technique. There are a number of segmentation algorithms developed and tested on Chest CT images.

Mesanovic et al. [2] implemented a region growing algorithm to find the lung boundaries. In [3], Hedlund et al. developed a 3-D region growing technique to segment the lung regions. Sluimer et al. [4], implemented a thresholding method to segment the lungs from a CT image. In the papers [2] and [3], the seed point was manually selected. Many region growing methods have been developed in past years, including the Graph cut method [5], Fuzzy connectedness [6], Watershed transform [7], Flood fill technique [8]. The methods reported in [2–8], diagnose the tumor in the advanced stages where a subject has to undergo chemotherapy or radiation treatments.

2 Methodology

The proposed method has various steps like pre-processing of the input image, segmentation of the region of interest and description of a variety of features to analyse the image. The flow of the complete work is depicted in Fig. 1.

High-Resolution Computed Tomography (HRCT) chest image is used as a non-invasive tool for diagnosing and analysing Lung cancer in early stages. It is very useful than X-ray because of its excellent contrast resolution. In the present work, HRCT images are used, to enhance the efficiency and accuracy of detecting the early stage

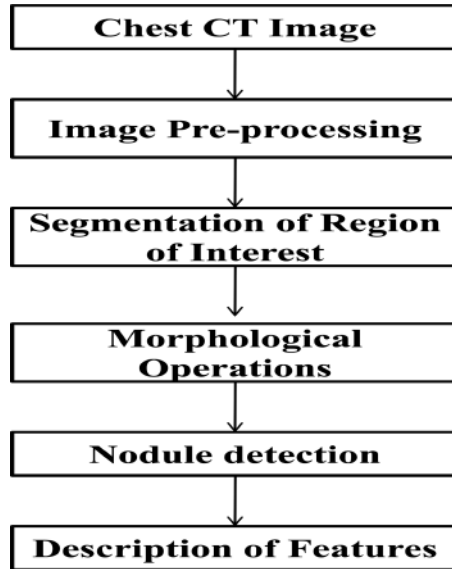


Fig. 1. Flowchart of nodule detection

Lung cancer. The HRCT dataset is a volume of DICOM images. The JPEG image format is produced and used for further analysis in MATLAB 2014a.

The primary task is to improve the quality of the image so that every pixel information pertaining to edges, borders, regions are considered for the processing. The image is converted into grayscale and filtering is carried out to remove the noise present in the image. Several filters were tested on different images and observed accuracy. The median filter is used in the work, as it is producing a better outcome. It works by moving through each image pixel and replacing each value with the median value of neighbouring pixels. This filter also restores the sharpness of the image.

3 Segmentation

Segmentation is the process of separating the valuable information from the complete image. There are a number of image segmentation techniques. They are mainly classified into Region based and Edge-based segmentation. Region-based segmentation groups similar adjacent pixels, whereas Edge-based methods detect discontinuities in the image and use them as an outline of each segment. In the paper, Watershed transform in combination with Morphology-based region of interest segmentation is used to highlight the lung nodules in chest CT images perfectly. Extracting the lung nodules and its metrics like size, area, correlation will assist us in diagnosing the lung cancer in early stage.

Watershed transform is a classic model of region-based segmentation method. It provides a simple framework for incorporating knowledge-based constraints. The basic idea here is to partition the image into different regions separated by boundary lines.

Dam is built to restrict the rising water of different catchment basin to merge on. Eventually, only the tops of the dams are visible above the water line. Dam boundaries correspond to the divide lines or watershed lines of the region or the watershed. Watershed technique main aim is to find the watershed lines. A set of markers are implemented to segment an image in region-based watershed segmentation.

After removing the noise, the image is converted into a binary image with a threshold with cut-off 128. This will map the image in the black and white image; pixel values greater than the threshold become white and below that become black. An Erosion operation is performed to eliminate white pixel. Watershed transform is performed on the image to extract lung regions. The nodules if present is highlighted in the process and using morphological operations the nodules are segmented out. The nodules shape and texture analysis are carried out to know the various metrics. The metrics considered here are area, perimeter, correlation, entropy, eccentricity, contrast, smoothness, skewness, variance, mean, standard deviation, homogeneity and energy. If a nodule is detected and has an area of more than set threshold, it is categorised to be Stage II cancer, and if the area is less than the threshold than it is Stage I cancer.

4 Experimental Results and Discussion

First, Two sets of the Lung Image Database Consortium - Image Database Resource Initiative (LIDC-IDRA) database [9], which is open access dataset is used to analyse the algorithm. Two different images of the database are acquired. Image 1 has a solid nodule on the right lung. The image is filtered and watershed transform is performed on it. After morphological operations, the nodule is segmented and its metrics are calculated.

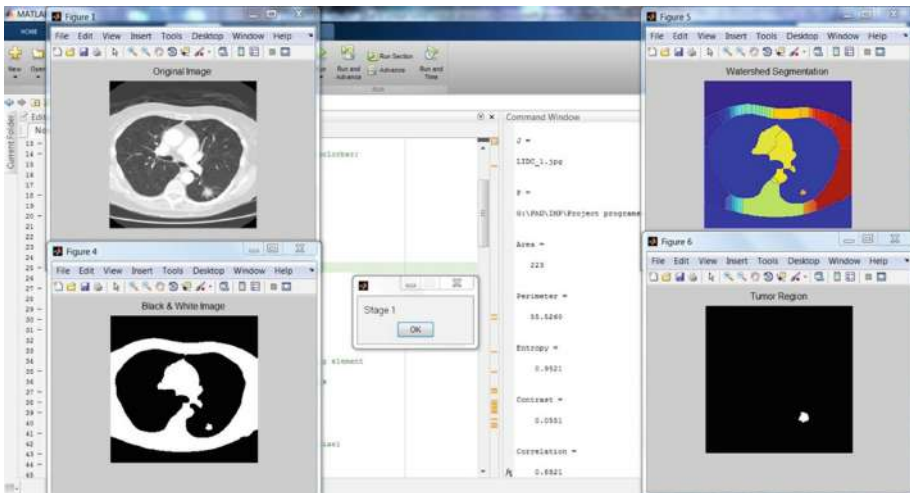


Fig. 2. The result of the technique on LIDC image 1

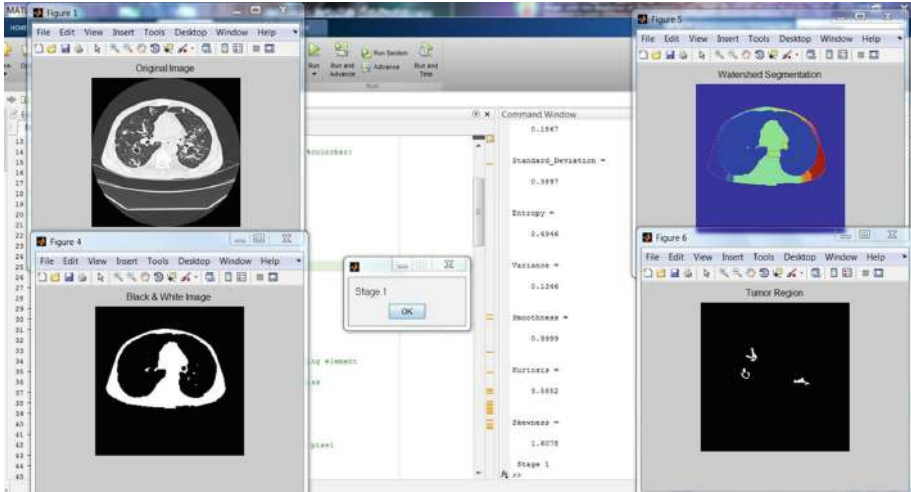


Fig. 3. The result of the technique on LIDC image 2

In both the images, the tumor is diagnosed to be stage 1 based on the parameters derived. The results of the technique on LIDC database images 1 and 2 are illustrated in Figs. 2 and 3 respectively.

The algorithm is performed on the images acquired from the Hospital. Four image datasets were acquired on a Seimens CT machine from a private hospital in DICOM format. They were converted into an image format (.jpeg) and processed to analyse the stage of lung cancer. The original image, Binary image, watershed transform output image and the nodule position and texture are shown in Table 2. for all the acquired input images.

CT Image 1 and 2 have a nodule in the left lung with a size of greater than 3 mm and area above the set threshold of 300 and are classified as stage II lung cancer. It was verified with the Radiologist view and resulted in the same. CT Image 3 has a small nodule of size less than 3 mm and area less than the threshold. It is classified as Stage I. CT Image 4 has no lung nodule, and it is a Non-cancerous lung image. The metrics area, perimeter, correlation, entropy, eccentricity, contrast, smoothness, skewness, variance, mean, standard deviation, homogeneity and energy are calculated for each image of LIDC database and CT images. Of which Area, correlation, entropy, mean, standard deviation are tabulated in Table 3. The area is correlated with the size of the nodule, and a threshold is set to determine the stage of lung cancer. The correlation, Homogeneity and Entropy of the output are calculated to check the variation in the images.

Table 2. The result of the technique on different CT images

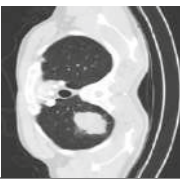




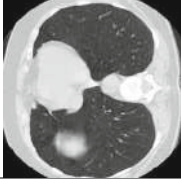






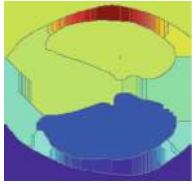


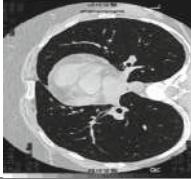

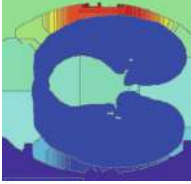


Image	Original input image	Binary image	Watershed output	Lung nodule	Stage
CT image 1					
CT image 2					
CT image 3					
CT image 4					

Table 3. Metrics of all the input images and stage of cancer

Input image/metrics	LIDC image 1	LIDC image 2	CT image 1	CT image 2	CT image 3	CT image 4
Area	223	93	1218	1235	213	No nodule found
Correlation	0.8821	0.8246	0.8878	0.8921	0.8746	
Entropy	0.9521	0.6946	0.9887	0.9891	0.9987	
Homogeneity	0.9725	0.9733	0.9724	0.9734	0.9687	
Mean	0.3719	0.1867	0.4374	0.4387	0.4789	
Standard deviation	0.4833	0.3897	0.4961	0.4962	0.4996	
Stage	1	1	2	2	1	Non-cancerous

5 Conclusion

The proposed paper consists of pre-processing, segmentation by watershed transform and detecting nodules in the lung CT image. The performance was tested with few images of LIDC database and images acquired from the Hospital. The results were compared with the database information and Radiologist and were convincing. Further, the nodule metrics were determined. The stage of lung cancer is diagnosed. This work can further be extended to 3-D images. Thus, lung cancer diagnosed in early stages can decrease the mortality rate.

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Conditions of Deadlock Detection in Multithreaded Applications Using Inheritable Systems

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Abstract. Normally deadlock is the common situation of multithreaded applications; it causes longer memory access time, page table memory utilization, and internal fragmentation. Due to these reasons, it takes more memory spaces, more access time, redundancy of process and etc., Most of the papers resolved the deadlocks using Cyclic Graphs, NP Complete, Banking Algorithms, Resource Allocation Method and several type of algorithms are implemented. We implemented with new approach of Fitness Program and Hereditary Programming concepts resolve the deadlock detection in multithreaded applications. This paper attempted to create a suitable and substantial simultaneity control program by utilizing Hereditary Programming (HP). In HP, a program is spoken to with a tree, by utilizing shared control factors; a proper program could be created. In any case invalid simultaneity control program has been generated. This paper enhances the simultaneity control program age framework all together that the program created can identify deadlock and can execute any system. We used Gridlock detection and evaluation of program authenticity for deadlock detects ions. It is tentatively demonstrated that a fitting simultaneity control program can effectively be produced by utilizing the proposed technique.

Keywords: Simultaneity control · Deadlock detection (Multithreading) · Resource allocation (resource) · (Genetic) · Hereditary programming (Object) · Credibility

1 Introduction

Data and system advancements have quickly and broadly spread. Database has been utilized as a part of different application areas. Database administration frameworks are utilized as a part of these areas. It has a tendency to be troublesome that a solid database administration framework fits all of database request territories. The catalog administration framework that might be adjusted to every database request region will be essential [1–3].

This document concentrates on the simultaneity control instrument, which is an imperative part of the database administration framework since it ensures the unwavering quality and impacts the execution of database handling [4]. An arrangement of catalog operation might be dealt with as component in the database administration framework. This unit is known as an exchange. Highlight of exchange contrast as per the database application regions. Cases of the highlights are the quantity of operation, the proportion of composes operation to peruse ones, the quantity of tables controlled, and the day and age of the primary operation to the last one. These elements impact the simultaneous implementation of database operation. At the point when all of operation is perused ones, all of operations could simultaneously be executed. At the point when all operation are the compose ones refreshing the estimations of similar information thing of a similar table, the majority of the operations should successively be executed. To facilitate is, no operation could simultaneously be executed. The simultaneity control system manages simultaneous execution of the operations. The simultaneity control instrument suited to a database application territory might be not quite the same as that appropriate to another one. The database administration scheme, still support just a single simultaneity control component regardless of sorts of database application areas. Above the level of simultaneity control, which might not be required for a particular database request, must be paid. This may corrupt the execution of database dispensation. The simultaneity control instrument redid suited to every database request is favored.

It has been that an age strategy for simultaneity control plan suitable to a particular database request by utilizing Hereditary Programming (HP) [5, 6]. The simultaneity control program created can be utilized as a motor of database administration system. The work and the terminals of program which is spoken to with tree, and the wellness measure work utilized as a part of HP have been planned. The work and the terminals incorporate those for the administration of simultaneous implementation of database operations. This administration is caught as methodology utilizing the factors appended to information things and exchanges. The examinations of the program ages demonstrated that the prevalent locking calculation could be produced below the simultaneous condition, while the calculation superior to anything the well known locking calculation could be created under the not really simultaneous condition additionally; the age technique has been stretched out to help semantic simultaneity control [6]. It has likewise tentatively been demonstrated that decreasing capacities and terminals is viable in creating suitable simultaneity control programs in HP [7]. This lessening is acknowledged by constraining the utilization of factors to one of two sorts of factors. Despite the fact that diminishing capacities and terminals has been appeared to be viable, all of simultaneity control projects couldn't be made due to constraints of utilization of variables. So the variable was reached out for producing any simultaneity control program [8–10].

2 Preparation

2.1 Hereditary Programming

In HP PCs programs are spoken to by way of established, named structure trees, which are called program trees in this paper. Hubs of trees are capacities or terminals.

Terminals are assessed specifically, whereas capacities are assessed after the assessment of kids' nodes. Functions and terminals are called images in this document. A case of an agenda is appeared in Fig. 1. The leaf hubs of the program tree are terminals. Alternate hubs are capacities.

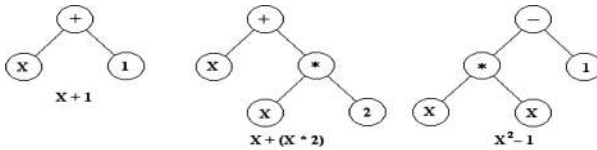


Fig. 1. An example of HP

The root node, which is the purpose of Symbol +, evaluates the adding the variables and values, it specified at the first argument, which is the left sub-tree The left sub-tree indicates the condition whether the variables X is add with right-sub tree than the value is 1. Another Diagram represent the root node as Symbol is +, It has two child nodes, one is left-node and right node. Left node contain the variable as X and right node contain the value of Symbol is *. Now this right node can act as Root node of another two child node, i.e. the value of left node is X and value of right node is 2. This first evaluates two child nodes and do the multiply this two nodes and then evaluates with the root node i.e. symbol of +. Finally we get the evaluation of $x + (x * 2)$.

2.2 Simultaneity Control

Exchange preparing frameworks more often than not enable numerous exchanges to run concomitantly [4]. Here an exchange is an accumulation of operations that frame a solitary sensible unit of work. Enabling various exchanges to refresh information simultaneity causes a few inconveniences with consistency of the information. Guaranteeing consistency notwithstanding simultaneous execution of exchanges requires additional work. This work is called concurrence control. As the serial execution of trade never neglects uniformity, it is the model of trust the uniformity. The logbook which is obtained by putting the tasks of trades one by one is known as a serial timetable. At the point when the impact of a plan is the similar to of serial timetable uniformity by reserved. Such a calendar is known as a serializable timetable.

3 Simultaneity Control

3.1 Outline

A simultaneousness control program controls exchanges to be simultaneously executed with guaranteeing the consistency of information. The simultaneousness control program suited to an application program is attempted to be produced by utilizing HP [5, 6]. The means of this framework are as per the following:

Each Computing Machine having processor for executing the task. Each Task having n number of procedure, it can be delivered number of threads. Above diagram represent the symbol of concurrency control. Each Processor may communicate with the procedure 1 and Procedure 2 and these procedure's may communicate with Thread's. We have to run this thread smooth manner i.e. without deadlock. In this thread can have shared memory.

Step 1: To Initiate the random population generation.

Step 2: After that populations are generated, it can be evaluate the fitness of population.

Step 3: Select the criteria.

Step 4: If criteria are not suited and will make Diversification.

Step 5: Compare with Existing fitness and Also Generate the new population.

Step 6: If conditions are satisfied goto the output.

Step 7: If conditions are not satisfied or terminated, repeat the process step 2

3.2 Simultaneity Control Program Generation System

1. Parameters for particulars of exchanges and hereditary operations are indicated.
2. Transaction is conjured.
3. A timetable is acquired by requesting the operations issued from the exchanges requesting to their request of the ages time of the operations.
4. Concurrency control programs created amend a timetable.
5. Fitness of the simultaneity control program is gotten by assessing the amended timetable.
6. Concurrency control programs are chosen frame the present ones in view of the wellness.
7. Hereditary operations are connected to the simultaneity control program chose in step (6) to produce the following age's programs.
8. If the quantity of ages done not achieve utmost at that point rehash from step (4).
9. Generally the age's framework ends and their best simultaneity control program is gotten.

3.3 Program Produced

The stream outline of a case of the program produced is appeared in Fig. 2. This program first checks the presence of a common control variable. On the off chance that it exists, at that point nothing is finished. Else, it proclaims a common control factors with the esteem 1. This are finished by the capacity hub named "Increment_ Sh_val." This hub announces a mutual control factors on the off chance that it doesn't exists. Next, it gets the estimation of the common control factors whose ID is equivalent to zero, and assesses whether the esteem is short of what one. Provided that this is true, the estimation of the mutual control variable is set to the estimation of the identifier of the information thing. Generally, an exchange falls into the holding up state.

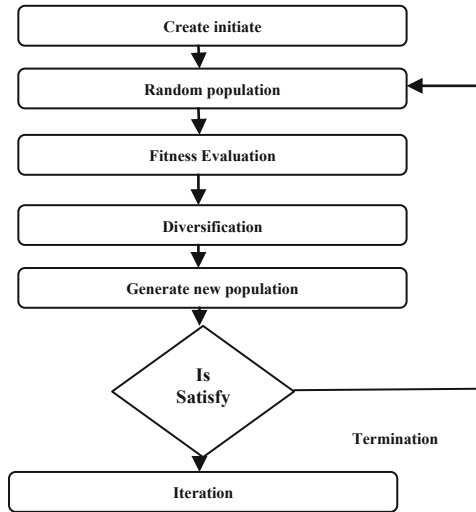


Fig. 2. Simultaneity control

3.4 Fitness Estimation Capacity

Wellness is ascertained by utilizing the accompanying six factors: serializability, the level of simultaneity, the reaction occasion of an exchange, the prematurely end proportion of exchange, the extent of program, and the level of contention correspondence. The re-masterminded plans must be serializable for guaranteeing consistency regardless of simultaneous execution of transaction. This is imperative for simultaneity control. At the point when the serializability isn't affirmed, the assessment esteem is set to zero. The littler the program is, the improved it is the point at which the program is the same. The extent of program is presented for this measure. The additional four elements be the mainstream compute of scaling the decency of the simultaneous implementation of transaction. Entertain allude to the past effort [5, 6] for additional data (Fig. 3).

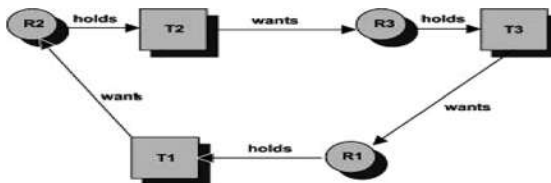


Fig. 3. Gridlock detection

4 Proposed Method

4.1 Requirements

The requirements are as follows:

1. Deadlock can be detected properly.
2. It is prevented that an invalid program is generated.

For communicating the exchange's hold up state by utilizing shared control variables, we utilize the unique shared control variables. It is characterized between an exchange and the information thing which the exchange holds up for. This shared control variable's id is set to Pause. It communicates the exchange's hold up state. By utilizing the exceptional shared control variables, deadlock discovery can work legitimately.

4.2 Grid Lock Detection

Gridlock can be recognized via looking through a coordinated diagram which called sit tight for graph [11]. By the uncommon shared control variables, we can know the exchange's sit tight for state, and can make the holdup - for chart. A sit tight for chart comprises of hubs and coordinated edges. Data things and exchanges are dealt with as nodes. Shared control factors are dealt with as edges from information things to transactions, while uncommon shared control factors are dealt with as edges from exchanges to information things. Looking through the circle in a sit tight for diagram can recognize the halt [11]. If a circle is found in a coordinated graph, deadlock appears. The seek calculation is profundity first search. This paper has demonstrated the practicality of the coordinated diagram in our framework.

4.3 Evaluation of Program's Legitimacy

So as to anticipate invalid projects generated, we present the component checking whether a created program can execute the timetable that we need to execute, and we mirror the program's legitimacy to person's fitness. Concurrency control programs control common schedules. If it can't control the calendar properly, its wellness is set to the most reduced value (1.0). The vital thing of this strategy is the thing that sorts of timetables are utilized as commonplace schedules, and what is the substantial outcome.

Program prematurely ending the exchange is invalid. Therefore, such a calendar is embraced as a normal schedule, and such program's wellness is set to the least esteem.

Program's validity is added as one of the factors of fitness. This is defined as

1 if program is valid

$N_i = 0$ (otherwise)

Table 1. Parameter Setting

Para.	Description	Setting 1	Setting 2
P1	No. of transactions	10	25
P2	Total No. of Data	6	6
P3	Write Data	0.5	1.0
P4	Max No of Write Operations	10	20

Table 2. Wellness Estimation-1

Program	Average	Max	SD
HP	6.0	8.0	0.8
2PL	4.6	4.0	0.1
TSO	4.0	5.6	0.1

Table 3. Wellness Estimation-2

Program	Average	Max	SD
HP	8.0	10.0	0.8
2PL	6.6	7.0	1.0
TSO	6.8	7.2	0.1

5 Experiment

5.1 Purpose

To confirm that simultaneity control projects can be produced by utilizing the proposed strategy, it is endeavored to create simultaneity control programs.

5.2 Procedure

Two arrangements of parameter settings on exchange are used. Values of them are appeared in Table 1. In each setting, conflict has a tendency to happen. In setting 2, a bigger number of contentions happen than in setting. The wellness estimation of the created program is contrasted and those of 2PL and TSO. Program’s legitimacy is likewise assessed.

5.3 Exploratory Outcome

As the aftereffect of the test, program was created. Figure 4 demonstrates wellness change of the most elevated individual at setting 1. The wellness focalizes around the 400th ages on the progress chart. Table 3 demonstrates the normal wellness esteem, the most elevated one, and the standard deviation of wellness of the program produced at setting 1. The normal wellness and the most astounding one are higher than those of the 2LP and the TSO programs. Figure 5 demonstrates wellness change of the most elevated individual at setting 2. The produced tree at setting 1 comprises of 56 hubs, sixteen of them are capacities and twelve of them are halt distinguishing hub. The created tree at setting 2 comprises of 76 hubs. Thirty three of them are capacities and nine of them are stop recognizing hub. In the past work [8], the program legitimacy was not assessed. By mirroring the program legitimacy to wellness, the importance of wellness has changed. Consequently, we can’t contrast the after effects of examination and the past ones.



Fig. 4. Fitness evaluation - setting 1



Fig. 5. Fitness evaluation - setting 2

6 Conclusion

This paper enhanced the simultaneity control program age framework with a specific end goal to create simultaneity control programs that can legitimately recognize halt and can execute any calendar. For distinguishing halt, a unique shared control variable was presented. For creating appropriate projects the instrument checking the legitimacy of the program produced was presented. It was tentatively demonstrated that a fitting simultaneity control program can effectively be produced by utilizing the proposed strategy. This paper predominantly centered on the legitimacy of simultaneity control programs. Come to an end of the test is may be simultaneity control program can be produced. More nonexclusive stop location utilizing shared control factors and mirroring system's execution cost to the wellness estimation work are incorporated into future work. Analyses with more reasonable parameter esteems are additionally in future work.

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Detection of Inappropriate Anonymous Comments Using NLP and Sentiment Analysis

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Abstract. The world became interactive and socially active now-a-days because of the increase in different types of content sharing applications. These content sharing applications are social media platforms which provide various features so that users can effectively interact and share their thoughts and ideology. One such platform is a discussion forum which promises the anonymous posting of user's views and complaints. The spammers target the forums as the craze of the forums increase. Though these platforms act as medium of knowledge sharing, all of the users don't use these platforms for a positive cause. They are also being used to abuse or bully targeted people taking advantage of their anonymous feature. Spamming and cyber bullying has grown rapidly to a limit that social media is being termed harmful. By reading spam and vulgar comments, readers will be diverted. Main aim is to detect these bad comments which are vulgar, inappropriate or not related to the specific context. The research is not based on the static contents but it live streams the comments and the entire research is being done. The research is based on NLP, Sentiment calculation and topic detection.

Keywords: PPM algorithm · TEM algorithm · SAM algorithm · Latent Dirichlet Allocation (LDA) · Natural Language Processing (NLP) · Machine learning · Topic extraction

1 Introduction

The social media platforms allow us to interact and share our ideas. These comments are allowed to be posted anonymously to get more genuine views. Though we have the access of reading the comments and coming to a decision but they may be spam and they cause bad impact on the reader's brain. YouTube has a feature of deleting the comments based on the number of dislikes. By this action we can understand the real motive is that to not entertain any spam comments. In our research in this paper our approach is to deal not only with the spam comments but also to look after the bad, vulgar and irrelevant comments which manipulate the readers mind and are out of topic which are of no use. We built a mechanism to identify the spam comments and apply the natural processing techniques and machine learning algorithms.

1.1 Existing System

In the existing system we can see people commenting randomly and we face a number of cases where the comments are Topic irrelevant, Either offensive or vulgar, Spam comments etc. We can generally observe that the forum pages wont make an effort to remove the spam until someone reports them to be vulgar. But by the time people will be seeing the comments and it is waste of time to remove them after getting reports.

1.2 Related Work

The initial research in this area was with the recognition of the email spam by Sahami et al. [1]. He used probabilistic learning methods to produce filters which are useful in this task. Domain specific features are considered for detecting spam. Carreras et al. [2] proved that AdaBoost is more effective than Naïve Bayes and decision trees. As increased growth in World Wide Web, the need for spam detection also has grown simultaneously. So they started to detect spam comments by analytics, the decision trees algorithm was used in [3] by Davison to identify link based web-spam. Drost et al. [4] used SVM to classify web spam with content based features. Their method is based on the link spam detection and the solution is based on training data by revealing the effectiveness of classes of intrinsic and relational attributes.

In [5] Mishne et al. used machine learning techniques the detection of spam comments. Comments in the posts are checked with the comments of linked pages. In [6] Bhattari et al. used the data corpus from the same set to detect spam comments. In [7] the authors made study on the comments and commenting behavior of the videos that have more than 6M views and comparison in sentiment analysis is made on finding the influence of the comments by other people's comments. In [8] Ruihai Dong et al. worked on topic detection using nlp.

2 Proposed Method

2.1 System Architecture

In our research we have dealt with detecting the spam comments based on NLP and Machine learning. The first is detecting the profanity of the comment then it goes for preprocessing where we tokenize, lemmatize, stemmetize and it continues with other preprocessing finally we reach to use TEM, SAM algorithms. The results are found out using sentiment analysis and then displaying the sentiment of the comments using word cloud and barplot.

The dataset we used for this research is live streaming posts of a forum which are obtained by web scraping the forum content. The dataset is dynamic and gets updated as the posts are added.

Our approach consists of four modules. The first module is about finding the vulgarity. The preprocessing is done in the second module. The third module comes with the algorithms where we find out the topic similarity and topic detection by forming dictionary and corpus formation. Finally comes our sentiment analysis. The results are

visualized using wordcloud. Wordcloud allows us to visualize the most frequently talked issues whose representation or the weight of the word is more (Fig. 1).

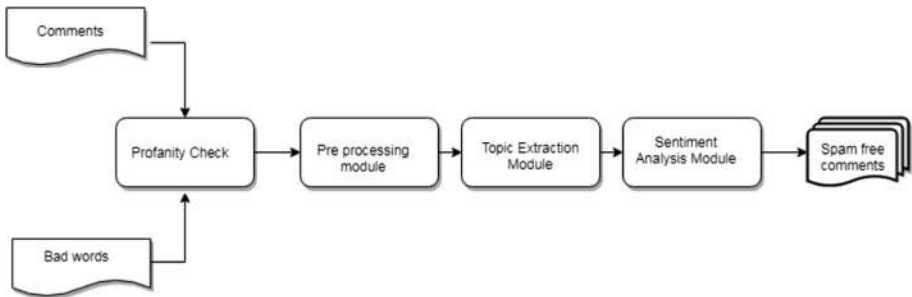


Fig. 1. Proposed architecture

2.2 System Components

- A. Profanity Check Module
- B. Preprocessing Module
- C. Topic Extraction Module
- D. Sentiment Analysis Module

The first step we deal here is about profanity check of the comments which can be done in different ways. Profanity is the module we used where we can check our comments based on the list of bad words. If the word consisting profanity is found out then we have to stop further preprocessing and as this comment is not for any use in the forum we try not displaying them.

This research then deals with the preprocessing. The comments are split and tokens are formed. Then we see for lemmatization and stemmatization. Then there comes our POS tagging which is a crucial step in the preprocessing as we need the parts of speech of words for topic extraction. After POS tagging we arrive at a stage of topic detection and topic similarity detection.

So the third module deals with topic extraction using TEM algorithm which depends on the values which are normalized. We understand by topic the main theme which is discussed in the comment and it is given by a set of unigrams and bigrams with a predominant number of occurrences in the comment. Here we applied Latent dirichlet algorithm to find out the topic similarity in the TEM module. Based on the results of the LDA we can find out the topic which the comments are based on.

Next modules deal with sentiment analysis using SAM algorithm we get the results displaying the positivity and negativity of comments.

Profanity Check Module: As growth in number of web users the presence of inappropriate content from users becomes more problematic. Social networking sites, forums, and any online community must take care of the content which is not accepted by the society norms. If this task is not being done the its like posting such content is acceptable.

The research on previous works shows that the current systems are not up to the mark. The general practice is they use a static list each time they check for profanity. This don't work if the vulgarity is in form of misspelled words, different languages and other reasons. These drawbacks make the current systems to detect profanity, obsolete some even depend on outsiders so that they are assigned with the detection of spam comments for the posts. This is suitable and doable up to a particular stage but when the task becomes huge this is not applicable. So all the comments are profanity checked based on vulgarity, abusive words and irrelevant topic discussion.

List Based Approach: This is the most standard approach where That is, in order to determine if a comment contains profanity in a particular forum, these systems simply examine each word in the document. If a match occurs the it is profane. Basically we introduced a system where as soon as the comment is introduced in the forum the comment is being checked for the profanity and the profanity module runs in the background and if it is found to be profane we stop further pre-processing. The profanity module is from Google where they update the list on periodic basis and we make sure that the list is updated in our profanity module which takes care of all the spellings, partially censored and other issues taken care of.

Pre-Processing Module: Preprocessing is an important stage in natural language processing because the words, tokens and other sentences identified in this stage are used for further preprocessing to find ngrams and applying algorithms.

Stop Word Removal: Many words in a sentence are used as joining words but they themselves do not make any sense unless combined and framed grammatically to form a sentence. So we can say that their presence do not contribute to the content or context of the document. Removal of these stop words is necessary because of their high frequency causes obstacles in understanding the actual content of document.

Tokenization: Tokenization is the process where the sentence or a word is broken into tokens. The main aim behind tokenization is to explore the meaning of the tokens formed and how they are preprocessed further to make meaningful outcomes after performing nlp. Though it is readable it still is left out with many punctuation words and expressions which are of no use for us and should be removed. Tokenizing is based on the delimiter which further depends on the language as different languages have different delimiters. Space is a delimiter in English.

Stemmatization: The word is the token is reduced to its root word. The root form is not necessarily a word by itself, it can be formed even by concatenating the right suffix. Stemming is a type of normalization. The sequence is returned with its root word.

Lemmatization: The lemma of the word is found. So we can see that the suffixes are removed in lemmatization. The word which is returned is called lemma. These two terms are not same, Stemming is just finding the root word but most times it's not preferable but lemming is a technique where morphological analysis of the words (Figs. 2 and 3).

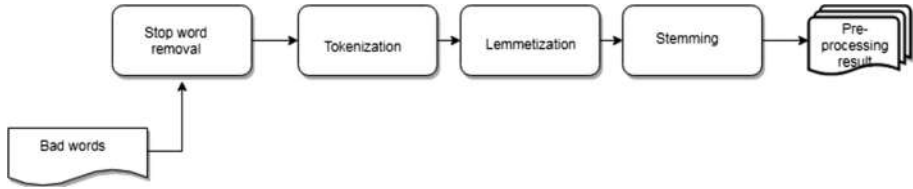


Fig. 2. Flow of pre-processing module

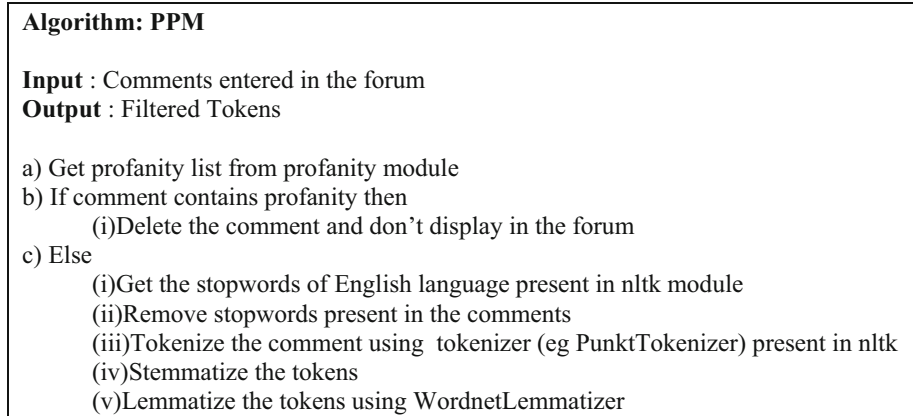


Fig. 3. Pseudo code pre-processing module

Topic Extraction Module: The tokenized comments now need to be preprocessed in such a way that we can extract the topic of discussion and categorize the comments based on the topic being extracted.

POS Tagging: In this processed tokens are assigned to their respective pos tags. The words are classified based on their part of speech, tense, number, case etc. Basic tagsets are like N for noun, A for adjective etc. Similarly we will have a list of tagsets but each one of them is not useful for topic extraction because as we know that mostly to obtain the topic being discussed in a given sentence or paragraph or document will rely on the nouns being discussed. Not only the nouns but we are also deciding it based on the adjectives and verbs being discussed as they describe the nouns and the situation which is being talked in a sentence.

Unigrams and Bigrams: Based on our pos tagged words, grouping of the words based on their part of speech can be done and then we can extract the topic being discussed. N-grams are sequence of items in a sequence can take values 1, 2 etc. but not a large value for N. Here generation of bigrams is taking place. Bi grams are formed by considering adjacent tokens and grouping them together. Before forming them to bi grams they are in uni grams stage and then we form the bi grams. Unigrams and bigrams are generated as they are essential to proceed towards LDA.

Topic Extraction: As we have our bi grams there is a need to apply an algorithm to extract topic. LDA is a topic extraction model which is vastly used for this purpose. Here we used LDA (Latent Dirichlet Allocation) to extract the topic. The input to this algorithm needs to be in form of dictionary and corpus. This model is used to identify the topic of the document by classifying text which is present in a document.

First we try to analyze the frequency of terms by a document term matrix. After this has been done we generate a LDA model upon the document. When we apply it, each token is identified by a unique id, which is transformed to a bag of words called corpus then the LDA is applied. Using the frequency of the words topic is extracted. Depending on the extracted topic our forum main discussion will be obtained daily basis and weekly basis (Figs. 4 and 5).

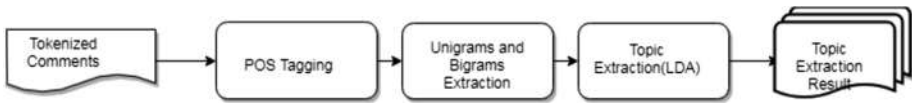


Fig. 4. Flow of topic extraction module

Algorithm: TEM

Input: Filtered Tokens

Output: Topic of the comment

- a) POS Tagging using nltk module
- b) Find the candidate nouns (i.e. tokens which are singular nouns (NN), plural nouns (NNS), singular proper nouns (NNP), plural proper nouns (NNPS))
- c) Generate Bi-grams using nltk module
- d) Dictionary formation using gensim module
- e) Corpus formation using gensim module
- f) Apply LDA algorithm using gensim module
- g) If topic of the comment is not relevant to the topic of the forum then
 - (i) Delete the comment and don't display in the forum
- h) Create a wordcloud of most discussed topics using wordcloud module

Fig. 5. Pseudocode topic extraction module

Sentiment Analysis Module: Sentiment analysis shows the sentiment of the people based on the topic being discussed and how the people's opinions are. This is a classification where the inserted phrase is decided based on the negative, positive and neutral sentiment.

In our research we used sentiwordnet. SENTI WORDNET is a document containing all the synsets of WORDNET along with their "positivity", "negativity", and "neutrality". Each synset has three scores Positive score, Negative score, and Objective score. These scores may range from 0.0 and go up to 1.0, the sum of all the three scores being 1.0. Each score for a synset term has a non-zero value.

So on the result obtained which shows the sentiment of the phrase describes how the opinion of the people is and also the opinion on the topic being discussed which helps a lot in case of our forum where students will be discussing all their issues which paves a way for the management and the teachers to look after the issues which are needed to be taken care and how they need to be handled are also discussed as we provided their suggestions section also so they can reach the staff and be resolved. This system helps not only the faculty and institution but also the students who want their issues to be solved (Fig. 6).

```

Algorithm: SAM

Input: Filtered tokens from preprocessing module, SentiWordnet module which
contains synset terms along with their positive and negative sentiment scores

a) For each token in the filtered token list:
    (i) If token= 'not':
        positivescore= 0
        negativescore= thresholdvalue
    (ii) Else:
        positivescore= positive score of synset term in sentiwordnet
        negativescore= negative score of synset term from sentiwordnet
b) Create a plot visualizing the positive and negative sentiments using matplotlib
module
    
```

Fig. 6. Pseudocode of sentiment analysis module

3 Results

The results are shown in the form of plots like word clouds and barplots.

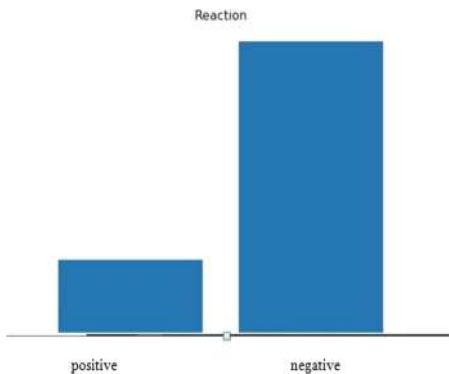


Fig. 7. Barplot visualizing the sentiment

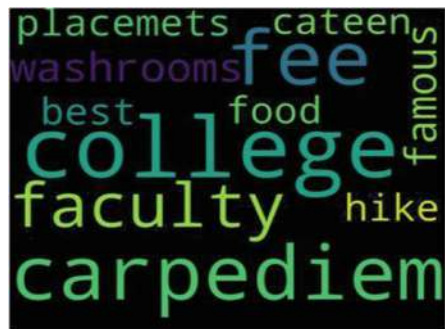


Fig. 8. Wordcloud depicting the most discussed topics

Figure 7 depicts a barplot representing the positivity and negativity of opinions people have towards the topic. Figure 8 is a wordcloud depicting the topics discussed on the forum. Frequently discussed topics are depicted in larger size which enables us to know about the most discussed topic. These results are visualized using the result of SAM algorithm for barplot and TEP algorithm for wordcloud on our dataset. Data set is obtained by scraping our website which consists of posts and comments made by users.

4 Conclusion

Our research has overcome the problem with spam comments and all the disadvantages which were in the existing system. In the proposed system the spam comments will be detected based on finding out its features and also the problem where topic irrelevant comments which lead to misconception are also dealt with. Future enhancements can be made to this research as we are streaming the comments not just taking the static content which provides a great scope not only to remove the spam comments but to make this evaluation of topic to be applicable in other areas of interest.

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Mahaviracharya Encryption Algorithm (MEA) with Modified Counter Mode and Comparing with AES Algorithm

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Abstract. Now a day's usage of internet is being increased day by day, as well as users also being increased. Online education, ecommerce and online banking are being increased in developing countries. Network security is playing a vital role to provide the security to the data in the internet. Even though there are number of algorithms, developing new algorithms for internet security is very important, because attacks are increased and processing speed is also increased. In this paper, we are discussing a new symmetric encryption algorithm with modified counter mode and comparing with Advanced Encryption Standard (AES) algorithm with ECB mode. For this comparison we are taking encryption time and decryption time as parameters with varies data sizes. The comparison results are summarized and highlighted the characteristics of the new algorithm.

Keywords: Mahaviracharya Encryption Algorithm · Rasilabdacheda misravibhaga sutram · Advanced Encryption Standard · Encryption · Decryption · Symmetric Encryption Algorithm · Mode of operation · Counter mode

1 Introduction

Cryptography algorithms are playing important role in network security area to provide encrypted data at sending side and decrypted data at receiving side. There are number of symmetric encryption algorithms and asymmetric encryption algorithms. Mahaviracharya algorithm is a symmetric encryption algorithm, which is using same key for encryption at sender area and decryption at receiver area.

Mahaviracharya was a 9th century Mathematician from Bharat (India). He was the author of *Ganitha Saara Sangraha*, a book on algebra and geometry. In this book, he discussed a rule. i.e. “*Rasilabdacheda misravibhaga sutram*”, for separating the unknown dividend number, quotient and divisor from their combined sum [1].

Rasilabdacheda misravibhaga sutram is any suitable optionally chosen number subtracted from the given combined sum happens to be the divisor. On dividing, by this divisor as increased by one, the remainder (left after subtracting the optionally chosen number from the given combined sum), the required quotient is arrived at. The very same remainder (above mentioned), as diminished by (this) quotient becomes the required dividend number [1].

A new symmetric encryption algorithm was designed based on *Rasilabdacheda misravibhaga sutram* named as Mahaviracharya Encryption Algorithm (MEA). As per this algorithm, the divisor (a) is taken as plain text, the quotient is taken as secret key (c) and combined sum (x) is taken as cipher text. When we decrypting the cipher text x , to get plain text a i.e. divisor in the above rule, we have to choose a number (k). But, for different k values, we will get different a, b, c values. So, to get correct a value here, we have to choose a suitable k value. Below, in decryption algorithm, a formula has been given how to find the suitable k value [2].

1.1 Encryption Method

$$\begin{aligned} b &= a * c \\ x &= a + b + c \\ x &\text{ is the cipher text.} \end{aligned}$$

1.2 Decryption Method

$$\begin{aligned} k &= \frac{c(x+1)}{c+1} \\ a &= x - k \\ a &\text{ is the plain text.} \end{aligned}$$

We can modify above decryption algorithm. The new Decryption algorithm is:

$$a = \frac{x - c}{c + 1}$$

2 Background

The National Institute of Standards and Technology (NIST) suggested five block cipher modes of operation; those are the Output Feed Back (OFB), Electronic Code Book (ECB), Cipher Feed Back (CFB), Cipher Block Chaining (CBC), and the Counter (CTR) modes [3]. In principle, a mode of operation is a procedure to improving the outcome of an encryption, decryption algorithms. This division describes these five modes of operation thoroughly.

2.1 Electronic Code Book (ECB) Mode

The electronic code book mode (ECB) is the simplest operation mode. In ECB mode original message is processed individual block of plaintext in each phase and the identical secrete key is used to encrypting every plaintext block. The ECB technique is perfect to small quantity of data, such as cryptographic key. The most important feature of electronic code book is that the identical b-bit plaintext block, if it occurs more than

one time in plaintext, for all time gives the same ciphertext. For long plaintexts, this mode could not be safe. If the structure of plaintext is well, it could be feasible to a cryptanalyst for utilize these patterns [3].

2.2 Cipher Block Chaining (CBC) Mode

The Cipher Block Chaining Mode (CBC) solves the difficulty in electronic codebook (ECB). It decreases the probability of occurring continual patterns in the cipher text. In CBC method, present message block and previous encrypted text block are XORed, the output of XOR operation is input for the cipher, every block is encrypted by equal key. Finally, because of the chaining method of CBC, it is a suitable mode for encrypting plaintext of greater length data. Moreover it is used to accomplish authentication, confidentiality [3].

2.3 Cipher Feed Back (CFB) Mode

Figure 1 illustrates the cipher feedback (CFB) mode. The figure shows, it is supposed that the part of broadcast is s bits; $s = 8$ is a general value. The message has been partitioned into slices. Each slice has s number of bits. A shift register has b number of bits. This shift register is primarily filled with an initialization vector (IV). This shift register is the input into CFB mode cipher. The encryption function outputs leftmost (most significant) s bits. The ciphertext C_1 was produced by this s bits have been XOR with the initial part of message P_1 . The s numbers of bits are transferred left side in shift register, and the right most s bits are filled with ciphertext C_1 . This same procedure

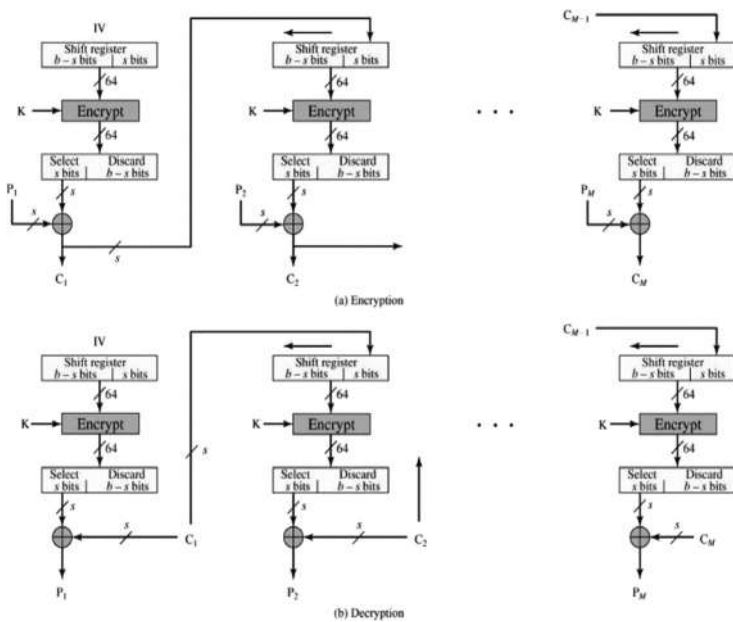


Fig. 1. Cipher feedback (CFB)

carry on up to entire message parts are ciphered. In decryption process, the same structure has been used with small change that is the plaintext is the result of encryption function output XOR with the acquired ciphertext [3].

2.4 Output Feed Back (OFB) Mode

The output feedback (OFB) mode and cipher feedback (CFB) mode are contains same structure. In output feedback mode, the shift register is filled back with the encryption function result. One benefit of the output feedback technique is that bit faults in transmit are not spread. The disadvantage of output feedback (OFB) is that, this is most susceptible to a modification attack of the message stream than is cipher feedback.

2.5 Counter (CTR) Mode

Figure 2 shows the Counter (CTR) Mode. A counter is a random number, equal to the message block size. Naturally, any one value is initialized as the counter then one is enhanced to every following part. In encryption, the plaintext block is XORed with the ciphered counter to gives the ciphertext block; chaining is not there. In decryption, the counter numbers are applied in same order, with each ciphered counter number XOR with a ciphertext part to get the matching plaintext part. The only prerequisite is that the counter number should be dissimilar for every plaintext part that is ciphered [3].

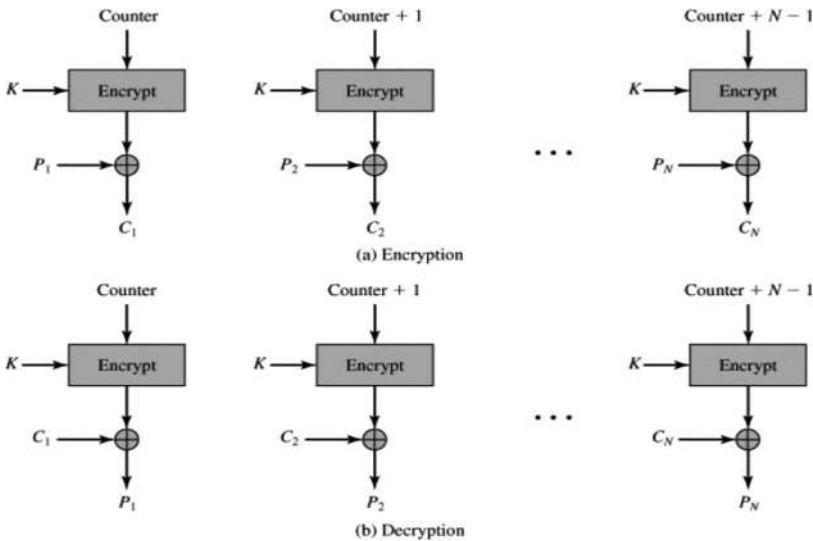


Fig. 2. Counter mode (CTR)

3 Mahaviracharya Encryption Algorithm (MEA) with Modified Counter Mode

This paper is describing the process of applying counter mode to Mahaviracharya Encryption Algorithm. Generally, in counter mode the counter has been initialized to any one number and then 1 is enhanced for every following part. But, here, counter mode is not applying as it is. In Mahaviracharya Encryption Algorithm whole plain text is taken as a single block. Counter mode is applied for that single block only, so the increasing of counter value is not required.

Plain text (P), Counter value (R), Secrete key (K) are variable length values and should be greater than are equal to 128 bits. Counter value is generated by using SecureRandom class in java language. Cryptographically tough random number generator (RNG) is provided by SecureRandom. A cryptographically tough random number slightly fulfils the statistical random number generator checks indicated in *FIPS 140-2, Security Requirements for Cryptographic Modules*, Sect. 4.9.1. Furthermore, SecureRandom should give non deterministic result [4]. Ciphertext length is equal to the plaintext length.

The encryption and decryption process as follows:

3.1 Encryption

1. Plain text: $P = p_1 p_2 p_3 p_4 \dots p_m$
 - P contains m number of digits and P should minimum 128 bits.
2. Counter value: $R = r_1 r_2 r_3 r_4 \dots r_s$
 - R is Secure Random number, contains s number of digits and R should minimum 128 bits.
3. Secrete Key: $K = k_1 k_2 k_3 k_4 \dots k_q$
 - K contains q number of digits and K should minimum 128 bits.
4. $B = R * K$
5. $X = R + B + K = x_1 x_2 x_3 \dots \dots \dots x_m x_t x_{t+1} x_{t+2} \dots \dots x_{t+n}$
 - $t = m + 1$
 - X length (number of digits: $t + n$) should greater than Plaintext (P) length (number of digits).
 - If X length less than P length then X should be expanded to x_{t+n} . To expand X , in this paper, we used BigInteger (x.getBytes ("us-ascii")) java code iteratively.
6. $X' = x_1 x_2 x_3 \dots \dots x_m$.
7. Ciphertext: $C = X' \oplus P$

3.2 Decryption

1. Ciphertext: $C = c_1 c_2 c_3 c_4 \dots c_m$
 - C contains m number of digits and C should minimum 128 bits.
2. Counter value: $R = r_1 r_2 r_3 r_4 \dots r_s$
 - R is SecureRandom number, contains s number of digits and R should minimum 128 bits.
3. Secrete Key: $K = k_1 k_2 k_3 k_4 \dots k_q$
 - K contains q number of digits and K should minimum 128 bits.
4. $B = R * K$
5. $X = R + B + K = x_1 x_2 x_3, \dots, \dots, x_m x_t x_{t+1} x_{t+2}, \dots, x_{t+n}$
 - $t = m + 1$
 - X length (number of digits: $t + n$) should greater than Ciphertext (C) length (number of digits).
 - If X length less than C length then X should be expanded to x_{t+n} .
6. $X' = x_1 x_2 x_3, \dots, x_m$
7. Plain text: $P = X' \oplus C$

This algorithm provides good security from brute-force attack, ciphertext only and known plaintext attacks.

4 Experiment Results and Analysis

In this experiment above algorithm is implemented using java language. This algorithm results are compared with AES algorithm results. AES algorithm with ECB mode is used to compare the results. Because, the variances among the modes are trivial in small files (less than 10 MB) and for large files ECB mode is taking less time to encrypt and decrypt than the other modes [5].

We have calculated the execution time for encryption and decryption methods for different sizes of text messages. For this experiment, we used Intel(R) core(TM) i5-7500 CPU @ 3.40 GHz with 4 GB RAM, Windows 7 Professional Service Pack 1, 64 bit operating System, Net Beans IDE 8.2, jdk-10.0.1_windows-x64_bin.

4.1 Performance Analysis Based on Encryption Time

Table 1 illustrate the encryption times of Mahaviracharya Encryption Algorithm (MEA) and AES algorithm for different data sizes of texts. Mahaviracharya algorithm is taking less time for encrypting the data than AES algorithm.

Table 1. Encryption time in milliseconds

Data size (KB)	MEA	AES
10	63	190
20	97	230
30	204	308
40	265	391
50	344	443

4.2 Performance Analysis Based on Decryption Time

Table 2 illustrate the decryption times of Mahaviracharya Encryption Algorithm (MEA) and AES algorithm for different data sizes of texts. Mahaviracharya algorithm is taking less time for decrypting the data than AES algorithm.

Table 2. Decryption time in milliseconds

Data size (KB)	MEA	AES
10	70	196
20	100	243
30	250	316
40	300	401
50	402	457

5 Conclusion

Mahaviracharya Encryption Algorithm can be implemented using counter mode with small modification. It is providing good security against brute-force attack, ciphertext only and known plaintext attacks. It is taking less time for encryption and decryption than the AES algorithm. In this experiment, Plaintext and secrete key are variable length, used with minimum of 128 bits length. In future this algorithm should be tested for various large block sizes of different data formats like audio, video and pictures with various key sizes and compare with existing symmetric and asymmetric key cryptographic algorithms in terms of the execution time, power consumption, and throughput etc.

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Text Processing of Telugu–English Code Mixed Languages

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Abstract. In social media, code mixed data has increased, due to which there is an enormous development in noisy and inadequate multilingual content. Automation of noisy social media text is one of the existing research areas. This work focuses on extracting sentiments for movie related code mixed Telugu–English bilingual Roman script data. The raw data of size 11250 tweets were extracted using Twitter API. Initially, the data was cleaned and the annotated data was addressed for sentiment extraction through two approaches namely, lexicon based and machine learning based. In lexicon based approach, the language of each word was identified to back transliterate and extract sentiments. In machine learning based approach, sentiment classification was accomplished with uni-gram, bi-gram and skip-gram features using support vector machine classifier. Machine learning performed better in skip-gram with an accuracy of 76.33% as compared to lexicon based approach holding an accuracy of 66.82%.

Keywords: Natural language processing · Sentiment extraction · Language identification · Twitter code mixed data

1 Introduction

Lot of people tend to utilize multiple languages in social networking. Yet there are different tasks conducted on code mixed texts, the task of sentiment extraction, particularly, has not been explored for multilingual code mixed texts. This kind of text differs from traditional English texts and to be processed differently. However, different forms of texts require different methods for sentiment extraction.

Code mixing is the utilization of one language in another language, the mixing of at least two or more languages or language categories in a content. It frequently happens when the utilization of two languages or two cultures cannot be separated from the components of one language well and frequent overlap between the two systems. Code mixing usually occurs in bilingual or multilingual communities and the importance of the language cannot be clearly separated.

Code mixing refers to placing of words, phrases and morphemes of one language into the articulation of another language. Below example is a mix of two languages namely Telugu transliterations and English.

Ex: NTR nenu ee Role cheyalenu ani cheppina character oke okka character....
Ade Sr.NTR gari Role in @Mahanati.

2 Related Work

Language identification became difficult as social media text contains informal text, bilingual or multilingual text of different scripts or within a script, so language identification is a major task in processing the text for future applications.

[5] Directs the word level language identification utilizing FIRE 2013 Bengali–English, Hindi–English, Gujarati–English code mixed information alongside 24 foreign dialects. They constructed a twofold classifier utilizing character n-gram features for $n = 1$ to 5 and two standard classifiers specifically Nave Bayes and Logistic Regression. Out of all Gujarati–English scored a higher exactness of 94.1%.

[1] Exhibited initial work on identifying Hindi, Bengali and English languages of code mixed data from facebook posts and comments utilizing two methodologies in a particular dictionary based approach and machine learning based approach. In Lexicon based approach they utilized British National corpus, LexNorm-list and SemEval 2013 twitter corpus for identifying English words. As there is no transliterated lexicon to recognize Bengali and Hindi words so they created trained set of words as a look-up, with this they accomplished 93.12% accuracy. Further in machine learning approach, features are character n-grams, presence in dictionary, length of words and capitalization. Support Vector Machine (SVM) classifier trained with these features brought about exactness of 94.75% and Conditional Random Field (CRF) brought about higher precision of 95.76%.

[2] Presented 3 approaches for identifying languages at the word level in code mixed Indian online networking content namely n-gram language profiling and pruning, Dictionary based detection and SVM based detection. TextCat language detection framework is utilized to generate n-gram profiles arranged by frequency, out-of-place measure is determined utilizing these profiles which is utilized to predict the language of the text. In lexical normalization lexicon is utilized to identify English words, Samsad English–Bengali lexicon and Hindi word-net were transliterated to Romanized text utilizing Modified Joint Source Channel Model to identify Hindi and Bengali words, this approach gained 38% and 35.5% F-score for English–Hindi and English–Bengali. Features such as n-gram with weights, lexicon based, minimum edit distance (MED) based weights, word context information are fed into SVM classifier for word level language identification which has brought about high performance of 76.03% F-score for English–Hindi and 74.35% F-score for English–Bengali.

[15] Introduced various strategies to analyze sentiment of text after normalizing the text. They utilized FIRE 2013 and 2014 Hindi–English data sets. They partitioned their work into two stages: In the principal stage they identified the language of the words

present in the code mixed sentences utilizing lexicons. In the second stage they extracted the sentiments of these sentences utilizing SentiWordNet. They handled finding abbreviations, Spelling rectifications, Slang words, word play, phonetic typing and transliterations of Hindi words into Devanagari script. They accomplished a precision of 85%. In [14], they also handled Named entity recognition, ambiguous words and got exactness of 80%.

[12] has proposed a framework to analyze the sentiment of English–Hindi code mixed text which is extracted using facebook graph API. This framework incorporates both dictionary based approach and machine learning based approach. In dictionary based approach, they made semi-automatic lexicons of words annotated with a semantic orientation polarity. They utilized the data structure to keep up these lexicons with their polarity. They characterized text based on the count of positive and negative words, they accomplished an exactness of 86%. In machine learning based approach, they implemented SVM, Naive Bayes, Decision tree, Random tree, multi-layer perceptron models with uni-gram words, list of negative words, list of positive words and list of negation words as features on WEKA tool. They accomplished an accuracy of 72% which is not as much as dictionary based approach.

[10] had extracted sentiment from Hindi–English live twitter information utilizing lexicon based approach. At first, they recognized the language of each word with the assistance of n-grams and tagged parts of speech of English–Hindi mixed sentences. They made two lexicons comprising of important words from the tweets and categorised the tweets as overall positive, negative and neutral. For looking through the words in lexicons, a linear search algorithm and dictionary search algorithm were tried among which dictionary based search has better execution. While classifying data they joined Breen’s algorithm and Cholesky decomposition for deciding sentiment. They achieved an accuracy of 92.68% for the positive case and 91.72% for negative case.

[13] presented their work as a part of the shared task at ICON 2017 challenge. They executed machine learning techniques on Hindi–English and Bengali–English code mixed online networking text. The released datasets were labelled with three names to be specific positive, negative and neutral. They build a model by training multinomial Naive Bayes classifier in WEKA with n-gram and sentiwordnet as features. At last, they acquired an F-score of 0.504 for Bengali–English and 0.562 for Hindi–English.

[6] had worked on automatically extracting Positive and Negative opinions. For the English–Bengali and English–Hindi code mixed information from facebook posts using machine learning approaches. The dataset is gathered from facebook and utilized altered information from ICON-2015. Preprocessing of data is made possible by removing noisy data, expansion of abbreviation, removal of punctuation, removal of numerous character repetitions from facebook posts. The machine learning algorithms are utilized to train the classifiers with number of word matches with sentiwordnet, Opinion lexicon, English sentiment words, Bengali sentiment words, density of revile words, parts of speech, number of every capitalized word, density of exclamation marks, density of question marks, frequency of code switches, number of smiley coordinates as features utilizing WEKA software. The best outcomes were created by Multilayer Perceptron model with an accuracy of 68.5% utilizing coalition of word based and semantic features.

3 Proposed Methodology

3.1 Data Set

The proposed work has been focused on a bilingual English–Telugu code mixed movie related data. The data has been scraped from twitter using Twitter API. The scraped data was then cleaned by removing punctuations, hashtags and further replaced short forms and slang words. Extraction of sentiment from bilingual code-mixed text has been done using both lexicon based and Machine learning based approaches.

3.2 Data Annotation

Each tweet is annotated with its respective sentiment labels mentioned in Table 1. The data is manually annotated by two authors whose native language is Telugu and have knowledge of English with prescribed guidelines.

Table 1. Sentiment labels

Polarity	Class label
Positive	1
Negative	-1
Neutral	0

3.3 Lexicon Based Approach

The proposed methodology consists of following steps:

- Step 1: Language identification
- Step 2: Back transliteration
- Step 3: Sentiment extraction

Language Identification. Identifying language of each word is the main and primary task for sentiment extraction of code mixed text. In this phase language is identified through lexicon based approach. Firstly, noise such as hashtags, punctuations and URLs are removed from the text. Slang words used by the users such as ‘hru’ for ‘how are you?’, are identified and replaced with the original. Each word in the text is then looked-up in language dictionaries and tagged with the corresponding language tag. For English, ‘en’ was tagged using British National corpus [9] and for Telugu, ‘te’ was tagged using ITRANS format of Leipzig corpora [7]. Further named entities in the text were tagged as ‘ne’, word level code mixed words in the text were tagged as ‘cm’ using lexicon which was created for movies and remaining words are tagged as ‘un’ (universal).

e.g.: “Aagnathavasi is really disappointed. Asalu movie lo emi ledhu chala worst movie. Songs are ok”

After language:

“Aagathavasi||ne is||en really||en disappointed||en Asalu||te movie||en lo||te emi||te ledhu||te chala||te worst||en movie||en.||un Songs||en are||en ok||en”

In the above sentence, each word is tagged with its corresponding language.

Back Transliteration. After identifying language of words in text, ‘te’ tagged words are back transliterated to their native script using Google transliteration API [4]. The main reason for back transliteration is to find the sentiment of Telugu words which are in transliterated format.

After back transliteration:

“Agnathavasi||ne is||en really||en disappointed||en అసలు||te movie||en లో||te ఏమి||te లేదు||te చాల||te worst||en movie||en songs||en are||en ok||en”

In the above sentence, all ‘te’ tagged words are back transliterated to Telugu script.

Sentiment Extraction. Sentiment extraction here is to classify each English–Telugu code mixed text either positive or negative or neutral through lexicon based approach. Based on the language of text, the sentiment of code mixed text is determined. Each word is looked up into sentiment lexicons to find the corresponding positive and negative lexicons present in each sentence. We used two sentiment lexicons to extract sentiment of the text:

- Opinion lexicon [8] which consists of 2007 English positive words and 4783 English negative words.
- Telugu sentiwordnet [3] which consists of 2136 positive words, 4076 negative words, 359 neutral words and 1093 ambiguous words.

We determined overall sentiment based on count of positive and negative words in code mixed tweets. If the count of positive words is more then the tweet is classified as positive sentiment, if the count of negative words is more then tweet is classified as negative sentiment and if the count of positive and negative words is same then the tweet is classified as neutral sentiment.

After sentiment extraction:

“Agnathavasi is really disappointed అసలు movie లో ఏమి లేదు చాల worst movie songs are ok **neg**”

3.4 Machine Learning Based Approach

Most statistical text classification approaches use machine learning classifiers, trained on a particular dataset using features such as n-grams and with or without part of speech. This approach involves annotation of data, creation of features and application of machine learning techniques to train the classifier. This approach is for a comparative evaluation against the lexicon based approach.

SMO implements the sequential minimal optimization algorithm for training a support vector classifier which is a supervised machine learning algorithm. It is used to train and test the data for sentiment classification.

After creating feature vectors of uni-grams, bi-grams and skip-grams then sequential minimal optimization (SMO) [11] is applied to the data for performing sentiment classification. The WEKA tool is used to perform the classification on the training data and creates a model for test data, the experimental results of which are presented in detail in Sect. 4.

4 Results

The results have been drawn on 11250 English–Telugu code mixed tweets and the proposed approaches are evaluated using precision, recall, F-measure and accuracy. In lexicon based approach the performance of language identification phase is shown in Table 2. The accuracy of the language identification is 75.60%.

Table 2. Language identification results

Class	Precision	Recall	F-measure
Telugu	0.936	0.463	0.620
English	0.881	0.985	0.930
Named entities	0.947	0.889	0.917
Word level code mixed	1.0	0.909	0.952

The accuracy of sentiment extraction for lexicon based approach is 66.82%. Each class results are shown in Table 3. The performance of machine learning based approach with uni-grams, bi-grams and skip-grams as features are shown in Table 4.

Table 3. Results of lexicon based sentiment extraction

Class	Precision	Recall	F-measure
Positive	0.807	0.810	0.809
Negative	0.627	0.360	0.457
Neutral	0.360	0.556	0.437

Table 4. Results of machine learning based sentiment extraction

Features	Precision	Recall	F-measure	Accuracy
Uni-grams	0.771	0.716	0.726	71.59%
Bi-grams	0.721	0.751	0.730	75.14%
Skip-grams	0.719	0.763	0.727	76.33%

Machine learning based approach performed far better in skip gram compared to lexicon based approach. Hence the error analysis for lexicon approach is discussed in Sect. 5.

5 Error Analysis of Lexicon Based Approach

Error analysis shows the limitations of lexicon based approach so the results were analyzed to understand the flaws of the approach.

eg: “cinema మొత్తం లో అరగంట dragging ahh wasn't good” **neu**

- There are mis-classification due to not considering negation.
- There are mis-classifications due to ambiguous of some words used in movie related texts.

eg: “chiranjeevi next movie second industry hit అవుతుంది మల్లీ ముందు craze వస్తుంది” **neg**

The above statements should be tagged as positive but was tagged as negative due to ambiguity. Since in the above example the English words such as hit and craze are considered as negative opinions.

- Due to presence of indirect sense, sarcasm and conflicts sentiment, there are mis-classifications.

eg: “trend setter for tollywood అప్పట్లో krishna ఇప్పుడు నాగార్జున” **neu**

The above example should be tagged as positive but due to indirect sense i.e., writer appreciating one person with reference of other person.

6 Conclusion and Future Work

In this work, two approaches for sentiment extraction of English-Telugu code-mixed languages were presented. In the lexicon based approach, the sentiment of each opinion bearing word in the sentence is extracted followed by sentiment counts to judge the sentiment of the whole tweet. The lexicon-based approach achieved the accuracy of 66.82%.

In the machine learning approach, code mixed language training data was used to build the model. After extracting relevant features from the training set, the classifier was trained to detect the sentiment of a particular tweet. With this the accuracy for the machine learning based approach was observed to be 76.33% in skip gram which was far better than the lexicon based approach.

The objectives to enhance the work in future are: This work can be extended further to improve and refine the techniques to resolve ambiguous words related to movie domain and to handle negation. As the data is related to movie domain, domain specific sentiment lexicons are to be created. This work can also be extended to identify the sarcasm, conflicts and indirect sense using some standard approaches. The work can be extended using more machine learning approaches and adding more features to enhance performance of the sentiment extraction model.

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A Proficient and Smart Electricity Billing Management System

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Abstract. Electricity is an energy that play a major role in human life. In day to day life, each and every device from machinery to wrist watch everything works on electricity. It is the most basic requirement next to food, shelter, and clothing. From the past decade's lot of changes took place in electricity departments but even now they are using manual billing system. This system has a wide range of disadvantages like malpractices are done while billing, escaping from punishment if any late payments, manpower for billing and collecting bills and wastage of paper billing. And moreover, if a fire accident or a technical problem arises the whole lane (transformer) will be terminated from power supply this may cause an inconvenience to the peer consumers too. Here, we are concerned about the economic loss that arises due to the manual billing system. In the manual billing system, every month end or for a couple of months bill is generated. An employee from the electricity department comes to each and every house for billing the meters based on the number of units the consumer has consumed. Hence, In this paper, we propose and discuss a new adaptive mechanism which reduces all the above-mentioned losses.

Keywords: Cash Deposit Machine · SIM · SMS · Electricity billing · Smart Retrofitting

1 Introduction

The purpose of this paper is to present a mechanism to prevent malpractices are done while generating electricity consumption bills, to prevent from escaping of punishment if any, to reduce manpower for billing and collecting bills and wastage of paper for billing. So far many mechanisms are introduced and implemented but this mechanism requires two devices, they are Integrated device - A device that displays price and power consumed, and is connected to the server by means of a SIM card and AAD-HAR card which is registered on the name of house owner by establishing a link with the electricity bill meter number and also supports e-payments (online payments). This device is fixed to the meter such that it requires technicians to replace or repair so that some malpractices can be prevented. Just by changing the price per unit in the server all the electric bill meters get updated by the new values. Cash Deposit Machines

(CDM) is provided in all electricity departments. Basically, this machine requests mobile number (or) AADHAR number including electricity bill meter number followed by displaying the charges and asking for payments then returns the change (or) deduce this extra amount in next payment at last prints a receipt of payment successful. Every minute the display readings changes based on the power consumption and display the price and stores the data directly in the server database. Every month 1st an SMS will be sent to the registered mobile number of a monthly bill if this bill remains due by 15th of month extra fine as the penalty will be added further if the bill is not paid power supply will be disconnected to the house automatically from the server, this disconnection cannot be stopped until and unless a bill is paid [1].

2 Related Work

Many systems have been proposed in order to reduce this manual billing. Nowadays electricity department is using a billing meter that directly detects the meters and copies the number of units consumed and billing is done but however, in this case, the manpower is again required in order to carry the device to all the meters. Many people/teams proposed a lot of techniques in order to reduce manpower in electricity billing and tried to make that work simple and efficient. Most of those solutions are GSM Based techniques where people place a GSM module connected to it and sends a message from a mobile to the particular SIM to which meter it is placed here they started generating bills to the consumers one in a month or for a couple of months [2]. The below-given figure is one such kind of smart billing system published in July 2015 [1] (Fig. 1).



Fig. 1. Smart billing system published in July 2015.

3 Methodology

This approach has been divided into two parts:

- (1) **A Smart Retrofitting Device:** Retrofitting device consists of four parts likely a Microcontroller, Relay, GSM SIM 800A Module and LCD Display. Here the microcontroller is used to program and control the GSM, Relay, LCD display as per required necessary [4]. The relay is placed between the mains that enter the house and this relay is operated by the microcontroller on the bases of the message signal that has been received by the GSM module. Here the messages to the GSM module will be sent by the electricity department.
- (2) **CDM (Cash Deposit Machine):** Generation of electricity is a task and also collecting those charges is also a time killing work for the electricity department. Here CDM similar to the kind of ATM's is to be placed at each and every substation and in offices of the electric department so that customers can pay their electricity bills at any time with 24*7 service this reduces the manpower too [7] (Fig. 2).

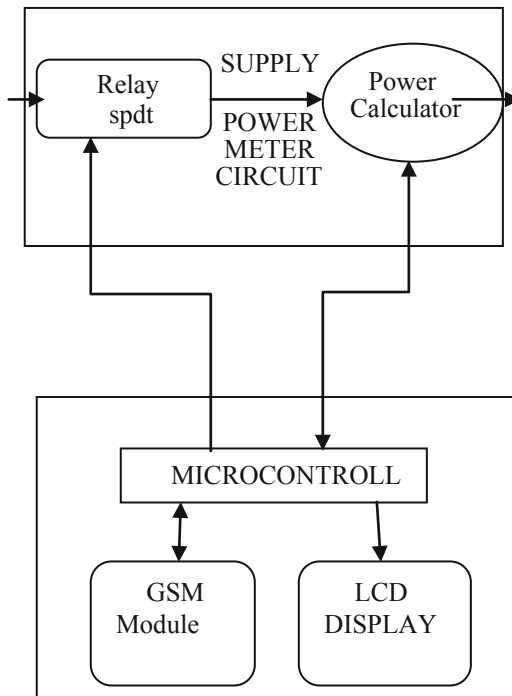


Fig. 2. Block diagram showing proposed methodology

The Retrofitting Device is set as it should respond only for the messages of the two numbers so that no other person can get access over that meters for every minute to minute or once in a day or once an hour the display will get updated with the value of

power consumed and charge for that consumption. This price value can also be updated through the message. The SIM card number will be same as the registered mobile number of the house owner in case they change their mobile number they should even update their details in electricity department by providing an acknowledgment letter [6]. This should also be linked with the AADHAR number of the customer that helps in case of bill payment. Every month end the GSM module will generate a message to the house owner's mobile number of monthly consumption. If at all any late payments the GSM module will automatically add finely to that bill. If the late payment is above one month automatically power supply will be terminated from the mains to house so that until and unless they pay the bill they will not be able to use power. In case of any fire accidents if we make a call to the electricity department and inform them they will turn off the relay board using Message so that it will be secure. CDM can be used for bill payments by using your registered mobile number or by entering your AADHAR number including meter number. As this machines will get connected to the server they directly update your house meters display [8].

4 Research Limitations and Practical Implications

This technique brings a lot of change where it avoids all the manual billing systems reducing manpower for generating and collecting the bills. It helps the government in the proper/strict collection of bills. Most of the malpractices can be avoided. Easy payment method for the consumers, however, the CDM service will be for 24*7. In case of fire accidents, easy handling of power is allowed. This system helps to save paper and all the data will be stored in the database so that a soft copy can be generated as on required [5].

5 Originality and Outcomes

This is a smart way of using technology to reduce manpower and increase work efficiency and accuracy without any malpractices. Here the work is the outcome of smart devices.

- Low cost and efficient in billing.
- Reduces paper wastage.
- It can be implemented in rural, remote areas.
- Reduces most of the manpower.
- Prevents most of the malpractices done by consumers.
- Automatic (programmed) penalties and punishments will be implemented which reduces revenue loss to DISCOMs.
- Power consumption and charges can be monitored through display on a meter.
- Direct implementation of new charges (per unit) from a server.
- The immediate power supply can be stopped from server in-case of fire accidents.
- The regular alerting system of bill payments through recorded calls and messages.
- User-friendly.

6 Conclusion and Future Scope

In this world of technology, a smart way of solving a problem is the most necessary task. This methodology will bring a solution for the wastage of high manpower, inefficient and inaccurate billing, abundantly increased malpractices, irregular payments in electricity billing departments. Proper implementation of bills, taxes will enhance the nation's economy. If the government is interested to make it through online payments on mobile application can be built or an updated version of the present available Mobile application can be developed this helps in making the transaction more easier. This Mobile application should help to file complaints, apply for new Meter connections, etc....

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Building a Character Recognition System for Vehicle Applications

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Abstract. Today number plate for vehicles is very important for their verification of its owner Id, address, vehicle identification and or for security purposes. Number plates are of different shapes, colors and sizes in different countries. In India, number Plates are of white background with black foreground color. By number plate we can identify the number by using image processing technique. By using image processing an image of the vehicle is captured to identify the number. We can also check the location and detect the non-permit holders of the stolen vehicles. The OCR, i.e., Optical Character Recognition (OCR) technique is used to read the characters from the image captured of the vehicle. Character Recognition is the one of the form of the OCR. In which we can read the characters from the vehicle number plate and use this for the identification of the owner of the vehicle with its detail like name of the owner, Place (state and district), the date of registration of the vehicle and its registration number and vehicle type, i.e., Either it is four wheeler or two wheeler. We have proposed this methodology to detect or check the detail of the vehicle. The vehicle number plate is also used for the Electric tolls to collect charge of pay-per-use of highways and note down the journey time measurement and ticket collection. The camera which is used for this process is infrared camera which capture the image at all conditions of the weathers either it is day or night.

Keywords: Licensed number plate system · Template matching · Optical Character Recognition techniques and its applications

1 Introduction

The licensed number plate in these days is very useful because of large increase of vehicles. The information extracted from the vehicles number plate [1] is used for various purposes like Access Control, Traffic Monitoring and Toll roads and border control areas, military areas and other restricted societies etc. for security purposes. The main concern of this paper is to provide effective security or to control crime activities. For this we have to capture the image of the vehicle by using HD-Cameras and then scan that image by using the OCR technique as shown in Fig. 1. By using this technique the number will compare with the database to check the vehicle [2] is belongs to its own owner or not. The recognition process is generally sub-divided into five categories:

- (a) Capturing the image of the license plate, i.e., Image acquisition.
- (b) Normalization, adjusting the brightness and contrast of the image.
- (c) Localizing the license plate.
- (d) Locating and identifying the individual symbol images on the plate, i.e., Character Segmentation.
- (e) Optical Character Recognition, i.e., OCR.

OCR Model

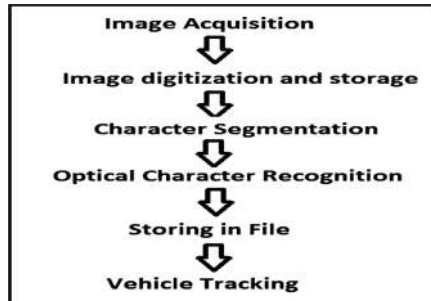


Fig. 1. Process of extracting text from an image

These operations are used to remove the noise from the images. To identify a vehicle a unique identification number is given to the vehicle which is provide to each vehicle as a number plate and it is applied on the front as well as backside of the vehicle which is vehicles unique ID. For example, HR51AX8052: which is the car number plate number which shows its detail as, i.e., First two letters shows their state code and the second two numbers show their district code and the third two letters are model of the vehicle type and at the end the end four digits are provided to the vehicle which is unique ID for the vehicle. By using this number, we can retrieve the detail of the vehicle. The RTO i.e. district-level Regional Transport Office is provide this number to each and every vehicle. The scheme of numbering has some advantages [11, 12], i.e., it shows the state and district registration of the vehicle and during police investigation in case of road accident or the vehicle related crimes if the witness read the number of the vehicle it will be helpful for the investigators to reach the criminal easily.

Hence, the remaining part of this work is organized as: Sect. 2 discusses about used methodology in this work. Further, Sect. 3 discusses our proposed method in detail. Further, some applications of registered vehicle number plate are discussed in Sect. 4. Then several applications of using OCR are discussed in Sect. 5. In last, Sect. 6 will conclude this work in brief with some future work.

2 Methodology Used

In this technology we are working on the CCTV footage [11], i.e., closed circuit Television with provide us an input image. The CCTV footage must be clear to see to the input image contrast must be clear and number must be formatted.

The process to detect a number plate the following steps are followed as (refer Fig. 2):



Fig. 2. Block diagram

- i. Input an Image of the vehicle from camera
- ii. RGB to grey Scale
- iii. Detect Licensed number plate from image
- iv. Character segmentation
- v. Character recognition
- vi. Display vehicle number
- vii. Comparing Number with database
- viii. Punished if suspected

- A. **Image Acquisition:** The Closed Circuit Television (CCTV) camera is used to capture the image. The sensor is used to spot the image and actions of the vehicle. The captured image is passed from the recognition process, to make sure the detail or the investigation or detection process [10].
- B. **Image Digitizing and Storing:** The image digitizing means to store the image in the format in which, the computer can read the image for the process. This is used to store the image in the form of bits.
- C. **Character Segmentation:** This means thinning is applied to the number plate to read each pixel of the image. Character Segmentation means slicing the image to read each character from the image of the number plate. It is two types, i.e., horizontal segmentation or vertical segmentation. In Horizontal segmentation, the unnecessary or unwanted part of the image is removed of the image and Vertical segmentation is used to separate the each pixel of the image.
- D. **Optical Character Recognition:** Optical Character Recognition (OCR) is the technique used to take out the text from the image. By using OCR the text from the number plate is extracted to detect the details from the database. Optical Character Recognition (OCR) is the process of converting the handwritten text or scanned text into machine or computer readable form OCR is used in various purposes passport ID, bank statements, programmed receipts, big business cards etc. It is similar with the image digitizing in which the image text is electrically search, store, and edit easily. The Artificial Intelligence and the computer vision are more focused by the OCR technique.
- E. **Storing in File:** At the last, the scanned text from the image is stored in the text format file.

- F. **Vehicle Tracking:** The vehicle tracking means to follow the path of the vehicle from which it is going from various traffics signals to sense the path of the particular course by scanned the image from the different cameras at different routes.

Hence, this section discusses about our methodology used with Optical Character Recognition (OCR). Now, next section will discuss about our proposed method in detail.

3 Proposed Method

At this time there is not any system is existing, which automatically scanned the moving vehicle. We have to check manually from the different-different CCTV cameras from different-different locations of the traffics signals from every area from where it is passing. A sensor is used which is automatically scanned the image to detect the vehicle from different locations and digital camera is used which is keep ready to detect the image (e.g., refer Fig. 3) After detecting the image we compare the image with different images which are captured at different locations at different places to detect the path from which the vehicle is passing through (for output, refer Fig. 4). This technology is work on the basis of 60–70% match of the images. By which it provide the result on the basis of different images of same vehicle number plate (the complete process can be looked into Fig. 5). The number plate is helpful in stolen vehicles, parking organization, toll plazas and constrained zones. The reason for converting image to text is to overcome the problems like-multiplicity of plate formats, dissimilar scales, rotations and Non-uniform clarification conditions caused during image possession.



Fig. 3. Captured number plate

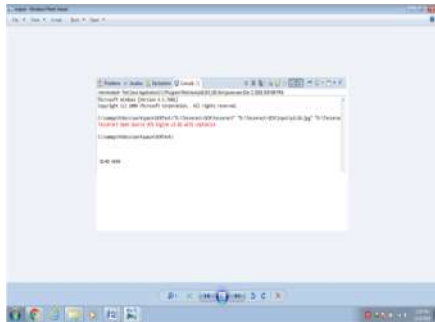


Fig. 4. Output of extract number plate

Some Challenges: Problem occur during capturing the image occur are- poor resolution of the image capturing camera, blurry imaging because of vehicle in motion and poor lighting in the particular area from where the vehicle is moving. Low contrast of light, over-exposure reflection and shadow of the image.

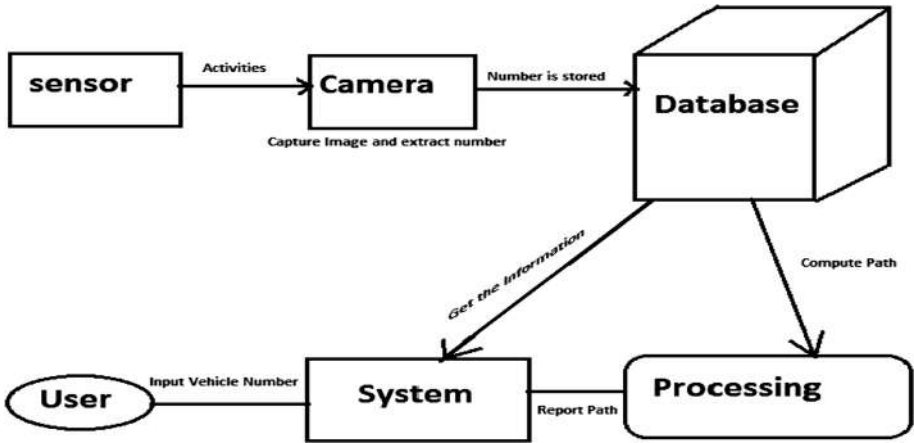


Fig. 5. Procedure for extracting number plate

Hence, this section discusses about our proposed method in detail. Now, next section will discuss several applications of registered vehicle number plate in detail.

4 Some Applications

Some of the applications of registered vehicle number plate are as follows:

- (a) **Parking Security:** Parking automation and parking security works with Character Recognition System as follows:
 - ticketless parking,
 - parking admission computerization,
 - vehicle position direction,
 - car robbery avoidance, “lost ticket” deception,
 - scam by changing tickets,
 - Partially or fully computerized payment process.
- (b) **Entrance Control:** Entrance Control is the mechanism in which the security is based in the restricted areas where the entry in the particular area or zone is based on the personal identification of the person to increase the security like in military areas, government areas, and highly authorized or private areas.
 - License plate recognition brings computerization of vehicle admittance control management,
 - providing increased security,
 - Car pool supervision for logistics,
 - Security guide support,
 - Event logging, event management,
 - Keeping access diary possibilities for analysis and data mining.

- (c) **Road-Tolling:** In this the particular use of the road or highway is concerned where we can pay per of the roads during a journey. It helps to find the location of a particular vehicle and also useful to measure the journey time.
- By sinking travel time,
 - Jamming and improve roadways quality,
 - Reduces fraud related to non-attendance,
 - Makes charging valuable,
 - Reduces mandatory manpower to process events of exceptions.
- (d) **Border Control:** It is helpful in the border areas which may be under the military or the army's team where the security need is very high to reduce the crime or for the investigation purpose.
- In opposition to terrorism,
 - unlawful cross border traffic,
 - Smuggling and against the law activities.
- (e) **Journey Time Measurement:** Journey time measurement is used during the travelling from various routes and the number of the vehicle is noted down on every route to measure the time or during any accidental case the investigation may be easily detect of the particular vehicle.
- Feeding back information to road users to boost traffic security,
 - Selection efficient law enforcement,
 - Optimizing traffic routes,
 - Dropping costs and time, etc.
- (f) **By Law Enforcement:** Law Enforcement is useful to find the stolen vehicle or to detect vehicle which breaks the traffic rules or for over speed vehicle purposes.
- Red-light enforcement
 - In excess of speed charging
 - Automobile lane control.

For example, Intelligent Transport System (ITS), we can say this application as ITS because here we track the vehicle and by using its number plate we can find the persons whole detail and its vehicle also. This makes the Regional Transport Office (RTO) system more intelligent and beneficial for the public. By using this traffic monitoring it can be handled.

Hence, this section discusses about several applications of registered vehicle number in detail. Now, next section will discuss about Optical Character Recognition applications.

5 Optical Character Recognition Applications

OCR (Optical Character Recognition) is vast use technology in today's life. It is used to scan the document text which is recognized by the computers. It is document management technology which is the smart way to manage or use the document text of the image for the security use or to save the record for the database in the companies or offices.

- (a) **Banking:** In bank, OCR is used in the check with no participation of the people. In this the check is inserted in the machine and the text on it is scanned automatically and the given amount is deposited in the account. The use of OCR is fairly used in the handwritten checks and manually conformation.
- (b) **Industry:** In the legal industry, the digitized paper is frequently used to reduce the use of paper. In order to reduce paper or space the elimination of paper documents, files, records are scanned by the computer insert or saved in the computer database with great security and long-time use of the data and information easily which is managed or processed by a particular person or persons access control.
- (c) **Healthcare:** Healthcare professions are also use the OCR technology in hospitals to save the patients records. They also have the volume of records of files of patients records like their insurance, personal information. To keep this with them they also make use of the electronic document scan to keep the document save in digitally with the help of computers.
- (d) **Digital Signature:** OCR is used in many fields as its support best result in their applications and has many benefits like in education, finance, and government sectors. Digital Signature is one of its basic applications as we use it in many works or as our identification purposes. Digital Signature is the electronic signature in which a particular person's signatures are scanned using the computer to verify the originality.

Hence, this section discusses about Optical Character Recognition applications in brief. Now next section will conclude this work with some future work in brief.

6 Conclusion and Future Work

We have checked and evaluated the OCR technology on the vehicle number plates to detect the text from the number plates for the security purpose and identification of the vehicle owner. Some of the issues are there during OCR technology used on the vehicles are proper format of the number plate of the vehicle, noise on the image and camera pixel clarity etc., which effects the effectiveness of the OCR technology. This software is implemented in JAVA and My-SQL is used for the database storage and the Tresseract is used as OCR to detect the text from the image. Hence, now some of the applications are:

- Lodge identity Check-In
- Tax-Free Shopping
- Self-Service convenience Meter Reading

- Receipt rules Scanning
- Scan Your Top-Up Codes

There is some condition for this software to work:

- Automobile shield should be white and according to rule given by government of India.
- Picture should be clear.

In last, some limitations of our work are: the downside in this is to read the characters with less intelligently. In some cases, the software reads the text from the number plate with wrong way but still it gives the right identification of the vehicle's owner detail. It may be due to the pixel ambiguity of the camera or due to the ineffective light towards the camera.

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Machine Learning Technique for Smart City Development-Focus on Smart Mobility

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Abstract. This work summarizes the current state of understanding the smart city concept and how machine learning can be applied for the development of the Smart City. The main innovations coming from the Smart City concept is the rise of a user-centric approach considering urban issues from the perspective of the citizen's needs. Smart City concept has been defined to get an understanding on how it can contribute towards urban development. In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of Smart Solutions. This paper presents a theoretical perspective on the smart cities focused on data mining using machine learning technique. In a smart city, a lot of data need to be automatically processed and analyzed. A review has been done on the machine learning algorithms applied on smart city. A smart city is to improve the quality and efficiency of urban services by using digital technologies or information and communication technologies. Data analytics plays an important role in smart cities. An insight has been brought into machine learning integrated with data mining applied to smart mobility and future focus to be on smart energy.

Keywords: Smart city · Machine learning · Data mining · Smart mobility · K-means clustering

1 Introduction

Cities have strong imbalances and negative effects are surpasses the positive ones if they are not properly managed. To understand how Smart City can define ideas and how to achieve urban growth priorities. How Smart Cities learn how to reduce the problems and how to engage citizens and how to participate in Smart City management processes. Accordingly, public officials should facilitate any contacts in Smart City and provide services automatically at real time. Smart movement, smart environment, smart personality, smart people smart energy, smart education and smart healthcare. Consumer approaches to urban issues from the predecessors of citizens' needs, involvement

of citizens in urban activities or realistic approach to urban challenges. It is a multi-share, municipal corporation based on sustainable and flexible growth and high-end life. Challenges of Smart Economy Action Activities are related to city production system. The Smart City model will lead to better urban planning and management and will help achieve a stable model of urban development. Challenges in the smart projects are collection of data and writing an appropriate algorithm to automate the decision making based on real time applications. Machine learning techniques utilizing the real time data is the stepping stone in the long-term project.

2 Related Work

Eiman Al Nuaimi et al. (3) took a shot at the Utilizations of enormous information to smart cities diminishing expenses also, asset utilization notwithstanding more adequately and effectively captivating with their nationals. He assessed the uses of huge information to help smart cities. Furthermore, it endeavored to recognize the prerequisites that help the usage of huge information applications for smart city administrations. Here they examined a portion of the fundamental open issues that should be additionally explored and routed to achieve a more complete perspective of smart cities and create them in an all-encompassing admirably thoroughly considered model.

Mohammad Saied et al. (1) studied on Machine Learning for Web of Things Information Investigation. The Smart City is a standout amongst the most vital utilizations of IoT and gives diverse administrations in spaces like vitality, versatility, and urban arranging. It was demonstrated that these administrations could be upgraded and improved by breaking down the smart information gathered from these zones. With the end goal to remove information from gathered information, numerous information scientific calculations were connected.

Jagannathan Venkatesh et al. (4) took a shot at Secluded and Customized Smart Wellbeing Application Plan in a Smart City Condition. They connected measured methodology for IoT applications – the setting motor – to smart medical issues, empowering the capacity to develop with accessible information, utilize broadly useful machine learning, and diminish register repetition and unpredictability. This uncovered the middle condition for reuse, bringing about new information get to frameworks being broadened and redesigned.

Mehdi Mohammadi et al. (2017) chipped away at the Empowering Subjective Smart Cities Utilizing Enormous Information and Machine Learning: Methodologies and Difficulties. The improvement of smart cities and their quick paced sending is coming about the age of extensive amounts of information at exceptional rates. They proposed a semi-directed profound fortification learning system to address the displayed difficulties and featured the situation of the structure in different smart city application spaces. At long last, they enunciated a few difficulties and slanting examination headings for joining machine figuring out how to acknowledge new smart city administrations.

3 Objectives

The target of the examination is to

- Traffic jams, street car crashes can be recognized at various occasions and by changing suitable activity controls.
- Enable sharing of activity data (gathered through sensors, smart movement lights and on-vehicle gadgets to drivers by means of smart telephones or other specialized gadgets) to the workers.
- To support decisions like opening new roads, enhancing the infrastructure based on congestion data, updating of car parking and alternative roads.

This would thusly change provincial and urban regions into place of law-based development. It is relied upon to diminish the costs in general wellbeing; security, transportation and asset in this manner enhance supportability of the city and personal satisfaction of its occupants. The above is planned to be achieved using Machine Learning data analytics with special focus on Smart Mobility.

4 Smart Mobility

Mobility is another critical piece of the city. Through the information mining, city authorities can enhance the quality of life in the city. This includes the improvement of the productivity and administration of the vehicle through the use of video surveillance and remote detection technologies to monitor traffic facilities and conduct related data analysis for managing traffic flow, pedestrian flow and cargo flow in real time and handling emergencies. It likewise advances blended model access which incorporates different methods of transportation, including and open transport, clean-fuel vehicles, cycling and strolling. Smart Mobility and Movement is the most ideal approach to decrease clog and to create quick, green and shoddy activity. Smart City Transport Framework enhances those going inside a city, decreasing vitality and diminishing carbon discharges. Most smart activity administration frameworks utilize information gathered from different sources about characteristic structures to enhance movement. The smart development is inventive transport and transportation foundation, which stores assets and makes new innovations for most extreme productivity. Openness, reasonableness and wellbeing of transport frameworks, and reduced urban advancement are basic factors in this specific situation. New easy to understand offices will make it simpler for individuals to change to coordinated transport frameworks concentrated on ecologically inviting transport modes.

5 System Analysis and Methodology

5.1 Machine Learning

Machine learning is an entrenched research territory of Artificial Intelligence. Machine learning is a field of Artificial Intelligence that enables PC frameworks to “learn” with

information, without being unequivocally customized to learn and act like people do. The framework can enhance their learning after some time in the computerized design, by eating those information and data as perceptions and certifiable connections. It is a part of computerized reasoning dependent on the possibility that framework check gain from information recognizes examples and settles on choices with negligible human mediation.

Two of the most widely adopted machine learning methods is supervised learning which trains algorithms based on example input and output data that is labelled by humans. Unsupervised learning which provides the algorithm with no labelled data in order to allow it to find structure within its input data. In this paper, we review the machine learning algorithms applied on smart city. A smart city is to improve the quality and efficiency of urban services. Data analytics plays an important role in smart cities.

5.2 Data Mining

Data Information Mining is the way toward discovering designs from substantial informational collections to separate important data to settle on better choices. This innovation utilizes strategy from machine learning, insights, and database frameworks for preparing.

There exist data mining systems like grouping, affiliation, choice trees, and characterization for the data mining process. Data mining is a generally new innovation to decide the patterns for what’s to come. Data Mining gets factual procedures or important data from unused data by using helpful insight and machine learning strategies (Fig. 1).

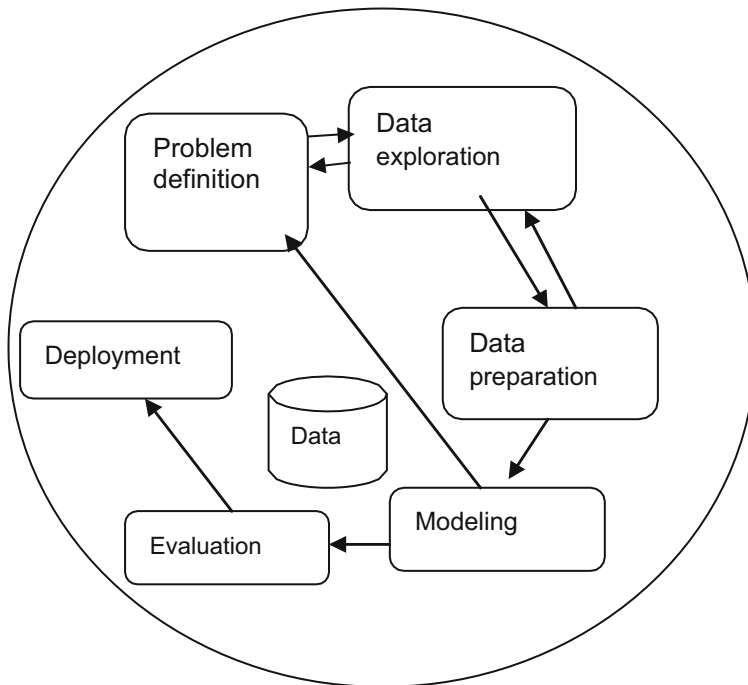


Fig. 1. Data mining structure.

5.3 Unsupervised Clustering

Unlimited answers are a sort of machine learning calculation used to draw endorsements from databases with information data without tapping inserted reactions. It is utilized for symptomatic data investigation to identify or rank in data shape, which utilizes man-made reasoning (simulated intelligence) calculation utilizing unclassified or non-decayed data and enables the calculation to work with no direction. Unsupervised learning calculations can perform more unpredictable preparing undertakings than managed learning frameworks.

5.4 Inputs for Analysis and Decision Making

The primary highlights of smart cities have better authority over the city's movement blockage, which advances transportation frameworks, enhancing the movements of regular folks and the general transport examples of cities. At the point when the populace builds, activity issues, contamination, and financial issues occur. Every sensor distinguishes an alternate parameter of the activity stream of the accompanying.

- a. The velocities of autos,
- b. Traffic thickness,
- c. Waiting time at the lights,
- d. Traffic jams,

The framework gives the consequences of these parameters, taking the outcomes and gives the suitable methods for lights and flags. Because of this, the utilization of smart movement lights and flags is a standout amongst the most critical systems that smart cities use to manage high volumes of activity and blockages. Smart movement lights and flags ought to be interconnected over the activity lattices to offer more data about activity designs.

5.5 Experimental Work

5.5.1 Basic Architecture for K-Means

For the purpose of this clustering task, a dataset which has records of vehicular telemetry in the City of Bangalore, India has been chosen. The data is taken from the Government database on line and from department. The data had details of vehicles and its position retrieved from GPS for the specified period. The data was stored in RDBMS. The data had details of vehicles in motion and in standing condition. The RDBMS has data on vehicle ID, data and time, latitude and longitude, speed, moving angles and information on the signal. The data available was big and it was required to break it up into smaller groups. The raw data may not have accurate information and hence processing of the data was essential. The traffic congestion in the city of Bangalore is very high and hence filtering to remove all the vehicles which are running at speed greater than 0 to get the data of vehicles which are not moving. This will remove data of vehicles which are parked and the buses which are in the bus stop or standing still in some kind of traffic jam or traffic lights. Then only the data which shows the vehicle waiting at the traffic jam or at traffic signal is identified.

With the available data clustering algorithm is applied. This way the main points where traffic congestion is more serious can be identified and communicated to the traveler. The k means was performed with 60 iterations (Fig. 2).

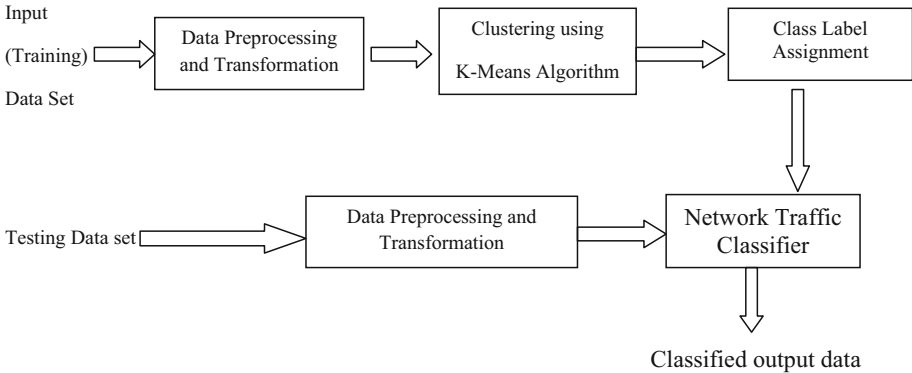


Fig. 2. System architecture for proposed system

6 Algorithm: - Unsupervised Clustering

6.1 K-Means Algorithm

K-implies bunching is to isolate n protests with groups, where every perception is grouped, and the bunch goes about as a model. In K-implies calculation, the goal is to bunch the unlabeled data set into a given K number of bunches (gatherings) and data guides having a place toward a similar group must have a few likenesses. In the traditional K-implies calculation, the separation between data focuses is the proportion of similitude. In this manner, K-implies looks to locate an arrangement of K group focuses, indicated as $\{S_1, S_k\}$, which limit the separation between data focuses and the closest focus. With the end goal to signify the task of data focuses to the bunch focuses, we utilize an arrangement of paired marker factors.

$\pi_{nk} \in \{0,1\}$; So that if data point X_n is relegated to the group focus S_k , at that point $\pi_{nk} = 1$. We figure the issue as pursues:

Calculation portrays how to take in the ideal group focuses $\{s_k\}$ and the task of the data points $\{\pi_{nk}\}$.

Algorithm: K-means Algorithm

Input: K, and unlabeled data set $\{x_1, \dots, x_N\}$.

Output: Cluster centers $\{s_k\}$ and the assignment of the data points $\{\pi_{nk}\}$.

Randomly initialize $\{S_k\}$.

Repeat

for n: = 1 to N do

for k: = 1 to K do

if $k = \arg \min_i \|s_i - x_i\|^2$ then

```

    πnk: = 1 else πnk: = 0 end
  end
  for k: = 1 to K do
    sk: = end
  until {πnk} or {sk}

```

K-Means is a quick and very adaptable calculation. Besides, there is a stochastic, online variant of K-means. In any case, this methodology has numerous confinements because of the utilization of Euclidean separation as the proportion of closeness. For instance, there are impediments in the sorts of data factors that it tends to be considered and are not solid against the limits of bunch focuses. Furthermore, the K-means calculation doles out every datum point to one, and just a single of the bunches which may prompt unseemly groups now and again. Uses MapReduce to analyse the numerous small data sets and proposes a cluster strategy for high volume of small data based on the k-means algorithm. Apply K-Means++ to cluster and classify travel pattern regularities. Introduced real-time event processing and clustering algorithm for analyzing sensor data by using the OpenIoT1 middleware as an interface for innovative analytical IoT services.

7 Conclusion

Here a methodology has been anticipated smart mobility utilizing K-means clustering. Smart mobility can be accomplished by use of the contributions of smart movement on constant premise to program the machine to take proper choice for smart mobility. A similar methodology can be reached out to fields like smart vitality in this way driving towards smart city. Smart Vitality is a standout amongst the most vital research regions since it is basic to lessen by and large power utilization. It offers high caliber, reasonable condition vitality companion. Besides, Smart Vitality foundation will turn out to be more perplexing in future.

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Smart Posture Detection and Correction System Using Skeletal Points Extraction

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Abstract. This paper is intended to present a smart posture recognition and correction system. In specific, Sitting in wrong posture for persistent period of time results in many health problems such as back pain, soreness, poor circulation, cervical pains and also decrease in eyesight in the long run. The proposed model makes use of real time skeletal points extraction. This system is based on computer vision and machine learning algorithms.

Keywords: Smart posture · Posture detection · Skeletal points · Posture correction system

1 Introduction

Human Posture shows an impact on human health both physically and mentally. Many methods have been proposed in order to find out different postures of a human being. [1, 9, 7] developed a fall detection algorithm based on posture analysis. Posture analysis also plays an important role in the field of medicine to find out sleeping posture of the patient [4, 6]. The major posture analysis approaches are sensor-based approach and image processing-based approach. Many models emphasize on posture detection using sensor-based approach in which the person needs to wear some special gadgets or sensors which is mainly helpful for fall detection [3, 5, 8, 9, 11]. Image processing-based approach helps to analyses standing posture as well as sitting postures [2, 10, 12].

In recent studies, it has been proved that sitting posture not only effects our body in a physical manner but also plays an important role in concentration on things. This implies that sitting posture also effects our learning abilities. The physical effect due to improper sitting posture is more in people who works with laptops or computers for a significant amount of time in a day. In sensor-based approach the person has to wear some sensors all the time which makes the person uncomfortable. In image processing-based approach a depth sensor is used to get a 3D image [12], which identifies the sitting posture. But in practical, laptops or desktops are not equipped with a depth-sensor thus making this approach failing to detect the sitting posture without a depth sensor.

2 Proposed Model

In the proposed model, there is no use of a depth sensor, rather a normal web camera or laptop camera is used to get a 2D image and analyse the sitting posture based on human skeletal points, thus making the model available for all the persons who spend a lot of time in front of their laptop screens. Thus the proposed model requires no additional hardware to correct the sitting posture. Fig. 1 explains the steps involved in the working model.

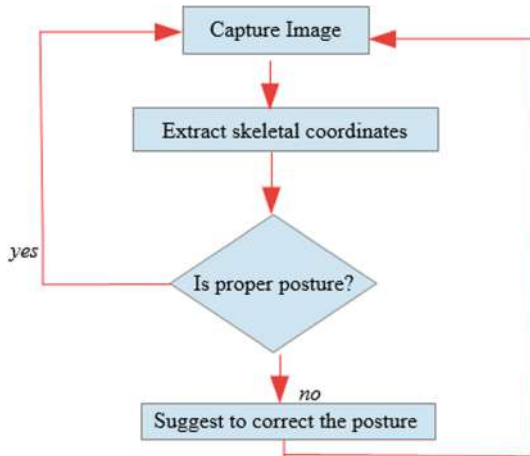


Fig. 1. Flowchart explaining the model

There are several steps involved in the development of smart posture detection and correction system. The entire design process can be divided into four major steps. They are (1) skeletal points extraction and dataset creation (2) Training the model using KNN (K-Nearest Neighbors) algorithm (3) Real time testing (4) Correction or Recommendation.

2.1 Skeletal Point Extraction and Dataset Creation

OpenCV is used for the extraction of skeletal points. The system requires a GPU for better performance. However the system can also perform with a CPU but the frame rate decreases.

For instance, Fig. 2 is a normal image of the person sitting in front of the laptop whereas Fig. 3 is the image after extracting the skeletal points and drawing the skeletal structure. The points in the Fig. 3 are the features used in the dataset. The labelling of the postures used in the dataset is done during the extraction of skeletal points. The dataset contains all the skeletal points as the system is intended to work for both sitting and standing posture. Only skeletal points of upper body can be used if the model is intended to be specific for sitting posture. The dataset used in the proposed model consists of 200 different samples of skeletal points which includes both correct and wrong postures.



Fig. 2. Image without skeletal points

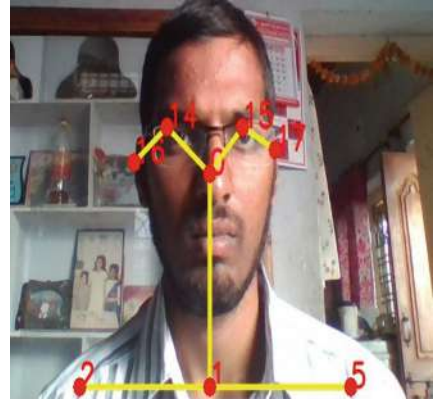


Fig. 3. Image with skeletal points

2.2 Training the Model Using KNN

The main idea used to train the model is to make use of the distance between the skeletal points. The major coordinates that play an important role in sitting posture detection and correction are the coordinates of the eyes, ears, nose, neck, shoulder joints and also the joints of the hands. The location of these coordinates are used to get a skeletal structure and are used to estimate the sitting posture of a person. The variation in the skeletal points of proper and wrong postures can be observed from Figs. 4 and 5.



Fig. 4. Example image for wrong sitting posture



Fig. 5. Example image for correct sitting posture

Now the model is trained using KNN algorithm. KNN classifies based on the distance between the skeletal points and the value of “k” (the number of neighbors to consider).

2.3 Real-Time Testing

After the model is successfully trained using machine learning, the task of testing the model comes into picture. Initially, the model is tested with python to estimate the sitting posture. Real time testing involves real time capture of image, extracting skeletal points by passing the image as an input to the pre-trained model. The extracted skeletal points are then given as test sample to the designed model. The model predicts whether it is a proper posture or not.

The Fig. 6 shows the real time extraction of skeletal points which are tested with the trained model, Fig. 7 shows that the model has predicted the posture as a correct one.



Fig. 6. Image during real time testing

```

IPython console
Console 1/A
Python 3.6.5 |An
bit (AMD64)]
Type "copyright"

IPython 6.4.0 --

In [1]: runfile(
[1]
Correct posture

```

Fig. 7. Image showing predicted output

2.4 Correction or Recommendation

The system continuously monitors the posture of the person who is sitting in front of the screen. Currently the system is designed to check for posture with a frequency of 15 s. Whenever the system finds an abnormal posture, a voice alert is generated to advise the user to adjust his/her posture.

3 Conclusion

The proposed smart posture detection and correction system introduced a design flow for sitting posture detection and correction. The designed system uses a web camera or laptop camera to capture the image. The captured image is processed to extract skeletal points using OpenCV, which are then passed through the trained model to determine the sitting posture of the person. The system gives a voice message to adjust the posture whenever a wrong posture is encountered. Thus the designed model makes sure that the

person does not sit in the wrong posture, which helps to reduce the adverse effects of sitting in wrong posture such as back pain, soreness, poor circulation, cervical pains and decrease in eyesight.

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Multicast Symmetric Secret Key Management Scheme in Mobile Ad-hoc Networks

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Abstract. Security is very important in Mobile Ad hoc Networks due to its characteristics like dynamic topology, limited battery power, open wireless medium etc. The security of MANETs in multicast transmission is yet more interesting area of research because many users form a group for transmission and reception of data in the exposed networks. There are many factors that affect the security in MANETS like battery power, storage, key dynamics, kind of traffic, routing algorithm, security protocol etc. Existing security solutions doesn't leverage the key management issues in group communication. In our work, we developed a symmetric shared multicast key agreement protocol- "Multicast Symmetric Secret Key Management Scheme" (MC-SSKMS) for group oriented communication in MANETs. We compared the results of our proposed protocol with the two contemporary protocols using Key Delivery Ratio (KDR), Delay in key Broadcast, Energy consumption metrics.

Keywords: MANET · Secret group key · Encryption · Decryption · Symmetric key

1 Introduction

Mobile Ad hoc Networks are one type of wireless networks that operate multi-hop radio transmission without any permanent infrastructure. Because of the unique characteristics of MANETS, like dynamic topology, radio links, scarcity of resources, without any central coordination etc., they are extremely susceptible to security attacks than wired and cellular wireless networks [1]. Secrecy is the most important issues of MANETs to thwart against attacks. Multicast communication plays an important role in MANETS to provide group oriented communication like military applications, search-and-rescue, and war fare situations. Secure Group Key in multicasting is required to leverage the group communication issues in MANETS. Creation of shared and secure cluster key means many users need to calculate a shared key to exchange information in a secure manner.

There are several group key management protocols for wired networks, infrastructure networks and as well as for MANETS. All these protocols are grouped into three types: (i) Centralized Group Key Management Schemes (ii) Decentralized Group Key Management Schemes (iii) Distributed Group Key Management Schemes. Distributed key Management protocols have no single point of failure, low message overhead and less computational complexity in rekeying than Centralized and Decentralized group key management protocols [2]. Rekeying means, when a user enters or leaves the cluster, a new Shared Secret Group Key is to be produced. Distributed Group Key Agreement protocols for multicast communication are classified in two categories: (1) Symmetric GKA (2) Asymmetric GKA. We proposed a symmetric GKA protocol-“Multicast Symmetric Secret Key Management Scheme” (MC-SSKMS) in MANETS and discussed the performance analysis using Key Delivery Ratio (KDR), Delay in key Transmission, Energy consumption metrics.

The remaining part of the paper is organized as follows: Sect. 2 describes related work, Sect. 3 presents Methodology of proposed protocol, Sect. 4 presents Simulation Environment and Parameters, Sect. 5 shows the Results and Sect. 6 shows the conclusion.

2 Related Work

Multicasting is an effective group communication method to transport multicast data from one source to a group of users. This communication mechanism uses IGMP (Internet Group Management Protocol) [3] which allows a group of people to join and access the data freely. This open group participation of user communication by IGMP leads to snooping of data. Group key management has been introduced to overcome this kind of threats. Secret Group key is a shared key that is distributed to every multicast user to transmit the data. This key is used by sender for encrypting data and group members to decrypt the data. The requirement for secure group communication is forward and backward security, 1 affects n solution etc. [4]. Forward security guarantees that the current content is not accessible when a user leaves the group. Backward security guarantees that new user cannot access data which is communicated before his join process.

Chang and Kuo [5] developed a trust model based on Markov Chain to thwart against attacks. A Hierarchical security model through a decentralized multicast key management scheme in wireless ad hoc networks is described in Huang and Medhi [6]. In this approach, message overhead in key transmission is reduced and solves 1 affects n problem. In Bouassida and Bouali [7], authors demonstrated the performance assessment metrics for multicast-Group key management protocols (GKMP). They focused on four basic group key protocols – “Group Key Management Protocol for Ad hoc Networks (GKMPAN)”, “Distributed Multicast Group Security Architecture (DMGSA)”, “BALADE”, and “Hierarchical group key management protocol (Hi-GDH)”. GKMPAN is a centralized approach which enhances scalability and security of ad hoc networks. DMGSA protocol belongs to Distributed key management schemes, in which rekeying process is performed periodically. BALADE protocol and Hi-GDH

are the Decentralized schemes. The authors have assessed the Key delivery ratio, Delay and Energy consumption, and Packet loss for the above mentioned protocols with varying group size.

In SEGK model [8], authors developed a mechanism to guarantee the forward and backward secrecy in which recalculating of secret gathered key is done very often. In this model, Tree Links and Periodic flooding of control messages are the two techniques used to find the malicious nodes. The first one is used when the node mobility is not important and the latter used in frequent changes in topology. B. Madhusudhan et al. [9] developed a method called “Mobility Based Key Management (MBKM)” for multicast communication in MANETS. In this method authors proposed that Group/cluster head periodically performs the rekeying process. By that the multicast group ensures Forward Secrecy and Backward Secrecy.

3 Methodology of Multicast Symmetric Secret Key Management Scheme (MC-SSKMS)

In Multicast Symmetric Secret Key Management Scheme, Symmetric Secret Group Key is used for encrypting the data in multicast communication. And the same Secret Group Key is used for decrypting the coded data by the group members. This Scheme involves of eight major steps:

- (1) Mobile node deployment
- (2) Grouping of ad hoc network
- (3) Cluster head selection based on node id
- (4) Symmetric-key based Secret-Group-key Agreement
- (5) Multi-cast route estimation using AODV
- (6) Encryption by AES
- (7) Successfully receiving the data and decryption process.

After deploying the Mobile nodes, the members who wish to communicate form a multicast group. Cluster/Group head is selected based on node id. (The node with small id). Then the heart of our proposed protocol, Symmetric-key based Secret-Group-key Agreement, is implemented. In this step, each user runs two methods-Pseudorandom number generator and Symmetric Group Key Calculation. As our proposed protocol is implemented in distributed environment, each user contributes its share to prepare a Secret Group Key.

- (i) Pseudorandom number generator: This method produces output as a sequence of random numbers for each node by taking input as a seed.
- (ii) Symmetric Group Key Calculation: All the cluster nodes first apply the hash on this random number using SHA, and then the resulting message digest is sent to all other nodes of the group along with their id. Each node concatenates the message digest values of all users in increasing order of the user-ids and applies a hash function on the resultant string [10] using Eq. (1).

$$SGK = F(MD1, MD2, MD3 \dots MDn) \tag{1}$$

where MD_i is the Message Digest value, F is a Secure Hash function.

During group communication, Multicast version of AODV routing protocol is used to construct a route between sender and all other members. In this routing protocol, similar to traditional AODV, the path is determined based on route request and route reply messages. Source uses Advanced Encryption Standard (AES) as the encryption algorithm to encode the multicast data with 128 bit key size. All the members in the group decrypt the encoded data with AES decryption algorithm. The Overall block diagram of the “Multicast Symmetric Secret Key Management Scheme” through step by step procedure is shown in Fig. 1.

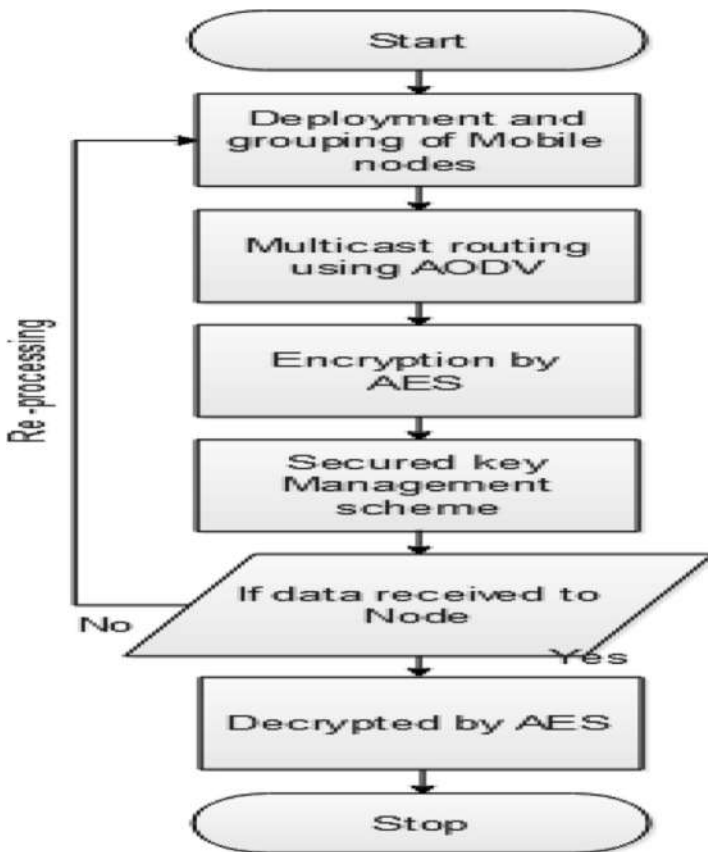


Fig. 1. Flow graph of Multicast Symmetric Secret Key Management System (MC-SSKMS)

4 Simulation Environment

We have done the experiments through NS2 Simulator. NS2 is an open source event driven network simulator to model and analyze the wired and wireless network traffic. We have chosen a Linux operating System i.e. UBUNTU 12.10, as Linux provides a numerous text processing scripts that can be used to analyze the packet transmission in NS2. We used Tcl (Tool Command Language) code which is as part of NS2 for implementing our work. We used CBR as traffic type for packet transmission and 1000×1000 transmission ranges for simulation. Tcl code generates two files namely NAM (Network Animator) and Trace files with different parameters as input. NS2 is used to model different kind of mobility models like Random Way Point model, Grid model etc. Our proposed protocol traffic is visually shown in NAM trace file. Awk programming is used to record the data values by taking trace file (.tr) as input. We have taken these recorded values and generated the graphs for our proposed method.

4.1 Simulation Parameters

We have considered the parameters (from Table 1), in our simulations to record values for the required performance metrics.

Table 1. Simulation parameters for implementing MC-SSKMS

Parameters	Value
Operating System	UBUNTU 12.10
Simulator Tool	NS-2(Version 2.35)
Mobility Model	Random Way Point Model
Routing protocol	Multicast AODV
Traffic type	CBR
Simulation Duration	50 ms
Max. Speed	20 ms
Transmission Range	1000×1000 m
Packet Size	512 bytes
Number of Nodes	20, 40, 60, 80, 100

4.2 Performance Metrics

We have taken three simulation metrics to assess the performance of symmetric group key agreement protocols.

- (1) **KDR (Key Delivery Ratio):** It is defined as Number of received keys divided by the product of the Number of transmitted keys and the number of Receivers using Eq. (2). It allows evaluating the consistency rate of the proposed protocol in terms of keys broadcast to the cluster members.

$$\text{KDR} = [\text{Received keys Number} / (\text{Sent keys Number} * \text{Receivers Number})] * 100 \quad (2)$$

- (2) **Delay in Key transmission:** The average delay of keys transmission (D) from the sender to the receivers is the time taken to transmit the group key to all the group members. To guarantee an effective harmonization between the encryption and decryption of data in group communication, this delay should be reduced.
- (3) **Energy consumption:** The Energy consumption (E) is described as the number of energy units required for delivering the keys to group members in multicast communication during the simulation.

5 Results

We have done the performance assessment of our proposed protocol with two existing protocols. First, we had shown the comparison of Key Delivery Ratio of MC-SSKMS with “Distributed Multicast Group Security Architecture (DMGSA)” and “Mobility based Key Management (MBKM)” protocols. The recorded values through NS2 simulations are shown in Table 2 and corresponding graphs are depicted in Fig. 2. It graphically visualized that our protocol has better Key Delivery ratio than other two specified protocols. Then we compared Delay of our proposed protocol with “Distributed Multicast Group Security Architecture (DMGSA)” and “Mobility based Key Management (MBKM)” protocols. The recorded values through simulations are shown in Table 3 and corresponding graphs are depicted in Fig. 3. It graphically showed that our protocol has less Delay than other two specified protocols.

Table 2. Results obtained for key delivery ratio with varying number of nodes observed from MC-SSKMS and other two contemporary methods

QoS	Key delivery ratio				
Nodes	20	40	60	80	100
DMGSA	80.9	89.87	84.9	83.34	83.9
MBKM	89.78	91.67	94.43	87.98	85.34
MC-SSKMS	92.85	94.61	96.74	92.7	89.91

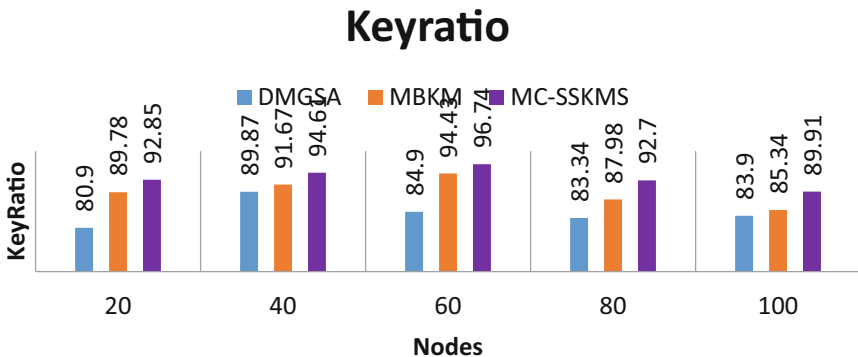


Fig. 2. Graphical representation of key delivery ratio for DMGSA, MBKM and MC-SSKMS

Table 3. Results obtained for delay with varying number of nodes observed from MC-SSKMS and other two contemporary methods

QoS	Delay				
Nodes	20	40	60	80	100
DMGSA	1.76545	3.34976	3.65748	4.56768	4.76896
MBKM	1.656479	3.106972	3.532987	4.324796	4.523796
MC-SKMS	1.312789	2.245609	2.689076	3.107033	3.888776

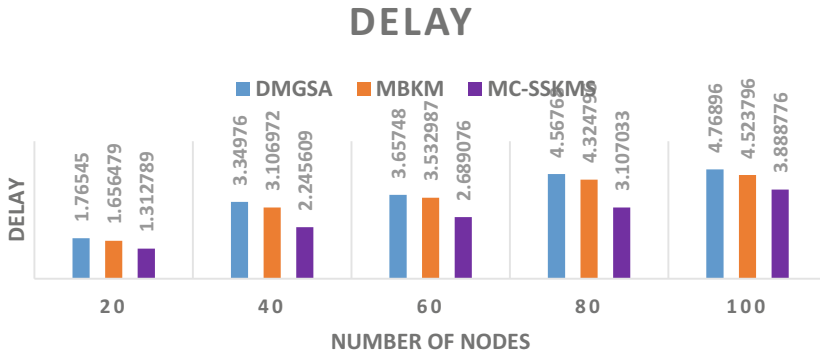


Fig. 3. Graphical representation of delay for DMGSA, MBKM and MC-SSKMS

Table 4. Results obtained for energy consumption with varying number of nodes observed from MC-SSKMS and other two contemporary methods

QoS	Energy consumption				
Nodes	20	40	60	80	100
DMGSA	23.7654	21.3245	21.1233	21.1034	21.3456
MBKM	24.24113	22.43122	22.21732	22.17674	22.56745
MC-SSKMS	24.17114	22.16345	21.94356	22.06782	22.34789

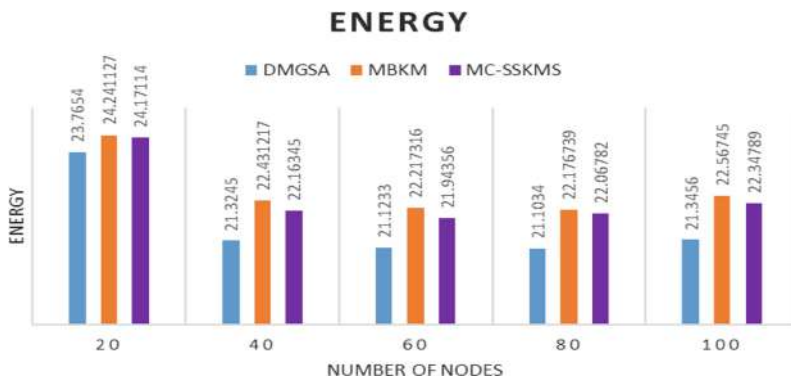


Fig. 4. Graphical representation of energy consumption for DMGSA, MBKM and MC-SSKMS

We compared Energy Consumption of our proposed protocol with “Distributed Multicast Group Security Architecture (DMGSA)” and “Mobility based Key Management (MBKM) protocols”. The recorded values through simulations are shown in Table 4 and corresponding graphs are depicted in Fig. 4. It graphically showed that our protocol optimized Energy Consumption than other two specified protocols.

6 Conclusions

We proposed a Symmetric Secret Key Management Protocol for multicast communication in MANETS. Compare to asymmetric key management schemes, symmetric key management schemes involves less computation. We used distributive environment, in which each user involves and gives its secret to calculate the shared Secret Group Key. AES-128 is used for Encryption and Decryption. Our proposed protocol provides security requirements like rekeying, forward secrecy and backward secrecy. Our MC-SSKMS protocol obtains better Key Delivery Ratio, less Delay and less Energy Consumption than DMGSA and MBKM methods with varying number of nodes. Due to dynamic rekeying process and efficient encryption algorithm, our approach gives less overhead and more security. We can extend our work to provide results for AES-192 and AES-256. And we can also compare the results with other dimensions like varying speed and traffic type.

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An Enhanced Virtual Private Network Authenticated Ad Hoc On-Demand Distance Vector Routing

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Abstract. One of the most frequently used protocol in the MANETS Mobile Ad Hoc networks is AODV the Ad hoc on-Demand distance vector routing. The protocol is open to various security threats. Through this paper we have proposed a novel Virtual Private Network Authenticated Ad hoc On-Demand Distance Vector Routing (VPNAODV) protocol which employs techniques like Virtual Private Network, Observer nodes and Digital signature to defend the protocol from attacks like flooding, wormhole, black hole, and Sybil attacks. Our proposed protocol enhances the basic AODV protocol while retaining the underlying functionality of the algorithm. Network Simulator-2 was used to simulate our results, we have compared these results of AODV with our proposed algorithm and found our proposed algorithm to be superior.

Keywords: VPN · Observer · Cluster · Digital signatures

1 Introduction

Ad Hoc Distance Vector network routing protocol is one of the largely used network protocol for routing in the MANETS. The protocol is Reactive in nature which indicate the updates are exchanged between the nodes on-demand while not in a periodic manner [1, 2]. The functionality of the MANETS allows each and every node which is a part of the network to behave as a specialized router, which can retrieve routes as and when required. These routes provided by the protocol are loop free. The bandwidth usage is considerable low as in case of any disintegrated nodes in the network the protocol does not need any additional advertisements. The neighboring nodes to have the exclusive faculty of detecting each other's broadcast messages. The principal objectives of our proposed algorithm are

1.1 Destination Sequence Number

When a new control packet arrives at the destination its sequence number is compared with the existing destination sequence value available in the route entry table, if this value is found to be more than the existing one then the value in the route entry table is updated followed by notifying all the nodes of this better route to the destination. This value can be altered by the malicious node to give an indication of a better route which

may result in the route entry table being modified and all the packets getting diverted through this fallacious node.

1.2 Hop Count

The algorithm prefers the packets having a larger value of sequence number and lesser hop count value. This characteristic can be used by the malicious nodes in order to present a false path with a smaller hop count by decrementing the current value of hop count.

2 Attacks on AODV Protocol

2.1 Wormhole Attack

A wormhole attack [3–5] disrupts the network routing, the nodes get an impression of the advertised link having hop count which is 1 or 2 hops shorter than the currently used path, and this may also lead to flooding and packet dropping. The attack is very dangerous difficult to recognize as these tunnels are concealed and out of bound in nature and won't be visible to the network.

2.2 Black Hole Attack

In this attack the malicious node [6] does not transmit the inward routing messages but drops them with an intention of reducing the routing information available with the other nodes. This attack is passive in character. The attack can be launched either arbitrarily, selectively or in mass making the destination inaccessible or downgrading the network communication.

2.3 Flooding Attack

In this attack the node chooses an IP address which is not available in the network. When the malicious node enters the network it establishes a path in between the nodes which already exist in the network. Once the path gets established the malicious nodes floods the network with a large amount of data packets which are invalid which result in congesting the network.

2.4 Sybil Attack

In this attack the malicious node [7] generates forged identity of additional nodes in position of a single node. This Identity can either be a duplicate Id or a fake identity. These fabricated identities used by the nodes are called Sybil nodes.

3 Literature Review

See Table 1.

Table 1. Literature review of various attack detection techniques

Attack type	Technique	Advantages	Disadvantages
Wormhole attack	Distance and location based approach to identify wormhole temporal and geographical	The techniques implements firm clock synchronization and global positioning system in order to coordinate all node	It restricts the distance of packet transmission and needs the nodes to be tightly synchronized
	Neighbor node analysis approach	The neighboring nodes are studied to make certain an well-organized and protected transmission throughout the network	In case of In order to maintain an accuracy in time by the nodes every node needs to be examined to detect the wormhole attack
Blackhole attack	A security-aware routing protocol for wireless ad hoc networks uses an Authenticated Routing for Ad hoc Networks	The protocol needs a secure server certification which helps the protocol to safeguard itself against attacks	The protocol fails to detect malicious behavior of these nodes
	Secure routing to prevent Black hole	Detects Black hole attack by modifying existing AODV protocol	Fails to detect corporative Black hole attack
Flooding attack	Node to node authentication	Employs node to node Authentication routing for Ad hoc networks	The protocol doesn't address issues related to traffic in flooding attack
	A profile based detecting scheme	Uses a threshold factor to detect the attacks	The system performance gets effected with this method

4 Proposed Algorithm

See Figure 1.

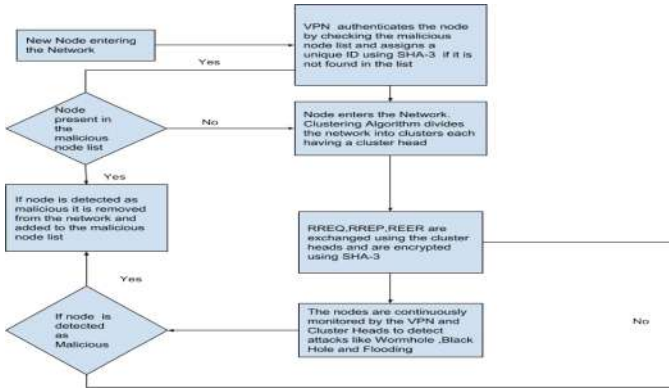


Fig. 1. Architecture of the EVPNAODV protocol

4.1 Key Management Configuration

Mobile Adhoc Network is constructed with ‘n’ nodes.

- A public and private key is assigned to all nodes
- The information of the direct neighbors at one hop distance is available to the nodes
- In order to send data node ‘S’ a relay node is selected by computing the distance to the destination node ‘D’.
- The Sending Node ‘S’ finds the next hop node and a forwarding node.
- Threshold for UB-THRESHOLD id assigned
- Read the RSS while sending data packets from source node add a new RSS with Node Address, rss, Reception time

IF table doesn't contain node address THEN

```

    IF rss >= UB-THRESHOLD, THEN
    Add-to-Malicious-list (Address
    Bcast-Detection-Update (Address) ELSE
    Add-to-Table (Address)
    Check private key and accept packet
    The source Send packets to destination node
  
```

4.2 VPNAODV Configuration and Security Setup

Source node sends a RREQ packet to the neighboring node for route identification.

- Neighbor node will verify RREQ packet for future processing nodes to reach destination.
- Node distance is calculated to identify neighboring nodes and to recognize optimal hop by hop communication.
- To stay away from the duplicate RREQ packets at the neighbor nodes the VPNAODV determines the routing packet by classifying relay value and forward value.
- Relay value and forward values are altered depending on information provided by the duplicate RREQ packets.
- RREQ packet is modified by organizing source address, destination address and previous interaction details.
- The last address field maintains the last transaction of the forwarded node.
- When a node receives a RREQ which has TTL = 0 or a RREQ with a similar Broadcast ID which is a duplicate entry will result in the P-Address of RREQ getting reviewed.

```

IF (Node == Address value in RREQ THEN
Set Relay value = 1
The node can participate in the destination node
discovery.
ELSE
The node can't participate in the
destination node discovery.

```

4.3 Message Encryption

Message Digest having a hash value of IV is used to supply the data integrity. The message digest produces a preliminary vector value IV which is present with the sending and receiving node. This message digest will be transmitted to the receiving node which will decrypt it.

The procedure to obtain the value of message digest as a key is as follows Message Digest having a hash value of IV is used to supply the data integrity.

The message digest produces a preliminary vector value IV which is present with the sending and receiving node. This message digest will be transmitted to the receiving node which will decrypt it.

The procedure to obtain the value of message digest as a key is as follows

- Whenever a node initiates a RREQ, RREP or a RERR an initial vector value of a hash function h' is used to create the message digest
- The initial vector sets the value of the Hash-Function = 'h'
- The initial vector value is used as a key which is available to all nodes.

- The next data transmission uses the initial vector value of the message digest where 'h' the hash function is a result of function 'h' applied on 'x'
- When even a node initiates a RREQ, RREP or a RERR it needs to verify the validity of the message by using the initial vector value in order to decrypt the message digest which was available with the target node initially, the hash value is used to decrypt and verify of the received value is equal to the Message-Digest field of received AODV message present in the Message Digest field

4.4 Sending Node

Assumption: The sending node and the receiving node have the initial vector value IV
Initialization process

```
While (Packets is available to be transferred) do; If
(Initial packet);
Set i=0;
Use SHAIV or sha3 as key to encrypt the packet C= E
(Message, IV);
Send packet(C); Continue;
Else (if not the initial packet) i++;
IV'= IV+i;
H= SHA3 (IV');
The packet is encrypted by using 'H' as the key C= E
(Message, H);
Send packet(C);
Continue;
```

4.5 Receiving Node

Verification is needed before the node accepts the packet to ensure if the destination is correct

```
The initial packet set the counter to IV While (packets
are available to be sent) do; If (initial packet);
Set i=0;
The packet is decrypted by using SHAIV as key. Message= D
(C, IV);
Send packet (Message); Continue;
Else (if not the initial packet) i++;
IV'= IV+i;
H= SHA3 (IV');
The packet is decrypted by using 'H' as the key. Message=
D(C, H);
Send packet (Message); Continue;
```

5 Simulation Results

The results are simulated in the existence of attacks like Wormhole, Flooding, Black hole and Sybil attacks. We can examine that the Average throughput, End-to-end delay, Energy Consumption Packet drop rate is superior in the case of our protocol VPNAODV even in presence of the attacks mentioned above which is represented by a redline.

5.1 Average Throughput

See Figure 2.

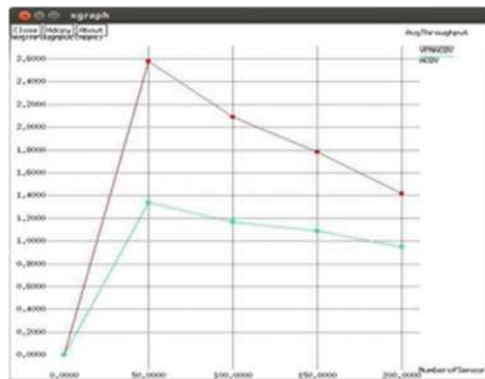


Fig. 2. Average throughput

5.2 End to End Delay

See Figure 3.

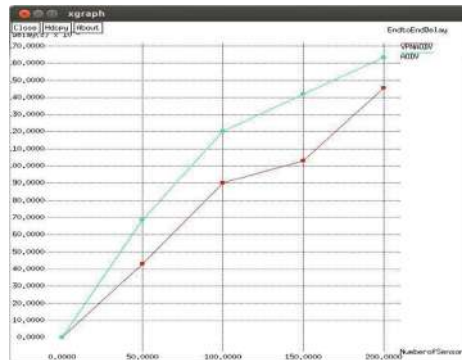


Fig. 3. End to end delay

5.3 Energy Consumption

See Figure 4.

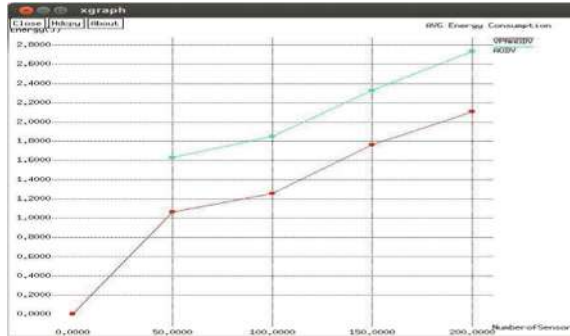


Fig. 4. Energy consumption

6 Conclusion

The algorithm is the major crux of the research work. The major contribution lies in the 2-Phase monitoring of the network which helps in monitoring the messages being passed in between the nodes and also encrypting them. When we compared our results with the traditional NS2 we have found our algorithm to perform better for parameters like Average throughput, End to End delay, Energy Consumption and Packet Drop Rate for various attacks like Wormhole, Blackhole, Flooding and Sybil attack.

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Safe Drive – Enabling Smart Do not Disturb on Mobile and Tracking Driving Behavior

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Abstract. One of the major cause for accidents is distraction. The risks of accidents increase because of attending to calls be it using Bluetooth devices or voice assisted calling. Existing solutions provide several apps providing modes like driving, home, office etc., where you can configure various do not disturb settings on the phone. However, these solutions only have option to turn off calling mode during driving. We present an innovative app and model using mobile sensors, crowd-sourced data, web services and feed, for smartly handling the calls. The proposed app will automatically put the phone in Do Not Disturb or Calling mode by smartly detecting unfavorable/favorable circumstances respectively. We present variance thresholding based approach on accelerometer data to sense the driving behavior and classify a situation as safe or unsafe to make or receive a call. Secondly, we provide a framework to connect to various services or apps and collect data to track historical data of accidents in the vicinity. Finally, we provide driver analytics and driving performance scores to incentivize safe driving practices.

Keywords: Accelerometers · Smartphones · Safe driving · Call management

1 Introduction

Research has shown that people who talk on phone while driving are four times likely to be met with an accident than those who do not [8]. People who talked on phone committed more traffic violations, committed more attention lapses, changed lanes less frequently but reacted quickly to events occurring directly in the line of sight [9]. It has become common for everyone to attend calls and browse their phones while driving. Many secondary activities particularly resulting from the use of handheld electronic devices are detrimental to driver safety [7]. Talking on phone while driving is considered as multitasking as a part of brain is used for processing auditory sentences [5]. The total number of road accidents during 2016 are 48 lakhs in India [10]. Modern leading mobile platforms like IOS added driving mode in version 11. It turns on “do

not disturb” mode by automatically detecting that the user may be driving. The feature can be disabled by the user [11]. While this is helpful, at times, people need to use phones even while driving. A safer way to use the phones for small duration during driving will be a welcome feature.

Researchers have worked upon determining safe driving behaviour using various sensor data available on mobile device. Authors of [1] used Android based smart phone, Nexus One, which contains Bosch BMA150 3-axis accelerometer. It configures the vehicle conditions and recognises gear-shifts relying on the accelerometer. It detects driving patterns of the user by accessing x and y-axis of the accelerometer. It detects the conditions of the roads travelled by the driver and makes a detailed map informing whereroad anomalies are present by using x and z - axis of accelerometer. Authors of [4] detect traffic honking, bumps and vehicle braking using Microphone, GPS, accelerometer. It utilizes GPS for traffic localizations. Authors of [2] determine whether a driver drives safely or not. It uses accelerometer and digital compass for measuring acceleration, deceleration, braking distance, and 2D and 3D rotation matrices for device orientations. S-Road Assist [6], an app available in Google play store, collects data of the accelerometer, gyrometer and GPS. It detects the orientation of phone in the car and uses that to detect anomalies in roads. It gives scores to driver based on the trip on various levels from beginner to expert. Authors of [3] present a survey on mobile phone sensing. The study includes various sensors on a mobile phone, viz. Accelerometer, GPS, Gyro meter, Digital Compass, Microphone and Camera.

In this paper we present a smart driving mode on a phone that, will adaptively turn on a “interactive do not disturb” mode whenever it senses unsafe driving conditions. It also limits the talk time to 2 min even during safe driving conditions. The interactive do not disturb mode responds to the caller by an appropriate message rather than ignoring the call. While in safe zone, it also reminds the user with voice prompts of any calls missed while in unsafe driving zones.

We use accelerometer data, as almost all phones have this sensor, and present an algorithm to sense the driving behavior (twists, turns, braking, speeding, and bumps). Secondly, we propose building and connecting to services or app collected data to track historical data of accidents in the vicinity based on GPS location to act as additional feature for detecting safe or unsafe zones. Finally, we propose a framework to collect report and reward driving behaviours to promote safe driving styles.

This paper is organized as follows. Section 2 provides an overview of features we propose in our app. Section 3 describes the methodology of detecting safe or unsafe driving conditions. Section 4 describes the app design. Section 5 presents our results and conclusion.

2 App Features

Our proposed app boasts of following features:

2.1 Smart DND Mode

Instead of completely silencing the calls, our app sends appropriate messages automatically when it is in “Do not Disturb” mode, like “driving, will call later”, or “too much traffic”, “curvy roads”, etc. The app can use auto speakerphone mode while driving. The app will also warn if the call is too long while driving. For important callers, whose call was rejected earlier because of unfavourable circumstance, the app will notify by voice prompts when in a favourable circumstance if user would like to talk to the person now and by “yes” from user, will connect the call. In case of an accident, the app will sense abrupt behaviour and report this to nearby hospital/police as well as near/dear ones configured in the app. Other users using the app can also get notified of the accident location, if they are on the same route, so as to caution them and prevent further accidents.

2.2 Recording Driving Behavior

As an extension to this work, we are also working on measuring driving behavior and classifying as safe, unsafe. Reporting it to concerned individuals if needed. Based on current speed, turn speed, variations in speed etc. we can determine the riding behaviour whether safe or rash.

Rating of drivers is collected over time. The data can be used by transport, courier services etc. to hire better drivers. We also mark road sections and subsections as safe/unsafe by analysing how many drivers ride in a safe/unsafe manner on that part of the road. This may help planning traffic regulation policies and manpower deployment.

App shall also educate people on good driving practices and share positive data from co-drivers in the city and also give a driving score to each individual encouraging them to improve. Such score can be used by local authorities to reward good drivers. The data can be shared via social networks like Facebook/Twitter etc.

3 Methodology

3.1 Approach

Figure 1 gives an overview of various sensors present of mobile device that can help detect driving behavior. We however only use accelerometer and GPS sensor as they are available on all mobile phones. Gyroscope sensor is present on mostly premium mobile phones. We collect 5 readings per second of accelerometer, then we do a moving average and variance of last 5, 10, and 20 s worth. We use the variations along x, y, and z axis to detect variations in speed, bumpiness of road, and twists and turns respectively. We use experimentally determined thresholds and define conditional rules to determine safe or unsafe condition. The process in essence is similar to a Decision Tree Classifier.

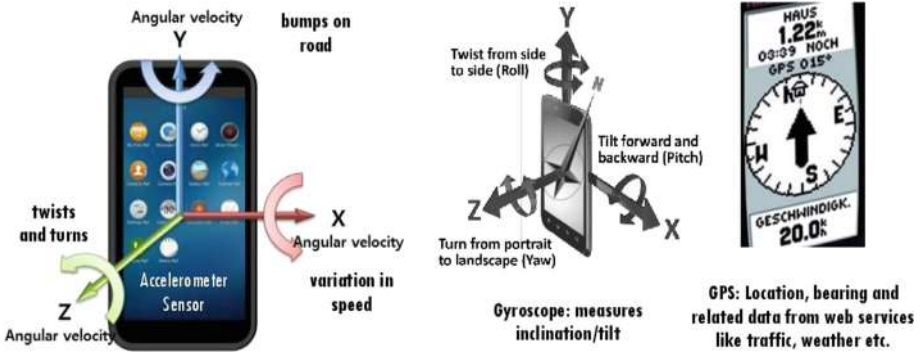


Fig. 1. Various sensors that can help detect driving behavior.

3.2 Data Collection

We collect the x axis, y axis, z axis information of the accelerometer five times per second. Then we calculate running mean and running variance as shown by following equations.

$$\mu_x = ((\mu_{xold} \times n - x_{old}) + x_{new}) / n. \quad (1)$$

$$\mu_y = ((\mu_{yold} \times n - y_{old}) + y_{new}) / n. \quad (2)$$

$$\mu_z = ((\mu_{zold} \times n - z_{old}) + z_{new}) / n. \quad (3)$$

Here μ is the moving mean, μ_{old} is the previous mean before adding the new point and x_{new} is the newly added point. n is the window size, for 5 s window $n = 25$. Based on the mean calculation we derive moving window variance, θ_x , θ_y , θ_z as follows. Here, s is the sum of squares of elements in the window.

$$s_x = s_{xold} - x_{old}^2 + x_{new}^2. \quad (4)$$

$$s_y = s_{yold} - y_{old}^2 + y_{new}^2. \quad (5)$$

$$s_z = s_{zold} - z_{old}^2 + z_{new}^2. \quad (6)$$

$$\theta_x = (s_x - \mu_x)^2 / n. \quad (7)$$

$$\theta_y = (s_y - \mu_y)^2 / n. \quad (8)$$

$$\theta_z = (s_z - \mu_z)^2 / n. \quad (9)$$

3.3 Threshold Based Method: Decision Tree Classifier

We experimentally determine threshold values τ_x , τ_y , τ_z for x, y, and z-axis respectively. The following algorithm present the algorithm used to classify safe or unsafe condition of driving.

Algorithm 1: Determine_safe_unsafe ($\theta_x, \theta_y, \theta_z$)

1. if $\theta_x > \tau_x$ or $\theta_y > \tau_y$ or $\theta_z > \tau_z$
 - a. return UNSAFE.
2. else
 - a. return SAFE.

3.4 Collecting Data from Social Websites

We plan to collect data from hashtags of twitter. This can be done by using the Tweepy module in Python. The tweepy module provides a functionality called “StreamListener”. Streamlistener is an instance of the program which authenticates to Twitter, provides it with some data such as hashtag which we are interested in listening. The Streamlistener after submitting the data continuously listens and waits for the response. Whenever a tweet is made with that hashtag (which satisfies our criteria) the twitter sends the data to this stream listener. This is illustrated in the Fig. 2.



Fig. 2. Collecting #roadaccident tweets from twitter server.

4 App Design

We designed the app using Android Studio requiring App Development in Java, XML, SQLite database, MP Android Chart Library, Web Services, Google Maps and web services. Figure 3 showcase the real time use of the app. Figure 4 shows the workflow of the app.

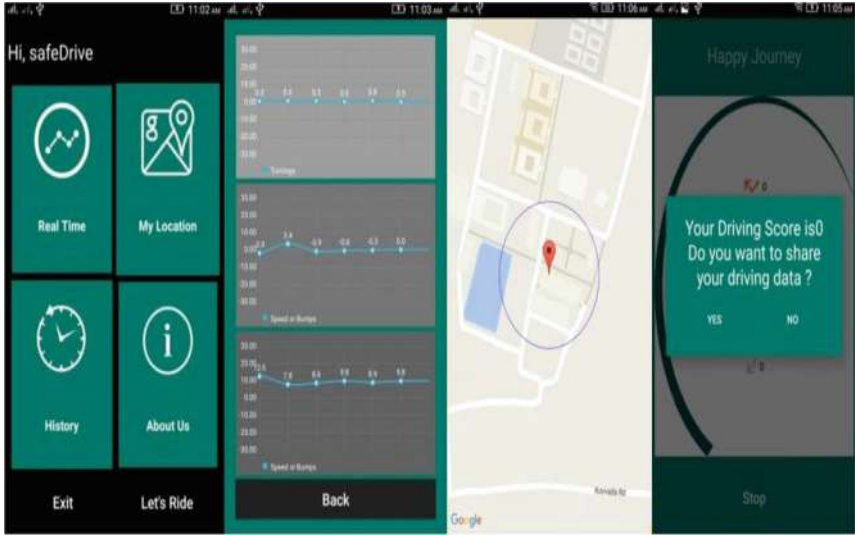


Fig. 3. Screen capture of real time use of safe drive app.

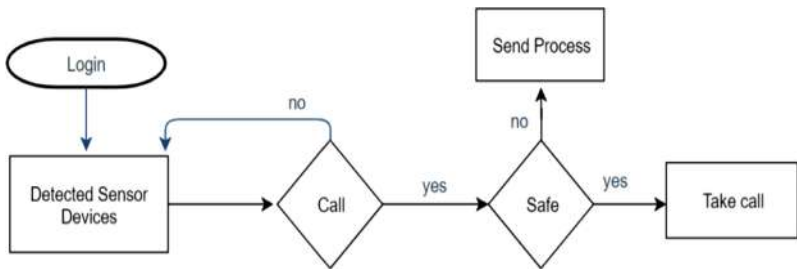


Fig. 4. Workflow of the safe drive app.

As shown in Fig. 4, after logging on to the app, the sensor devices concerned will be detected. Whenever a call is detected, the app will check whether it is safe to pick up the call as discussed in Sect. 3. If it is not safe to pick up the call, the app will perform actions as proposed in Sect. 2, else the app allows the user to pick up the call.

5 Results

Figure 5 shows some results of five second moving variance. Top row left shows the normal driving scenario on a smooth road without traffic. There is not much variation other than initial start and ending stopping times. The top right shows scenario where one is driving slowly in traffic. There is slight variation. Bottom left shows a bumpy road. Notice how there is more variation in z direction. Finally, bottom right shows scenario of acceleration from 0 to speed of 60 kmph. There is more variation Y initially and gradually drops as the speed smooth out.

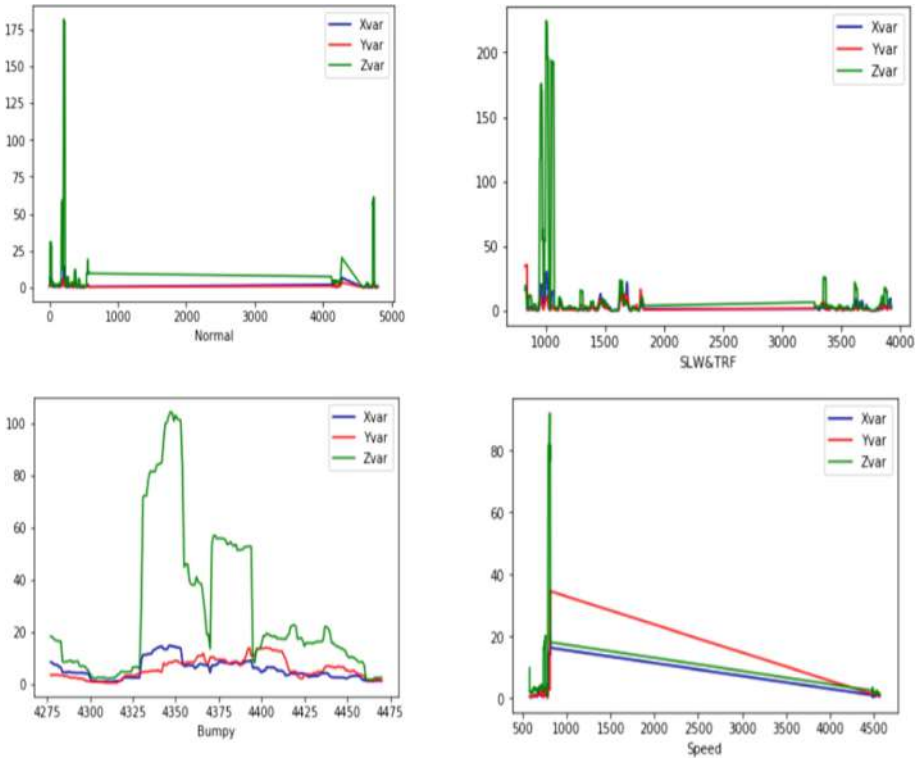


Fig. 5. Plots of 5 s moving variance. See text for more description.

Using thresholds of 20 in Y, Z, and X direction, we got quite appreciable results in terms of user experience, where user’s response correlated to the safe/unsafe decision made by our application.

5.1 Conclusion and Future Work

This article discusses the use of a Smartphone to aid the user by managing calls while driving. It uses built in sensors of the phone to reach conclusions with high accuracy. It automatically declines or allows calls based on the situation. This work can be extended to evaluate the drivers profile based on his driving patterns. Government canmake it mandatory for the drivers to install this app to decide whether they are reliable or not. The driver score can be considered while issuing the drivers license. It will also work as a proof for their actions in legal proceedings. In future we would like to include Gyroscope sensor as it can detect tilt, which is particularly useful for two-wheeler driver safety rating.

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Viability of an Uncomplicated IoT SaaS Development for Deployment of DIY Applications Over HTTP with Zero Investment

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Abstract. IoT administrations are ordinarily conveyed of IoT as physically disconnected vertical arrangements, in which all framework segments running from tangible gadgets to applications are firmly coupled for the prerequisites of each explicit venture. The productivity and versatility of such administration conveyance are naturally constrained, presenting noteworthy difficulties to IoT arrangement developers. In this context, we propose a novel SaaS structure that gives basic stage administrations to IoT arrangement suppliers to productively convey and constantly expand their administrations for DIY applications over HTTP with no investment required. This paper initially presents the IoT SaaS engineering, on which IoT arrangements can be conveyed as virtual verticals by utilizing figuring assets and middleware benefits on free cloud services. At that point we present the itemized instrument, usage of area intervention, which helps arrangement suppliers to productively give area explicit control applications by designing their own SaaS for IoT. The proposed methodologies are exhibited through the implementation of a sample experiment for building the need. A prototype proposed method is discussed in this paper.

Keywords: IoT · SaaS · DIY · HTTP · Multi-layer architecture

1 Introduction

Current Internet of Things arrangements are ordinarily given in single spaces [1], for instance establishing connections among components [2], assembling the board, using third party cloud services [3], etc. In such applications, domain specific [4] or on the other hand venture explicit necessities drive the plan of all framework parts and decide generally innovative components going from sensors and savvy gadgets to middleware parts and application rationales. The administration conveyance process is organized by IoT arrangement suppliers, who review target application situations, break down application prerequisites, select equipment gadgets, incorporate subsystems given by different merchants, create applications, give processing framework and keep up administrations all through the lifetime of the framework. Despite the fact that this

administration conveyance demonstrate has pushed the quick development of IoT organizations over the most recent few years [5], it prompts numerous physically detached vertical frameworks [6], in which equipment, systems, middleware and application rationales are firmly coupled [7].

2 Literature Review

Various studies show unparalleled attributes provisioned by IoT cloud service providers as seen in Table 1.

Table 1. Investigation into the current IoT software platform landscape; a feature comparison^a

IoT software platform	Device management	Integration	Protocols for data collection	Support for visualizations
Appcelerator	No	REST API	MQTT, HTTP	Yes (Titanium UI Dashboard)
Bosch IoT Suite - MDM IoT Platform	Yes	REST API	MQTT, CoAP, AMQP, STOMP	Yes (User Interface Integrator)
Ericsson Device Connection Platform (DCP) - MDM IoT Platform	Yes	REST API	CoAP	No
EVERYTHING - IoT Smart Products Platform	No	REST API	MQTT, CoAP, WebSockets	Yes (EVERYTHING IoT Dashboard)
IBM IoT Foundation Device Cloud	Yes	REST and Real-time APIs	MQTT, HTTPS	Yes (Web portal)
PLAT. ONE - end-to-end IoT and M2 M application platform	Yes	REST API	MQTT, SNMP	Yes (Management Console for application enablement, data management, and device management)
ThingWorx - MDM IoT Platform	Yes	REST API	MQTT, AMQP, XMPP, CoAP, DDS, WebSockets	Yes (ThingWorx SQUEAL)
Xively- PaaS enterprise IoT platform	No	REST API	HTTP, HTTPS, Sockets/Websocket, MQTT	Yes (Management console)

^aSource: "Comparing 11 IoT Development Platforms" - An article by Miyuru Dayarathna on Feb. 04, 16 • IoT Zone, DZone. <https://dzone.com/articles/iot-software-platform-comparison>

As IoT keeps on being received in additional, more organizations mesh into our everyday life through developments [8] like savvy cities, the inherent impediments of

such vertical frameworks have begun to develop. It is hard to expand administrations in light of the fact that such exercises frequently require changes [9, 10] on the whole framework layers. This work goes for utilizing cloud administration conveyance models to empower effective and adaptable IoT administration conveyance [11]. The center thought [12] is to understand a space autonomous customizable SaaS structure that gives fundamental stage benefits on cloud for IoT arrangement suppliers to productively convey and persistently broaden their administrations [13] for DIY applications over HTTP with zero investment.

The commitment of this paper is two-crease. First is the structure and usage of an IoT SaaS design. It acquires the multi-occupant character of cloud to empower an idea of virtual verticals [14], rather than physically separated vertical arrangements [15]. In virtual verticals, each IoT arrangement client possesses for all intents and purposes secluded arrangement can tweak to their physical conditions and gadgets while sharing the fundamental figuring assets and middleware administrations with other clients. The methodology is based on extensible space middle people that handle area explicit gadget and information models [16].

3 Proposed Engineering Architecture

To address the exhibited impediments and empower efficient and versatile conveyance of IoT customizations, we propose a layered IoT SaaS engineering architecture, outlined in Fig. 1. The IoT foundation comprises of organized labels, sensors, actuators, keen gadgets, etc. There are a wide variety of protocols used for IoT but the existing freely available cloud PaaS providers only work with HTTP to facilitate the joining of IoT framework with DIY applications.

Layer 7	Administration of SaaS; monitoring utilization by IoT end devices and users
Layer 6	Build or make-use-of interfaces for end-user visibility and access
Layer 5	Establish communication between end devices and cloud services
Layer 4	Design or Finalize services to be deployed onto the cloud
Layer 3	Customize IoT SaaS or build from scratch over PaaS based on provisionary
Layer 2	Survey on cost effective cloud provisions for IoT services over HTTP
Layer 1	DIY IoT end device hardware with customized code to suit end-users' needs

Fig. 1. A simple graphical representation of a layered architecture for development and deployment of the proposed solution; a bottom-up approach.

On IoT SaaS, two sorts of administrations identified with information are given to deal with continuous occasions and persevered information individually. Occasion

handling is to process and break down real-time occasions produced by tactile gadgets. In the IoT SaaS model represented in Fig. 2, the assets incorporate not just cloud assets for example, virtual machines and programming cases in customary cloud contributions, yet in addition IoT assets, custom coding for services per individual. The service to give control applications is to be itemized prior to customization.

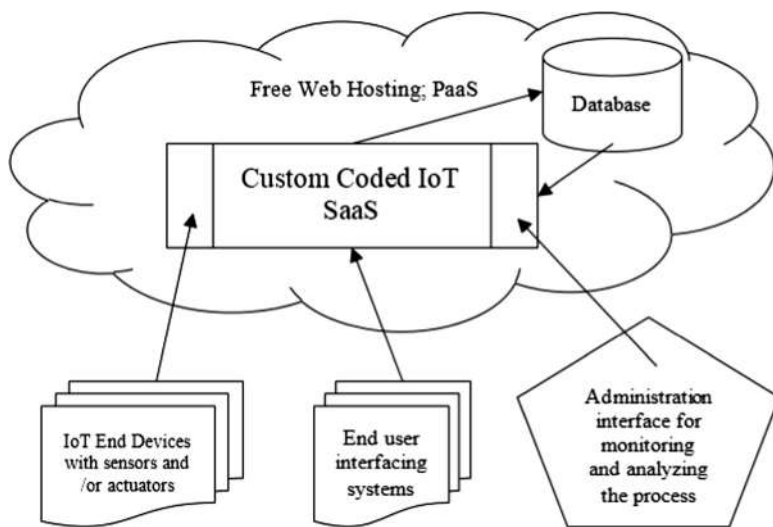


Fig. 2. Model representation of relationships among various elements of the proposed architecture

The metered data of both IoT and cloud assets is made to give a far reaching perspective for administration of utilization. In the long run, charging limits with different plans of action at runtime can break down the metered data concurring to charging plans charged by various commercial IoT cloud providers and lead to the utilization of freely available cloud services which could be easily custom coded to meet the needs given, a little investment in time and effort for gaining knowledge on programming while developing DIY IoT applications.

4 System Implementation

The implementation of IoT SaaS design is based on an open-source that can be expanded and altered based on users' motivation based on providers listed in Table 2 accompanying are arbiters point by point. With the goal that few event processors are required by the devices, the objective of this procedure is distinguished. The previously mentioned IoT commercial metering models are reached out from the fundamentals which are intended for big business benefits as opposed to IoT administrations for DIY applications. The way towards giving control applications on the IoT SaaS engineering is shown in Fig. 3.

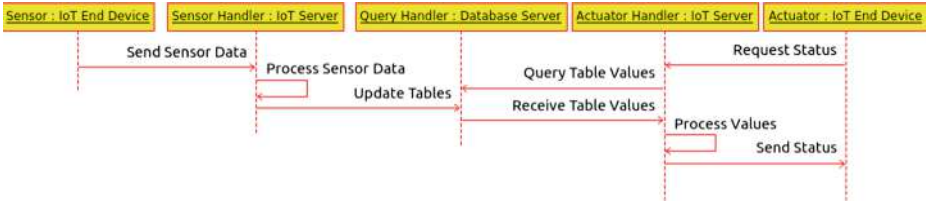


Fig. 3. Interaction among various elements of the proposed system

Each virtual vertical arrangement can settle to utilize the applications, which can be conjured using CISCO Packet Tracer reducing the cost of building by identifying the right equipment through simulation. Along the minimal lines of pseudo codes enlisted below are to benefit the IoT asset and the executives after they are created. The advancement should be possible by either third party designers or PaaS providers.

Pseudo code for, IoT end device sensor-

```

A: READ SENSOR VALUE
  IF SENSOR VALUE CHANGES
    B: CREATE HTTP REQUEST OBJECT WITH SERVER URL
    ESTABLISH CONNECTION OVER HTTP
    IF HTTP SESSION SUCCESS
      SEND SENSOR DATA OVER HTTP
    ELSE GOTO B
  ELSE GOTO A
  
```

Pseudo code for, server sensor handler over the cloud for IoT end device sensor-

```

A: LISTEN TO HTTP REQUEST
  IF HTTP REQUEST DATA NOT NULL
    ESTABLISH DATABASE CONNECTIVITY
    RECORD DATA ON DATABASE
    SEND HTTP ACKNOWLEDGEMENT
  ELSE GOTO A
  
```

Pseudo code for, IoT end device actuator-

```

CREATE HTTP REQUEST OBJECT WITH SERVER URL
A: ESTABLISH CONNECTION OVER HTTP
  IF HTTP SESSION SUCCESS
    GET STATUS, READ HTTP RESPONSE DATA
    APPLY STATUS ON ACTUATOR
  ELSE GOTO A
  
```

Pseudo code for, server actuator handler over the cloud for IoT end device actuator-

```

A: LISTEN TO HTTP REQUEST
  IF HTTP REQUEST DATA NOT NULL
    ESTABLISH DATABASE CONNECTIVITY
    RETRIEVE STATUS DATA FROM DATABASE
    SEND HTTP REPLY BY BINDING STATUS DATA
  ELSE GOTO A
  
```

5 Experimental Setup and Results

The experimental workbench consisted of CISCO packet tracer for simulation along with Apache JMeter (configured to match all the providers over a common scale) for testing the cloud providers.

Table 2. Implementation findings of major cloud providers for IoT deployments over HTTP. Highlighted rows specify zero investment PaaS providers suggested for DIY implementations.

Cloud Provider	Type of Service	Usage Policy for DIY deployments	Limitations for running services	Support for Customization	Complexity of customization
Google Cloud	IoT Core	Free Trial on expiry pay per use	None	High	Low
Amazon EC2 / Lightsail	IoT Core	Free Trial on expiry pay per use	None	High	Low
Microsoft Azure	IoT Core	Free Trial on expiry pay per use	None	High	Low
Blynk	IoT SaaS	Free Usage / Plan Based	Yes	None	N/A
ThingSpeak	IoT SaaS	Free Usage / Plan Based	Yes	Very Low	Low
MediaTeK Cloud Sandbox	IoT SaaS	Free Usage	Yes	Very Low	Low
Hostinger	Web Hosting (PaaS)	Free Usage / Plan Based	Yes	High	High
AwardSpace	Web Hosting (PaaS)	Free Usage / Plan Based	Yes	High	High

In comparison (Table 3) with the freely available services and the commercial services, the latter does provide a clear betterment in performance. But, when cost is a factor in comparison to the performance in the development and deployment of DIY

applications, the farther customization of freely available cloud services could be used. Zero investment here involved more effort and time involved as there are no outright services available at present to completely fulfill the needs of user requirements.

Table 3. Concise observations of various attributes of development and deployment over commercial (trial-usage) and free cloud providers.

Type of cloud provider	Estimated SLOC	Effort ^a (in person months)	No. of end devices supported (per second)	Average Response Time per HTTP Request	Average HTTP Overhead per Request
Commercial (Trail Use)	12	0.075	122	2.11 ms	356.91 Kb
Free	31	0.234	26	8.62 ms	567.46 Kb

^aFor an organic project where attributes are set to very low, moderate for commercial and free cloud services respectively, calculated using <https://strs.grc.nasa.gov/repository/forms/cocomo-calculation/>

6 Conclusion and Future Enhancements

This paper proposed IoT SaaS—a novel cloud approach that underpins effective and adaptable IoT administration customization using freely available services. On the cloud IoT services arrangement suppliers can effectively convey new customizations by utilizing assets and administrations, for example, space intervention; application setting the board and metering on cloud. The area goes between an extensible system for IoT SaaS to connect with different domain specific information models and give control applications that depend on physical gadgets, building the executives and two control applications are customizable to exhibit required DIY component.

The proposed engineering and reference execution is by and large additionally formed into a mechanical evaluation IoT cloud over HTTP. In the meantime, the future research can take a shot at the IoT SaaS will be led in two ways. First is to assess and show the asset utilization of IoT applications so as to successfully allot processing assets on the multi-occupant IoT administration stage. The application oriented asset model will think about gadget conduct, physical setting of utilizations, information handling prerequisites and use of designs. Second is to explore an individual cloud space for high availability and performance of IoT devices and cloud conditions.

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Novel Algorithm on Human Body Fall Detection

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Abstract. This research work provides a novel algorithm in computer vision for detecting human fall by the help of the trigonometric equation without any sort of machine learning or deep neural networks. Manual monitoring for fall detection can be very expensive as well as time consuming. There are many kinds of research on fall detection recently, but most of them either use wearable sensor technology or machine learning. Very few kinds of research have used image processing technique, where the end result is not much promising. Wearing additional sensors for detecting fall can be uncomfortable for senior citizens. Additionally, machine learning techniques, which requires heavy computational power of computers, might not be financially feasible for massive use, especially residential places. In this research, we have developed an algorithm, that depends on traditional computer vision and trigonometric logic, which requires very less computational power. This is ideal for massive use either for residential use or industrial purposes.

Keywords: Human fall detection · Algorithm · Computer vision

1 Introduction

Falls are a hazardous situation and quite common especially among elderly people, and this leads to additional injury, fracture, and other health issues to them. The frequency of fall, measured by World Health Organization (WHO), is measured as approximately 28–35% of people age of 65 each year increasing to 32–42% for those over age 70 years old [1]. Without the timely rescue, falls may even endanger their lives. It is very much required to notify someone immediately after the occurrence of fall so that they can take proper care before happening worse condition. With the advancement of technology, an automatic system that can detect the fall of a body will be much more helpful to save severe injuries.

One of the major concerns before designing an automated system for fall detection is the cost efficiency so that they can be used not only industrial deployment but also single residential use. In this paper, we present a new algorithm for fall detection which is light for computation, as a result, it is economic for deployment.

2 Related Works

Recently there have been many kinds of researches done on human fall detection. The most used techniques that are popular can be divided into two categories: wearable sensors and vision-based technology.

Wearable sensors are the most common types that are used in different hospitals. Bagalà et al. presented “Evaluation of Accelerometer-Based Fall Detection Algorithms on Real-World Falls”, where they introduced 13 algorithms for fall detection associated with wearable sensors (accelerometer and gyroscope) [2]. They got an average of 83% successful detections. Other significant researches on human fall detection based by wearable sensors are [3–9], which are not described here because of lack of space. One of the major disadvantages of wearable sensors is that the number of false positives is quite high. Also, it requires a portable battery, and wearing it all the time may be uncomfortable for the user.

Vision-based detection system requires one or more cameras for monitoring person activity, and it detects fall from the frames of the video. Generally, the camera either contains two-dimensional information, or 3D information, where the output is depth in addition to the 2D image. 3D cameras can be quite expensive depending on the specifications. Kepski et al. researched on fall detection using the data from a ceiling mounted 3d depth camera [10]. Rougier et al. also used 3D camera for head tracking to detect falls [11]. Miaou et al. designed a fall detection system using omni-camera images and personal data of the user [12]. Without personal information, the accuracy was about 70%, and with personal information, it was about 81% [12]. Recent years, machine learning techniques are very popular for detecting falls from videos. Liu et al. used k-nearest neighbor classifier [13] from 2D video information. Alhimalé et al. used neural network for fall detection [14]. Other significant works for detecting human fall are [15–18]. Using artificial intelligence increases the successful detection rate for fall of elderly people. However, one of the main disadvantages is that, they require heavy computational power. Pedro et al. showed that the computation of nearest neighbor search can be significantly improved by parallel calculation on the GPU [19]. However, the additional GPU or computer with heavy computational power is not financially feasible for massive deployment for residential and industrial sectors, because they are quite expensive. Additionally, it is also worth researching how much video instances they can work simultaneously.

In our research, we provide a very cost-efficient fall detection technique based on computer vision, that requires very low computational power to detect fall, and is a financially feasible solution for massive residential and industrial deployment. We tried to build a system which should be light and is able to detect the fall in real time. This method is very convenient in terms of computational power, so it can easily be implemented on small devices such as Raspberry-Pi.

3 Approach

Our novel algorithm is vision based, where we assume a camera is connected to a computer via a wired network, or wireless network. The camera is mounted on the wall for monitoring the desired person. Our algorithm won't work efficiently if the camera is mounted on the ceiling of the room. We used 2D video output for our research work and testing our algorithm. Our approach for human fall detection is described elaborately with details in Sect. 3.2, the pseudocode and pictorial view of our algorithm are provided respectively in Sects. 3.3 and 3.4.

3.1 Brief Overview

The algorithm predicts the fall of a person by comparing the frames. The brief overview of the procedure of our novel algorithm can be summarized by these four steps, the details of these steps are further described in Sect. 3.2

1. Subtracting the background from the frame.
2. Using thresholding and pixel manipulation techniques to get the optimal frame.
3. Using contours to detect the ROI (Region of Interest) changing from other frames.
4. Calculating the position of the body and determining whether it is a fall or not.

3.2 Description

To subtract the background from the foreground, we first use frame comparison between the first frame when video starts capturing and the current frame. The first frame will be either empty or can have objects in it. The absolute difference between current frame and first frame will find the objects or pixels that are changed relative to the first frame. In this way, we get the moving body from the background. But in this approach, there are several constraints such as clothes and background should not be of same pixel intensity as it may not be able to subtract background clearly.

For background subtraction, MOG2 algorithm can also be used. However, there are noise issues with the dataset that we tested with. To get finer foreground, we use silhouette of the body and applied thresholding, dilation and erosion by tweaking the parameters to get the desired output. In this way, we got rid of unnecessary noise and distortion of the moving object.

Contour is an outline or bounding box of a shape or something. With contours finding for binary image implemented in OpenCV, several numbers of contours come to picture [22]. To get rid of extra contours, we set a minimum area of the contour and extract only those contours which have larger area than the threshold area. As the method is getting applied to the background subtracted moving body, it is likely that contour will be around moving human or around a large object if it is moving. After getting the contours or Region of Interest, we bound the body with an ellipse as an ellipse is much more efficient in determining angles than that of a rectangle.

For an example, a rectangle will always return angle either 0 degree or $\pi/2$ degree. But with ellipse, it returns a variation between 0 to π degree. The angle of the body with both horizontal and vertical should be considered to determine whether it is fall or

not. Again, with some additional logical gate and parameters, the rectangle bounding box is also usable in this scenario. However, we found an ellipse to be more convenient.

Let α and β be the minor and major axis of the ellipse respectively. Major axis determines the width of the ellipse and similarly minor axis determines height. So technically, approximate height of ellipse will be $2*\beta$ and approximate width will be $2*\alpha$. However, when a person falls, the orientation may change, resulting the minor and major axis not to be same all the time while analyzing the video. Table 1 summarizes the symbols used in the mathematical expressions of our research, and Fig. 1 depicts the angles that are used to calculate the estimation of human fall.

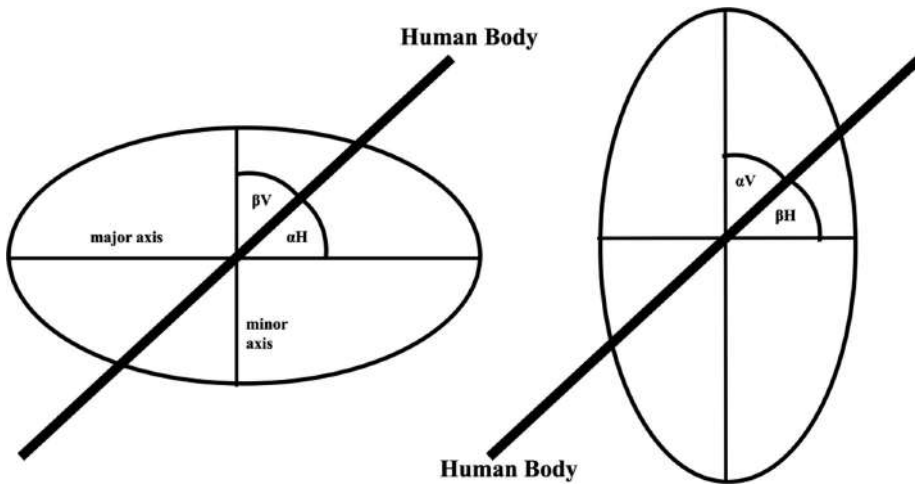


Fig. 1. Human body position with respect to ellipse while falling

Table 1. Symbols used in our algorithm

Symbol	Description
α_H	angle of minor axis with horizontal axis
α_V	angle of minor axis with vertical axis
β_H	angle of major axis with horizontal axis
β_V	angle of major axis with vertical axis

For a body to fall, we observed that if body leans over the angle of $2\pi/5$ from the vertical and an angle of $\pi/10$ with the horizontal and if it follows the following condition then it can be considered to be a fall.

$$\text{Abs}(\beta_H + \pi/2 + \alpha_V + 3\pi/2) = \pi \tag{1}$$

When the value of α and β are close while changing the orientation of the ellipse, their values require to be exchanged for finer tuning. The details are provided in the pseudocode in Sect. 3.3 (Figs. 2 and 3).

3.3 Pseudo Code

```

start
//Capture frame 1 and save that frame
firstFrame = CaptureFirstFrame()
while(true):
    //Calculate frame difference between two frames
    frameDelta= absdiff(firstFrame,current_frame)
    //Select the region of interest by contouring
    contourArea = ContourAreaOfCurrentFrame()
    foreach (number of pixel changed in contourArea):
        update  $\alpha_H$ ,  $\beta_V$ 
        if(Abs ( $\beta_H + \pi/2 + \alpha_V + 3\pi/2$ ) =  $\pi$ ):
            //update the minor and major axis value if
            //they are changed while body falling
            Gamma = Beta;
            Beta = Alpha
            Alpha = Gamma;
            //delaying certain time to confirm fall
            Delay(2s)
            Print("Fall Warning")
End

```

3.4 Pictorial View of the Algorithm

For testing our algorithm, we used the “Le2i” public dataset [20] for indoor environment fall detection. The demo of our research result can be found in [21]. The metrics used for evaluation of the performance of the algorithm are accuracy, precision, specificity, and sensitivity. They are defined as follow (Figs. 4 and 5):

Accuracy = $(\text{TruePositives} + \text{TrueNegatives})/(\text{Total number of Events})$.

Precision = $\text{TotalPositives}/(\text{TruePositives} + \text{FalseNegatives})$,

Specificity = $\text{TrueNegatives}/\text{TotalNegatives}$

Sensitivity = $\text{TruePositives}/\text{TotalPositives}$

The results of our research are summarized in Tables 2 and 3. The algorithm performs very well lighted environment. For testing purpose, we used total of 51 videos from the “Le2i” dataset.



Fig. 2. First frame which will be compared with all other frames and the areas changing will be represented as contours.



Fig. 3. Blurred frame to remove noise and retaining the as much information as possible.



Fig. 4. Silhouette of the moving body of human. This was done by thresholding. For finer tuning, dilation was added by image processing technique.



Fig. 5. Marking area of interest with bounding ellipse and determining angle and size of ellipse. Then using Eq. (1) to determine it is a fall or not.

Table 2. Results of fall detections

Event	No. of events	True positive	False positive	True negative
Falls	41	39	2	0
Sitting	6	0	1	5
Walking between falls	4	0	0	4
Total	51	39	3	9

Table 3. Performance of the algorithm based on metrics

Metrics	Performance
Accuracy	94.11%
Precision	97.61%
Specificity	90%
Sensitivity	95.12%

3.5 Limitations

The limitations of the algorithm are to compare frames not in reference to the first frame but relative to previous frames. However, there is a lot of noise when in comparing with other relative frames. If it is possible to reduce the noise with additional techniques, then results would be much better. The algorithm does not work in occlusion, it requires the full sight of the human body. So, for an occluded area, additional camera might be required for installation to avoid this limitation.

Another limitation is it compares the other frames with the first frame. As it is always comparing with the first frame, so when the first frame is not empty it may not display all the contours. The algorithm was not tested for a scenery of multiple person, our research assumes no warning is required in such scenario.

4 Conclusion

We used traditional Image processing techniques and mathematics to determine the angles of a moving body and determining whether a fall is happening or not. There is no requirement of any additional device or sensors that the subject under observation should wear all the time during observation. A simple camera needs to be installed in the room and the algorithm is enough for fall detection of elderly people. This approach is in real time and computationally light and economically feasible to implement, as it does not require heavy processing unit with graphics card or any kind of additional sensor. As a result, the maintenance cost of the system will also be very much economical for massive deployment in the industrial and residential sector.

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Sensitive Information Security in Network as a Service Model in Cloud-IPSec

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Abstract. The integration of material for use of the Internet, which is utilized by IT technology, is a cloud. The well-defined cloud is one of the best modern technology companies for product performance and changes depending on demand. Now, all the infrastructure of day-to-day business infrastructures, there is a lot of data necessary for the safe transfer of data through the Internet. This may include a company's confidential information about product designs, product expiration dates, patent owner information, human resources, job evaluation, etc. Currently, all organizations are waiting on the web. Conversely, the information necessity be moderated, although it can capture the information. Consequently, all customers must use the cloud. In Hacker's observation which in some cases is the immediate move that the sensitive information will be held within the virtual private cloud. The global security record during 2018, containing the data mobility in the cloud at about 86.67%, a global analyst estimates that this liming can be achieved at 100%. Therefore, this research paper focuses on IP security, which is a typical set of rules for obtaining Internet Protocol (IP) communication by verifying and encrypting the transfer of the information stream from the network routing as OSPF and EIGRP (Enhanced Interior Gateway Routing Protocol) protocol to implements, the effects of using the IP security tunnel on the Network as a Service in the edge router. AES - Encryption algorithm, SHA1 hash algorithm and Pre-Shared keys are used in the proposed structure. The looking at of the domino effect also shows to facilitate the ESP protocol is vaguely less effective than the header authentication protocol, which is obviously due to the ESP protocol that supports data encryption, where Cloud is implemented with GNS3, tested in the Wireshark to protect against attacks.

Keywords: IPSec · GNS3 · Cloud computing · ISAKMP · AES · SHA · Authentication · Confidentiality · Integrity

1 Introduction

NIST declared three services: PaaS, SaaS and IaaS. SaaS offers commercial software via the online channel. Pass service must provide all the necessary resources to distribute applications and services completely from the Internet without the need to download or install software. Pass service is designing, developing, testing, [1, 3] distributing and distributing applications. When SaaS, PaaS provides applications to customers, IaaS does not. It simply offers hardware, so your business can invest in

whatever it wants. Instead of purchasing servers, software, trunks, and pay for data center space, [5] service providers hire these resources.

In 2012 Wolf suggested that one of the latest cloud services is NaaS. New cloud computing model as a service in which to have access to additional computing resources, has collaborated with virtual PC, firewalls, routers and [1, 5] switches and ASA. Tenants can use NaaS to make personal transfer decisions based on application needs, such as load balancing, protecting sensitive data or packets and personal multicast services. The main perception of NaaS is to reduce the cost of exchange data and to better improve the network flexibility in the cloud consumers. It includes bandwidth and [2] flexible and extended VPN on demand (Fig. 1).



Fig. 1. Network as a service model in cloud computing

NaaS offers genuine network to users. The user can have as many numbers as necessary, sharing and implementing the required policy. With NaaS, a user can also have a network such as IPv4 and IPv6 departments working side by side or separately.

2 Related Work

Cloud encryption uses algorithms toward fashion a way to shield personal info. To ensure that data and data are kept secret, encryption improves measurement, measurement and implementation of the debut. On the other hand, it controls the function of honesty through the use of algorithms of [13]. John et al. have examined the powerful generation of IP-VPN cloud computing. The encrypted text to be decrypted and this can be referred to by the right use of “blind” [11]. In all organizations the network as a service Security problems are very powerful in the market. The protection of a network largely involves the use of programs and procedures for protecting the various network devices from unauthorized access [12]. Safe tunnels assurances, the integrity of the transmitted data and the legitimacy of the communications [7]. IPSec is set up at the top level the protocol is called ISAKMP, with the SKEME protocols at the lower level and a subset of Oakley Exchange keys [6]. Many institutions use a way to protect their systems using the corresponding algorithms. On the other hand, algorithms are also used to create security systems. Critics in 2013 through the protection of cloud cryptography are a reviewer, confidentiality, lack of respect and integrity required and recorded information on an internet server [15].

3 GNS3 with Cloud Implementation and Experiment

Cloud with GNS3 Authentication and Encryption algorithm to implement by using IPsec can provide different types of privacy and confidentiality, integrity, verification of source data protection and hour's access control. This requires the latest version of GNS3's open source code with a router and loopback network adapter where the IP address uses an NIO Ethernet node in a virtual cloud. C7200-advipservicesk9-mz. 152-4. S5. Image router images The Cisco C7200 dynamics are downloaded to the GNS3 open source website. Each dynamic has a unique idle number like 0x638500e0. The router defines Ethernet-e, Serial-s and Fast Ethernet-fe. Apiece router has its own blank number. Telnet cloud in Gns3 127.0.0.1: 5009, IP address and port number, generally VNC port numbers range is 5000 to 10000 and the UDP tunnel range is 10000 to 20000 and so on router. Integrated configuration for gate numbers and python 3.6.3 (Fig. 2).

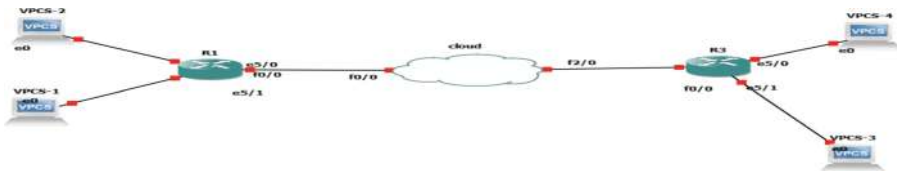


Fig. 2. Configure cloud with network as a service.

3.1 Proposed Technique IPSEC with Cloud Environment

In general, VPN is used to protect cloud computing over the Internet. A VPN can provide different types of privacy and confidentiality, integrity, verification of source data protection and hour's access control. IPsec provides security support at the IP level; the system can identify protocols and security systems needed to determine the algorithm using the cryptographic keys necessary to afford the service.

IPsec can be implemented and deployed in the one site and other site; like a router, gateways, vpcs, and both where in the network IPsec is deployed depends on the security [7] requirements of the users. The capability and implications are of the implementing IPsec at various network devices (hosts and routers). There are merits in implementing IPsec in both routers [2] and end hosts as they address different problems [6, 7]. The host implementation is most useful when security is desired end to end [6]. However, in cases when security is [13] desired over a part of a network, router implementation is desirable [7].

Algorithm: pre-desires are VPCS = VAP{VAP1,VAP2,.. .. VAPi}, Routers RE: = {series C7200 routers, re1, re2, re3 ...rem} and Cloud Cd: = {Cd-1, Cd-2..... Cd-n}. Below steps are 1 to 13.

1. Routing = {OSPF or EIGRP}, O = {Non-Securing and SHA Securing}, S = {Security algorithms}.

2. Set REO = Routing x O where, Iterative {for all d belongs to REO} : Iterative {re z € to RE, where z € to {1,2,3,...z}}, Set up and config ro on roz, Iterative {Inter configuration REO to S}
3. Start server with IP_x port, Loop {for all VPCS_j = VAP, where j = 1,2,...n}. Establish connection to Cloud at IP_x port. Set up all RE x Routing {re1,re2... rn with OSPF and EIGREP}
4. Set up REOS with Router. Iterative {re z belongs to RE, where z belongs to {1,2,3, ...z} and inner dz belongs to REOS is {OSPF & EIGRP x O X S}. Iterative do simulation.
5. Stop

Proposed Technique Implementation in Network as a Service Model in Cloud

1. Open all putty terminals
2. Enabling the terminals
 - a. Configuration of terminal
 - b. Set on the connecting for router | cloud| switch |Ethernet| serial line
 - i. Each router or cloud Assign the public or private IP address
 - ii. Configure the route of sensitive data travelling method through OSPF | EIGRP
 - iii. Configure loop and assign address (private or public address). No sh
 - iv. Creating or set crypto isakmp key keystring address peer-address
 - v. Creating or Set crypto isakmp key keystring hostname h_name
 - vi. Creating or Set crypto keyring k_name
 - vii. Design the Preshared-key address address key key
 - viii. Design the Preshared-key hostname h_name key key. No sh
3. Context ctname
 - a. Crypto map m_name ipsec-isakmp
 - b. Assigning or Set individual peer address (global | private)
 - c. Set or creating the isakmp preshared-key isakmp_key
 - d. Set or creating mode {aggressive || main}
 - e. Set pfs {group1 | group2| group 5}
 - f. Set or implementing IPsec transform-set transform_name
 - g. Match address a_name [preference]
 - h. Match crypto-group g_name {primary | secondary}. End/End /End
4. Algorithm for creating IKE Policy
 - a. Open all terminal by using putty
 - b. Enabling all router | switch | VCPN | cloud
 - c. configure terminal
 - d. making the crypto isakmp (Internet Security Association and Key Management Protocol) policy priority
 - e. implementing cryptographic encryption techniques {des | 3des | aes | aes 192 | aes 256}
 - f. implementing hash {sha | sha256 | sha384 | md5}
 - g. implementing authentication {RSA-sig | RSA-encr | pre-share}

- h. apply the Diffie-Hellman group {1 | 2 | 5 | 14 | 15 | 16 | 19 | 20 | 24}
- i. set the time (of working authentication | encryption) lifetime seconds. Exit Exit
- j. show crypto isakmp policy. Repeat these steps for each policy you want to create. Exit/Exit (Figs. 3, 4, 5, 6, and 7)

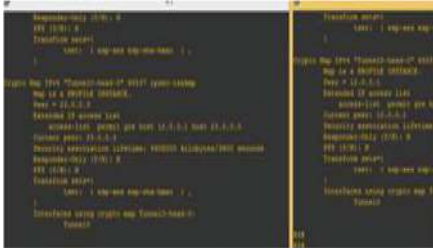


Fig. 3. Crypto map

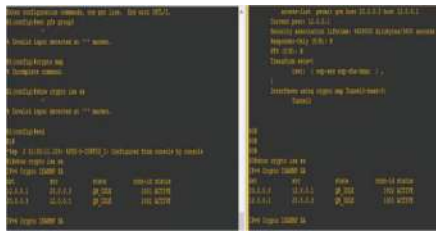


Fig. 4. crypto isa sa

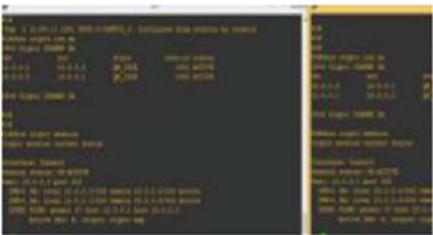


Fig. 5. Crypto session and verify



Fig. 6. Crypto IPsec security association



Fig. 7. Debug crypto isakmp and debug crypto IPsec

4 Analytical Analysis

4.1 Space Complexity

In IPsec Authentication Header size is 12 and ESP size is 10 bytes of constant header fields and size of the variable authentication data. In the specific field contains a data of the authentication is a method. IPsec uses for authentication keyed hashing for message authentication (HMAC). Now to analyzing and combined with the hash algorithm

(SHA-1) purpose of the security. Hashing techniques are implementing distribution keys for security. The size of the key is 160 bits in HMAC-SHA-1 and working of the algorithm is working in 64-bytes of the message block. They provide a truncated 96-bit (12-byte) ICV to meet the size of the IPSec AH and ESP authentication data. Now analyzing of Authentication Header size is 24 bytes per packets and Encapsulation Security Payload size is 22 bytes per packets. This overload is necessary for every security reason based on the authentication request to be transmitted in the form of a transport. In addition, 20 bytes of IP headers per packet are needed for the tunnel space at the tunnel site. Any Header compression mechanisms aren't used in total overhead of 44 bytes per packets (Table 1).

Table 1. IPsec header field sizes (Bytes)

Protocol	Transport mode			Tunnel mode		
	Fixed	Variable	Total	Fixed	Variable	Total
IPSEC A.H	12	12	24	12 + 20	12	44
IPSEC ESP	10	12	22	10 + 20	12	42

4.2 Time Complexity

4.2.1 Encryption or Decryption

Network as a Service in Cloud to implementing by the IPsec protocols by using encryption is AES-256. The encryption or decryption function of AES requires a constant number of steps representing the constant “c”. For example, AES-128 calls the key plan to generate the round keys, one step “light up” with a round key and then 10 calls to the rounding function, which in turn requires a constant number of simple steps - 16 in parallel applications. S-Box, a Shift Rows shift of bytes, 4 parallel applications of the linear function Mix-Columns (missing in the last round) and one step key add-round. The function of round in AES-192,256 is equal as the constant numbers. For each standard mode and bit length “L”, the number of calls in the AES encoder / decoder function is the linear function f (L).

The CTR or ICM (Counter or Integer Counter Mode) encoding function is $f^{CTR}(L) = \lceil L / 256 \rceil$ — (1)

Sometimes these spaces must do more than call the block number (for example, the GCM needs to make a limited field multiplication at the 128-bit block) but in normal modes they are always linear or constant in the length of the message. The function g (L) returns the number of “external” (non-AES) stairs as a function of the length of the message. Therefore, the encryption or decryption time of AES in each standard state is the line function of the message length, c.f (L) + g (L). For example, of bits of 512 and 1024 bits to apply the AES algorithm

AES 512 and AES 1024 bits Number of Rounds (Nr) = (N_k/32) + 6 — (2)

Where Number of 32-bit words in cipher Key (N_k) = (Key Size)/32. — (3)

4.2.2 Authentication

SHA1 fills the freshness data by adding 1 to 512 stuff bits. The SHA1 algorithm uses five intermediate 4-byte registers instead of four. Thus there necessity is a final message reports 160 bits. 4 chunk of 64 bytes to the messengers of achieve each had his own algorithm for 20 cycles step by step. In the specified feature is an active subscriber encryption calculation, the current log-in and continuous number. When looking for SHA1, it is conceivable to find that 10 to 13 operations per phase are required. Then getting whole number of operations (T) is estimated as per block of operations as in $1110 = 900 + 210$ $n = N/512, - (4)$ Where $N = \text{Input} + \text{Pad} + \text{Size}.$ — (5)

Input is the input text, pad is the padding field, size is the size field, and N is the total message size. The HMAC-SHA1 algorithm formulated as SHA1 (M0, SHA1 (Mi, Tp t)) where — (6) $M_0 = \text{Key ex-or opad}$ — (7) $M_i = \text{Key ex-or ipad}$ — (8)

M0 and Mi are two unmitigated form of the input Key and be generated by exclusive or key to complement the inner (512 bits) and in addition to the external ipad (512 bytes). Key is an capricious extent secrete key communal by sender and receiver. Tp t is the given input message subject to authentication. $N_k = (N + K)/512$ — (9)

$N_k = 1 + N/512,$ — (10) where, K is the size of the superfluous appended interior form of the key (512 bits). The total number of operations (T) needed for HMAC-SHA1 Is of O_{n_k} where, $T(n_k) = 32 + (2 + n_k) + 1110.$ — (11)

Delay: Delay is the travelling from R1 to R3 through the Cloud the total time is called delay. Based up the above Fig. 8 calculate delay and rate (Table 2; Fig. 9).

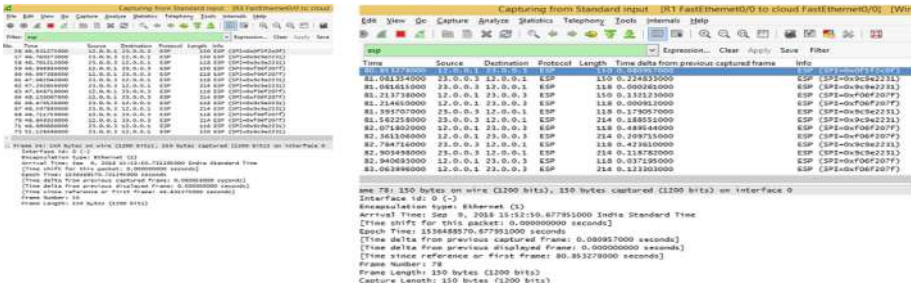


Fig. 8. ESP capturing from standard input R3 to cloud and R1 to cloud

Table 2. Time delay and time delay rate

Time Delay	
R1	R3
1565.479792	1597.731605

Time Delay Rate	
R1	R3
13.495515	12.781



Fig. 9. Time delay and time rate of R1 to cloud and R3 to cloud in network as a service

Above table mentioned reports are generated when random traffic is generated from R1 to Cloud and R3 to Cloud respectively.

Jitter: The receiving packets of in variation of the delay are called jitter.

By the Fig. 10 calculate the jitter from R1 to Cloud and R3 to Cloud in Network as a Service by using Wireshark with GNS3 (Table 3).

Table 3. Jitter and jitter rate

Jitter	
R1	R3
-0.152759	-4.161321

Jitter Rate		
R1	R3	Packet
-0.0010936	-0.033559	milli-seconds

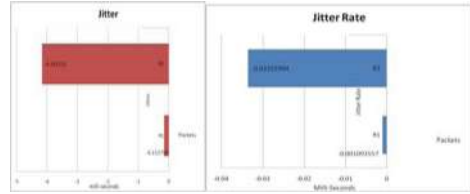


Fig. 10. Jitter and jitter rate of R1 to cloud and R3 to cloud in network as a service

5 Conclusion

Security is the foremost side in the each modern technology like cloud. Each miniature new attack is generated in the fretful field. Therefore, it requires the authoritative security mechanism to knob all classification of attacks. So, this paper focuses the strongest security mechanism. The security mechanism is IPsec to provide a nice way to secure the sensitive data when it is transferred through the Network as a Service of the Cloud building up a protective channel between receiver and sender. Since IPsec supply the Confidentiality and Integrity, Authentication and Anti-reply off to secure traffic over the Network as a Service in the Cloud. The information is routed by using the OSPF and EIGRP protocol the check model of the Network as a Cloud. If choosing any alleyway from the model, the packets are fully protected, encrypted and decrypted. Testing time comparison of time delay and jitter of routers R1 to Cloud and R3 to Cloud, by using Wire-Share analysis, it is not possible to lose the best performance analysis of sensitive data. In that case, sensitive data encrypted and fully secure communication channel used for sending and receiving the data. Sensitive data is encrypted to spending time, decrypted receiving them. By using Wire-Shark to observe the Encapsulation Security Payload (ESP) has performed authentication, confidentiality, and integrity for sensitive data to transmit in a protection communication media. So to calculate the time delay and jitter of the packets transmitted in a source to destination and destination to the source of the ESP in the NaaS. To observe in wire-shark, the packets were not to be dropped or less. Among the fully provide the security and authentication, confidentiality, integrity, and anti-replay to Network as a Service with GNS3 architecture have been adopted ensuring network security, routing, encapsulation and encryption to be performed by using IPsec tunnel and transport mode.

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Exploratory Data Analysis to Build Applications for Android Developer

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Abstract. In this paper, authors used the Exploratory Data Analysis (EDA) that embodies different patterns and find useful tidings from Google play store application (app) data. The intrinsic objective behind this is to analyze the features of the dataset in order to help the developers to understand the trends within the market and the end user needs towards the application, as well as the mechanism of App Store Optimization (ASO) that leads to enhancement of the popularity of the developer app.

Keywords: EDA · Optimization · Android apps · Google play store · Android app research · ASO · Data analysis

1 Introduction

There are over 7.7 billion [1] people in the world, out of which 2.1 billion people have Android devices [2]. Providing a new app to choose over the 2.5 million available play store apps would be a tough task for the developer. The purpose of this study is to assist developers to make their app more successful in Google play store. Android is a Google's mobile operating system which is free licensed software. The simplicity of android enables us to deliver vast applications. By the end of 2018, it occupied 85% of the global market [3].

From John Tukey words, Exploratory Data Analysis can never be the story, but nothing else can serve as the foundation story. We applied EDA as part of machine learning to answers the questions like what are currently trending apps? What are the most used apps by the users in the play store? And ratings vs reviews and category wise usage. In this paper we make a sense to the developer about App Store Optimization (ASO) in order to make the app more successful.

Authors applied machine learning analysis on data to help the developer to get a better idea. This work is intended to find the quintessential part of the apps so that developer grasps the utility of app based on the people's needs. As a developer, probing what user wants is time taking process. Our results can help developers develop features in apps that can improve their number of downloads.

2 Analysis

By studying existing work, the two crucial things for a developer is App Store Research and App Store Optimization (ASO). Initially, the purpose of app store research is to measure and find the trends and vital factors of present android market. You had a great product or service idea which you had to turn into a concrete and functional mobile app. Developing a great app is a good start but launching a new app with nearly 2.5 million [1] in the google play store makes it difficult to stand out and to be discovered from the other apps.

Secondly, app store optimization is to increase the visibility and discoverability of an app in the play store by using ‘ranked keyword’. After analyzing, understood that there is a significant relation between apps store optimization and app store research, which helps to increase the chance of getting an application successful for a start-up developer. Data is collected from Kaggle and applied exploration data analysis to unbox the useful insights about the apps in play store. EDA is one of the important aspects of machine learning, Exploratory data analysis (EDA) is an approach to summarize their statistics to know more about the data, often with visual methods. A statistical model is useful to make assumption, but primarily EDA is for seeing what the data can tell us to make useful tidings.

3 Design and Implementation

3.1 Mind Map: Smart Way to Build Application for Android Developers

The raw data collected from the dataset is unorganized and not in a clear picture, this makes us difficult to understand the information. In order to make the data organized, we are applying the EDA process as in Fig. 1. Exploratory data analysis is an approach of analyzing the data and summarizing their main characters often with visual methods. In the process of EDA, we have predicted results such as several downloads based on app size, average app rating, app with highest reviews, most used apps category wise, usage of free apps vs paid apps. Figure 2 shows how the EDA involves analyzing the insights via graphs.

3.2 App Store Optimization

ASO is just like a search engine optimization (SEO) [1] which provides app via keyword search in the google store and appears to be in the top searches. This makes possible to display the app to your potential users. Key things in the google play store optimization include

1. App Description
2. App Logo
3. App Name
4. App Category

There are certain organizations which provide the facility of ASO like Gummi cube, Lab cave, App Radar and some other agencies.

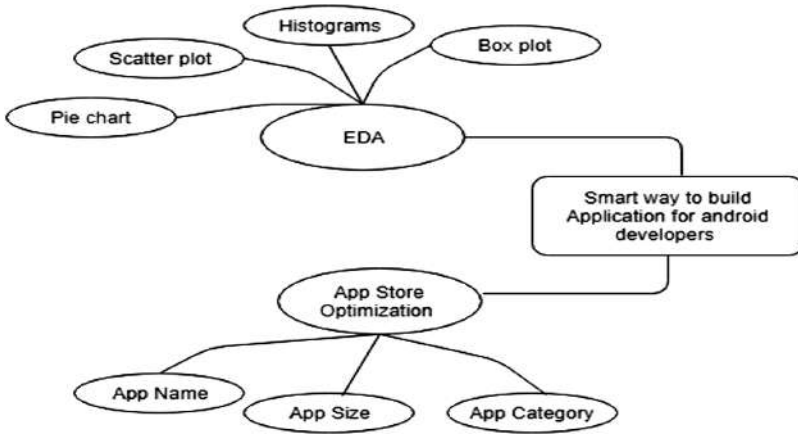


Fig. 1. Mind map

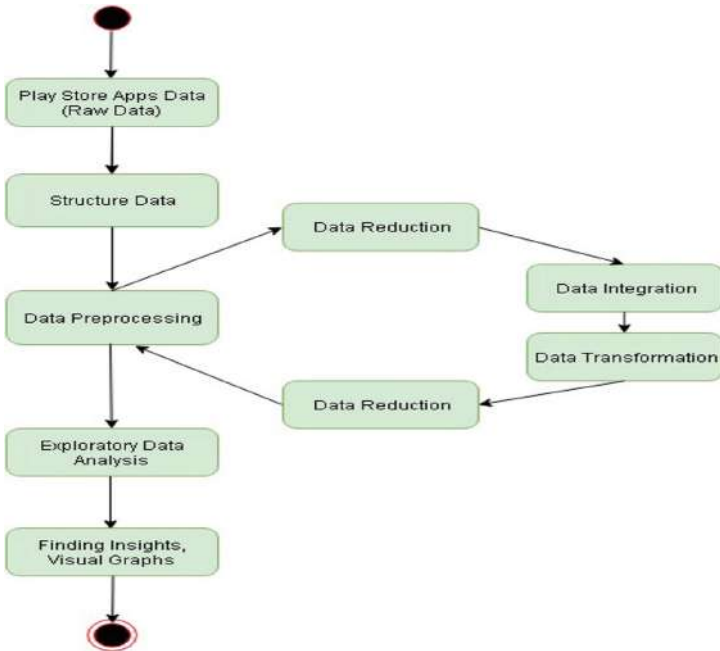


Fig. 2. Process of finding insights from data

4 Evaluation

In this study, Authors attempt to answer two things, firstly to help the Android developer to get better knowledge about the android market and the following thing is how to increase the developer's app search ranking.

To understand the android market, we used the EDA process to learn more about data insights often by using graphs. In this paper, we evaluate the following things and shown in Fig. 3.

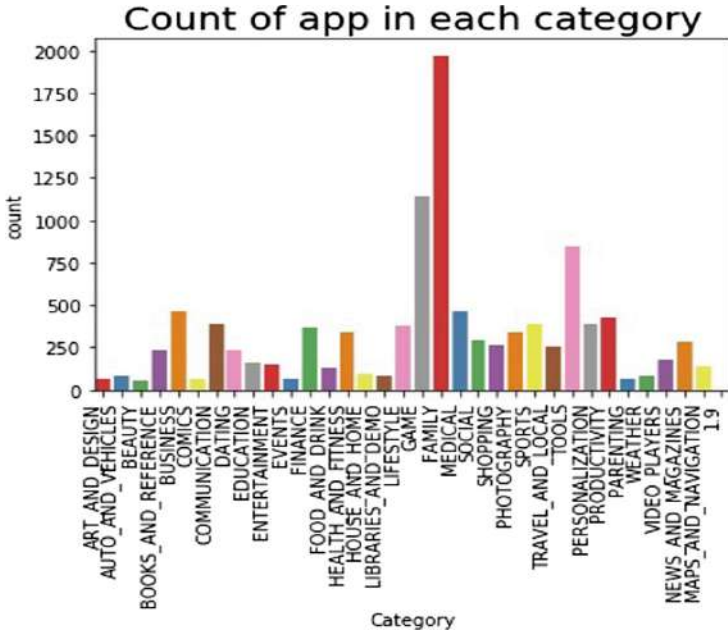


Fig. 3. Count of apps in each category

1. Average rating of apps are 4.2 [1]
2. Most of the top-rated apps optimally sized below 2 MB to 40 MB [1]
3. Most of the top-rated apps are optimally priced between 1\$ to 30\$ [1]
4. Medical and family apps are the most expensive
5. User tend to download an app that has been reviewed by many people
6. Most used apps by category wise are Family (Fig. 3).

App store optimization improves the visibility of mobile apps. Generally, when you launch your app on the play store you hope for a greater number of downloads and that 5 may not be possible if you are unaware of optimization. After applying ASO, developers can expect to increase the app downloads more than 1000% in a month [4].

As of the now the visualizations and analysis which had made are from the datasets up to 2018 but coming to the current statistics and analysis of the google play store apps were very different from our analysis of 2018. There were apps found to be more downloaded which haven't found even 2 years before. The following information is as of January 2019.

1. The average rating of current apps is 4.2 [1]
2. Number of Android apps in google play store-2,565,324 (Fig. 4)
3. Free apps and Paid apps available in the play store are 95.1% and 4.9% (Fig. 5).

Number of Android Applications



Fig. 4. Number of android apps in google play store [1]



Fig. 5. Free apps are about 95.1% and paid apps are about 4.9%

5 Conclusion

Every day, many apps have been deploying in the play store. This paper helps user to improve their understanding level about android applications. As a developer, if anyone want to develop an android application, EDI helps to analyze the android market and ASO aids to optimize your app visibility in the Google play store.

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Time Series Data Mining in Cloud Model

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Abstract. For attaining spatial time-series data in past one decade many of the attempts have been implemented on data sets to perform various processes for mining and classifying prediction rules. A novel approach is proposed in this paper for mining time-series data on cloud model we used walmart data set. This process is performed over numerical characteristic oriented datasets. The process includes theory of cloud model with expectation, entropy and hyper-entropy characteristics. Then data is attained using backward cloud model by implementing on Libvirt. Using curve fitting process numerical characteristics are predicted. The proposed model is considerably feasible and is applicable in performing forecasting over cloud.

Keywords: Time series data prediction · Data mining · Cloud computing · Data prediction · Libvirt

1 Introduction

With the speedy development of abstraction the data technology is particularly abstraction information acquisition technology will abstracts the information and implements based on many sustainable applications. The abstraction process implemented for performing the data processing or identification or discovery of data that performs pure mathematics on overall data to perform abstraction over databases in a cloud with the set of association rules. The abstraction process comprises of clump of rules based on which the evolution rules offer us with the robust weapon for creating abstraction information resources at a full length [1]. Some of the properties related to abstraction in our study comprise of properties such as time and statistical data inputs that play a crucial role in performing data processing.

The process of performing the time series prediction has become invariably in the most of the scientific fields where the study includes most of the subsequent aspects that are required such as analytic thinking or to perform similarity search or to generate a successive pattern mining or a cyclic pattern mining to obtain the time related knowledge for performing the statistic prediction [2]. The data sets are partitioned into a sequence or sub sequences for imparting the well identified characteristics for obtaining a pre targeted pattern that generates possible association rules by classifying the generated pattern over cloud.

The information mining technology is used to verify the obtained cyclic fragments over a predefined set of statistical data that is generated by imparting the alternate patterns that are based on the time series prescribed [3] for generating the cyclic association rules.

We are using the api called as Libvirt for accessing the native layer interface for KVM (the virtual machine used in the cloud model) which internally uses the cloud platform known as OpenStack to perform initial management operations over the virtual machines that loads and operates the cloud platform effectively. We have implemented the Libvirt library using php 5.0 as it supports xampp server too. We have used the toolkit for implementing the Libvirt using its API available [3]. The main package that is used by us is Libvirt-php package.

The analysis of statistical mining is at a great research interest where the square measure comprises of many shortcomings because of the sleek and distribution properties of data. In this paper we present a prediction model that support cloud model by imparting the Libvirt-php package for describing the time series prediction along with the usage of the virtual systems in the cloud environment using numerical characteristics such as: pictures information, then the virtual square measure standardization using cloud droplets. The process is implemented for performing the curve fitting to obtain prediction rules from even a dead cloud model too for calculating range values.

2 The Cloud Model

Cloud model is predicted to be uncertain due to its property such as qualitative and quantitative which are always uncertain due to fluctuating needs or dynamic requirements of a user or a service receiver. Due to this we use the quantitative conversion methods based on the mathematical models that are based on the randomness of data and fogginess of prediction. Using these two properties the major question is solved is how to map the cloud data for qualitative and quantitative aspects.

Definition: Let U_1 be a universal set, and C be the qualitative aspect that is associated to U_1 . Where there is a probability that for all x belongs to U_1 which is directly implemented for a possible constant $C_{degree} \rightarrow x$, the price prediction will meet the tendency of normalization $[-1,0,1]$:

$$\mu: U_1 \rightarrow [-1, 0, 1] \quad (1)$$

$$\mu: x \in U_1, x \rightarrow \mu(x) \text{ with } C_{degree} \quad (2)$$

In Eq. 1 and 2, the distribution of x on U is defined fat cloud is illustrated in Fig. 1 that shows numerical characteristics of the cloud using Libvirt.

For performing this operation the cpu usage or probable CPU usage at the cloud virtual servers can be easily defined as:

$$\text{Utilization of CPU} = 100 \text{ ns} * (DS_2 - DS_1) \quad (3)$$

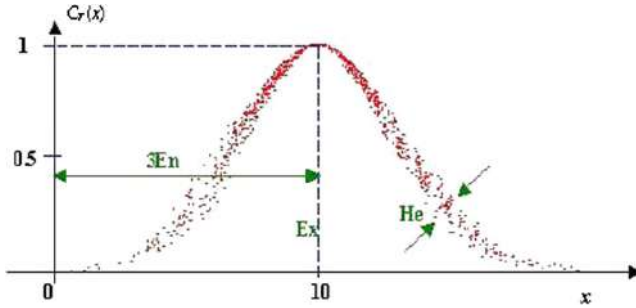


Fig. 1. The numerical characteristics of Libvirt

In Eq. 3, DS represents the data sets either on a dead cloud or an active cloud with the frequency of 100 ns which is ht default value of a virtual system that is used as a cloud server CPU measuring aspect.

In the Libvirt cloud model, we tend to use the expectation parameter with $E_{\text{expectation}}$ then the parameter entropy with E_{entropy} , and therefore the parameter hyper-entropy with H_{entropy} for representing the construct to be full.

The Expectation ($E_{\text{expectation}}$): The mathematical expectation of the virtual servers drop in a cloud are divided or distributed within the universal constant value 100 ns.

The Entropy (E_{entropy}): The probable uncertainty of virtual servers in a cloud model is measured with the qualitative construct for determining the possible randomness and opacity property of Libvirt cloud model.

The Hyper-entropy (H_{entropy}): this property will measure the uncertainty while measuring the Libvirt servers for entropy either in a dead virtual server or to verify the second order entropy in a live server to perform randomness measure of processing the entropy.

The generator that is used for backward cloud is always uncertain as the conversion model realizes the random conversion between numerical data and text data for performing mapping based on the quantitative to qualitative approach by using the language worth ($E_{\text{expectation}}$, E_{entropy} , H_{entropy}). Using these parameters the cloud model establishes the reverse and forward cloud generator models.

3 Libvirt Cloud Model

Various virtual machines are used in a cloud model to monitor solutions that are implemented on monitoring module which is a very crucial model in a virtual machine. The Ceilometer in a Libvirt library or API document is used to configure and use the model in php for monitoring all the components in a cloud model. For performing this we need to on the mentoring service in host model which is by default disabled in the config file without which the data cannot me collected and placed in to dimensions.

The Libvirt model will also hold the information such as the present state of CPU, the overall disk space utilized in the storage model adopted in the cloud which may be a

star Raid model or the mesh RAID model. Now a days a new model is also evolved called as hybrid RAID model which comprises of the most of the features. All these models are used to perform a write operation or a re-write operation in a cloud model either before mining the data or after generating the results as per the request of the user in a real time scenario.

4 Cloud Based Time-Series Framework

In the cloud model the process of time-series data processing is very crucial as the data in cloud increases drastically and the free size of disk will decrease due to which the cloud may fail. The time series comprises of huge data over a period of time that may be related to a shopping mall or a industry that is related to time based sales or our own experimental world. It comprises of some of the characteristics in cloud model numerically are:

The main plan of time-series data processing framework supported cloud model is as follows:

The process initiates with the extraction of experimental knowledge for a specific period of time on a time-series databases for obtaining the cloud droplets from Libvirt.

Then the next step includes the generation process of backward cloud for extracting numerical characteristics using the property Entropy over a cloud drop using Libvirt.

Then in next step all the obtained cloud drops will be compared with $E_{\text{expectation}}$ with H_{entropy} and the data items generated from virtual CPU's.

Lastly the obtained major rule is to fit all the generated items with the possible numerical characteristics for performing the prediction or forecasting.

4.1 Data Pre-processing

The major step in any cloud model is to perform pre-processing of data to generate the information which in-turn is required to generate the knowledge. The process includes the cleaning data and filling the missing values with a probable constant value or a with mean value obtained or any other statistical method adopted. The complete process is shown in Fig. 2 to obtain the cloud droplets.

4.2 Characteristics for Extracting Numerical Data

By considering the characteristics for extracting the numerical data from a given data set for obtaining the time series knowledge comprises of descriptions that direct with the interior information with the php info file over Libvirt API. Using this API we can create and modify the backward cloud generator frame work with cloud droplets over the attributes that comprises of numerical data. In order to obtain this process we need a model to be built with following properties of building model:

Statutory Test: for assuring the data set does not comprises of any random numbers or random numerical data we need to perform this statutory test on the complete data

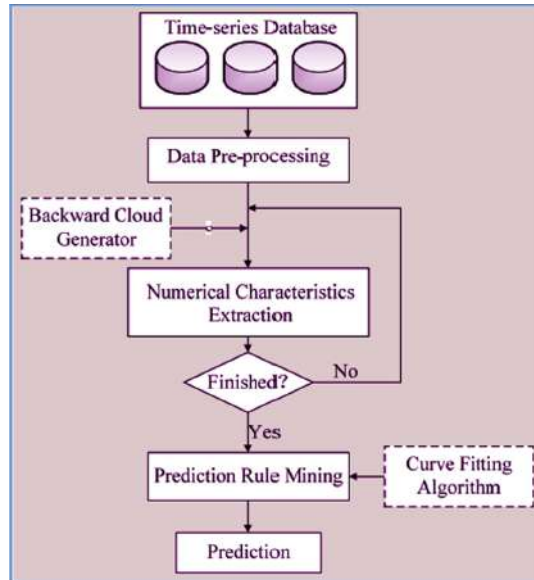


Fig. 2. The framework of time-series data mining

set or data cube available in cloud model. This process can be implemented using “pseudo-regression techniques” by initiating with the root test till the leaf test in a statutory order.

Sample Based Noise Test: after extracting the information from a data set or a data cube we need to perform noise test by using sample data set over the target data set which may be a shopping mall data set or any other scientific data set such as ARIES over the sequence of data to obtain the time series predicates.

Identification of a Model: the model is to be identified based on the calculated likelihood ratio, that specifies to either adopt a model estimate or not based on the parameters provided by Libvirt API for obtaining the optimal solution for identification of a dead cloud and to perform back tracking on the cloud model.

Testing the Model: the model is to be completely verified for any missing data or missing virtual servers that are not the part of cloud model by performing various types of noise test in the Libvirt model. Based on this input only the further data is extracted and modified based on the requirements.

Predicting the Model: in a cloud model the complete data is to be verified towards its consistency and completeness for performing forecasting or prediction based on the time series.

Complete Evaluation of the Cloud Model: for performing the verification of time series data over a cloud model we need few parameters data such as mean based absolute error then the root mean based square error and the overall percentage level of mean error are to be defined [11].

4.3 Prediction Based Rule Mining

Prediction is a process that is principally implemented on the prediction curves that are spotted based on the numerical characteristics that are extracted based on the curve algorithm that is imparted for attaining the time-series knowledge. This process is implemented for supporting the cloud model for performing identification of the curve fitting for a sample set using any one of the curve fitting techniques available in Libvirt. The main aim is to identify and select the promising time series knowledge with numerical variations that performs correct curve fitting rule for performing the prediction.

Based on the relation attained in between prediction objects and data factors is represented in Eq. 4 as:

$$W = n \sum_{i=1}^m \quad (4)$$

The prediction is performed on a prediction curve that is squared for a given constant value which ranges from 1 to m possible predictions for n time series for a window range W . here W also represents the curve fitting technique where the goods are predicted based on the time series by considering several constraints that are predicted for obtaining the target factors.

Cloud performance indicator is another aspect of the cloud data when we use virtual machines for forming a cloud the performance indicators represent the data that is collected from a data set based on its domain, though data which we are considering in this paper is only numeric data the `memory_status()` function will refresh the data in data cube that is generated over a period of time. But we cannot identify the cloud utilized or cloud status, because as the data is added to the cloud the memory leftover free will start to diminish which is the major disadvantage in time series data bases `cloud_memory_status()` function will provide this information regarding the memory usage and leftover.

4.4 Prediction

The statistic may be a written record over a series of observations that are made for generating the additional fitting curves which are also some times considered to be the square measure as foreseeable rules. Based on these prediction rules we can perform statistic knowledge prediction. Consistent with the data of the operate and time parameters, we are able to acquire relationship price of fitting curve operate.

For example consider the data points collected on various time intervals called as the cloud drops as shown in Fig. 3, which comprises of time series data obtained in summer which is the output after calculating the mean temperature values over a period of time.

Using the Libvirt API we and easily identify the relationship attained to predict and manage the conditions imposed for obtaining the time series knowledge for performing decision making. The numerical model or mathematical model is used to perform long trends towards seasonal changes and irregular temperature changes by considering the historical knowledge using the time series data. We are able to effectively predict the long trends in seasonal changes.

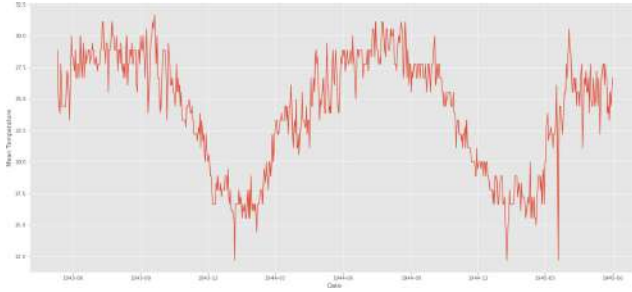


Fig. 3. Time series temperature data of Bangalore in summer

For performing this test we have configured the cloud on Table 1 specific environment.

Table 1. Experimental environment for cloud model

Sl.No	Name of component	Operating system	Storage size	Ram size
1	Controller	Linux	1 TB	4 GB
2	Compute	Linux	1 TB	16 GB
3	Huge Block Storage	Linux	1 TB	8 GB

The prediction results attained using times series are illustrated in Table 2.

Table 2. Prediction results attained over cloud model

Duration	Predicted data	Actual data
T1	83.78	83.21
T2	84.17	82.36
T3	85.72	85.88
T4	88.63	88.11
T5	75.35	79.25

We have used walmart data set to perform prediction of time series sales for a period of ten years and the results attained are almost matching with the actual sales.

5 Conclusions

Most of the present day abstraction knowledge have the time dimension which has the tendency to get modified over time. The statistical area comprises of the time dimension in abstraction that gets associated with statistical rules through statistic area for performing the association rule mining. In this paper we have used a Libvirt API for performing the time series knowledge rules for performing the data mining based on three numerical characteristics of cloud model. This model represents the options of

your time series knowledge then the digital options of a series of sample sets were obtained. Then based on these feature points the rule curve fitting was foretold for getting prognosticative models. And finally we have taken a data set of temperature and illustrated the cloud drops and the configuration of execution environment for obtaining the results.

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Multi-node MIL-STD-1553 Avionics Bus-Monitor Development Under Linux Platform

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Abstract. MIL-STD-1553 communication protocol is popular and extensively used in avionics applications. In 1553 protocol, Bus Controller (BC) schedules data in terms of messages to Remote terminals (RT) on the communication bus (Node). Numbers of Electronic avionics systems are connected on 1553 for the data exchange with Bus Controller. Data messages i.e. traffic on the bus is monitored by Bus Monitor (BM) which display and store data for analysis. This scenario is simple for single node as only one BC is available. In the case of complex scenario where numbers of communication channels i.e. nodes are more than one, data exchange take place simultaneously and monitoring terminals (Bus Monitors) are equals to nodes for communication. Avionics system consists of ‘n’ independent nodes with n Bus Monitors that are connected separately and that are running independently. There is no sync between these nodes and Bus Monitor to start data capture as well as time reference of events. This problem is resolved by development of single Bus Monitor for all nodes of avionics systems connected. In this paper we are presenting the system development of Bus Monitor which captures the data from n nodes of 1553 communication with time synchronization on single computer. As only one computer and Multi node 1553 card is involved, this technology enhances the data analysis capability and also cost effective for the avionics applications, mainly in the field of Hardware In Loop Simulation (HILS) that is used for validation of avionic system’s software in real time using multi node environment

Keywords: Hardware In Loop Simulation · MIL-STD-1553 · Bus Monitor · On board computer · Real Time Linux · Bus Controller · Remote Terminal

1 Introduction

Complex avionics systems communicate with each other in the form of electrical signals like analog and digital. Faster update of data and execution of control and guidance algorithm in hard real time are the vital requirement for communication interface between subsystems. The distance, electrical interface cable complexity contributes in drop and even total loss of signals. MIL-STD-1553 introduction in data communication enhanced the speed of communication of 1 Mbps with the simplicity in cable interfaces. This is more reliable and redundant protocol for avionics system as compared with the other serial communication protocols.

- (1) *Bus Controller (BC)*: The bus controller is responsible for initiating messages on MIL-STD-1553 data bus. The commands may be for transfer of data or the control and management of the bus.
- (2) *Remote Terminal (RT)*: Remote terminal either receives data or transmit the data on the bus. It has 32 sub addresses and each sub address can receive data up to 32 hex words.
- (3) *Bus Monitor (BM)*: Bus Monitor is a terminal that listens to the exchange of information on the MIL-STD-1553 data bus between BC and RT. Bus monitor collects all the data from the bus for analysis purpose (Fig. 1).

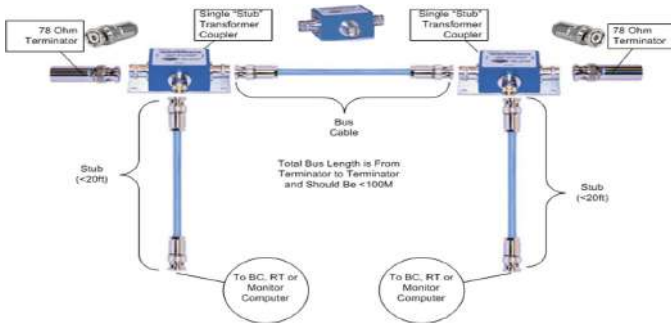


Fig. 1. MIL-STD-1553 bus components

Recent trends show that most of the serial communication channels are replaced by MIL-STD-1553 in avionics industry because of the advantages in speed and reliability. All data communication i.e. Ground systems to Embedded Computer for initialization and health checks of flight subsystems, Onboard Embedded computer to all flight hardware subsystems, 1553 interface is used.

Bus monitor plays significant role of continuously monitoring the traffic of messages on bus. It captures all the data which flows on the bus. The hex data is converted to the engineering units as per the Interface Control Document. In this protocol the information is sent with command word followed by data words. The following example explains the details of the message. Command word *0x0C98* stands that message is from RT to BC on sub-address-4 with data words 24 [6]. INS subsystem working as RT-4, the information may consists of about positions of vehicle (3 float variables) and velocities of vehicle (3 float variables) in the raw data [1]. This data captured by BM and converted to engineering units and this well-structured data is used for the analysis.

2 Problem Definition

On Board Embedded Computer (OBC) is configured as BC which interface with subsystems such as actuator controller, Navigation system are configured as RTs. Data is exchanged between BC to RT and vice versa interpreted in command word along with the hex data words information depending on the information to be send. When avionics systems use only one node then it is simple to capture the data on single Bus Monitor. It is essential that initialization and health checks have to be done before flight by ground system. Ground system computer (BC-1) communicates with onboard embedded computer (RT) seeking information for health checks and loading of initial data on node-1. After take-off i.e. during flight, onboard embedded computer become master (BC-2) and exchange data between subsystems (RT) on node-2. Before real flight, during HILS simulation runs, it is required to send data to INS from testing computer. This is configured as node-3. The environment of validating control and guidance in close loop and under hard real time environment is popularly known as HILS [3]. This configuration as stated above requires three Bus Monitors for monitoring and capturing the messages of three nodes. These BMs are running independently so synchronization and monitoring the reference of events occurred on another node are really challenging task. It is very difficult to predict the behavior or failure of simulation run if samples are not captured and not well synchronized. Configuration of Bus monitor for every node adds the cost and operational complexity in HILS testing environment. So the cost effective solution with improvement in performance and efficiency was the main challenge to drive the development of this project (Fig. 2).

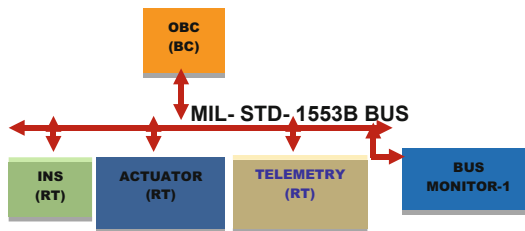


Fig. 2. MIL-STD-1553 bus components

3 Bus Monitor Overview

This development initiated with latest Intel i7 based computer architecture along with Linux operating system [9] (Ubuntu with real time kernel) and 4 nodes MIL-STD-1553 PCI based interface card [8]. Subsequently software is developed. Architecture of the software has three parts: data capture, extraction and online display [11].

3.1 Data Capture from Hardware

Bus Controller of each node is scheduling the messages systematically as per the requirement document which is available in form of Interface Control Document (ICD). There are different type of activities on Node-1, Node-2 and Node-3.

Initial data loading as well as health checks information to ground on node-1, avionics subsystem communication on node-2 and the incremental angles, velocities during HILS runs send to INS on node-3. The design of combined data capture application program is the main core of this architecture (Fig. 3). It is explained as flowchart (Fig. 4) and in terms of algorithm (Fig. 5).

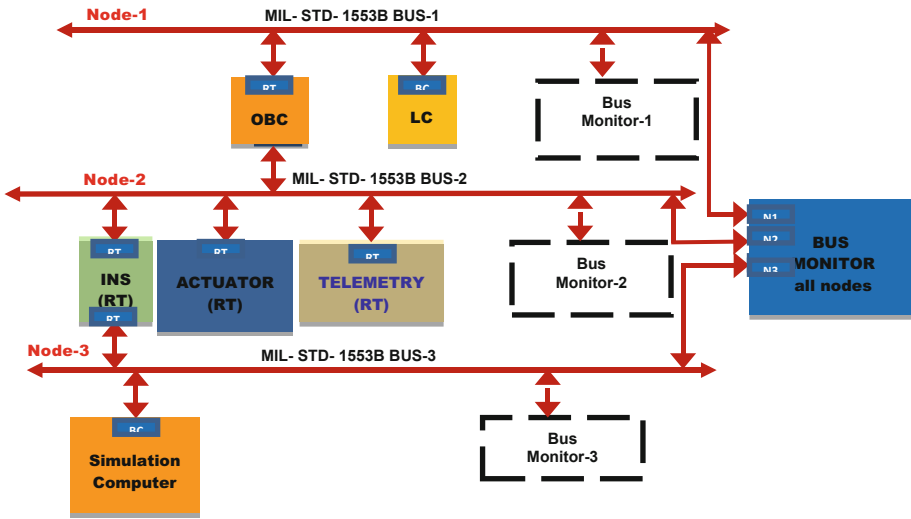


Fig. 3. Multi-node configuration of Avionics system and Bus monitor

3.2 Extraction Software Architecture

Extraction algorithm is written separately to convert the raw data to engineering units for each node and the function or method is called from the main program after data capture routine. These engineering data is displayed online as well as saved for further analysis with node number and time stamp.

Four node MIL-STD-1553 card from DDC is used for the development (Mini-Ace BU61688). Software development kit (SDK) provides the framework for developing drivers in real time operating system [8]. This card is configured under Linux (Ubuntu) operating system. Installation, compilation and configuration of the driver program is done based on the architecture of computer to access to the 1553 four node card. After running the device card manager program, 1553 card information is displayed (Fig. 4). DevNum is allocated to respective node to access the information and data of the card. All access to DDC hardware is performed through a high-level application programming interface (API) that encapsulate common procedures that the user would need to perform to setup and use a MIL-STD-1553 interface.

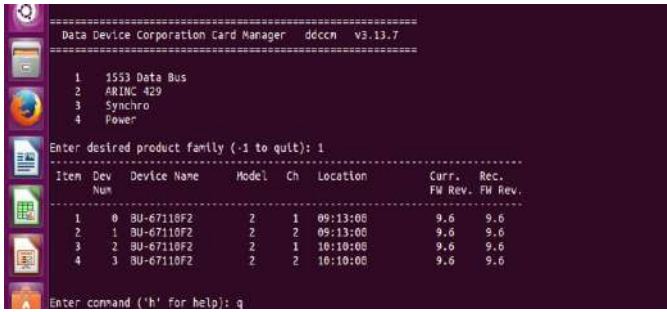


Fig. 4. Device configuration of 4 node MIL-STD-1553 card.

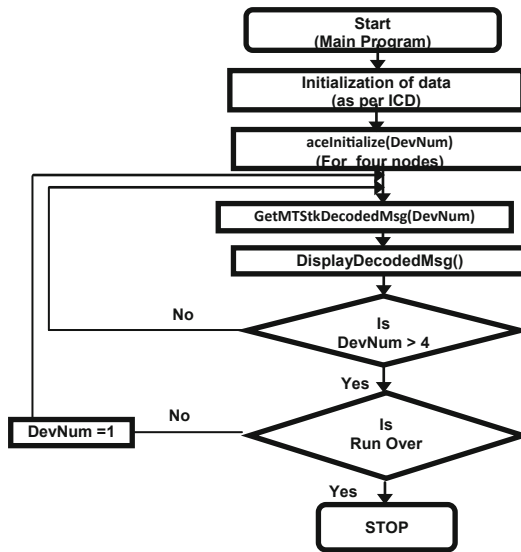


Fig. 5. Flowchart of application software

4 Software Development

Design of the application program under real time operating system is the main core work of this project. The framework of application software is designed with program in C software language under real time Linux accessing the card via driver program and display to the GUI using QT framework.

Application Programming Interface (API) `aceMTGetStkMsgDecoded()` is used for the data capture in polling mode for all four nodes.

In the HILS configuration the three nodes have to be configured, so the software is developed with four node 1553 card keeping the fourth node ideal. In the case of avionics systems it is possible that with the ‘n’ number of nodes, this bus monitor is capable of capture the data of nodes in polling mode.

Time Tag Register returns the value (0x0000–0xFFFF) in any stage after trigger. By default the resolution of TTR is 2 μ s, so this highly precise and reliable 1553 hardware timer is used for time synchronization. The first command initiation is done on node-1. This TTR value is used for computing time interval stamp. The saved data for each node is validated and analyzed as per the ICD and it is observed that all the data on each node is captured as per the requirement. Number of runs has been carried out before deployment of this software.

5 Integration and Testing

The fully integrated Bus Monitor with application program to capture the ‘n’ node data is tested in different configurations to test the performance of software and hardware (Figs. 6 and 7).



Fig. 6. 4 nodes Bus Monitor Execution program.

It is found that, number of samples captured by both manufacture’s software [12] and developed Linux based bus monitor is exactly same. Real Time Linux operating system’s performance [9] for capturing, extraction and online display is enhancement to the user as this software is easy for configuration, coding, extraction.

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Disease Prediction of Mango Crop Using Machine Learning and IoT

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Abstract. India is leading producer and an exporter country of Mango with annual production of approximately 19 tons, accounting for 40% of the world's total production. The production has been declined in recent years due to damage from pests and other disease-causing agents, in response to find a better solution to this problem the Prediction of Disease of Mango Fruit Crop using Machine Learning and IoT' is an advanced alerting system. The main objective is to develop a system that can forecast the attack of diseases on Mango fruit crop using past weather data and crop production. The field sensors collected live weather data to calculate disease prediction in real time. The Random Forest Regression model was trained on past weather data and used to calculate disease outbreak probability. The model showed pretty accurate results in relation to the forecasting of the disease.

Keywords: Internet of things (IoT) · Random Forest Regression · Machine learning

1 Introduction

Artificial Intelligence is helping farmers across the world to improve yield and adopt modern agricultural practices. In Maharashtra's Konkan region, Alphonso mango is a significant commercial crop. The Alphonso is grown mainly in western India; notably in Sindhudurg, Ratnagiri and Raigad districts and in remaining Konkan region of Maharashtra, India. India is a major exporter of Alphonso but, in recent years the world famous Alphonso was banned in major consumer markets due to foreign pests found in exported consignments. The pests and fungi were the major cause and dealt a serious loss to cultivators. Various pests attack mango fruit crop in its vegetative and reproductive phases. The different pests observed on the mango plant are Spiralling whitefly, Leafhopper, *Deanolis sublimbalis* and Thrips. The major harmful diseases to mango are Powdery Mildew, Blossom Blight and Bacterial Canker. Thrips pose serious damage to fruit and found to be deprecating the yield of mango farms. Mango thrips has been widely observed in recent years in India. In the very beginning of the Mango flowering stage flower thrips feed on petals, anthers, pollen, and floral nectaries, resulting in the

discoloration and malformation of panicles [1]. The weakening of the inflorescence and reducing fruit sets, bronzing of the fruit surface was also recorded due to the presence of air in emptied cell cavities which acts as an incubator for thrips. This effect is mostly recorded in mature and ripped fruits and these fruits are portrayed unsuitable for fresh marketing.

The flower thrips have a wide range of hosts, consisting of weeds that act as a refugee between mango flowering seasons and during the application of pesticides to mango flowers. The study of thrips species infesting chilli and other plants has been completed in India. However, thrips species investigation in mango orchards of Konkan has not been completed, although thrips has increased and referred as highly dangerous pest attacking mango inflorescences. Other dangerous consequences consist of the pest resistant evolution of thrips populations, pest resurrection and the outbreak of secondary pest infestations. Based on records, the consumption of synthetic pesticides in Southeast Asia has increased from 0.74 kg/ha in 1990 to 1.5 kg/ha in 2000.

Considering last few years continuous significant loss in mango production in India and Thrips are an increasing threat to the production of mango. This study is aimed at an advanced delivering probability of the outbreak of thrips. This study is based on finding patterns from past data and analyzing current data for predictive analysis of the outbreak of thrips. As a part of the study it requires analysis of local farm environment. The sensor network in targeted farms furnishes the real time data requirement. Prior to the actual implementation and use, machine learning algorithm is trained on past 20 year's data and prediction is done by the algorithm. The main objective of this study is to minimize the impact of thrips on the mango crop, which reduces the use of pesticides and reduction in the cost of production.

2 Related Work

Several works has been done in the domain of plant disease prediction and detection using various computational tools approach.

The thermal indices play an important role in the thrips population [1]. In a particular study the correlation between thermal indices and Thrips outbreak were analyzed. Thrips count is recorded using method of gently tapping shoot or panicle and holding a white paper in the palm in the orchards on weekly intervals. For analysis, mean count per panicle was recorded and weather records were collected using agro met observatory located in the experimental area. The peak in the thrips population was observed in the flowering phase. The stepwise regression analysis revealed that maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, and sunshine hours are the factors, thrips population dynamics depends on [1]. Several ranges in thermal indices were studied and a positive and significant correlation regarding the thrips population has been revealed. The correlation helped to predict the Thrips outbreak in advance.

The convolutional neural network models with different layers are found to be very good in image processing and have been used to perform plant disease detection and diagnosis very precisely [2]. The models were trained and tested on publicly available images dataset of healthy and diseased plants. Training was provided with an open

database of 87,848 images, containing 25 different plants in a set of 58 distinct classes of [plant disease] combinations, including healthy plants [3].

Among these models best performance architectures reaching a 99% success rate in identifying the corresponding [plant, disease] combination (or healthy plant) was found.

In India farmers mostly prefer manual monitoring of crops and some smartphone applications, but these apps have lot of database limitations, feasibility issues and are only bound to disease identification and detection part. The technologies used were broadly classified into 2 algorithms namely Artificial Neural Network and Machine Learning algorithm [4]. ANN was used to detect disease and pests along with soil analysis. The machine learning algorithm used classification and regression tree to predict crop condition. Prevention is better than cure, this approach aims at predicting the attack of pests/diseases in the future thereby making farmer to prevent such attacks. The technologies preferred earlier were applied to the dataset obtained from open source platforms and showed very good results.

Organic farming produces highly nutritious fruits with good yield. The disease forecasting model greatly helps farmers to prevent the pest/insects attacks and minimize the use of pesticides. This system will help in moving towards organic farming practices. In the Mango pre-harvesting phase the excessive use of fertilisers and pesticides affect the fruit quality and soil fertility [5]. The system provides very required time for taking preventive measures to deal with this kind of situation.

3 Methodology

3.1 Data Acquisition

3.1.1 Area Survey

Survey of five villages in Devgad Taluka was conducted to find general trend in outbreak of Thrips in those areas. General Findings of survey were as follows (Fig. 1; Table 1):



Fig. 1. On field data acquisition setup

Table 1. Survey data of thrips outbreak

Month	Outbreak intensity
December	Very low
January	Medium
February	High
March	Low to very low

3.1.2 Data Collection

The low-cost weather data collection system was developed using ATmega Micro-controller board and temperature and humidity sensors [6]. Data for live monitoring was collected from on-field IOT kit in the month of February. The data from the module was continuously synchronizing on things Speak cloud [7]. The module had the advantage of sensing local temperature and humidity which help in increasing accuracy of prediction. Modules were set up in Devgad Tehsil of Maharashtra district where Devgad Alphonso is registered under GI 379 [8] in Geographical registry of India. In recent years it is largely hit by a sudden attack of thrips. Historical data of 20 years about temperature and humidity were obtained from the meteorology department of Vengurla, Sindhudurga. The data was in the format of min & max temperature and humidity of Sindhudurga district. The live weather data can be used for weather forecasting using time series analysis models which will increase accuracy in disease prediction [9].

3.2 Disease Prediction

Past data was used to train random forest algorithm along with real-time data obtained from the field of temperature and humidity. The score was given on basis of the intensity of the outbreak and it lies within range of 0.3 to 0.9. The score was decided and standardized after discussing with the cooperative society of mango producers. Benefits of this scoring system were observed in model prediction (Fig. 2).

Bias and Variance should be minimized by an efficient algorithm. Decision Tree provides low Bias but it is prone to over fit [10]. Therefore, multiple trees are implemented together which is known as the ensemble method. This model is Random Forest. Random Forest produces hundreds of decision trees, sometimes thousands of decision trees [11]. During training of this algorithm, random samples are used by each and every tree in the Random Forest. Single sample may be used multiple times in different trees. This process is called bootstrapping. Prediction is done by every tree in the random forest algorithm. As single tree in the random forest is trained by different sample it results in low variance of the forest even if each tree has high variance. Finally the prediction is made by averaging the predictions of each decision tree in the random forest. Recently Credit spread approximation and improvement has been done using RFR. The importance of the Random Forest algorithm among different learning algorithms is studied by Fernandez-Delgado et al. [12]. Random Forest captures the interaction between the target and the features, both linear as well as non-linear. Random Forest is an additive type of model in which each base model is added to make

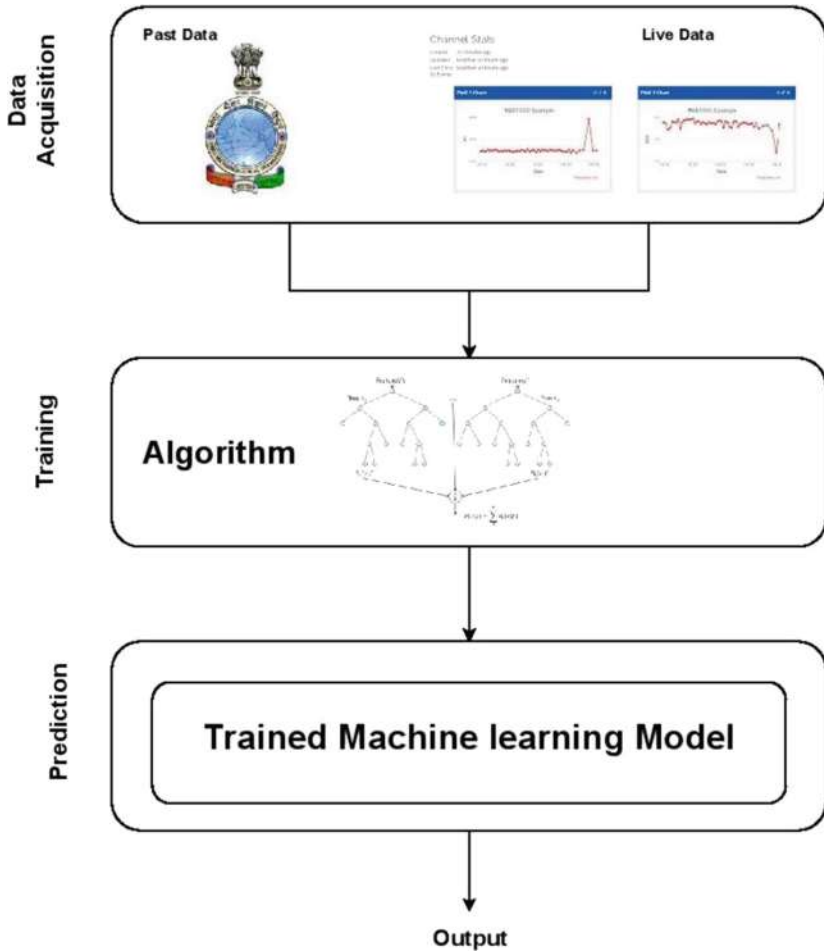


Fig. 2. Architecture of proposed system.

a combined decision or prediction. The base models are the decision trees. Ensemble trees increase the accuracy of the data prediction. In the prediction of the disease, Random forest algorithm was used because it gave a low mean absolute error.

4 Result and Analysis

Temperature and humidity data was given to algorithm as input for prediction. Algorithm predicted attack value ranging from 0.9 to 0.3 for each day. Average value of five days was calculated to predict likelihood of outbreak of disease in next five days. Short interval was considered because outbreak period of Thrips is very short and farmer has to take action as quick as possible. Second reason was short period average has considerable impact of each day attack on average likelihood.

From Table 2 it is observed that difference between average prediction by algorithm and feedback given by farmer is very less, i.e. it lie between + or -0.07 of error. Farmers were alerted two days prior to predicted timeline. It has helped farmers to take prior preventives which can inhibit the outbreak of Thrips. It was found that farmers who were alerted in advance have average feedback of 0.35 to .4 after taking preventive measures. Table 2 shows the feedback given by second group farmers who were not alerted in advance. Major difference between feedbacks of two groups can be observed in the Table 2.

Table 2. Prediction of algorithm and feedback by farmers

Date	Average of prediction by algorithm	Feedback given by farmer	Difference
Jan 25-31	0.43	0.5	-0.07
Feb 1-5	0.625	0.6	0.025
Feb 6-10	0.74	0.7	0.04

Results obtained by parameter tuning shows that n_estimator at 20 gives the lowest error. Table 3 shows parameter tuning for best combination of parameters. In this study n_estimator with value 20 shows least error. As this study opted regression approach to solve the prediction problem, algorithm with least error on testing data is best fit method. It means that difference between predicted and actual value is very minimal. Regression approach was used because prediction of attack cannot be given as binary output due to uncertainty of weather. This regression approach helped farmers to decide what preventive measures should be taken depending upon current outbreak status, prediction of outbreak and available resources etc.

Results obtained by parameter tuning shows that n_estimator at 20 gives the lowest error. Table of error for different values of estimator is as follows:

Table 3. Error for different values of estimator

n_estimator	Mean absolute error	Mean squared error	Root mean squared error
20	0.0467	0.0066	0.0817
35	0.0479	0.00723	0.0850
50	0.0472	0.0072	0.0849

Table 3 shows parameter tuning for best combination of parameters. In this study n_estimator with value 20 shows least error. As this study opted regression approach to solve the prediction problem, algorithm with least error on testing data is best fit method. It means that difference between predicted and actual is less.

5 Conclusion

Disease prediction helped farmer to minimize the loss due outbreak of thrips. It helped farmers to take a preventive measure which has minimized loss of yield. Also reduction in quality of mango is prevented which will help farmers in increasing income and fruit quality. Random forest algorithm is proven to be pretty accurate in predicting likelihood of attack of thrips. This technique has helped farmers to take preventive measures which has impacted productivity of farm and reduced use of chemical pesticides on crop. Gradually it will prevent incidents of occurrence of foreign flies in fruit lot exports.

The system can be extended to roll out in Mango orchards with more precise on field sensors. The low implementation cost will help in micro farming in India. The image processing using convolutional neural network to assess current health of plants can be integrated with this system which will surely give very precise forecasting results. The already developed accurate models of disease detection and classification can also be used in hand with this system to increase throughput.

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A Methodology to Find Artifacts of the Hacker in Man-in-the-Browser Attack

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Abstract. Man-in-the-browser attack is an evolved version of man-in-the-middle attack which mainly targets the internet banking. These attacks fall under the category of session hijacking, so, it is difficult to detect and stop the malicious actions as they are performed using legitimate session. Computer forensics plays a prominent role in finding the traces left behind by the hacker while compromising a computer. These traces will explain how the attack was carried out, which could serve as an evidence in the court proceedings.

Keywords: Hacking · Session hijacking · Computer forensics

1 Introduction

Cybercrimes are evolving day-by-day. Hackers are finding new ways to carry out attacks on the information systems. Session hijacking is one category of cyber-attacks where the hacker takes control of a user's legitimate session to perform malicious actions. As these actions are originating from a legitimate session, it is difficult to differentiate between the legitimate actions and malicious actions. Therefore, these types of attacks provide a great advantage to the hackers. Session hijacking attack can be carried out using various methods such as man-in-the-middle, man-in-the-browser, and more recently man-in-the-mobile.

Man-in-the-browser attacks are specialized version of man-in-the-middle attacks. They mainly operate at application layer by compromising the victim's computer with a trojan. This trojan takes control of the browser to carry out session hijacking attack. Man-in-the-browser attacks does not bother about encrypted communications because all those operations are performed when the data leaves the browser and the attack is done prior to that stage. Now, as the hacker is using legitimate session to perform malicious actions, it is difficult to stop those actions. Moreover, the actual identity of the hacker is hidden now, and all the malicious actions are originated from legitimate user.

As normal mechanisms do not detect the identity of the hacker, scientific and analytic techniques are required to resolve this crime. All these techniques are integral part of a domain called computer forensics. Computer forensics is a branch of forensic science. Its intention is to find the digital evidence that could be used in court proceedings. Computer forensics does not detect or prevent the cybercrime, it is applied once the crime has been committed.

2 Man-in-the-Browser Attack

Man-in-the-browser attack is a sophisticated attack on internet banking. It can impact ranging from just stealing of data to modifying the internet banking transactions. Man-in-the-browser attacks uses malware especially trojans. These trojans are downloaded to the victim machine as part of drive by downloads or by redirecting the victim to malicious website by injecting the malicious iFrame into the legitimate website using vulnerabilities in that website. Man-in-the-browser malware can be a small component of the trojan that has infected the victim machine. There could be other components in the trojan such as rootkits. These trojans compromise the victim machine and installs a browser extension. After successfully infecting the victim machine, the browser extension sits between the browser application and the internet and looks for the websites that the user is visiting. Trojan has a list of websites in the background. When a user visits a website that is present in the list then the malicious actions are triggered.

These trojans mainly target the banking websites. Once the user logs in to the banking website, session gets hijacked and hacker gets the control of the session. A configuration file that is attached to the trojan decides what functions need to be executed after session hijacking. This configuration file gets updated time-to-time. There are several functions that a man-in-the-browser malware can perform.

One of the functions is to steal login credentials, keystrokes, screenshots of virtual keyboard keystrokes. Potentially any data that is entered in the browser is available to the hacker. All the stolen data is sent to the hacker either passively or actively.

If the stolen data is not enough to get the control of user's session, man-in-the-browser malware injects HTML code into the legitimate website asking for additional information such as date of birth of the victim, mother's maiden name etc. Malicious HTML code is embedded in the web injection file that tells the man-in-the-browser malware how and when to inject the code. Injection of HTML code alters neither the HTTPS header nor the look and feel of the website. Everything looks so legitimate that even the security professionals can be fooled.

The most dangerous function that a man-in-the-browser malware can perform is modifying the output of user's request. Consider a user transferring money using internet banking. After filling the necessary details in the online form, user clicks on submit in the browser. At this point, man-in-the-browser malware reads all the form values and modifies the output according to its configuration file. It could change the recipient account number in those values. After those changes are made, the malware remembers the legitimate details and the request is forwarded to the server. The request is processed at the server and an acknowledgement is sent back to the user. The malware changes the acknowledgement according to the legitimate details provided by the user. The user is totally unaware of these changes. Moreover, even the server is unaware of these malicious actions since they originated from legitimate source. To maintain the persistence, man-in-the-browser malware uses JavaScript and ajax. JavaScript can perform actions that are entirely invisible to the end user and it can override the built-in prototypes of Document Object Model. Man-in-the-browser malware have the mule account databases to carry out automated money transfers. Mule accounts are the bank accounts of legitimate users of other countries. Hacker uses

these mule accounts as the intermediary nodes between his bank account and the account from which the money was grabbed using man-in-the-browser attack. Even the mule account holders are unaware of this attack. Hacker can hide his identity by making mule account holders as the culprits in this scenario.

While performing all these functions, man-in-the-browser malware stays connected to the hacker. Man-in-the-browser malware can add the victim machine to the botnet which is controlled by a command server which is again controlled by the hacker. Hacker makes changes to the configuration files and uploads them to the command server. Now the command server issues commands on behalf of the hacker to the malware running on the victim machine. PHP scripts are used for communication between victim machine and command server.

Man-in-the-browser malwares compromises the browser application using techniques such as browser helper objects, Document Object Model exploitation, API hooking, and changing the registry values in windows operating system. Browser application runs with system level privileges so if the hacker can control the browser application then ultimately the processes which are invoked by the browser will have system level privileges.

Browser helper objects are DLLs that help the browser to access Document Object Model. They are add-ons or extensions that help in improving the functionality of the browser. They add registry entries in the windows operating system to load at the startup of the browser application.

API hooking is another technique used to compromise the browser application. There are several APIs or DLLs that help in connecting the browser application to the internet. These APIs are intermediary nodes between browser application and internet. The data flows through these APIs. Browsers use these APIs to connect to the internet and get the desired data from the internet and display the HTML content on the screen. Man-in-the-browser malware corrupts these APIs by injecting the malicious functions into the API code. By corrupting the APIs, the received HTML code from the internet is rewritten such that additional input fields can be added to the legitimate website only on the victim machine. One example of the API hooking is corrupting the wininet.dll in windows operating system. Wininet.dll has several functions such as `httpsendrequest()`, `navigateto()`, `httpopenrequest()`, `internetreadfile()`. These functions as their names suggests are very important for the browser to send, receive, and display the content in the browser. If these functions are corrupted everything that the user sees in the browser can be altered without breaking the SSL communication.

Man-in-the-browser malware makes changes to the windows registries. These changes help the malware in various aspects like loading the add-ons when the browser starts, altering the browser security settings so that the malicious HTML code can be injected into the websites without being blocked by the browser, and mainly to maintain the high-level privileges to carry out the attack.

Being this sophisticated, man-in-the-browser attacks have wreaked havoc in the banking industry belonging to USA and European countries. Although the banking industry have employed many preventive measures such as two factor authentications, they were easily circumvented by the man-in-the-browser malwares because once the user logs into the account, hacker can change these security mechanisms.

There are several man-in-the-browser malwares but the most important and the most popular one is known as Zeus. Zeus was the first man-in-the-browser malware. Later, when the source code of the Zeus was released many variants were developed increasing the complexity of man-in-the-browser attack. The other examples of man-in-the-browser malwares are Torpig, URLZone, Adrenaline, Sinowal, Silent Banker, Shylock, Spyeeye, Carberp, and Sunspot (Figs. 1, 2, 3).

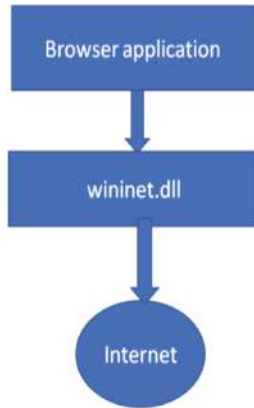


Fig. 1. Normal working procedure of a browser application.

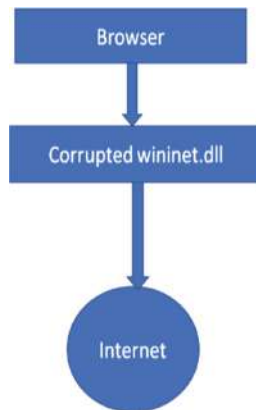


Fig. 2. System affected with man-in-the-browser malware.

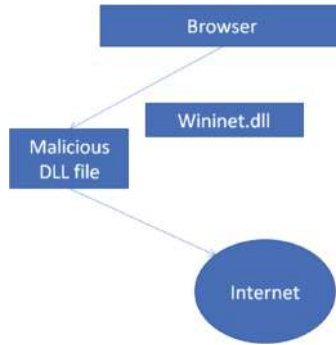


Fig. 3. Implementation of API hooking technique.

3 Technique to Find the Artifacts of Hacker in Man-in-the-Browser Attack

In order to analyze the man-in-the-browser malware, automated malware analysis is performed using cuckoo sandbox tool. The input for this tool is the source code of man in the browser malware like zeus, torpig, etc. The artifacts that are found after this analysis are behavior patterns of this malware such as process memory allocation, target network accessing, creating numerous files, etc. A virtual machine with windows 7 operating system is infected with this man in the browser malware and its hard disk, registry files, memory dump are acquired using FTK imager. Access data's FTK is used to analyze the hard disk in order to find the malicious files that were created by this malware. Access data's registry viewer is used to analyze the acquired registry files. The artifacts that are found in the registries are disabling the anti-virus application, disabling the firewall, elevating the privileges of browser, etc. A memory forensic framework called volatility is used to analyze the acquired memory dump. This analysis will give the information about the victim's machine such as the malicious processes that were running, established unauthorized network connections, etc. (Figs. 4 and 5).

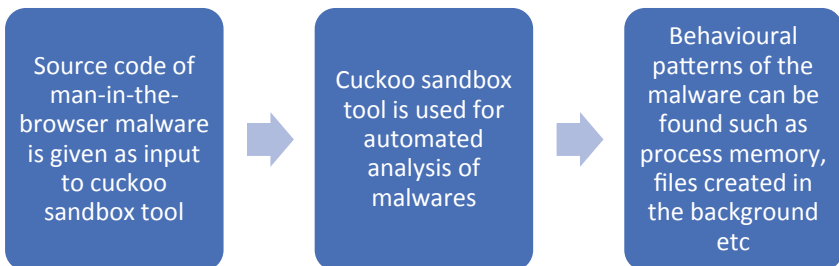


Fig. 4. Automated malware analysis using cuckoo sandbox.

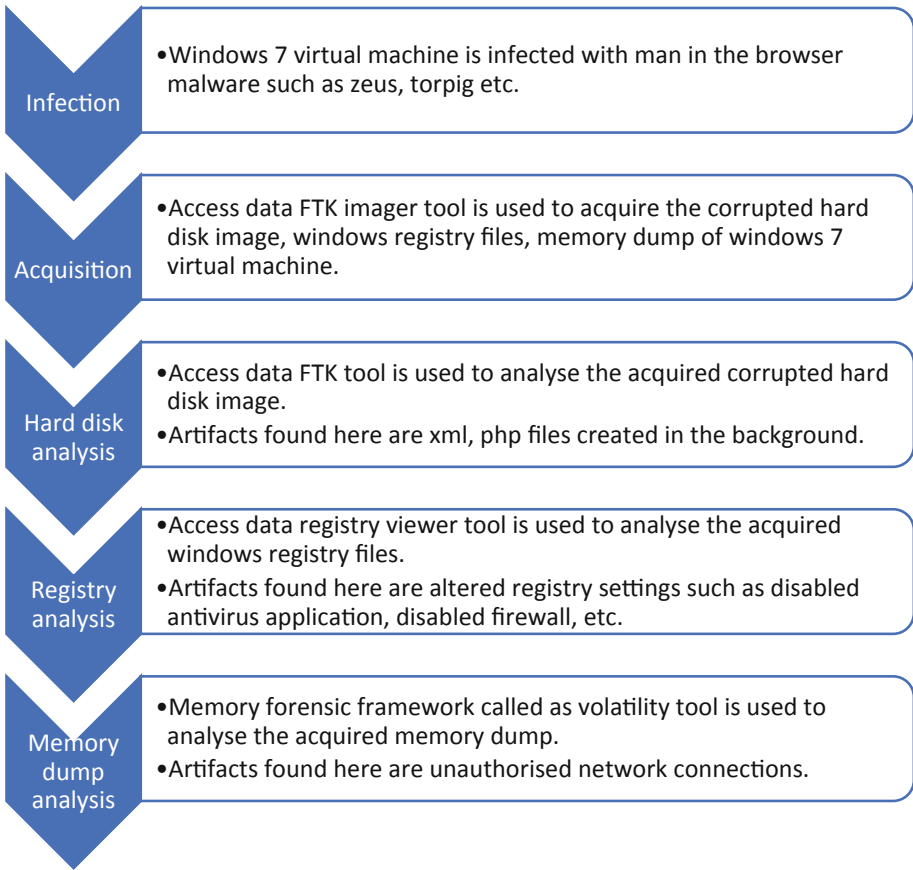


Fig. 5. Manual analysis of man in the browser malware.

4 Conclusion

Cybercrimes will keep evolving day-by-day in terms of complexity. Man-in-the-browser attack is one such crime where it can bypass all the security mechanisms once it gets installed in the victim machine. Strong login protection, two factor authentications were easily thwarted by this attack. This attack is so complex that prevention of this attack is the only viable option. In order to stop being a victim of this attack practices such as avoiding free public wifi, updating anti-virus solutions, patching the operating system, updating the browser application, avoiding the usage of browser extensions should be carried out. Computer forensics are used to resolve the cyber-crimes like man-in-the-browser by analyzing the compromised machines, finding the traces of the hacker and generating a report that is admissible, authentic, complete, trustworthy, and believable during the court proceedings.

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Implementation Effects of E-ID Device in Smart Campus Using IoT

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Abstract. In the present world, teachers and student's parents are very busy in their scheduled life. Irrespective of this, their health and work can be been recorded and monitored with the help of E-ID device using IoT platform. We can introduce E-ID device for every university employee including the student. By connecting all these together on IoT platform, the university will be called as "smart campus". The synchronized data of the student or teacher or university authority of each and every minute will be stored. The top-level management of university to the ground level of student's parents will get student's details like attendance, health, fitness, extracurricular activities, security, campus facilities and the access for labs and air conditioner can be done automatically by E-ID devices. In this way, power consumption can be reduced and energy efficiency will be increased. Finally, the educational organizations will have transparent information in hands within a few minutes by using E-ID device on IoT platform.

Keywords: Internet of Things · Student · Parent · E-ID device · Smart university · Smart campus · Fitness · Attendance · Security

1 Introduction

In the competitive world, students are joining from their various places and staying away from their parents. The students are also pursuing a dual degree from one university campus and connecting other university faculties by monitoring from a long distance and here the university authorities can monitor them by results-oriented only. So the education system is converted into bossism commanding orientation and objective oriented. In recent years, many latest technologies have emerged mainly with electronic gadgets like E-learning, E-commerce, E-Health, E-fitness, E-security etc. Combination all these onto a single platform using IoT can be used by the educational organizations to educate and track the students, monitoring teachers and also monitoring can be done by the student's parents to provide them with best education by using sensor technology, GPS tracker, radio frequency, WSN, cloud, digital displays boards and security. All these can be introduced by one single E-ID device on the smart campus.

2 Literature Review

2.1 Education System Using Internet of Things

The physical objects are connected and converted into networks through the internet, it was a radical change by the effect of IoT [13, 14]. IoT makes communication possible between people and the environment, along with the people and things [4]. To react to the environment, the cloud services, near-field communications, real-time localization, and sensors are embedded thereby transforming normal objects into smart objects [2]. The IoT has an option to merge the Internet information and services together [4]. In education, instructor has a special preference, the particular objective is to gather the data and provide knowledge to the students in improving their learning aspects by using an IoT system [7]. In recent education, “there are seven different types of technologies provided to the students so that they feel it as a real-time experience” which is mentioned by the author [8]. The different types of electronic gadgets like cameras, microphone, video projectors, sensors and face recognition algorithms with required software make a classroom as intelligent classroom environment [1]. Student’s concentration, performance and achievements can be improved with smart classroom environment [9]. Industries and higher education experts [10, 11] mentioned that problems can either be solved or created using IoT in the areas of security, privacy and data ownership issues. Using IoT, students will receive alerts from the administration when they struggle in learning issues of their academics [11]. IoT systems are running in many universities by connecting everything to the cloud on campus like security, temperature management and access to electronic devices [11].

In the year of 2009, EU Commission had identified the importance of IoT in the form of conferences to the scholar for the revolution and innovative ideas, things to reconstruction IoT [15]. The author [5], suggested that an IoT must be the source of Internet-connected to sensors with some database. The architecture of IoT is proposed with three segments [14]. They are the hardware segment, the middleware segment and the presentation segment. In the hardware segment, collection of the information is done through sensor devices or any embedded communication device. In middleware segment, data is stored computed and analyzed using the cloud environment. Finally, in the presentation segment, the data is presented after analysis. IoT system must consist of a medium for the transformation of data, to track the required thing, to take data from the source and analyze the data for the future purpose [13]. Key role in the hardware segment is a wireless sensor network for various IoT applications such as home automation and energy saving [17]. The sensor device collects the data from the sensor and sends it to the connectivity model, which is always monitored. In wireless sensor networks communication is through wireless [6] and sensor measurements are important to reduce the cost. Therefore, instead of using separate facilities for energy-saving, these in built acts as energy saving devices [12]. ZigBee is a standard that specified for wireless network with low communication rate, which is suitable for applications in many areas [16].

3 Purpose of the Study

The aim of the study is to develop the effective educational organization with the smart campus using IoT. This can be possible using the latest technologies under the IoT platform. In the ancient educational organizations, they could provide security and quality of education under the guidance of a teacher throughout the period of learning stage. But now-a-days, as the population has increased drastically, the students are under the single teacher guidance. The aim is to study and monitor every student with respect to the health status, security, attendance along with their academic activities. We can also reduce wastage of power consumption using E-ID devices. An innovation of IoT in education is shown in the Fig. 1.



Fig. 1. Innovation of IoT in education

The student's parents and educational organization are having good options for rectifying the student problems like rationalization, ragging by the implementation of E-ID device with the IoT platform.

4 Research Methodology of Smart Campus

4.1 Research Methodology

The implementation effects of E-ID devices in the smart campus using IoT involves applications to be developed and many electronic devices are to be interlinked to the cloud with the internet facility. Under this system development, majorly two roles are important one is student another one is university campus authorities. Further, they will be again subdivided and developed to reach the goals of smart campus by using E-ID device (Fig. 2).

The entire system was developed as:

1. Student orientation E-ID device
2. University campus authorities E-ID devices

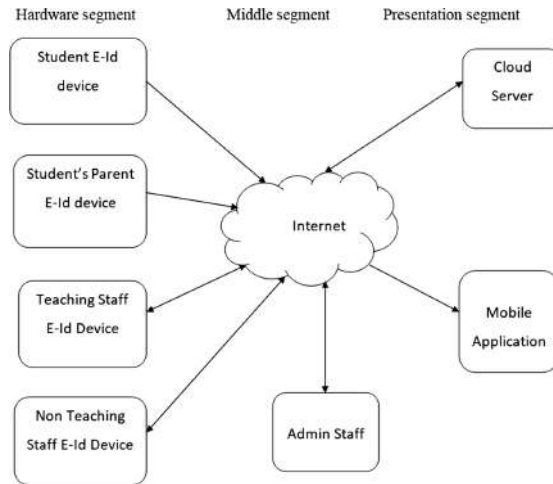


Fig. 2. Design of smart campus.

Student Orientation E-ID Device. The student orientation E-ID devices are of two types, one is master E-ID device which is kept with student another one is duplicate student E-ID device which is for the student's parent for the observation of all activities of the student.

- a. Student E-ID device (Master E -Id device)
- b. Student's parent E-ID device (Duplicate E-ID device)

Student E-ID Device. The student E-ID Device is fully designed and developed by electronic devices and connected to an application which involves both hardware and software. Hardware equipment is an embedded system with different type of sensors. The hardware here involves the following devices to frame as E-ID device. They are RFID, Bluetooth, GPS tracker, RFID readers, Temperature Sensor and a display to the wrist band to view the results supported by ZigBee Network. The software here involves the mobile application, cloud server, pure pulse technology to track the heartbeat, cardio fitness and sleeping time of the student.

Student's Parent E-ID Device. The student's parent E-ID Device is similar to the student-Id device which is a duplicate one. The hardware here involves the same devices as student and RFID (synchronized master E-ID) to frame as E-ID device. The software here involves the mobile application to display student's data on the parent device.

University Campus Authorities E-ID Device

Admin Staff. The admin staff has a power of controlling all the data received from the teaching staff, non-teaching staff and student E-ID device. The Head of the department can monitor the data of both the teacher and the student. Also, whether the teacher has covered the syllabus of the subjects by comparing with the lesson plan and the recorded class. The admin staff is further classified into 2 types. They are

- Teaching staff E-ID device
- Non Teaching staff E-ID device.

The major role is played by the teaching staff.

Teaching Staff E-ID Device. The teacher role in educational organization plays a very important role. The teacher's E-ID device consists of same hardware and software. The external hardware devices that are to be placed in the room are microphone recorder, camera to capture the blackboard class and RFID reader. The hardware for the E-ID devices are Bluetooth, GPS tracker, RFID, a display to the wrist band to view the results. The software here involves the same as student E-ID and also a feature to upload the notes and a lesson plan of class.

Non Teaching Staff E-ID Device. They are allotted with the E-ID device which involves both hardware and software, similar to the teacher E-ID device.

5 Discussions on How E-ID Device Works

5.1 Student E-ID Device

The student wears the E-ID device which consists of above-mentioned hardware devices. When the student leaves their home their GPS tracker is on. When he/she enters the campus, tracking will be started. This can be observed by the parents in their mobile application. Student gets the classroom details with teacher name on the notification in the mobile application uploaded by the respective authorities before the class. The student enters classroom and the attendance is recorded using the RFID in the E-ID device. In the computer labs, the RFID reader identifies the Roll number of the student which reads and saves the entered student's ID. The IoT set up helps the computers and air conditioner to connect to the student's E-ID device. With the help of IP present in the computer, the tracking can be possible. The temperature sensors identify the temperature in the lab, connects to the internet using ZigBee. The emitter device in the lab senses the temperature of a lab and sends out the RFID signal continuously using IoT. The receiver connects to a PC via a USB interface or through the ZigBee, sends the received signals from the emitter to the cloud. There is a cloud server in the middleware segment.

The data collected by RFID, the status of each computer in the lab, and the temperatures of the lab, are sent to the cloud server. The data is then computed, analyzed and controlled. At the presentation segment, two major systems are provided to students and the controller of the admin office. While the students use the mobile application to connect to the system and retrieve the status of the selected computer lab, which will help the students to make proper decisions if there are seats available or not. The second system is at the admin office site. The status of the usage of computer labs as well as the changes of the temperatures of each lab is observed and updated every 30 min. The results on the screen allow the controller to control the air conditioners in the lab and will track each computer if it is idle for a specific time, it shuts down automatically. Through the RFID signals in the E-ID device, the student or faculty

presence is identified and when there is no student or faculty in the lab the air conditioner, fans and lights gets off automatically using sensors (Fig. 3).

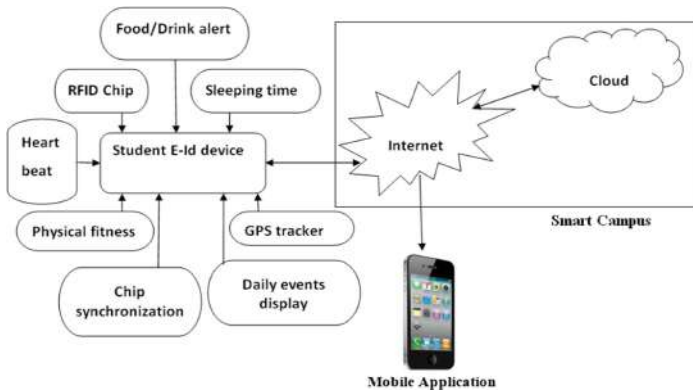


Fig. 3. Implementation of student E-ID devices in smart campus

The device consists of a health tracking system. Using this, students heartbeat can be tracked, cardio fitness and sleeping time can be known from the device display. It involves pure pulse technology. The device emits green light which is in contact with the skin the light enters into the blood and observes the blood flow and heartbeat i.e., blood flow to and from the heart is captured per minute and by using the heart resting time cardio fitness and workouts can be tracked. By finding the resting time of the heart the sleeping mode is being identified. Even the alerts of meals and drinks intake are been provided. The data collected by the E-ID device is transmitted to the cloud using IoT. Monitoring of student data is done by the admin office staff. The data is also displayed on the mobile application and some part of the data is also displayed on wrist band display as notification.

5.2 Student's Parent E-ID Device

The parents E-ID device consists of above-mentioned hardware devices. The student location is being identified and observed by the parent in their mobile application through GPRS and GPS systems. The device consists of full data of the student, which is displayed on the wrist band through the RFID synchronized device. The data collected by the E-ID device of a student will be monitored in the parent's mobile application (Fig. 4).

5.3 Admin Staff

The admin staff has access to the server. The data collected from the devices of student, teaching and non-teaching staff will be monitored and if required the data can be analyzed. The teachers data is analyzed in order to know whether the classes are going according to the lesson plan or not and the attendance is also recorded.

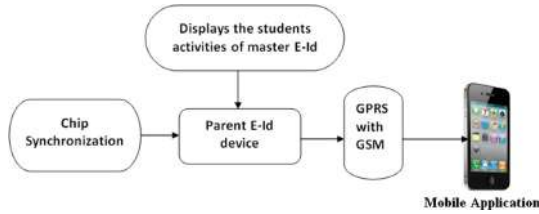


Fig. 4. Implementation of parent E-ID devices in smart campus.

Teaching Staff E-ID Device. The teacher’s attendance is recorded using RIFD at the office room. Class to be taught is given in the lesson plan with the location of a class mentioned to the students through the mobile application. After the class is completed, the recorded class using external devices like microphone and camera will be uploaded to a server which will be monitored by admin office staff. By this method, the student, student parent’s and university authorities are notified about the completion of the lesson and quality of teaching using IoT. Similarly, health tracking can also be done using pure pulse technology (Fig. 5).

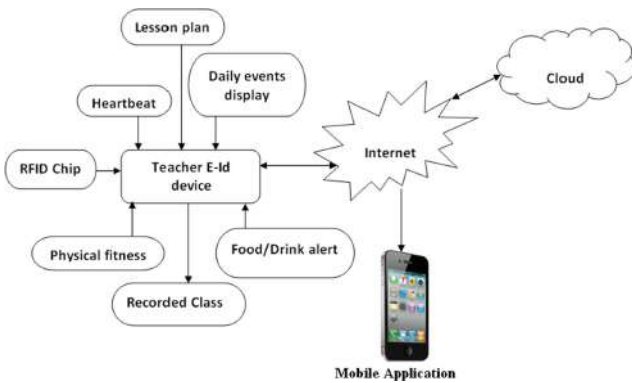


Fig. 5. Implementation of teacher E-ID devices in smart campus

Non Teaching Staff E-ID Device. The Non-teaching staff has an E-ID device for the purpose of recording attendance and health tracking in an above-mentioned way. In general, the evaluation of exam paper is done manually by removing the hall ticket number of the student on the exam paper before correcting. This may involve some mistakes while removing the hall ticket. To overcome this, the answers script can be provided with the bar code of the student hall ticket which can be called as smart exam paper. In this smart exam paper, during evaluation only the bar code is seen by the faculty which doesn’t help them to know the student details without the scan. After the correction, the non-teaching staff decodes the bar code and the result is sent to the server then to the mobile application of the student and parent. The feedback of the student can be collected by the non-teaching staff. The feedback form is sent to the student mobile application to be filled and results can be analyzed using the cloud.

5.4 Limitations

1. The E-ID device is only suitable to the hands to implement the of pure pulse technology.
2. The E-ID device is to be charged after a period of every 3 days.

6 Conclusion

If all educational organizations introduce and implement education with latest technologies like IoT it will be useful in the right way. The IoT is playing a major role in the making of a smart campus by using E-ID device. The different types of staff and students on campus are interlinked by IoT and this system of education will guide every educational organization from the top level to bottom level of education system. The students of the present academic year can be identified where there are in the present situation and in comparing the past and future of academic student's performance of the smart campus of an organization. By the implementations of E-ID device will overcome the situations faced by them under the control of teachers E-ID device. Students will get right path to his/her education every time effectively.

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Malware Detection in Executable Files Using Machine Learning

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Abstract. Extrusion of personal or sensitive data by malicious software is causing a great damage to the world. This is a very critical issue for individuals as well as various sectors of the society at large. Hundreds and thousands of cyber attackers' cross-swords for computer systems by dropping a bombshell of malware with an intention to rift crucial data. That is why, securing this data is an important issue for the researchers. This paper focuses on developing an application which can distinguish a malicious and legitimate file with the help of machine learning algorithms.

Keywords: Cyber attackers · Extrusion · Legitimate · Malware · Machine learning

1 Introduction

Due to the rapid increase of technology and more usage of computer systems, lots of benefits are observed and ease of life is happened. But, with these advancements there is also a negative energy surrounding the world in the form of cyber-attacks [1]. They exploit the personal or sensitive data by making a new kind of malicious software which is known as malware. Malware continues to cyber espionage and does a lot of unwanted activities on the computer systems. Thus, the detection of this harmful software counteracts many numbers of developers, researchers and security analysts who care and secure the cyber world. Many organizations protect their data by using various security products as suggested by security best practices. But modern-day hackers easily bypass them causing a great disrupt to business of an organization, causing a great loss for the company. Though there are several methods proposed by Antivirus industry for malware detection, each of these methods have their own set of lapses [2]. To overcome these issues related to traditional antivirus software, the concept of using Machine Learning techniques to detect malware is developed.

Generally, when the user downloads software, he/she cannot detect whether it is malicious or legitimate until the individual run them on their system. And if the

downloaded file is a malware, it may damage the resources of the system. The proposed application frame work checks whether an executable file is malware or not using the machine learning algorithms namely Decision tree and Random forest with almost 99% accuracy.

2 Literature Review

Yanfeng Ye et al. [3] proposed a malware detection system for executable files using object oriented associative classification techniques which worked better compared to traditional anti-virus systems and the proposed system was used in one of the tools of King Soft's Anti-virus software. Munkhbayar Bat-Erdene et al. [4] proposed a framework which uses Symbolic Aggregate Approximation (SAX) and supervised learning classification methods. Mozammel Chowdhury, Azizur Rahaman, Rafiqul Islam [5] has developed a framework using machine learning and data mining techniques for malware classification and prediction and obtained better results compared to the similar works. Michael Sgroi and Doug Jacobson [6] proposed a dynamic model that utilizes easily accessible runtime attributes in a generalizable way such that it can be extended between operating systems. These attributes are correlated in a statistically meaningful way by using machine learning. Deep Neural Network Based Malware Detection by Joshua Saxe and Konstantin Berlin [7] used two-dimensional binary program features. They introduced an approach that addresses the issues related to low false positive rates and highly scalability, describing in reproducible detail the deep neural network-based malware detection system. In [8] Gavriluț et al. proposed a framework in which can be used to differentiate malicious and legitimate files by using different machine learning techniques. Dimensionality reduction and Pre-Processing are the important basic steps which improves accuracy values to any ML work. The concept behind these are easily understood from the work of M. Ramakrishna Murty et al. [9]. A good review on machine learning and data mining techniques used in intrusion detection was done by Anna L. Buczak, and Erhan Guven [10].

3 Classification Algorithms

There are many machine learning models available for classification. In the current application, decision tree and random forest models were used.

3.1 Decision Tree Algorithm [11]

The main steps in identifying the node attributes for constructing decision tree are as follows:

Step-1: If all the training examples are positive or all are negative, then entropy will be zero i.e. low.

Step-2: If equal distribution of classes in training examples, then entropy is high.

Step-3: Otherwise, entropy is calculated from the training data-set using

$$E(T) = \sum_{i=1}^c -P_i \log P_i \quad (1)$$

Step-4: For every attribute/feature, calculate entropy for all categorical values using

$$E(T, X) = \sum_{c \in X} P(c)E(c) \quad (2)$$

Calculate gain for the current attribute using

$$Gain(T, X) = E(T) - E(T, X) \quad (3)$$

Step-5: Take the attribute with maximum gain.

Step-6: Repeat the steps 1 to 5 until the tree is built.

3.2 Random Forest Algorithm [12]

The major steps of the algorithm are as below:

- Generate m learning sets of k samples from the given data using random sampling with replacement where $k <$ total no. of samples in the dataset.
- Build a separate decision tree for each of m sets.
- Do the prediction of new data by aggregation of different tree results.

4 Experimental Work

The main aim of the proposed work is to provide a web application frame work where a user can upload an exe file and at the server side, a machine learning classification algorithm will test whether the uploaded file malicious or benign and the result will be shown to the user. The major part of the proposed work is to classify a file as either benign or malignant. Figure 1 shows the architecture diagram of classification process.

4.1 Training Dataset Characteristics

The dataset [13] was taken from Kaggle and it consists of both legitimate as well as malicious binary executable file parameters. It consisted of 1,38,048 records and 54 features. Some of the attributes are Machine, SectionsMax Entropy, MajorSubsystem Version, ResourcesMinEntropy, ResourcesMaxEntropy, ImageBase, VersionInformation Size, SizeOfOptionalHeadersectionsMeanEntropy, Subsystem, MajorOperatingSystem Version, Checksum.

4.2 Feature Extraction

This is the first step in learning phase. It is carried out by pefile [14]. Pefile is a multi-platform Python module that is used to parse the Portable Executable files. The information contained in the headers of .exe file is read by pefile.

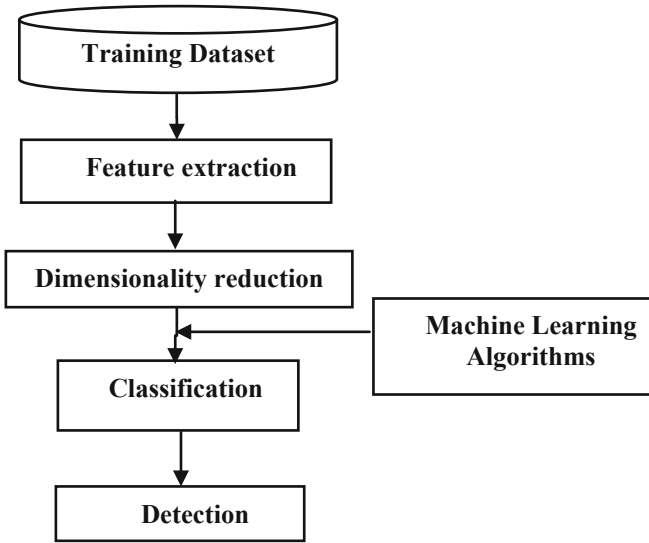


Fig. 1. Architectural diagram of classification process.

4.3 Dimensionality Reduction

Less dimensions lead to less computation/training time, some algorithms do not perform well when there are large dimensions. This step is carried out as selecting the independent variables which are relevant for differentiating legitimate and malware files. This selection is done using the algorithm which is known as tree-based feature selection. The classes in the sklearn feature_selection [15] module are used for feature selection/dimensionality reduction on sample sets.

4.4 Classification

In this stage the model is built by using the dataset and then a classifier is generated, which stores the required features information in “.pk1” format which is used for future detection. As experimentation purpose two tree-based classification algorithms namely decision tree and random forest were used as classifiers and their accuracies were compared.

4.5 Detection

Finally, the detection phase. For this phase, the web application is created by using python flask framework. Here, a user can upload any exe file, then at the backend, the machine learning algorithm will work and identify whether the uploaded file is malware or not and the same will be notified to the user.

5 Experimental Results

5.1 Phase-1 Learning

After applying tree-based feature selection algorithm to the data set for dimensionality reduction, it identified 12 out of 54 as independent attributes for classification process. These attributes were shown in Fig. 2.

```

Researching important feature based on 54 total
features

12 features identified as important:
1. feature Machine (0.182627)
2. feature ResourcesMaxEntropy (0.080330)
3. feature MajorSubsystemVersion (0.079442)
4. feature ResourcesMinEntropy (0.074673)
5. feature VersionInformationSize (0.073044)
6. feature DllCharacteristics (0.064753)
7. feature Subsystem (0.060086)
8. feature Characteristics (0.058528)
9. feature SectionsMaxEntropy (0.052081)
10. feature ImageBase (0.043241)
11. feature SectionsMinEntropy (0.030620)
12. feature ResourcesMeanEntropy (0.018714)
    
```

Fig. 2. The identified independent features.

Then the classification algorithms were applied on the reduced dataset. The accuracies of the algorithms were shown in the form of confusion matrix in Fig. 3. It was observed an accuracy of 98.9% for decision tree and 99.4% for random forest for the dataset taken.

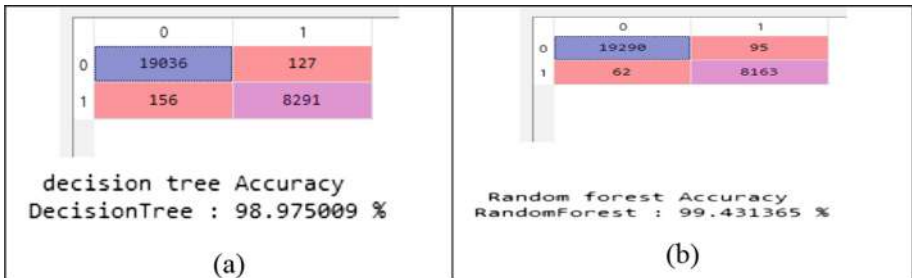


Fig. 3. Confusion matrix for (a) decision tree and (b) random forest

5.2 Phase-2 Prediction

For building the web application, Flask [16] was run on the local host. Figure 4 shows the process of running flask. After it gets started, the required web application frame work can be created.

```
D:\Project>python checker.py
* Serving Flask app "checker" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: on
* Restarting with stat
* Debugger is active!
* Debugger PIN: 269-495-657
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

Fig. 4. Starting of Flask app

Figure 5 shows the initial page of the web app where a user can upload a file. The application was first checked by uploading a malicious file. Figure 6 shows the screenshot of uploading a malware file called Metasploit.exe and Fig. 7 shows the result after the file is checked at the back end.



Fig. 5. Home page of the application where user uploads a file



Fig. 6. Uploading a malware file



Fig. 7. Output for malicious input

Similarly, the application was checked by uploading the legitimate files. Figure 8 shows the screenshot of uploading benign file chromesetup.exe file. Figure 9 shows the result after uploading the file.



Fig. 8. Uploading a benign file



Fig.9. Output for a benign file

6 Conclusion

This paper proposes a user-friendly web application which helps to test whether a .exe file is malware or not by using machine learning algorithms. Our approach combines the use of algorithms like decision tree and random forest to generate a anti malware detector. The possibility of false rate of this app depends on the dataset considered. By using latest datasets, it is still possible to improve the accuracy rates.

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Implementation of Wireless Sensor Network for Home Appliances Control Using IoT

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Abstract. To help, keep up open to living conditions inside a home, home observing, and mechanization are used. Making the house savvy is to take into consideration astute programming executed of a few directions in the wake of investigating the gathered information. Mechanization can be practiced by utilizing the Internet of Things (IOT). This gives the occupant gets to specific information in the house and the capacity to control a few parameters remotely. The fundamental point of proposed framework is to plan of IOT based detecting and observing framework for shrewd home computerization. In this framework we are utilizing Temperature, LDR, and Gas sensor for detecting condition. As indicated by the sensor esteems the gadgets will control by microcontroller.

Keywords: Microcontroller · GPRS · Temperature · LDR · Gas sensor

1 Introduction

The home robotization is control as concern home gadget structure focal control summit computerization is the current certainties everywhere supplementary stuff is mortal refined apiece day accordingly [9]. Generally, the crucial errands as concern killing scheduled or else convinced gadget in addition to long-ago, whichever tenuously or else within propinquity.

Creating vigor productivity in addition to sustainable supremacy source innovations is whirling hooked on a should in addition to escalating the keenness intended for a quantity of nations roughly the earth. A vigor gifted domicile to facilitate is wholly pragmatic in addition to mechanized utilizing the snare of things (IoT) move on. The growth during the ubiquity of IoT has generally spread to basic in-home applications and regular assignments.

The work of IoT in home is with the finish ambition as concern liveliness observing as well as thrifty whilst next to the equivalent occasion accomplishing in addition to trust awake an explicit breadth of relief. Habitat robotization frameworks utilizing IoT comprises of three noteworthy parts. The preliminary subdivision is the perceive in addition to in sequence procurement ingredient. This is refined via situation sensors or else gadgets, similarly, called equipment, next to a hardly any areas everyone throughout the dwelling headed for estimate as well as accrue sought statistics, meant for illustration, warmth, light power, and gas.

The second piece as concern the scaffold is the in sequence preparing. Sensors grant in sequence within makeshift structure. These in turn are sending headed for the mainframe throughout a scheme as concern diffusion, restless involvement. The mainframe next to facilitate summit makes a construal of the in a row hooked on comprehensible qualities. These traits are transmitted headed for a doohickey to be controlled naturally and additionally to a UI.

The preceding quantity as concern IoT robotization is the trap. Mainly frameworks exploit an attendant headed for relocate in sequence ensuing to handling, so it very well may be gotten to by the client. The muddle moreover screens in sequence and joystick gadgets tenuously. Via consequently executing a few directions, mechanization frameworks container auxiliary occasion, bestow a higher delicate contentment within domicile, as well as auxiliary verve. In this task we use sensors to quantify the states of the home condition. The detected qualities are exchanged to the microcontroller. The microcontroller will send directions to the gadgets to play out the required activities. The apparatuses status is shown on the LCD show.

2 Literature Review

Muhammad Asadullah el Jan 12, 2019 [9] in this paper they proposed a minimal effort in addition to effortless headed for comprehend remote controlled home computerization framework is reveal utilizing Arduino get on, Bluetooth module, PDA, ultrasonic feeler and dampness sensor. Advanced mobile receiver relevance is exploiting in the proposed framework which enables the patrons headed for organize up to 18 gadgets together with domicile apparatuses along with sensors utilizing Bluetooth modernization.

Kodali, Jain [10] centers roughly edifice an enthusiastic secluded home safekeeping scaffold which sends cautions headed for the administrator via utilizing Internet stipulation at hand should be an occasion of whichever infringe in addition to raises a vigilance, the sound the alarm in addition to the standing sent by the WIFI allied microcontroller oversaw scaffold canister be gotten via the buyer lying on his phone booth starting in the least disconnection self-regulating as concern whether his chamber headset is allied by the muddle.

According to our overview, there exist numerous frameworks that can control home machines utilizing android-based telephones/tablets. Every framework has its special highlights. Presently certain organizations are authoritatively enlisted and are attempting to give better home computerization framework highlights. Following models portrays the work being performed by others. Sriskanthan [11] clarified the model for home mechanization utilizing Bluetooth by means of PC. Yet, shockingly the framework needs to help portable innovation.

3 Proposed Home Monitoring Method

Within the proposed framework temperature, LDR, gas sensors are utilized as info gadgets, the microcontroller will peruse sensors information as indicated by the sensors information the microcontroller will work yield gadgets that are DC fan, DC engine and Bulb and so on, the architecture of the system is shown in the Fig. 1. Additionally, we are utilizing GPRS/GSM module for getting to web server, so framework will refresh the status of machine on web server likewise we can control apparatuses from web server.

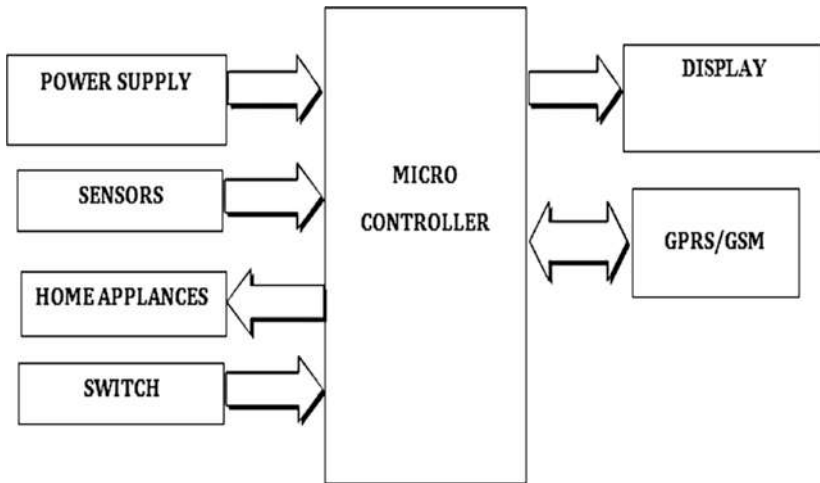


Fig. 1. Architecture of the system

The main use of this proposed method is to offer comfortable living conditions to the user, in this we have discussed about three different applications perform in home. The first application is based on the room temperature one can able to switch on or off the fan. The second application will help to on or off the light related to light intensity. The third application finds usage in kitchen to know the leakage of the gas.

3.1 Microcontroller

This vicinity frames the organize entity as concern the intact task. This subdivision in effect comprises as concern a Microcontroller amid its interrelated hardware approximating precious stone during capacitors, reorganize hardware, Pull up resistors (if necessary, etc. The Microcontroller shapes the nucleus as concern the endeavor seeing as its joysticks the gadgets creature interfaced and speak with the gadgets as indicated via the curriculum creature self-possessed.

ARM is the retrenchment as concern Advanced RISC Machines, it is the first name of a set as concern processors, in addition to is the given name as concern an unselfish modernization as well. The RISC management set, in addition to relate translate module are an assortment a smaller amount not easy than those of multipart Instruction Set Computer (CISC) plans.

3.2 Liquid-Crystal Display (LCD)

It is an echelon timber prove, electronic illustration cabinet that utilizes the light regulation belongings as concern watery trinkets. Fluid gems don't produce light straightforwardly. LCDs are reachable just before be evidence for subjective pictures or else unchanging pictures which container be at hand given away or covered up, for example, stipulated vocabulary, digit, in addition to 7-fragment illustrate as in an advanced timepiece.

3.3 Power Supply Unit

Supply of 230v, 50 Hz air conditioning signal from fundamental supply board is given to a stage down transformer. The transformer is chosen with the end goal that its yield ranges from 10v to 12v. Thus the fundamental capacity of the power supply is to give the voltage supply required for the rationale families, which is a yield of +5v.5v controlled supply can be appeared beneath.

The Power Supply Unit Diagram The heavens conditioner energy overall 230v is allied by the transformer, which stepladder the appearance conditioner current downhill to at first sifted by a basic capacitive waterway headed for distribute a dc electrical energy supplementary repeatedly than not have several enlarge or else air taming energy selection.

A director path container utilizes this dc giving headed for furnish an aimed at to facilitate not very soon have a good deal enlarge energy. This current bearing is in the main gotten utilize one as concern various legitimate voltage control IC units.

3.4 GSM Module

Worldwide (GSM) is a lot of ETSI philosophy demonstrating the scaffold pro a superior booth organization.

The system is organized into various discrete segments:

- Pedestal posting Subsystem – the pedestal station in addition to their regulator clarified
- Association as well as switch Subsystem – the quantity as concern the arrangement nearly everyone reminiscent of a unchanging structure, during several belongings in a minute called the “midpoint coordination”
- GPRS Core Network – the discretionary part which permits bundle-based Internet associations

SIM was anticipated headed for be a confined secluded skeleton. It has well thought-out the consumer proof utilizes a pre-shared type and investigation feedback, with greater than-the-air encryption. Nevertheless, GSM is feeble touching a mixture of group of assault, every solitary as concern them point an interchange section as concern the structure.

3.5 DC Motor

A DC locomotive depends lying on the approach to facilitate in the vein of crowd-puller shaft repulses in addition to not at all approximating gorgeous post pulls in solitary a different. A curl of line with a at hand departure throughout it produce an electromagnetic field lined up with the focal position as concern the loop. By switch the in progress lying on or else rancid in a round its gorgeous ground container be bowed lying on or rancid or else by exchanging the attitude as concern the in progress within the bend the itinerary as concern the fashioned beautiful grassland container be exchanged 180°.

3.6 Temperature Sensor

Thermistors are a temperature detecting devise. It is utilized to detect the temperature. In this undertaking by relies upon the estimation of temperature the fumes fan will run.

3.7 Light Dependent Resistor (LDR)

The LDR is utilized to quantify the light power. LDRs are tremendously costly predominantly within luminosity/monotonous sensor circuits. Regularly the opposition as concern an LDR is exceptionally high, here and there as towering when 1000000 ohms, yet whilst they be lit awake amid luminosity hindrance drop drastically.

3.8 Gas Sensor

Gas Sensor (MQ2) unit is accommodating used for gab spillage appreciation (Domestic and Commercial). It is apposite pro distinctive H₂, LPG, CH₄, CO, Alcohol, Smoke or Propane as of its sky-scraping affectability furthermore sudden answer moment, inference container be full as speedily as point in time allow. The affectability as concern the feeler container is unbiased by potentiometer.

4 Results

Figures [2](#), [3](#), [4](#), [5](#).

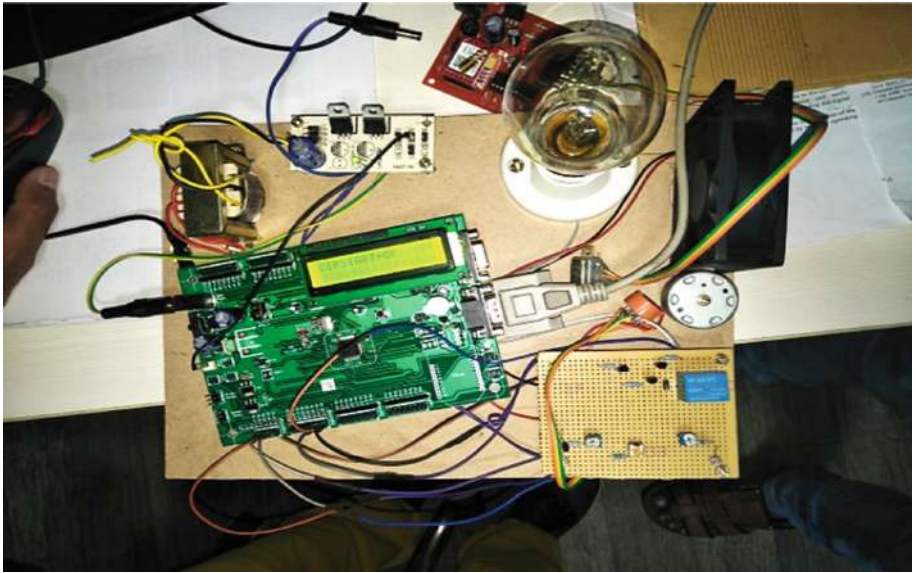


Fig. 2. System hardware model



Fig. 3. Room condition values will be displayed on web page



Fig. 4. Initially system shows sensor value on LCD display



Fig. 5. The LDR value is below threshold value so that Bulb will turn ON

5 Conclusion and Future Work

In this work we executed a keen home robotization framework for detecting and checking the home machines by utilizing IoT innovation. The plan of the savvy home robotization is entirely adaptable and can be effectively extended and connected to bigger structures by expanding the quantity as concern sensors, estimated limitation, as well as organize gadgets. Greater usefulness and quickness might be additionally extra headed for the framework pro influencing the home robotization framework to develop, adjust, and advance independent from anyone else utilizing progressed IoT.

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Load Balancing in Cloud Through Multi Objective Optimization

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Abstract. The Scheduling and Load balancing in cloud is considered as NP complete problem where the tasks are assigned to the cloud are dynamic in nature so the heuristic approach can be followed to find the solution. Load balancing directly affects the reliability, response time, through put and energy efficiency of a server. The optimized solution for load balancing should consider various objectives like minimizing energy consumption and minimum execution time so that reduced cost. Balancing the load across cloud servers is possible through virtual machine (VM) migration from overloaded servers to under loaded servers conditionally. Even migration of VMs from under loaded servers may take place in cloud to release the under loaded servers and make them free so that the energy consumption can be improved.

Keywords: Load balancing · VM allocation · Multi objective optimization · Resource utilization · Energy consumption etc.

1 Introduction

Cloud computing is an era of distributed computing, based on service oriented architecture where users expects services to be provided with minimum response time and cloud service provider (CSP) expects to maximize the resource utilization to meet the service level agreement (SLA). Improved resource utilization can reduce energy consumption. Minimum number of resources in cloud datacenters also releases less carbon dioxide which helps the environment. Resource consumption also varies across workloads as the services may be heterogeneous. Concurrent sharing of resources is the main characteristic of cloud. The scheduling and allocation of virtual machines to corresponding physical machines will affect the energy consumption. virtual machine (VM) migration [4] can be applied for balancing the load across cloud servers. VM Migration algorithms were proposed in previous works based on workload aware consolidation and CPU utilization and energy consumption. The unused physical servers may be powered off to reduce power consumption. The scheduler should check the workloads of physical machines before assigning new task and allocation should be optimum so that the minimum number of physical machines must be used. Idle servers also consume some amount of energy. Thus, idle servers must be switched off to reduce energy.

1.1 Load Balancing in Cloud

Large pool of servers connected to each other in cloud. The servers may have heterogeneous configurations and different amounts of workloads may be assigned dynamically to each server. The Load distribution among cloud servers must be uniform and also should consider their capacities. Load balancing is the process of distributing workloads and computing resources across one or more servers. Distribution of load must ensure maximum throughput in minimum response time to provide customer satisfaction and also to utilize the resources efficiently. Load balancers protect against server failures and scale up services so that system performance is improved [5].

Cloud servers with heterogeneous workloads have different resource consumption characteristics. Monitoring the load of servers regularly and allocation of resources based on user requirement to achieve multiple objectives like minimizing energy consumption and maximizing resource utilization is the main objective of this work.

1.2 Role of VM Migration in Load Balancing

Virtual machine migration is the process of moving virtual machine from one physical machine to another. Managing more number of virtual machines on a single server is also a complex job. VM migration may be needed to reduce the load of an overloaded physical machine or to make the under loaded physical machine idle, so that the idle physical machine can be switched off and energy can be saved. The system failures also can be controlled through VM migration.

The downtime and migration time may become overhead when migrating a virtual machine and the application performance can be degraded but these parameters can be made negligible by taking optimal migration policies [1] and the VM migration can balance the load across the cloud servers then the overall performance of the cloud services can be improved.

VM migration is of two types

Live Migration: The running VM can be migrated from one physical machine (PM) to another physical machine. The downtime is minimum in this case so the system performance will not be effected but it is complex to migrate the state of the VM.

Cold Migration: The virtual machine can be switched off in the source physical machine and switch on after migrated to destination physical machine. The migration is simple compared to live migration but the downtime may increase.

The cloud servers experience dynamic workloads so the CPU usage also varies from one VM to another VM. A violation of service level agreement (SLA) occurs when CPU demand exceeds the available capacity of the CPU. This problem can be resolved through VM migration from overloaded/underloaded server to other compatible server.

2 Related Works on Load Balancing in Cloud Computing

A Multi-Objective Load Balancing (MO-LB) [3] system is developed to eliminate the need for VM migration to solve the problem of an over-utilized PM, and to scale up a VM that is located on a PM with no available resources. To do this, the MO-LB system reduces the workload of a set of VMs—that deliver SaaS or PaaS and are located on an over utilized PM and transfers their extra workload to a set of compatible VM instances located on underutilized PMs.

Ensuring reliable QoS defined via service level agreements (SLAs) [6] established between cloud providers and their customers is essential for cloud computing environments therefore, Cloud providers have to deal with the energy-performance trade-off—the minimization of energy consumption while meeting the SLAs.

3 System Design

Figure 1.

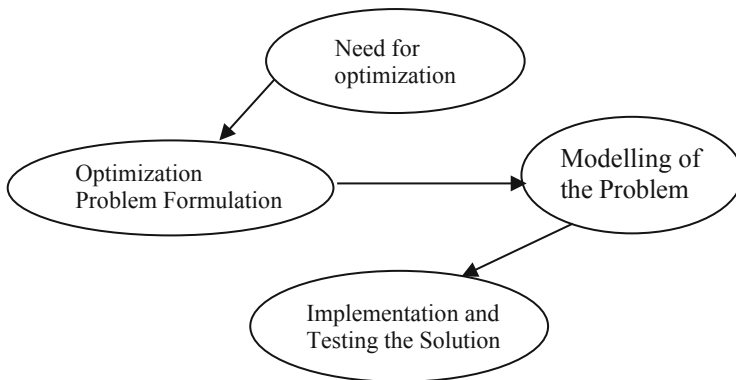


Fig. 1.

3.1 Mathematical Model

Maximizing or minimizing multiple objective functions subject to a set of constraints is represented as multi objective optimization problem. The objectives may be o_1, o_2, o_3 etc. The minimization of o_1 i.e. $\min f(o_1)$ or maximization of o_2 i.e. $\max f(o_2)$ [2] are the objectives of may be competing with each other, in such case there is no unique solution. The heuristic solution may be possible.

Scheduling and load balancing in cloud also can be considered as NP complete problem with multiple objectives like minimum spanning time, maximum throughput etc. The objectives of current load balancing problem are maximum resource utilization and allocation of minimum resources so that less power consumption. In Resource allocation problem where the state of reallocation is impossible without making one criteria worst to improve other criteria (Fig. 2).

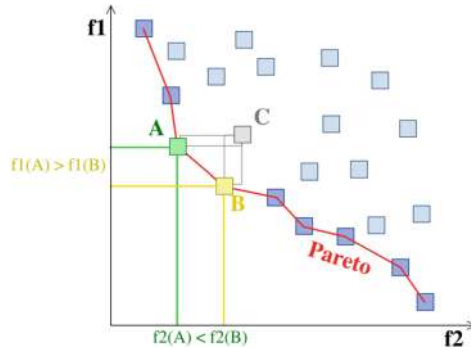


Fig. 2.

A Pareto improvement is a change to a different allocation that makes at least one individual or preference criterion better off without making any other individual or preference criterion worse off, An allocation is defined as “Pareto efficient” or “Pareto optimal” when no further Pareto improvements can be made.

3.2 Algorithm

VM allocation policy is designed by considering the CPU utilization of physical servers and the physical servers are categorized as overloaded if the utilization is more than 70% and the virtual machine is chosen from that physical machine for migration to under loaded physical machine (CPU utilization is less than 30%). The algorithm chooses VM based on its bandwidth requirement to migrate so that the migration time is reduced.

Algorithm: VM Allocation Policy

Input: Number of virtual machines (m), number of Tasks(n) and Number of CloudServers /Physical Machines (s)

Output: Balanced cloud Servers with less energy consumption

1. Initialize n, m and s
2. Collect the requirements of CPU usage for each VM based on task assignment
3. Calculate the total requirement of VMs on every server

$$TVM_{cpu} = \sum VM_{cpu}$$

4. The CPU capacity of server (scapacity) is observed
5. The CPU utilization of server is calculated as follows

$$S_{CPU_utilization} = (VM_{cpu} / S_{capacity}) * 100$$

6. for i=1 to S
 - If $S_{CPU_utilization} > 70$ then S_i is overloaded
 - Else if $S_{CPU_utilization} < 30$ S_i is underloaded
7. Predict the VM to migrate from the overloaded servers based on migration cost (bandwidth utilization)
8. Choose the compatible destination host from underloaded servers for assigning the migrated VM.
9. Compare the resource utilization and power consumption before and after migration.

4 Simulation Environment

The cloud environment is simulated using cloudsim3.0 and conducted the experiments with 2 datacenters, 4 Physical Machines (PMs), 20 virtual machines and 200 independent tasks. The homogeneous PMs were considered with heterogeneous virtual machines (VMs). CPU utilization of physical machine is observed before task assignment. If the CPU utilization is more than its threshold (70%) then migration policy applied. Sometimes the VM is migrated from under loaded machines also to make them switched off. The migration cost is calculated based on bandwidth requirement and a VM with less bandwidth utilization is chosen to migrate so that the migration overhead can be minimum.

The power consumption of physical machines calculated based on the number of resources used before and after migration. The resource utilization is improved so that some resources were switched off. The minimum usage of resources or host machines results reduction in power consumption was observed. The workflow can be depicted as follows (Fig. 3).

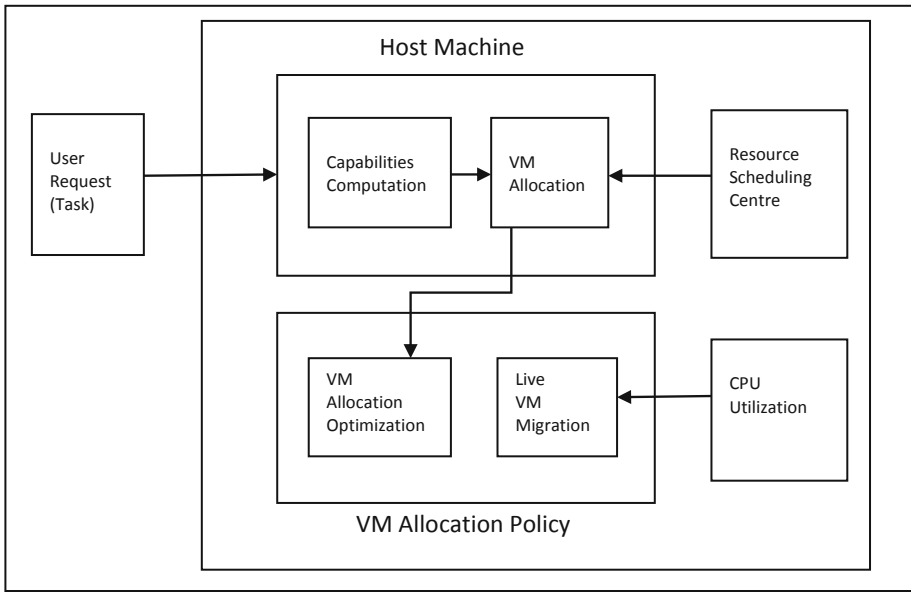


Fig. 3.

5 Implementation and Result Analysis

The VM Allocation Policy in cloudsim is used to allocate VMs to the corresponding host machines (PMs). The VM allocation policy is modified based on the CPU utilization by the corresponding PM. The VMs with different amounts of ram requirements are considered. The CPU utilization is computed and compared with VM requirements after task assignment, if it determines as overloaded physical machines then applied the VM migration policy based on minimum migration time and compared the results before and after migration and found the results effective (Tables 1, 2, 3).

Table 1. Properties of jobs submitted

Job Id	Job length(MI)	File size
1-20	500	300
21-40	1000	600
41-60	1500	900
61-80	2000	1200

Table 2. VM properties

VM Id	MIPS	Size (MB)	Bandwidth
1-5	500	10000	1000
6-10	1000	10000	2000
11-15	1500	10000	3000
16-20	2000	10000	4000

Table 3. Host properties

Host Id	Bandwidth	RAM	Number of PE
Host 1	10000	4096	2
Host 2	10000	4096	2
Host 3	10000	8192	4
Host 4	10000	8192	4

The following results shows that resource utilization is improved after migration for 4 host machines with the vm allocation policy considered based on threshold (Fig. 4).

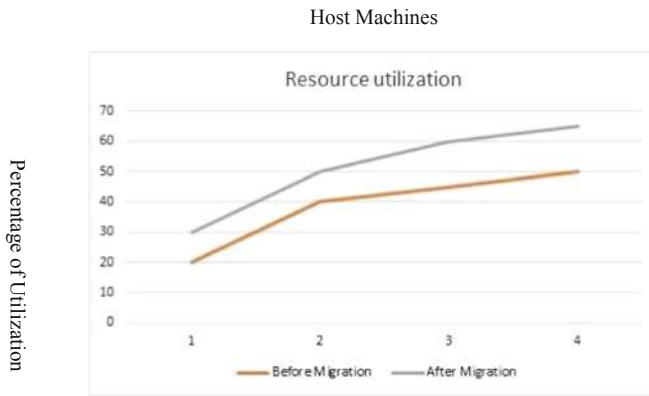


Fig. 4.

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Classifying Difficulty Levels of Programming Questions on HackerRank

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Abstract. In recent times, there is a surge of job opportunities in the IT industry leading to increased skill improvement platforms for computer programming. While the problem setter may provide an indicative difficulty level, the actual level of difficulty faced is subjective to who is attempting the problem. Research indicates that right choice of problems to solve on a learning track boosts the motivation levels of the student and helps in better learning. In this paper we provide a framework to auto classify programming problems on online coding practice platforms into easy, medium, and hard based on attempt statistics for each problem.

Keywords: Difficulty level · Prediction · Programmers · Instructor's

1 Introduction

1.1 A Subsection Sample

Career opportunities is one of the primary goals for higher education. A recent statistical analysis [1] indicate significant growth and scale of employment in IT industry in India as compared to any other sector. {3.9 million direct and 1.3 crore indirect}. Computer programming is an essential skill for securing IT industry job. Therefore over the past years there is significant rise of coding training and testing platforms that give online learning track and real time feedback to students. These platforms provide easy to use interface, good collection of problems to solve with boundary test cases inculcating problem solving skills. They save significant time of instructor who would otherwise have to manually check the code and point out the errors. [2] describes the efficacy of automatic machine assessments as done on online platform like Hackerrank to teach computer programming. Their analysis indicate that use of Hackerrank improved exam results significantly, dropping failure rate by two-thirds.

In [3] authors used average time spent to solve problem in multiple attempts and total time used for submission to classify problems as easy medium and hard. They used that information to provide dynamic choices of problem selection in any assignment. Their result indicate significant improvement in student motivation to the extent that 70% of students worked additional problems for which no credit was given.

Similar to the text difficulty classification [6] we are classifying the programming questions based on the suitable characteristics for programming.

In our work, we take attempt data of 47 problems attempted by 14571 users on Hackerrank and based on how many people attempt a problem, number of total attempts, time taken to a successful attempt and number of successful attempts, we classify the problems as easy, medium, or hard. This system can be later used to adaptively suggest problems to solve in sequence by the student in a manner that boosts the motivation and thus improve the learning outcome.

2 Methodology

Data Collection is the first step in any work related to analyzing and predicting outcomes from data. We used data from hackerrank contests created to train second and third year students in C programming at Vishnu Institute of Technology, Bhimavaram, AP. There were a total of 47 problems in 4 different contests with over 14 K attempts. Each problem was identified by problem setter as easy, medium or hard vit a variable score depending upon the difficulty level of the problem. Our methodology from data collection to difficulty level prediction is demonstrated in Fig. 1.

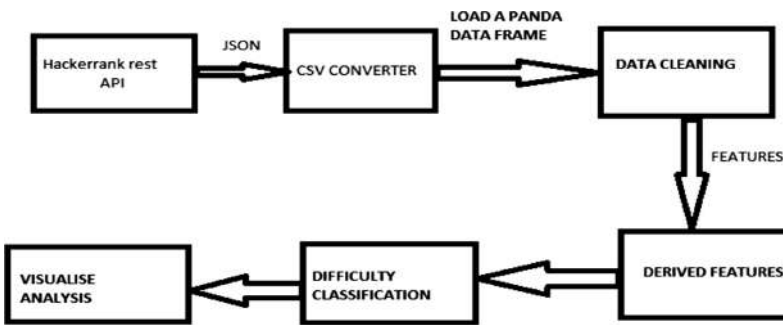


Fig. 1. Methodology of classification

We first collected HackerRank data using their Rest API and converted into CSV file format. We then loaded the csv into a Pandas dataframe followed by data cleaning, feature extraction and classification. From the features we derived the following features such as number of attempts of each question (count), level prediction of questions, time taken to solve the program (time from start). Using the derived features we classify the difficulty level prediction and finally visualize them to study the performance.

2.1 Data Collection

Hackerrank provides a neat REST API that is provides access to download the contest statistics in JSON format. The raw data had following features as shown in Table 1 below.

Table 1. The above table is representing the head (five rows) of the data.

	id	contest_id	challenge_id	hacker_id	status	created_at	kind	language	hacker_username	time_ago	...	is_preliminary_score
0	1312034876	11207	28152	4300058	Accepted	1546047668	code	c	17PA1A0515	about 9 hours	...	0.0
1	1312031278	11207	28152	5196151	Accepted	1546006269	code	c	17pa1a04a7	about 21 hours	...	0.0
2	1311998254	11207	28107	5310458	Wrong Answer	1545832448	code	c	17pa1a04g3	3 days	...	0.0
3	1311990643	11207	28152	5310458	Wrong Answer	1545799634	code	c	17pa1a04g3	3 days	...	0.0
4	1311989242	11207	28155	5310458	Wrong Answer	1545796684	code	c	17pa1a04g3	3 days	...	0.0

challenge/name	challenge/slug	inserttime	testcase_message0	testcase_message1	testcase_message2	testcase_message3	testcase_message4	Unnamed: 23
Square or Not (Amazon)	2	1546047675	Success	Success	Success	Success	Success	0
Square or Not (Amazon)	2	1546006269	Success	Success	Success	Success	Success	0
Finding the lone one	2	1545832458	Success	Wrong Answer	Success	0	0	0
Square or Not (Amazon)	2	1545799641	Success	Wrong Answer	Success	Wrong Answer	Wrong Answer	0
Multiply Time	1	1545796689	Success	Wrong Answer	Wrong Answer	Wrong Answer	0	0

2.2 Data Cleaning

Data cleaning is important part. It is easy to work on the cleaned data rather than the uncleaned data. During this process we have removed the NaN values and replaced them with the specific value required (0). Later we deleted the extra columns like “time ago” and “contest id”. So these columns have been removed by us using Pandas dataframe manipulation techniques.

2.3 Derived Features

The given data has “challenge/slug” feature specifying the level given by the problem setter in text format. We changed it to its corresponding integer value. We derived the count of number of attempts on each question by all the participants of the contest. There we got the total number of successful and unsuccessful attempts on a question by all users. We also derived the average time taken by to solve a particular problem.

2.4 Difficulty Classification

Based on the time taken to solve the question correctly, number of attempts used to get a successful solution, we classified the difficulty level of the questions d_q . Logical reasoning says that difficulty level of question increases with increase in time taken by the programmer to solve the program, with increase in number of attempts by the programmer to solve the program, and also with less total score assigned to most of the programmers. i.e.

$$d_q \propto T_q, \text{ where } T_q \text{ is the time taken to solve problem } q.$$

$$d_q \propto N_q, \text{ where } N_q \text{ is the total number of attempts for problem } q.$$

We calculate d_q by combining the above two observations as shown below

$$d_q = c \times T_q \times N_q$$

where c is an experimentally determined constant (Fig. 2).

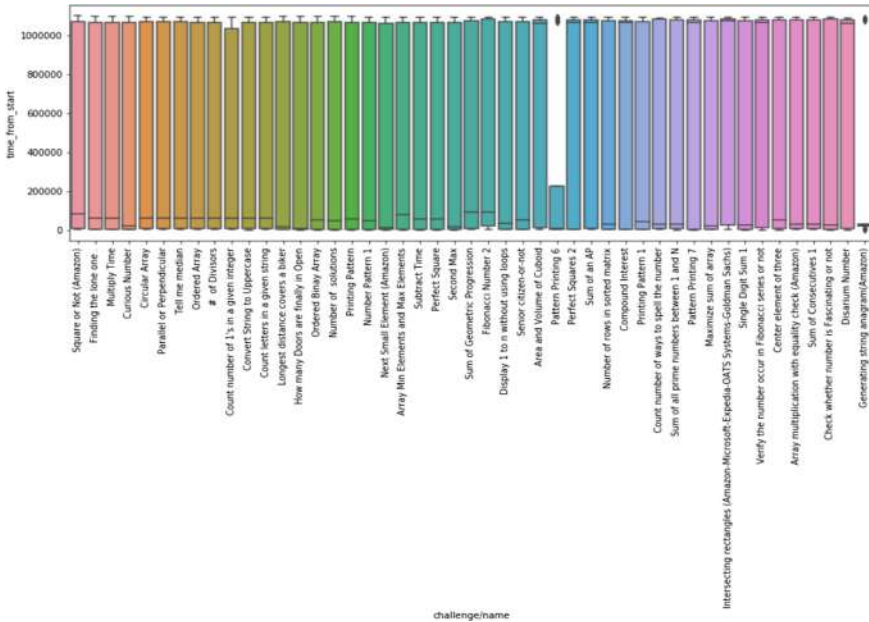


Fig. 2. Boxplot between question name and time taken

Based on the above criteria we will predict the difficulty level of the question and categorize the difficulty level and improve the programming ability, interest, confidence levels, and precise improvement in programming.

By this the average growth rate of programmers will increase to a greater extent.

From these, we are taking the points into consideration, the above analysis will be favorable, initiative and prompts the programmer to attend for further programming problems.

In order to calculate the programmer’s intellectuality, we consider the performance based phenomena called success rate calculator.

$$\text{Success rate} = \frac{\text{Number of Questions solved}}{\text{Number of attempts}}$$

The resultant value of success rate lies between 0 and 1 i.e., (0 ≤ success rate ≤ 1).

If the value of success rate nearly equal to 1, then the performance of the programmer is considerable under more success rate i.e., success rate ≤ 1.

If the value of success rate nearly equal to 0, then the performance of the programmer is considerable under medium success rate.

If the value of success rate is absolutely equal to 0, then the performance of the programmer is considerable under low success rate i.e., success rate = 0.

If the value of success rate absolutely equal to 1, then the performance of the programmer is considerable under perfect success rate i.e., success rate = 1.

When the number of solved questions increases the success rate increases and there by this basis summons programmer not to go for many attempts for submission.

From the essence of difficulty level formula calculation, the three attributes Easy, Medium and Hard can be initialized to specific problem can be categorized.

So, the interface will visualize both instructor's point of view of difficulty level to problem and also our above formula level (predictor) point of view to problem.

3 Results

In our statistical analytics we have incorporated the following features in order to get the prediction of difficulty level of programming questions based on programmers data analysis in programmer's point of view.

The features involved are:

Time taken to solve (time from start)

Score assigned for programmer (score)

Instructor specified level (challenge/slug)

The above features provokes following questions:

How the problem can be classify the performance on the basis of measures of difficulty?

How does the time spent on the question can derive the difficulty of the question?

Based on the above features we can classify the questions into three levels (Easy, Medium, Hard). How have we classified?

Assessment of difficulty of questions:

As mentioned earlier, based on the time taken by the programmer to solve a question correctly, we have classified the difficulty of questions. Answering a tougher question takes time for a programmer as it takes time to evaluate the logic and answering an easier problem takes less time. So, time acts as a parameter to determine the difficulty of the question.

In hackerrank platform tougher questions are given more marks as compared to easier one and in tougher problems there may be partial execution which results in the deduction of marks to the programmer.

The level mentioned by the instructor will also affect the difficulty of the problem which in turn reduces the marks scored by the programmer.

The approaches and techniques that are used in this are:

Clustering using k-means:

-In this algorithm we grouped the data points into easy, medium and hard (Fig. 3).

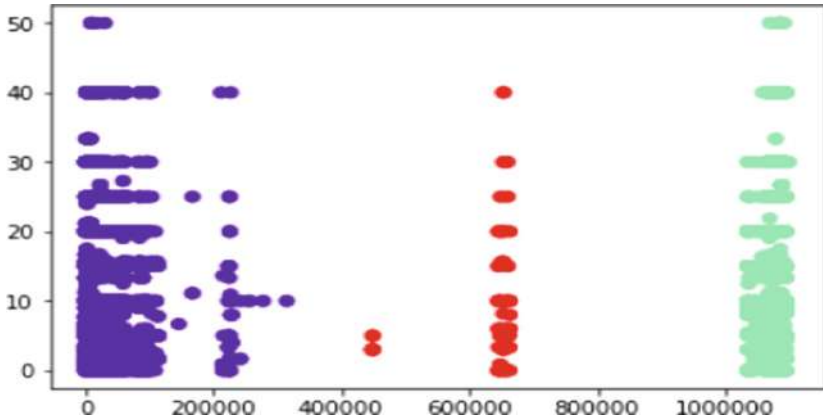


Fig. 3. The above clustering represents the grouping data.

Bar plots: - We plotted the data points on the bar plot in which x-coordinate is consisting of “Number of attempts of each question (count)” and the y-coordinate consisting of “Names of the questions(challenge/name)” (Fig. 4).

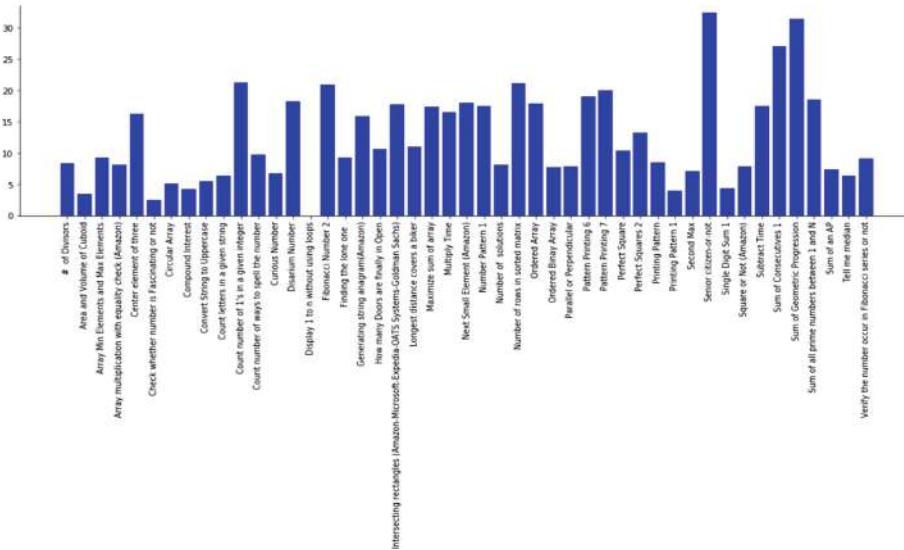


Fig. 4. The above bar plot plotted between the name and count.

Higher the height of the bar tougher is the question. From the above data “display 1 to n without using loops is an easiest question” and “senior citizen or not” is the toughest one. The difficulty rating matters for all the features of the corresponding question. The score mentioned on the y-axis rates the difficulty.

ratio for all the programmers we can also derive the best performer of the course. If a person has attempted an accountable number of questions with the above calculated ratio nearer to 1, then we can conclude him/her as one of the best programmer of that course.

4.2 Conclusion

From this paper we want to give the programmer a better interface about difficulty level which he may feel about the question. This will boost the confidence of the programmer and he/she will get more interest towards coding. This will also improve their coding agility. This will provoke the feel of competitive programming among the user.

4.3 Future Work

Up to the base, we predicted difficulty level of questions based on statistical analysis of group of programmer's solving that question. Now if we inculcate, incorporate, an individual programming statistics into the interface, then we can predict the difficulty of question he/she has encountered.

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Self-Adaptive Communication of Wireless Sensor Networks

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Abstract. Wireless sensor network is a network of devices that collect the information from the environment and communicate by means of wireless links. These networks are susceptible to interference from environment that almost leads to the disconnection of nodes in the network. Moreover, changes in environment, energy exhaustion or crash in system may result in frequent node failure and topology changes thereby disturbing natural functioning of the network. Because of the dynamic nature of sensor networks, new nodes enter and the network topology regularly changes that mandate the network to act autonomously, recover itself and remain functional by finding an alternative communication path between the communicating nodes. This paper mainly emphasizes on how nodes in such networks discover their neighbors and self-organize themselves to perform peer-to-peer data routing with topologies that are generally dynamic and decentralized. It also deals with how remaining nodes in the network automatically self-heal & reorganize the network topology in case of node failures.

Keywords: Wireless Sensor Networks (WSNs) · 6LoWPAN · Self-heal · RPL · Dynamic routing · Contiki

1 Introduction

Internet of Things (IoT) assists in forming an intelligent network that can be sensed, monitored and controlled with IoT enabled devices that use embedded technology to communicate with each other or the Internet. IoT based Wireless Sensor Networks (WSNs) are prevalent in many fields because of their ability to implant small, low-power battery operated and low cost sensors for monitoring applications. A wireless sensor network is a self-configuring wireless network comprising of spatially dispersed devices using sensors in monitoring physical or environmental conditions at different locations. Wireless sensor networks function unattended where the sensor nodes are organized randomly and are expected to self-organize themselves to form multi-hop networks [5].

The foremost challenge in wireless sensor networks is the frequent node failure due to harsh environment, energy depletion and also interference from the environment. Nodes might crash or can be moved physically resulting in changes in network topology

thus disturbing the network functionality. Similarly, the dynamic nature of such network allows new nodes to enter in the network which also often lead to topology changes. So nodes in wireless sensor network must act autonomously to recover from environmental disturbances by adapting and organizing themselves in the network without requiring human intervention and also providing a well-organized information exchange methods especially in multi-hop scenario. In this paper, we mainly discuss on how nodes self-heal themselves and reorganize the network topology in such dynamic and decentralized network.

The rest of this paper is organized as follows. Section 2 gives a brief introduction about 6LoWPAN protocol. Section 3 presents an overview of RPL routing protocol. In Sect. 4, we discuss about the experimental implementation and testing results of RPL protocol. Finally, we draw conclusions in Sect. 5.

2 6LoWPAN

The most important feature of an IoT is the communication between the devices that are provided using communication protocols. Some of the communication protocols for IoT are Zigbee, ZWave, Bluetooth, LoRaWAN, 6LoWPAN and Sigfox. Out of the available communication protocols, an IPv6 over Low-Power Wireless Personal Area Networks (6LoWPAN) is used. It is an open standard low power wireless network protocol facilitating IPv6 networking on devices constrained with limited memory, power and processing running 802.15.4. It connects the break between low power devices and IP world [10] by using an adaptation layer between MAC and network layer so as to hold interoperability between IEEE 802.15.4 and IPv6 [11]. The main task of an adaptation layer is compressing IPv6 header, fragmenting IPv6 payload and compressing UDP header. Routing problems are very difficult for 6LoWPAN networks given low-power and lossy radio links, battery supplied nodes, multi-hop mesh topologies and frequent topology changes due to mobility which requires routing to be self-manageable without human intervention. Therefore, a routing protocol for low-power and lossy Networks called RPL was proposed by IETF ROLL Working Group measuring the routing necessities on numerous applications such as industrial automation [14], home automation [15] and building automation [17].

3 Related Work

The research works are mainly concentrated on the simulation evaluation of RPL protocol with various simulators. The authors in [18] performed a study and estimation of RPL repairing mechanisms on metrics such as convergence time, power consumption and packet loss. In [13], RPL performance with various network settings is done using Cooja simulator for several metrics such as signaling overhead, latency and energy consumption. The authors in [19] proposed an RPL objective function based on fuzzy logic. RPL based on two objective functions called ETX and hop count in Cooja simulator is done for selecting parents in [20]. A study on RPL performance is done in [21] using OMNET ++ simulator with ETX metric in forming DODAG topology.

4 Routing Protocol for Low-Power and Lossy Networks (RPL)

4.1 Overview

Low-power and Lossy Networks consist of tremendously constrained nodes with low memory, processing power and energy (battery power) interconnected by an uneven lossy links supporting low data rates. The routing protocol in these networks should be able to adapt to the dynamic nature of metrics and handle lossy data link. To deal with these concerns, an IPv6 Routing protocol over Low power and Lossy Networks called RPL is designed for solving routing concerns that have incredible application in numerous fields. RPL constructs a Destination Oriented Directed Acyclic Graph (DODAG) where every node arrive at a single destination with no outgoing edges [1]. The DODAG is built depending on an objective function by choosing and optimizing routes based on several metrics/constraints estimating communication path for each of the wireless links. RPL uses ICMPv6 control messages to build routing topology and update routing information:

DODAG Information Object (DIO): holds information about DODAGID, RPL Instance ID, rank and a DODAG parent set to maintain DODAG.

DODAG Information Solicitation (DIS): helps a node to solicit DIO from reachable neighbor RPL node.

Destination Advertisement Object (DAO): supports downward routes by disseminating destination information upward along DODAG to the root node [4].

4.2 Construction of RPL DODAG

RPL DODAG as shown in Fig. 1 is constructed using two routing modes: routing upward and routing downward.

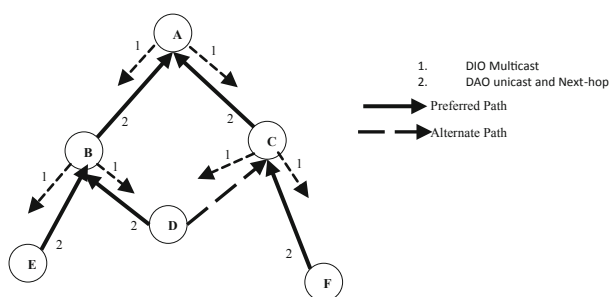


Fig. 1. RPL DODAG topology formation

Upward Routing

6LoWPAN Border Router or root node begins creating DODAG topology multicasting a DIO control message to downward nodes as an announcement of its presence in the network. The nodes in wireless radio range of root will receive the DIO and

process the DIO message to compute their rank and decide parent based on metrics defined by an objective function. In addition, the node that receives DIO processes it to come to a decision in joining DODAG. When a node chooses to join the graph, a route will be established towards root node by updating the DIO message and multi-casting updated DIO message to its neighbors. This procedure persists until the entire network is connected by forming paths using DIO message which is called upward routing. Meanwhile, if a new node needs to join the graph or when a node is booted for first time, the node sends a DIS message to solicit DODAG formation information from neighboring nodes.

Downward Routing

RPL creates and continues route in downward direction with DAO messages thus propagating the destination information upward along DODAG called as downward routing and it supports two modes of downward routing: Storing mode or Non-storing mode. Every node in storing mode stores downward routing tables for their sub-DODAG and also observes its routing table to prefer the next node for sending data packet whereas the nodes in non-storing mode do not store downward routing tables and each node has to propagate the list of its parent to the root node which in turn computes the paths to the destinations. In this paper, the downward paths are created using storing mode.

5 RPL Experimental Implementation and Results

The simulation of an RPL protocol implementation is made using Contiki Operating system and Cooja simulator. Contiki is a specifically designed open source operating system for low-power wireless IoT devices [2] and contain an in-built Cooja network simulator which is a widely used tool in wireless sensor networks domain to perform simulations of small to relatively large wireless networks of connected devices embedding sensors to develop, debug and evaluate projects. Many research papers have mainly focused on simulation of RPL protocol using Cooja simulator in Contiki operating system. This paper mostly focus on hardware implementation of RPL protocol using CC1310 wireless sensor module consisting of 32-bit ARM Cortex M3 controller that runs at 48 MHz and has a memory of 128 KB flash and 20 KB RAM and cc1310 radio [9]. The cc1310 transceiver module is ideal for use in IoT applications as they provide excellent battery life and long range operations with a sub-1 GHz radio. In this paper a small network is created with four nodes where initially one node acting as root node or 6LoWPAN Border Router (LBR) is connected to the computer through USB whereas client nodes operating on batteries are positioned at various locations. The network topology is monitored using WireShark, a protocol analyzer which is loaded into another node. The RPL experimental test up is shown in Fig. 2.

The network is formed based on the test cases mentioned below and the corresponding results are obtained. The following Table 1 shows the routing metrics that are considered in the implementation of this work and the parent selection is made based on the objective function that uses these metrics and constraints.



Fig. 2. RPL experimental setup

Table 1. RPL routing metrics considered

Nodes with IP addresses	RSSI	ETX	Node energy
LBR (fe80::212:4b00:fae:762d)	-57 dB	256	1
Node A (fe80::212:4b00:fae:99dd)	-80 dB	473	767
Node B (fe80::212:4b00:fae:99da)	-85 dB	682	514
Node C (fe80::212:4b00:fae:99aa)	-78 dB	446	520

5.1 DODAG Construction

LBR constructs DODAG using control messages with upward and downward routing nodes such that it multicasts a DIO control message to all downward nodes. Meanwhile node A waiting to join DODAG multicasts DIS control message. Now node A on receiving DIO from LBR sends a unicast DAO control message to LBR so as to join in DODAG topology. The method of a node joining DODAG is shown using the traces of a Wireshark protocol analyzer in Fig. 3.



Fig. 3. RPL DODAG topology formation

5.2 Multi-hop Packet Forwarding

Some nodes are within while other nodes are beyond radio range of root node and there is a need for an intermediate node to relay the data packets. Here, node A is within and node B is beyond radio range of LBR and node A within radio range of LBR acts in response to DIO message from LBR with DAO messages to join DODAG. Node B unable to hear from LBR starts sending DIS message to solicit DIO from neighboring nodes to join DODAG. When node A which is in radio range of node B receives DIS message, it starts multicasting DIO message to node B so as to make it join DODAG through multi-hop scenario. Node B on receiving DIO from node A sends back a response through a uni-casted DAO control message which in turn will be forwarded back to LBR. The topology formation in multi-hop scenario is shown in Fig. 4.



Fig. 4. RPL supporting multi-hop packet forwarding

5.3 RPL Repair Mechanism

A routing protocol should be able to repair routing topology when failure occurs called as repair mechanism. In multi-hop scenario, if node A fails due to changes in environment then there will be no route in up direction towards LBR for node B also since node A acts as an intermediate to node B and both nodes become unreachable from LBR as shown in Fig. 5.



Fig. 5. RPL node failure

A local repair is initiated by node A as shown in Fig. 6 where it repairs itself and joins back in the network topology by establishing a route back to LBR in DODAG and starts multi-casting DIO control messages. Meanwhile node B with no neighboring nodes in its radio range multicasts DIS control messages and on receiving DIO from node A which repairs itself it joins back in the network topology which is shown in Fig. 7.

Node	Type	Web	Cong	Parent	Up PWR	Down PWR	Last seen	Status
193D:212:4000:fae:95aa	TI	web	congr				199	OK
193D:212:4000:fae:95aa	TI	web	congr				179	OK
193D:212:4000:fae:95aa	TI	web	congr				179	OK

Fig. 6. Local repair initiated

Node	Type	Web	Cong	Parent	Up PWR	Down PWR	Last seen	Status
193D:212:4000:fae:95aa	TI	web	congr				229	OK
193D:212:4000:fae:95aa	TI	web	congr				229	OK
193D:212:4000:fae:95aa	TI	web	congr				26	OK

Fig. 7. DODAG construction after repair

5.4 Dynamic Routing

6LoWPAN networks support multi-hop topologies and here a multi-hop scenario is considered such that node A acts as an intermediate between LBR and node B and suppose node A fails due to environmental disturbances or energy depletion and if other node C comes in radio range of node B, then node B will establish the communication with node C using the control messages and forward data packet to it which in turn will forward data packet to LBR as shown in Fig. 8.

Node	Type	Web	Cong	Parent	Up PWR	Down PWR	Last seen	Status
193D:212:4000:fae:95aa	TI	web	congr				17	OK
193D:212:4000:fae:95aa	TI	web	congr				38	OK
193D:212:4000:fae:95aa	TI	web	congr				88	FAIL

```

Neighbors
[nt] 1 000b:1962:90f7:9300:0005:2:0:0:ff:fe::0: Reachable
[nt] 1 193D:212:4000:fae:95aa 0:12:40:0:0:fae:95aa:00 Reachable 17:0
[nt] 1 193D:212:4000:fae:95aa 0:12:40:0:0:fae:95aa:00 Reachable 17:0
[nt] 1 193D:212:4000:fae:95aa 0:12:40:0:0:fae:95aa:00 Reachable 17:0

Routes
[rt] 1 193D:212:4000:fae:95aa/120 v& fae95:212:4000:fae:95aa 26:0
[rt] 1 193D:212:4000:fae:95aa/120 v& fae95:212:4000:fae:95aa 88:0
  
```

Fig. 8. Dynamic routing formation and routing table

A dynamic routing path is created where the node self-heals itself in the absence of an already existing node and joins the DODAG. It is clearly observed from above results that multihop mesh topology network routes is supported in low-power networks using RPL and self-adapts to network topology changes caused due to environmental disturbances and node failures.

6 Conclusions

Wireless technologies are continually improving and numerous applications are effectively implemented in varied application scenarios. The main benefit of wireless sensor networks is its wireless communication that provides greater flexibility. However, wireless communication suffers from interference and environmental disturbances leading to the disconnection of nodes in the network thereby not providing reliability. This paper mainly focused on how sensor nodes self-heal and organize themselves from environmental disturbances and node failures and reorganize the network topology in dynamic networks.

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Evaluation of Performance Metrics in GeoRediSpark Framework for GeoSpatial Query Processing

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Abstract. Now-a-days we are moving towards digitization and making all our devices producing bigdata. This bigdata has variety of data and has paved the way to the emergence of NoSQL databases, like Cassandra, MongoDB, Redis. Bigdata such as geospatial data requires geospatial analytics in applications such as tourism, marketing, rural development. Spark framework provides operators for storing and processing distributed data. Our earlier work proposed “GeoRediSpark” to integrate Redis with Spark. Redis is a key-value store that uses in-memory store, hence integrating Redis with Spark can extend the real-time processing of geospatial data. The paper investigated on storage and retrieval of Redis built in geospatial queries and added two new geospatial operators namely GeoWithin and GeoIntersect to enhance the capabilities of Redis. Hashed indexing is used to improve the processing performance. Comparison on Redis metrics on three benchmark datasets is made in this paper. Hashset is used to display geographic data. Output of geospatial queries is visualized in specific to type of place and nature of query using Tableau.

Keywords: Geospatial data · Consistent hashing · Location-based query · Master-executor daemon · REmote DIctionary Server (Redis) metrics · Hashset · GeoHash · Resilient Distributed Datasets (RDD)

1 Introduction

Companies that use big data for business challenges can gain advantage by integrating Redis with Spark. Spark framework provides support for analytics, where process execution is fast because of in-memory optimization. Out of various NoSQL databases, Redis provides key-value pair, in-memory storage and suits to applications that require fast results. As such, when integrated, Redis and Spark together can index data efficiently and helps in analytics of variety of data driven applications. Geospatial data helps in identifying the geographic location of an object, its features and boundaries on earth. Such data can be analyzed to serve various purposes such as tourism, health care, geo marketing and intelligent transportation system.

Even though Redis has no declarative query language support, data can be indexed like in relational databases and structured as JSON fragments. Cassandra monitors nodes, handles redundancy and can avoid lazy nodes, where as Redis can monitor these

activities at higher granular level. Even though some works are reported for labelling and retrieving Redis data, are not efficient either at indexing or at retrieval. This paper aims at adding the functionality of spatial querying for Redis database by integrating it with Spark.

Hashed sharding computes a hash value for each of the shard key, based on this each chunk is assigned a Redis instance. Ranged sharding divides data into ranges based on shard key values and then each chunk is assigned a Redis instance. Let the Redis instances are numbered as $0, 1, \dots, n - 1$, where n is the total number of instances in the cluster. Let the range $R = 16384$, and hash function is CRC16 of the key modulo 16384, now the hash function maps key-value pair to the Redis instances in this range as shown in Fig. 1.

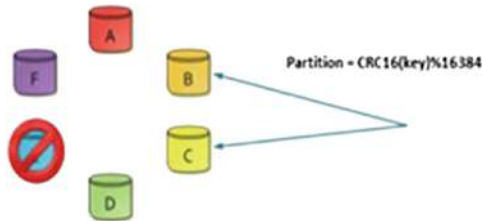


Fig. 1. Consistent hashing used in GeoRediSpark for storage and retrieval

The present study proposed “GeoRediSpark” to integrate Redis with Spark for efficient query processing on the existing operations GeoRadius, GeoDist and to enhance the functionality of Redis by adding GeoWithin and GeoIntersect and finally to visualize the query output. This paper is organized as follows: Sect. 2 presents literature survey on existing works for geospatial query processing. Proposed system is briefed in Sect. 3. Results are discussed in Sect. 4.

2 Literature Survey

Spark-Redis integration for deriving customer’s geographical insight is presented in [1]. Spredis is presented by authors. Magellan system is presented in [2] for geospatial analytics. NYC Taxicab dataset is used by them to analyze neighborhoods of a particular city that have most frequent pickups, popular times for cab pickups. Redis-Spark is used in [3] for creating recommendation engine using machine learning. Authors of [4] used Spark-Redis integration to generate predictions in real time for interactive applications. It is a recommendation engine for spatial data processing on Hadoop. Spark comparison based on: query language, spatial partitioning, indexing, and data analysis operators is reported in [5]. Their STARK system provides a number of spatial predicates for filter and joins. Drawback with this framework is that, filters can delay the processing time irrespective of any kind of data and persistent indexing causes the memory wastage. The processing performance can be improved with the use of hashed indexing that uses less memory. Work reported in [6] presents distributed query

scheduler for spatial query processing and optimization. It generates query execution plans using spatial indexing techniques. Although the query execution performance is improved and communication cost is reduced, their architecture is costly to implement and the use of filters can increase the processing time of a query. Spatial- Hadoop and GeoSpark are discussed in [6]. Authors proved that GeoSpark is faster than SpatialHadoop for geospatial big data analytics. Spatial data processing system that schedules and executes range search is described in [7]. k-NN, spatio-textual operation, spatial-join, and kNN-join queries are described. Bloom filters are used to reduce network communication. Hashed indexing can improve the query processing time by reducing the use of memory for storing global and local indexing. Location Spark caches frequently accessed data into memory while stores the less frequently used data into disk, but usage of filters on the spatial data increases the implementation cost of this architecture. Authors of [8] described Panda architecture for spatial predictive queries such as predictive range, k-NN and aggregate queries. Advantage of Panda System is that, it can display answer on the right side of the interface along with a set of statistics showing the system behaviour, pre-computed areas will be marked and illustrated. But usage of grid and list data structures to store the data may cause memory wastage. Also processing the grid data structures requires more amount of time. The identification of object moment is very important in system and variations may lead to major differences. Distributed Profitable-Area Query (DISPAQ) is described in [9]. It identifies profitable areas from raw taxi trip data using PQ-index. Z-skyline algorithm prunes multiple blocks during query processing. But usage of predictive function increases the computation overhead, though it reduces the processing time for executing frequent queries. Performance can be improved by dividing the places in to zones. Data mining is used to increase marketing of an educational organization in [10]. Authors used student residence distance, calculated by Haversine formula (orthodromic distance) and k-means is used to cluster the locations. Student residential address is calculated using latitude and longitude and visualized minimum, maximum and average distance. Their visualization can be used by organizations with 1000 to 2000 students to improve the admission rate. For huge data, visualization is difficult. Surrounding join query is described in [11].

The present work mainly focused on Understanding the existing architecture of Redis and to integrate it with Spark for processing Geospatial queries. To incorporate location-based functionality such as Geowithin and Geointersect in addition to Georadius and Geodist built in commands of Redis. To visualize the results Redis Hashset visualization and GeoJSON are used with Tableau as it handles different types of data and supports business analytics operations for generating automatic reports.

3 Proposed System

This section presents the detailed functionality of the proposed system to perform geospatial querying in the GeoRediSpark Architecture. In this, Redis is integrated with Spark framework as shown in Fig. 2, so that query response time for spatial data analysis could be optimized. Details of the architecture and methodology can be found in our previous work [12]. A cluster of 3 nodes where each node has an Intel Core i5

processor, 16 GB RAM, and a 1 TB disk is used as experimentation setup. All experiments were executed in Redis Cluster mode with a single master that controls and manages each executor in cluster nodes. On our cluster we run Windows 10 Pro with Redis 3.2.100, Spark 2.2.0, Scala 2.11.8, python-3.6.4 and Java 1.8.

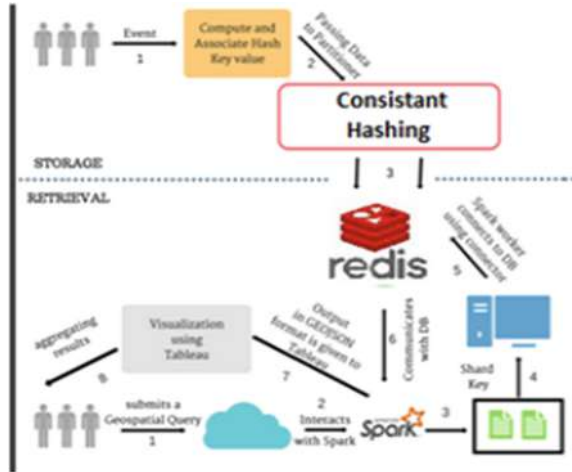


Fig. 2. GeoRediSpark architecture

3.1 Dataset and Statistics

The following datasets are considered for experimentation:

- (i) India Dataset - Geographical dataset of India which contains about 650 tuples of data. The dataset is taken in the form of.csv. It contains information about Place, State, Country along with its Latitude and Longitude values. The Place Type is also considered for processing the dataset. This dataset is downloaded from [13].
- (ii) Uber Taxi Trip Dataset - The dataset is downloaded from [14]. The dataset is taken in the form of .TSV. It contains information about CarID, Time and Data, Latitude and Longitude values. The dataset contains about 1048500 tuples.
- (iii) Road Network Dataset - The dataset is downloaded from [15]. The dataset is taken in the form of.csv. It contains information about NodeID, Latitude and Longitude values. The dataset contains about 21000 tuples. Table 1 presents statistics of datasets used.

Table 1. Statistics of test data used

Sno	Dataset name with URL	Size in MB
1	India Dataset	0.06
2	Taxi Trip Dataset	56.0
3	Road Network Dataset	0.7

4 Results and Analysis

Results of location-based functionality GeowWithin, GeoIntersect, GeoradiusSummary and Geodist are presented here. Sample queries for finding nearby places of specified locations are shown as follows:

Example 1: GeoWithin: In a given polygon, find various locations.

Example 2: GeoIntersect: In a given two polygons find the common locations.

Example 3: GeoradiusSummary: In a specified radius, summarize all cities, colleges, Companies, Hospitals, Banks, Restaurants.

Example 4: Geodist: What is the distance between locations.

Table 2 presents Redis metrics [16] derived using Redis-Stat monitoring tool. Such monitoring helps in identifying problems and to enhance experimental setup. For performance metrics, latency (Response time) L in milli seconds, for Memory metrics, used memory M, for Basic activity metrics, keyspace (Resource utilization) KS, persistence metrics (to check volatility of dataset) rdb_changes, Error metrics (rejected connections) RC are monitored.

Table 2. Redis metrics for all datasets

Sno	Dataset	Redis metrics				
		Latency	Used memory	Keyspace/keyspace_misses	Persistence metrics	Rejected connections
1	Dataset 1	2.00/s	949 kb	1000/0	25420 m	0
2	Dataset 2	2.14/s	883 kb	597/0	25421 m	0
3	Dataset 3	1.99/s	774 kb	201/0	25420.9 m	0

It can be observed from Table 2 that latency is 2/s (approximately) for each of the dataset, meaning that we can not get response prior to that time because of execution of commands such as intersection and sorting the result. Memory used is 869 kb which is not greater than total available memory, indicating that the Redis instance is not at risk and don't require swapping. Consistent hashing at storage and retrieval (HSET and HGET commands) helped to avoid swapping process. Memory based storage and query processing requires greater I/O speed. This drawback is overcome by in-memory geospatial data storage and processing [17].

The following Figs. 3, 4, 5 and 6 presents the Redis metrics for the three datasets.

As Redis is an in-memory store, if keyspace is larger, then more physical memory is required. Keyspace is 599.3 approximately, and keyspace_misses, rejected connections is zero, indicating optimal performance of geospatial query processing with Redis-Spark integration. Rdb_changes is 25420 m approximately, the value is increased based on time of execution.

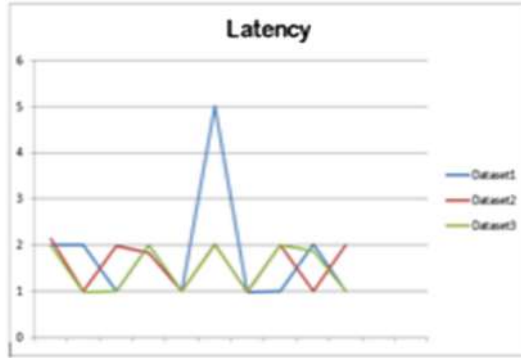


Fig. 3. Performance metrics: latency

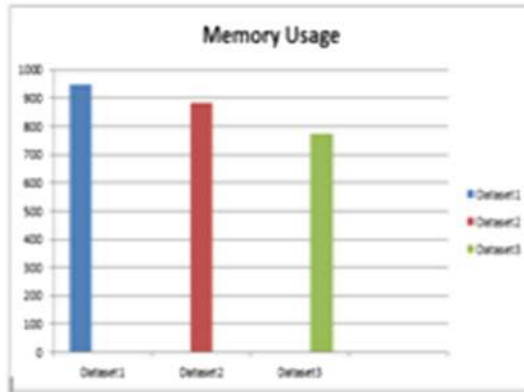


Fig. 4. Memory metrics: used memory

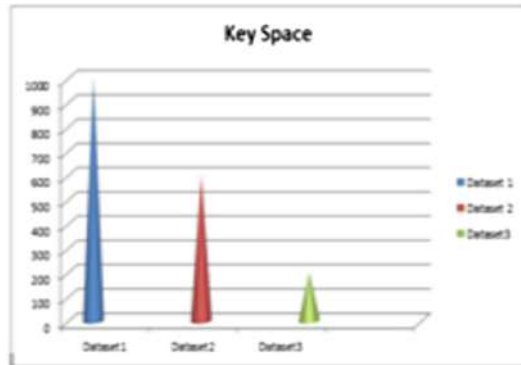


Fig. 5. Basic activity metrics: key space

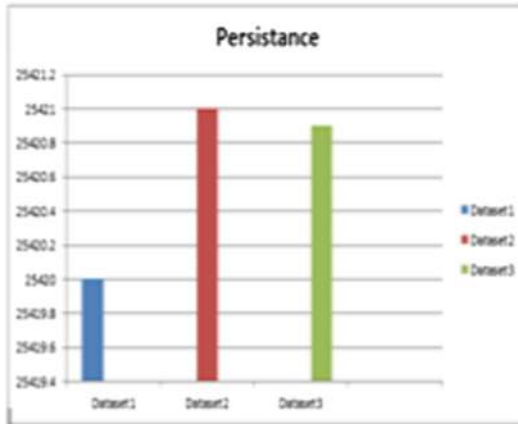


Fig. 6. Persistence metrics: rdb_changes

5 Conclusions and Future Work

GeoRediSpark added Geospatial query processing that works as an effective storage and retrieval system. Using consistent hashing during storage and retrieval helped in faster data access. Integrating Spark and Redis made us to process spatial query data stored in Redis without having to move data into Hadoop environment. Geohash helped to distribute data and also enabled to improve query performance. When shard key is appended with geospatial query, Redis instance routes the query to a subset of shards in the cluster. Three benchmark datasets are used for experimenting on a variety of queries. We enhanced the command set of Redis by adding two commands, namely Geowithin and GeoIntersect. GeoRediSpark performance is compared with various maps. Results of geospatial queries are visualized using Tableau.

Redis cannot store large data. Future work is to set up configurations for Spark as well as Redis at Multi-node clusters which can produce best results for processing large datasets especially Geographical data. We can also propose additional functionalities for finding k-nearest places. Our work will also be in the direction of effective searching techniques, as Geohash search fails in some edge cases such as, when same point belongs to different domains.

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CNN Based Medical Assistive System for Visually Challenged to Identify Prescribed Medicines

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Abstract. Developing assistive systems for visually challenged people is an active area of research in computer vision community. Such system provides a medical assistive tool to take the correct medicine at the right time as prescribed by the doctor and makes visually challenged people to live independently for their day to day activities. Many prototypes were developed to deal with misidentification of medicines but are incapable of determining exact pill picked by the person. This paper presents an automated system where feature extraction is done to recognize the pills based on structural, texture and Hu moments. If the pill is picked from the medicine box, the label present on the pill is considered for Text Recognition. Pill label and expiry date are extracted from the label and classified using Convolutional Neural Network (CNN) and is converted to speech. This audio is produced to indicate the person about the medicine picked. Experimental results proved that our system is better than existing works.

Keywords: Image analysis · Pre-processing · Feature extraction · ANN · CNN · Text to speech engine · Pill recognition · Adverse drug event

1 Introduction

As per World Health Organization (WHO) statistics given in [1], 253 million people are with vision impairment, out of which 36 million are blind and for 217 million it is moderate to severe vision impairment [1]. It is also observed that 81% of people are aged 50 years and above. 55% of visually impaired people are women. 89% of visually impaired people live in low and middle income countries. Many articles report that in recent years there has been a dramatic increase in prescription drug misuse leading to accidental overdoses. Pill identification can be done either as computer vision based approach and non computer vision based approach (online platforms). Various medication problems faced by visually challenged people is reported in [2], such as unable to read the prescription labels, expiry date of the medication. Hence identification of proper prescribed oral medicine based on several feature extraction is proposed in this paper to assure person safety and to facilitate more effective assistive patient care. This Medical Assistive system for visually challenged, mainly focuses on providing a medical aid for the blind people to live independently without depending on others for their day to day activities. There are many systems existing that serve the need for

medical pill recognition. They have drawbacks in recognition of pill, number of shapes estimated, background modeling estimation and accuracy. A better system overcoming these drawbacks is presented. Few pharmaceutical companies are including the medication name in Braille on the drug package. This paper is organized as follows: Sect. 2 presents literature survey on pill recognition systems. Proposed system methodology is presented in Sect. 3. Section 4 presents results and discussion.

2 Literature Survey

Work reported in [3] identifies a pill from a single image using Convolutional Neural Network (CNN). Pill region is identified first and then data augmentation techniques are applied. This work has addressed the challenge of minimal labeled data and domain adaption. It gave a good Mean Average Precision (MAP) score of 0.328 with images with noise, different backgrounds, poor lighting conditions, various resolutions and point of view. But Region of Interest (ROI) detection has not included the segmentation of the pill to completely ignore the background. Pharmaceutical Pill Recognition Using Computer Vision Techniques is described in [4]. Authors initially converted the images to grayscale and then performed background subtraction, followed by applying affine transformation to rescale the images. Deep convolutional neural network is used to distinguish pills from other categories of objects, but it would not work well for distinguishing specific pills amongst other pills. The neural network created was 3 layered with 200 hidden nodes and 9 output nodes which was trained with 10 iterations. Their method gives more accuracy for shapes such as circle (75%), oblong (70%) and less accuracy for shapes like triangle (10%) and square (15%). Authors of [5] presented Computer-Vision Based Pharmaceutical Pill Recognition on Mobile Phone. Pill image is captured using mobile phone and shape and color features are extracted. Shapes such as circular, oblong, oval are considered. Neural Network Based Assistive System for Text Detection with Voice Output is given in [6]. Webcam is interfaced with Raspberry pi that accepts a page of printed text and converts it into digital article. After performing image enhancement and segmentation features are extracted. Finally audio is generated. There is no clear explanation on dataset used and accuracy. Adaptable Ring For Vision-Based Measurements and Shape Analysis is described in [7]. Authors described how to accurately detect the shape of a pill based on outer and inner ring. Advantage of their method is that new features can be added to detect new shapes. But disadvantage is that any change in the pill angle will reduce the accuracy. Image noise also decreases accuracy of the system. Text Detection from Natural Scene Images is discussed in [8]. Three extraction methods for large characters (30 pixels in height) are given that are based on Sobel edge detection, Otsu binarization, rule based connected component selection/extraction, RGB color information and Edge based text detection has given higher accuracy. Their method could not perform well for large and small characters. Automatic number recognition for bus route information aid for the visually-impaired is given in [9]. Authors described extraction of bus route number information from natural scenes. This information is converted to audio. Such system helps visually impaired people to know the bus information without someone's help. It takes considerable amount of time to execute on smart phones. Text recognition face

challenges such as recognition of various font characteristics of the characters and quality of images. Technical review on various text recognition approaches is presented in [10]. There were many systems existing that serve the need for medical pill recognition. Each of the method has its own drawbacks in the areas of recognition of pill, accuracy. Most of these systems have a lesser accuracy with the classifier they have used. There were also limitations in the number of shapes estimated. So a better system overcoming these drawbacks is presented in this paper.

3 Proposed System

Figure 1. presents the architecture of the proposed system for recognizing the pill and helping the visually impaired about the medicine he has picked. It works in two ways:

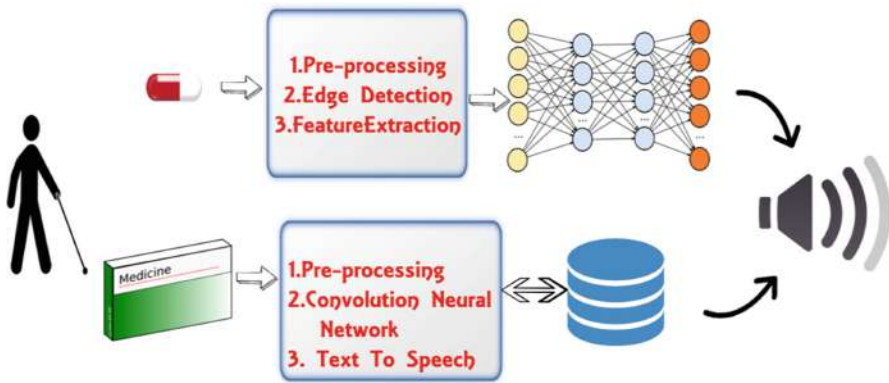


Fig. 1. Architecture of the proposed system for recognizing the pill

Case 1: Medicine Pill: The pills are recognized based on their features. The image undergoes preprocessing (Noise Removal and Morphological Operations) and edges are detected using Sobel Edge Detector. Then the binary mask of the image is extracted. Feature Extraction (seven features of Hu Moments), Color features (six), Texture features (24 values obtained from Gray Level Co-occurrence Matrix (GLCM)) are obtained. The extracted features are then trained with the Layered Neural Network with 37 neurons at input layer, one hidden layer with 100 neurons and output layer with 1000 neurons.

Case 2: Medicine Box: When the person picks pill from the box, the label (text) present on the pill cover is extracted using Optical Character Recognition and is compared with the templates available in the database. Text to Speech Engine communicates to person whether the medicine he has picked is right pill for the right time.

(i) Preprocessing: In pre-processing Noise Removal is performed by Deblurring using Gaussian. Morphological Operations such as Erosion followed by dilation is done. Then the image is converted from RGB to gray. Among the three methods Average

method, Lightness method and Weighted method (luminosity method), luminosity method is best as it is the advanced method of simple average method. Hence we used luminosity method for conversion from RGB to grayscale. Sobel method is used to detect outer line of the medicine pill that forms the edge. Hu moments (orthogonal invariants and skew orthogonal invariant) are used for object classification. The six color features are the 3-D co-ordinates of the most significant colors in the image. Consider three distances (1, 2 and 3 pixels), four angles (0, 45, 90 and 135°) and two properties (energy and homogeneity), 12 offsets are possible and hence 12 GLCM's values. A feature vector of dimension 24 is obtained. Finally 24 values of texture features are obtained. The area and boundary features are considered for obtaining the structural features of the image. The edge of an image is detected and from it the parameters namely area and perimeter are obtained. The normalised values of area and perimeter of the binary masked image are the inputs given to Neural Network. Prepare csv file training the ANN classifier with 37 neurons at input layer, one hidden layer with 100 neurons and output layer with 15 neurons (15 shapes). Test the classifiers (deep learners such as ANN, CNN). A Convolution Neural Network with 2D Convolution layers with 'Relu' as activation function is trained. Two case studies are proposed in our earlier work [11] that are based on ANN and CNN. Details of the methodology and proposed algorithms can be found in [11].

3.1 Dataset Description

The dataset available at <https://pir.nlm.nih.gov/challenge/submission.html> is used for experimentation. Figure 2 presents statistics of medicines considered for experimentation where x-axis presents shapes of various pills and y-axis presents count of pills.

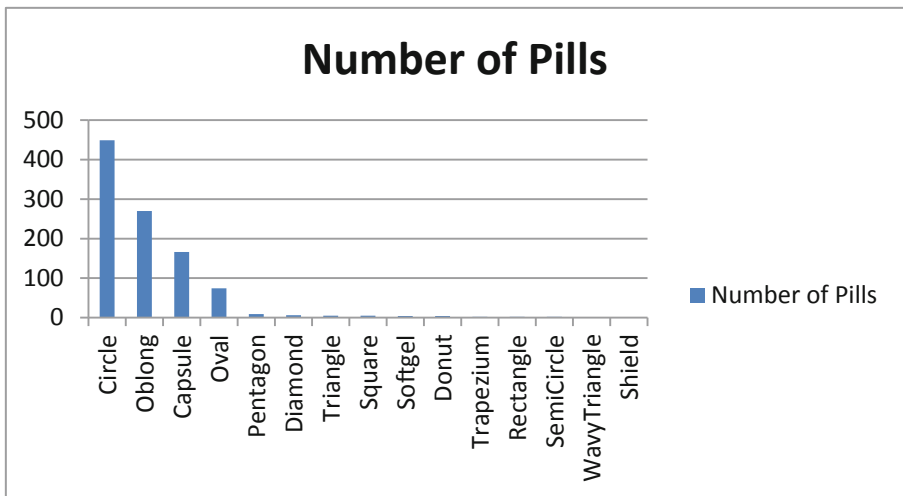


Fig. 2. Statistics of medicines w.r.t shape of the pill and with/without imprint

4 Results and Analysis

Dataset is created for the common medications of diseases such as Diabetes, Hypertension, Acute Respiratory Diseases, Arthritis and Polycystic Ovarian Diseases.

Figures 3, 4, 5, 6 and 7 presents training and testing accuracy for identifying the medicines for each of the disease with respect to number of epochs.

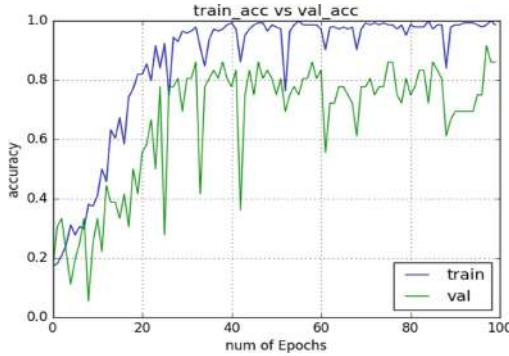


Fig. 3. Accuracy for Diabetes

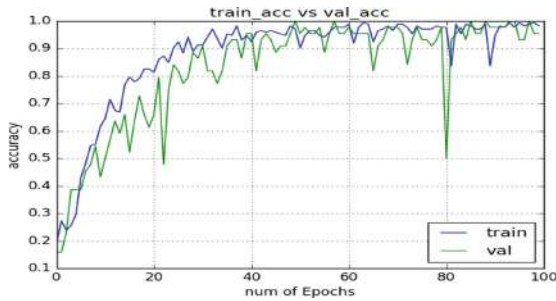


Fig. 4. Accuracy for Hypertension

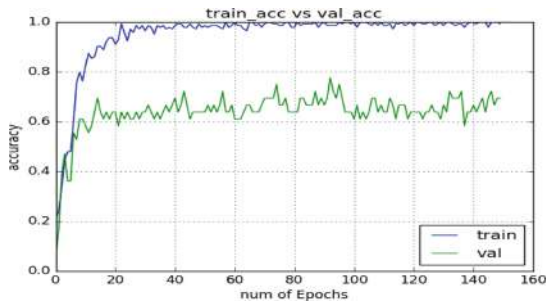


Fig. 5. Accuracy for Acute Respiratory

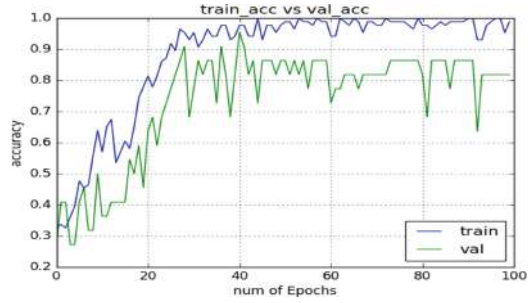


Fig. 6. Accuracy for Arthritis

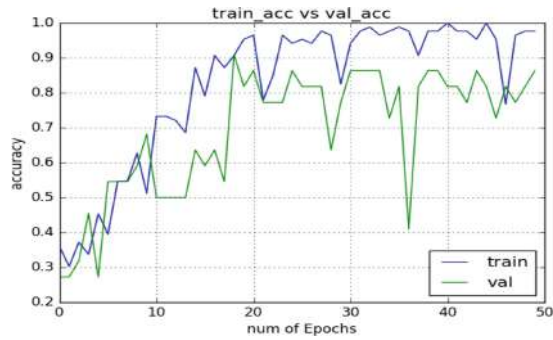


Fig. 7. Accuracy for Polycystic Ovarian Disease

The following Table 1 presents accuracy of neural network after 98 and 100 epochs.

Table 1. Accuracy of neural network after 98 and 100 epochs.

Sno	Disease	Medicines considered	Total samples	Training samples	Testing samples	Accuracy	
						After 100 epochs	After 98 epochs
1	Diabetes	Galvus Glimestar Glucobay Semi Rectilim Volix	180	144	36	86.11	91.6
2	Hypertension	Amlodac Amlong Aten25 Cilnep MetXL Stamlo5	216	172	44	95.45	100

(continued)

Table 1. (continued)

Sno	Disease	Medicines considered	Total samples	Training samples	Testing samples	Accuracy	
						After 100 epochs	After 98 epochs
3	Acute Respiratory Diseases	Azythromycin Cetzine Coldact Deriphyllin Sinarest	180	144	36	69.44	77.8
4	Arthritis	Acceloine Dicoliv Dipane	108	86	22	81.81	95.45
5	Polycystic Ovarian Disease	Dytor Metformin Spiro	108	86	22	86.36	90.91

For Diabetes and Acute Respiratory Diseases five medicines are considered. Each medicine has 36 images. A total of 180 images for these medicines are considered. For Arthritis and Polycystic Ovarian Disease 3 medicines are considered each of having 36 images. A total of 108 images are considered. For Hypertension, 6 medicines each of 36 images are considered. A total of 216 images are considered. The overall accuracy achieved for Diabetes is 86.11%, for hypertension 95.45%, for Acute Respiratory diseases 69.44%, for arthritis 81.81%, for polycystic ovarian disease 86.36%. More accuracy was achieved by changing the number of epochs. Figure 8 presents screenshot of identifying correct medicine at correct time.

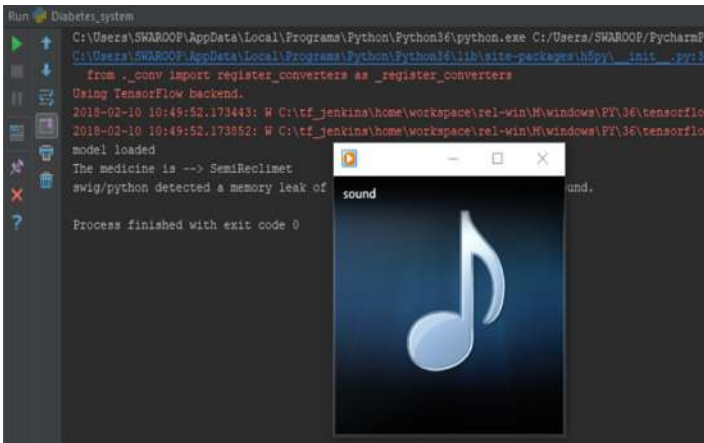


Fig. 8. Output after Text to Speech

5 Conclusions and Future Work

This is the high time where we cannot forget the problems faced by visually challenged people in identifying their medicines. An attempt is made in this paper to help the people in need. During execution we found that pill identification is effected by various external factors such as illumination conditions, pill manufacturing, pill cover, shape and imprint. The proposed system has been implemented both with presence and absence of imprints. Experimentation is made to identify prominent features for classifying the pill. The first three modules namely pre-processing, edge detection and feature extraction has given good results with the reference images of the dataset. The proposed system classifies the pill given to it. A training dataset consisting of 2000 reference images of 1000 pills was considered. For the implementation of neural network we considered 800 samples of images from our dataset for training. 200 out of them have been given for testing. The proposed system classifies the pill given to it. The accuracy achieved was 91%. For case 2 diseases namely Diabetes, hypertension, Acute Respiratory diseases, Arthritis are considered. For Diabetes and Acute Respiratory Diseases five medicines are considered. Each medicine has 36 images. A total of 180 images for these medicines are considered. This template can be extended for other medicines also. More accuracy was achieved by changing the number of epochs. Recognition of expiry date became difficult in some of the medicines because of different notation followed by each of the pharma company. Future work is to adapt normalization of data formats during text recognition process.

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Experimental Analysis of Machine Learning Algorithms in Classification Task of Mobile Network Providers in Virudhunagar District

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Abstract. Data mining has many classification algorithms with desired features. The machine learning algorithms such as K Nearest Neighbor, Support Vector Machines and Neural Network are some of the most popular algorithms used for classification task. Since classification is gaining importance due to the enormous amount of big data in real world datasets, the choice of a perfect classification algorithm is an ultimate need. For the classification task, the “Mobile Phone network satisfaction” real world dataset has been collected from the mobile phone users. In today’s world, mobile network chosen by the users has a greater impact on the individual user’s day-to-day activities and also on the business of network providers. Hence, the performance and accuracy of the mentioned machine learning algorithms has been investigated and analyzed in the prior described datasets. The proposed work analyses the performance of the KNN, SVM and Neural network classifiers and also analyses the mobile users’ affinity and usage nature based on different age groups.

Keywords: K nearest neighbour · Neural network · SVM · Mobile dataset

1 Introduction

Data mining is the process of extracting knowledgeable information from massive amounts of data. Data mining has become increasingly important in real world due to the enormous increase in huge amounts of data. Data mining is a process that uses many data analysis tools to discover patterns and relationships in data. From simplest analytical and statistical steps to visualization, data mining provides meaningful outputs among different attributes. These outputs are used to forecast many predictions. Data mining also takes the advantages of advances in the fields of Artificial intelligence (AI) and Machine Learning. Data mining, an integral part of KDD involves many functionalities such as classification, clustering and association rules in different categories of attributes. Classification is one of the pervasive problems that focus all kinds of applications. Classification problems generally aim to identify the characteristics that indicate the category to which each given case belongs to. This types of classification patterns and analysis can be used both to understand the existing data and to predict how new instances will fall under a particular category. Data mining creates

classification models with the help of machine learning algorithms by analyzing already classified datasets (test cases) and by inductively getting a predictive pattern. Mobile phone users are increasingly high in all parts of a country. Users will prefer the particular mobile network depending on the mobile network services provided. The user's affinity classification towards a mobile network will increase the business of network providers. The classification approach is performed using the machine learning algorithms. The following sections briefly describes the three machine learning algorithms based on its different types of applications in existing systems, the proposed work with its methodology and its evaluation results.

2 Related Work

Bansal, V. et al. [1] in their research focused on Customer Satisfaction of Mobile Phone Service Users Operating in the Malwa Region of the Punjab. The analysis was carried out using Cronbach's Alpha, Weighted Average, Ranking, Chi Square and the Percentage method. The satisfaction of Mobile User on Bangabandhu Sheikh Mujibur Rahman science and technology university, Gopalganj, Bangladesh was carried out by [2]. The results indicate that Network Coverage, Internet offer, Tariff offer are the main factor for affecting customer which helps to retain the customer and to create customer loyalty. In [3], the researchers analyzed the customer satisfaction on mobile datasets. The results found that image and perceived quality have significant impact on customer satisfaction. Image and customer satisfaction were also found to have significantly related to customer loyalty.

2.1 Machine Learning Algorithms for Classification Task – Theoretical Background

K-Nearest Neighbour Method:

KNN is a non parametric method and is widely used in many applications such as text recognition, web mining and medical diagnosis. In pattern recognition, the KNN algorithm is widely used for classifying objects based on the closest training examples in the feature space. KNN is also described as a type of instance-based learning, or lazy learning where the function is only approximated locally and all the computations are deferred until classification. KNN is used even in no prior knowledge about the distribution of data.

KNN has been analyzed in medical datasets such as identification of heart diseases and breast cancers. KNN has been used with many types of distance metrics but the Euclidean distance function is the most widely used metric. In medical domain problems the distance metric is validated on different type of data sets such as numerical, categorical and the combination of both. In [4], based on the distance function the classification accuracy of KNN is analyzed by using different types of datasets. In [5], authors analyzed the feature based classification of MRI images using K-nearest neighbor classifier and proposed that KNN classifier with Euclidean distance yields better accuracy when compared with other distance metrics. In [6], authors proposed a K tree method to learn optimal values of K and in the test stage KNN classification has

been adopted. The results conclude that optimal K values produce classification with good accuracy. By considering all the above factors, it is obvious that for a KNN classifier the value of K and the distance metrics has a vital role in better classification and also for higher accuracy rate.

2.2 SVM Classification Method

SVM classifier has high generalization ability and has several advantages over other multivariate classifiers. In training SVMs, the boundaries are determined from the training data. It is constructed by locating a set of hyper planes and by using these boundaries are discovered. These boundaries are defined as support vectors. SVMs are used for classifying non linear, overlapping and non separable data. Penalty value is assigned for data that fall on wrong side and optimal position is found. Traditional SVM classifiers and its modifications are used in existing systems. The advantage of SVM were: SVM's did not make any assumptions about the type of relation between target property and molecular descriptors and it has the low risk of over fitting problems. It can be able to output the expected classification accuracies for individual compounds.

2.3 Neural Network Classification Method

Artificial Neural Network can compute any complex models of thinking and can forecast data patterns. When properly trained, it is used for mapping problems that concern with the manipulation of symbols and memory. During the training phase, the goal is to determine the weights assigned with each connector lines. The training error is computed and the weights are adjusted until the error declines. The accurate forecast can also be easily predicted. In general, ANN has the following components (Fig. 1):

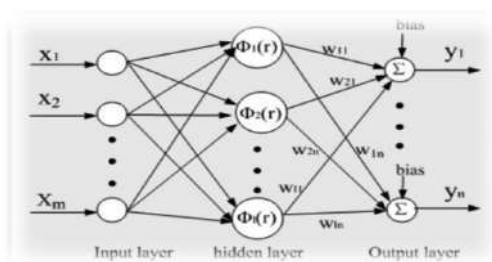


Fig. 1. Architecture of neural network with three layers

1. Architecture – Neurons.
2. Determining weights on the connections.
3. Activation function.

The learning rules are categorized as Hebbian, Perceptron, Widrow Holf or delta, Competitive, Outstar, Boltzmann and Memory based. Neural Networks are used in

wide range of applications such as intrusion detection systems, Business, Bankruptcy Forecasting, Signal processing, Authentication in mobile Adhoc networks [7] and so on. Based on the results of the wide varieties of applications, it is obvious that machine learning algorithms are used with different parameters and functions and yields better performance. The proposed analysis thus focuses on these algorithms with the real world “mobile network satisfaction” dataset collected.

3 Proposed Work

Input Data:

The mobile phone network satisfaction dataset is collected from 200 users in the form of questionnaires. The dataset contains 32 attributes.

Preprocessing of Data:

Data preprocessing is the foremost important step. Most computational tools are unable to deal with missing values. To overcome this problem we simply removed the corresponding columns (features) or rows (samples) from the dataset that contains the missing value.

Experimental Analysis:

The Experimental analysis was carried out using the Orange Visual programming tool. The conventional algorithm and the performance metrics are used in the visual programming tool. The test and score widget is used for comparison. The classifiers are analyzed with the tool and the best performing one is selected for the learning outcome in the proposed work. The overall flow diagram is represented in the Fig. 2.

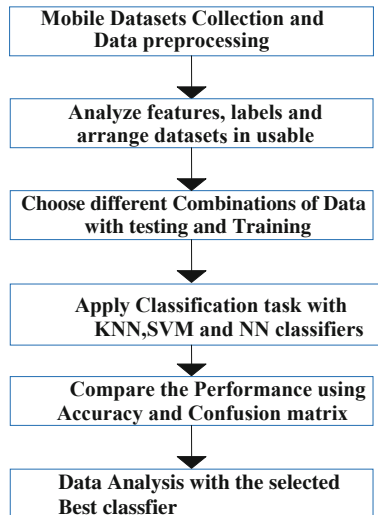


Fig. 2. System design

3.1 KNN Based Classification Methodology

It is also known as lazy machine learning. In this classifier, the learner can store only the training data and the predictions are made by the classifier based on the data instance being classified. The function KNN learner (K, distance, weight_id) is used in which K represents the number of nearest neighbors, distance refers to the distance measures such as Euclidean between instance, and id represents the id of meta attribute with instance weights. The classifier function is KNN classifier (K, rank_weight, weight-id) in which rank weight represents the neighbours weighted according to their rank or order and not on their distances. The distance between two data points such as x_1 and x_2 is decided by a similarity measure (or distance function). There are several other types of distance functions, such as cosine similarity measure, Manhattan distance, chebyshev distance, Minkowsky correlation, and mahalanobis. The Euclidean distance is the most widely used distance function and it is used. 10 folds cross validation with k value is selected as 4 for the experimental set up. The weight assigned is uniform weight, in which all points in each neighborhood are weighted equally.

3.2 SVM Based Classification Methodology

SVM classifier with test error settings was used in orange visual programming. The parameters used are cost-1.0, and Regression loss epsilon -0.10.cost refers to the penalty parameter and epsilon defines the distance from true values in which there is no penalty associated with predicated values. Kernel function allows creating models with linear, polynomial, RBF and sigmoid kernels. Radial basis function is used in the proposed classifier.RBF kernel for two samples x and y can be defined as:

$$K(x, y) = \exp\left(-\frac{\|x - Y\|^2}{2\sigma^2}\right) \quad (1)$$

3.3 Neural Network Classification Methodology

Multilayer perceptron learning Algorithm is used. Activation functions with Relu function. Rectified Linear unit function is used in the proposed work. It is an activation function that represents the argument of the positive part. Stochastic gradient descent optimizer is used and the maximum number of iterations is set as 200.

$$h_j(x) = \alpha(w_{j+} \sum_{i=1}^n w_{ij} x_i) \quad (2)$$

w_{ij} are the weight of the connections and α refers to the activation function which can be either a sine function or sigmoid function or soft max function.

3.4 Performance Analysis

Precision and Recall: Precision refers to the positive predictive value and Recall refers to the proportion of relevant instances that have been retrieved over the total number of instances.

Classification Accuracy: Classification accuracy represents the correctly classified examples.F1 represents the weighted harmonic mean of precision and Recall. AUC represents the area under the curve. It is equal to the probability that a classifier will rank a positive instance higher than a negative instance. It is assumed that “positive” ranks higher than the “negative” (Table 1).

Table 1. Evaluation results of the classifiers

Method	AUC	CA	F1	Precision	Recall
KNN	0.750	0.835	0.818	0.819	0.835
SVM	0.832	0.800	0.739	0.760	0.800
Neural network	0.837	0.820	0.812	0.808	0.820

Table 2 represents the confusion matrix. ‘S’ represents satisfied customers. ‘US’ represents unsatisfied customers. The performance metrics analysis shows that KNN shows highest classification accuracy when compared with SVM and NN. The Number of instances is 200, Classification rate $167/200 = 0.835$ and unclassified data $33/200 = 0.165$ for KNN. Classification rate $164/200 = 0.820$ and unclassified data $36/200 = 0.18$ for Neural network and Classification rate $160/200 = 0.8$ and unclassified data $40/200 = 0.20$ for SVM. Based on the KNN classifier, depending on the age group the network provider is classified.

Table 2. Confusion matrix

	Predicted		Σ
	S	US	
S	151	8	159
US	25	16	41
Σ	176	24	200
KNN			
	Predicted		Σ
	S	US	
S	156	3	159
US	37	4	41
Σ	193	7	200
SVM			
	Predicted		Σ
	S	US	
S	145	14	159
US	22	19	41
Σ	167	33	200
NN			

Table 3 represents the classification based on Age group with respect to the network provider. The Age group below 30.5 prefers the category-D network provider. Category-B is preferred by 61 users in the age group below 30.5. Table 4 represents the mobile usage of the respondents based on the number of hours of usage, number of calls and in internet usage in specific. Table 5 represents the classification of the

network providers based on age group. Recharge purpose is taken into three categories such as for the main balance, for internet and for SMS purpose. For the age group below 30.5, the main balance recharge is high (Table 6).

Table 3. Age group Vs network provider classification

Network provider	Age group			
	<30.5	30.5–42.0	42–53.5	>53.5
Category - A	4	1	0	1
Category – B	61	3	3	2
Category – C	8	0	0	0
Category - D	72	5	2	1
Category – E	31	4	1	1

Table 4. Age group Vs usage classification

Usage	Age group			
	<30.5	30.5–42.0	42–53.5	>53.5
Usage hours	More than 5 h	5 to 10 h	1 to 2 h	Less than 1 h
Number of incoming or outgoing calls	Less than 5	5 to 10 calls	5 to 10 calls	5 to 10 calls
Internet usage	More than 10 h	5 h	1 to 2 h	Less than 1 h

Table 5. Age group Vs recharge purpose classification

Recharge purpose	Age group			
	<30.5	30.5–42.0	42–53.5	>53.5
For data recharge only	83	7	2	3
For SMS recharge only	5	1	0	0
Main balance or full talk time recharge	88	5	4	2

Table 6. Age group Vs complaints by users classification

Complaints by users	Age group			
	<30.5	30.5–42.0	42–53.5	>53.5
Coverage problem	15%	20%	20%	40%
Less data speed	60%	50%	30%	10%
Receiving unwanted messages and calls	30%	30%	35%	40%

From the above tables, the following conclusions are drawn:

There is an association between age group and the category of network provider. The association between the age group and category depends on the respondents' mobile usage. The Internet usage is high for age group less than 30.5 and the less data speed problem will have a negative impact on the usage. The Data recharge is high for age group less than 30.5. The following Fig. 3 represents the usage of networks based on age group. Fig. 4 classifies the complaints based on age group.

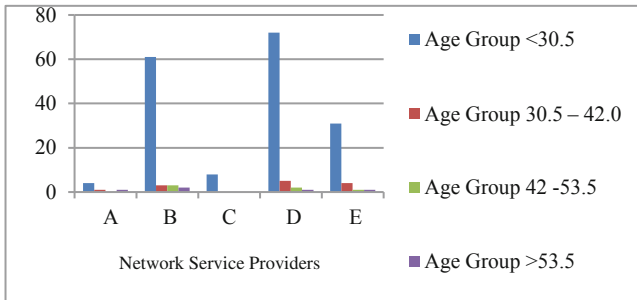


Fig. 3. Age group Vs network provider

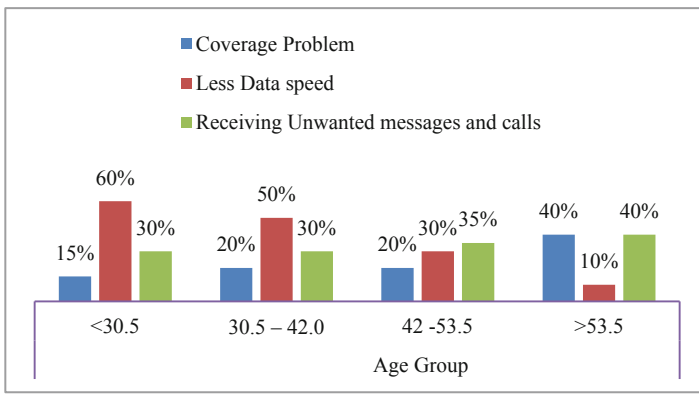


Fig. 4. Age group Vs complaints

4 Conclusion

The Experimental analysis of the different types of machine learning classification algorithms is performed and it is found that KNN outperforms well for the mobile phone network satisfaction dataset. Considerable downfall is seen in category-c which has a greater impact on the complaints by users. It is revealed that category-D outperforms well in Virudhunagar district and the usage is high among young people. For our training set, KNN is thus a competitive classifier with less error rate and estimated

high accuracy. Since category-c shows higher downfall in Virudhunagar district, category-c has to maintain the customer's loyalty by some offers or measures to increase the business.

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Performance Evaluation of SVM and Neural Network Classification Methods for Diagnosis of Breast Cancer

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Abstract. Breast cancer is the major and detrimental ailment amid all of the afflictions. Females are regularly affected through this disease. Data mining is a knowledge innovation progression to detect the sickness among enormous quantity of information. We proposed an approach used for the prognostication of tumor and presented through support vector machine and neural network classification methods. 10-fold and 5-fold cross validations are applied in the intended system to obtain precise results. The breast cancer database is used in this procedure which is from UCI machine learning repository. By using WEKA tool we studied the both classification techniques which are support vector machine and neural network classification models with 5 and 10-fold cross validations. In addition, support vector machine with 5-fold cross validation got high accuracy.

Keywords: Breast cancer tumor · Classification · Support vector machine · Neural network · WEKA

1 Introduction

In India, On behalf of every two women who are identified with breast cancer, one female expires [1]. It is the main regular tumor in female in India [2]. In metropolitan regions, one in twenty two female diagnosed with this malignancy for the period of life span [3]. In medical province, patient's data is extremely important. This information is used to excavate and interpreted into valuable information. Data mining on medical data gives a mode to discover hidden association existing in the data.

In the early stage, if we detect tumor, we can reduce the risk factor. A lot of research has been done to know the prediction of tumor threat with data mining classification techniques. If we identify the tumor in early stage, there may be a chance to reduce the risk. In the real life, Data mining applications play a major role

particularly in medical health field. Patient's dataset plays a vital part in order to detect disease. In this revise, the UCI machine learning repository breast cancer dataset has been taken to conduct experiment.

The document is organized as follows. The study of the author's testes with different classification techniques which are pertained for the assessment of cancer tumor is explained in Sect. 2. Section 3 specifies detailed explanation about supervised learning algorithms which are designed for the examination of cancer disease. Section 4 provides the details about dataset. The relative study of support vector machine and neural network classification procedures are analyzed in Sect. 5. Section 6 shows the conclusion work of whole evaluation.

2 Literature Survey

Categorization of algorithms is usually applicable for medicinal issues, in particular when applied for the diagnosis purpose.

According to Navyasri [4], an investigation has been done between J48 and Naive bayes supervised learning algorithms to notice cancer growth in female and corroborated that J48 supervised learning algorithm produce proficient results to identify tumor compare to Naive bayes algorithm. Islam [5], discussed about female deaths because of the crucial reason is breast cancer. Chang [6], analyzed the prediction of tumor in females, using Bayesian logistic regression classification technique. He used Wisconsin diagnosis breast cancer dataset for experiments. Nithya [7], did a research on detection of tumor in females. She did a comparative study on different classification methods in R environment with Wisconsin dataset. Aavula [8], did a survey on prognosis of breast cancer according to latest academic thinking. He experimented with different breast cancer datasets for survivability prediction.

A lot of study is carried out on the prognosis of tumor in women. In this paper, one of the best classification algorithms is used that is support vector machine which gives best results. A comparative examination is done between support vector machine and neural network algorithms on breast cancer dataset.

3 Supervised Learning Algorithms

A series of constructing a class label types which came from a dataset which includes class tags is explained as supervised learning.

Support vector machine:

It is one of the automaton knowledge algorithms which is used in classification problems. In this algorithm, we plot each data item (value of each feature) in an n-dimensional space where n refers to the number of features [9]. As Supervised Learning mainly works on the categorization of the initial data provided, the SVM can be useful to do it by introducing a hyper plane in between the various labels. The SVM is effective even in High dimensional spaces. So, as breast cancer may have a number of attributes, the SVM can be used for categorizing different attributes [10]. The SVM model is even effective in cases where a number of dimensions are greater than the

number of the samples. It utilizes/requires only less amount of memory as it uses only a subset of training points in the decision function.

Neural Networks:

In automaton learning these are one of the main tools. The way that we humans learn, the neurons are brain-inspired systems which are planned to replicate [11]. Neural networks consist of layers that are input and output layers, also a hidden layer containing of units that convert the given input into the output layer which can use. Neural networks are excellent tools for finding patterns which are at too a complex structure or numerous for a programmer to extract the machine to recognize. The ANN could be used as a show tool, to send more serious and probable cases of cancer for further diagnosis like Mammography or MRI. The intension of the ANN is to help the radiologist discern, to give the result as accurate as possible to predict tumor's from the rest. If the number of amiable patients being subjected to unnecessary and possibly harmful tests of mammography and breast MRI falls down as a result of this computer based screening then the ANN would have helped as a useful tool [12].

4 Data Set Details

Patient's information plays a crucial role to prognosis tumor in females. The dataset has the following attributes with 286 instances [13].

- Age: If a women's age is more than 40, the chances of breast cancer are high. So age is one of the best attribute to detect abnormality in women.
- Menopause: the risk of tumor may increase at the time of menopause stage in women's life. It doesn't cause cancer directly, but it is one of the reason based on families history.
- tumor size: This attribute plays an important role to identify cancer in females. If we find the tumor in early stages, we can reduce the risk of cancer.
- inv nodes: the number of axillary lymph nodes which gives histological examination. node-caps: this attribute gives the information about the outer most layer of a lymph node.
- deg-malig: degree of malignancy plays a Vitol role to detect cancer. Breast: this attribute gives the information about the rashes on the nibble. breast-quad: quadrants of breast find out the abnormality on the breast.
- irradiat: examination of irradiation plays a crucial role. Most women suffer from this.

5 Experimental Results

WEKA tool is one of the useful software to conduct experiments with different classification techniques. We conducted experiments with 5-fold and 10-fold on support vector machine and neural network classification methods.

Approach:

1. Properly categorized occurrences
2. Kappa sign
3. Average utter inaccuracy
4. Source average square inaccuracy
5. Comparative utter inaccuracy
6. Error of the ZeroR

Performance evaluation of Support vector machine classification:

Performance table of support vector machine classification with cross validation 10:

No-recurrence events	Recurrence events
171	30
57	28

Performance table of support vector machine classification with cross validation 5:

No-recurrence events	Recurrence events
176	25
61	24

Performance evaluation of neural network classification:

Confusion matrix of neural network Classification with cross validation 10:

No-recurrence events	Recurrence events
160	41
54	31

Confusion matrix of neural network Classification with cross validation 5:

No-recurrence events	Recurrence events
150	51
50	35

Comparative Analysis:

	CCI	ICI	KS	MAE	RMS	RAE	RRS	TI
SVM with cv-10	199	87	0.1983	0.3042	0.5515	72.7021%	120.6668%	286
SVM with cv-5	200	86	0.18	0.3007	0.5484	71.858%	119.9828%	286
Neuralnetwork with cv-10	185	101	0.1575	0.3552	0.5423	84.8811%	118.654%	286
Neuralnetwork with cv-5	191	95	0.1681	0.3373	0.5335	80.598%	116.7385%	286

5.1 Complete Precision Through Class

	TP rate	FP rate	exactness	recall	f-compute	Roc region
SVM with cv- 10	0.696	0.516	0.671	0.696	0.677	0.590
SVM with cv- 5	0.699	0.541	0.667	0.699	0.671	0.579
Neuralnetwork with cv-10	0.647	0.489	0.648	0.647	0.647	0.623
Neuralnetwork with cv-5	0.668	0.507	0.653	0.668	0.659	0.643

The support vector machine with 5-fold has identified correctly 200 instances; whereas neural network classification with 5-fold has identified 191 classified instances. In support vector machines performance table, 176 instances recognized to the class non recurrence event whereas in neural networks presentation table, 160 instances identified.

6 Finale Along with Forthcoming Work

Assortments of methods be studied about the abnormality tumors in women. This paper is examined under support vector machine and neural networks classification techniques with 5-folds and 10-folds. Support vector machine with 5- fold got high accuracy compare to neural network classification method. These two techniques are powerful classification techniques. Support vector machine algorithm is very useful on large database whereas neural networks are adaptive. The analysis of these algorithms is examined. In forthcoming, the tumor expert methods are going to achieve high accuracy rate.

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Data Aware Distributed Storage (DAS) for Performance Improvement Across a Hadoop Commodity Cluster

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Abstract. Big Data is the order of the day and has found in-roads into many areas of working other than just the internet, which has been the breeding ground for this technology. The Remote Sensing domain has also seen growth in volumes and velocity of spatial data and thus the term Spatial Big Data has been coined to refer to this type of data. Processing the spatial data for applications such as urban mapping, object detection, change detection have undergone changes for the sake of computational efficiency from being single monolithic centralized processing to distributed processing and from single core CPUs to Multicore CPUs and further to GPUs and specific hardware in terms of architecture. The two major problems faced in this regard is the size of the data to be processed per unit of memory/time and the storage and retrieval of data for efficient processing. In this paper, we discuss a method of distributing data across a HDFS cluster, which aids in fast retrieval and faster processing per unit of available memory in the Image Processing domain. We evaluate our technique and compare the same with the traditional approach on a 4-node HDFS cluster. Significant improvement is found while performing edge detection on large spatial data, which has been tabulated in the results section.

Keywords: Cluster · HDFS · Big Data · Image processing · Remote sensing · Spatial Big Data

1 Introduction

Remote Sensing – Spatial Big Data

Remote Sensing data is collected from over 1100 active satellites across the globe, the volume estimates are as high as ZettaBytes. As data scientists do not tend to throw away data, the volume keeps increasing. In terms of velocity, the measurement is based on the capacity to process the existing data before a new set of data is received and to produce data products in near real time if not in real time. The rate at which data flooding is happening across the globe, it is evident that the velocity of data is

incomprehensible even by the best GP-GPU based systems and the world is moving towards more complex hybrid system architectures. The variety in this remote sensing data comes from the varied data formats, varied sensor resolutions, and various sources including traditional optical satellites to microwave satellites. Spatial Big Data is the operational word for many GIS based solutions in order to deliver better systems.

Block/Window based Processing

Matrix based processing has been adopted by many commercial tools such as Matlab, which exploit the inherent features of spatial raster data embedded in the neighbourhood pixels. The blocproc functionality provided by Matlab is on the premise that the images can be either too large to load into a unit of memory or else they can be loaded into memory but then are too large in terms of units of time [10] consumed for processing. Due to processing of various blocks independently there could be problems of local and global thresholds. While performing edge detection on raster data Matlab uses global thresholds for processing the different blocks in order to match the results obtained by full in memory processing of the data. It may be noted that the blocproc functionality of MATLAB provides a zero padding interface to block processing.

To process images in smaller chunks called blocks is a more conducive approach as many of the linear filtering and morphological functions use block or neighborhood processing. This approach has the advantage of processing lesser information, which makes it faster and suitable to the MapReduce paradigm. It has the advantage of processing data per unit of available memory and per unit of time, thus improving the efficiency of processing while considering the limitations of commodity hardware.

2 Background and Motivations

2.1 Literature Survey

The development of better Remote Sensing (RS) sensors both satellite based and airborne has enabled the GIS industry deliver solutions for environmental monitoring, disaster management, military intelligence and many other applications. The use of high-resolution satellite imagery has increased the accuracy of various predictions and has aided in modelling once impossible weather applications. Various techniques in vogue for processing RS images use methods based on MPI to modern Map Reduce programming. Craig et al. [1] has conducted a variety of research for incorporating High Performance Computing (HPC) in RS missions. Lv et al. [2] used map reduce architecture to implement parallel K Means clustering algorithm for remote sensing images. Li et al. [3] used the Map Reduce programming model in the implementation of a structured SVM to recognize natural features in images and processed 6.5 million photos of Flickr. Bajcsy et al. [4] in their work on providing standard benchmarks and stress tests for big image processing operations on hadoop computer cluster platform concluded that computational elasticity of hadoop cluster platforms benefits the image processing operations by way of providing high level of scalability in architecture.

A cluster computing environment in the form of cloud computing has led to many a system for spatial data processing. Zhao et al. [5] proposed a cloud computing based system providing an application as a Map Reduce service for satellite imagery analysis. Yang et al. [6] implemented a privacy preserving cloud based Medical Image File Accessing System to improve reliable analysis and storage of medical images. Shelly and Raghava's [7] system based on Hadoop and Cloud Computing demonstrates effective speedup and efficiency gain of Iris template matching as compared to sequential process. The size of input file used was as high as 13.2 GB. Alonso-Calvo et al. [8] proposed a distributed image processing approach based on images transformed to region based graphs thus allowing parallel execution of image processing algorithms.

2.2 Hadoop and MapReduce

The hadoop environment distributes data across nodes using a fixed block size independent of the semantics associated with the data. A variety of customized Input format readers read entire lines of information or small images, which are distributed across the nodes in order to provide the processing tool a more meaningful data. Satellite imagery is also one such category wherein objects lying in a region can be identified through techniques called as Region Growing techniques. The volume of data to be read into the processing algorithm depends entirely on the resolution of the image and the size of the object being looked for. The matrix method of storing image pixels provides faster access to nearby pixels thus providing an efficient way to process the data. Given an image, HDFS distributes the data using the Block Size parameter and thus scatters all the pixels across the available nodes, which increase the access time and thus the processing time. For e.g.: if a chunk of $8192 * 8192$ pixels contains the entire park area of a neighbourhood and the block size is defined as 32 MB, these pixels get divided into two different nodes and add to the time taken to retrieve the data. If T_r is the time taken for reading 1000000 pixels of the image then total time taken to read the chunk of $8192 * 8192$ on a single node is

$$T_t = 67 * T_r \quad (1)$$

However, if the data were distributed based on the block size of 32 MB then total time taken would be

$$T_t = 32 * T_r + T_{nl} \quad (2)$$

which is the time taken to read the $32 * 1000000$ pixels on both the systems plus the network latency for the data to reach the process. Though the reading of data happens in parallel on both the systems, which is half of the earlier time, the network latency adds that extra time to the processing. Two parameters are important while processing the data in this manner viz.;

Heterogeneous systems

Stability of network and systems in the network

In a HDFS, which is a commodity cluster, the I/O on multiple machines is not uniform and hence the slowest reader/writer is the weakest link and secondly any instability in the network or system would lead to restart of the reading process from a redundant node, thus consuming even more time.

2.3 Motivation

The Map Reduce environment as described in the Literature Survey is a candidate for implementation of Image Processing algorithms and provides an efficient platform for parallel processing of data. The increase in accurate spatial data and their usage on GIS platforms serving the common person necessitates the usage of modern methods to improve the processing of voluminous, high velocity, multi variant satellite imagery.

In this paper, we discuss the method to distribute data across nodes keeping in view the Image Processing semantics in view. The storage of Meta information along-with the data enables one to store data as chunks of various sizes in contrast to the HDFS block size, which enforces the same block size across the cluster always. [9] Shows the efficiency of data retrieval using the data distribution method presented here, on a Read block of an Image.

3 Implementation

3.1 Data Pre-processing

The imagery data is inserted into HDFS cluster by copying it from the local disk to the cluster.-copyFromLocal is used to accomplish this job.

The images are distributed across the cluster based on the `hdfs.blocksize` parameter, which does not take any other constraints into consideration. In the current implementation, the data placement is of paramount importance and is effected based on the chunk size chosen by the user.

The input image is processed to divide it into chunks of user defined size based on the image and the application and these chunks are handed over to the HDFS default writer in the given size and flushed into HDFS (Fig. 1).

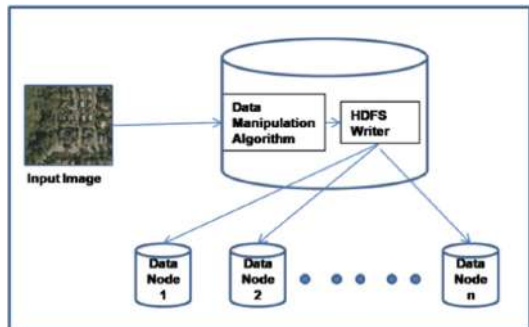


Fig. 1. Data distribution across HDFS cluster

The Image data is split as a matrix to be stored on the existing cluster. The image can be visualized as a set of boxes each of which is stored in a separate node of the cluster. The image is divided into square chunks with a reasonable overlap to avoid any artifacts in the resulting image after performing image processing operations such as edge detection, histogram equalization etc. Figure 2 shows the division of data with overlaps at every chunk. We also observe that in this division

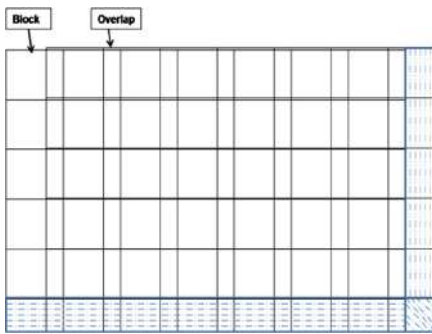


Fig. 2. Data divided into chunks; 4 different sizes

scanline in the block is calculated as

$$B_{i,s} = \begin{cases} 1 & i = 1 \\ p * (i - 1) & 1 < i < R \\ p * (i - 1) & i = R \end{cases} \quad (3)$$

$$B_{i,s} = \begin{cases} 1 + M & i = 1 \\ p * (i - 1) + M & 1 < i < R \\ p * (i - 1) + (p - R * M) & i = R \end{cases} \quad (4)$$

The time taken to write the file into HDFS is equivalent to the direct copy of the file into the cluster.

Table 1. Description of symbols for chunk size calculation

Description	Symbol
# of scanlines	s
# of pixels per scanline	p
Default block size (hadoop)	D
# of Overlap Pixels	L
# of bytes per pixel	B
# of Blocks	$R = p/D$
# of pixels/block in a scanline	$M = D/B$

of data there are four different sizes of data. The size provided by the user (which forms the maximum number of chunks), the size of the reminiscent chunk in the scan direction, the size of the reminiscent chunk in the pixel direction and the lower right corner chunk which is smaller than the other three sizes. The division of any image results in these four sizes of chunks.

Table 1 describes the symbols utilized in the calculation of the chunk sizes for distribution across the cluster.

$$\text{If } R * D_b < p \text{ then } R = R + 1$$

The beginning and ending for each

4 Evaluation and Results

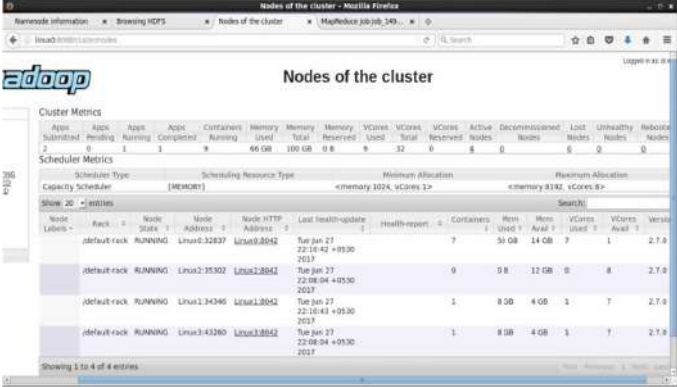
For the evaluation of the above schema, a HDFS cluster of 4 nodes was used and their configurations are as in Fig. 3. The cluster is a commodity cluster with varying sizes of memory and vcores.

4.1 Data Pre-processing

The USGS explorer was used to download spatial data in the form of jpg files. Each of these jpg files was of 1 to 1.2 GB and hence the command line tool “montage” is used to mosaic and stitch the images together to make a 5.1 GB file.

“montage *.jpg -mode Concatenate -tile 6*5 mosaiced.jpg”

The experiment is conducted with three images of different sizes namely 600 MB, 1.5 GB and 5.1 GB. The nodes of the cluster are shown in Fig. 3. The nodes of this cluster represent a Hadoop commodity cluster, which consists of systems with varying set of resources.



The screenshot shows the 'Nodes of the cluster' page in a web browser. The page title is 'Nodes of the cluster - Mozilla Firefox'. The browser address bar shows 'localhost:8020/cluster'. The page content includes a 'Cluster Metrics' table and a 'Scheduler Metrics' table. The 'Cluster Metrics' table has columns for App, Submitted, Pending, Running, Completed, Name, Containers, Memory, Memory, Memory, V-Cores, V-Cores, V-Cores, Active, Decommissioned, Lost, Unhealthy, and Nodes. The 'Scheduler Metrics' table has columns for Scheduler Type, Scheduling Resource Type, Minimum Allocation, and Maximum Allocation. Below these tables is a detailed table of nodes with columns for Node, Rack, State, Node, Node, Node, Last health-update, Health-report, Containers, Mem, Mem, V-Cores, V-Cores, and Versio.

Node	Rack	State	Node	Node	Node	Last health-update	Health-report	Containers	Mem	Mem	V-Cores	V-Cores	Versio
default-rack		RUNNING	Linux0-32837	Linux0-8042	Linux0-8042	Tue Jan 27 22:08:42 +0530 2013		7	50 GB	14 GB	7	1	2.7.0
default-rack		RUNNING	Linux3-35302	Linux2-8042	Linux2-8042	Tue Jan 27 22:08:04 +0530 2013		9	0 B	12 GB	0	8	2.7.0
default-rack		RUNNING	Linux1-34346	Linux1-8042	Linux1-8042	Tue Jan 27 22:08:43 +0530 2013		1	80 B	4 GB	1	7	2.7.0
default-rack		RUNNING	Linux3-43260	Linux3-8042	Linux3-8042	Tue Jan 27 22:08:04 +0530 2013		1	80 B	4 GB	1	7	2.7.0

Fig. 3. Nodes of the cluster

4.2 Data Processing

The jpg files are read into memory using the GDAL library, which caters to large, images that cannot fit into memory. The Hadoop API does not support compression of data as processing of uncompressed data improves performance. Data read from local disk is written to HDFS using Hadoop API in an uncompressed format. The chunk size is calculated as per the equations above and each chunk is written using the default HDFS writer. As discussed above, any image is broken down into four different sizes and to pick the correct height and width of the chunk important parameters such as Chunk Height, Chunk Width, Chunk Colour Model etc., are stored in the hbase database and picked up for the mappers to process the data. Each mapper processes a chunk of data and hence the custom input reader to the MapReduce provides 4 different sized chunks for processing. The Reduce phase writes the processed data into the HDFS at the respective locations of the image. HDFS does not provide random access to the data, but by implementing the hbase interface, both the mapper and reducer read and write data at random from HDFS.

4.3 Results

The experiment consisted of processing images downloaded from USGS explorer and using montage to stitch them together and running an edge detection algorithm. The images were sub-divided into chunks keeping the overlap factor intact across the images both in scan and pixel directions. In addition, the experiment was conducted by varying the chunk size within a file from 32 MB to 128 MB with hdfs blocksize at 128 MB.

The graphs shown in Fig. 4 reflect the time taken for an image of a given size to be processed using the default strategy of distribution and the data aware strategy of distribution. The data aware storage (DAS) improves the performance by almost 30% in files of smaller size to 50% in larger files. We also observe that there is not much variation in the processing time with the change in chunk size of the data.

This improvement can be attributed to the fact that the matrix method of storing an image brings out the variation in the neighbouring pixel’s value without having to traverse the HDFS for the neighbouring pixels.

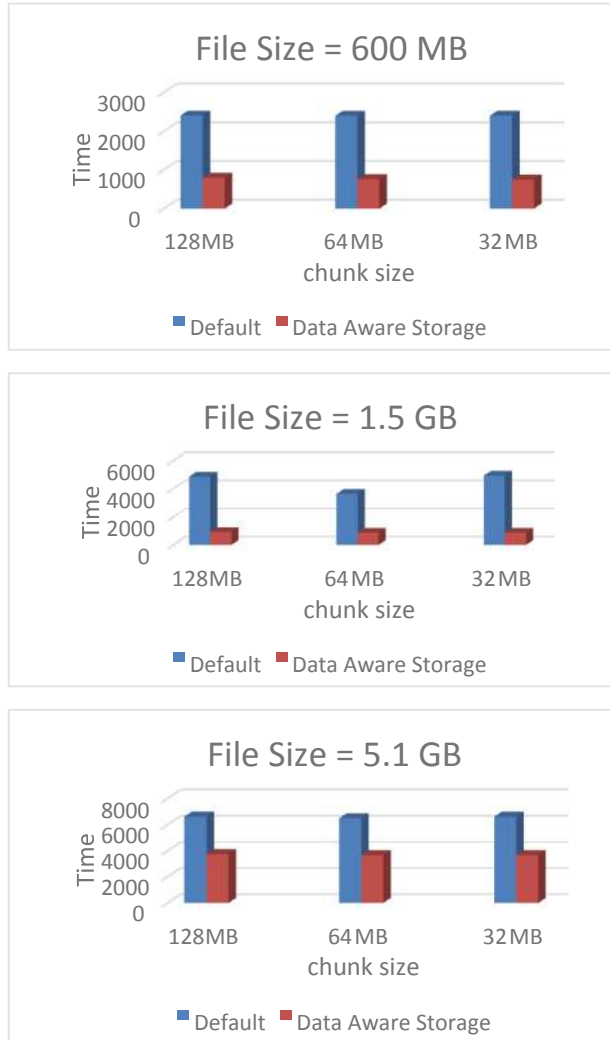


Fig. 4. Comparison of the edge detection algorithm performance on images of different sizes using default and DAS based distribution of data

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Dodecahedron Model for Storage of Unstructured Data

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Abstract. Nowadays, due to the development of the internet and social media, the unstructured data is growing exponentially at a high rate. With the growth of a variety of unstructured data, comes a problem of organizing and querying this unstructured data. In this paper, we present a way of organizing the unstructured data efficiently. We call this model as Dodecahedron Data Model (DDM). DDM stores a variety of unstructured data with the help of a distributed hash map. DDM provides various operations to store and retrieves the unstructured data, and interlink related and unrelated data.

Keywords: Dodecahedron · Distributed hashmap · Faces · Interlinking · Unstructured data

1 Introduction

Development of the internet and social network lead to increase of unstructured data exponentially. However, there is lack of a generalized model for unstructured data, which is a major challenge for big data. Many solutions were proposed to manage unstructured data. But, most of them focused on limited data types, due to which their scalability and usability are limited. Therefore there is a need for a generalized model to store a variety of unstructured data. There is a need to manage diverse kinds of data which are interrelated, so the data model should be evolved as per the user's wish. In this paper, we present you generalized data model which not only used to store different types of unstructured data but also perform operations which are efficient and simple compared with others. A data type is a particular kind of data which is defined by its value. Data structures are used to store and organize data of particular data type or multiple data types. At present there are data structures such as an array, linked list, queue, graphs etc. in these data structures if we want to store any new data type then we need to modify the definition in the code, or we need to write the extensions at the point where we need to use. In order to simplify these changes done to code, in dodecahedron we can store any data of any datatype without any extension or modifications done to the code. In our proposed model, we use a 3-Dimensional figure for storage of different types of data. This figure belongs to the family of the polyhedron.

A polyhedron is a 3-Dimensional figure with at polygon faces. The polyhedron is named based on number faces present in the shape. There different types of polyhedrons and some of the regular polyhedrons are shown in the Fig. 1 given below.

From the family of the polyhedron, we use the structure of dodecahedron for our implementation. Dodecahedron contains $2 + 10 = 12$ faces and each face consist of the Pentagon which we use to store data of different data types.

We use the dodecahedron model for storing and organizing various unstructured data and use functions for addition, deletion, search etc. in a dodecahedron.

Throughout the paper we refer Dodecahedron as DDH and Dodecahedron Model as DDM.

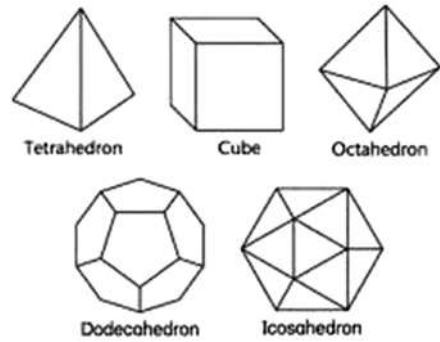


Fig. 1. Regular polyhedrons

2 DDM Modeling

The data structure is based on a 3D diagram of a polyhedron. In this, we are using DODECAHEDRON for demonstrating this structure. In DODECAHEDRON there are 12 faces, we use each face for storing each data type so we use 8 faces for all 8 primitive data types and 4 faces which are retained are used to store version history of all faces, link to other dodecahedron and central face is used to store label of dodecahedron remaining '1' face is remained empty for further usage of any datatype from 8 data types or apart from 8 data types.

Dodecahedron is implemented using a concurrent hash map. Dodecahedron is built using the properties of hash key and graphs. Dodecahedron uses two basic building blocks. They are Dodecahedron and Face. Dodecahedron is linked to other dodecahedron using labels. Every face in dodecahedron is used to store data and link of next face or next dodecahedron. Each face of a pentagon is divided into two parts quadrilateral and triangle, quadrilateral part reserved for data and triangle part reserved for storing the link of next face or dodecahedron. It stores null if no Face or Dodecahedron linked. In this, we can insert any data type just by mentioning the datatype, variable name, and data Such as (variable name, datatype, data value/data) in this order and we can insert any data type and also replace any data type with other data type. The data type can be linked to any other data type in another dodecahedron just by mentioning the face address in the address space of the triangular part of the face in the previous dodecahedron. By this, we can connect any data type with any datatype of the face in other dodecahedron or face of the existing dodecahedron. DATA MODEL FORMAT: There are two types of data objects namely dodecahedron and face,

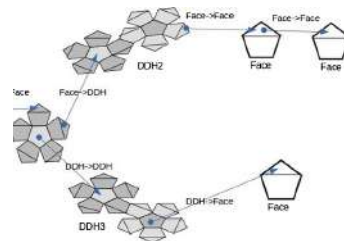


Fig. 2. Dodecahedron Data Model (DDM)

these both can be connected in 2 square ways. They are DDH-DDH, DDH-FACE, FACE-FACE and FACE-DDH. For more details see Fig. 2.

3 Salient Features

- It is used to store unstructured data without any restrictions on storing the data.
- The stored data can be easily retrieved and connected between various data types without any restrictions.
- Though the structure becomes complex as the data is stored randomly, the scalability of the structure increases due to the hash key value.
- While retrieving the data, the user can retrieve the whole chain of data sequentially even though it is stored randomly.

4 Implementation

The overall process is that the unstructured data such as image, videos, audios, etc. are organized in a dodecahedron data model (DDM). In DDM any unstructured data is stored as you wish and interlinked as you wish between any data type. Further, this unstructured data is stored in the graph database. This process of DDM includes 3 stages:

Stage 1: Load the data into the Dodecahedron Data Model. In this step, the user will submit the unstructured data to the DDM. DDM specifies a standard, in that order, only any data item will be added. Any data that can be stored in DDM will go to one of the faces of the dodecahedron.

Stage 2: Add interlinks among the data objects. Once the data added to the DDM model in Stage 1. The relationships among the data can be formed by specifying the links. DDM enables that option of specifying the interlinks in a flexible way. The user just has to provide a pair of data objects, for which the link to be made. Here data objects can be anything between Face and Dodecahedron.

Stage 3: Perform operations on the DDM model using DDM Query Language.

The above stage 1 stage 2 process can be better understood by algorithms mentioned in references [2].

DDM supports the following operations: Search, Insert, Delete and Update. Each of the above operations will be explained in detail in the DDM Query Language section.

Properties	
<p>Dodecahedron</p> <p><u>Properties:</u> Label: String Contains label of Dodecahedron. Hedron Size: Integer Contains No. of faces of Polyhedron Ex: 12 - Dodecahedron. It can be customized also. Polyhedron: ConcurrentHashMap Contains faces and its data. Polyhedron = (VariableName, DataType) => Face Next: Object Contains address of the next Face/Dodecahedron.</p> <p><u>Methods:</u> Dodecahedron(Label,Hedronsize): constructor for initializing a Dodecahedron. pushData(VariableName, DataType, DataValue): Adds data to one of the available faces of the Dodecahedron. removeData(VariableName, Type) Removes the data from face containing variable name and type which is stored already on Dodecahedron. display-Data() Displays all the connected data of a Dodecahedron.</p>	<p>Face</p> <p><u>Properties:</u> variable_name: String Contains the variable_nameoftheFace: data,type: StringContainsthedata typeoftheFace: data: T Contains the data value of the variable. next: Object Contains the address of the next face/Dodecahedron.</p> <p><u>Methods:</u> Face(variable_name; datatype; data): Constructor for initializing a face data. linkFace() Adding face to the linkedlist of a Face. linkDodecahedron() Adding Dodecahedron to the linkedlist of a Face. removeLinkFace() Removes link of a face from a linkedlist of a face of Dodecahedron. removeLinkDodecahedron() Removes link of a Dodecahedron from a linkedlist of a face. displayData() Displays all the connected data of a Face.</p>

Example:

Let see how DDM models the unstructured data with an example. One such unstructured data can be a power point presentation of most general form. It contains title and presenter details in slide 1, contents in slide 2, on subsequent slides contains

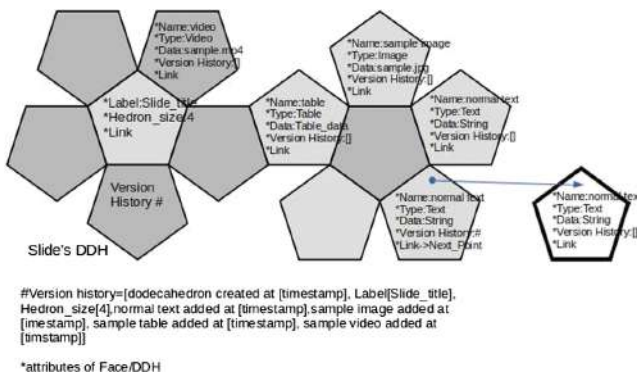


Fig. 3. DDM for single slide of ppt

the specific data about the content which can be combination of text/images/videos/audios/table/charts etc. PPT title and author details will be stored in one DDH and for its each slides/contents extra DDH will be created with slide title as label and types of data exist in the slide as hedron size. DDM model can be viewed as follows (Fig. 3).

5 DDM Querying Language

DDM querying language is used to perform operations on the dodecahedron. The operations can be divided into two types. The algorithms for operations are mentioned at the end of document.

- (i) Operations performed on dodecahedron.
- (ii) Operations performed on faces of the dodecahedrons.
 - (i) Operations performed on dodecahedron is only searching for the dodecahedron. This searching is done just to find the dodecahedron from a cluster of dodecahedrons. This search is used to find the dodecahedron based on label given in the central face of the dodecahedron. operations performed on dodecahedron such as insertion, deletion, search take time complexity $O(1)$ as we are using concurrent hash.
 - (ii) Operations performed on faces are (a) insertion, (b) deletion, (c) searching and (d) updating. Time complexity for all operations on the face is $O(E)$ where E denotes the number of links present in the cluster.

Operations:

I. Insertion

Addition of new data can be done in a way that selecting the dodecahedron where the user needs to insert data and while inserting the data the user needs to mention the variable name, data type, and data. If the faces of the dodecahedron are filled then the user can link the data with last used face by a linked list. The time complexity for a search operation is $O(E)$ where E denotes the number of links present in the cluster.

II. Deletion

Similar to insertion delete also work multiple levels, such as deleting a dodecahedron or face or link between them. Algorithms for the above deletions will be similar to insertion and runs at the same time complexity.

III. Search

Searching can be done using a subset of links instead of a sequence of serialized links. One key there is no need to have primary keys. If multiple data is present for any subset value then searching can be done using the nearest different data value from the given multiple data sequences.

IV. Updation

In order to update data, any subset of links can be used and further mentioning the data type, variable name, and data which is to be updated.

The time complexity for a search operation is $O(E)$ where E denotes the number of links present in the cluster.

What else DDM supports:

Following modules also supported by DDM model.

VERSION HISTORY: Version history of faces are stored at the starting face of the sequence. And version history of all faces of the dodecahedron is stored at one of the faces which are not used for regular operations.

LINK: Naming of the link which is universal, and it connects to any two data objects here objects can be face or dodecahedron or any data structure.

6 Comparisons

We have compared popular data models for unstructured data with our DDM in different aspects shown in table below

Comparison			
Feature	Neo4j	Json	DDM
Modelling	It uses graph model	Its uses key value pairs	Combination of key value pairs and graph models
Scalability	Scaling is hard	Not good for complex data	Scalable
Sharding	Not possible	Possible	Possible
Version history	Not supported	Not supported	Supported
Partial key sequence search	Possible	Not possible/key sequence must be provided	Possible

7 Future Scope

- In this paper, we have mentioned only one-to-one relation. This can be further extended to many-to-many relations and a user can use it upon his will.
- The data storage can be changed to a distributed database and also version history we used can be changed to maintain on display record of data which present in the sequence.
- The data sequence can be authenticated for modifications using authenticated data structure. The data can be encrypted using SHA algorithms in order to hide the data from public view.
- This can be further developed to directly identify and assess data and relations among the data for given unstructured data.
- Labeling of the link can be done such that, the user can retrieve the data by mentioning the link which connected the two data types though there is no need of the user to know the data or data types connected to the link.

Algorithms	
Insertion	Search
<pre> InsertFace(ConcurrentHashMap ddh,String variableName,String dataType,T data) Input:Unstructured data will be added to one of the dodecahedrons Facef=new Face(variableName,dataType, parse- Data(data)); if f!=null then faceKey=variableName+" "+dataType ddh.appendLast(faceKey,f); end end CreateLink(ConcurrentHashMap poly- hedrons,String s1,String s2,String s3,String s4) Input: Collection of dodecahedrons polyhedrons and four strings are pro- vided begin if s3.isEmpty and s4.isEmpty then /* create link between dodecahedron and dodecahedron */ ddh1=plyhedrns.get(s1) ddh2=plyhedrns.get(s2) if ddh1.link==null then ddh1.link=ddh2 else ddh1.appendLast(ddh2) end;else if s4.empty then if plyhedrns.get(s1)!=null then face1=findAllFaces(s2,s3) if face!=null then /* link between dodecahe- dron and face */ pluhe- drns.get(s1).appendLast(face1) end;else face1=findAllFaces(s1,s2) if (plyhedrns.get(s3)!=null) then /* link between face and dodecahedron */ face1.appendLast(plyhedrns.get(s3)) end; end; else face1=findAllFaces(s1,s2) face2=findAllFaces(s3,s4) if face1!=null and face2!=null then face1.appendLast(f2) end; end; end </pre>	<pre> findFaceInCluster(String variable- Name,String dataType, String[] queryValues) Input: strings variable name, data type and queryValues string array will be given begin result=[] i=1 for each Dodecahedron ddh in plyhe- drns result=[] for each Dace f in ddh If queryVal- ues.split(",").include?(f.variableName) then result.put(i++,f.data) if f.faceKey.match(faceKey) result.remove(i-); while(f.list.hasLink()) do begin tempFace=f.list.nextFace If queryValues.split(",").include? (tempFace.variableName) then result.put(0,tempFace.data) if tempFace.faceKey.match(faceKey) then result.remove(i-); end; end; end; end; return result; end </pre>

8 Conclusion

In this paper, we present to you a combination of key, value and graph model to create a structure which is capable of handling any data type and interlink them as a solution for a generalized model for unstructured data. In the proposed model unstructured data can be randomly stored and interconnected at different levels as per usage and retrieved the same. The model uses positive aspects of both hash key and graph to increase scalability. The structure can be complex as the data is stored randomly but is connected with each other.

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A Smart Home Assistive Living Framework Using Fog Computing for Audio and Lighting Stimulation

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Abstract. This work proposes an innovative Ambient Assisted Living framework for mature adults suffering from dementia. A novel Fog computing based ubiquitous recognition model is used to stimulate subjects and immediately trigger an associative recall in recognizing familiar persons and everyday objects. When a known person is sensed in the house, then a relevant audio file is played on smart speakers located in the house, so as to trigger associative recall based on the principles of music therapy. Also, the lighting effects are used to assist the subjects in identifying domestic objects accurately. Person and object recognition is achieved by using the Haar Cascade Classifier. The system was successful in the identification of 82% of the familiar people or objects so that the benefits of music therapy and lighting are realized for everyday living.

Keywords: Audio-lighting stimulation · Smart home · Associative recall · Dementia · Fog computing · Internet of Things (IoT)

1 Introduction

Dementia is a chronic disorder that causes permanent and gradual cognitive decline which is more likely to occur in elderly people. Dementia has affected an estimated 50 million people across the globe and is likely to rise to about 152 million people by 2050 [1]. The main side effect of dementia is the loss in memory of placing of objects, forgetfulness of recent context and circumstances and even loss of recognition of individuals. Sensory stimulation is the activation of various senses like *vision*, *hearing*, *smell*, *taste*, and *touch*. Multi-Sensory Stimulation (MSS) has been an increasingly popular approach to care used by several dementia care centers in recent times [2]. There are several types of sensory stimulation each with their own benefits. One of the more effective methods to combat the impacts of dementia is music and light treatment as we explain in the following.

Studies have shown that colors influence memory [3]. Color cues can be used to provide a powerful information channel to the human cognitive system and play an important role in enhancing memory performance [4]. Audio stimulation is also effective for enhancing mood, relaxation, and cognition [5]. Music can help individuals who are experiencing dementia to recall their past, it also helps at decreasing sentiments of dread and tension that they frequently feel. The impact of music and light treatment is useful for individuals with dementia as it causes them to distinguish all the more effectively their environment and keep up their feeling of personality.

Design of smart home has evolved into a significant research area with the development of the Internet of Things (IoT) technology. The health care based smart home environment assists elderly or disabled people living independently in several ways. Sensing, reasoning, and acting are the primary tasks involved in modeling a smart home [6]. The growing amount of enormous data and substantial processing capabilities of devices between cloud and source of data in the IoT environment paved the way to a new paradigm, fog computing, wherein a portion of the computation is shifted towards the origin of data from the traditional cloud-centric computation. In fog computing, computation occurs using the infrastructure on the way to the cloud from the source of data [7]. It offers several benefits like improved response time, data protection and security, reduced bandwidth consumption etc. [8].

In this work, we propose a framework for audio and lighting stimulation program for the elderly using fog computing model in a smart home. Training the model to identify the familiar persons and daily usage objects, classification of them is done using fog devices. This gives quicker response time when compared to training and classification being done on the cloud. When any person or object from this trained group is sensed and classified using the trained model, audio and lighting stimulation are given, which triggers the associative recall mechanism to help the elderly in recognizing the person or object better. The organization of the paper is as follows. Section 2 presents related work done in this field. Section 3 describes the proposed system and implementation details with experimental results are discussed in Sect. 4. Finally, Sect. 5 concludes the work suggesting future enhancements.

2 Related Work

The problem of designing smart home environments to assist elderly and disabled people has been addressed earlier in the literature. Wang et al. proposed an enhanced fall detection system for monitoring the elderly person using wearable smart sensors which can detect the accidental falls in the smart home environment [9]. Suryadevara et al. proposed a wireless sensor network based home monitoring system for elderly activity behavior that involves functional assessment of daily activities [10]. The proposed mechanism tries to estimate the wellness of elderly people based upon the usage of household items connected through various sensing units.

2.1 Smart Homes for Sufferers from Dementia

Jean-Baptiste et al. proposed an action recognition system dependent on Markov decision processes to help individuals with dementia to complete their different everyday home exercises [11]. A probabilistic learning approach for standards of conduct in savvy homes for individuals with Alzheimer's has been recommended by Zhang et al. [12]. Both of the works don't think about the acknowledgment of parental figures or familiars of the sufferer. A client-focused model savvy home is presented in [13]. A structure, with cameras, wearable gadgets, and sensors, distinguishes and predicts the hostility of individuals with dementia [14]. A processing stage created with the utilization of sensors that are set at home to check the temperament of individuals with dementia [15]. These referenced works centre around conduct observing, chiefly through a system of sensors.

2.2 Frameworks for Observing Individuals with Dementia

A stereo vision-based framework was structured for the discovery of individuals with dementia at their home [16, 17]. Kasliwal et al. proposed a GPS beacon for individuals with dementia for the checking of their present area and sending this information to their guardians' cell phones [18]. Ceccacci et al. created observing framework for dementia people by utilizing a user interface [19]. Khan et al. proposed a framework for the detection of agitation and aggression in dementia people [14]. Additionally, a figuring stage that utilizes sensors has been proposed for the checking of sufferers' mindset [15].

3 System Description

The generic architecture of our fog computing based smart home environment is shown in Fig. 1. The sensor node, which is shown in the lower level of the architecture, gathers information from several sensors connected to it, perform some processing, and communicate with other connected nodes in the network. Typically all these sensor nodes communicate with the gateway device, which has higher processing and storage capability compared to the sensor node.

The sensor nodes could use different protocols, like Zigbee, Wi-Fi, Z-Wave etc., to communicate with the gateway device, which depends upon the sensor nodes and gateway device being chosen based on the application requirement. The edge gateway collects the data from various sensor nodes, which would be further processed by fog devices as per the application requirement. The summary information from fog devices could be optionally sent to the cloud for further storage and analysis.

3.1 Fog Node and OpenCV

OpenCV (Open Source Computer Vision Library) is an open source library which has several inbuilt functions for implementing computer vision and machine learning algorithms [20]. These algorithms can be used to perform various tasks like identification of objects, detection of faces etc. In our design, the machine learning model for the person identification is designed using OpenCV Haar Cascade Classifier and this model is trained on the fog node. The appropriate audio-visual stimuli would be controlled by the fog node to assist the resident with dementia to recognize the visitor immediately.

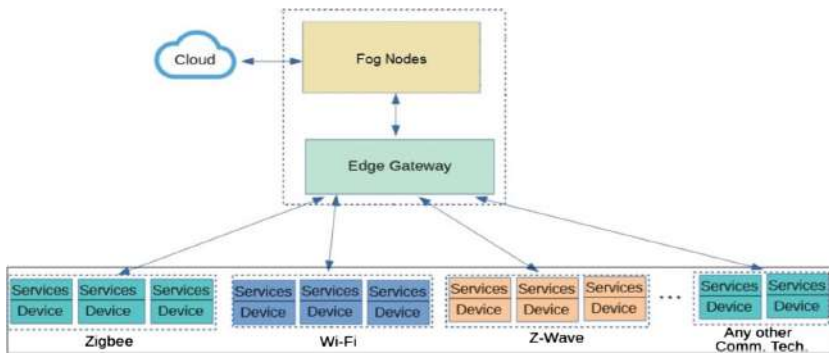


Fig. 1. Generic architecture of fog computing based smart home environment

3.2 Sensing Units and Audio-Lighting Stimuli

Two types of sensing units, also called sensor nodes, are used in the smart home environment for managing the data effectively. The sensing unit type#1 is used to detect the motion at the entrance and take a picture of the visitor using the camera sensor. This picture is sent to the fog node for the identification of the visitor. The sensing unit type#2 is associated with selected domestic objects to identify the reach of the resident to them, so as to give appropriate audio and lighting stimuli. This unit could also be used to identify the location of the resident, in which room he/she is present, and inform the same to the fog node when any visitor arrives so that the appropriate audio and lighting stimuli for the visitor will be played only in that room.

3.3 openHAB and Hue Lights

The open Home Automation Bus (openHAB) is a home automation platform which provides the ability to connect a large number of devices and systems [21]. openHAB communicates electronically with devices in the smart home environment and performs user-defined actions. Various parameters of hue lights like color, brightness, saturation are controlled wirelessly in our smart home environment using openHAB. The basic operation of the system designed using our proposed framework is shown in Fig. 2.

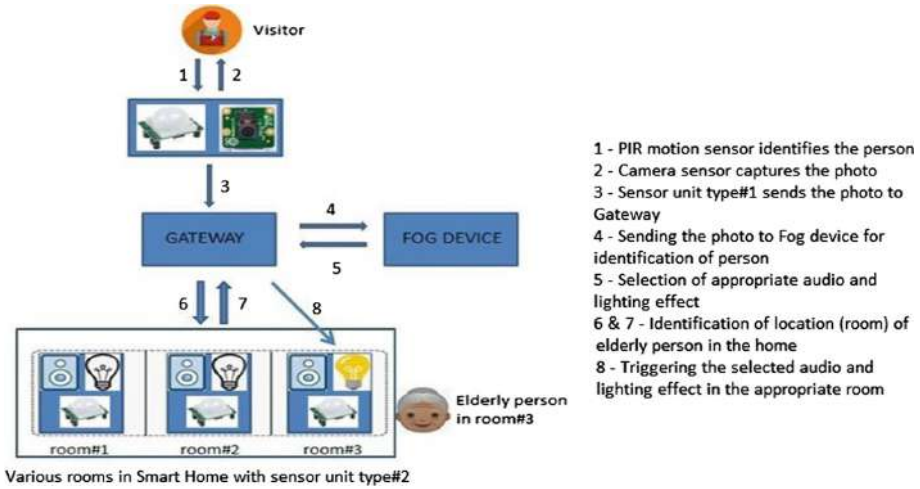


Fig. 2. Basic operation of the proposed framework

4 Implementation Details

4.1 Experimental Setup

The deployment of various sensor nodes, gateway and fog devices in our experimental setup are shown in Fig. 3 (a). In the experimental setup, two Raspberry Pi units are used to implement the fog node and gateway. The sensor nodes are configured to communicate using Wi-Fi. Initially, the machine learning model is trained using a set of images of familiar persons using OpenCV on the fog device. The sensor unit type#1 connects the Raspberry Pi camera sensor and PIR motion sensor using Raspberry Pi module. As shown in Fig. 3 (a), the sensor unit type#1 is placed near the entrance to the house. Whenever there is any motion, the PIR motion sensor connected to the sensor node detects it, and the camera sensor gets activated. The picture taken is stored in the local MySQL database of the sensor unit type#1. The fog node, which also has a local database installed, receives this image for classification using database synchronization. We have used Haar Cascade Classifier, one of the classifiers in OpenCV, for classifying the visitor.

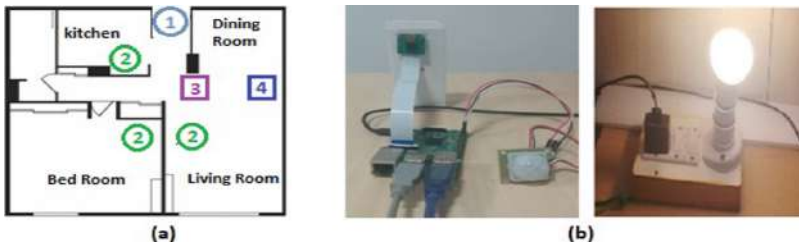


Fig. 3. (a) Deployment of various sensor nodes and devices (1-Sensor unit type#1, 2-Sensor unit type#2, 3-Gateway, 4-Fog device) (b)PIR and Camera sensor connected to Raspberry Pi, One of the hue lights employed in the smart home

The fog node should trigger the appropriate audio and visual stimuli in the room the person with dementia is present when any visitor arrives. As shown in Fig. 3 (a), we have used three units of type#2 sensor node (each with hue light, speaker to play the music, and PIR sensor) placed in kitchen, living room and bedroom. The PIR sensor of this type#2 sensor node is associated with one domestic object in each room (living room – Sofa Set, Bedroom – Bed, Kitchen – Oven). This PIR sensor serves two purposes, one to identify the reach of the resident to that object and the other to identify the location (room) of the resident when any visitor arrives. The fog node, through the gateway device, triggers the appropriate audio and lighting stimulation on the speaker and hue light in the appropriate room, when any visitor arrives or the resident nears the domestic object under consideration. Figure 3 (b) shows various sensing nodes used in our smart home environment.

4.2 Experimental Results

The machine learning model used to identify the person is trained using pictures of five known people. When any one of these five persons visits the house, the model could classify the person and could label the visitor with the supplied information during the training process. For our demonstration purpose, we have connected the display device to the fog node and displayed the visitor photo captured along with the label. The sample visitor photo along with label displayed by the fog node on the monitor is shown in Fig. 4 (a).

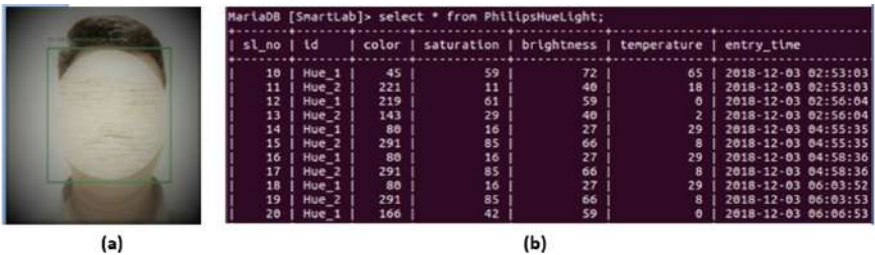


Fig. 4. (a) Visitor identification by fog node (b) Fragment of PhilipsHueLight database table which stores hue light values

The developed system was used continuously for one month, and sensing information along with the corresponding stimulated audio, lighting information is stored in the database for verifying the functionality of the system. Figure 4 (b) shows the snapshot of the fragment of PhilipsHueLight database table, which stores hue light values. Table 1 shows the result of the classifier algorithm running on fog node for one particular day. Out of five trained persons, the classifier could classify four persons correctly based on the camera picture taken by sensing unit type#1. It wrongly classified person#1 as person#4 at time stamp 2018-12-03 19:15:32.

Table 2 shows the stimulated audio and lighting information given to sensing unit type#2 when the system recognizes the visitors and the resident nears the domestic

Table 1. Classification of the persons based on the images captured by sensing unit type#1

Person arrived	Arrival timestamp	Classifier output
Person 4	2018-12-03 10:05:03	Person 4
Person 2	2018-12-03 10:20:15	Person 2
Person 4	2018-12-03 11:03:16	Person 4
Person 3	2018-12-03 11:30:21	Person 3
Person 5	2018-12-03 12:30:45	Person 5
Person 2	2018-12-03 15:02:32	Person 2
Person 4	2018-12-03 15:16:45	Person 4
Person 1	2018-12-03 19:15:32	Person 4
Person 3	2018-12-03 19:25:22	Person 3

objects under consideration. The system could produce correct audio and lighting stimulation for four persons (#2, #3, #4, #5), and failed to give for person#1, as he was incorrectly classified as person#4 by the classifier in the fog node, and the audio, lighting stimulation for person#4 was triggered when person#1 visits the house. Additionally, when person#3 visits the house second time, even though he was recognized correctly by fog gateway, the exact location of the resident was wrongly identified as the living room by PIR motion sensors. Hence, audio and lighting stimulation for person#3 was given wrongly in the living room instead of the bedroom. The audio and lighting stimulation for sofa set and bed was triggered correctly when the dementia person approaches these objects.



Fig. 5. (a) An instance of the configuration panel in openHAB (b) Visual stimuli given for dementia person in the kitchen for person#4, in the living room for person#5, in the living room for sofa set

Figure 5 (a) shows an instance of the configuration panel in openHAB which provides information about various things in our experimental setup. The variation in the lighting effects triggered, when different persons and objects are identified is shown in Fig. 5 (b). The results suggest the communication mechanism among various modules is working properly and the proposed system is useful in terms of giving audio and lighting stimulation according to the situation.

Table 2. Stimulated audio and lighting information for different visitors and objects in the smart home on one particular day (C - Color, S - Saturation, B - Brightness)

Exact location of the resident	Location identified by PIR sensor	Person/House hold Object	Hue Light Parameters			Audio file played	Triggering action correctness
			C	S	B		
Kitchen	Kitchen	Person 4	143	29	40	File 4	Yes
Kitchen	Kitchen	Person 2	35	40	60	File 2	Yes
Living room	Living room	Sofa Set	55	62	59	File 6	Yes
Living room	Living room	Person 4	143	29	40	File 4	Yes
Kitchen	Kitchen	Person 3	45	59	72	File 3	Yes
Living room	Living room	Sofa Set	55	62	59	File 6	Yes
Living room	Living room	Person 5	219	61	59	File 5	Yes
Living room	Living room	Person 2	35	40	60	File 2	Yes
Living room	Living room	Person 4	143	29	40	File 4	Yes
Bed room	Bed room	Bed	95	25	35	File 7	Yes
Bed room	Bed room	Person 1	143	29	40	File 4	No
Bed room	Living room	Person 3	45	59	72	File 3	No

5 Summary and Future Work

Fog computing extends the concept of cloud computing, by pushing the data processing towards the network edge, making it ideal for the internet of things (IoT) and other applications that require quick response times. In this research work, we proposed a framework for audio and lighting stimulation program for the elderly using fog computing model in the smart home environment. The machine learning classification model is trained on the fog node using images of known persons. When anyone from this trained group is sensed or the resident nears domestic objects under consideration, appropriate audio and lighting stimulation is given, which helped the elderly to recognize them quickly using music and lighting therapy.

At present, the system could classify the people from the trained group, and give the relevant music and lighting stimuli. The proposed system could be extended to get the model trained to recognize the unfamiliar persons and automatically train itself to trigger the relevant stimuli.

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Hybrid Genetic Algorithm: Traveling Salesman Problem

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Abstract. A genetic algorithm has three main operators namely selection, crossover and mutation. Each operator has various sub operators. Selection of sub operator that can be applied on particular problem is difficult task. Thus this paper proposes a hybrid genetic algorithm (HGA). HGA algorithm finds the sub operators that can be applied on traveling salesman problem. After that it finds the threshold value. Based on threshold value it switches from one sub operator to other sub operator. The HGA algorithm score over existing genetic algorithm on traveling salesman problem on large number of cities.

Keywords: Hybrid genetic algorithms · Traveling salesman problem · Genetic algorithms · Combinational optimization

1 Introduction

Genetic algorithms [1–4] are a type of meta heuristic optimization algorithms and a subset of evolutionary computation [5]. Combinational optimization problems such as TSP [6] have often been considered to be solvable by genetic algorithms for effectively large and complex data spaces [7]. Genetic algorithms leverage the ideas of biological evolution through considering members of the data spaces as DNA strands containing genetic encoding which are then selected as parents, crossed and mutated to produce off-springs for subsequent generations.

Genetic algorithm basic principal are selection and reproduction. Objective of selection is reduced the search space. Objective of reproduction is expanded the search space. The selection process selects two parents from population for reproduction. Reproduction includes crossover and mutation. Crossover is the process of selecting two parents and producing new child or offspring. Mutation operator tweaks one of more gene on chromosome to obtain a new solution.

With regard to this, several selection techniques have been devised such as Tournament, Ranking and Best Solution etc. However, these strategies have their own individual trade-offs and the ideal strategy to be applied is not only problem-specific but also dependent on the crossover and mutation operators that are applied alongside them [8, 11].

In this paper we propose to design a Hybrid Genetic Algorithm (HGA) consisting of a two selection, crossover and mutation operators selected in a manner that balances each-other's trade-offs. The aim of the design is to conceptualize a generalized GA that can perform optimally for all problems. This design is then tested for TSP – a NP-Hard problem that is traditionally considered difficult to solve. The system is experimented against the standard TSPLIB [9] and the results shown are promising.

The rest of this paper is arranged as follows: Sect. 2 explains the theoretical background; Sect. 3 explores the proposed approach and operator selection strategies; Sect. 4 discuss the algorithm and Sect. 5 details the experimentation method and its results; Sect. 6 contains the conclusion and further works.

2 Theoretical Background

2.1 Genetic Algorithm

The GA was introduced by Holland in 1975 [10]. A genetic algorithm is a subclass of evolutionary algorithms that takes inspiration from natural evolutionary processes of selection, crossover and mutation.

GA is iterative process of fixed size population. Population is collection of individual that is also called chromosome or solution. A chromosome is a solution of the particular problem. Each solution has an objective function. It is the fitness of a chromosome which determine its ability to reproduction. Each chromosome is made of gene of alleles.

GAs begin by generating an initial population, $P(k = 0)$, and then each of its individual is evaluated by its objective (fitness) function. While the terminal condition is not satisfied, a portion of the population is selected, somehow altered, evaluated, and placed back into the population. At each step in the iteration, chromosomes are probabilistically selected from the population for reproduction according to the principle of survival of the fittest. Offspring are generated through processes called crossover and mutation. Then the individuals are replaced by their offspring. This process can be modeled by a continuous generational genetic algorithm.

It saves the offspring in a temporary location until the end of the generation. At that time the offspring are added into the current population. GAs employs on three genetic operators: selection, crossover, and mutation. Selection of parents for next generation is based on their fitness value. Parent individuals are mated and used to produce offspring by the crossover and mutation operators. This process combines the fittest chromosomes and passes superior genes to the next generation, thus providing new points in the solution space.

A traveling salesman problem is NP complete or optimization problem. In this a salesman wants to visit all cities in the shortest path/cost. It can be symmetric or a symmetric TSP. Symmetric TSP, considers the Euclidean distance between cities.

3 Proposed Approach

The proposed approach involves the combination selection, crossover and mutation procedures as per traditional gGAs. However, in our methodology we select two selections, crossover and mutation operators that are applied on the dataset according to a threshold value (Ts). Before the threshold point a particular operator is applied and then a switch is made to the second operator after the threshold point. Experimentally it has been found that this Ts is universally true for all the three operators.

Selection of the suitable operators that are considered for the hybrid is based on the following criteria:

- Maintaining diversity of the population
- Allowing for elitist selection
- Preventing early convergence
- Obtaining a high convergence rate

3.1 Selection Operator

Tournament Selection: As per (Miller, Goldberg 1995) [8] tournament selection is ideal because it can be applied efficiently to both parallel and non-parallel architectures, simple to code and whose selection pressure can be altered according to tournament size. Tournament selection runs multiple tournament among a few individuals that are chosen randomly from population. The winner of each tournament is qualified for crossover.

In our approach, the tournament size is set to 3 in order to maintain a balance between high pressure and prevention of premature convergence.

Best Two Selection: In Best Two Selection the individuals from a population at a particular generation are sorted and the two best are chosen. It means we always pick the two fittest individuals of the population. It helps us in getting better results on performing further mutations and crossovers and maintain elitism in the population.

3.2 Crossover Operator Selections

Partially Mapped Crossover: Partially Mapped Crossover (PMX) builds an offspring by choosing a random segment from parent-1 and copy that into offspring. It finds the elements that have not been copied from parent-2. For each of these element it finds the corresponding element in parent-1. Copied the parent-2 element on that parent-1 position in offspring. Because we are not putting parent-1 element on that position. After that rest of the offspring is filled from parent-2. For example, Table 1, it-1, random segment is chosen c5–c8. In this 4, 5, 6 and 7 genes are copied in C0. Then find i and j gene in parent-1 and parent-2 respectively. 7 and 3 genes are parent-1 and parent-2 respectively. Find the 3 gene position in parent-1, on that place copy 3 in offspring.

Ordered Crossover: First we choose two random points and copy the genes between those two points from parent-1 to children. Secondly, we start filling missing chromosomes from right of parent-2 to the respective children. For example, Table 3, it-1,

random points are chosen from c2–c5 are chosen and 2, 3, 1 and 4 are filled in offspring. Then start filling from parent-2 the missing chromosome. 6, 8, 7, 9 and 5 are filled.

3.3 Mutation Operator

Mutation helps retain the diversity in the population. While both swap and inverse mutation preserve most of the adjacency information, Inverse mutation breaks only two links, swap mutation breaks all links and leads to greater disruption of order [12].

Inversion Mutation: In inversion mutation, we pick the random solution from generation. Two random numbers are generated which are further used to define a length to reverse. So basically we swap elements inside the randomly generated length. For example, Table 1, it-1, co, 4, 5, 6 and 7 are placed in reverse.

Swap Mutation: In swap mutation we consider a generation and then take an array of the solution. Two random numbers are generated which are further used to perform mutation. We swap or exchange the positions of the two numbers picked up from the array. i.e. Table 3, it-1, 4 and 6 genes are swapped.

3.4 Threshold Value

The Threshold value is an important parameter in HGA as it dictates the threshold point after which a switch is made from one operator to another. The established threshold value is a variable which is dependent on the nature of the problem that is being solved by the HGA. Threshold value is found using experiment it shown in Fig. 1.

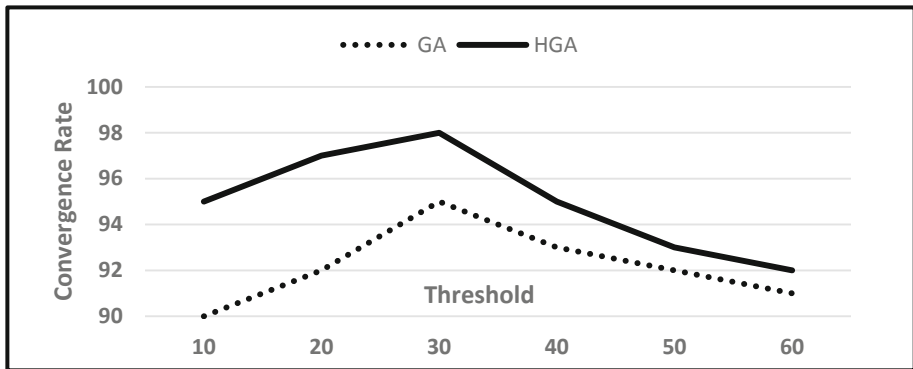


Fig. 1. Threshold value.

The experiment is run on different number of threshold on TSP and found that when number of operations are twenty or thirty percent convergence rate is better.

4 Algorithm

The algorithm of HGA is shown as:

Algorithm: Pseudo code HGA

```

1: Input = G(gen, Ths, The, Thm)
2: Output = multiple schedule
3: P ← generateSolutions(n);
4: c=m=i=1;
5: for gen=i= 1 → N do
6:   if (s < Ths) then
7:     P' ← selectTournament(p);
8:   else
9:     P' ← selectTwoBest(p);
10:  end if
11:  if (c < The) then
12:    P' ← selectPMXCrossover(p');
13:  else
14:    p' ← performOrderedCrossover(p');
15:  end if
16:  if (m < Thm) then
17:    p' ← performSwapMutation(p');
18:  else
19:    p' ← performMoverMutation(p');
20:  end if
21:  computeObjectives(p');
22:  p'' = addoffsprings(p')
23:  m++, c++, s++;
24: end for;

```

First solution of the TSP is coded in array of integer. This array is called chromosome and its length is a number of cities. Solutions are generated and fitness of individuals is evaluated on the sum of the Euclidean distance between each of the cities of the solution. After that tournament selection ($s = 3$) is chosen till the selection threshold then best two selection is chosen. Then PMX crossover is performed for some iteration and then ordered crossover is performed. Similarly, inverse and swap mutation is performed.

4.1 Illustrative Example of HGA

Table 1 the working of PMX and inverse operator. Similarly Table 3 shows the working of ordered and swap operator. Tables 2 and 4 show the cost matrix of TSP for Table 1 and Table 3 respectively. After each iteration we have chosen the results of pervious iteration as input for next generation. Last column of Tables 1 and 3 show the objective function that is calculated based on cost matrix (Table 2 and 4 respectively).

Table 1. PMX and inverse operators

Iter	Opear	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Obj
It-1		P10	1	2	3	4	5	6	7	8	9	
		P20	9	8	7	6	5	4	3	2	1	
	PMX	C0	9	8	3	4	5	6	7	2	1	5516
	Invers	C0'	9	8	3	7	6	5	4	2	1	4527
It-2		P11	9	8	3	4	5	6	7	2	1	
		P21	9	8	3	7	6	5	4	2	1	
	PMX	C1	9	8	3	4	5	6	7	2	1	5516
	Invers	C1'	9	5	4	3	8	6	7	2	1	4907
It-3		P12	9	8	3	4	5	6	7	2	1	
		P22	9	8	3	7	6	5	4	2	1	
	PMX	C2	9	8	3	4	5	6	7	2	1	5516
	Invers	C2'	9	8	3	4	5	1	2	7	6	5295
It-4		P13	9	8	3	4	5	6	7	2	1	
		P23	9	8	3	4	5	1	2	7	6	
	PMX	C3	9	8	3	4	5	6	7	2	1	5516
	Inver	C3'	9	8	3	7	6	5	4	1	2	4295

Table 2. Cost matrix of TSP for Table 1

	1	2	3	4	5	6	7	8	9
1	0	679	134	366	499	843	187	243	441
2	679	0	918	598	754	911	941	183	804
3	454	918	0	790	286	873	144	428	932
4	366	598	790	0	428	931	911	845	324
5	499	754	286	428	0	720	561	764	660
6	843	911	873	931	720	0	543	438	867
7	187	941	144	911	561	543	0	919	341
8	243	183	428	845	764	438	919	0	987
9	441	804	932	324	660	867	341	987	0

Table 3. Ordered and swap operators

Iter	Opear	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Obj
It-1		P10	2	3	1	4	5	9	8	7	6	
		P20	5	2	3	9	4	1	6	8	7	
	ord	C0	2	3	1	4	6	8	7	5	9	3880
	swap	C0'	2	3	1	6	4	8	7	5	9	3804
It-2	swap	P11	2	3	1	4	6	8	7	5	9	
	swap	P21	2	3	1	4	5	9	8	7	6	
	ord	C1	1	5	9	4	6	8	7	2	3	4901
	swap	C1'	1	5	9	6	4	8	7	2	3	4842
It-3		P12	1	5	9	6	4	8	7	2	3	
		P22	2	3	1	4	5	9	8	7	6	
	ord	C2	5	9	3	6	4	8	7	2	1	4424
	swap	C2'	5	9	3	6	4	7	8	2	1	3893
It-4		P13	2	3	1	4	5	9	8	7	6	
		P23	5	9	3	6	4	7	8	2	1	
	ord	C3	2	3	1	4	7	8	5	9	6	3760
	swap	C3'	2	3	1	7	4	8	5	9	6	3724

Table 4. Cost matrix of TSP for Table 3

	1	2	3	4	5	6	7	8	9
1	0	357	134	524	779	818	876	936	883
2	357	0	586	259	969	979	976	639	209
3	134	586	0	846	725	715	934	710	591
4	524	259	846	0	514	257	180	374	405
5	779	969	725	514	0	782	481	466	392
6	818	979	715	257	782	0	214	744	716
7	876	976	934	180	481	214	0	762	992
8	936	639	710	374	466	744	762	0	774
9	883	209	591	405	392	716	992	774	0

5 Experimentation and Results

The hybrid system was tested against standard TSPLIB data sets with the following set parameters:

- Tournament Size (s) = 3
- Population Size = 100
- Threshold Values (T_s , T_c , T_m): 30%
- Crossover Probability (P_c) = 0.95
- Mutation Probability (P_m) = 0.1

The tournament size (s) is set to 3 although a maximum tournament size of 5 can be set when combined with two crossovers [8]. This size is set to prevent any early convergence instances. The threshold value (T_s) is set to as determined experimentally to be the optimal. The population size is set to ten times the chromosome length with a relatively high P_c and a low P_m values. Due to the stochastic nature of GA, the algorithm is run ten times and the best result in the ten runs is noted.

In the experiment the convergence rate is calculated as follows:

$$\text{Convergence Rate} = 1 - \frac{\text{fitness} - \text{optimal}}{\text{Optimal}} * 100$$

The obtained convergence rates show significant improvement over traditional gGAs. While the rate drops from 100% to about 93% for eil101, for larger city data sets it remains at the 93% level. The convergence rate can be further improved by adjusting the tournament size as per the problem statement.

The obtained convergence rates show significant improvement over traditional gGAs. While the rate drops from 100% to about 93% for eil101, for larger city data sets it remains at the 93% level. The convergence rate can be further improved by adjusting the tournament size as per the problem statement.

The results are as follows:

Sn. no.	Dataset	Optimal solution	Obtained best solution	Convergence rate
1.	burma14	30.8	30.8	100.00%
2.	dantzig42	679	685	99.11%
3.	berlin52	7542	7773	96.90%
4.	eil51	435	426	97.89%
5.	eil101	629	673	93.10%
6.	eil76	538	553	97.20%

6 Conclusion and Further Works

The obtained results depict that a HGA has the potential to be worked upon using different operator selection strategies and threshold values to design a highly accurate gGA. Further work on the topic would include testing TSPLIB against varying tournament values and operator selection strategies. It would also be interesting to see the results that are obtained when this method is applied against other problem statements.

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Critical Evaluation of Predictive Analytics Techniques for the Design of Knowledge Base

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Abstract. The present diagnosis methods in medical fields are aided very much by the cluster analysis methods. Data Summarization techniques are used to discover the hidden patterns in huge datasets. They may be used for future interpretation in diverse aspects in different environments. In the context of medical data bases, the enormous growth of medical information and its corresponding use for disease diagnosis is a strenuous process. Therefore Disease diagnose systems requires the conventional data analysis combined which proficient knowledge of different diseases. Recent developments in Data segmentation techniques may be used to analyze the reports of the liver patients together with trends of the diseases and standard processes for resource utilization in health care problems. Development of new system based on the above analysis in turn assist the physician for better diagnosis of disease. In the present paper, various classification techniques are applied to predict the disorders in the liver functions accurately. The present paper is aimed at proposing a new method for the prediction of the diseases with a better accuracy than the existing traditional classification algorithms. It was found that these results are very much promising and more accurate.

Keywords: Clustering analysis · Classification · Feature selection · Knowledge base · Medical diagnosis · Gastroenterologists

1 Introduction

Popular Data mining techniques are applied in diverse applications in the areas of Medical diagnosis and Information Retrieval [1]. Artificial Intelligence is a branch of Computer Science and it helps the computers to provide intelligent behavior. Learning is one of the basic requirements for any system to exhibit intelligence. Machine learning, indeed, is the most rapidly developing branch in AI research. Machine Learning methods are developed to analyze the large medical datasets. In review of these methodologies, it was found that several Clustering Techniques are built for addressing the various problems in the classification systems developed for medical resources analysis [2]. It is obvious to mention that decisions are made based on the recent developments in clustering methods on medical datasets. These developments

have not yet incorporated in the literature of wide-scale medical applications. The present study is focused on cluster analysis for the development of medical diagnosis systems to assist physicians. The primary idea of cluster analysis is not only separating and grouping of distinguish compatible units from differing units but also developing a new system for the thinking process using the logical conclusions deduced from them. Rai and Ramakrishna Murthy [3, 4] work out on the cluster analysis to group large numbers of objects (persons or jobs) into smaller numbers of mutually exclusive classes with members have similar properties. They developed clusters that are having the configurations with an unique cluster based on similarity metric such that each object would be classified into only a single unit. In the present paper, Clustering methods are used to develop an efficient and reliable algorithm to derive a training sample to deduce accurate predictions in the pathological status of the patient and to design an advisory system based on MLC methods.

2 Related Work

Currently, Massive data is collected by specialists from clinical laboratories and stored in large data bases using imaging equipments blood and other samples examination. The Data must be evaluated for extracting the available valuable information in the form of patterns. The extracted information should be matched to particular pathology during the diagnosis.

In the design of Computer Aided Diagnosis System, AI algorithms are used in for extracting the information, regularities, predicting the disease trends by avoiding wrong diagnosis in routine. These systems are also used for dealing with special cases from patient records stored in medical databases.

Intelligent techniques used in the data analysis include Time Series Analysis, Data Visualization, Clustering and other Machine learning techniques.

Lavrace et al. [1] explained different data mining techniques applied in various application areas. They developed some applications on selected data mining techniques in medicine. They stated that those techniques are appropriate for the analysis of medical databases. Clustering plays a major role among all the data analysis methods for dealing with non-label massive datasets.

Xu et al. [2], Rai et al. [3] discussed about different Cluster Analysis in several applications. Ramakrishna Murthy [4] proposed a method to improve accuracy and to reduce dimensionality of a large text data in cluster analysis. They used Least Square methods and Support Vector Machines using singular value decomposition.

Dilts [6] discussed about the critical issues faced by investigators in medical resource-utilization domain and also its importance in validation [6, 7].

Hayashi et al. [7] evaluated the performance of various cluster analysis methods by applying on various datasets based on cross validation technique. Kononenko et al. [8] discussed the Medical diagnosis application using machine learning techniques. They provided an overview data analysis and classification methods in the design and development of Medical diagnosis systems that possesses intelligence.

Gaal [9] proposed some Cluster and Classification methods to use in the development of Medical Expert Systems to assist the physicians for providing automated advises.

Ramana et al. [11] worked on the analysis of patient data stored in medical records using the concept of learning from past experiences. They opined that this analysis improves medical diagnosis more accurately. They applied several classification algorithms on ILPD Dataset [10]. They include, Decision Tree Classification, Bayesian Classification and Back Propagation, Support Vector Machines (SVM) and Association rule mining.

Ramana et al. [12] also applied the above classifier on UCI dataset [10] and evaluated the parameters: Sensitivity, Precision, Accuracy and Specificity. They considered some classification algorithms among the different traditional classification strategies and found their performances. They opined that relevant data extracted from liver patient datasets may be used in medical diagnosis and other applications. Finally, they concluded that Naive Bayesian Classifier can be applied for processing the numerical attributes and it is very useful for the prediction of labels.

3 Problem Definition

The proposed model is aimed at obtaining clean data from the raw data by the application of preprocessing techniques with increased accuracy in cluster analysis and also the prediction of class values. Priority is given here to preprocessing to improve the data grouping and consequently the classification results. The proposed model is shown in Fig. 1. The proposed model is divided into four phases. In the first phase, data is divided into number of Clusters using some clustering techniques, where each cluster has manageable elements such as sub cluster. A variety of Clusters are identified as the end result of this phase. Classification techniques are applied, in the Second phase, to form new clusters for identifying/assigning individual objects to the predetermined classes based on specific criteria. The outcome of this phase is a variety of classes are formed. In the Third phase, Feature Selection techniques are applied to find the dominating attributes by minimizing dimensionality of each class. In the Fourth phase, these classes are used for deriving the expert system rules and to take the expert doctor advices for disease identification for particular classes. During the above phases like Clustering, Classification, and Feature Selection selected techniques are tested and the best techniques are applied.

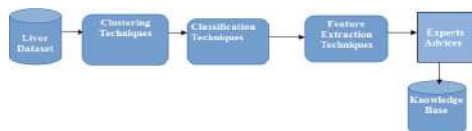


Fig. 1. Proposed model

4 Experimental Dataset

In this paper two data sets are combined to form a new dataset with 1083 patients' records of which 651 are liver disease patients and 432 are non-liver disease patients. The first dataset is ILPD dataset which is a part of UCI Machine Learning Repository data set [8] comprising of 583 liver patient's records with 10 attributes (obtained from eight blood tests). The second data set is Physically collected dataset comprising of 500 records collected from various pathological labs in south India. It contains 13 attributes (obtained from ten blood tests). The common attributes in these two datasets are: Age, Gender, TB, DB, ALB, SGPT, SGOT, TP, A/G ratio and Alkphos. Out of these attributes TB (Total Bilirubin), DB (Direct Bilirubin), TP (Total Proteins), ALB (albumin), A/G ratio, SGPT, SGOT and Alkphos are related to liver function tests and used to measure the levels of enzymes, proteins and bilirubin levels. These attributes helps for the diagnosis of liver disease. The description of Liver Dataset Attributes and Normal values of attributes are shown in Table 1.

Table 1. Attributes in liver dataset

Attributes	Information (Normal value)
Age	Age
Gender	Gender
TB(LFT)*	Total- Bilirubin (Normal values: 0.22–1.0 mg/dl)
DB(LFT)*	Direct- Bilirubin (Normal value: 0.0–0.2 mg/dl)
Alkphos(LFT)*	Alkaline Phosphates (Normal values:110–310U/L)
SGPT(LFT)*	AlamineAminotransferase(Normal values:545U/L)
SGOT(LFT)*	AspartateAminotransferase(Normal values: 540U/L)
TP(LFT)*	Total Protiens (Normal Values: 5.5–8gm/dl)
ALB(LFT)*	Albumin (Normal Values: 3.5–5gm/dl)
A/GRatio(LFT)*	Albumin and Globulin Ratio (Normal Range >= 1)

*Technical Clinical Terms

5 Methodology

5.1 Clustering Analysis

Proposed Improved Bisecting k -Means algorithm is considered for the analysis. This algorithm is implemented and compared with selected clustering algorithms namely, k -Means algorithm, Agglomerative Nesting algorithm, DBSCAN algorithm, OPTICS algorithm, Expectation Maximization algorithm, COBWEB algorithm, Farthest First and Bisecting algorithm. These Clustering algorithms evaluation is performed based on Accuracy, Entropy, F-Measure, and Purity on Liver Dataset and proved that IBKM performed better for selected clustering algorithms in this study [5]. So, the reason IBKM Clustering algorithm is considered for Clustering the Liver Dataset with manageable Clusters.

5.2 Classification

Selected Classification algorithms are used for prediction of the class label. They are Naïve Bayes' Classification algorithm, C4.5 Decision tree Classification algorithm, k-Nearest Neighbor Classification algorithm, Support Vector Machines (SVM) Classification algorithm, ID3 Classification algorithm, and Random Forest Classification algorithm.

5.3 Feature Selection

Selected Feature Selection algorithms are used to find out the dominating features of every Class. They are Principal Components Analysis, Correlation-Based Feature Selection Greedy, Correlation-Based Feature Selection (CFS) Best-first, Correlation-Based Feature Selection (CFS) exhaustive algorithm, Correlation-Based Feature Selection (CFS) Random algorithm.

6 Experimental Results

Weka is a Tool that has been used to test the proposed strategy. It is a group of machine learning algorithms collected for data mining. Weka tools are composed of data pre-processing, Classification, Regression, Clustering, Association Rules and Visualization. In this dataset was preprocessed 32 outliers were eliminated in the total dataset, the cleaned dataset was implementation of proposed model, consisting of three major phases namely, Clustering, Classification, and Feature Selection respectively. In this clustering phase after testing six algorithms, the IBKM Clustering algorithm is selected as the best and applied on the liver dataset of 1051 records and clustered the data into six clusters i.e. k is given as six. After the clustering, 6 clusters are formed. Results are presented in Table 2.

Table 2. Comparison of performance selected classifiers to cluster result

Classification algorithms	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9
NaiveBayes classifier	109	67	50	38	36	37	58	180	162	154
ID3 classifier	110	91	71	34	32	48	75	174	176	167
RandomForest classifier	111	96	73	35	36	48	76	179	176	170
Actual result	114	97	77	36	40	55	83	188	186	176

In the above clustering, C0, C1, C2, C3, C4, C5, C6, C7, C8, C9 are taken as class labels and the number of records in each class for different clustering algorithms are shown in Table 2. It can be observed that Random Forest Classifier gives high performance, so considered the Random Forest Classifier for further analysis. Graphical representation of the results is given in Fig. 2.

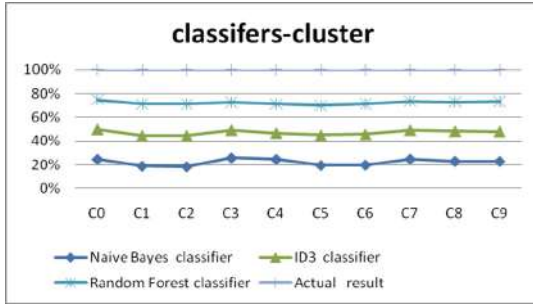


Fig. 2. Performances of selected classifiers to cluster result

Details of Random Forest Classifier

Random Forest Classifier is used to produce a set of decision trees from randomly selected subset of training set. It aggregates the votes from different decision trees and uses in the final class of the object. For example training set is given as: [A1, A2, A3, A4] with corresponding labels as [B1, B2, B3, B4], random forest may perform three decision trees taking input of subset for example, [A1, A2, A3], [A1, A2, A4], [A2, A3, A4]. So finally, it predicts the decision trees based on the rank of major of votes.

Feature selection algorithms are applied on every class (class c0–class c9) and find out the dominating features (attributes) in every class. In every class apply one of the six Feature selection algorithms selected and find out the dominating features. After that the common dominating features are considered for final dominating features of the classes.

Feature selection algorithms are applied on every class (class c0–class c9) of Liver dataset with respect to the attributes Age, Gender, TB, DB, ALKPHOS, SGPT, SGOT, TP, SERUM-ALBUMN, and A/G RATIO. In the result tables dominating attributes are indicated as symbol “1” non-dominating attributes are indicated as symbol “0”. In this way every algorithm results represent the dominating attributes as 1 or 0.

Finally, conclude the common dominating attributes as represent the dominating features of every class c0 to c9 respectively. A typical Class with its dominating features is given in Fig. 3. The typical sample class A with dominating features below in Fig. 3.

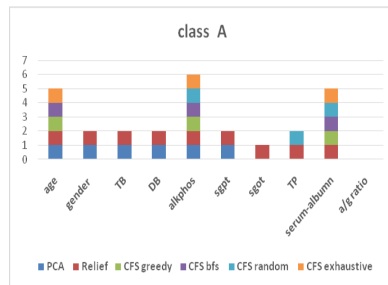


Fig. 3. Typical class with dominating features

Dominating features are: Age, ALKPHOS, and SERUM-ALBUMN

A knowledge base has been designed using the dominating features of each class. After that a table is prepared for minimum and maximum ranges of dominating features of every class, Annotation (advisory) by Gastroenterologists is done for diseases identification, treatment, and precautions for all classes. The expert advisories/ Annotation information regarding every class has been used in building Expert Advisory System. A typical Gastroenterologists annotation for a sample Class is given below.

As per the Annotation (advisory), the Sample class consisting of the Patient Records with the Dominating Attributes: Age, ALKPHOS, SERUM-ALBUMN have

The diseases: (1) Chronic hepatocellular disorders, (2) Alcohol hepatitis, and (3) Cirrhosis liver.

7 Conclusion

In this paper a model is proposed for using predictive analytic techniques in effective liver diseases diagnosis, The main objective of this study is to compare the result of liver diagnosis using classifiers over proposed method using liver diagnosis gives the efficient accuracy. This proposed model has three phases. In first phase, clustering analysis is done by IBKM clustering algorithm using cluster the total liver dataset into 6 number of clusters after the clustering 2, 4, 5 clusters have more number of records then those clusters split into sub clusters. Then finally found the 10 clusters. In second phase classification is done by Random forest classification algorithm using as the input of before clustering, then getting 10 classes. In third phase using as the input of before classification, in every class applied feature selection algorithms, After getting the dominating attributes of every classes in that choose the common dominating attributes are considered as the dominating attributes for every class, based on that classes liver diseases diagnose is done with help of liver expert doctors (Gastroenterologists) and also taking the suggestion and precautions for those liver diseases; The above liver expert advices is using prepare the knowledge base for every class and label the liver diseases, the above model using knowledge Base is very important for the development of automatic liver disease diagnose expert systems efficiently.


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Beyond the Hype: Internet of Things Concepts, Security and Privacy Concerns

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Abstract. Today's Internet of Things (IoTs) has occupied maximum fields/areas where they are working a tremendous works, i.e., providing better life experience to human beings. For example, in e-healthcare, IoT devices are providing a lot of data to doctor, also helping doctors to identify certified medicine or discusses or helping doctors to remember various certain activities of a patients, etc. Similarly, chatting applications (online social networking) have made communication easier among human beings. IoTs are with everything (applications) in this physical world and they are connected on a large scale and integrated securely through Internet infrastructure. But, are we satisfied with this security (security in IoTs)? On another side, these devices (IoT) or applications are collecting a data from your every movement/tracking your (humans) movement. This data is stored as large data (called big data) and used or sold to third parties (like organization) to make profit for them (via analytics process). These devices have an issue of leaking your movement or person to unknown users, which is a serious issue. This work (or article) will discuss some facts like about IoTs, which may protect people or provide awareness to people or protect them when they are visiting any website/browsing or coming online (for working something or making a communication).

Keywords: Internet of Things · Security · Privacy · Big data · Privacy in virtual world

1 Introduction to Internet of Things

The Internet has evolved in 1990 (creation of World Wide Web (W3), a network of network: concept created/built by Tim Berners-Lee [1]) but has received attention from maximum customers during the past decade only. Today's Internet has become the richest source of information and utilize by multiple devices for example, for finding path, or any hotel over the road network (using help of Global Positioning System (GPS)). Internet has seen its first revolution in 1990 to 2000, and second revolution

from 2001 to 2010, whereas, third revolution since 2011 onwards to till date. Till 2010, Internet was a universe of interlinked human and creates new generations of interactive experiences, but today's it has moved to a new level, i.e., provide or using (sharing) information with internet of things or smart devices. Internets of Things (IoTs) or Internet Connected Devices are the devices (with consisting sensing feature) or use Internet network for making a communication or provide better life experience to human beings. In general, IoT or smart devices are the concept of connecting smart objects or operating together to solve some specific/real – world problems. With respect to this, IoT or Internet Connected Devices has become popular since 2011, i.e., with the rapid development of small low-cost sensors, wireless communication technologies, and new Internet techniques. *Today's several applications that use IoT* devices are: intelligent transportation, communication, e-healthcare, smart home, smart animal farming, finance, retail, environmental monitoring, etc. [2]. Hence we can say that (as discussed previously) now days, we are living in the third revolution of Internet where internet is connected with IoT, “a world of networked smart devices equipped with sensors, connected to the Internet, all sharing information with each other without human intervention”. Note that “Internet of Things” term was first time coined by the cofounder and Executive Director of MIT’s Auto-ID lab, Kevin Ashton in the mid 1990s [3]. Various definitions have been given by various scientists and researchers (in the past decade), but most of the accepted definition is “Intelligent interactivity between human and things to exchange information & knowledge for new value creation” [4]. Hence, with the rise of connected devices (with internet of things) and connected individuals (systems/devices with sensor), we received combination of four terms (i.e., big data, cloud, social media, and mobile devices and things) or technologies (technology pillars) which works as fuel to industries and help IoTs to re-shape [5]. All these four pillars (of technology) (big data, cloud, social media, and mobile devices and things) are interconnected with each other and work efficiently (with respect to cost and accessing to find/search records over records or a database). But, IoTs have different views/aspects for these pillars, i.e., tracking or leaking information of user to malicious users (by malicious systems/devices, for example, in a Hollywood movie “Eagle Eye”, computer systems or army personal track a user or its location everywhere with the help of small drone) [5]. Basically, this issue (with people) is a long (complex) process/task to discuss and highly critical to taking care of/focus, so this issue is being discussed in further sections with several suggestions and technology (also refer Table 1). Apart that, discussing IoT features by providing total number of connected devices/connections makes IoT explanation easier. In general, IoT is a complex ecosystem encompassing all aspects of the Internet, including analytics, the cloud, application, security, etc. In technical words, connecting devices/things with internet used three main technology components (i.e., physical devices with sensors/connected things, connection and infrastructure, and analytics and applications) [5]. Today’s Internet of Things are providing several benefits to users/customers through several applications like smart farming, smart parking, smart homes, etc. IoT devices have the potential to change the ways of communication completely (with people and technology). In future, IoTs is likely to mix the virtual and physical worlds together to provide an easy and comfort experience to everyone (organizations or people). But, the items which will contain sensors to produce data (home, the car, and with wearables

and ingestible, even the body puts particular) will put several security and privacy challenges. Now day's physical objects are increasing with a high rate in developed countries (including developing countries) to provide growth/progress to respective nation/country. Human in these countries uses IoT devices to increasing productivity of their business (e.g., retail, e-commerce, etc.) or protect themselves (e.g., smart home), etc. These increasingly internet connected devices detect and share each and every observations about us, and store this information in the respective database/server (to which these devices are interconnected). But, note that here these devices comes with a critical issue, i.e., 'privacy'. All users require/want privacy all the time or want to protect their personal information from outside world/unknown user/strangers.

Now days Internet of Things (IoTs) devices are using much in our (human-being) lives/real-world's applications than mobile phones, but both devices contain our personal data like contacts, messages, social security numbers and banking information, even every activity made by us online (being made on internet or made by devices) or offline. It also accesses records which are running offline to our Systems/Mobile/Devices (in the backend). Also, various security concerns can be with respect to a single device, for example, a mobile phone can quickly turn to 50 or 60 concerns [6] when considering multiple IoT devices in an interconnected home or business (e.g., cost, time, security, privacy, etc.). Importantly, we need to find that which/what IoT devices have access to (i.e., need to understand their security risk). Note that the growth in IoTs/connected devices has increased since the last decade. With this, IoT also have increased the potential attack surface for hackers and other cyber criminals (e.g., Ransomware attack affect millions of computers in 2017 and steal TeraBytes of data). More devices connected online (to Internet) means more devices require protection, whereas, IoT systems are not usually designed for cyber-security. In current days, the numbers of cyber-criminals/attackers are increasing every day, and the data breaches by them is increasing every day and it will be continue in future also. Several other issues (for mobile security) are already a challenge with respect to connected devices (i.e., IoTs) and will be continued in future. For example, let 10 IoT connected devices is not creating problems for a user, but what if IoT devices are in billions a connected together, then each one represents a potential doorway into our IT infrastructure and our company or personal data. Think "How much data these connected devices can collect"? Note that when internet of things connects together, a lot of data will be generated, collected at several locations for making valuable decisions in future for various applications/areas like automated home appliances, defence, smart grids and high-resolution assets. Storing similar data at several locations work as backup in emergency-case. These concerns require new methods, strategies, regulations to protect IoTs ecosystem (i.e., by incorporating security and privacy into its design and implementation (refer Sect. 3 and 4)). Note that IoT ecosystem is a network of many internet connected things which are connecting together, and sharing information with each other's.

Hence the remaining part of this work is organized as: Sect. 2 investigates several threats in internet of things ecosystem. Also, this section discusses analysis of these (respective) attacks with possible solution/countermeasure. Then, some critical challenges have been included in Sect. 3. Then, this work provides many suggestions or techniques (methods) to secure an IoT ecosystem in Sect. 4. In Sect. 5, this work tells

us what we can do/solutions for avoiding tracking of IoTs or not being trapped with IoTs devices. In last, this work is concluded (in brief) with some future remarks in Sect. 6.

2 Threats with Internet of Things

The growth in IoTs/connected devices is increasing and will be increasing over the next decades. Several things/devices are connected to the Internet now days (and it will be always increasing), i.e., these (IoT) devices provide a virtual environment to human being/to a physical object, but when it get used as services with applications, this virtual form start to interact and exchange essential or important information (of respective users whoever are using these devices), and these devices make useful decisions based on this collected information/data. Now, there are several IoT threats which can be categorized into four types: Privacy, Security, Trust and Safety. In security, denial of service and other attacks are possible in IoT. In privacy, like background knowledge, timing or transition etc., attacks (with the personal information) possible done (by cyber criminals). IoT leads to several physical threats in several national projects/departments/areas, for example, automation industry (cars and homes), environment, power, water and food supply, etc. Note that when many applications interconnect with these devices to make a smart environment (with device to device or machine to machine), we need to consider security (physical), privacy (data, identity and location). Due to located or using IoT devices in sensitive areas like e-healthcare, then these devices may get tampered/accessed by the individual attacker/a group of attackers for their financial use (read or change data) [6]. With such attacks/access, attacker could control a system (which is built by integration of IoT) and change functionality of this system accordingly. For example in 2010, Stuxnet virus by spread by some attackers in Iran to control/damage their nuclear weapons. Internet of Things security is no longer a foggy future issue [6, 7], as more and more such devices enter the market and our lives, i.e., from self-parking cars to home automation systems to wearable smart devices. Now days there are (will be in future) so many sensors, so many devices, that they are even sensing you, but they are always around you to track your footprint. It is tracing your every movement/task (made by your online/offline) all the time. So, we need to be aware from such types of attacks/tracking.

2.1 These Threats Are in Real

Among the recent examples, one attacker hacked into two cars and wirelessly disabled the brakes, turned the lights off and switched the brakes full on, i.e., all beyond the control of the driver [8]. In another case, a luxury watercraft/yacht was controlled by some researchers, i.e. via hacking the GPS signal (which was embedded in watercraft for navigation-purpose). In summary, a full control can be reach to cyber attacker/third party/user to take benefits against a respective user. Also, hackers can take over automated/smart home through tampering or hacking hubs (fixed in a home), i.e. IoTs devices are being so vulnerable, which allow attackers to look into or control with heating, cooling, lighting, power and door locks, (also similar for industrial control

systems). For example, in Hollywood movie “I.T” (released in 2016), an attacker tracks every movement of a victim (from a remote location) and tries to blackmail him/her. Also in similar movie, attacker tries to control his home automation, phone or other connected devices (to internet). Through this, attacker makes pressure on victim to accept his proposal, or blackmail other person for his financial purpose. Moreover this, now days, we are already looking hacked TV sets, power meters (i.e., used to steal electric power), smart phones, video cameras and child monitors [5, 12]. Hacking such devices (i.e., internet connected devices) has raised serious privacy concerns. Today’s we can imagine a worm that would compromise large numbers of these Internet-connected devices (on a large scale) and can controlled them via a botnet [15] or a collection of computer infected system (e.g., Wannacry attack, Ransomware attack, HTTP bot, etc.). It is not just the value or power of the device that an attacker/malicious user want. An attacker wants to slow down network bandwidth through a DDoS (Distributed Denial of Service) attack. Note that here biggest issue is not security of IoT devices, but a privacy issue (collected information leaked by devices to other connecting devices) is a great concern. Also, with low bandwidth, attacker can compromise device and can use it against a user/attack a third party. Now imagine a Botnet of 100,000,000 IoT devices all making legitimate website requests on your corporate website at the same time. In result, respective website will get slow down and will not properly. With such incidents, in near future, IoT will create unique and complex cases as security and privacy challenges for several industries/organizations.

Also, machines are becoming autonomous, so they are able to interact with other machines (in near future) and are free to make decisions which may impact the physical world. For example, problems with automatic trading software, which can get trapped in a loop causing market drops. The systems may have fail safe built in, but these are coded by humans who are fallible (i.e., error-prone), especially when they are writing code that works at the speed and frequency that computer programs can operate. If a power system were hacked by some attackers and they turned off the lights of an area/a city. It is not a big issue/problems for many users, but it matters for thousands of people who are present in the subway stations (i.e., in hundreds of feet underground in pitch darkness), then this issue became too (highly) critical. Such issue really requires attention from research communities in near future. Hence, Internet-Connected Things (ICT) allows the virtual world to interact with the physical world to do things smartly and that come with several safety issues.

2.2 Some Potential Threats to Internet of Things Ecosystem

When several IoT devices are interconnected together, they create an IoT ecosystem, which work together (as automatically) to serve firms/organizations in an efficient manner. But as discussed above, these devices face several security and privacy issues. Several researchers have performed many security tests to expose IoT vulnerabilities, and make the world (or people) aware of the potential security concerns of internet connecting devices without proper security measures. Some of the key threats are included here as:

- **Threat Posed by Compromised Devices:** Since many devices contain inherent values by their design and nature of functions, a connected device presents a potential target to be exploited by an attacker. A connected security camera could expose personal information of users [4], for example, a user's location when compromised. Once these devices become trusted, then these devices are easy to hack or tamper, through this controlling, managing things become easier. It is like that controlling the lights in a house/business offices, or controlling an automobile or medical device which may affect human health/physical harms [4]. Can we put trust on these devices? If yes, then how much? This question is really a tricky one.
- **Threat over Communication Link:** This threat contains monitoring and intercepting messages during a communication session. A lot of data is being transmitted among these devices/in the IoT ecosystems (a network of connected IoT devices together), but during this transmission/transfer of information via communication, various attacks are possible, which is too dangerous and critical. Note that this communication can be intercepted, captured, or manipulated (or shared with others/unknown users) during transmission. For example, an attacker may trace the footprints of a user via his/her communication, on the other side, attacker may track energy usage (based on downtime and uptime of a system for firms/organizations/users) to plan an attack on the entire smart system/home system/industrial control systems [4]. Whereas, other attacker can manipulate the data (which is transmitted to the utility company/firms/organizations) and may affect this information. Here, successful attacks may affect trust among user, devices, firms and manufactures (of such devices) with respect to data transmitted in IoT infrastructure.
- **Threat on the Master:** Threats against manufacturer (of IoT device) and Cloud Service Providers (CSP) raises several critical issues (in IoT ecosystem) like safety, trust, privacy. As manufacturer and IoT cloud (both contain trillions amount of data, i.e., in which some data is highly sensitive data). This data is so useful, core, strategic asset because it contains some meaningful information in it (determined by analytics process [9]). Note that this has higher competitive information in view of underground APT (Asia-Pacific Tele-community) group, if leaked/intercepted. If the Master is compromised, it gives opportunity to an attacker to manipulate many devices at once, some of which may have already been deployed in the field. For example, if a provider who issues frequent firmware/software have the mechanism compromised, malicious code could be introduced to the devices.

Note that the small size and limited processing power of many connected devices could limit the use of encryption and other security measures. It may also be difficult to patch flaws in low-cost and essentially disposable IoT devices.

2.3 Analysing Different Types of Attacks (with Possible Solutions)

In general, the security attacks are categorized into four broad classes, i.e., Low-level attack (when an attacker tries to attack a network and in result fail to do attack on respective network), medium-level attack (when attacker/intruder/eavesdropper just attack on a network to listen the medium without altering any information/integrity of data), High-level attack (when an attacker tries to attack on a network and in result, it

alters the integrity of data/modifies the data) and Extremely High-level attack (when an intruder/attacker/eavesdropper attacks on a network (with unauthorized access) and performing an illegal operation, i.e., making respective network unavailable, and sending bulk messages to other users, or jamming network). Apart such attacks, the IoT is facing various types of attacks including active attacks and passive attacks [10, 11], which may easily disturb the functionality and abolish the services of communication link/network. Note that in a passive attack, an attacker just sense messages (passing through) or may steal the information, but never attacks physically (this attack is similar to medium level attack). On the other side, in active attacks case, attacker disturb the performance of a network/communication physically (this attack is similar to extremely high level attack). Note that in general, active attacks can be classified into two categories, i.e., internal attacks and external attacks [11]. Any devices can be prevented against any vulnerable attacks via using proper awareness/making communicate smartly trough these devices. Hence, the security constraints must be applied to prevent devices from malicious attacks.

Different types of attack, nature/behavior of attack and threat level of attacks with possible solution have been discussed in Table 1. Hence, this section discusses several threats like Route diversion, eavesdropping, DoS, etc., investigated in IoTs with their behavior, level and possible solutions for respective attack. Now, next section will discuss several common challenges in internet of things in detail.

Table 1. Different type of attacks with possible solutions for respective attacks

Type	Threat	Behavior	Possible solution
Passive	Low	It is used to identify the information about the target node. Examples include passive eavesdropping and traffic analysis. Intruder silently monitors the communication for his own benefits without modifying the data	Ensure confidentiality of data and do not allow an attacker to fetch information using symmetric encryption techniques
Man in the middle	Low to medium	Examples of this attack include Alteration and eavesdropping. An eavesdropper can silently monitor the transmission medium and can do modification if no encryption is used and also manipulate the data	Ensure integrity by applying data confidentiality and proper integration. Encryption can also be applied to avoid data modification
Eaves-dropping	Low to medium	Causes loss of information, for example in medical environment, privacy of a patient may be leaked by sensing the transmission medium	Apply encryption technique on all the devices used in communication

(continued)

Table 1. (continued)

Type	Threat	Behavior	Possible solution
Gathering	Medium to high	Occurs when data is gathered from different wireless or wired medium. The collected message may get altered by the intruder. Examples are skimming, tampering and eavesdropping	Encryption, Identity based method and message authentication code can be applied in order to prevent the network from this type of malicious attacks
Active	High	Effects confidentiality and integrity of data. Intruder can alter the message integrity, block messages, or may re-route the messages. It could be an internal attacker	Ensure both confidentiality and integrity of data. Symmetric encryption can be applied to preserve the data confidentiality. An authentication mechanism may be applied to avoid unauthorized access
Imitation	High	It impersonate for an unauthorized access. Spoofing and cloning are the examples of this attack. In spoofing attack a malicious node impersonate any other device and launch attacks to steal data or to spread malware. Cloning, re-write or redundant data	To avoid from spoofing and cloning attacks, apply identity based authentication protocols. Can use un-clonable function as a countermeasure for cloning attack
ePrivacy	High	Intruders fetch the Sensitive information of an individual or group. Such attacks may be correlated to gathering attack or may cause an imitation attack that can further lead to exposure of privacy	Anonymous data transmission, Transmission of sample data instead of actual data can help to achieve privacy. Can also apply techniques like ring signature and blind signature
Interruption	High	Affects availability of data. This makes the network unavailable	Accessing of data and usage of data is restricted by some authorization technique
Routing diversion	High	Alter the route of transmission to create huge traffic and hence the response time increased	Apply connection oriented services to avoid route diversions
Blocking	Extremely high	It is type of DoS, jamming, or malware attacks. It create congestion in the network by sending, huge streams of data, similarly different types of viruses like Trojan horses, worms, and other programs can disturb the network	Firewall protection, apply packet filtering, anti-jamming, active jamming, and updated antivirus programs in order to protect the network from such attacks

(continued)

Table 1. (continued)

Type	Threat	Behavior	Possible solution
Fabrication	Extremely high	The authenticity of information is destroyed by injecting false data	Data authenticity can be applied to ensure that no information is changed during the data transmission
Denial of Service	Extremely high	To disturb the normal functionalities of device, the malicious node create traffic in the network by retransmitting the same data and by injecting bulk messages into the network	Cryptographic techniques help to ensure security of network. Authenticity helps to detect the malicious user and block them permanently.

3 Common Challenges in Internet of Things

As discussed above (in Sect. 3), the security, privacy, safety, etc., issues are the biggest challenge to rectify/solve in IoT ecosystem. In general, challenges are the problem where research is still going on or questions still require answers (still require attention from research communities). These issues and challenges require attention of researchers and need to be solved for providing trust in devices (through this, industry will get new competencies and capacities) and higher growth rate of IoTs devices. Some major challenges can be (identified from various areas in IoTs application/its ecosystem) included as:

- a. Infrastructure: Today's Smart Infrastructure like Smarter Cities, Smart Grid, Smart Building, Smart Home, Intelligent Transport Systems (ITS), and ubiquitous healthcare, etc. [2] require safety (need to be trustable, mobile, distributed, valuable, and powerful enabler for these applications) as essential component in its infrastructure. For this, we need to move on IPv6 addressing mechanism (for large number of sensors and smart devices/things to be connected to the Internet) for each IoT devices. Note that IPv6 is a technology/addressing scheme (in network) considered most suitable for IoT, as it offers scalability, flexibility, tested, extended, ubiquitous, open, and end-to-end connectivity. Hence, it is a major challenge for IoT devices to move this addressing (new) scheme (IPv6).
- b. Data and Information: The large volume of data (generated by several IoT devices) presents a biggest challenge for service providers in an IoT ecosystem. Big Data is being so important and useful to organizations [13]. For that, we need to overcome challenges like storing information at a secure place, and by a secure mechanism, which will be a boost to IoT service providers with analyzing this data, and discovering relevant trends and patterns.
- c. Computer Attacks: These attacks are the most common threats in an IoT/Cloud Environment. Some attacks can be like Denial of Service (DoS), DDoS, etc. spread malware in IoT devices. With such attacks, attacker exploits, or attacks on the user's privacy or even modification of the electronic components of the device. Note that Server and computer security come under this challenge.

- d. **Software Vulnerabilities:** This is also a major security challenge in the vulnerabilities of IoT applications and software. These softwares must be updated (at regular interval), analyzed, tested and configured correctly to prevent security problems (i.e., in platform and backend). Note that Operating Systems (OS) security vulnerability comes under this challenge.
- e. **Data Interception:** Cyber security introduces for preventing any interception to communications (between IoT devices). Session kidnappings, or communication protocols and capturing network data are some (few) threats to which it is essential to adopt standard security measures. Note that Data security comes under this challenge.
- f. **Data Privacy:** IoTs taking the responsibility of data collection, storage and analysis mechanisms to a greater scale. There are several devices which are connected to the Internet and also several elements that require protection, i.e., the device itself, the network, the application or the platform that it uses. As discussed above, some manufacturers of smart devices like mobile, TVs, etc., collect data about their customers to analyse their viewing habits (based on particular timing or trends) so this collected data (by smart TVs/smart phone, etc.) may have a challenge for data privacy during transmission.
- g. **Technical Vulnerabilities in Authentication:** IoTs work with devices (having multiple natures) which are connected to the Internet and collect user data in a cloud through their tool itself. Here, we need to work in depth on the authentication mechanisms to ensure the privacy of the user/protecting user's information against any attacks.
- h. **Data Encryption:** The transmission of data (by non-encrypted) having a major security problem which is an important concern in network security. Now days, Data security is a biggest challenge for a computing environment/IoT ecosystem. While transmitting data seamlessly, it is important to hide from observing devices on the internet.
- i. **Complex System:** The more devices, people, interactions and interfaces, the more the risk for data security raised (system has more variety and diversity). Hence, challenge of managing all points in a network to maximize security also increases.
- j. **Technical Concerns:** We require to increase network capacity, i.e., which can carry more data throughout the network because of the increased usage of IoT devices in everyday life/for every work (like automation, parking, manufacturing, etc.). These devices are generating a lot of data, which will also increase (day by day). Hence, there is a higher need to increase network capacity. Hence, it is also a challenge to store this large amount of data (i.e., Big Data) for final storage and further analysing (for determining useful decision).
- k. **Lack of Common Standard:** Many standards are being used for IoT devices, i.e., no unique standard is available (by IoT manufacturing industries). Hence, it is a big, serious and major challenge to find difference between genuine (permitted) and non-certified (non-permitted) devices connected to the World Wide Web/Internet.

Hence from above discussion, we get to know about several issues and challenges in IoTs. In general, IoTs is a relatively new technological advance. Ignorance of IoT security, both by companies and individual users, also increases the risks of cyber-

security due to lack of experience and the human factor. Apart from above points, some other challenges in IoTs are: Insufficient testing and updating, Brute-forcing and the issue of default passwords, IoT malware, Ransomware, WannaCry, IoT botnets aiming at Cryptocurrency, Data security and Privacy issues (mobile, web, cloud). Small IoT attacks can be prevented for providing efficient Detection, Artificial Intelligence and Automation, Ubiquitous data collection, Potential for unexpected uses of consumer data. Generally, these internet connected devices have capability to make human being lives easier, better and longer. So, if these issues/challenges (or issues) not addressed or solved in near future then these (IoT) devices may lead to a lot/more problems than they are useful (giving benefits) to human beings.

Hence, this section discusses several challenges faced with internet of things like preserving privacy and maintaining security, not having good standards for IoT devices, etc. Now in continuing with this, next section will provide some solutions to secure an IoT ecosystem.

4 Securing Internet of Things Ecosystem

In near future, Internet of Things will be a game changer for several applications, including business. But together this, security and privacy issues will also raise on a larger scale and will require attention from manufacture/research communities. In general, IoT security depends on the ability to identify devices, protecting IoT hosting platform, and protecting data (collected by smart/IoT devices) and share this data with Trusted IoT Device (a trusted device is required to be reliably identifiable and associated with a manufacturer/provider. IoT devices should be able to communicate with the intended/authorized hosting services) and Trusted IoT Master. Here a trust master has the knowledge about secure communication with several embedded sensors (in devices/products), and issues regarding to software (i.e., when it needs to be updated and when not). Note that this updation to these devices keeps them securely (with assurances that using code/services are authentic, unmodified and non-malicious). Sharing information with trusted entities only increase trust among users and on technology. Now, here we are discussing all necessary tasks/components to require/secure an IoT ecosystem.

4.1 Maintaining Data Integrity with Internet of Things

Now days several insurance companies are installing IoT devices on vehicles and collecting data about health and driving status in order to take decisions about insurance claim. But, this data may leak to some other unknown/malicious user. Also, as sensitive data in-transit travels through the IoT cloud hosting, it should be encrypted in network layer to prevent interception. Hence, stored data (captured by devices) should be in active-active mode and seamlessly encrypted to avoid data theft (and leaking of data). Blockchain Technology (first time used in Bit coin: A Crypto- currency [14], in 2009) can be used to fulfil this wish, i.e., can provide higher security to a distributed, decentralized and centralized system.

4.2 Establishing Trusted Identity Internet of Things

As discussed above, IoT is built on a network of uniquely identifiable devices, whereas, public key cryptography plays a biggest role in establishing trusted identities (in IoTs). Public key cryptography used a concept of using two different keys to share any information among systems/users. Where one of the key is made public (i.e., public key) and the other is kept private (i.e., private key). Information can be read if both of the keys apply correctly on encrypted information. It is also called asymmetric encryption because it uses one key for encrypting and other one for decrypting. This process is done by a Certification Authority (CA), via issuing a digital certificate to confirm the authenticity of a device. Similarly, a digital certificate contains several fields that help in establishing and validating the identity of a device/system (related to a corresponding public key). These certificates will be used to identify devices, sign firmware /software updates, and facilitate encrypted communications, i.e., to provide sufficient level of security to passes/stored information. Also, trust can be built via creating blocks and storing encrypted information in blocks with consisting information with respect to previous and next block's records (i.e., a Blockchain concept) in an IoT environment.

4.3 Establishing a Public Key Infrastructure for Internet of Things

As discussed above, identity infrastructure is built on both/combination of public and private keys. Note that in asymmetric key cryptography, public keys are freely available for all, but the private keys kept as secret and secure (must be). If a private key is not kept secure/private, then credibility of respective key may get compromised. The secure generation and storage of these keys is paramount. Public Key Infrastructure (PKI) (an Asymmetric Key Cryptography) need to be secured by a novel propped solution (which is properly implemented with some real world attacks) against tamper-resistant hardware /to protected stored data. Using this mechanism, we can easily mitigate an attacker/attack in a network.

4.4 Protecting Aggregated Big Data with Encryption

The data collected, transmitted, and stored in clouds/IoT can be protected using encryption mechanisms. Providing confidentiality to large data can be achieved by good encryption mechanisms (like digital signature, etc.). For that, we can use Blockchain technology to secure this data, i.e., storing this data in blocks (after encrypt) then make a connection with next blocks (according to data/information). A data is situated in two forms (in a cloud/IoTs communication) like data at rest (static) and data in mode (dynamic).

- i. Protection of Data at Rest: When IoTs devices are communicating, then they generating a lot of data, which is stored at several locations with secure mechanisms. Encrypting this data and keeping it at server side provides scalable, cost effective storage, and fast processing in near future. These encryption mechanisms provide availability, integrity and usage of respective collected data (i.e., accessible all time to users). Note that this data is stored at several locations in form of clusters

(across multiple of data nodes) in unprotected manner. So, storing this data with protected manner and avoiding any possible entry point to any malicious users/insider is an essential issue to overlook/focus in near future. To overcome this issue of protecting stored data, firms/organizations need to use sufficient encryption mechanism (after compression of data)/lock down sensitive data at rest in big data clusters (without affecting systems/devices performance). For that, it requires transparent and automated file-system level encryption that is capable of protecting sensitive data at rest on these distributed nodes.

- ii. Protection of Data in Motion: Encrypting communicated data (moving through IoT ecosystem) presents a unique challenge because it has a high variety and increasing at a higher rate. As data (from a device) moves from one location to another (to another device), it is highly vulnerable to attacks like fibre tapping attack, man in middle attack, etc. Note that an attacker can listen a communication (which is being with two parties/devices) with tempering/attaching a cable (with fibre coupling device) and no device (or mechanism) can detect it. This attack is looks like insider-attack (a type of active attack). In this, attacker can record all activity that runs across a network, and data is captured and stolen without the owner's knowledge (even sender and receiver's knowledge). In worst case, this type of attack can also be used to change data, and has potential to override the controls on the entire system. IoTs communication (over public networks) will require to be secured via similar ways we protect other communications over the Internet, i.e., using Transport Layer Security (TLS). Note that encryption is also required at the back-end infrastructure level of manufacturers, cloud service providers, and IoT solution providers.

A data can also be protected using Blockchain concept. Security can be provided to any types of data via creating blocks and storing encrypted data/information in blocks with consisting information with respect to previous and next block's records. This process is clearly impossible to compromise (except in case of covering majority of blocks) by any attacks. Hence this works presents several suggestions or techniques to (provide security) securing an IoT ecosystem in an efficient manner. Now, next section will discuss several possible ways to avoiding a user from being trapped by IoTs devices (with a real world example).

5 What Can We Do?

Today's IoTs are creating environment like cyber physical systems, where researcher are looking for cyber security but they do not look over the physical security of systems/devices. When attacks are happening on any IoT devices, they we need to protect these devise with possible encryption mechanism and efficient symmetric or asymmetric cryptography key to strengthen the security of IoT devices/environments. Also, we can use security tools like data encryption, strong user authentication, resilient coding and standardized and tested APIs (Application Programming Interface). Also, we need to look over security of physical space (including cyber space), i.e., Physical security is also an issue here, since these devices are usually used in open (like in smart

metering, smart transportation, etc.) or in remote locations and anyone can get physical access to it. This kind of issue requires much attention from research community. Note that some security tools need to be applied directly to the connected IoTs devices. In this era, traditional computers, the IoT and its cousin BYOD (Bring Your Own Device) have similar security issues. These IoT devices do not have any sufficient capability to defend themselves (automatically) and need to be protected via some external software like firewalls and intrusion detection/prevention systems. Creating a separate network like virtual private network or any private network is also a solution, but with large number of devices, it fails. Also, protecting devices with firewalls also fails in case of software updating for next version (due to timely security updates on the devices). At updating time, any attacker can sense or enter in a device. Hence, securing IoT is more difficult from other types of security initiatives (like physical security). When someone has physical access to the device once, the security concerns raise automatically. When we evaluate security of IoT or protect data in IoT, then we get that this technology is still in progress very much. In summary, losing of privacy, security or trust is always start with user's permission only. Hence, using/at the time of configuring IoT devices, a user need to be more careful and aware about not to every location/information of himself.

Hence in this section, we discuss the ways, through which, we can protect ourselves in this smart worlds/era (in connection of IoTs), i.e., provide several solutions for avoiding tracking by IoTs or not being trapped with IoTs devices. Now next, sections will conclude this work in brief with few future remarks.

6 Conclusion

Today's Internet of Things is emerging as a big revolution (third wave) in the development of the Internet. Note that in the past, in 1990s' (as first wave), Internet wave connected 1 billion users, while in 2000s', mobile connected another 2 billion users (as another wave). The Internet of Things has the potential to connect 10X as many (28 billion) "things" to the Internet by 2020, ranging from bracelets to cars. This paper reveals that due to the decreasing the cost of sensors, processing power, smart things are getting cheaper and cheaper. Also, several governments (like Japan, Australia, Dubai, India) are pushing to use the applications of IoTs devices like smart home, smart cities, smart transportation, smart grid, etc. Dubai will fully upgraded before 2022 with smart things/devices. In India, concept of smart cities is already launched and Amravati city is going to be the first India's smart city before 2022. Apart that, we also reveal that now days several smart objects/things like smart watches, smart specs, and thermostats (Nest), etc., are already getting attention from public users. But, using such devices/rising of IoTs creates several serious issues about privacy, security, safety, etc. Now, this work worried about user's privacy, i.e., IoT devices/smart gadgets (which is configured badly) might provide a backdoor for hackers/strangers to look/in to break into corporate networks/personal life of respective user. Hence, preserving user's privacy, security at the device level, protecting the master, and encrypting communication links are critical to the secure operations of IoTs. In summary, security needs to be built in as the foundation of IoT systems, with rigorous validity checks,

authentication, data verification, and all the data needs to be encrypted. Also, user's privacy needs to be persevered with new algorithms/mechanism.

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A Route Evaluation Method Considering the Subjective Evaluation on Walkability, Safety, and Pleasantness by Elderly Pedestrians

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Abstract. To improve the quality of life (QOL) of elderly people, we propose a route planning method considering the subjective evaluation on walkability, safety, and pleasantness of the users. By using this method, it is possible to plan a route with lower physical load, higher safety, and more enjoyable for each elderly user. To quantify their preferences, the acceptable time delay is used for the cost functions. In this study, we confirmed that the factors can take into consideration the mental and physical situation of the user and acquired the quantitative cost functions for these factors. The cost functions were constructed based on the subjective evaluation data. The basic validity of the method was confirmed by a subjective evaluation experiment.

Keywords: Pedestrian navigation system · Elderly users · Preferences · Cognitive model · Quality of life

1 Introduction

The aging is progressing in Japan [1]. Improvement of the quality of life (QOL) of elderly people is considered important [2]. In a report [3], more than 50% of elderly people pointed out the problem of “getting tired easily when going out.” Therefore, support methods for enriching their outdoor activities is drawing attention.

Conventional pedestrian navigation systems only provide the shortest path and are inappropriate as aids for the elderly to go out. An empirical study of personalized tourist route advice system mentioned that a shortest or a minimum-cost path does not fit what tourists need [4]. Tourists would like to follow routes that can give them the most satisfaction by including as much as possible those features that they like. This concept must be also useful for improving the QOL of the elderly pedestrians. Toward realizing route guidance method effective for improving QOL of elderly people, mechanisms considering their physical difficulty, mental weakness, secure feeling, and preferences can be useful.

The aims of this study are to confirm the factors can take into consideration the mental and physical situation of the user and to acquire the quantitative cost functions

for these factors. This study consists of two stages. (1) construction of the revised cost functions, and (2) evaluation of basic validity of the proposed method.

2 Related Work

Novack et al., proposed a system for generating pedestrian routes considering pleasant when having green areas and social places as well as streets with less traffic noise [5]. They developed a way to integrate them into a routing cost function. The factors and the way are theoretically defined based on the results from general studies. Torres, et al., proposed a routing method for personalized route assistant based on multiple criteria, which can design accessible and green pedestrian routes [6]. The factors are selected preliminary only to show the usefulness of the method itself. The common issues of these studies are that necessity and sufficiency of the factors and appropriateness of each cost quantification for the factors were not confirmed.

Matsuda, et al., proposed the acceptable time delay, used as the cost for route planning to consider the users' preference for safety and walkability [7]. The delay refers to the time actually acceptable to users for bypassing a spot or for walking by a spot (see details in Sect. 4). A questionnaire survey was conducted from youth to elderly people, and seven factors and the values of the delay were acquired based on the subjective data. The issue is that the sufficiency of the factors was not evaluated.

3 Proposed Method

We propose a route planning method considering the subjective evaluation on walkability, safety, and pleasantness of elderly pedestrians. It will be possible to plan a route with lower physical load, higher safety, and more enjoyable for each elderly user. The features of this study are the following three:

- (1) We examined factors indicating user's preferences. First, we reexamined the spots concerning the categories of "walkability" and "safety", defined in the previous study [7], and added new spots belong to those categories. In addition, we set up "pleasantness" as a new category, and added spots that belong to it.
- (2) One of the preconditions of the guidance is the aim of a user. The aim "move to a destination", used in the previous study, was redefined as "move to a near destination" and "to a distant destination". In addition, "a walk" is set in this study.
- (3) We defined "environmental condition" as another precondition for the guidance: "daytime", "nighttime", and "bad weather" (heavy wind, rain, etc.).

4 Acceptable Time Delay for Considering Users' Preferences

Two situations are assumed for the acceptable time delay [7]. Figure 1 (a) shows the first situation, where the delay is the additional time accepted by the user to avoid a place with a high physical load (e.g., a steep slope) or high risk (e.g., road without

sidewalk). In the situation shown in Fig. 1 (b), the delay is defined as the additional time that the user can accept to select the route with a preferred spot which is easier to walk or lower risk (e.g., an intersection with traffic signals).

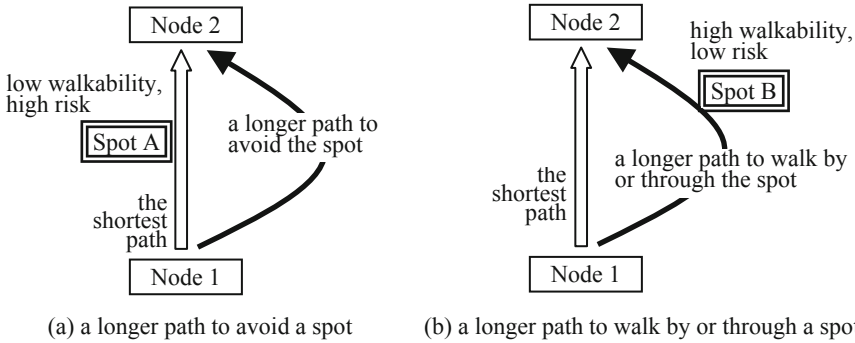


Fig. 1. The situations assumed for the definition of the acceptable time delay.

Based on the concept about the acceptable time delay, the cost considering the user’s preference is defined as Eqs. (1) and (2). When the value of the detour route for a user increases (that is, the acceptable time delay becomes longer), the revised cost decreases. The revised cost will be used instead of the original cost, when the path has one of the spots (described in Table 1 for this study). This cost function makes it possible to take pedestrian preferences into consideration in route planning.

$$\alpha = (\text{time for the shortest path}) / (\text{time for the shortest path} + \text{the acceptable time delay}), \quad (1)$$

$$\text{the revised cost of the longer path} = \alpha(\text{the original cost} : \text{physical distance}). \quad (2)$$

5 Construction of Revised Cost Functions Based on Subjective Evaluation Data by Elderly People

The cost functions were constructed in three steps. In the first step, potential factors (spots) were selected as candidates in each category. In the second step, subjective data for the acceptable time delay was acquired for each candidate factor. In the third step, a cost function for each factor was constructed based on the acquired data.

5.1 Addition of Candidate Factors Based on Small-Scale Surveys

As the first step in constructing the proposed function, we select candidates for factors to reflect the preference of elderly users in route planning. We conducted questionnaire surveys for elderly people and gathered specific places and areas of concern in selecting

routes. We got data from total 27 people over the age of 60 in Tsukuba City and Shinjuku Ward, Tokyo. The former is in the countryside, and the latter is a typical urban area. In addition to the factors used in the reference documents, additional factors were added (for details see 5.2).

5.2 Collection of Subjective Evaluation Data on Acceptable Time Delay for Each Factor

As the second step, we collected data of subjective evaluation on acceptable time delay for each factor from groups of elderly people, using the paper-based evaluation format.

Two conditions were set to define a situation to subjectively evaluate the acceptable time delay for each factor. The first is “an aim”; “a walk” (about 15 min), moving “to a near destination” (about 15 min), and moving “to a distant destination” (about 30 min) were set. The second is the “environmental condition”; “daytime”, “nighttime”, and “bad weather” (the last one is defined only when moving to the destination) were set.

For each assumed situation, each participant answered the acceptable time delay for each candidate from the categories of “walkability”, “safety”, and “pleasantness”. Table 1 shows the candidates selected based on the data obtained in Sect. 5.1. The question was “When there is a detour route with/without the spot, how many minutes of the delay can you accept? “ We got data from 150 people over the age of 60. There were 75 participants in Tsukuba and 75 in Shinjuku Ward, Tokyo (96 in the 60’s, 70 in the 70’s, 43 in the 80’s and over, 11 in the female, 81 in the male).

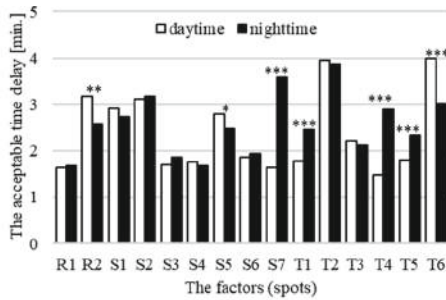
Table 1. The candidates of factors (spots) which may have relationships with user’s preferences on routes.

Category	Aim	Factors (spots)
Walkability	“a walk” & “to a goal”	R1: steep slope /stairway R2: crowded street
Safety	“a walk” & “to a goal”	S1: a sidewalk S2: an intersection with traffic signal S3: road with guardrails S4: an intersection with crosswalk S5: a pedestrian-vehicle separated traffic signal S6: a pedestrian overpass S7: a bright path
Pleasantness	“a walk”	T1: school T2: a park T3: waterfront T4: a police box T5: clear wide road T6: quiet road
	“to a goal”	T1: a guide map T2: a police box T3: clear wide road T4: road with less cars

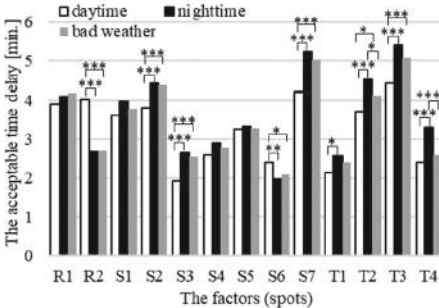
5.3 Revised Cost Function for Each Factor

The third step is the construction of the revised cost functions. Using the data acquired in Sect. 5.2, the acceptable time delay of each factor in each condition can be obtained as a weighted average. If common values can be used in all situations, the computational cost will be minimal. Therefore, the goal was to use common values in as few conditions as possible. In order to confirm the necessity of setting the time delay for each condition, the difference between the assumed conditions was statistically analyzed.

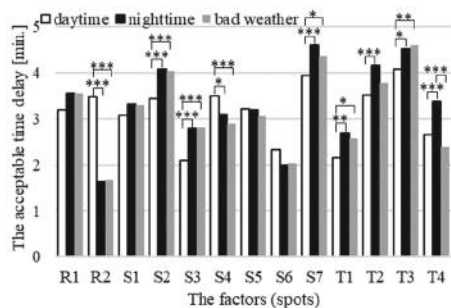
Statistical Analysis of Differences Between the Environmental Conditions. Figure 2 (a) shows average values of the acceptable time delay in daytime and nighttime with the situation where the aim is “a walk.” The marks indicate the difference is significant by the t test (***: $p < 0.001$, **: $p < 0.01$, and *: $p < 0.05$). The differences in some conditions are significant. Therefore, the values should be set separately in daytime and nighttime.



(a) at the aim “a walk”



(b) at the aim “move to a near destination”



(c) at the aim “move to a distant destination”

Fig. 2. The average values of the acceptable time delay to compare between the environment conditions: daytime, nighttime, and bad weather.

Figure 2 (b) and (c) show the values in the situations where the aims are “to walk to a near destination” and “a distant destination,” respectively. The differences in some conditions are significant between daytime and nighttime, also daytime and bad

weather. But not between the situation with nighttime and bad weather. Therefore, the values can be set in common at nighttime and bad weather.

Statistical Analysis on Differences Between the Distance Conditions. Figure 3 (a), (b), and (c) show average values of the acceptable time delay with the aim of walking to a near or distant destination in different environment conditions: daytime, nighttime and bad weather. The differences in some conditions are significant. Therefore, the values should be set separately in the environment conditions.

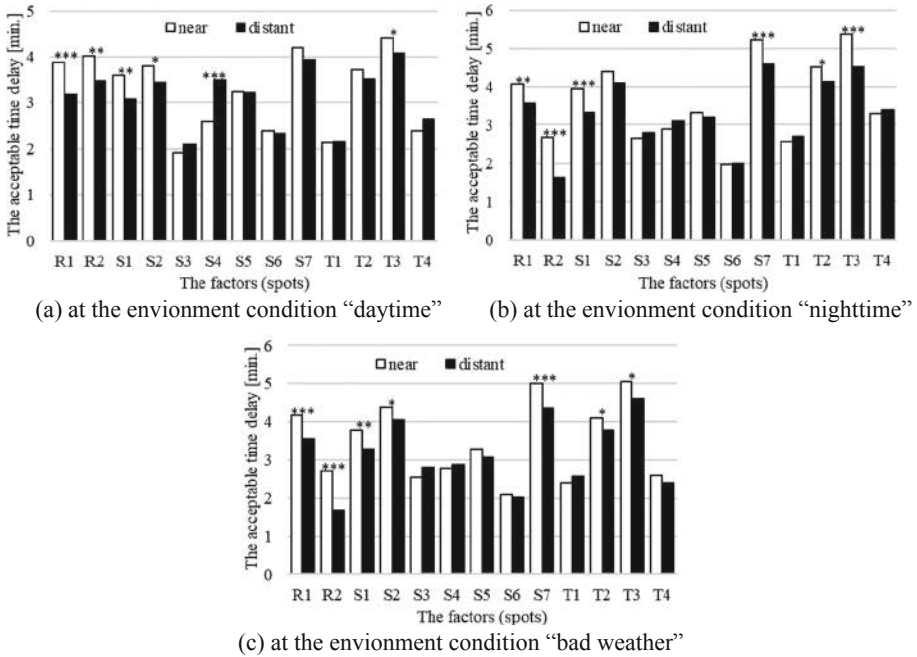


Fig. 3. The average values of the acceptable time delay to compare between the distance conditions: near and distant destinations.

Revised Costs function for Spots for Assumed Conditions. As the results through the analysis in the previous two sections, the three sets of values of acceptable time delay were obtained for the proposed method (Figs. 4 and 5). For the aim "a walk", 15 factors (spots) were set for the condition "daytime", and 15 for "nithttime", as indicated in Fig. 4. For the aims "to a near destination" and "to a distant destination," 13 factors were set for the condition "daytime", and 13 for the "nighttime or bad weather" (Fig. 5). In this study, the revised cost functions are defined for each of the 82 factors by using the Eqs. (1) and (2). Therefore, the total number of the revised cost functions are 82.

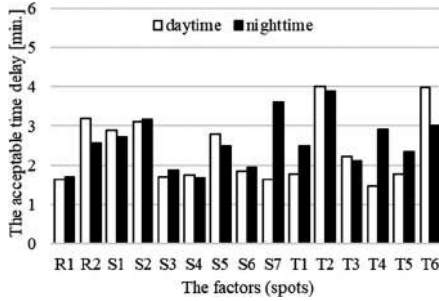


Fig. 4. The values of the acceptable time delay for the aim “a walk”, which are used for the revised costs function of the proposed method.

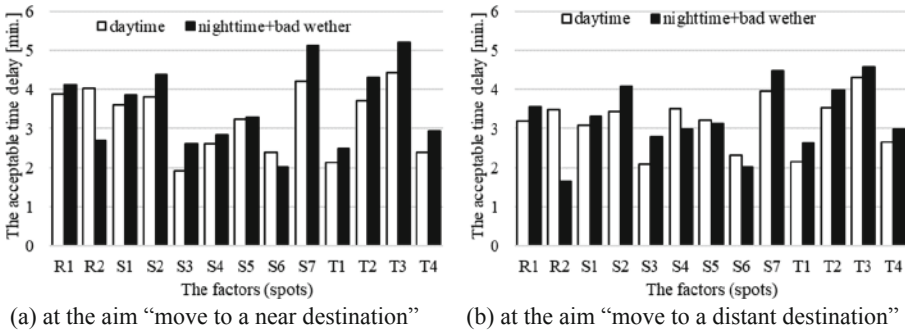


Fig. 5. The values of the acceptable time delay for the aim “move to a destination”, which are used for the revised costs function of the proposed method.

6 Evaluation of Basic Validity of Proposed Method

In order to evaluate the basic validity of the proposed method, subjective evaluation experiments by elderly people were conducted, in which the shortest distance route and the route by the proposed method were compared.

For every three types of aim, we selected the shortest route and the route by the proposed method corresponding to each condition in Tsukuba city and Shinjuku Ward, Tokyo. Because of the limited resource and time, we assumed “daytime” as the only environment condition in this experiments. Participants were asked to select a higher appraising route in three viewpoints after watching the video moving through each route. The viewpoints are “easier to walk”, “safer to walk”, and “more favorite”. The participants were 40 elderly people over the age of 60. Table 2 shows the results. “3/37” indicates that three of the participants selected the shortest route and 37 selected the route by the proposed method. The marks indicate the difference is significant confirmed by the binomial test (***: $p < 0.001$, **: $p < 0.01$, and *: $p < 0.05$).

Table 2. Results of participant’s selection on a higher appraising route in the three viewpoints after watching the video moving through each route.

Aim	Route	The viewpoint of subjective evaluation		
		“easier to walk”	“safer to walk”	“more favorite”
“a walk”	Tsukuba	3 /37 ***	3 /37 ***	3 /37 ***
	Shinjuku	11 /29 **	12 /28 *	15 /25
“to a near goal”	Tsukuba	4 /36 ***	5 /35 ***	4 /36 ***
	Shinjuku	9 /30 **	7 /32 ***	5 /34 ***
“to a distant goal”	Tsukuba	11 /29 **	12 /28 *	15 /25
	Shinjuku	11 /28 **	7 /32 ***	5 /34 ***

As a result of the experiment, it was found that the preference of the route by the proposed method is higher than that of the shortest route from the viewpoints of “easier to walk”, “safer to walk”, and “more favorite”. It can be concluded that this result shows the basic concept of the proposed method is appropriate.

7 Conclusion

Our target is improvement of the quality of life (QOL) of elderly people. Toward realizing route guidance method effective for the improvement, mechanisms considering their physical difficulty, mental weakness, security feeling, and preferences can be useful.

We propose a route planning method considering the subjective evaluation on walkability, safety, and pleasantness of elderly pedestrians. To quantify their preferences, the acceptable time delay is used for the cost functions.

The aims of this study are to confirm the factors can take into consideration the mental and physical situation of the user and to acquire the quantitative cost functions for these factors. The cost functions were constructed based on the subjective evaluation data on the acceptable time delay in several different conditions.

The basic validity of the method was confirmed by a subjective evaluation experiment on the routes by the proposed method and the shortest routes. The participants were asked to select a higher appraising route after watching the video moving through the routes, and they selected the former routes in most of conditions.

By using this method, it is possible to plan a route with lower physical load, higher safety, and more enjoyable for each elderly user. The next goal is to carry out experiments at all different conditions with more participants, and to make a reliable assessment of the usefulness of the method.

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Multi Controller Load Balancing in Software Defined Networks: A Survey

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Abstract. As the single centralized controller is not meeting the requirements of large scale networks, the distributed control plane have been proposed for software defined networks. But the distributed SDN also have overlooked challenges in terms of scalability, consistency, reliability and load balancing. The increase in traffic flow at one particular switch may increase the load of the controller handling that switch, leads to uneven distribution of load among controllers. This unbalanced load distribution results in poor network performance. This paper presents a state-of-the-art for controller load balancing by switch migration techniques.

Keywords: SDN · Control plane · Load balancing · Switch migration

1 Introduction

Today the requirements in the networks are rapidly increasing. The traditional networking technology has its own limitations in terms of new technological innovations, complex configuration management and operational costs. There is a requirement for the new networking architecture to overcome the drawbacks of traditional networks. From the last decade Software Defined Networking (SDN) come into existence, which is decoupling the controller logic intelligence from the networking devices data plane. With SDN the network can provide augmented automation, centralized provisioning, reduced hardware management cost, enhanced security, vendor independent and cloud ready infrastructure. In SDN, the networking elements (switches) follow the instructions given by the controller to forward the packets from source to destination. The controller reactively or proactively [1] insert the flow entries into the flow tables of switches upon arrival of PACKET IN message from the switches.

SDN is having prominent role in large scale networks, enterprise networks, data center networks and wide area networks. As the size of network increases the single centralized controller may face difficulties to handle flow processing events. It will produce poor response time and highly unreliable. The shortcomings can be overcome by introducing the concept of multiple controllers to distribute the work of single controller among multiple controllers. To handle multiple controllers [2] address different challenges in terms of scalability, consistency, reliability and load balancing. In distributed SDN the switches are statically assigned to the controllers. The switches set under one controller is called domain of that controller. But this static assignment may

result in variation of load among controllers. Imbalance of load among controller leads to degradation in performance of the network in terms of controller throughput and packet loss rate. We require a dynamic mapping between controllers and switches so that the load is evenly distributed among controllers. The load imbalance in controllers occur due to large number of flows generated at one particular switch at runtime. There are two solutions for this problem.

1. Increase the capacity of the controller by providing more resources. (processing speed, memory, bandwidth).
2. Shift the switches from overloaded controller to underloaded controller.

In the former case, to avoid load on single controller there is a possibility of increase in capacity of the controller, but the network may not utilize the given resources efficiently. In the later case the allotted resources can be utilized efficiently in a network. There are many models to address this issue.

There is a recent survey [3] on SDN with multiple controllers, covering all aspects related to multiple controllers. The contribution of our paper mainly focused on load balancing of multiple controllers in SDN and it does not include any models presented in that survey paper. Our paper covers the latest models/proposals published in the area of multi controller load balancing in SDN.

The remaining part of the paper is presented as follows. Section 2 describes the process of switch migration in case of uneven load distribution among controllers. In Sect. 3, we explain the existing models present on controller load balancing. Section 4 gives the comparative analysis of models presented in Sect. 3. Finally it follows the conclusion.

2 Switch Migration

Handover the switch functionality which is handled by one controller to other controller is called switch migration. The process of switch migration is shown in Fig. 1. The first controller is called initial controller and second controller is called target controller. After migration of switch from initial controller to the target controller all asynchronous messages [4] generated by the switch will be received and processed by the target controller. However the role of initial controller will become master to slave and the role of target controller will become slave to master according to OpenFlow Specification [4]. There are three reasons for switch migration to happen in software defined networks. First reason is when the new controller is added to the existing controller pool. In this case the switches from other controllers are migrated towards the new controller. The second reason is when any one of the controller is down. In this case all switches of the down controller are migrated to other controllers. The third reason is the load of one controller is more than its capacity. In this case switches from overloaded controller are migrated to the underloaded controller. The challenging task is the selection of switch to be migrated in overloaded controller and selection of target controller among existing controller pool.

This paper presents a state-of-the-art for controller load balancing to fully utilize the allotted resources of a network. The switch migration should be done when the load of any

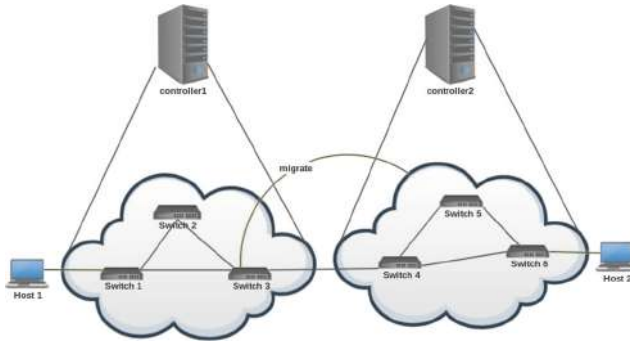


Fig. 1. The switch migration process

one of the controller increases. So the task is how to compute the controller load? There are many metrics to be considered while calculating the load of the controller. Different models used different metrics to calculate controller load and based on that load balancing can be performed by switch migration. Through North bound API [5] developed applications which does controller load balancing communicates with the controller.

3 Existing Proposals

In the literature there are several proposals for controller load balancing. Almost all the models are using mininet [6] emulator as an experimental testbed. There are many open source controllers available like RYU [7] python base controller, OpenDayLight [8], ONOS [9] Java based controllers etc.

3.1 ElastiCon

Elastic Controller [10] is the initiative model for all switch migration techniques. First the controller load is calculated based on the statistics, CPU, average message arrival rate from each switch. It provides global network view by the concept of distributed data store. Once the load on controller is beyond the given threshold, the neighboring switch and nearest controller are selected for switch migration to reduce inter controller communication in terms of migration time. The author of this paper presents a switch migration protocol as a series of message exchanges between controllers to possess the properties of liveness and safety according to OpenFlow standard. The messages include start migration, Role-request, Role-reply, Flow-mod, barrier messages. Because of message exchange between controllers before migration, the response time may increase significantly. The author proved by experiment that it takes 20 ms to complete switch migration process and throughput reduces when two core CPU is used than quad-core processor. Migration can be performed in limited amount of time with less impact on response time. But to minimize the migration time, it is not considering the load of target controller. If the load of that controller is also in overloaded stage then this model doesn't work well as the load of target controller is not considered in this model.

3.2 DHA

Cheng et al., addressed the problem of controller load balancing as Switch Migration Problem (SMP). To maximize the network utilization, Distributed Hopping Algorithm (DHA) [11] was designed based on time reversible markov chain process having the objective as to serve more requests under available resources. The load of the controller in this model is calculated based on number of PACKET-IN messages from switches to controller. According to this algorithm when there is a large variation in load of controllers, switch and controller are selected randomly for migration and migration activity will be broadcast to all other neighbor controllers to stop them for other migration process. After migration the controller will update its utilization ratios of switches and broadcast the updation to the neighbors for state synchronization among controllers to have a global network view. This model increases the average utilization ratio for all available resources. Compared with ElastiCon, DHA takes long migration time but reduces the response time.

3.3 SMDM

To improve migration efficiency Switch Migration Decision Making scheme [12] (SMDM) was proposed. Uneven load distribution among controllers can be found by switch migration trigger metric based on load diversity of controllers. A greedy based algorithm was designed that gives the possible migration action choices if load imbalance occurs among controllers. The load is calculated as number of PACKET-IN messages and minimal path cost from switch to the controller. This model is described in three steps. First the load diversity is measured for each controller and decision to perform switch migration is made based on that. the result of this step gives set of outmigration controllers (The controllers which are overloaded) and immigration controllers (the controllers which are underloaded). Next calculate the migration cost and migration efficiency for all possible actions generating in last step. In the last step measure the migration probability of switches managed by outmigration controller set and select the switch which is having maximum probability and also select one of the controller from immigration controller which gives maximum migration efficiency. The simulation results in this model proved by the authors that response time, migration time and migration cost are less for this model compared to above discussed schemes ElastiCon and DHA because of selection of migrating switch and target controller based in efficiency formulation.

3.4 HeS-CoP

This scheme [13] provides a heuristic switch controller placement (HeS-CoP) for Data Center Networks (DCN) with the intention of well distribution of load among controllers and reduce the packet delay. The two parameters, number of OpenFlow messages and CPU load are considered to compute the load on controller. This model uses discrete time slots to decide whether to change master role for switches based on the load at previous time slot. In every time slot standard deviation of control traffic load is calculated. If it is less than previous slot no need to change the master roles, if it is

greater then check for the average CPU load. If it increases change the master role for the switch having lowest traffic first, if it decreases change the master role for the switch having highest traffic first to reduce the packet delay. It is also based on the greedy strategy in which an orchestrator is used and it uses two algorithms. Decision maker algorithm decides whether to perform switch migration and Forward and Backward algorithm selects switches and controllers for migration and send changed topology to Decision maker procedure so that it can send changed topology to all other controllers. By making use of REST API [14] and SSH, controllers and orchestrator are able to exchange information. The main extra consideration of this scheme compared to DHA and SMDM is the characteristics of DCN and CPU load. But execution time of HeS-CoP is more compared to SMDM and switch migration time is almost similar.

3.5 BalCon

Balanced Controller [14] proposed an algorithm to migrate cluster of switches when load imbalance occurs in the network. The load on the controller is calculated based on path computation load and rule installation load for a new flow. Once the controller load is beyond the predefined threshold, the algorithm generates a set of switches for migration ordered according to new flow generation from highest to lowest. From that set it finds the best cluster in which switches are strongly connected according to traffic patterns. Afterwards cluster migration takes place to a new controller. This scheme balances the load among controllers by migrating less number of switches and reduces load on overloaded controller about 19 percent. As this model is based on cluster migration, it reduces the message exchanges for migration that results in less migration cost.

3.6 EASM

The main objective of Efficiency Aware Switch Migration [15] (EASM) is high efficiency migration and control the load imbalance quickly. Data interaction load, flow entry installation and state synchronization are considered as the main parametres to compute overall load on controller. Migration cost can be measured based on number of hops between controller and switch. It constructs the load difference matrix which is similar to load diversity matrix in SMDM to avoid local optimization problem. Compared to ElastiCon and DHA it gives reduced response time and increased throughput.

3.7 DCSM

Dynamic Controller Switch Mapping (DCSM) [16] is not only performing controller load balancing but also handles the network in case of controller failure. This model uses hierarchial architecture of controllers in which one controller is selected as root controller based on lowest controller ID. All remaining controllers will send load statistics to this root controller. Here the load of controller is calculated in terms of CPU

load and Memory load. Based on the load information given by other controllers, the root controller compares that load with the total load percent to be considered for overload and will send a message to add or remove the switches in underloaded and overloaded controllers respectively. If the root controller fails, the next lowest ID controller is chosen as root controller to handle single point of failure.

3.8 MQPC

The main goal of Load Balancing with Minimum Quota of Processing Capacity (MQPC) is to reduce the response time of controllers and balancing the load among controllers when load imbalance occurs. This model [17] proposed a solution based on minimum utilization of processing capacity of the controllers using Matching Game to have a minimum load at every controller. The load is calculated based on number of PACKET-IN messages and the number of hops present between switches and controllers. The controllers can elect preferred list of switches to have based on the processing capacity of controllers. At the same time the switches can also elect preferred list of controllers to have based on response time of controllers. According to the preference list mapping between controllers and switches will be done to maintain load balancing. The authors of this paper proved by their experiments that the load balancing is done evenly compared to static mapping and response time also reduced with maximum utilization of resources.

4 Comparative Analysis

Table 1 gives the comparative analysis of different models for controller load balancing in SDN. As we already mentioned in this paper that there are many open source controllers available like OpenDayLight, FloodLight, Beacon, RYU, ONOS etc., each one having its own features according to the OpenFlow specification. Each model is using different controllers according to the requirements and implementation. In multi controller load balancing there are mainly two kinds of architectures Flat and Hierarchical. In Flat architecture the controllers communicate with each other via East-West bound [3] interface. There is no root controller to maintain all other controllers. In Hierarchical architecture the root controller is used for communication to maintain a hierarchy of controllers but this may again leads to single point of failure.

To balance the load among controllers, the important consideration is how to calculate the load, what parameters are used to calculate the load on the controller to have a minimum response time. Number of PACKET-IN messages coming from the switch, Rule installation load, CPU load, Memory and Cost of completing operation will effect the load on controllers. Afterwards the selection of switch and controller is in such a way that results in less migration time.

Table 1. Comparison table

	Parameters used for load calculation	Method/Strategy	Calculation of threshold is for	Controller	Migration time	Controllers architecture	Response time
Elasticon	Number of Packet -In messages	Nearest controller is selected as target controller	Individual controller and for all controllers	Beacon/floodlight	less	Flat	more
DHA	Average message arrival rate from each switch	Target controller is selected randomly	Upper limit and lower limit on controllers load	Beacon	less	Flat	Less compared to Elasticon
SMDM	Processing of packet in events and cost of completing operations	One switch is migrated at a time based on switch migration efficiency	Controllers load diversity	Beacon	medium	Flat	Less compared to DHA
HeS-CoP	CPU load and number of OpenFlow messages	Change the role of controller to master for a switch based on the load variation in discrete time slot	No threshold	ONOS	more	Hierarchical	–
BalCon	Path computation load and rule installation load	Cluster of switches is migrated	Controller load	RYU	medium	Flat	–
EASM	Data interaction load, flow rule installation load and State synchronization	Based on switch migration efficiency, the switch and controller are selected for migration	Load difference metric	OpenDay Light	medium	Flat	Less compared to DHA
DCSM	CPU load and Memory load	The root controller will add or remove switches to the remaining controllers based on load information present in its database	Load percentage	FloodLight	–	Hierarchical	–
MQPC	Number of PACKET-IN messages and number of hops between controller and switch	One-to-Many Matching Game solution in which minimum quota is used for assigning switches to controller	Processing capacity of controllers	–	medium	Flat	Less

5 Conclusion

To efficiently utilize the network resources in SDN, there is a requirement for controller load balancing in distributed environment. The load on the controller is measured in terms of number of PACKET-IN messages, rule installation load, CPU load, memory load and path between controller and switch. The switch migration process is in such a way that leads to effective load balance among controllers and that should not lead to other migration under same control traffic. The efficiency of switch migration will increase the network throughput. In a Wide Area Networks, Data Center Networks and cloud networks this load balancing strategy is important with available resources. There are couple of improvements to the models presented in this survey are being developed.

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Interesting Pattern Mining Using Item Influence

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Abstract. Interesting patterns are very much needed in mining of significant association rules which play a big role in knowledge discovery. Frequency based pattern mining techniques such as support often lead to the generation of huge number of patterns including the uninteresting ones with high dissociation. Though dissociation is used to distinguish between two patterns having equal support, but if both of support and dissociation are same then it becomes very difficult to distinguish them. To overcome these types of problem we have introduced a new method of pattern mining based on the concept of item influence. How many other distinct items have been appeared with an item throughout the dataset is referred to its *item influence (ii)*. The proposed method includes three consecutive steps such as- (1) measurement of item influence for all of the items present in the database, (2) calculation of *transaction influence (ti)* for all of the transactions present in the database using item influence and (3) measurement of *influential weights (iw)* for all of the generated itemsets. Pruning is done based on the minimum threshold value corresponding to influential weights. Experimental analysis shows the effectiveness of the method.

Keywords: Pattern mining · Item influence · Transaction influence · Influential weight · Dissociation

1 Introduction

Interesting pattern mining is a challenging paradigm in data mining. As because of the usefulness of interesting patterns in significant association rule mining, researchers have paid much more attention in this field throughout the last decades. Several new methods have been introduced in the literature to overcome the challenges in mining interesting patterns and the process is still going on. Frequency based measures [1] such as *support* may often leads to the generation of huge number of patterns including uninteresting ones. Though interestingness is inherently a subjective matter yet only interesting patterns are capable of finding significant association rules. Analysis of the earliest algorithm Apriori [1] shows that frequency is not a good concept of pattern

mining. For example frequency based measures may generate interesting patterns with high dissociation [3–6] which is not expected. *Dissociation* (d) of an itemset refers to the percentage of transactions where one or more items are absent but not all. Note that dissociation for 1-itemset is not applicable. In most of the cases patterns with high dissociation generates pessimistic association rules [11] which have less significance in knowledge discovery.

The formal definition of frequent pattern and association rule are as follows. Let DB a database consisting of n number of transactions $T = \{t_1, t_2, t_3, \dots, t_n\}$ and $I = \{i_1, i_2, i_3, \dots, i_m\}$ be a set of m number of items where each transaction is a subset of I i.e. $T \subseteq I$. *Support*(s) is a metric that refers to the percentage of appearance of an itemset in the database and used for finding the frequent patterns w.r.t user defined minimum support threshold parameter *minsup*. An itemset having at least *minsup* amount of *support* is referred to as *frequent pattern* (FP). An *association rule* (AR) is an expression in the form of $A \rightarrow B$ where itemsets $A, B \subset I$ and $A \cap B = \emptyset$. *Confidence*(c) is an interestingness measure used for finding the *association rule*(AR) from the set of frequent patterns w.r.t user defined minimum confidence threshold parameter *minconf*. *Confidence* indicates the conditional probability of B given that A has occurred and expresses the strength of a rule. A rule having at least *minconf* amount of *confidence* is referred to as *association rule* (AR).

Example 1. A synthetic dataset is presented in Table 1. Consider 10% *minsup*. Table 2 shows the extracted patterns along with their dissociation.

Table 1. A synthetic dataset

TID	Item	TID	Item
t_1	A,B	t_6	C
t_2	A,C	t_7	B,C
t_3	D	t_8	D
t_4	A,D	t_9	A,C
t_5	D	t_{10}	B,C

Table 2. Frequent pattern with dissociation

Frequent pattern	Support	Dissociation
A	40%	NA
B	40%	NA
C	40%	NA
D	40%	NA
AB	10%	60%
AC	20%	40%
AD	10%	60%
BC	20%	40%

The result shows the generation of frequent patterns such as AB, AD with high dissociation. Pattern with lower dissociation is much more interesting. In addition, both of AB and AD possesses equal support and equal dissociation. So it is difficult to identify which one is more interesting pattern.

Moreover *isolated items* [12] may be frequent due to their high support but do not participate in association rule mining. This is a serious contradictory matter in ARM. One of the possible solutions of the problems is concerned with the application of *weighted support* (ws) [9, 10], but unfortunately in most of the cases the item weights have been chosen arbitrarily or needs domain knowledge of the database. Also *support* is unable to find valuable patterns with low frequency [8].

In this paper we have introduced a new concept of interesting pattern mining based on item influence. However the major contributions are- (a) introduction of non-frequency based pattern mining using item influence (b) automatic item weight fixation and (c) rejection of isolated patterns that have no contribution in rule generation.

The rest of the paper is as follows. Section 2 presents related work. Proposed method is described in Sect. 3. Experimental analysis is shown in Sect. 4. Finally Sect. 5 concludes the paper.

2 Related Work

Several frequency based techniques have been introduced in the literature for frequent itemset mining (FIM) [2, 7, 15] throughout the last decades. Due to the limitations of frequency based measures some of the scholars have suggested for alternative concepts for mining of interesting patterns without *support* parameter. Tang et al. [17] has introduced *occupancy* based interesting pattern mining concept. Utility based pattern mining [18] is another variant of interesting pattern mining process without support pruning. Schaus et al. [19] has voiced for constraint based pattern mining. Preti et al. [16] has well discussed the options for pattern mining beyond frequencies. In [20] authors have ignored the support threshold. In [9, 13, 14] authors have adopted *weighted support* based pruning strategies.

3 Proposed Method

The proposed method consists of three major steps including the measurement of item influence for 1-itemset, transaction influence for transactions and influential weights for all itemsets. The detailed flow chart of the proposed method is furnished below.

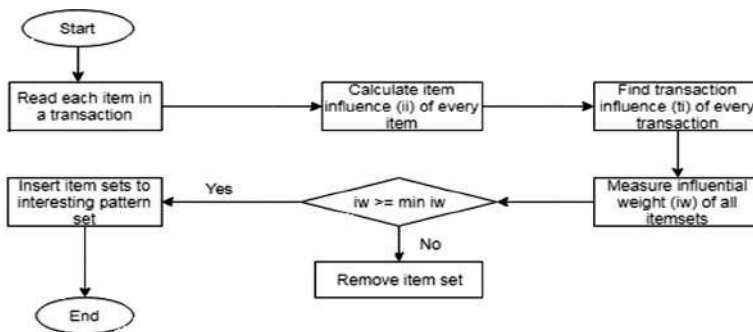


Fig. 1. Flowchart of the proposed method

3.1 Item Influence

The first step deals with the calculation of *item influence* (ii) for every 1-itemset.

Definition 3.1. *Item influence* (ii) of an item is the ratio of its co-appeared items with respect to total number of items present in the database.

Let $I = \{i_1, i_2, i_3, \dots, i_m\}$ is a set of m items and $T = \{t_1, t_2, t_3, \dots, t_n\}$ is a set of n transactions contained in the database DB where $T \subseteq I$. Again, let $I_{cai}(i_j)$ is the set of co-appeared items of i_j in T where $I_{cai}(i_j) \subset I$, $I_{cai}(i_j) \neq \{\emptyset\}$, $i_j \in I$ and $j = 1, 2, 3, \dots, m$.

$$\begin{aligned}
 ii(i_j) &= \frac{|I_{cai}(i_j)| + 1}{m} && \text{if } I_{cai}(i_j) \neq \{\emptyset\} \\
 &= 0 && \text{if } I_{cai}(i_j) = \{\emptyset\}
 \end{aligned} \tag{1}$$

Refer to Table 1, $I = \{A, B, C, D\}$ and if $j = 2$ then $i_2 = B$ and $B \in \{t_1, t_7, t_{10}\}$. Now $t_1 \in \{A, B\}$, $t_7 \in \{B, C\}$ and $t_{10} \in \{B, C\}$. So the set of co-appeared items of B in DB becomes $I_{cai}(B) = \{A, C\}$. Hence the item influence of B is $ii(B) = \frac{|I_{cai}(B)| + 1}{m} = \frac{2+1}{4} = 0.75$. In the similar way $ii(A)$, $ii(C)$, $ii(D)$ are 1, 0.75 and 0.50 respectively. The range for item influence is $[0, 1]$. Higher the item influence refers to items of high importance in association rule mining.

3.2 Transaction Influence

In this step *transaction influence* (ti) of all the transactions are found out using *item influence* (ii) of 1-itemsets.

Definition 3.2. *Transaction influence* of a transaction is the average of item influences of the items present in that transaction.

The *transaction influence* (ti) of a transaction t_k where $t_k \in T$ and k stands for $1, 2, 3, \dots, n$; is defined in Eq. (2). Refer to Table 1, for $k = 1$, $ti(t_1) = \frac{ii(A) + ii(B)}{|t_1|} = \frac{1+0.75}{2} = 0.875$. Table 3 shows all ti values of transaction in Table 1.

$$ti(t_k) = \frac{\sum_{i_j \in t_k} ii_j}{|t_k|} \tag{2}$$

Table 3. ti of 1-itemset

Transactions	ti
t_1	0.875
t_2	0.875
t_3	0.50
t_4	0.75
t_5	0.50
t_6	0.75
t_7	0.75
t_8	0.50
t_9	0.875
t_{10}	0.625

Table 4. Extracted patterns using proposed method

<i>Extracted interesting patterns from the dataset in Table 1 with $miniw = 10\%$</i>		
Interesting patterns	iw	Comparative analysis among patterns
A	0.48214	(Most interesting pattern to least one)
B	0.32142	C, A, B, D, AC, BC, AB, AD
C	0.55357	Though Support-confidence method
D	0.32142	can't make any difference in between
AB	0.125	AB and AD as their support and
AC	0.25	dissociation both are equal, but the
AD	0.10714	proposed method shows that their
BC	0.1964	influential weights are different. So AB
		is more interesting pattern than AD.

3.3 Influential Weight

The third step deals with the measurement of *influential weights* (*iw*) for all of the generated itemsets.

Definition 3.3. *Influential weight (iw) of an itemset refers to the ratio between sum of the transaction influences (ti) of the transactions that possesses the itemset and total transaction influence (ti) of the database.*

Let X be an itemset where $X \subseteq I$ and $t_k \in t(X)$ where $t(X)$ represents the transactions that possesses X . Hence the influential weight (*iw*) of X is defined as follows.

$$iw(X) = \frac{\sum_{t_k \in t(X)} ti(t_k)}{\sum_{t_k \in T} ti(t_k)} \tag{3}$$

For example we have chosen two itemsets say A and AC from Table 1 where $A \in \{t_1, t_2, t_4, t_9\}$ and $AC \in \{t_2, t_9\}$. Considering Table 3 and definition 3.3, influential weights for A and AB are as follows.

$$iw(A) = \frac{ti(t_1) + ti(t_2) + ti(t_4) + ti(t_9)}{\sum_{k=1}^{10} ti(t_k)} = 0.48214 \text{ and } iw(AC) = \frac{ti(t_2) + ti(t_9)}{\sum_{k=1}^{10} ti(t_k)} = 0.25.$$

In the similar way influential weights for all of the itemsets are calculated. The list of interesting patterns extracted from Table 1 using our method is shown in Table 4.

Patterns are pruned with respect to user defined minimum influential weight threshold *miniw*. The patterns that possesses at least *miniw* amount of influential weights are treated as interesting patterns.

$$Interesting\ pattern = \{ X \subseteq I | iw(X) \geq miniw \} \tag{4}$$

3.4 Algorithm

```

Inputs: Database DB, miniw
Output: Interesting patterns that satisfy miniw from DB
(1) Scan DB
(2) for (j=1; j≤m-1; j++) { /* m= number of items */
(3)  $I_{cai}(i_j) \leftarrow$  set of co-appeared items ( $i_j$ )
(4) if  $I_{cai}(i_j) \neq \emptyset$ , then  $ii(i_j) \leftarrow \frac{|I_{cai}(i_j)|+1}{m}$ 
(5) else  $ii(i_j) \leftarrow 0$ 
(6) end if
(7) }
(8) for (k=1; k≤n; k++) { /* n= number of transactions */
(9)  $ti(t_k) \leftarrow$  transaction influence ( $t_k$ )
(10) }
(11) for (i=1; i≤j; i++){
(12)  $iw(i) \leftarrow$  influential weight ( $i$ )
(13) if  $iw(i) \geq miniw$  then insert item  $i$  into list  $L_1$ 
(14) end if /*  $L_1$  = set of interesting 1-itemsets */
(15) }
(16)  $L=L_1$  /* L = set of all interesting patterns */
(17) for (l=2;  $L_{l-1} \neq \emptyset$ ; l++)
(18)  $C_k \leftarrow L_{l-1} \bowtie L_1$ 
(19)  $\forall i \in C_k$  {
(20)  $iw(i) \leftarrow$  influential weight ( $i$ )
(21) If  $iw(i) \geq miniw$  then
(22)  $L_k \leftarrow L_k \cup \{i\}$ 
(23) end if
(24) }
(25)  $L \leftarrow L \cup L_k$ 
(26) }

```

4 Experimental Analysis

We have tested the proposed method on standard real datasets shown in Table 5. The result in Table 6 shows the average influential weight (*Avg. iw*) of top 5 interesting patterns along with their average dissociation (*Avg. d*). Table 7 shows the number of generated patterns from the specified database with different *miniw*. It states the affect of *miniw* on pattern mining.

Table 5. Real databases

Database	# Transactions	# Items
Extended Bakery_1 K ^a	1000	50
Extended Bakery_5 K ^a	5000	50
Extended Bakery_20 K ^a	20000	50
Grocery ^c	9835	169
Connect ^b	67557	130
<i>t25i10d10 k</i> ^b	9976	929
Chess ^b	3196	76
Mushroom ^b	8416	119

Table 6. Avg. iw & Avg. d of patterns

Database	Avg. iw	Avg. d
EB_1 K	0.052	0.0812
EB_5 K	0.0472	0.08388
EB_20 K	0.047	0.08368
Grocery	0.058	0.27658
Connect	0.996	0.00394
<i>t25i10d10 k</i>	0.03	0.26172
Chess	0.9934	0.20506
Mushroom	0.9506	0.04546

^a<https://wiki.csc.calpoly.edu/datasets/wiki/ExtendedBakery>

ExtendedBakery

^bwww.philippe-fournier-viger.com/spmf/

^c<https://github.com/stedy/Machine-Learning-with-R-datasets/blob/master/groceries.csv>

Table 7. Affect of *miniw* on pattern mining

Database	miniw (%)	# Patterns	Database	miniw (%)	# Patterns
EB_1 K	2	108	Connect	100	0
	3	83		99	33
	4	56		98	190
EB_5 K	2.7	96	<i>t25i10d10 k</i>	5	143
	3	85		9	25
	4	57		11	14
EB_20 K	2.7	94	Chess	93	230
	3	80		95	78
	4	60		97	30
Grocery	2.5	91	Mushroom	50	169
	3.8	44		60	51
	5	32		70	31

A comparative study in between Apriori [1] and our is presented in Figs. 2 and 3. The study in Fig. 2 clearly shows that our method is capable of extracting less number of patterns with equal minimum threshold while Fig. 3 supports mining of patterns with less dissociation. Patterns with less dissociation are more associative.

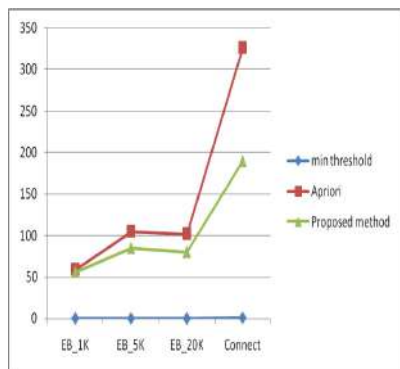


Fig. 2. # Patterns with equal minimum threshold

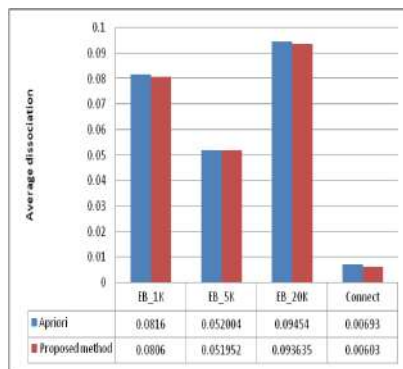


Fig. 3. Study on average dissociation

5 Conclusion and Future Work

In this paper we have introduced a new technique of interesting pattern mining using the concept of item influence. It is a non-frequency based weighted pattern mining technique that follows downward closure property. The method consists of a strong pruning process based on influential weight. Mechanism of initial weight assignment is automatic. The proposed method not only controls the generation of huge number of patterns but also generates interesting patterns with lower dissociation. Our method is efficient in pruning of the isolated items.

Our future effort should concentrate on the development of algorithmic efficiency in terms of time and memory and mining of significant association rules.

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Search Engines and Meta Search Engines Great Search for Knowledge: A Frame Work on Keyword Search for Information Retrieval

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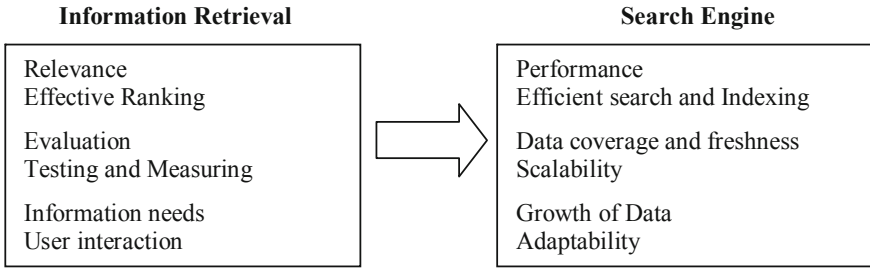
Abstract. In the modern information society knowledge have much higher priority, information is more and more accessible. Information Retrieval (IR) is a highly applied scientific discipline. IR is retrieving high quality pages that are relevant to user's need. IR is concerned with filtering specific information from a set of data where Search Engine (SE) and Meta Search Engine (MSE) play an important role. SE is a web-based tool it searches the information as per the keywords given by the user. MSE sends the search query to multiple search engines at the same time to get the result to the user. The paper explores on IR, IR Algorithms, and Technological Evolution of SE. Further, it discusses about SEs Use Case Diagram, working process, types and its limitations of SEs. It also discuss about MSEs Technological Evolution and working process. Finally, paper presents framework for keyword search Architecture, modules for IR, program output written in java with Graphical User Interface, discussion, conclusion and suggestions for future research.

Keywords: Information-Retrieval · Search Engines · Meta Search Engines · Keyword search

1 Introduction

Information retrieval is concerned with the storage, structure, analysis, organization, searching and retrieval of information. A Search Engine (Google, Bing, Yahoo etc) is a web-based tool it searches the information as per the keywords given by the user. SE searches the information from its own database. MSEs Searches more hits for a single query, Meta Search Engine (Mamma, Dogpile, etc.) sends the user query to different search engines simultaneously and the top results shown as output to the user. SEs and MSEs have greater significance in IR for the sake of knowledge searching.

1.1 Information Retrieval and Search Engine Components



1.2 Information Retrieval (IR) Algorithms

Different types of IR Algorithms are there mainly Page Rank, Hyper Link Induced Topic Search (HITS), Distance Rank, and Eigen Rumor Algorithms etc. have been popular.

1.3 Technological Evolution of SEs

Technological Evolution of SEs started in the year 1960 with the invention of Salton’s Magic Automatic Retrieval of Text. The Evolution of SEs shown in the Table 1.

Table 1. Technological evolution of search engines

Sl. no	Name of the search engine	Founder	Year
1	SMART(Salton’s Magic Automatic Retrieval of Text)	Gerard Salton	1960
2	World Wide Web	TimBerners- Lee	1991
3	Yahoo	David Filo& Jerry Yang	1994
4	Lycos	Bob Davis	1994
5	Alta Vista	Paul Flaherty	1995
6	Google	Sergy Brin, Brin Lara	1998
7	Scirus (Scientific SE)	Elsevier	2001
8	Gigablast	Matt Wells	2002
9	Bing - (popular SE in US)	Microsoft	2009
10	Shodan (Internet connected devices SE)	John matherly	2009

1.4 Search Engine Use Case Diagram

User sends query through the user interface to the Query Search Engine (QSE). QSE search the results, load the pages, loaded pages will be classified, sorts the pages, and finally sorted pages are shown as output to the user (Fig. 1).

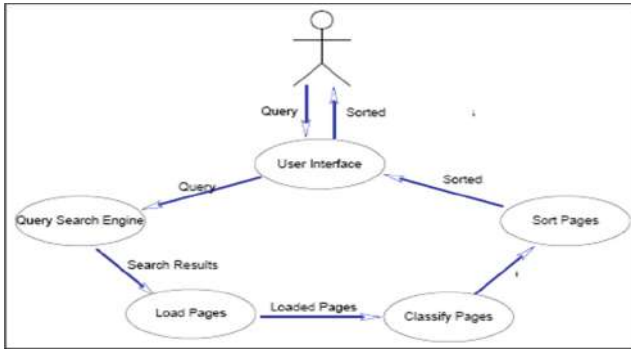


Fig. 1. Search engine use case diagram

1.5 Search Engine Working Process

Search Engine works on four principles.

- a. Crawling
- b. Indexing
- c. Ranking
- d. Search and Display.

SEs performance is measured in terms of the response time, Coverage, Query throughput, Freshness, and indexing speed. The Primary goals of SEs are effectiveness (quality) and Efficiency (speed) (Fig. 2)



Fig. 2. Search engine architecture (Source: <https://tinobusiness.com/how-a-search-engine-works-an-explanation-in-3-steps/>)

2 Types of Search Engines

SEs is classified into different categories on the basis of their indexing, retrieval systems and other characteristics.

2.1 General Search Engines

General search engines search the information from their own database. Crawler based search engines create their listing automatically with the help of “spider” or “robot”.

Examples: Bing, Google, Yahoo etc.

2.2 Subject Search Engines

These search engines dedicated to search specific subject areas like Science, Medicine etc.

Science ex: Scirus, Biocrawler, Sciseek, Search4science

Medical Science ex: Medexplorer, Mednets, PubMed, Medlineplus, MedHunt, WebMD

2.3 Limitations of Search Engines

SEs does not index more than 16% of web. The limitations of SEs are query limitations, lower effectiveness, coverage, duplicates this leads to the invention of MSEs.

3 Meta Search Engines

Meta Search Engines searches the information from different search engines simultaneously to retrieve user query. MSEs are also known as multiple search engines.

Examples of MSEs are Metacrawler, Mamma, Dogpile, Excite, Webcrawler etc.

3.1 Technological Evolution of MSEs

MSEs Evolution started in 1994 discovered Meta Crawler. The Technological Evolution of MSEs is shown above in Table 2.

Table 2. Technological evolution of MSEs

Sl. no	Name of the meta search engine	Year of establishment
1	Meta Crawler	1994
2	Dogpile	1995
3	Mamma	1996
4	Metaseek	1997
5	Meta Spider	2000
6	Nano Spider	2002
7	Harvester	2003
8	Linba Crawler	2003
9	Helios	2004
10	Clusty	2005

3.2 Meta Search Engine Working Process (MSE)

MSE works on five principles they are

- a. User query acceptance
- b. Processing the Query
- c. Multiple queries to Launch
- d. Collecting and merging the results and
- e. Present the results to user (Fig. 3)

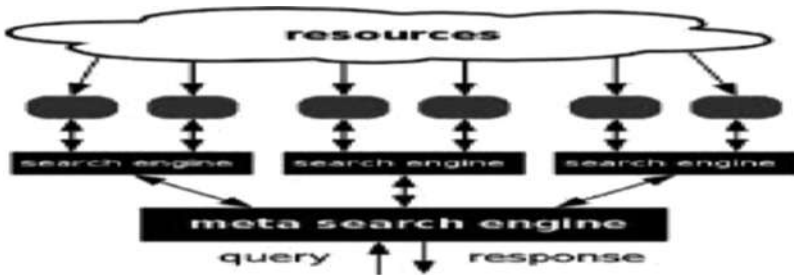


Fig. 3. Meta search engine architecture (Source: https://en.wikipedia.org/wiki/Metasearch_engine)

4 Keyword Search Architecture and Modules

Key word search modules are as follows

- a. Query Processing
- b. Web Crawling
- c. Indexing
- d. Ranking
- e. Search and display (Fig. 4)

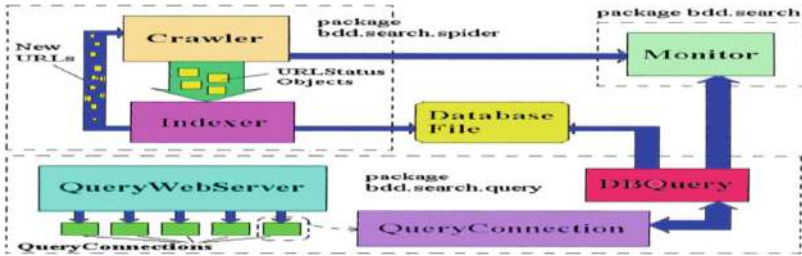


Fig. 4. Keyword search architecture

1. Query Processing is query submits to SE it searches and creates the URLs to the key words, which is related to query.
2. Web Crawling mainly used to create a copy of all the visited pages. Web Crawler visits the links on web and updates the search engine’s index periodically.
3. Indexer request the page from the server, the server scans the page and prepares the visits the links on web and updates the search engine’s index periodically. URLs along with the key words in the relevant page.
4. Ranking is search the word frequency to determine the relevant web page. The Rank is given on the basis of the number of times the word appeared in the web page
5. Search and Display Finally it searches the sorted words, on the basis of occurrence in the page and results will be displayed to the user.

5 Keyword Search Program Output

```

import java.sql.*;
import javax.servlet.*;
import javax.servlet.http.*;
/*
 * Inserting record into a population table
 */
public class Search Url extends HttpServlet {
public void doGet(HttpServletRequest request, Http Servlet Response response)throws
IOException, ServletException
{
    String keyword = request.getParameter("keyword");
    PrintWriter out = response.getWriter();
    response.setContentType("text/html");

    String clobData = null;
    Connection con = null;
        Statement st=null;
        ResultSets=null;

    try {

```

```

Class.forName("com.mysql.jdbc.Driver");
con = DriverManager.getConnection ("jdbc:mysql://localhost/search_engine", "root",
"root");
st=con.createStatement();
rs=st.executeQuery("select b.keyword,b.heading,b.url_desc,b.url from
search_url,search_url_desc b where a.keyword='"+keyword+"' and
a.keyword=b.keyword");
out.println("<html>");
out.println("<body bgcolor='hyderabad'>");
out.println("<p align='center'><font size='20'>SEARCH ENGINE</font></p>");
while(rs.next())
{
String keyword1=rs.getString(1);
String heading=rs.getString(2);
String url_desc=rs.getString(3);
String url=rs.getString(4);
out.println("<a
href='/SearchEngine/'+url+'><h2>" +heading+"</h2></a>");
out.println("<br>");
out.println(url_desc);
out.println("</body>");
out.println("</html>");
}
} catch (Exception e) {
e.printStackTrace();
out.println("<body><h4><font color='red'>Notable Display "
+ e.getMessage() + "</font></h4></body></html>");
}
}
}
}

```

5.1 Search Engine Search Crawler – KeyWord Search Frame Work

The Graphical User Interface (GUI) Fig. (5) presents the Search Crawler. It searches the entire database and counts the occurrence of keywords as per the query.

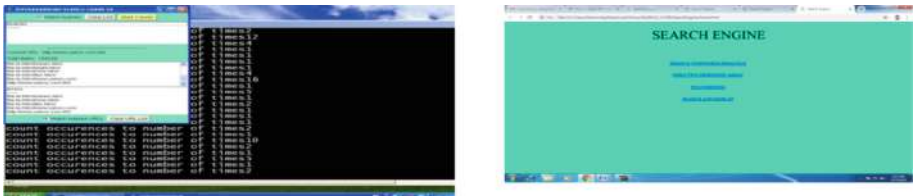


Fig. 5. Search Engine -search Crawler

The GUI Fig. 6 keyword search frame work, searches the key word from database. Output gives the search results on the basis of occurrence of keywords in the database.

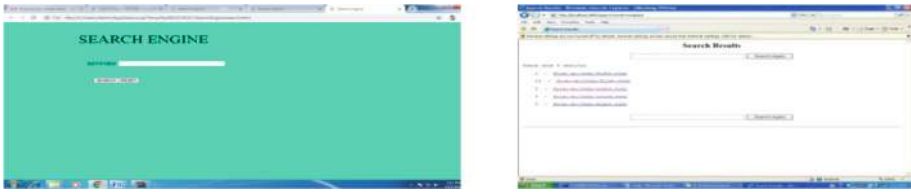


Fig. 6. Search Engine - keyword search

6 Conclusion and Suggestions for Future Research

Search Engines are significant and necessary tools that help users to find relevant information in the World Wide Web. SEs finds information as per user's query and presents most relevant information to the user. Keyword search frame work with GUI, out put of the program in java is discussed. Query searches the data base as per the occurrence of the keywords. SEs and MSEs are going to play a very crucial role in IR on emerging Semantic Web. It is not merely retrieval efficiency that is going to be considerable in future. The future search engines will be more interactive they will be talking and thinking search engines to facilitate information retrieval by the knowledge workers of tomorrow. No SE and MSE cover the entire web.

The future work on SEs and MSEs is that there is an immediate need to dig and discover deep web to develop a new ranking method to find out exact search results as per the users query from the web.

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Model Based Approach for Design and Development of Avionics Display Application

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Abstract. Avionics displays play an important role in flight information visualization in aircrafts cockpit. The paper describes model-based approach for HMI design, development, assessment and simulation of aircraft display systems. Example of the Primary Flight Display will be taken for proving the efficacy of the model-based approach. In this paper we will focus on the approach to model the display design. The approach uses the model based tool with appropriate modeling-standards and code standards for generating effective auto code. The proposed approach can be mapped to model-based guidelines of RTCA DO-178C guidelines. OpenGL SC (Safety critical) based SCADE Display IDE has been used for the development and assessment of user interface display graphics.

Keywords: Primary Flight Display · SCADE Display · OpenGL SC · DO-178C

1 Introduction

Modern Avionics display system mainly consists of Primary flight display, Navigation display, Multifunctional display and Engine indicating and crew alerting system. PFD is designed to provide the pilot with visual information regarding flight overall situational awareness such as aircrafts attitude, airspeed, vertical speed, heading, altitude etc. PFD is the most critical and often referenced display. The display computer mainly comprises of display hardware and application software. The display application software is safety critical software that displays the information in standard graphical

and alphanumeric forms such as text, numerals, scales, dials, tapes, and symbols together termed as “Display Symbologies”. The development and certification of air-worthy application software for the avionics display system is a very long process as it is safety-critical software and involves several stages of verification and validation, compliance and traceability. To reduce the development time and cost, the model-based approach is used for design and code generation of graphics for avionics display. A model-based approach for display symbology design can greatly reduce the workload of modeling and improve work efficiency in design of user interface of display systems. In this paper, the OpenGL SC (Safety Critical) based SCADE display tool is used. The tool provides a platform to design and simulate interactive graphical interface, it also features a target-independent code generator which allows generating C code using OpenGL library. This flight worthy application software is capable of executing both on the flight simulator as well as on the target hardware [1].

1.1 OpenGL SC Code Generation for Safety Critical Systems

SCADE Display is used as a display software prototyping and development tool in various industries like aerospace, rail transportation, automotive, nuclear etc. It is ideally suited to support the design of safety critical embedded display. SCADE display provides a complete environment for developing prototype, verifying the model and generating code from the model. A safety-critical application comprises everything needed to perform one or more safety functions, in which failure of application can be fatal. As implementation of graphics in safety critical systems can be tricky, especially when using the complex APIs needed for modern graphics. OpenGL SC API makes development of Display or HMI easy, as it specifically aims at profiles suitable for use in safety critical application. In general, anyone developing software for safety critical systems must follow RTCA DO-178 guidelines in order to develop airworthy certifiable application. DO-178 was first published by RTCA. It was written by group of experts from aircraft and aircraft equipment manufacturing companies. The objective of the guidelines is to ensure that software performs its intended function with a level of confidence in safety that compliance with airworthiness requirements. SCADE display code generator provides OpenGL SC API based DO-178 certifiable code, which makes the certification process easier [8] (Fig. 1).

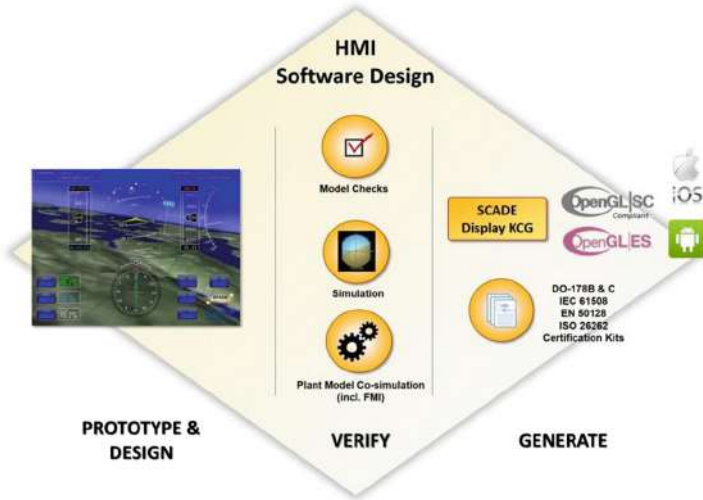


Fig. 1. HMI Software design using SCADE display [11]

2 Avionics Display Design Approach with Model Based Tool

1. Initially the type of project is specified and based on the overall project design requirement literature survey is carried out, which defines the type of data to be displayed, its range and its representation using appropriate symbol and color. For primary flight display and EICAS of a civilian aircraft, SAE-ARP standards were referred. Table 1. Describes the standards referred for design of PFD and EICAS (Fig. 2).

Table 1. Design standards for aircraft display development

Standards	Description
ARPXXXX-X	List out all the functionality to be indicated on PFD, ND and EICAS
ARPXXXX-X:Appendix X	Symbology design description of Primary Flight Display
ARPXXXX-X:Appendix X	Symbology design description of EICAS
SAE AIRXXXX	Mentions Numeral, Letter and Symbol dimensions for aircrafts instruments display
ARPXXXX	Certification Considerations for complex aircraft System

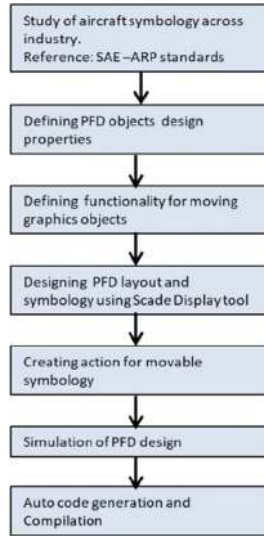


Fig. 2. Design approach for display using Model based tool

2. Design graphical interface. This includes scheming appropriate layout to put up all the modules of the display. PFD mainly includes airspeed, altitude, attitude, heading and autopilot modules. Further appropriate display elements are defined in each module to represent the appropriate flight information, for example airspeed pointer, airspeed readout etc. Finally, all the display elements are added into appropriate module group for better identification.
3. Appropriate movement is added to the Symbology to be driven in order to interact with the simulation input. This includes Transition, Rotation or Conditional group. Transition properties are implemented to move a Symbology in horizontal or vertical direction. For example, Movement of airspeed tapes in vertical direction based on increase/decrease of airspeed value. Rotation properties are implemented to rotate a symbol in clockwise or anticlockwise direction. For example, rotating the heading dial based on current heading of the aircraft. Conditional group is mainly implemented to replace a specific symbol with a failure annunciation due to equipment failure or system failure. In order to provide dynamic movements to the symbols, appropriate variable is plugged to the group. Figure 3 shows dynamic movement of airspeed tape based on increase/decrease of airspeed value.
4. Simulation of the display symbology is performed using SCADE Display simulator to verify the symbol motion based on the simulation input. Design optimization and correction is performed using Integrated Design Checker which enforces compliance of a display specification to methodological, naming and graphical design rules. Figure 4, shows the SCADE display simulation environment.
5. SCADE Display KCG Code generator is used to generate OpenGL SC (Safety Critical) based C source code consisting of resource file, Symbology layer file, Target configuration file and log file [9] (Fig. 5).

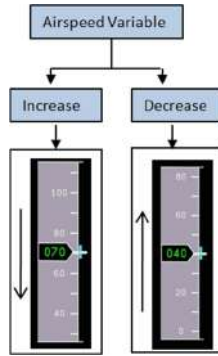


Fig. 3. Assigning variables to rotation group

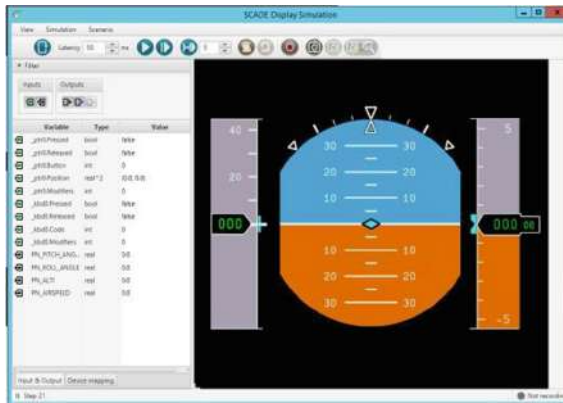


Fig. 4. Display simulation environment [10]

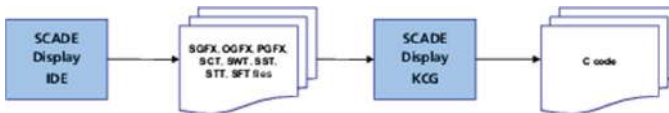


Fig. 5. C code generation using SCADE Display IDE [10]

3 Design Scheme for Avionics Display

3.1 Primary Flight Display

Figure 6 describes the Primary flight display, It mainly consist of 6 different modules namely Airspeed Indicator, Attitude indicator, Heading, Altitude indicator and, Vertical speed as mentioned in the Fig. The display layout on a primary flight display can vary enormously depending upon the type, manufacturer and functionality of aircraft.

However, the great majority of PFDs follow a similar layout convention. Other information displayed on the PFD includes ILS glide slope indicators, navigational marker information, course deviation indicators, Display configuration settings and much more. If no valid data for the display system is available due to equipment or subsystem failure, an appropriate failure annunciation is displayed on screen. Fig indicates failure of airspeed, the airspeed indicator is assigned with a failure flag, during airspeed failure the flag is set high and failure annunciation is displayed [12] (Fig. 7).

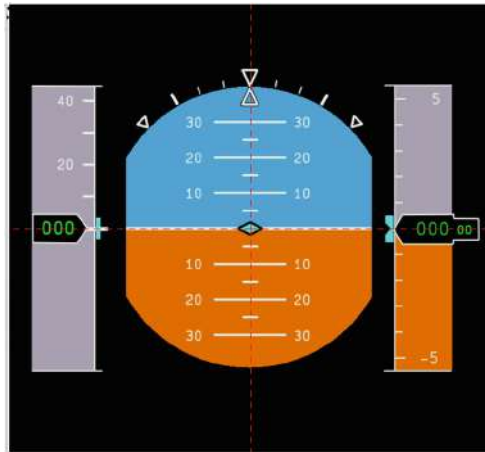


Fig. 6. Primary flight display layout

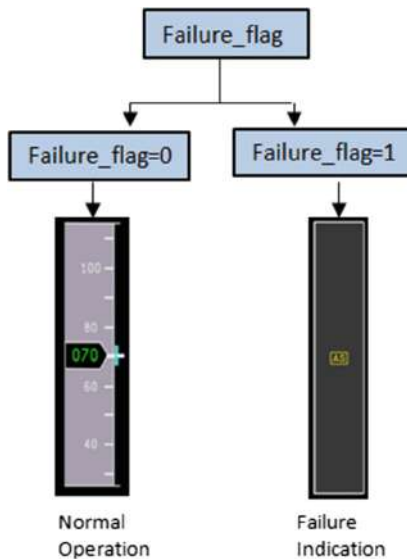


Fig. 7. Airspeed failure annunciation

3.2 Engine Indicating and Crew Alerting System

EICAS will display all the engine parameters like Engine Torque indicator, 2 ITT (Interstate Turbine Temperature) RPM (revolution per minute), OIL Temperature, Fuel System, Cabin Data, Pitch Trim, Landing Gear and Warning. If no valid data for the display system is available due to equipment or subsystem failure, an appropriate failure annunciation is displayed on screen. Figure 8 indicates failure of Left Engine Torque, the Left Engine Torque indicator is assigned with a failure flag, during Left Engine failure the flag is set high and failure annunciation is displayed [13].

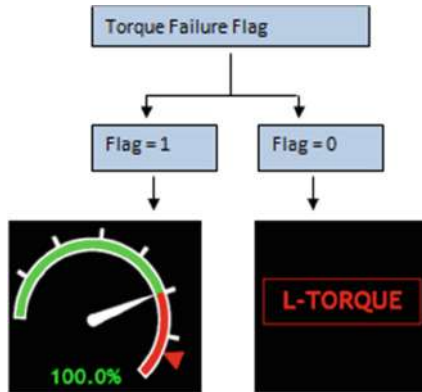


Fig. 8. Failure annunciation in EICAS

4 Conclusion

In this paper, the implementation of the display system shows that the use of SCAD Display tool will fundamentally change the development process of HMI. The goal of this effort was to design, develop and assessment of user interface for Primary flight display and Engine indicating crew alerting system. The model based approach for display HMI development provides a cost effective solution and reduces the certification efforts.

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Thyroid Diagnosis Using Multilayer Perceptron

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Abstract. Thyroid disease is one of main origin of serious medical issues for human subsistence. Therefore, proper diagnosis of thyroid disease is treated as an important issue to determine treatment for patients. A new approach on Multi-layer Perception (MLP) using back propagation learning algorithm to classify Thyroid disease is presented. It consists of an input layer with 4 neurons, 10 hidden layer with 3 neurons and an output layer with just 1 neuron. The relevant choice of activation objective and the number of neurons in the hidden layer and also the number of layers are achieved using MLP test and error method. The proposed method shows better performance in terms of classification accuracy. For simulation results MATLAB Tool is used.

Keywords: Thyroid · Multi-layer Perception (MLP) · Activation function · Artificial neural networks

1 Introduction

Currently artificial intelligence addresses huge number of issues for developing professional systems to diagnose various kinds of defect with high precision [1]. These systems assist staff in hospitals and medical centers to quickly diagnose patients and relinquish them essential treatments without need for a medical expert. As a result, these systems abatement cost and time for diagnosis [2, 3]. Artificial Neural Network is the most important artificial intelligence technique that has been used to design diagnostic rule for distinct diseases such as diabetes, heart disease, breast cancer, skin disease, and thyroid [4].

The following paper is organized as Sect. 2 describes about literature review of neural network, Sect. 3 explain the proposed methodology, in Sect. 4 details the results and discussion finally Sect. 5 gives the conclusion remarks of proposed algorithm.

2 Literature Review

Classification technique such as an artificial neural network (ANN) can be used to differentiate between several types of thyroid cancers. Time-Delay-Neural Network (TDNN) is used to classify thyroid cancers as normal or abnormal, which reported classification performance up to 86.06% [5, 6]. Feed Forward Neural Network (FFNN), Artificial neural network (ANN) is a known artificial intelligent skill for determine complication that are difficult to be solved by human beings or conventional computational algorithms [7]. ANN can study and modify itself to solve various nonlinear problems via adjust convinced load during training process with offline data. There are many existing architectures of ANN [8]. In general, fundamental architectures of ANN are: single layer feed forward, multilayer feed forward, and recurrent.

3 Proposed Methodology

In this work, a multilayer feed leading ANN is exploited to observe the type of thyroid cases. The architecture and procedure of ANN mimic the biological nervous system of human beings. A multilayer ANN has input layer, output layer, and one or more finite number of undisclosed layers. Each layer consists of personal elements called neurons or nodes. The number of neurons in each layer is chosen to be sufficient to solve a particular problem. Except the neurons of output layer, each neuron of a certain layer in feed forward network is connected to all neurons of a next layer by synaptic weights [7]. The synaptic weights are initialized with random values. During workout procedure, synaptic substances are altered via learning algorithm to make inputs produce the desired output. The structure of multilayer feed forward neural network is shown in Fig. 1.

3.1 Training MLP Network

In this proposed methodology MLP neural network is used for training the thyroid disease in terms of feature vector in database. These feature vectors of all images form a feature database. These features are inputs for MLP network. This MLP is trained initially using feature database. The MLP network is designed in this algorithm is with three layer structure. There are seven inputs and two outputs for the MLP network.

3.2 Testing MLP Network

This is last stage of classification, where input is selected from database, the features are given as inputs for trained MLP network. The MLP compares these features with trained database and classify image into benign Thyroid or malignant Thyroid.

3.3 Back Propagation Neural Network (BPNN)

This Propagation network learns by examples. This algorithm changes the network weights according to the requirement during training. In BPNN the neurons are organized in layers and signal moves in forward direction. The errors on the output side are propagated in the backward direction. Back propagation algorithm uses supervised learning technique. This algorithm computes error between the input and output and according to that adjusts weight to get minimal error. This process is continued till to get no change in error. Figure 1 shows Back propagation neural network, it is useful for Pattern Recognition and Mapping Tasks.

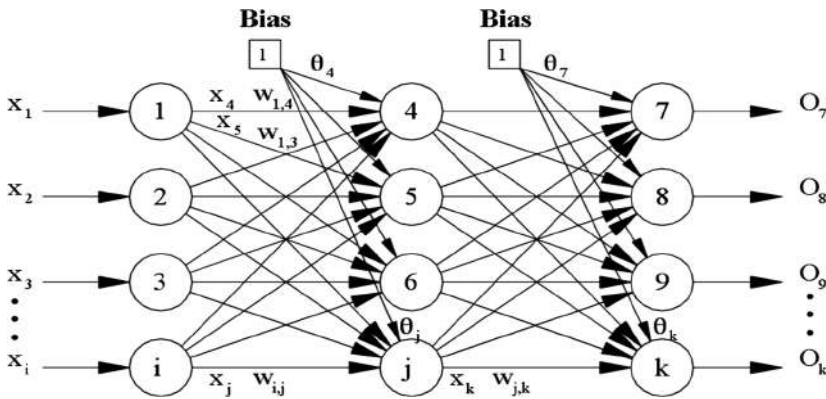


Fig. 1. Back propagation neural network with one hidden layer

In this work, back propagation is used as a learning algorithm to train ANN. At first, synaptic weights are initialized with random values. Then at each iteration of back propagation algorithm, one input sample is applied to ANN to produce the actual output. After that, the error is figure out between the certain output and desired output. Depending on this error, the synaptic weights are updated as Eq. (1) to minimize error.

$$w_{i+1} = w_i + \Delta w \tag{1}$$

Where $w_{(i+1)}$ is updated value of the synaptic weights is current value of the Synaptic weights, and is the restore change of weights, which is determined as Eq. (2).

$$\Delta w = n \frac{\partial E}{\partial W} \tag{2}$$

Where n is the learning rate parameter, and error of the derivative with respect $\frac{\partial E}{\partial W}$ to value of synaptic weights.

The ANN performance is computed by calculating the classification rate as Equation

$$\text{Class functionration} = \frac{\text{Number of last samples that are correctly classified by ANW}}{\text{Total number of samples}} \times 100 \quad (3)$$

4 Simulation and Results

Train using scaled conjugate gradient back propagation and Training automatically stops when generalization stops improving, as indicated by an increase in the cross – entropy error of the validation samples and also Training multiple times generate different results due to different initial conditions and sampling (Tables 1, 2 and 3).

Table 1. Info train

Field	Value	Min	Max
Indices	1x5040double	1	7200
Performance	1.0862	1.0862	1.0862
Confusion	0.0625	0.0625	0.0625

Table 2. Info validation

Field	Value	Min	Max
Indices	1x1080double	6	7199
Performance	2.8558	2.8558	2.8558
Confusion	0.0528	0.0528	0.0528

Table 3. Info test

Field	Value	Min	Max
Indices	1x1080double	12	7195
Performance	2.8442	2.8442	2.8442
Confusion	0.0444	0.0444	0.0444

Thyroid Inputs is a 21x7200 matrix, static data represented data: 7200 samples of 21 elements and Target ‘Thyroid Targets’ is a 3x7200 matrix, static data represented as 7200 samples of 3 elements (Figs. 2, 3, 4, 5 and 6).

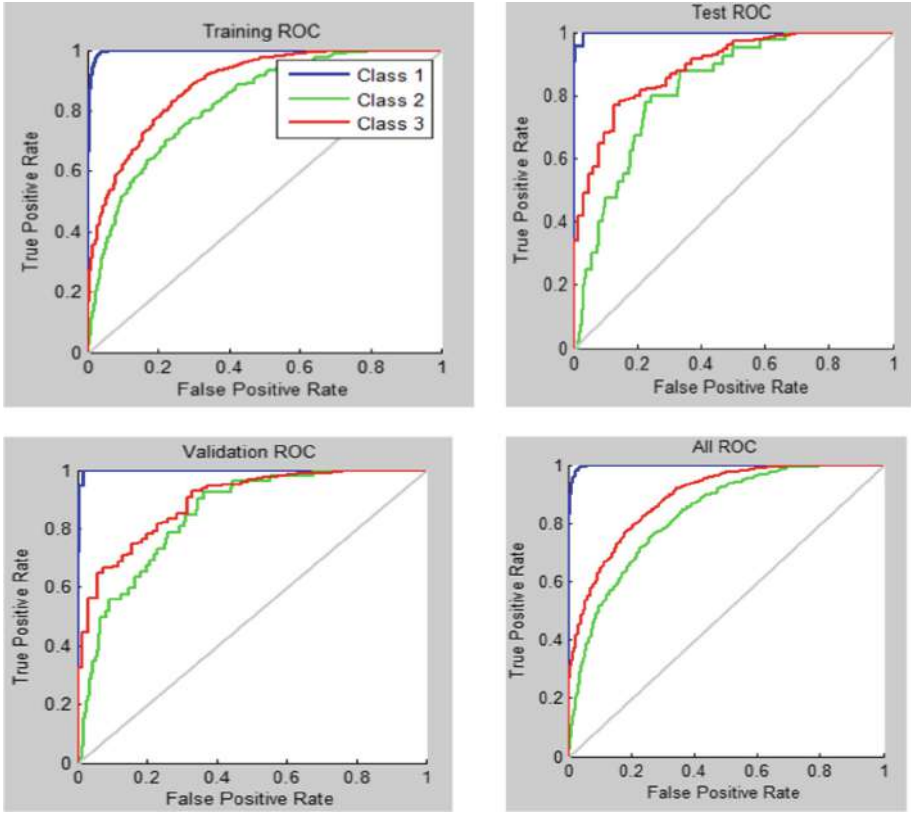


Fig. 2. True Positive rate vs False Positive rate

These operations are extended until the error reaches a very small value (approximately zero). At this time, the algorithm assembles, and the training process is stopped. The flowchart of back propagation algorithm is shown in Fig. 1. After that, a test process is commenced to evaluate the performance of trained ANN via applying test samples that are not used in the training process.

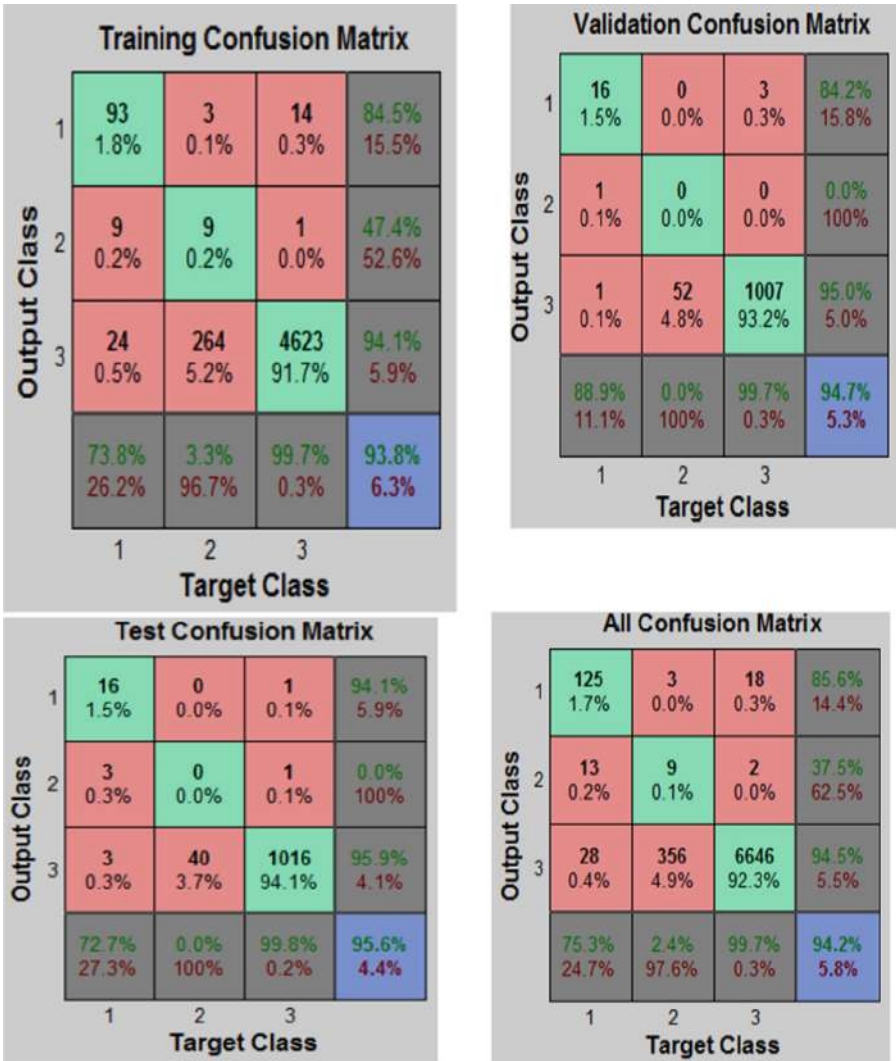


Fig. 3. Training confusion matrix

Results in Table 4 also show that there was an increasing trend in the classifier accuracy when the number of coefficients was increased. The MLP performance without F-Ratio and with F-Ratio for coefficient 10 accuracy increased by 3.65% and AUC increased by a percent of 3.05. From this work it is observed that 99.6 of AUC for with F-Ratio.

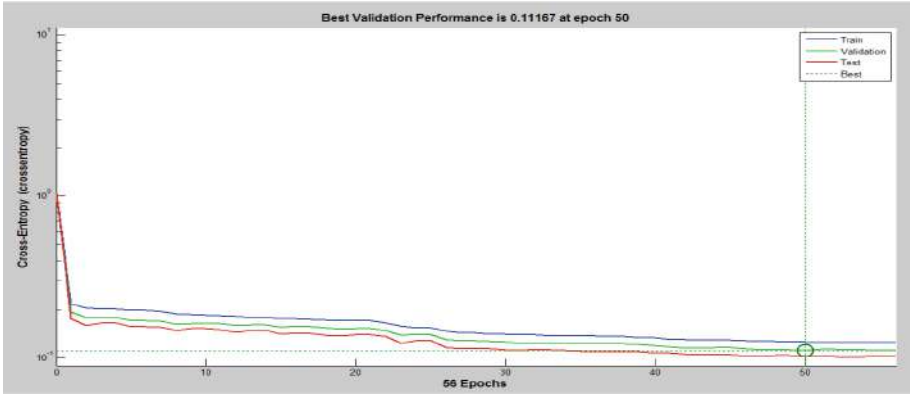


Fig. 4. Epoches vs cross-entropy

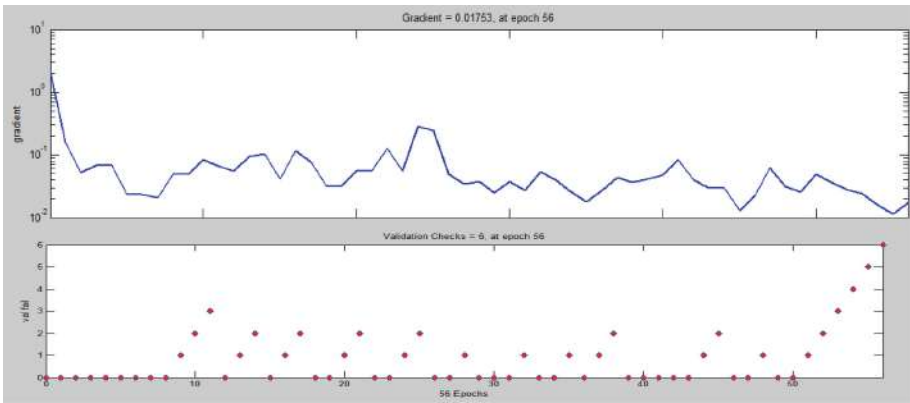


Fig. 5. Validation checks vs gradient and epoches vs valfail

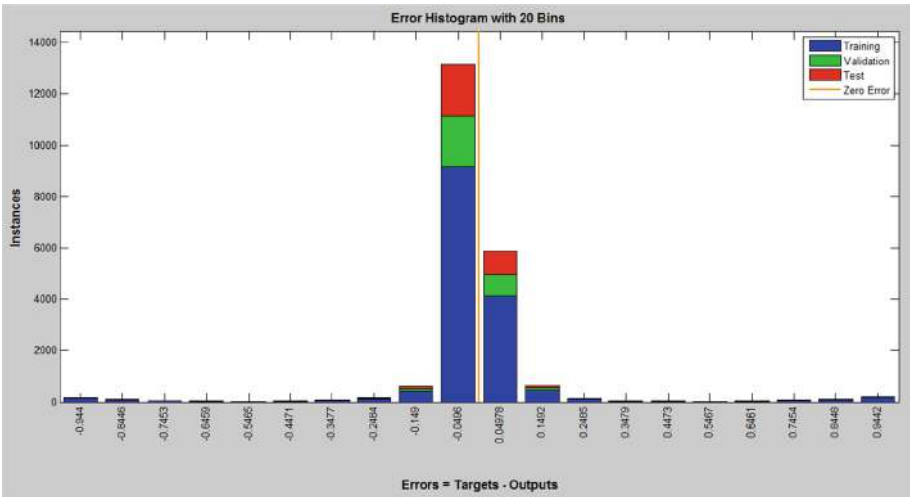


Fig. 6. Instances vs error and targets-output

Table 4. MLP Performance

Rank	Coefficient.	No. of hidden	AUC	Accuracy
Without F-Ratio	10	40	95.68	83.78
	15	5	97.5	86.58
	20	15	97.76	88.12
With F-Ratio	10	10	98.59	86.82
	15	5	98.57	88.35
	20	5	99.6	89.01

5 Conclusion


In this work we have patented novel approach for classification of thyroid cancer using multilayer perceptron modal, which classifies thyroid as cancers or non-cancers. The obtained results were analyzed using with F-Ratio and without F-Ratio at different values of hidden layers. The use of F-Ratio analysis to rank the significance of coefficients increases the classification accuracy and the sensitivity of the MLP. The results obtained shows that multilayer perceptron with F-Ratio analysis has better classification accuracy.

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Optimal Sensor Deployment Using Ant Lion Optimization

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Abstract. Wireless Sensor Networks (WSN's) consists of small and tiny devices called sensor nodes. These sensor nodes are deployed in the required landscape to gather information. Improving coverage rate of sensor nodes imposes a bigger challenge in the sensor network deployment task. Our work proposes a solution based on the Ant Lion Optimization (ALO) algorithm to augment the coverage rate of the sensor network. The extensive simulations corroborate the approach usability in WSN. The results signify the improved performance and better convergence rate of the proposed algorithm approach achieving the objective of better coverage rate.

Keywords:: Wireless sensor network · Coverage · Ant lion optimization

1 Introduction

Traditionally equipped physically connected wired networks to the modern wireless networks with the advancement of microelectronics give way for the introduction of the WSN's. A WSN is a set of smart and tiny intelligent sensor nodes that are connected to base stations, spatially dispersed over an area and operates with battery power. WSN's comprises of few to several sensor nodes that are interconnected [1]. These nodes can sense, process and transmit information from one point to the other [2]. Each node comprises of a radio transceiver, a memory module, a microcontroller and a power supply usually a battery.

In the recent years, WSN's has found in the vast scope of fields from daily-life to mission-critical applications. The rapid adaptation of the WSN's was because they were easily deployable having little hardware and were able to communicate seamlessly in remote environments with each other. The primary purpose of these sensor nodes is to monitor and capture exciting event happening in the region of interest (ROI) and report to the central unit (base station). These sensor nodes mostly deployed in the field area where there is a need of an unattended mode of operation (less human reachability). The following are the usual challenges faced in the design of the WSN's [3]: High Unreliability, Load Balancing, Energy Efficiency, and Enhanced Network Coverage.

The significant concern of research in the WSN's area is the coverage rate of the network. It must assure that the monitored area field must be entirely covered and sensed over the full lifespan of the whole network. Improper placement of sensors in the ROI is the main contributing factor towards coverage problem. Many linear techniques have been proposed in the past literature [4–8] related to sensor deployment. K. Chakrabarty et al. proposed a virtual force algorithm for sensor deployment [9]. The sensor field is depicted by a grid. Initially sensors are placed randomly and then the sensors are divided into clusters and cluster heads randomly. Then VFA is executed on the cluster heads to obtain new locations for the sensors. Li-HsingYen et al. proposed clustering K-means approach to improve the network coverage. In this the clusters are formed based on near proximity distance and then cluster heads are elected based on energy. Using optimization techniques for solving real-world problems has become a new paradigm in the diverse field of applications. The optimization techniques are a combination of mathematical theories and collective intelligence that can solve the problem quickly and efficiently. The first metaheuristic optimization technique called Particle Swarm Optimization (PSO) [10] for improving the coverage rate of the network was proposed by Wu Xiaoling et al. [11]. The PSO technique was used to maximize coverage accuracy based on probability sensor model.

The above limitations motivate us to plan a system that optimizes the sensor deployment process. Our work solely focuses on solving the coverage problem. We consider the coverage as a single objective problem and ant lion optimization algorithm is used to maximize the coverage rate of the sensor network. This paper is formulated as follows: Section 2 illustrates the ALO in detail. Section 3 explains the WSN coverage. Section 4 proposes a methodology to solve the coverage problem. Section 5.1 depicts the experimental setup and Section 5.2 shows the performance evaluation. Lastly, Section 6 ends with the conclusion.

2 Ant Lion Optimization

Mirjalili et al. in [12] proposed a nature-inspired metaheuristic based on hunting mechanism of the antlions called Ant Lion Optimization (ALO) algorithm. The life-cycle of the antlion comprises of two phases: larvae and adulthood. The hunting process is carried out by larvae. Reproduction is carried out by adults. Antlion larvae dig the sand in a circular path with its jaw resulting in a pit. The antlion are the search agents that hides at the bottom corner of the cone-shaped pit waiting for the prey to fall inside the trap. When the prey gets caught inside the trap, the antlion throws the sand with its jaw in order to pull the prey inside for consumption. The hunting process is accomplished out in five phases: The random walk of ants, constructing traps, entrapment of preys (ants) in traps, catching prey, and reconstructing traps.

The antlions and ants move in N-dimensional search landscape for foraging process. Ants randomly walk in the landscape searching for food and this movement behavior can be formulated as:

$$X[l] = [0, cummsum(2r(l_{1,...,n}) - 1)] \tag{1}$$

where l is the iteration, n is the maximum number of iterations, $cummsum$ is the cumulative sum, $r(l)$ is the random function distributed uniformly in the range $[0, 1]$ and is 1 if $rand > 0.5$ else 0. The random walk position of ant in the boundary space is normalized and formulated as:

$$X_i^l = \frac{(X_i^l - a_i) \times (b_i - c_i^l)}{(b_i^l - a_i)} + c_i \tag{2}$$

where a_i is the lower boundary of the random walk of i^{th} variable, b_i is the upper boundary of the random walk in i^{th} variable, c_i^l is the minimum of i^{th} variable at l^{th} iteration, and b_i^l indicates the maximum of i^{th} variable at l^{th} iteration. The antlion traps affect the random walk movement of the ants and is modelled as:

$$c_i^l = Antlion_j^l + c^l \tag{3}$$

$$b_i^l = Antlion_j^l + b^l \tag{4}$$

where c^l is the minimum vector of all variables at l^{th} iteration, b^l is the maximum vector of all variables at l^{th} iteration, c_i^l is the minimum vector of all variables for i^{th} ant, b_i^l is the maximum vector of all variables for i^{th} ant, and $Antlion_j^l$ shows the selected i^{th} position of antlion at l^{th} iteration and is calculated using Roulette wheel mechanism. The vectors in (3) and (4) defines the ants random walk around a selected antlion. The ants move within a hypersphere around antlion. When the antlions sense that ants are trapped in the pit, the sliding of ants towards antlions and throwing of sand outwards when the ants try to escape is modelled with decreasing radius as:

$$c^l = \frac{c^t}{10^{w(l/L)}} \tag{5}$$

$$b^l = \frac{b^t}{10^{w(l/L)}} \tag{6}$$

where l is the current iteration and L is the number of maximum iterations. The w is the constant which helps in exploitation process and is given as:

$$w = \begin{cases} 2 & l > 0.1L \\ 3 & l > 0.5L \\ 4 & l > 0.75L \\ 5 & l > 0.9L \\ 6 & l > 0.95L \end{cases} \tag{7}$$

The best solution (antlion) obtained during process is refer to as elite. The ants move around the selected antlion by roulette wheel mechanism and elite is modelled as:

$$Ant_i^l = \frac{R_A^l + R_E^l}{2} \quad (8)$$

where R_A^l is the random walk selected by the roulette wheel at l^{th} iteration around the antlion, R_E^l is the random walk around the elite at l^{th} iteration, and Ant_i^l indicates the position of i^{th} ant at l^{th} iteration.

The stepwise details of this algorithm is as follows:

1. Initialize parameters: no. of ants (A), no. of antlions (AL), iterations (L)
2. Evaluate the fitness of Ants and Antlions
3. Determine Elite (finding the best antlion)
4. Set iterations 1 to L
5. for every ant A
 - a. Choose antlion using Roulette wheel mechanism
 - b. Update trapping of ants in antlions pits using equation 3 and equation 4
 - c. Create random walk using equation 1 and normalize using equation 2
 - d. Update ant position using equation 8
 - e. Evaluate the fitness of all ants
 - f. Update elite if superior antlion is found
6. Return Best Antlion (Elite).

3 Wireless Sensor Network Coverage

WSN to be operable the sensors must sense, process and transmit the information. Lack of sensing ability leads to a coverage problem. According to [13], there are three main reasons for coverage problem: random deployment, limited sensing range and inadequate sensors to cover the ROI. The sensors can be deployed in the ROI either manually or randomly. In manual deployment, sensors are placed manually where the location is known prior. In contrast, sensors are placed stochastically in the random deployment. In [14], the author discussed two models to evaluate the sensing range and coverage area of a network. They are the Binary and probability model.

3.1 Binary Sensing Model

In the binary sensing model, the sensing coverage of a sensor S is a circular disk on a two-dimensional plane. The circular disk is of the fixed radius rs called the sensing radius. Any event e that occurs at a point $P(xi,yi)$ on the plane the probability that the node will get detected by the sensor S is given by:

$$B_{cov} = \begin{cases} 1 & d(S, P) \leq rs \\ 0 & otherwise \end{cases} \quad (9)$$

$$d(S, P) = \sqrt{(xs - xi)^2 + (ys - yi)^2} \tag{10}$$

In the equation (10), $d(S,P)$ is the Euclidean distance between point $P(xi,yi)$ and the sensor node $S(xs,ys)$.The main shortcoming of the binary sensing model is it ignores imprecision in sensor detection due to interference or hardware malfunctioning. Hence sensor coverage is not a perfect circle.

3.2 Probability Sensing Model

Probability sensing model ensures that the undetected regions are equally addressed. There are three distinct regions on the plane: Inner, exterior, and the uncertain region.

- Inner region: Region with radius $(rs-rc)$ which ensures sensor will detect event e with probability one.
- Exterior region: Region beyond $(rs+rc)$ which says events are undetected with probability zero.
- Uncertain region: This is the area in which sensor will detect an event e with the probability that decays exponentially with distance.

Assume area A in a two-dimensional plane represented by $m \times n$ grid. Each sensor node is covered by a circle with radius rs and expressed as $Ci(xi,yi,rs)$. The transmission radius of each sensor node denoted as rc . The probability that any event e that occurs at a point P covered by the node Ci is:

$$P_{Cov}(x, y, ci) = \begin{cases} 1 & d(S, P) < rs - rc \\ e^{\frac{\alpha_1 \beta_1 \delta_1}{\beta_2 \delta_2 + \alpha_2}} & rs - rc < d(S, P) < rs + rc \\ 0 & otherwise. \end{cases} \tag{11}$$

Different values of $\alpha_1, \beta_1, \delta_1$, and $\alpha_2, \beta_2, \delta_2$, yield different probability detection of the sensors. The values of α_1, β_1 , and α_2, β_2 , falls in the range of $[0, 1]$. The δ_1, δ_2 is calculated as:

$$\delta_1 = rc + rs + d(ci, p) \tag{12}$$

$$\delta_2 = rc - rs + d(ci, p) \tag{13}$$

To calculate for more sensor nodes to measure the target cov and is given by:

$$P_{Cov}(cov) = 1 - \prod(1 - P_{Cov}(x, y, ci)) \tag{14}$$

The network coverage rate is defined and calculated as the ratio of the area covered and the total area of the grid. The formula is given as:

$$Area_{cov}(cov) = \frac{\sum P_{Cov}(cov)}{TotalArea} \tag{15}$$

The coverage of the sensor field is calculated as the fraction of grid points that exceed the threshold C_{th} [15].

4 Proposed Methodology

ALO based strategy is proposed to solve the coverage problem. ALO helps in determining the optimal sensor node location that can maximize the coverage rate of the sensor network. The sensor nodes are deployed in a landscape which is a two-dimensional area. All the sensor nodes know their respective positions. The target area is divided into an equal number of grid points. The base station is located at a fixed point on the grid.

Initially, the sensors are placed randomly on the ROI. Then the ALO is executed at the base station. The ALO algorithm determines the optimal location of the sensors. The base station then transmits the optimal location points to the sensor nodes. Upon receiving this information from the base station, the sensor nodes move to the new optimal positions. These location coordinates are obtained based on the coverage objective function. Given a set of N sensors $S = s_1, s_2, \dots, s_N$ that are to be placed on a grid, the coverage problem is to optimally deploy sensors so that maximum coverage is achieved and the objective function can be formulated as:

$$f = \text{Maximize Area Coverage Ratio} = \frac{N_{\text{effective}}}{N_{\text{all}}} \quad (16)$$

Here $N_{\text{effective}}$ is the number of grid points covered by the sensor and N_{all} is the total grid points in the entire area. The coverage ratio can be calculated as following:

1. Calculate the coverage rate using equation 11.
2. Calculate the joint coverage rate using equation 14.
3. Repeat step1 and step 2 to calculate the joint rate of each grid point.
4. Calculate the area coverage rate using equation 15.

The Fig. 1 depicts the flowchart for optimal sensor deployment using ALO. The final sensor deployment takes place after coverage optimization.

5 Simulations

5.1 Experimental Setup

The setup is carried on MATLAB 2018a software. The sensing field is assumed as 20x20m² grid area and 10 sensors are to be deployed on the 2D plane. The number of search agents assumed for our experiment is 40 and the halting criterion is assumed as 1000 iterations. The ants position is assumed as the sensor node optimal positions and the elite is considered as the maximum coverage rate value.

5.2 Performance Evaluation

Our aim was to deploy sensors optimally in the ROI using ALO. To validate our work, we compared the results with algorithms like Whale Optimization Algorithm (WOA) [16], Grasshopper Optimization Algorithm (GOA) [17], and Dragonfly Algorithm (DA) [18]. Table 1 shows the simulation results for two different radii 3 and 5 after running the algorithms for 20 trials. The second column depicts the algorithm types. The third column shows the best coverage value obtained. The fourth, fifth, and sixth column shows the mean, standard deviation and coverage rate values. The best values are highlighted as boldface. The random (Rand) deployment strategy resulted in less coverage rate. It is clear from the data that ALO outperformed other techniques. ALO was able to deliver a 5-8% more coverage rate.

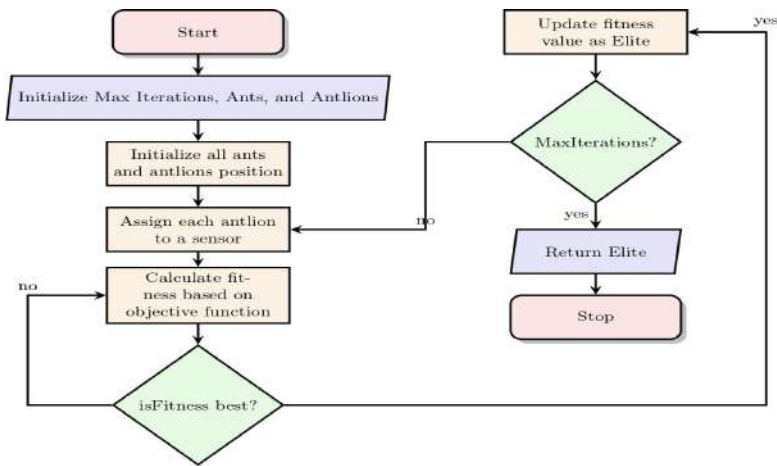


Fig. 1. Optimal sensor deployment using ALO.

The Fig. 2 shows the uniform sensor deployment using ALO. The red square denotes the base station, the red stars denote the cluster heads, and the blue stars denote the sensors. The Fig. 3a shows the coverage rate achieved using different algorithms. It is clearly noted that ALO performed better from other algorithms. The Fig. 3b shows the average execution time taken by the algorithms to deploy the sensors. The ALO's execution time was less from other algorithms. However, execution time may vary depending on the processor and cache speed. In conclusion, ALO was found providing better optimal coverage with minimum execution time.

Table 1. Statistical results obtained for 20x20 network.

Radius	Algorithms	Best coverage	Mean	Std deviation	Coverage rate (%)
3	Random	0.2664	0.2553	0.0101	26.64%
	WOA	0.3491	0.3427	0.0060	34.91%
	GOA	0.3618	0.3587	0.0101	36.18%
	DA	0.3448	0.3325	0.0119	34.48%
	ALO	0.3945	0.3819	0.0017	39.45%
5	Random	0.5489	0.5328	0.0115	54.89%
	WOA	0.7924	0.7860	0.0218	79.24%
	GOA	0.8084	0.8060	0.0229	80.84%
	DA	0.8030	0.7930	0.0229	80.30%
	ALO	0.8402	0.8360	0.0037	87.29%

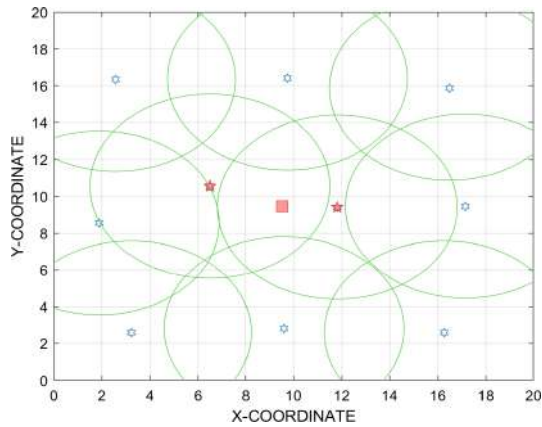


Fig. 2. Optimal sensor deployment using ALO.

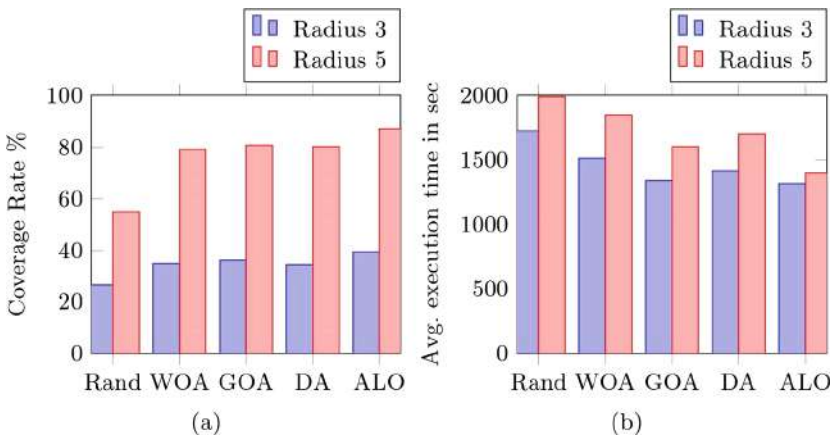


Fig. 3. Bar graphs for coverage rate and average execution time.

6 Conclusion

The ALO optimization algorithm technique used for optimal sensor deployment in our work discussed in detail. The main aim of our work was to solve the coverage problem in WSN's. The results show that ALO outperformed all the other algorithms discussed in terms of better convergence rate, performance, and objective value. In later works will try to solve this problem by taking load balancing and routing paradigm into consideration.

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Text Steganography: Design and Implementation of a Secure and Secret Message Sharing System

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Abstract. Textual communication among parties where sensitive information is exchanged is prone to potential risks. Therefore, it is indispensable to have mechanism to protect such communications from malicious attacks. In the contemporary world, national cyber security has become a concern which needs to be given paramount importance. Cyber criminals have acquired wherewithal to challenge the critical digital infrastructure of a country if there is no sustainable effort to safeguard information security and forensics. For secret messaging, two important techniques are cryptography and Steganography. The focus of this paper is on text Steganography which is light weight and faster than other forms where audio or image or video is used as cover media. Light weight means of text embedding and extraction mechanisms are defined and implemented for secure and secret sharing of information. A prototype application is built to demonstrate proof of the concept.

Keywords: Text steganography · Information security · Cryptography · Secret message sharing

1 Introduction

Secret sharing of messages is the art practiced since ages. However, the techniques like cryptography and steganography made it much more secure in the information age. As explored in [1, 3, 5, 16] text steganography has its merits over other forms where cover image is audio, video or image. The complexity is reduced with steganography. The process of compression is not required and there is no need for high bandwidth consumption. As the adversaries are gaining knowledge in different methods of text steganography, it is a continuous process to upgrade systems with novel methods.

Many approaches came into existence as found in the literature. Combination of different abbreviation methods is employed in [1] while Vigenere cipher and lossless compression technique are used in [2] for sending secret messages through mails. Based on secret messages or the nature of the data also certain techniques were defined. For instance, for sharing of financial data, the concept of adding additional zeros is used in the method proposed in [7] which proved to be good enough to ensure secure transmission of data to desired destination. Usage of diacritics is studied in [10]

and [12]. From the literature it is understood that it is required to have more light weight approaches that do not compromise security in text steganography.

In this paper, we proposed a light weight approach to have text embedding and extraction procedures. The proposed approach is presented in Fig. 1. The contributions of this paper are as follows. A methodology for text embedding and extraction process is proposed and a prototype is implemented to demonstrate proof of the concept. The remainder of the paper is structure as follows. Review of literature on related works is provided in Sect. 2. The proposed methodology is presented in Sect. 3. Section 4 shows results of empirical study while Sect. 5 concludes the paper and provides directions for future work.

2 Related Work

This section provides review of literature on text Steganography. Shivani, Yadav and Batham [1] proposed a novel approach for hiding secret data using text Steganography. Text file is used as cover as it consumes less space and needs low bandwidth. It also achieves less time and consumes minimal overhead. They employed abbreviation methods in combination with Zero Distortion Technique (ZDT). In order to have higher security, encryption is carried out with a technique known as Index Based Chaotic Sequence (IBCS). It shows better performance in terms of time consumption and hiding capacity. Tutuncu and Hassan [2] on the other hand proposed a text Steganography method which involves Vigenere cipher and lossless compression technique to achieve email-based text Steganography. Different lossless compression algorithms are used in a proper sequence such as Run Length Encoding, Burrows Wheeler Transform, and Move to Front, Run Length Encoding and Arithmetic Encoding. Stego key is generated using Latin Square. In order to increase complexity and security Vigenere cipher is employed. Finally, the secret message is embedded into an email message.

Osman et al. [3] explored capacity performance of text Steganography. Capacity is one of the metrics used to know the performance of it. Other metrics include saving space ratio and embedding ratio provides further performance details. There are many format based Steganography techniques that are evaluated. The methods analyzed for capacity performance include Quadruple Categorization (QUAD), Vertical Straight Line (VERT) and Changing in Alphabet Letter Patterns (CALP). Other performance measures employed are Saving Space Ratio (SSR) and Embedding Ratio (ER). Shi et al. [4] explored the notion of search in Internet for achieving text Steganography. It is known as search based text steganography which uses features of web pages. Web page is used as cover data for the method.

Shutko [5] explored aprosh and kerning concepts in text steganography. Aprosh and Kerning are the two parameters for changing text. Lwin and Phyo [6] combined both text and image steganography. Word Mapping Method is to embed secret message into cover text. Then the cover is embedded into image using LSB technique. A text steganography system is built in [7] for financial statements. The concept of adding additional zeros systematically is employed to achieve this. Stojanov et al. [8] proposed a concept known as property coding to embed secret text into a MS word document.

It employs properties of different document objects in order to achieve this. Al-Nofaie et al. [9] explored Arabic text steganography that exploits “Khashida”, a stego cover technique, with whitespaces. Usage of two diacritics for Arabic text is used for security in [10]. The two diacritics are called as Fathah and Kasrah to achieve the diacritic hiding scheme.

Unicode space characters are used in text steganography employed in [11]. Their scheme increases capacity performance. Encoding Hindi text is studied in [12] using numerical code, letters and their diacritics. The concept of sharp edges is exploited in [13] for Arabic text steganography. The concept of alphabet pairing is employed in [14] where embedding of message is made by pairing alphabets of secret text into 4 parts and each part has two bits. It involves both encryption and decryption for higher level of security. Various steganography techniques based on US and UK words are found in [15, 16], while the proposed method in this paper is a new approach.

3 Proposed Approach

This section provides the methodology of research for Text Steganography using the keywords of the US and the UK. Here the original content is plaintext which is passed through network giving some problems relating security issues. To overcome the problems, the plaintext will convert to cipher text based on encryption. For encryption mechanism, use the keywords of differently spelt words of the US and the UK. The encryption mechanism contains two steps. First, find the ASCII value of each character of plaintext. Based on the index position of the character a set is selected from the sets framed by considering US and UK sets Table 1. The number of sets with 256 words depends on the number of differently spelt words of US and UK. second step is to find the word from the sets by respective ASCII value and index position of the sets, then select the word from set1 based on the ASCII values of each character of plaintext. The procedure of replacing the character from plain text with matching of ASCII value of the character with index value of the sets is done repeatedly until all the characters of the plain text is replaced with words in US and UK sets. This is the procedure to convert from plaintext to cipher text.

Then at the other end the cipher text will be converted to original plaintext. Use the decryption mechanism for converting cipher text to plaintext as follows. Find the index position of keywords based on set of keywords to select the set depending on the index position of words from set1, set2 and so on. Then from the index we get the ASCII values of the cipher text. Afterwards, based on ASCII values are obtained to the equivalent characters. Thus original plaintext is obtained. This is the methodology using for encryption and decryption mechanism.

The following sub sections provide methodology for both embedding and extraction processes. Embedding includes inserting secret message into a cover text and then encrypting the cover file. The reverse process is followed in the extraction phase. As shown in Fig. 1, a typical scenario of secure and secret sharing of information is considered between sender and receiver. This kind of model operandi is common in

military and other systems where information needs to be exchanged in presence of interested and skilled adversaries. The overall security and secret sharing is provided with the text Steganography. More details on embedding and extraction procedures are provided in the sub sections.

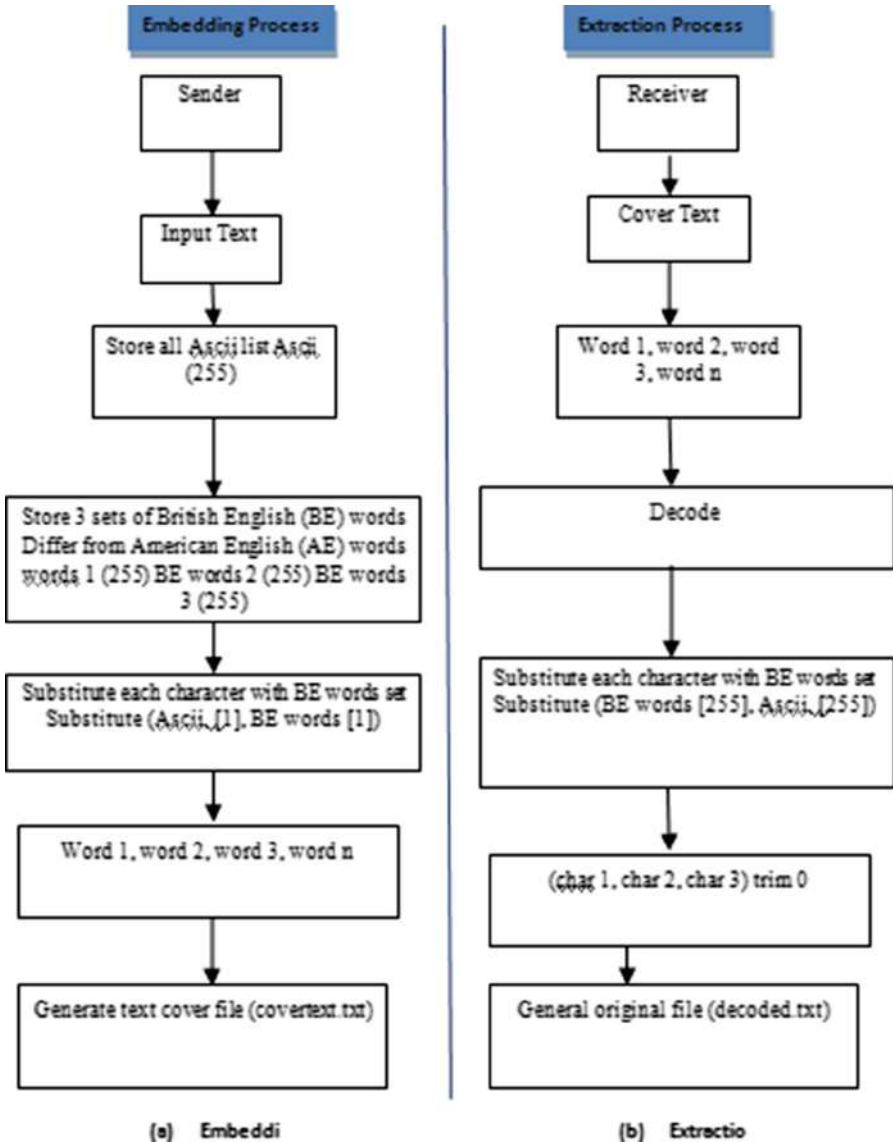


Fig. 1. Proposed mechanisms for embedding and extraction

3.1 Embedding Process

Embedding process includes a series of steps to hide secure information in textual data. The pseudo code of the same is provided here.

```

1. Secret message msg with length n is taken
2. Pre-process msg to find ASCII value of each character in Plain Text
3. Continue pre-process to ensure each character of msg is preceded with ASCII values
4. Generate tokens T
5. Take G ASCII list [a-z], [A-Z], [0-9], [/\...@\...&...] into a vector A
6. Make a vectors BEW1, BEW2, BEW3 to hold BE words For each token t in T
7. Replace t with sequences of BEW1, BEW2 and BEW3 words
8. End For
9. Encrypt T
10. Save T to covertext.txt
    
```

Listing 1: Pseudo code for embedding process

As shown in Listing 1, it is evident that the given secret text is embedded into a cover text file and sent to destination. Then at the receiver side, extraction process takes place.

3.2 Extraction Process

Embedding process includes a series of steps to hide secure information in textual data. The pseudocode of the same is provided here.

```

1. Take covertext.txt as input
2. Decrypt T to have T'
3. Follow reverse process to embedding
4. Replace BE words in T' with ASCII G values [a-z], [A-Z], [0-9], [/\...@\...&...]
5. Extract msg from resultant T'
    
```

Listing 2: Pseudo code for extraction process

As shown in Listing 2, it is evident that the given cover text is subjected to extraction process in order to obtain the original secret text that has been shared.

The proposed approach is given in mathematical form as follows.

I = Index (T) => To find index of text

G = Character to ASCII (Text) => Here we convert character to ASCII value

A1 = {Set of UK Series} => This is the set taken by UK series

A2 = {set of US Series} => This is the set taken by US series

Encryption: -

$$\text{Cipher text} = \operatorname{argmin}_{0 < i < n} T_i(x) = \begin{cases} A_{1i} & i \in \text{UK series} \\ A_{2i} & i \in \text{US series} \end{cases}$$

Decryption: -

$$I_1 = \text{index}(\text{cypher text})$$

$$\text{Cyphertext}_i(x) = \begin{cases} A_{1i} & i \in \text{UK series} \\ A_{2i} & i \in \text{US series} \end{cases}$$

Value = $\text{argmin}_{0 < i_1 < n}$

Original text = ASCII to character (value)

Here first we find the index of cipher text and if index

i_i then select UK series from sets of A1, take the value if index

i_i then select US series from sets of A2, take the values. This process contains until the last index of plain text. after that we connect ASCII value to respective US or UK sets and get cover text.

Parameter	Description
T	Text
I	Index
A_1	Set of UK series
A_2	Set of US series
$\text{argmin}_{0 < i < n}$	For all values of i from 0 to n

4 Results

This section provides the results of the proposed system. It includes the comparison based on Execution time and Memory allocation. The sample sets of UK and USA words as shown in Table 1.

Table 1. Differently Spelt US and UK words list

UK words	US words
Colour	Color
Flavour	Flavor
Humour	Humor
Neighbour	Neighbor
Analyse	Analyze
Breathalyse	Breathealyze

The following A1 and A2 shows the list of words to be used for framing sets of US and UK words

A1 = {Set of UK Series} => **UK Words:** {æroplane, æsthetic, ageing, aluminium,}

A2 = {set of US Series} => **US Words:** {airplane, aesthetic, aging, aluminum,}



Fig. 2. UI for loading input file for embedding process



Fig. 3. Input file has been loaded

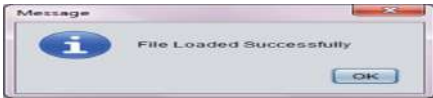


Fig. 4. Get the message of file loaded



Fig. 5. Get the message of File Encryption



Fig. 6. Get the message of File Decryption

As presented in Figs. 2, 3, 4, 5, 6, it is evident that the prototype application has been evaluated with secret message, cover text file, the embedding and extraction process. From the Figs. 2 to 6 after successful loading of the plain text file the cover text file is generated by considering the differently spelt words of US and UK for which individual sets are made for differently spelt US and UK words list. The proposed approach first takes the plain text and converts the plain text message characters to respective ASCII values which in turn are replaced with the sets which are framed by considering words of UK(A1) and cover text file is generated. The proposed approach also takes the plain text and converts the plain text message characters to respective ASCII values which in turn are replaced with the sets which are framed by considering words of US(A12) and cover text file is generated.

From the Figs. 7 to 14, we understand that the execution time and memory allocation for proposed algorithms is less when compared with other existing algorithms like A New Synonym Text Steganography, Steganography using SMS and Text Steganography changing word spelling. The text steganography algorithms are presented in horizontal axis and vertical axis shows either memory usage of execution time. Memory usage for encryption (UK) and (USA) is compared. In Figs. 7 and 8, memory usage details are presented for UK words with respect to encryption and decryption. Figures 9 and 10 show execution time taken for encryption with UK words pertaining to encryption and decryption. Figures 11 and 12 show the memory usage with US words for encryption and decryption. Figures 13 and 14 on the other hand provide execution time for encryption and decryption with US words. The results revealed that the proposed method outperforms the state of the art in all experiments.

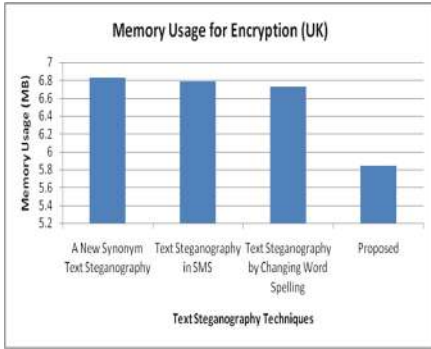


Fig. 7. Memory usage comparison for encryption (using UK keywords)

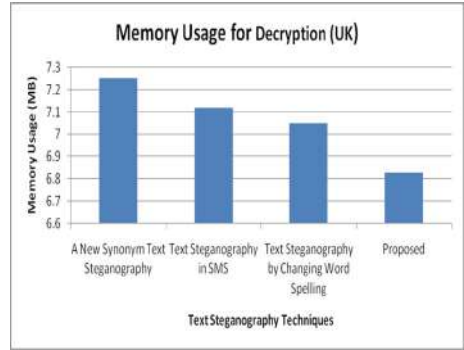


Fig. 8. Memory usage comparison for decryption (using UK keywords)

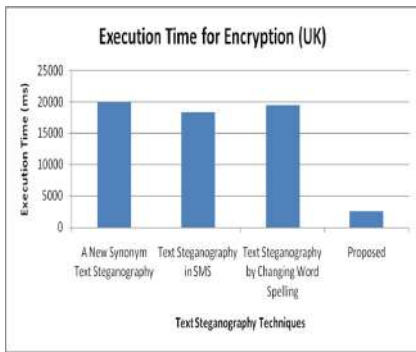


Fig. 9. Execution time comparison for encryption (using UK keywords)

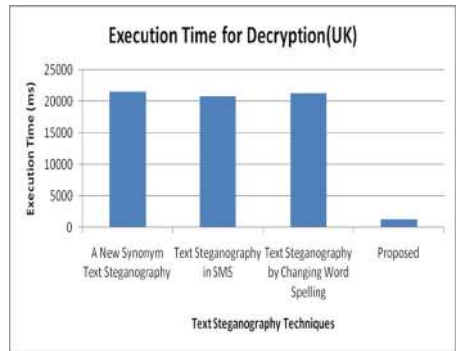


Fig. 10. Execution Time comparison for decryption (using UK keywords)

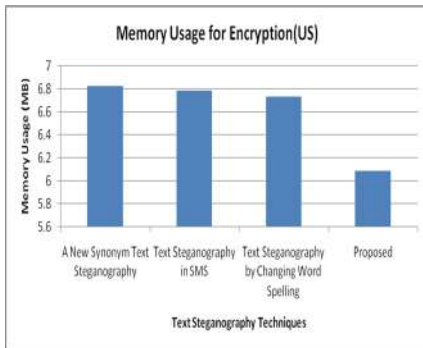


Fig. 11. Memory usage comparison for encryption (using US keywords)

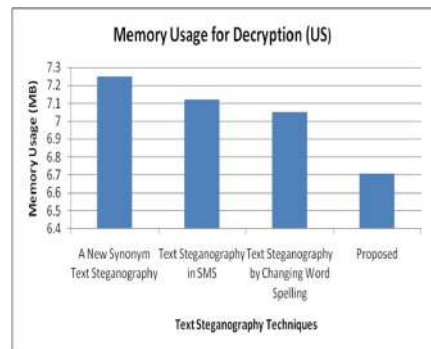


Fig. 12. Memory usage comparison decryption (using US keywords)

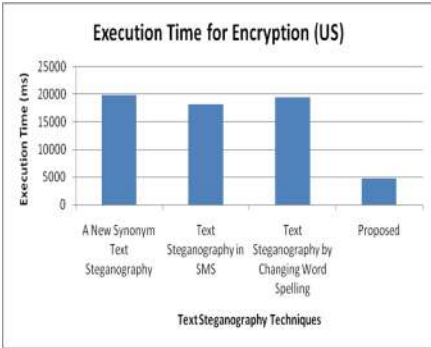


Fig. 13. Execution time comparison for encryption (using US keywords)

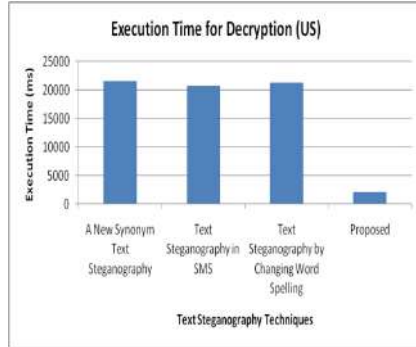


Fig. 14. Execution time comparison decryption (using US keywords)

5 Conclusions and Future Work

In this paper text steganography is studied besides proposing embedding and extraction procedures to have secure and secret sharing of textual data. The cover media is text and thus it is made light weight to have communication between sender and receiver. The proposed system is implemented by developing a prototype using Java programming language. The system is able to demonstrate proof of the concept. However, it needs further research and development to have a robust system leveraging information forensics to safeguard sensitive communications of the real world. The proposed system can be used in the secret communication module of exiting information sharing systems.

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Commercial and Open Source Cloud Monitoring Tools: A Review

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Abstract. The cloud computing has become most popular due to its advantages. The more number of organizations are migrating to cloud to reduce the complexity of maintain resources. So cloud management becomes most challenging task. To reduce the complexity of management and improve the overall performance of cloud, an efficient cloud monitoring tool is required. The cloud monitoring tool helps to improve the overall performance and reduce the management complexity. The major functions of cloud monitoring are to tracking QoS parameter of Virtualized, physical resources and applications that are hosted on cloud. Hence cloud monitoring tools monitors all the resources and events and perform dynamic configurations of cloud for better performance. In this review paper, we have discussed basic concept of cloud monitoring tool and discuss various commercial and open-source cloud monitoring tools and its taxonomy.

Keywords: Cloud computing · Cloud monitoring · QoS parameters · Configuration management

1 Introduction

According to National Institute of Standards and Technology NIST, cloud computing is a “Model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction” [1]. The top benefits of Cloud computing are: economic cost, High Speed, Global Scale, high productivity, security and performance. Not all clouds are provide same service and not one type of cloud computing is right for everyone. Several different models, types and services have evolved to help offer the right solution for customer needs. The different types of cloud deployments: public, private and hybrid. There are three main broad categories of cloud service models: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). These are called the cloud computing service stack because they build on top of one another.

The large number of industries and end users are migrating to cloud as industries and end users understand the potential welfare of using cloud. The workload and complexity of managing cloud activities [6] and operation increases due to large

number users and their data. Hence there is an important rise in the implementation of cloud monitoring and managing tools.

1.1 Need for Cloud Monitoring Tools

Cloud monitoring tool is automated and manual tool used to manage, monitoring and evaluating cloud computing architecture, infrastructure, and service. Cloud monitoring is the process of reviewing, controlling and managing the operational and active workflow and processes within a cloud infrastructure. It is the use of manual or automated IT monitoring and management techniques to ensure that a cloud infrastructure or platform optimize the performance of cloud [5]. It helps to manage the performance of cloud especially when consumer adapted mission-critical services or scientific applications. The cloud monitoring tools [2–4] helps in performing smooth operations of cloud such as Accounting and Billing, SLA management, Service/resource provisioning: Capacity planning, Configuration management, Security and privacy assurance and Fault management.

1.2 General Cloud Monitoring Architecture

This section presents our multi-agent approach for cloud monitoring Tool. The cloud monitoring Tool has five important functions: Data Collection, Data Filtering, Data aggregation, data analysis and decision making. The multiple agents are injected into various parts of cloud to perform above said functions. The Fig. 1 shows the general architecture of cloud monitoring tool.

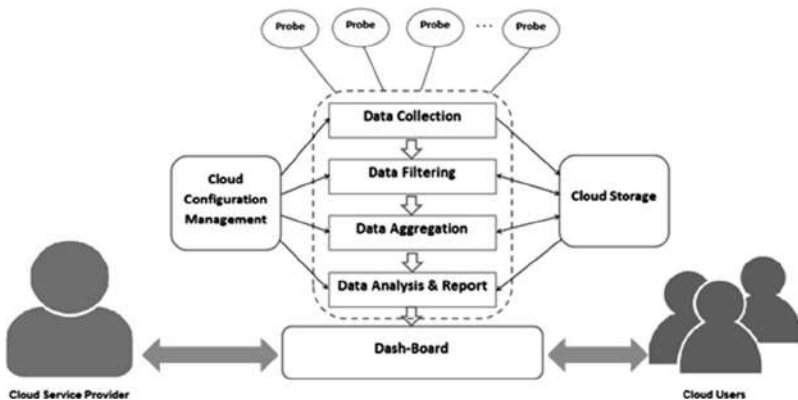


Fig. 1. General architecture of cloud monitoring Tool

The cloud monitoring tool collects the data from different probes that are installed in various part of the cloud. We found various data collection methods in our literature survey. These are push based, pull based, hybrid and adaptive push-pull methods. The *push* method passes the information from components of cloud to central server. In the *pull* method, central server ask component of cloud to send the information. The hybrid

method uses combination of push and pull based data collection. The adaptive push pull uses either of push and pull method at one time based on User Tolerate Rate and percentage of data change. The adaptive push pull improve the performance by consuming lesser computational and communication power.

The redundant, invalid, conflict and irrelevant data increase time and space complexity. To reduce this overhead, the collected will be filtered. A filtering algorithm could be more efficient to deliver more relevant information or data. Data cleaning is very important activity to remove unwanted data from cloud system. Filtering can decrease the impact of monitoring data transfer over the network load and increase the performance of cloud. The agents in data filtering phase will reduce unwanted data using some well-known intelligent data mining techniques that adapt machine learning algorithms.

The data aggregation is a process in which information is gathered and expressed in a summary form for statistical analysis. The main purpose of data aggregation is to reduce network traffic and secure private data [6]. The data aggregation can be implemented in cloud monitoring by adopting data mining techniques like clustering and classifications. Once data has been aggregated it must be processed and analyzed in order to extract the useful information. Data analysis is a process of reviewing, transforming, and modeling data with the goal of extracting useful information, suggestive conclusions, and supporting decision making [15]. The data analysis is used to improve the performance by identifying status of resources, predicting future status and detecting critical conditions.

The agents interact with other agents to take intelligent decision. The collector agent collects the up-to date data and passes data filter agents. The agents work collaboratively and pass message and information between themselves. The agent manager periodically checks the health of agent and working functionality of all agents in cloud monitoring system. The agent manager stores all the details of agent in database. The agent manager stores the intermediate data that is generated from data collection to decision making process. The agent manager collects analyzed or processed data to take control decision to improve the performance. Connection between agents and agent manager to gather the information is made from time to time due to the very high cost of the continuous monitoring. To reduce communication cost, the agents will update the data only when the certain amount of data changes occurs.

1.3 Properties of Cloud Monitoring Tools

In this section, we briefly discussed properties of cloud monitoring tools [4]. The cloud monitoring tool must support these properties to improve the performance. These features are also referred to as monitoring capabilities. These are:

Accuracy: provide accurate measures that are as close as possible to real values.

Adoptability: adopt and support dynamic nature of cloud.

Autonomic: manage its resources automatically without human interactions.

Availability: available all the time for all users of cloud

Comprehensiveness: support heterogeneous resource, several kinds of data and multiple tenants.

Elasticity: The size of cloud increases and decreases dynamically based on its usage.

Extensibility: extending resource/service as per new requirements of user.

Non-Intrusive: adopt significant modifications as the changes in the requirements.

Scalability: provide services when large number users and organizations are added.

Timeliness: respond within time limit

Resilient: A monitoring system must be persistent in delivering services when the cloud changes as per new requirements.

Reliable: perform required task at any point of time under stated conditions.

Portable: Cloud environment incorporate with heterogeneous platforms and services.

Multi tenancy: The CMS should maintain concurrency in serving different data or information to many users at a particular point in time.

Customizability: The requirements changes from customer to customer. So CMS should maintain customizability for all the operations of cloud.

2 Commercial Cloud Monitoring Tools

In this section, we have discussed most popular commercial cloud monitoring tools which makes management task simple for producer.

- a. **Amazon CloudWatch** [8, 35] is a monitoring service made for variety of users like developers, system operators, site reliability engineers, and IT managers. It delivers with data, information and actionable understandings to monitor the applications know and answer to system-wide performance changes, improve resource utilization, and a unified operation and activities.
- b. **CloudMonix** [9] is enhanced cloud monitoring and automation solution for Microsoft Azure Cloud. CloudMonix' s live monitoring dashboard permits Azure Cloud administrators in advance to understand the cloud resources, get informed with signals on cautions and exclusions and organize automated regaining and restoration activities [7].
- c. **CA Unified Infrastructure Management (CA UIM)** [10] provides a single, analytics-driven solution for proactive, efficient and effective managing and monitoring modern, hybrid cloud infrastructures. It is the IT monitoring solution that adopted artificial intelligence techniques to provide intelligent analytical report, broad coverage and an extensible, portable architecture.
- d. **AppDynamics APM** [11] is an Application Intelligence monitoring tool monitors operational understanding, application performance, user experience and business influence of the software applications. Application Performance Management and helps in mapping application automatically.
- e. **New Relic Cloud Monitoring** [12] is used to monitor dynamic cloud application and Infrastructure in an intelligent manner. It monitors applications in one place which helps in viewing error rates, page load, slow transactions, and list of running servers.

- f. **PagerDuty** [13]: The Pager-Duty has more freedom in customizing the parameter and alert mechanism. It also supports other clouds such as NewRelic and AWS. It supports incident management tool which helps for cloud monitoring systems and triggering alarms.
- g. **Bitnami Stacksmith** [14] is an independent, easy custom delivery with a unique goal i.e. to make it modest to get in progress with the AWS services from the command line. It employs artificial intelligent algorithm to improve the performance of cloud activities.
- h. **Microsoft Cloud Monitoring (OMS)** [15] is having more visibility and control across the hybrid cloud with easy operation management and safety. It is a group of cloud-based services for handling the on-premises and cloud settings from one single place.
- i. **Datadog** [16] helps in monitoring events and performance metrics for IT and DevOps Organizations. The Tool support scalability properties and work efficiently even if size of data increases. The tool helps in real-time customizable consoles with slice & dice displays and signals by labels, characters etc.
- j. **Nimsoft** [17] supports multi-layers monitoring and monitor both virtual and physicalcloud resources. Nimsoft provides their consumers to view and monitor the resources that are hostel on different cloud infrastructure.
- k. **Monitis** [18] is a multi-agent based cloud monitoring tool. The agents are installed on network before firewall. The agent collects all the data from network devices using plugins.
- l. **RevealCloud** [19] is used to monitor different types of cloud. The consumers can monitor across different cloud layers e.g. SaaS, PaaS, and IaaS. It is not meant for specific cloud rather it can monitor all types of cloud to get most benefits from popular clouds.
- m. **LogicMonitor** [20] also supports consumers to monitoring across the different layers of cloud like IaaS, PaaS, SaaS. SSL and SNMP protocols are used for communication purpose.
- n. **Cloudkick** [21] is used to monitor and manage server instances that are running on Amazon EC2 cloud and other cloud providers using a single, amalgamated interface. Small and low overhead agents are installed on each instance that collect different metrics from CPU, Memory and Network.

3 Open Source Cloud Monitoring Tools

Open source monitoring tools can offer a number of advantages over cloud providers' native options. In this section, we briefly discuss about most popular and powerful open source cloud monitoring tools. These are:

- a. **Nagios** [22] monitors all type of components of the cloud like network protocols, operating systems, System performance metrics, applications, web server, web services, website, etc. Nagios provides a high level of performance by consuming lesser server resources using a core 4 monitoring engine which.

- b. **Zabbix** [23] is enterprise level monitoring framework designed to monitor applications, platform and cloud infrastructure and database. It is agent based cloud monitoring tool where multiple agent installed on server and client to collect, filter and analyze the data.
- c. **Cacti** [24] is a monitoring tool which can be installed on various operating systems like Linux or Windows OS and connect to RRDTool which is used to generate various types of graphs related to relevant network data. It works with SNMP and presents the network statistics in the easy to understand form.
- d. **Icinga** [25] is the monitoring framework that monitors all the available systems in the network, which alerts user many ways and provides a database for your SLA reporting.
- e. **Collectd** [26] is monitoring tool that monitors various components like system resources, network, sensors, databases, applications and services etc. The Collected is agent based monitoring tool written in C language and operate in Linux and Mac Platform.
- f. **Opsview core** [27] is enterprise cloud monitoring tools offers a free license to use Opsview Monitor, limited to 25 monitored hosts. It monitors multi-tenant Virtual and physical IT infrastructures with high availability and large dashboard feature.
- g. **Ganglia** [28] are a scalable, distributed monitoring tool for high-performance computing systems like grid and cloud computing. The Ganglia monitors applications, platform and infrastructure of cloud and grid computing.
- h. **Hyperic** [29] is application monitoring and performance management for physical, virtual, and cloud IT infrastructures. Auto-discover resources and collect availability, performance, utilization, and throughput metrics.
- i. **Riemann** [30] provides a unified, straightforward tool to monitor distributed applications and IT infrastructure. It enables developers to define various types of events to monitor, as well as streams that generate alerts when a particular type of event occurs.
- j. **cAdvisor** [31] is Container Advisor, it was one of the first open source monitoring tools built for containerized applications such as grid and cloud computing. It does not monitor all the application that runs on cloud, but only those components that are installed in containers.
- k. **Elasticsearch** [35] is an open source, RESTful search engine built on top of Apache Lucene and released under an Apache license. It provides scalable, multitenant monitoring solution and performs real-time searches to manage the cloud effectively.
- l. **Graphite** [32] is a popular open source tool to monitor cloud application, platforms and infrastructure. It doesn't collect data or store it persistently, but enterprises can integrate Graphite with a variety of other tools, including Riemann, to perform monitoring activities.
- m. **Prometheus** [33] is one of most popular, robust monitoring system. It monitors various of layers of cloud like SaaS, PaaS, and IaaS. It provides high customization options and native visualize engine that helps in integrating third party tools also.

4 Taxonomy of Cloud Monitoring Tools

In this section we present taxonomy of cloud monitoring tools. We consider properties of cloud monitoring system and cloud types (public, private and hybrid cloud). Some monitoring tools are designed and implemented for specific cloud type. The taxonomy contains five parts: properties of cloud monitoring tool, agent based or agent less monitoring and cloud type. These are briefly discusses in Sect. 1. Tables 1 and 2 describe commercial and open source cloud monitoring tools respectively (Fig. 2).

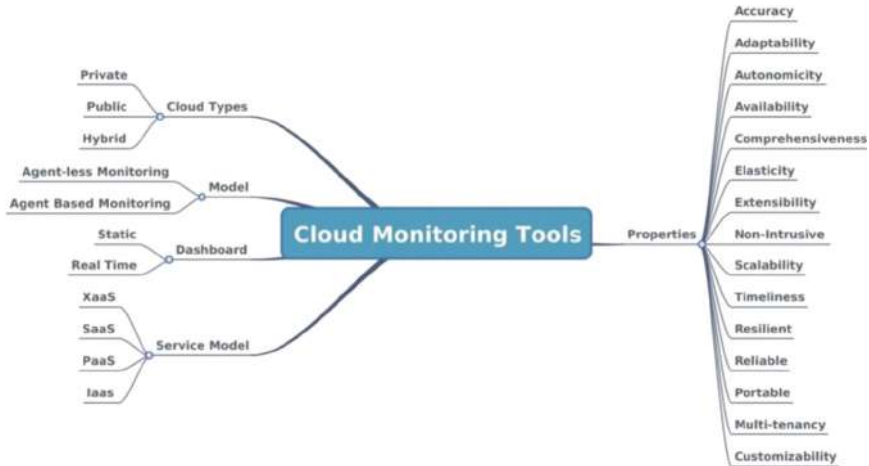


Fig. 2. Taxonomy of cloud monitoring tools

Analysis of Taxonomy: The five component of taxonomy are Cloud monitoring layer/service models. Properties of cloud monitoring tools, model (agent based/agent-less model), Cloud type, and live Dashboard. The first component of classification is service models. The monitoring tool monitors the at different layers these are SaaS, PaaS, IaaS and XaaS. The SaaS means monitor Application, PaaS means monitors platform, IaaS means monitoring infrastructure and XaaS means hybrid model that monitors all three layers. Very few tool monitors platform behaviour and are limited to linux os and windows os. The new CMTs support autonomic and availability properties as they adopted AI algorithm and troubleshoot the problem based on historical data. Most of the monitoring tool does not support all the properties. We feel the cloud monitoring tool is robust if it supports all the properties.

A new monitoring tools must support all the properties of CMT to improve the performances. The latest monitoring tools provide live dashboard facility to view various types of performance metrics and graphs. As the complexity of cloud complexity is increasing day by day with new user requirement, an efforts needed for monitoring of cloud infrastructures need to be increased. The size and scalability of new cloud is more complex compared to existing cloud monitoring tool as new monitoring solution needs to be more scalable, effective and faster in operation. The

Table 1. Commercial cloud monitoring tools

Commercial tools	Levels	Properties										Agent Based?			Cloud type			Live Dashboard											
		Accuracy	Autonomic	Availability	Comprehensiveness	Elasticity	Extensibility	Non-Intrusive	Scalability	Timeliness	Resilient	Reliable	Portable	Multi-tenancy	Customizability	Public Cloud	Private Cloud		Hybrid Cloud										
[8]	XaaS	✓		✓		✓	✓	✓		✓						✓			✓										
[9]	XaaS	✓	✓			✓												✓		✓									
[10]	SaaS	✓	✓		✓																✓								
[11]	SaaS	✓	✓																			✓							
[12]	XaaS	✓	✓			✓			✓														✓						
[13]	PaaS		✓																					✓					
[14]	XaaS			✓																					✓				
[15]	XaaS	✓	✓			✓																				✓			
[16]	XaaS	✓																									✓		
[17]	XaaS		✓																									✓	
[18]	XaaS																												✓
[19]	SaaS	✓			✓																								✓
[20]	SaaS	✓																											✓
[21]	XaaS	✓			✓																								✓

Table 2. Open-source cloud monitoring tools

Open source tools	Level	Properties			Accuracy	Adaptability	Autonomic	Availability	Comprehensiveness	Elasticity	Extensibility	Non-Intrusive	Scalability	Timeliness	Resilient	Reliable	Portable	Multi-tenancy	Customizability	Agent Based?	Cloud type		Live Dashboard	
		Public Cloud	Private Cloud																					
[22]	XaaS	✓				✓			✓		✓		✓		✓		✓	✓	✓		Public Cloud	Private Cloud	✓	
[23]	XaaS							✓	✓		✓		✓		✓		✓	✓		✓		Public Cloud	Private Cloud	✓
[24]	XaaS					✓			✓					✓	✓				✓		✓	Public Cloud	Private Cloud	✓
[25]	XaaS	✓								✓					✓		✓				✓	Public Cloud	Private Cloud	✓
[26]	XaaS	✓				✓			✓		✓						✓			✓		Public Cloud	Private Cloud	✓
[27]	XaaS												✓				✓		✓		✓	Public Cloud	Private Cloud	✓
[28]	XaaS					✓							✓		✓		✓			✓		Public Cloud	Private Cloud	✓
[29]	XaaS	✓						✓	✓				✓				✓			✓		Public Cloud	Private Cloud	✓
[30]	SaaS					✓				✓				✓			✓			✓		Public Cloud	Private Cloud	✓
[31]	XaaS													✓			✓				✓	Public Cloud	Private Cloud	✓
[32]	SaaS														✓		✓				✓	Public Cloud	Private Cloud	✓
[33]	SaaS	✓				✓			✓								✓		✓		✓	Public Cloud	Private Cloud	✓

demand for real time reporting of performance measurement is increasing while performing monitoring operations. Therefore, cloud monitoring systems need to be advanced and customized to the diversity, scalability, and high dynamic cloud environments.

5 Conclusion

Cloud monitoring plays a very important role in supporting efficient management of various cloud operational areas, including account management, SLA management, service/resource provisioning and fault management. To improve the overall performance of cloud, an efficient cloud monitoring tool is needed. In this paper, we have discussed basic concept of cloud monitoring tool and reviewed the technical details of the commercial and open source monitoring. We also given taxonomy of commercial and open-source monitoring tools w.r.t five components Cloud types, Model, Properties, Dashboard, Service model. This review paper offers research scholars an opportunity to gain insights of the tools and perform research work in the area of cloud monitoring. Our future work is to design and implement economical agent based cloud monitoring system to enhance the performance of cloud.

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Developing Social-Media Based Text Corpus for San'ani Dialect (SMTCS D)

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Abstract. This paper aims at developing and designing a social media based text corpus of San'ani Dialect (SMTCS D). The corpus is considered the first in the research area that codifies one of the most popular and spoken dialects in Yemen representing nearly 30% of Yemeni speakers. Our primary objective is a compilation of authentic and unmodified texts gathered from different open-source social media platforms mainly Facebook and Telegram Apps. As a result, we obtained a corpus of 447,401 tokens and 51,073 types with an 11.42% Token:Type Ratio (TTR) that is composed in entirely manual and non-experimental conditions. The corpus represents daily natural conversations which are found in the form of fictional dialogues, representing different situations and topics during the years 2017 and 2018. The data is preprocessed and normalized which then is classified into ten different categories. The analysis of the corpus is made using LancsBox, and different statistical analyses are performed.

Keywords: Corpus design · San'ani dialect · Social media · Token · Type · Category · LancsBox · Statistical analysis

1 Introduction

Arabic Language is one of the six main languages of the world with approximately thirty dialects. It has three major varieties. The first form is classical Arabic which is the form of the Holy Quran and historical literature. The second form is Modern Standard Arabic (henceforth MSA) which covers the written form mostly and rarely formal speech that is used in media, academics, and news. The third form is Colloquial Arabic or Dialectal Arabic (DA) that presents the regional dialects used as informal speech. So Arabic Language is a good example of diglossia where two varieties of the same language are used by the speakers for formal and informal interaction. MSA is the high variety that represents the official language in all the Arab countries while Colloquial Arabic or DA is the low variety that is used for informal speech.

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Arabic dialects are classified into many broad categories based mostly on their regional locations. The broad regional dialects of Arabic are Egyptian Arabic (EGYA), Gulf Arabic (GFA), Levantine Arabic (LVA), Hassaniya Arabic (HSNA), Iraqi Arabic (IRQA), Sudanese Arabic (SDNA), Maghrebi Arabic (MGHBA), and Yemeni Arabic (YMNA). EGYA includes all the Arabic dialects spoken in Egypt. GFA includes the Arabic dialects in KSA, UAE, Kuwait, Oman, Bahrain, and Qatar. LVA contains Arabic dialects spoken in Syria, Palestine, Lebanon, and Jordan. HSNA includes the dialects in Mauritania, Western Sahara, south western Algeria, and Southern Morocco. IRQA covers dialects spoken in eastern Syria and Iraq. SDNA contains dialects in Sudan, and Southern Egypt. MGHBA includes dialects in Tunisia, Libya, Algeria, and Morocco. Finally YMNA covers the dialects of Arabic spoken in Yemen and Southern KSA [1–3]. Further division of the above categories is based on regional and social status.

Most of the available Arabic dialect corpora are directed to certain Arabic dialects namely Egyptian, Gulf, Levantine, Iraqi and Maghrebi, while the rest of the dialects have few resources or data. One of these Arabic dialects with a shortage of available data is Yemeni Arabic which is the aim and focus of this paper. As mentioned earlier, Yemeni Arabic covers Arabic dialects used in Yemen. It can be further divided into three main dialects which are Tazi, San’ani, and Hadrami. San’ani Yemeni covers almost 30% of the population being spoken in north Yemen. The number of San’ani Yemeni speakers can approximate 9 million speakers.

This paper describes the design and collection of San’ani Yemeni Arabic corpus. It tries to cover a gap in research providing an authentic resource of Yemeni Arabic. The corpus is collected from social media platforms namely Facebook and Telegram. We present our method of data extraction and pre-processing. This study is structured in the following section headings. 1. Introduction and related work; 2. Data Collection and Selection; 3. Data Preprocessing (cleaning and normalizing); 4. Corpus Design and construction; 5. Corpus processing; 6. Results; 7. Conclusion.

1.1 Related Work

A number of surveys were conducted by many researchers to account for the available Arabic corpora [1, 4, 5]. The most recent one was done in 2017 by Wajdi Zaghouani in his paper Critical Survey of the Freely Available Arabic Corpora [4]. [4] provided a categorized list of 66 free source Arabic Corpora. The six main categories are further divided into subcategories. The first category contains twenty-three Raw Text Corpora which is divided into eleven monolingual corpora, four multilingual corpora, two dialectal Corpora, and six web-based corpora. The second category contains fifteen Annotated Corpora. It includes six named entities Corpora, three error annotation Corpora, and six Miscellaneous Annotated Corpora. The third category is the Lexicon corpora. It lists nine lexical databases and seven words lists. Speech Corpora is the fourth category that lists only one corpus. The fifth and sixth categories are respectively Handwriting Recognition Corpora with four corpora listed and Miscellaneous Corpora types. The final category includes Questions/Answers, comparable corpora, plagiarism detection, and summaries. It lists seven free source corpora. With further investigation to the freely available corpora listed in [4], only two corpora are available for dialectal Arabic. These dialectal Arabic corpora cover only four Arabic dialects which are Gulf, Levantine, North Africa, and Egyptian.

Another study [1] presents a list of Arabic corpora divided into five main types which are Speech Corpora, Arabic handwriting Recognition Corpora and Evaluations, Text Corpora, Evaluation Corpora, And Lexical databases. [1] lists corpora regardless of their free accessibility. The list contains a number of Arabic dialectal resources that cover the following Arabic dialects, i.e., Gulf, Iraqi, Levantine, Egyptian, Jordanian, Tunisian, and Moroccan. No resources are available for Yemeni colloquial Arabic.

The quantity, quality, coverage, and accessibility of available Arabic corpora are the main motives for Arabic researcher to opt for better resources [6, 7]. Many of the available Arabic resources are criticized for focusing on the two formal forms of Arabic – Classical Arabic (CA) and Modern Standard Arabic (MSA) [2, 5, 7]. The reason of this is related to the nature of dialectal Arabic which is mostly used in informal spoken situations. This leads to the paucity of written texts in Colloquial Arabic. However, the recent advancement in technology and the vast spread of social media platforms generate the required colloquial text. Some of the social media colloquial Arabic resources are the Multi-Dialect, Multi-Genre Corpus of Informal Written Arabic [7] and Creating an Arabic Dialect Text Corpus by Exploring Twitter, Facebook, and Online Newspapers [2]. [7] was collected from Twitter representing five Arabic dialects which are Maghrebi, Egyptian, Levantine, Iraqi, and Gulf. [2], on the other hand, used Facebook and on-line newspapers in addition to Twitter to obtain the data.

As far as our investigation of available Arabic corpora, Yemeni colloquial Arabic seems nowhere to be found. All the Arabic colloquial resources cover some dialects of Arabic but not all of them. The aim of this work is to produce an authentic corpus of San'ani Yemeni Arabic making use of available social media data. The result of this study is an original and authentic text corpus of San'ani dialect that is preprocessed, designed, and prepared for further NLP applications.

2 Data Selection and Collection

2.1 Data Selection

In developing a new corpus, one should be careful about the data s/he is going to select for compilation. The corpus builder should consider many factors during the selection process in order to fulfill or follow the recent methodologies used in corpus building and design. In our paper, we adhered closely to the six common criteria posited by [8] that validate the data selection process. These criteria are as follows:

- a. the mode of the text; whether the language originates in speech or writing, or perhaps nowadays in electronic mode;
- b. the type of text; for example if written, whether a book, a journal, a notice or a letter;
- c. the domain of the text; for example whether academic or popular;
- d. the language or languages or language varieties of the corpus;
- e. the location of the texts; for example (the English of) UK or Australia;
- f. the date of the texts.

2.2 Data Collection

The data was collected manually using a copy-paste method. We avoided using any extraction tools to make sure that we obtain only the purely dialectal text forms that are published during the years 2017 and 2018. Our focus is on the most popular and open-source platforms mainly used by Yemenis Facebook and Telegram apps as the source of data collection. The texts are published in the form of fictional dialogues and are divided part-wise. The total number that we are able to find in purely San'ani Dialect (SD henceforth) is about ten different short stories (fictional) written by different authors and are accessed publicly (No need to get any official permission). Each one discusses natural conversation of San'ani people's life and daily talks. We first composed our data into ten files based on their topics (see Table 2). Then we marked up each document with meta-data and merged all into a single category to obtain ample texts and perform the analysis as a single document.

3 Preprocessing

Our main objective is compiling raw and authentic texts in a machine-readable form which represent spoken variety. These texts should be useful for any computer processing. However, not all raw data is valid for processing. The raw data needs to undergo a number of steps for making it valid for any practical usage. Using tools for extracting such data brings about wrong results as it contains a lot of ill-formed texts that are to be preprocessed for making it valuable and valid for further analysis. According to [9] preprocessing has a direct impact on the quality of the results returned by an analysis. It is also a convention that any data that is collected from social media will have a number of non-alphanumeric and non-keyboarding characters and hence, will vary slightly in terms of the number of words and their frequencies before cleaning and after cleaning (see Table 2). It shows the number of corpus tokens and their types before and after pre-processing.

3.1 Cleaning

We developed a small code in python for corpus cleanings that is used in eliminating all noisy data which affect some processing operations while playing with our data such as sorting, frequency count, and finding patterns, etc. These include non-alphanumeric characters such as symbols, emojis, shapes, and other non-printable computer characters.

3.2 Normalization

As our data is developed and collected from different platforms and is written by different authors and social media users, it is difficult to deal with inconsistent and non-standardized orthographical variations across our corpus. These variations are of multiple types and may affect in one way or another in meaning change. We observed some morpho-phonemic processing like synthesis, epenthesis, deletion, insertion, etc.

The data contains a lot of variant forms like laugh written texts as used in social media context (i.e., /haaa/ or /haaaaaa/ etc.) where inconsistent letter lengthening or repetition occurs. For data to be analyzed, normalization process is required for producing only correct, standard and machine-readable forms. This means we have to get rid of all abnormal forms and outliers. As a solution, we developed a many-to-one module for data normalization where we match multiple written variations of the same word to one standardized form. This is done using Python programming and Django API. The following are a list of some cases where a normalizer was required.

1. Adding space between the letters of the word making it a problem while counting the frequency as in 'تش تي' /tash ti/ instead of 'تشتي' /tashti/ meaning 'to want.'
2. Substitution of one letter for another which brings about a word with no meaning as in 'تعزل' /ta'aril/ instead of 'تعرف' /ta'arif/ 'to know.'
3. Some words are written with some letter lengthening making them either new words with different meanings as in 'جددي' /djaddi/ 'renew (you)' instead of 'جدي' /djadi/ 'my grandfather' or new types of the same word as in 'تعبيتك' /ta'abbtak/ instead of 'تعبتك' /ta'abtak/ 'made you tired'.
4. The word 'تفاجأ' /tafa:j'a?/ 'was surprised' is written in different wrong spellings by different writers as 'تفاجأ' /tafa:j'a?/ or 'تفاجا' /tafa:j'a/ or 'تفاجى' /tafa:ja/ or 'تفاجىء' /tafa:ja?/.
5. Deletion as in 'تفونها' /tafu:naha:/ instead of 'تلفونها' /talafu:naha:/ 'her phone.'
6. Two words mistakenly are happened to be connected with each other with no space to separate them.
7. Morpheme swapping as in 'توقائعكم' /tawaaqa:ta'akum/ for 'توقعاتكم' /tawaaqu'a:takum/ 'your expectations'.
8. Romanized texts are found 'اوكي باي تيك كير' /u:ki ba:i tai:k ki:r/ 'Ok bye take care'.
9. Some words are written letter by letter with space in between 'أ ح ب ك' /?a Ha ba ka/ instead of 'أحبك' /?aHibaka/ 'I love you.'

4 Corpus Design and Construction

A carefully-constructed and well-designed corpus usually acquires many properties. Corpus simply is a collection of texts that are stored in a database and can be searchable and processed using a number of methods. Building a corpus from scratch requires going under many stages. Our data selection was carefully made in order to constitute a representative sample of San'ani Dialectal Corpus (SDC henceforth) following the norms of [10] that a corpus is designed to constitute a representative sample of a defined language type. However, we can't say that our selected corpus is perfectly a watertight representative sample of all SD. This is due to the unavailability of written text corpus in different genres. In the construction process of SDC, the researchers followed the principles postulated by [8]. These principles are as follows:

1. The contents of a corpus should be selected according to their function in the community in which they arise.

2. The corpus should be as representative as possible of the chosen language.
3. Only components in the corpus that are designed to be independently contrasted are contrasted.
4. Criteria determining the structure of the corpus are small in number, separate from each other, and efficient at delineating a corpus that is representative.
5. Any information about a text is stored separately from the plain text and only merged when needed.
6. Samples of language for the corpus, whenever possible, consist of entire texts.
7. The design and composition of the corpus are fully documented with full justifications.
8. The corpus design includes, as target notions, representativeness, and balance.
9. The control of subject matter in the corpus is imposed by the use of external, and not internal, criteria.
10. The corpus aims for homogeneity in its components while maintaining adequate coverage, and rogue texts should be avoided.

(Cited in [11], p. 77)

Figure 1 illustrates different steps of constructing SDC as mentioned by [10]. These stages begin with planning and end up with text handling using different tools and methods. In our case, we first collected our corpus from Facebook and telegram channels which are publicly available. Then we cleaned all abnormalities in the corpus which include all non-alphanumeric and non-printable characters. In the normalization stage, we developed a many-to-one module for corpus normalization and then built an API for normalizing our data which aims at standardizing the variations into one standard form. The data then was stored in notepad text files and saved in UTF-8 formatting. The available on-line LancsBox tool was used for calculating different statistics.

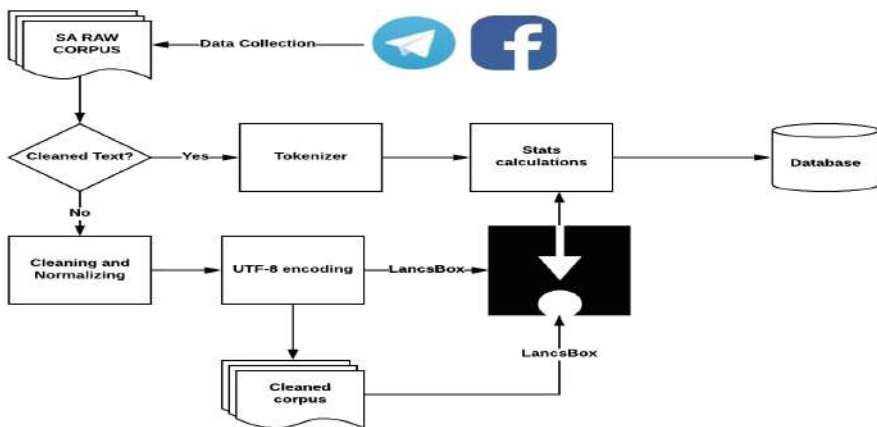


Fig. 1. It shows Design Stages of SDC

5 Corpus Processing

In the processing stage, we made use of LancsBox tool which is found to be suitable for data analysis and visualization. Different methods were used such as word-list method to sort and count for the frequency. We also made use of KWIC and n-grams methods to disambiguate the word category and parts of speech (POS) as well as to find the patterning and the structures in which such words occur.

5.1 Corpus Size

The length of our pre- and post-cleaned corpus is shown in Table 1 and is visualized in Fig. 2 with a summary of their statistics.

Table 1. It shows the size of our corpus

Total corpus	Total corpus size Pre-cleaning	Total corpus size Post-cleaning
Tokens	455,420	447,401
Types	52,784	51,073
Type:Token Ratio(TTR)	11.59	11.42

As shown in Table 1, the difference between tokens and types in pre- and post-cleaning stages is 8,019 and 1,711 subsequently. While the total token:types ratio (TTR) is found to be 11.59% and 11.42% consequently. However, if we look at our corpus file by file as shown in Table 2 and visualized in Fig. 3, the type:token relationships are found to be inverse. This means the more the number of tokens, the less the TTR we get.

5.2 Types of the Corpus

Our corpus is a corpus of San'ani Dialect. The dialect is spoken by nearly 9 million speakers who represent about 30% of all Yemeni speakers. As the texts are still not codified and are radically different from the written manuscripts in official documents in Yemen (i.e. MSA), we were not able to find texts in different stand-alone genres.

Figure 3 illustrates token:type ratio (TTR) as per category along with their number of occurrences. We notice that the data obtained vary in size and hence, TTR results in different statistics (i.e., inverse relationship) if being calculated file by file. Thus, integrating all categories or files into a single one is a must for obtaining an accurate TTR.

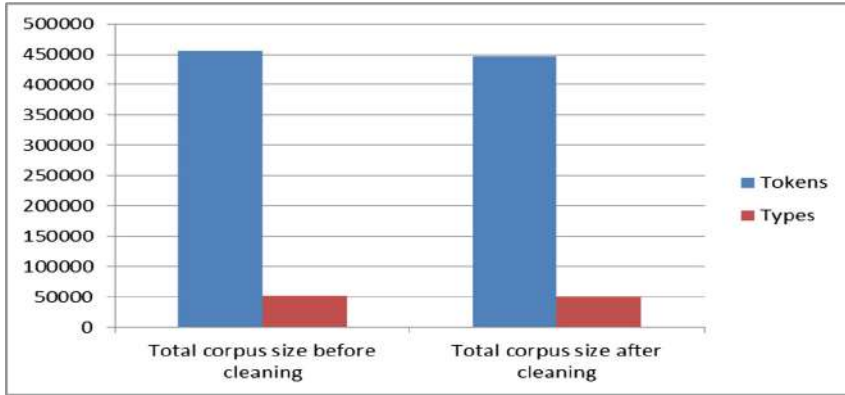


Fig. 2. It shows the total size of SDC with its token-type frequencies

Table 2. It shows statistical variation between raw and cleaned corpus as per category

San'ani Stories	No. of tokens		No. of types		TTR
	Pre-cleaning	Post-cleaning	Pre-cleaning	Post-cleaning	
حب تحت القصف /Hub taHat-alqasf/ 'Love under war'	72,515	72,115	15,648	15,099	21.58
في بيت جدي /fi bayti djadi/ 'in my grandpa house'	69,674	69,299	14,667	14,580	21.05
عودة الماضي /ʔawdaʔalma:dhi/ 'Back of the past'	64,779	62,794	13,904	13,518	21.46
ضحايا القدر /dhaha:ya al-qadar/ 'Destiny Victims'	129,580	124,398	21,483	20,439	16.58
إرادة قلب /ʔiradat qalb/ 'The will of Heart'	66,195	66,012	14,643	14,338	22.12
أوجعتني كثر الله خيرك /ʔawjʔatani kathar allahu khairak/ 'You Hurt me God bless you'	14,423	14,418	3,593	3,575	24.91
بين الحب والثأر /baiyna-al-Hubi wa-tha'ar/ 'between love and evenge'	7,203	7,203	2,163	2,161	30.03
كل الحكاية أشقت لك /kullal-Hika:yata ʔashtaqtu lak/ 'all the tale I miss you'	8,058	8,056	2,328	2,318	28.89
لا تخليني يتيم مرتين /la: takhalayini yat:mun marataini/ 'don't make me an orphan twice'	10,404	10,387	3,070	3,039	29.51
ما دريت /ma: darayt/ 'I didn't know'	12,759	12,711	4,008	3,969	31.41

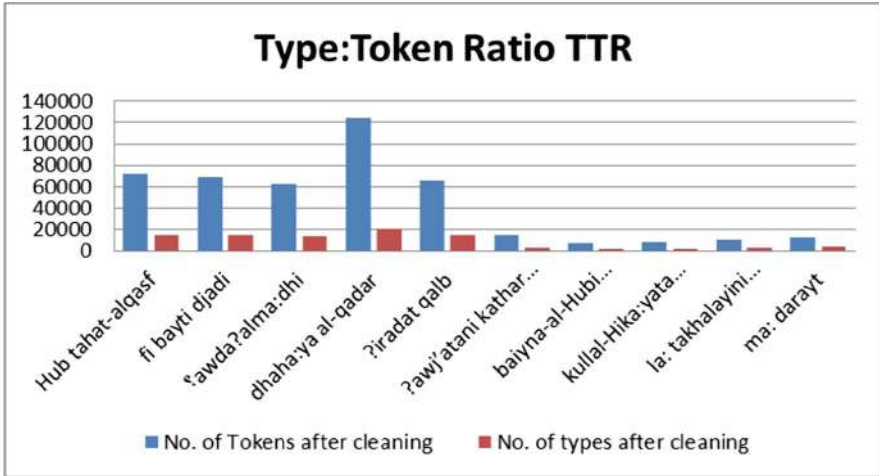


Fig. 3. It shows the type-token Ratio of the SD per category

6 Results

The main result of this paper is generating a social media based text corpus of a well-organized, cleaned and machine-readable, searchable text for San'ani Dialect (SD). This will be useful as a base for developing NLP applications as well as a resource for any relative future research. We obtained a result of 447,401 tokens and 51,073 types with a Type:Token Ratio (TTR) of 11.42% that represents ten different daily and fictional conversations of SD posted on social media platforms in the years of 2017 and 2018. Our constructed corpus is considered the first of its kind in the research area addressed that fulfills the research gap of the lack or the unavailability of any reference corpus for SD.

7 Conclusion

In this paper, we prepared and developed a new corpus for San'ani Dialect that is collected from the most popularly used social media platforms in Yemen namely Facebook and Telegram apps. The corpus is manually gathered and designed in a way that makes it useful, searchable and accessible for developing further natural language processing applications. Not only the corpus can be the base resource for NLP applications, but also the way the corpus was constructed and designed makes it acquire additional benefits. These benefits are the product of the corpus normalizer that is used to map written variants of the dialect into one normalized and standardized form. Such mis-writing errors occur as a result of carelessness as well as of educational and social backgrounds of the authors and social media users. These variations can be (a) mistyping, or mis-keyboarding which include errors occurred in the morpho-phonemic and phonological level; (b) Short forms and abbreviations as well as

inconsistent word lengthening representing emotions that are conventions in social media writings; (c) The transliterated foreign words, etc. All of these were normalized and assigned their standard forms in the corpus.

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A Survey on Data Science Approach to Predict Mechanical Properties of Steel

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Abstract. In any engineering application it is very important to understand the mechanical properties of the material being used. Data science in the arena of material science and engineering helps manufacturers, designers, researchers and students to better understand the selection, discovery, development of materials for different kind of applications. It helps to find out the properties of the material without performing any experiments and makes easy to find out whether the material is suitable or not for the product we want to develop. Stainless steel is most widely used in all industries because it is environment friendly and can be recycled. It is used in all most all applications like construction purposes, household purposes, etc. The principal purpose of this paper is to survey different data science techniques used by the researchers and scholars in the domain of material science and engineering for predicting the mechanical properties of any metals or materials. This deep literature research is aimed to design a method where a comparative study of different data science algorithms will be done and to identify the algorithms with decent prediction accuracy to be integrated with the GUI (Graphical User Interface) so as to deliberate as a tool that is user-friendly and easy to access. The future work aims at a user-friendly GUI proposed to predict the tensile strength and yield point of the steel by specifying some processing parameters of steel using the data science techniques.

Keywords: Data science techniques · Material science · Mechanical properties of steel

1 Introduction

In this information era there is a huge amount of data like feedbacks, customer's data, medical data, materials data and shares data etc., data science aids us in to keep all the data simple and easy to understand. Data Science helps in making quality decisions. Over the last few years data science has changed our technology a lot. Data Science has succeeded in adding value to business models with the help of statistics, machine learning and deep learning. The main aim of the data science is to develop novel approaches, algorithms, tools, methods and the associated infrastructure to extract the high value information based on the available data and resources. The Data Science techniques are widely classified into machine learning, regression, logistic regression, pattern recognition, feature selection, attribute modelling, clustering, association analysis, anomaly detection, social network analysis, time series forecasting, classification etc.

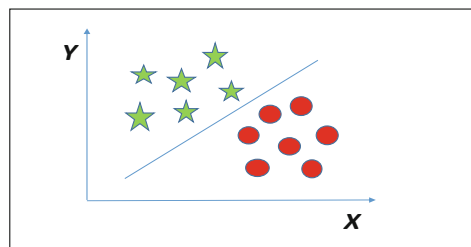
In the recent years the data science in the field of material science and engineering has become popular. The main goal of it is to reduce the cost and save time in material design and its behaviour. The practitioners of the advance material science and engineering have commonly relied on observations made from cleverly designed controlled experiments and sophisticated physics-based models for identifying the mechanical properties of the material based on their composition and temperature. In the recent vision, the experts of the field have identified an integrated approach of data science analytics to establish desired casual relations between the chemical composition, processing parameters and properties of the material. There is a lot of progress in the recent years by using data science techniques in material sciences and engineering for discovering the design, structure, physical and mechanical properties of any material.

2 Classification Techniques

Machine learning, a data science technique consists of both supervised and unsupervised learning. In supervised learning we have classification and regression techniques. Supervised learning is training the computer with the available data and allowing the program to predict the possible values of data which is called as classifying new observation from the available data. Classification is applicable for both structured and unstructured data. In these techniques the given data is classified into different classes based on the requirement. These techniques predict under which category or class does the new data falls. The most widely named classification algorithms are Linear Regression, Naïve Bayes, Decision Trees, Neural Networks, SVM, Random Forest, Nearest Neighbour classification algorithm etc. Few classification methods are detailed below.

2.1 SVM (Support Vector Machine)

It is a supervised machine learning algorithm that performs regression and is a classification technique. It is well known for its kernel trick that handles nonlinear input spaces. In this algorithm each data item in dataset is represented as a point and plotted in n-dimensional space. Here 'n' represents all features in dataset where each feature represents a particular coordinate. Classification is performed by finding hyper plane which differentiates classes accurately. SVM classification separates hyper plane, i.e. for the given labelled training data which trains the algorithm and results an optimal hyper plane as output to categorize new examples.



2.1.1 SVM Kernels

Kernel is used for implementing SVM algorithm. Using kernel trick, the kernel transforms low-dimensional input space to high dimensional input space or converting non-separable problem to separable problem by adding up more dimensions. This trick helps in building accurate classifier. The study of hyper plane in linear SVM is done by transforming the problem using linear algebra, using the inner product of any two given observations. To predict new input dot product is calculated between the input (x) and each support vector (x_i) as below

$$f(x) = B(\theta) + \text{sum}(a_i * (x, x_i))$$

SVM kernels are classified into three types: Linear kernel, Polynomial kernel, Radial Basis Function Kernel.

2.2 Decision Tree

This algorithm is non- parametric supervised learning method that performs both classification and regression techniques. The main goal of decision tree is to develop a model which predicts target variable by learning simple decision rules hypothesize from data features. There are multiple algorithms to develop a decision tree model and can be used to solve the problem characteristics. In which some of them are ID3, C4.5, CART, CHAID, MARS, conditional inference trees, etc. we can classify decision trees into categorical and continuous decision trees based on the target variable categorical or continuous. The major challenge encountered in decision tree is identifying attribute for root node in every level. This process of identifying the attributes is known as attribute selection. The attribute selection methods **Information gain** and **Gini index** are used to select the attributes in the dataset.

- a. **Information gain:** The measure of change in entropy is information gain. Assume S be set of instances, A is attribute, S_v is the subset of S where $A = v$, and values(A) be the set of all possible values of A then

$$\text{Gain}(S, A) = \text{Entropy}(S) - \sum_{v \in \text{values}(A)} \frac{|S_v|}{|S|}$$

Entropy: It measures the impurity in set of instances

$$\text{Entropy} = -p_+ \log_2 p_+ - p_- \log_2 p_-$$

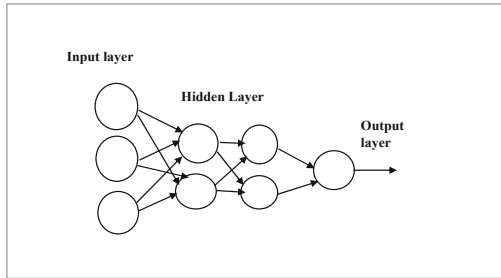
Here, P_+ - Proportion of positive examples in S, P_- - Proportion of negative examples in S

- b. **Gini Index:** It is a measure which checks the frequency of randomly chosen element identified incorrectly. Lower the Gini index of an attribute higher the priority of attribute selection. The formula for calculating Gini index is given as below

$$\text{GiniIndex} = 1 - \sum_j P_j^2$$

2.3 Neural Networks

The term neural networks have been evolved from the functioning of human brain which is adopted from the simplified models of biological neural network. It is a subset of algorithms in the field of machine learning built around a model of artificial neurons across three or more layers. In neural networks basic functional and computational unit is node. Nodes are interconnected in layers and forms interconnected network to provide output.



Basic element in neural network is node which have three components: weight, bias and activation function. weight of a node is defined as the signals received from input then it is multiplied and added up in the node. Bias is the constant attached to neurons and added to the weighted input before the activation function is applied. Activation function lies inside the layers of neural networks and modifies the data they receive before passing it to the next layer.

Neural Network algorithm is used for both classification and regression techniques [7–12]. They identify non-linear patterns, no direct or one-to-one relation among input and output then neural network identifies patterns in input and output combinations. These are mostly used in pattern recognition applications because of their ability to respond to unexpected input patterns and generate related output patterns.

Architecture of Neural network has three layers: input layer, hidden layer, output layer.

Input layer: This layer receives input information of the neural network from external environment. The inputs are normalized within the limit values by using the activation function.

Hidden layer: In this layer we have neurons which are responsible for extracting patterns associated with the process being analysed. In this layer most of the internal processing from a network is performed.

Output layer: This layer also consists of neurons, produces the final network outputs which are processed by the neurons in the previous layers.

There are different types of neural network models in which most commonly used are back propagation, radial basis function, feed forward, feedback, convolutional, recurrent, and modular neural networks, etc.

2.4 Regression

Regression technique initially originated from statistics but in the context of data science it is mostly used for prediction and forecasting. This technique models and analyses correlation between variables and predicts the output variables that are continuous based on the training data. This predictive modelling technique mainly looks into the relationship between dependent and independent variables. Regression algorithms are mainly trained to predict real numbered outputs. Regression depends on hypothesis which may be linear, non-linear, quadratic and polynomial. The hypothesis function depends on input variables and hidden parameters, after training the hypothesis parameters they predict the output variables for new input variables.

3 Steel, It's Types, Grades and Mechanical Properties

Steel has vital impact in our daily life. Steel is used in our houses for household purposes, in construction of buildings, manufacturing cars, electricity tower lines, steel pipelines, different tools like hammer, knife etc., rail-roads and compartments of train and so on. Steel is an alloy which is a mixture of several metals in which most of the part is iron. Steels are iron alloys with 0.002% to 2% of carbon. It may also contain some other elements like manganese, phosphorus, sulphur, silicon, copper, Nickel. The chemical compositions of all these elements differ based on the type of the steel.

3.1 Types of Steels

The steels are grouped according to their chemical composition and some physical and mechanical properties. The 4 most important and widely used steels are

- i. Carbon steels
- ii. Stainless steels
- iii. Tool steels
- iv. Alloy steels

Carbon Steels: These steels mainly compose of iron, carbon and also contains some alloying elements such as manganese, silicon and copper. Appearance of carbon steels is dull and matte and they are vulnerable in nature. The carbon steels are 3 types:

- **Low carbon:** The carbon content in this steel is 0.04% to 0.3% which is called as mild steel, a low-cost material and easy to shape.
- **Medium carbon:** The carbon content in this steel is 0.31% to 0.6%. It is ductile and robust with long-wearing properties.
- **High carbon:** The carbon content in this steel is 0.61 to 1.5%. It is hard to cut, weld, and bend but when it is heat treated it will become extremely hard and brittle.

Stainless Steels: Stainless steels contain alloying elements such as chromium, nickel and molybdenum other than carbon. Stainless steels are very strong and can withstand to elevated temperatures. The main alloying element in stainless steel is chromium so stainless steel is corrosion resistant when compared to carbon steels and alloy steels.

Stainless steels are mostly used in all products like home appliances, hardware instruments, medical instruments, etc. Based on the crystalline structure of stainless steels they are classified into 4 types:

- i. Austenitic steels
- ii. Ferritic steels
- iii. Martensitic steels
- iv. Duplex
- v. Precipitation hardening

Tool Steels: They are called as tool steels as they are used to manufacture metal tools like stamping tools, cutting tools. Tool steels consists of tungsten, molybdenum, cobalt and vanadium in differing amounts to increase heat resistance and durability. The carbon content in the tool steels are between 0.5% to 1.5%. There six types of tool steels: cold-work, hot-work, water-hardening, shock-resistant, special purpose and high-speed steels.

Alloy Steels: Alloy steels composes alloying elements such as nickel, copper, aluminium, manganese, titanium, chromium excluding carbon. The presence of alloying elements in varying compositions can manipulate the properties of steel such as brittleness, toughness, hardness, corrosion resistance, strength formability. These steels are used for different application purposes such as pipelines, electric motors, power generators, transformers, car parts, etc.

3.2 Steel Grades

World steel Association has declared over 3,500 different grades of steels. Steel grades distinguish different types of steels based on their unique physical, chemical and mechanical properties of steels. The most commonly used steels are classified into grades by national and international standards. Engineers, researchers, manufacturers, etc. rely on these standards to use steel in their applications. There are many number of organizations which classified steel into different grades. The most commonly used standards are:

- SAE steel grades
- British standards
- International Organization of Standardization ISO
- Germany steel grades
- European standards
- Japanese steel grades
- China steel grades, etc.

A significant observation is that we have all the types of steels like carbon steels, stainless steels, alloys steels, and tool steels present in all types of grades but the only difference comes in their steel numbers.

Example: In SAE grade the steel number for stainless steel are given as 304, 304L, 305, 316. In British standards it is given as EN25, EN 27 and EN 39.

3.3 Mechanical Properties of Steel

The mechanical properties of steels play an important role in selection of steel for a particular application. Below are some of the mechanical properties of steels.

- Tensile strength
- Yield strength
- Elongation
- Hardness
- Toughness
- Ductility
- Flexibility
- Density
- Modulus of elasticity
- Thermal expansion
- Thermal conductivity
- Electric resistivity

In which Tensile strength and yield strength are the properties taken mostly into consideration.

Tensile Strength: Tensile strength is defined as the capacity of a material to resist the maximum stress applied on it.

Yield Strength: Yield strength is defined as the utmost stress a material holds without persistent distortion. It is the stress at which a specific amount of deformation is produced in metal.

4 Literature Study

[1] In this paper single and multilayer feed forward back propagation models are used to predict the reduced mechanical properties in metallic materials due to the presence of hydrogen based upon their composition of elements. To train and validate the models 40 readings were collected which are the properties of different aluminium alloys before and after the effect of hydrogen at varying strain rates, temperatures and current densities. The inputs for the model are different alloying elements like aluminium, copper, magnesium, manganese, iron, lithium, zirconium and zinc and processing parameters like strain rate, time, current density and temperature. The model predicts the mechanical properties like tensile strength, yield strength, elongation percentage as output. Initially all the collected data is normalized in the range of 0–1. The equation used to normalize the data readings are

$$N_v = \frac{2 \times (N_i - N_{\min})}{(N_{\max} - N_{\min})}$$

N_V Represents normalized value, N_i is the value which is to be normalized, N_{max} is the maximum value in the dataset N_{min} is the minimum value in the dataset. The back-propagation method is a gradient descent technique in which the training rule employed is Levenberg-marquardt known as trainlm in MATLAB, the tan sigmoid activation function is used for the hidden layers and purelin for the neurons of the output layer. Here, Model1 is for predicting the mechanical properties tensile strength and yield strength, Model2 is for predicting percent elongation. The performance of the model is assessed by calculating Mean square error (MSE). The performance of the model is assessed by plotting scatter diagram and computing Mean Absolute Error (MAE). The R value of ANN model1 and model2 to predict tensile strength, yield strength and elongation percentage is 0.99.

[2] The major objective of this paper is to predict tensile stress, yield strength, strain hardening, percent elongation and stress coefficient for ASS 304 steel. Experimental results collected from tensile tests performed in super plastic forming region by using ELECTRA 50, a universal tensile testing machine at varying temperatures i.e. 0 to 900°, and varying strain rates like 0.01 s⁻¹, 0.001 s⁻¹, 0.0001 s⁻¹ is used to train and validate the ANN model. The inputs to the model are rolling direction, temperature and strain rate. A total of 360 experimental values are gathered for training and validating ANN model. In this data 90% data i.e. 324 values are used as training data and for testing data 10% i.e. 36 values are used. The correlation coefficient of the model is 0.9339.

[3] In this paper the mechanical property micro hardness of six different types of stainless steel is predicted using artificial neural network. In the developed back propagation neural network model, the input layer consists of one input neuron i.e. distance from the ground surface and six neurons in output layer i.e. micro hardness value for six different types of stainless steels. There are four hidden layers in this model in which 2 neurons in first layer, 3 neurons in the second layer, 4 neurons in third layer, 5 neurons in fourth layer. The experimental data is initially normalized in MS excel in steps of 0.03. A total of 36 samples were collected by experimentation. Out of 36 samples 26 samples were used for training the model and the left over ten samples are used to validate the model. The model consists of total 6 layers including input, output and hidden layers with learning parameter $\mu = \lambda = 0.2$ and error of 0.16. The correlation (R value) for this model is 0.99.

[4] The proposed method in this paper predicts the mechanical properties tensile strength, yield strength, elongation percentage, strain hardening, and strength coefficients of 304L and 316L grades Austenitic stainless steel. Here the composition of the steel is kept constant and will be testing the steel with different temperatures and strain rates to know their mechanical properties. For this purpose, the experimental data is considered by performing uniaxial isothermal tensile tests at an interval of 50°C–650°C and at varying strain rates 0.0001 s⁻¹, 0.001 s⁻¹, and 0.01 s⁻¹, 39 experiments with 13 different temperatures and 3 strain rates are conducted on 304L and 316L. The mechanical properties are predicted at any temperatures and strain rates using a feed forward back propagation ANN models, where temperature and strain rate are considered as the input to the model and predicts the mechanical properties.

Initially the input values are normalized from 0.05 to 0.95 using the below equation.

$$X_n = 0.05 + 0.9 * \frac{x - x_{min}}{x_{max} - x_{min}}$$

Here x_{min} is the minimum value in the input(x), x_{max} is maximum value in the input (x), x_n represents normalized data of input (x). After the network is trained the input data goes back to its actual values utilizing the below equation

$$x = x_{min} + (x_n - 0.05) * (x_{max} - x_{min}) / 0.9$$

The data of experimental results is splitted into training and testing data. In which 85% of data is given for training the ANN and the training function used is Levenberg-marquardt and the left over 15% data is used for testing the ANN. The ANN network used in this paper is implemented in MATLAB 2012 version. In the ANN architecture for 304L the initial input layer composes 2 neurons, the middle layer composes 6 neurons, and the final output layer composes 5 neurons. For 316L the input layer is built with 2 neurons, middle layer is built with 17 neurons and the output layer is built with 5 neurons. The recommended ANN model in this paper is validated using coefficient of correlation, standard deviation and average absolute error. In this model to evaluate the accuracy coefficient of correlation, average absolute error and standard deviance are calculated between experimental and predicted values. The coefficient of correlation for the developed model is 0.94 except for strain hardening component (n). The correlation coefficient is above 0.95 for Ass 316L except for strain hardening component (n). The average absolute error values for Ass 304L, 316L are less than 7.5% and 2.82%. Standard deviation for Ass 304L, 316L are below 9.23% and 6.9%. t-test, f-test, levne's test are performed using Minitab v16 software. The p-values for the mean paired t-test is above 0.05.

[5] The model implemented in this paper predicts mechanical properties of a low carbon steel using radial basis function and back propagation model. The developed model predicts hardness of low carbon steel and the relation between the chemical composition and mechanical property of the steel. The normalized values of alloy elements C, Si, P, S, Cu, Cr, V, Mn, N, Sn, Ni, Sc, Mo, Al. are given as input, hardness value of the steel is predicted based on the alloy elements. The data considered for the model is 70 which is categorized into three subsets. In which the training set consists fifty percent of total data used for modifying neuron weights. The validation set comprises one fourth of the total data for validating prediction errors by training process. The rest over data is testing set to test the trained network. The quality of the model is given by using standard deviation ratio, Pearson correlation and average absolute error. For RBF network the correlation coefficient is 0.987, max error is 1.505, min error is -2.5368 and standard estimation of error is 1.087. For back propagation network the correlation coefficient is 0.9712, max error is 1.60, min error is -2.94, and standard estimation of error is 1.099.

[6] The implemented model in this paper predicts tensile strength of steel using FCM clustering based on rough sets. A total of 63 objects are considered for training

and testing the model. Initially there are 13 attributes (C, Cr, Mn, Si, Ni, P, S, tapping temperature, temperature before and after fine rolling, roller way speed, opening degree of air damper, spinning temperature) for each object. Further attribute reduction carried out by using john's algorithm and only three attributes C, Cr, P are considered. The total set of 63 objects is divided into 40 objects for training and 23 objects for testing. Here we consider two models, model1 with all attributes i.e. 13 neurons as input and model2 with only reduced attributes i.e. 3 neurons as input. The accuracy of model2 is higher than model1. The average relative error for model1 is 4.51% and model2 is 1.62%, the computation time for model1 is 15.6 s and for model2 is 2.52 s.

5 Proposed System

The practitioners of the advancing materials science and engineering have standardly depended on the observations made from conventional tests and physics-based models to know the properties of steel. The most widely used technique to know the mechanical properties like tensile strength and yield point is by using universal Tensile Testing machine (UTM). But it is always complex to conduct the experiments and find out the mechanical properties of steel all the time. Literature survey emphasises that several data science techniques like artificial neural network, clustering, regression can achieve significant results in predicting the mechanical properties of steels or any metals by using various parameters like composition, temperature, stress and strain rates, distance from the ground surface, etc. The main objective of this paper is to propose a method which predicts the mechanical properties like Tensile strength and Yield point of British standard stainless steels considering low and medium carbon using the carbon content, temperature, manufacturing process and size of test piece of the steel. The aim is to propose a method to make a comparative study of different data science algorithms and find out the accurate algorithm for predicting the mechanical properties of steel. Unlike from the literature survey where only one algorithm is trained for steel properties prediction, the focus maybe shifted to different data science algorithms to be developed in python and R language to predict the mechanical properties of steel. The accuracy between the actual and predicted values of various classification and regression models will be evaluated by using different metrics like correlation coefficient (R), explained variance (R^2), Root Mean Square Error (RMSE). Predictive performances will be evaluated by using confusion matrix, gain and lift charts, F-measure, cross validation, Gini coefficient, etc. The future objective is to propose a method where the data science algorithms can accurately predict the mechanical properties of steel will be incorporated into user-friendly GUI to execute as a predicting tool for steel mechanical properties.

6 Conclusion

Data science and analytics will definitely effect the current material sciences by maximizing the accuracy and reliability in predicting the material properties with the help of large ensemble of datasets from different material databases and by using

different data science techniques. The user-friendly GUI incorporated with different data science techniques proposed as part of future work, once developed may yield better results in different applications like manufacturing industries, construction fields etc. The proposed idea will be a break through to the conventional approach of conducting experiments like tensile tests using Universal Tensile Test machine (UTM) to find out the mechanical properties of steel. This paper also aims to help the research society by presenting all the consolidated findings summarised from the deep literature study of various papers and proposed to develop a predictive tool as the future work.

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Image Steganography Using Random Image

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Abstract. Now-a-days every person depends on computer and Internet. Security is one of the major problem in public communication systems, the information may be accessed by third parties during the transmission of data through a network. Network security is not sufficient, and cybercrime is also increasing. It is possible to provide more security to data with the combination of cryptography and steganography. Cryptography is basically secret writing and steganography is the method hiding data in an object. Cryptography and steganography both methods can be used for preventing, and protecting data from different types of attacks. In the existing system data bits are encrypted and then embedded into cover image using, it results degradation of cover image. The degradation and security of hidden data are the drawbacks. To overcome these drawbacks, a new technique is proposed using random image. Initially text is converted to an image, and it is embedded into a random cover image. The proposed method may provide more security with the help of random image. It is not easy to perform the steg analysis on random image. Performance measures such as MSE, PSNR are showing good results when compared with the existing method.

Keywords: Cryptography · Network · Random image · Steganography · Steg analysis

1 Introduction

Cryptography is the study and practice of encrypt and decrypt data using mathematical concepts. Cryptography methods ensure to store and/or transfer the data across insecure networks, so that no other person or machine cannot read the data except the intended receiver. Cryptanalysis is the method of analysing the secure data communication. Traditional cryptanalysis is having any combinations of Analytical reasoning, pattern finding, and usage of mathematical tools, tolerance, and determination. Attackers are also called as cryptanalysts [1]. The data which is easy to read and understand without any additional things is called the plaintext, it is also called as the original data. Encryption is the process which converts the plaintext into different form. Ciphertext is the result of encryption, which is unreadable gabble text. Encryption ensures that data is hidden from all others who are not intended. Decryption converts the ciphertext into its original form, it is the reverse of encryption. Figure 1 illustrates this process.

N. Subramanyan—Academic Consultant

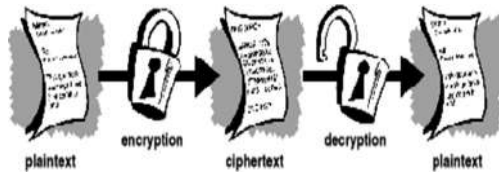


Fig. 1. Conventional cryptography

Encryption or decryption is requires the cryptographic algorithm for implementation. It is a mathematical function or problem, it works with a key combination, the key may be anything like a word, phrase, or number used for encrypting the plaintext. With a different key the same plaintext encrypts to different ciphertext. The strength of the key and strength of the cryptographic algorithm are the two main things, the security of encryption and decryption depends on these two things. If only one key is being used for both encryption and decryption, it is called conventional cryptography, symmetric-key cryptography or secret-key cryptography are the other names. The Data Encryption Standard (DES) is a widely used cryptosystem is an example of conventional cryptosystem. Figure 2 is an illustration of the conventional encryption process [1].

If pair of keys used for both encryption and decryption it is called a public key cryptography. It is an asymmetric system, it is shown Fig. 3. With a public key, encryption is performed, a corresponding secrete key or private key used for decryption. Distributions of key problems are solved by the public key cryptography. By keeping private key secrete, public key can be given to anyone. Anyone with a public key can encrypt the data, but cannot decrypt the data, only the person with a corresponding private key can decrypt the data. It is computationally not possible to retrieve the private key from the public key. RSA, Diffie-Hellman and DSA are some examples of public key cryptosystems.

1.1 Image Processing

Image processing is a technique to convert a raw image into digital image and to perform some operations on image, to enhance image quality or to extract some useful information from the image. It is similar to signal processing, here image is the input, and output may be features or characteristics associated with that image [2].

Image processing in one of the rapid growing technologies today, covering the applications in various aspects of business to scientific research areas. An image is a two dimensional signal defined by $f(x, y)$, where x and y are the two coordinates of the spatial plane horizontally and vertically, and the amplitude value at any pair of coordinates (x, y) is called the intensity of the image at that level.

If x, y and intensity values of f are discrete and finite quantities, then we call the image as a digital image. A digital image is composed of finite number of pixel elements. The value of $f(x, y)$ at any given point is called the pixel value. The three basic phases of image processing are pre-processing, enhancement, and display or information extraction. The set of operations which enhances the image data by reducing the unwanted distortions or noise on image are performed at the lowest level

of abstraction is commonly called the pre-processing. In pre-processing both input and output are intensity images. Pre-processing [2] preserves or enhances the features of the image for further analysis.

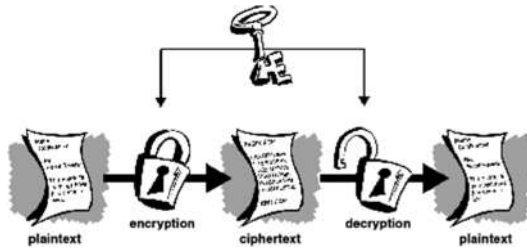


Fig. 2. Conventional encryption

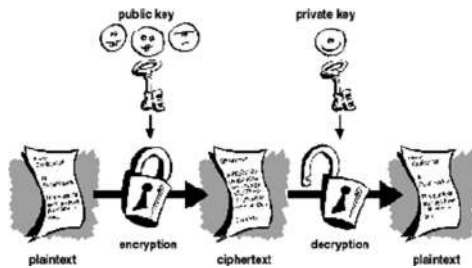


Fig. 3. Public key encryption

1.2 Steganography

Data can be hidden within data using Steganography technique. Steganography can be used along with cryptography as an additional security to protect data. Image, video file or an audio file can be taken for steganography for hiding data.

2 Existing Method

In the existing method [3], bits of message are hidden in least significant bits (LSBs) of RGB color channels of 24-bit color image. Two rounds of operations are performed in this existing method.

In round 1 first, each plaintext character is converted into ASCII code. Find the length of plain text. Generate a 3 digit random number, using folding technique generate a single digit key. Generate ciphertext by performing XOR operation between key and ASCII values of plaintext.

In round 2, Split the selected color cover image into RGB color channels. For each ciphertext character, first two bits of ciphertext are embedded in R channel using modified LSB substitution and XOR operation with cover image bits. Next, two bits

will be embedded in G channel using raster scan method and XOR operation with cover image bits. The remaining four bits will be embedded in B channel using raster scan method and XOR operation with cover image bits. The stego image is generated by combining the RGB color channels after embedding process.

Embedding and cover image size are the two limitations. Embedding depends on the size of the cover image, if data is more; cover image size needs to be increased.

3 Proposed Method

In the proposed method, random image is used to hide the secret message. Since, in the Random image [4, 5] pixels are not arranged sequentially. So it is very difficult to identify the information easily. Data will be converted into Gray scale image. Gray scale image will be embedded in the Random image. Three components required for image steganography [5] are, cover image, secret message and stego image.

Cover image: It is the image in which the secret messages are going to be hide.

Secret message: The message which is to hide in cover image is called secrete message. It can be anything such as image, text message.

Stego image: It is the image, generated after embedding the secret message in it.

The stego image is transmitted to the receiver, at the receiver side decryption is initiated on stego image to retrieve the embedded hidden message from it. Figure 4 illustrates the overview of image steganography.



Fig. 4. Steganography overview.

For embedding grayscale image into random image [5] [6], two pixels of cover image and one pixel of source image is considered.

Pixels of cover image		Pixel of source image	
1011 <u>1100</u>	0111 <u>1100</u>	0011	0001
L1	L2	HOB	LOB

L1 of cover image pixel is replaced with higher order bits and L2 is replaced with lower order bits of source image. After replacing the final output is shown below.

10110011 01110001

3.1 Encryption Algorithm

1. Read a text file containing plaintext. Generate a grayscale image of size $(r + 1) \times (r + 1)$. Where r is the square root of length of text file.
2. ASCII values of each characters of text file are taken as pixel values of grayscale image.
3. Generate a RGB random image with the size $(r + 1) \times (r + 1)$.
4. Final stego image is generated by embedding the lower nibble and higher nibble of each grayscale image pixel into random RGB image color components.

3.2 Decryption Algorithm

1. Read the RGB color stego image.
2. Split the color image into RGB channels.
3. Extract the lower nibble and higher nibble of each grayscale image pixel from the red, green and blue channels.
4. Concatenate the lower and higher nibbles and create a grayscale image.
5. Obtain the plaintext by finding the ASCII codes for pixel values of grayscale image.

3.3 Illustrative Example

Encryption begins with the input text file let the file sample.txt of size 8250 bytes, the grayscale image of size 91×91 is generated for the given text as shown in Fig. 5(a). RGB random image of size 91×91 is shown in Fig. 5(b). After embedding the grayscale image into random image, the final stego image is shown in Fig. 5(c). In decryption, the stego image of Fig. 6(a) is taken as input for decryption. After extracting the embedded nibbles from the red, green and blue channels, the generated grayscale image of size 91×91 is shown in Fig. 6(b). After converting the pixel values of grayscale image into to ASCII codes, the plaintext file of size 8250 bytes is generated. The proposed method has following advantages, secrete data is converted into image, correct size of cover image is estimated based on the data to be hidden and degradation of image after encryption is not identifiable.

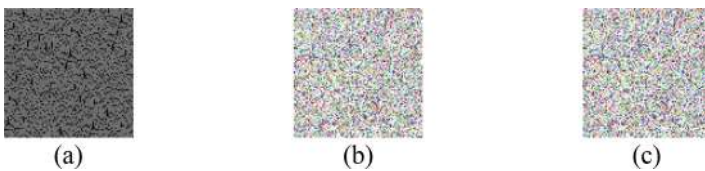


Fig. 5. (a) Grayscale image of size 91×91 . (b) RGB random image of size 91×91 (c) Stego image after embedding the grayscale image

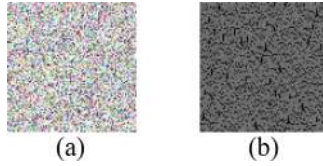


Fig. 6. (a) The stego image. (b) Grayscale image of size 91×91

4 Result Analysis

There are three standard parameters peak signal to noise ratio(PSNR), mean square error(MSE), and correlation used for evaluating the performance of image compression methods [7, 8]. PSNR and MSE are error metrics. Used to compare original image with compressed image. For measuring the level of security in encrypted information the entropy parameter is used. The quantitative as well as qualitative analysis shown in tables. Generally, three parameters are used for evaluating the steganography techniques are hiding capacity, distortion and security. Two ways are used to represent hiding capacity using bit rate and maximum hiding capacity. Number of bits that can be hidden in cover image pixel is called the bit rate, is also represented as bits per pixel (bpp). Maximum possible amount of data embed in cover image is called the maximum hiding capacity. Data in stego image is imperceptible. After hiding data in cover image, one cannot identify any distortion in them. MSE, RMSE and PSNR are parameters used to measure the distortions in the image. Complexity of steganography method may also considered as a fourth parameter. Mean square error [8] is the accumulative square error between the cover image and the stego image. Peak Signal to Noise Ratio is used to measure the peak error. Peak Signal to Noise Ratio is the ratio of power of a signal and power of a noise that affects the fidelity of its representation. Logarithmic decibel scale is a measure used for PSNR [8]. Comparison of MSE and PSNR is shown in Fig. 7 and Tables 1 and 2.

$$MSE = \frac{1}{MN} \sum_{y=1}^M \sum_{x=1}^N [I(x, y) - I'(x, y)]^2 \quad (1)$$

$$RMSE = \sqrt{\frac{1}{MN} \sum_{y=1}^M \sum_{x=1}^N [I(x, y) - I'(x, y)]^2} = \sqrt{MSE}. \quad (2)$$

$$PSNR = 20 * \log_{10} (255 / \sqrt{MSE}) \quad (3)$$

The results shown in Tables 1 and 2 and bar graphs of Fig. 7 shows MSE and PSNR for proposed method has better values than that of the existing method.

Table 1. Mean square error

Image details (PNG images)	Embedded image size (in KB)	MSE	
		Existing method	Proposed method
Random1	1	21294	10480
Random2	5	21255	11073
Random3	10	21335	11136
Random4	15	21281	10911
Random5	20	21253	11010

Table 2. Peak signal-to-noise ratio

Image details (PNG images)	Embedded image size (in KB)	PSNR (in db)	
		Existing technique	Proposed technique
Random1	1	4.8481	7.9270
Random2	5	4.8560	7.6878
Random3	10	4.8397	7.6631
Random4	15	4.8508	7.7519
Random5	20	4.8564	7.7129

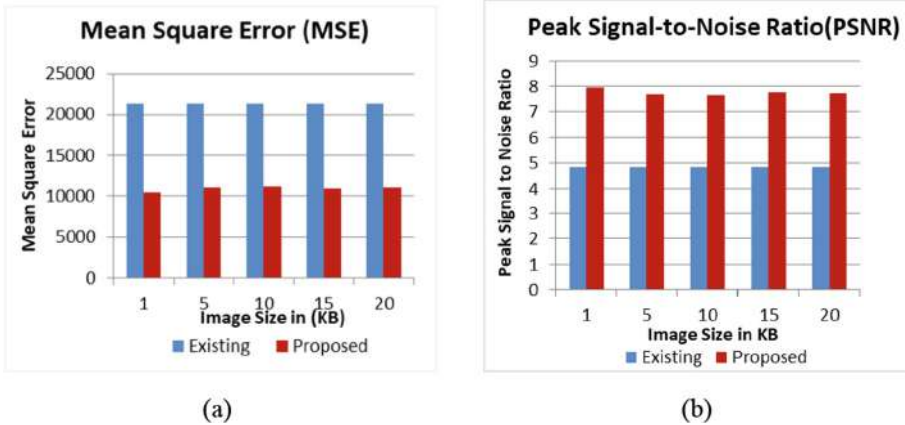


Fig. 7. (a) Histogram of MSE for existing and proposed method. (b) Histogram of PSNR for existing and proposed method.

5 Conclusion and Future Scope

Reliable secure communication is needed now-a-days, to provide secure communication. Many techniques are available in cryptography. Steganography is one of the method to provide security, the existing algorithm is a combination of cryptography and steganography, size of cover image limits the amount of data embedded. In the proposed method a new replica of cryptography and steganography is presented using

random images. First the secret data is converted into image, then it is embedded into the random cover image. Proposed method ensures more security to the data, since the data is embedded into random image. It is very difficult to perform the steg analysis on random image. Further, the work can be extended to embed text and images into audio and video files.

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Method Level Code Smells: Chernoff Face Visualization

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Abstract. Software that is badly written and prone to design problems often smells. Code smells results in design anomalies that make software hard to understand and maintain. Several tools and techniques available in literature helps in detection of code smells. But the severity of the smells in the code is often not known immediately as it lacks visualization. In this paper, two method level code smells namely long method and feature envy are visualized using chernoff faces. Techniques proposed in literature either use knowledge driven approach or data driven approach for code smell detection. In the proposed approach a fusion of both knowledge and data driven approach is used to identify the most relevant features. These most relevant features are mapped to the 15 desired features of chernoff faces to visualize the behavior of the code. The result shows that almost 95% of the smells are visualized correctly. This helps in analyzing the programmer's capability in maintaining quality of source code.

Keywords: Code smell · Refactoring · Long method · Feature envy · Chernoff faces

1 Introduction

One of the essential elements of the agile based approaches is refactoring. It is one of the extreme programming principles, which helps in modifying the existing source code without affecting its behavior. Refactoring is used to improve the design of existing code [10]. Refactoring is possible on the working source code with test cases in place. Refactoring of a code is needed whenever a design anomaly is detected in the existing source code. These anomalies will hinder the maintenance process. Hence there is a need to detect these smells. Once the smell is detected it can be refactored to ensure that the source code follows proper design principles.

There exists several tools and techniques to refactor the source code and to detect the code smells [8]. As there is no formal definition of code smells, each tool uses its own approach to detect the same. Further because of the pressure of rapid application development, the process of smell detection is often ignored as it is time consuming activity to make use of third party tools to detect the same. Hence there is a need for a better way to know the anomalies in the source code.

In this paper two method level code smells are considered and mapped to the facial expression using chernoff faces. The facial features represents the existence or

non-existence of the smells in the source code. Visualization of bad quality code is a difficult task in real time systems development. As “face is the index of mind”, it is a fact that the facial representation of code features will clearly indicate its design anomalies. The visualization can help in quickly detecting the severity of particular smell so that it can be refactored quickly. Each new version of the source code may represent different faces. This will also help in visualizing the type of changes made to the source code from one version to another. The data set is arrived based on project metrics as features which include package, class and method metrics. Tirupathi et al. [3], gave the ranking of most relevant features based on gain ratio for long method and feature envy code smells. The priority of these features is rearranged based on the rules to detect the same features available in literature [4]. A total of 15 features are used to plot the faces representing the smells in the method. The results shows that more than 95% of the method level smells were represented correctly using chernoff faces.

The remaining part of this paper is organized as follows: Section 2 specifies the background of need of chernoff faces in visualization and state of art of detection of smells, Sect. 3 describes long and feature envy methods and also highlights the metrics and rules available in detecting the smells. It also specifies the proposed methodology used in visualization of faces. Section 4 specifies the results and Sect. 5 concludes the paper.

2 Related Work

The mechanism of rapid application development and peer competition results in development of code which is difficult to understand and maintain. Such source code element is said to be smelly. Code smell detection techniques are classified into seven categories [9]. This includes probabilistic approaches, metrics based approaches, manual approaches, search based approaches, symptom based approaches, cooperative based approaches and visualization based approaches. Some of the tools like JDeodorant uses code smell visualization but this visualization is done inside the program by highlighting the lines of code which are candidates of smelly method or a class. Further the visualization based approaches requires human intervention as it is a semi-automated process. Metric based approaches uses several code level metrics for the identification of smells. The search based approaches uses several machine learning algorithms to detect the smells.

Fontana et al. [4] proposed metrics based smell detection strategies that classify the smelly code based on certain threshold limits for benchmark of 74 java systems. Later several classification algorithms were applied to detect four smells.

Herman invented chernoff faces to represent multivariate data using human face. The parts of faces such as mouth, nose eyes and ears can represent values of certain attributes [1]. The motivation to map such features to faces is that the visualization can help in even identifying minor changes to the faces. However the attributes that are mapped to the facial features has to be carefully selected. Further utmost 18 attributes can be mapped to facial features.

As per the ancient Chinese art of face reading, no face lacks expressions. The deepest and the hidden characteristics can be quickly revealed by mapping the same to

the facial features. Hai Lee [2] presents the ten basic face patterns and also provides mechanisms to map the characteristics to the face features.

One of the major issues with smell detection is the proper visualization of the anomalies in the existing code. This is possible by mapping the features of a method or a class to facial characteristics. This helps in proper visualization of the smell. In the proposed approach the most relevant characteristics are computed and arranged to map it to facial features for better visualization of the smells.

3 Visualization of Long Method and Feature Envy Smells

Refactoring is needed whenever a smell is detected in working software. Long method and feature envy are method levels smells which are either identified by using knowledge driven or data driven approach. In this paper, fusion of knowledge driven and data driven strategy is adopted to identify most relevant features (metrics) to detect the smell, which are then mapped to the facial features for quick visualization smelly code. Later the smelly elements can be refactored to resolve certain design anomalies.

3.1 Long Method and Feature Envy

A method which contains many lines of codes is referred to as long method. A long method is often difficult to maintain, understand and is often complex. It can be refactored by shifting some lines of code into a new method. This is possible by invoking an Extract method.

A method is prone to feature envy smell if it is tightly coupled to other classes than its own elements. The elements of source code which change at the same time has to be kept at one place. Any method which is prone to feature envy has to be refactored by using Move method to move the part of the method to the class to which it is coupled. If the affected method uses functions of several classes then the method is moved to the class whose functions are majorly used (Extract method).

Tools uses different mechanisms to detect long method and feature envy smells. Each tool uses different thresholds to detect a code smell. Metrics of code element are computed and compared with the threshold to detect whether a code smells or not. The other mechanisms used to detect long method includes knowledge driven approaches that generates rules to detect whether a code smells. However these smells in a code segment is not known immediately as it is not visualized.

3.2 Indicators and Metrics Used

The object oriented metrics are classified into several categories including method, class, package and project level metrics. These metrics follows containment relation as method is present in a class, class is present in a package and package is a part of project. The following are few method level metrics which are used to detect the long method and feature envy smells [7].

- LOC (Lines of Code): This includes total number of lines of code in method including comments and blank spaces.
- CYCLO (Cyclomatic Complexity): This represents the number of linearly independent paths in a method
- MAXNESTING (Maximum Nesting): It represents the maximum nesting level of a control structure in a given method
- NOP (Number of Parameters): This represents the number of arguments in a method.
- NOAV (Number of Accessed Variables): It represents the number of identifiers which are access directly or accessed via accessor methods.
- NOLV (Number of Local Variables): Total number of variables that are accessed directly or via accessor methods including global variables.
- ATFD (Access to Foreign Data): Number of attributes of other class accessed directly or by invoking accessor methods.
- FDP (Foreign Data Providers): Total number of classes where the foreign data are defined, counting each class only once.
- CINT (Coupling Intensity): The number of distinct operations called by given method.
- LAA (Locality of Attribute Access): It is the ratio of number of attributes of methods class divided by total number of variables accessed.

In addition to the above metrics, other metrics are the candidates for identification of given method smell. For each source code element, metrics are evaluated to find the required conditional attributes. Several tools are used to identify whether the code smells or not. An approach is presented to identify the most relevant features using information gain [8]. Further the data driven approaches [5–7], specify certain rules for the identification long method and feature envy smells.

Long Method:

- $((LOC_method \geq 33) \& (CYCLO_method \geq 7) \& (MAXNESTING_method \geq 6) \& ((NOLV_method \geq 6) \mid (ATLD_method \geq 5)))$
- $((df.LOC_method \geq 33) \& ((NOP_method > 4) \mid (NOLV_method > 4)) \& (MAXNESTING_method > 4))$
- $((LOC_method > 65) \& (CYCLO_method \geq 0.24) \& (MAXNESTING_method \geq 5) \& (NOAV_method > 8))$

Feature envy:

- $FDP_method \leq 5 \& ATFD_method > 5 \& LAA_method < 0.33$
- $ATFD_method > 3 \& LAA_method < 0.33$

3.3 Chernoff Face Visualization of Method Level Smells

The methodology to visualize the method level smells is depicted in the Fig. 1.

Two code smells namely long method and feature envy are defined. Collection of heterogeneous systems are needed so that various method, class and project level metrics are evaluated for each system. These metrics constitute conditional attributes.

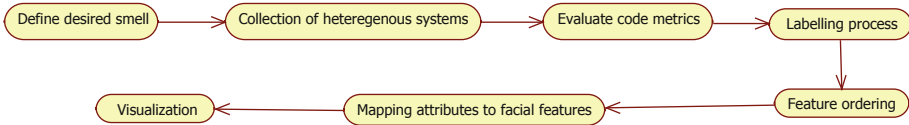


Fig. 1. Smell visualization workflow

In the labelling process, rules are derived to decide whether a code smells or not. Several tools are used to identify whether the source code element smells or not. Initially polling process is adopted to decide the label. Later the data set is validated by manual validation of labels (decision attributes) [3, 11].

In the feature ordering phase, the conditional attributes (metrics) are arranged to find the most relevant attributes for a particular smell. The ordering of features is the most important phase of the visualization. This is because these features are to be mapped to the chernoff faces for proper visualization. The most relevant features which are arranged based on decreasing order of information gain are again re-ordered using the data driven strategy i.e. the order is rearranged using the characteristics of the knowledge driven approach (rules) i.e. the metrics used in rules can be used to reorder the conditional attributes again. The resultant minimal 15 features are mapped to the facial features which are then visualized using chernoff faces. The characteristics of faces will help in visualization of the smells and its severity.

4 Results and Analysis

In the proposed paper 74 projects are initially proposed, which resulted in 4,19,995 objects that represents the methods of classes in the projects [4]. Stratified sampling is applied to obtain sample of 1900 objects. To balance data sets 1/3 of positive and 2/3 of negative instances data is considered. Each of these resultant data sets consists of 417 objects for long method and 420 instances feature envy respectively. 57 features (metrics) are initially computed for each object and the decision attributes specifies existence of the smell.

These most relevant features are initially computed using information gain [3]. There resultant order of the features is adjusted using the features used in rule generation of each smell. The fusing of knowledge and data driven strategy helps in selecting the best possible features.

These features are mapped to 15 facial features for visualization of the quality of the method developed. The simulation of the experiment is realized by providing these 15 features to faces () method in R. For long method and feature envy 837 methods are visualized to identify the correctness of smelly and non-smelly methods. The manual validation shows that almost 95% of the smells are visualized effectively.

Figure 2, specifies the visualization of smelly long method.

Few instances of smelly long method is specified in Fig. 2. The common features of the smelly long method is it includes horns, pointed caps and spread mouth. The Fig. 3, specifies the non-smelly long method.

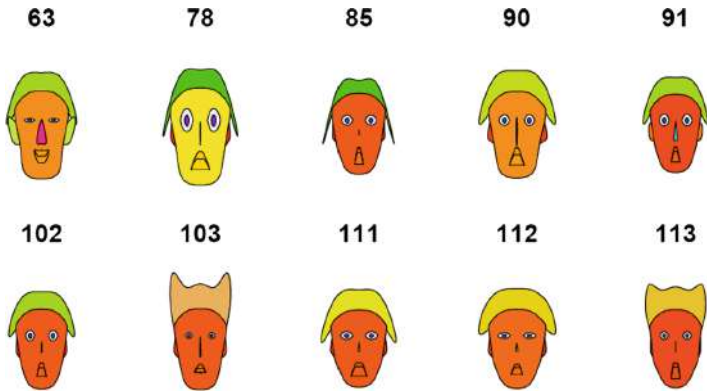


Fig. 2. Smelly long method

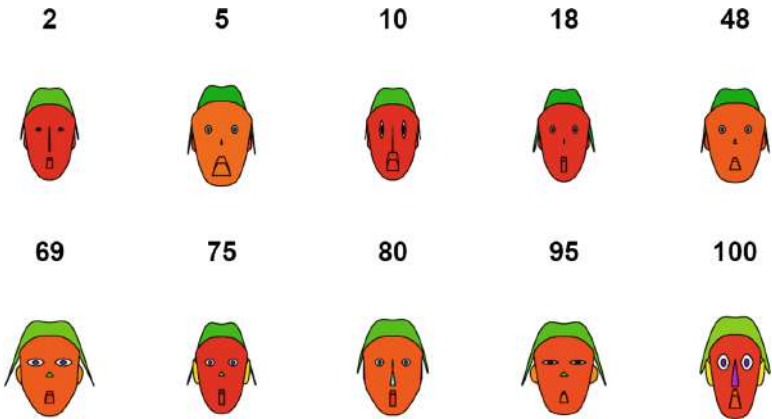


Fig. 3. Non-smelly long method

The common feature of the non-smelly long methods is the red color domination and it doesn't contain horns or the pointed caps. It is observed that 396 of smelly and non-smelly instances out of 417 instances were recognized correctly based on the respective facial features. Figure 4, specifies the visualization of feature envy smell and Fig. 5 specifies the non-smelly feature envy methods.

Few objects methods that are prone to feature envy smell are depicted in Fig. 4. It is observed that these smelly method visualization includes pointed nose and broad open mouth.

It is observed that 399 of smelly and non-smelly feature envy instances out of 420 instances were recognized correctly based on the respective facial features.

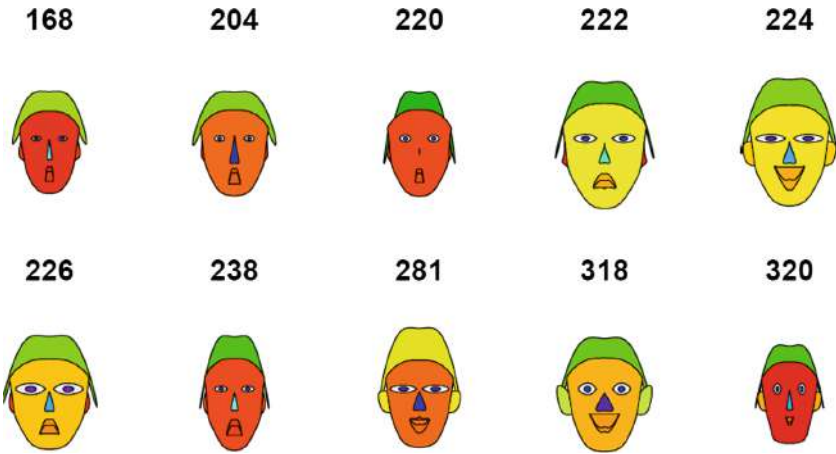


Fig. 4. Smelly Feature envy method

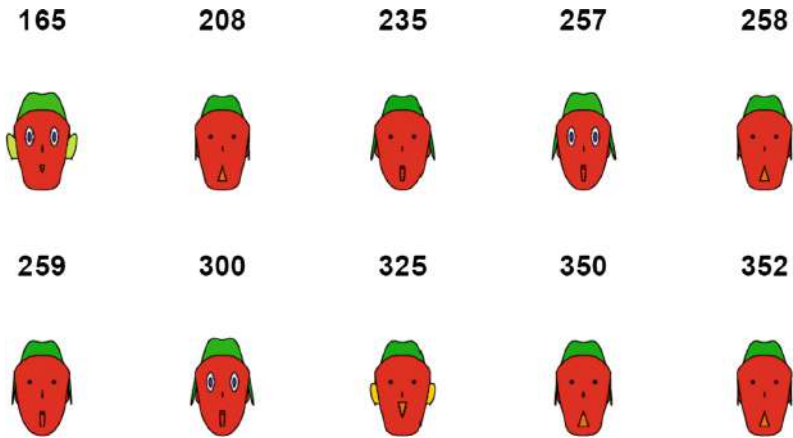


Fig. 5. Feature envy non smelly methods

5 Conclusion

Code smell detection is the important activity for the refactoring of the source code. The agile methods requires instant feedback about the design problems in the existing code. In this paper both knowledge and data driven strategy is used to identify the most relevant features that can be mapped to the facing features for visualization. It is observed that one can easily identify the smelly code by visualization. The visualization may also help in knowing the severity of design level anomalies in the source code. In future class level, package level, project level and other method level smells can be visualized and the video of such faces can help in knowing the capability of the programmer.

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Fingerprint Identification and Matching

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Abstract. Taking the fingerprints are thought to be the good and quickest strategy for Bio-metric recognizable proof. It can use in secure manner to utilize, remarkable in each individual but don't effect in through out the life. In Human-Beign the Fingerprints are very important in points of interest called details, which can be utilized as ID marks for security purposes. In this paper it is an investigation and execution of a unique finger impression acknowledgment utilizing picture preparing instrument in MATLAB. The approach predominantly includes extracting the details that focuses through test with different finger prints and after that performing coordinating in light of the quantity of details matching among two fingerprints being referred to. For each undertaking, some traditional and exceptional techniques in literary works are broke down. In view of the examination, a coordinated answer for unique finger impression acknowledgment is created for show. It at last creates a rate of points that it gives the correct information regarding the prints of fingers that it is matching or not.

Keywords: Edge detection · Minutiae · Fingerprint · Prewitt · MATLAB

1 Introduction

FINGERPRINT acknowledgment alludes to the computerized technique for checking a similarity with one another. These are the one among the numerous types of biometrical technique for distinguish human beign for identifying their behaviour. After certain time checking the similarity and consistency of finger prints it can be used in century, and late mechanized because of headway in registering capacities. Distinctive mark distinguishing testimonies is eminent in the scrutiny of inalienable truthfulness in protecting different figures taken from diffent places accessible in gathering and to set up utilize and accumulation to do authorization. Computerized picture preparing is a procedure of controlling pictures in an advanced PC. This preparing can be accomplished by improvement of a PC based calculation with a specific end goal to process these pictures. It is an innovation broadly utilized for computerized picture tasks like element extraction, design acknowledgment, division and morphology [1].

2 Fingerprint

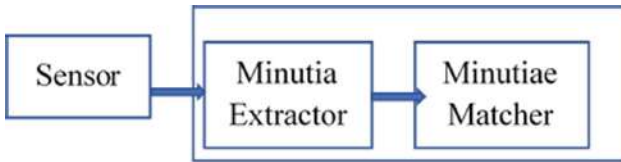
A biometric image of fingerprint is the component example of a human finger (Fig. 1). This is the engravings shaped by contact edges of the skin and thumbs. They have for some time been utilized for distinguishing proof due to their unchanging nature and distinction. Permanence alludes to the lasting and perpetual behaviour of the human fingerprints. Independence alludes to the uniqueness of edge subtle elements crosswise over people; the uniqueness of a finger impression can be controlled by the example of edges and wrinkles and also by highlights called particulars, which are some anomalous focuses on the edges (Fig. 1). In any case, appeared by concentrated research on unique mark acknowledgment, fingerprints are not recognized by their edges, but rather by the details focuses.



Fig. 1. A finger print picture captured from an optical sensor

3 Recognition of Fingerprint

The recognition of fingerprints is a technique, which is used for evaluating unknown fingerprint with well-known fingerprint for determining if, impressions are of same palm or finger. This technique follows with two types: first is verification of fingerprint and second is identification of fingerprints. The verification of fingerprints is conducted to check genuineness of an individual with his unique finger impression. Thus, the client furnishes his unique mark along with character data such as identification number. The unique finger impression confirmation framework recovers the unique finger impression layout as per identification number and then match the format by means of ongoing gained unique finger impression from the client. Generally it is the basic outline guideline of AFAS (Automatic Fingerprint Authentication System). Manual unique mark check is so dull, tedious and costly that is unequipped for meeting the present expanding execution necessities. A programmed Fingerprint recognizable proof framework is broadly received in numerous applications, for example, building or region security and ATM machines [1–3]. Likewise, it possibly averts unapproved permission to get to control frameworks, Systems based on attendance and time, shrewd cards, mobile phones, vehicles, computer systems, and workstations. The acknowledgment in biometric frameworks provides additional noteworthy consoles, securities than conventional approaches for acknowledging individuals [6].



The identification of fingerprint is used for specifying the identity of person using his fingerprint without the knowledge of person's identity. Moreover, the fingerprint identification system is employed for matching the fingerprint with the database consisting whole fingerprints. The fingerprint identification can be utilized in several criminal investigations and it follows Automatic Fingerprint Identification System (AFIS). Different strategies are used for acquiring the fingerprints. From the obtained fingerprints, inked impression strategy is highly used. Inkless unique finger impression scanners are likewise present disposing the process of digitization. These strategies has high proficiency and worthy precision aside from some cases in which the client finger is dry. Unique mark eminence is essential as it affects uncomplicatedly from the particulars mining calculation. There are two sorts of debasement ordinarily influence unique finger impression images: (1) edge lines are not entirely nonstop as it incorporates slight cracks (holes); (2) the parallel edge lines are not isolated due to the closeness jumbling upheavals. The findings of the checked fingerprints should be 500 dpi with size 300×300 .

4 Minutiae Extraction Techniques

Removal of suitable plays a significant role in a recognition system. The fingerprint recognition method employ feature-based matching, in which the minutiae mostly ridge bifurcation and ridge ending are filtered from registered images of fingerprints and input image of fingerprint, and count of corresponding minutiae pairs among two images is utilized for recognizing a suitable fingerprint picture. Division is a major device in picture preparing, particularly emphasizes the region for highlighting extraction for differentiating the spotlights in a unique finger impression picture at which the picture brilliance changes pointedly or, all the more formally, has discontinuities. From that point the particulars focuses are separated in the last extraction venture by edge diminishing, details checking and expulsion of false details forms.

5 Fingerprint Matching Techniques

Two portrayal frames for fingerprints isolate the two methodologies for unique mark acknowledgment. The primary approach, which utilizes picture based techniques [3, 4], tries to do coordinating in light of the worldwide highlights of an entire unique finger impression picture. It is a progressed and recently rising strategy for unique mark acknowledgment. Furthermore, it is helpful to take care of some recalcitrant issues of

the main approach. The second approach, which is particulars based, speaks to the unique mark by its neighborhood highlights, similar to terminations and bifurcations. This method was seriously examined, likewise the foundation of existing accessible unique mark acknowledgment items. Given two arrangements of details of two unique mark pictures, the particulars coordinate calculation decides if two details groups are from a similar finger or not from a single finger. The rejection of matches is impeccable in check or ID framework, in light of the fact that every time a biometric is wedged, the format is probably going to be a major challenge. Subsequently, the frameworks of biometric is designed for making a match choice, with respect to a specific number, and sets an acknowledgment level of similitude based on trial layout and selected reference format. Once the examination is done, a score speaking is carried out to create the similitude level, and the obtained score is used for making the match choice.

6 Algorithm Implementation

Implementation of the fingerprint verification system is broken down into four distinct phases illustrated in the following section:

- i. Acquisition of images
- ii. Detection of edges
- iii. Comparison of images.
- iv. Decision making.

A. Image Acquisition

The fingerprint pictures are caught utilizing the inkless fingerprint impression sensor (scanner). The nature of the fingerprint pictures is essential since it influences straightforwardly the particulars extraction calculation. The determination of the filtered pictures is inside the satisfactory qualities (500 dpi), while the size is around 300×300 and is in JPG organize.

B. Detection of Edges

The edge represents the boundary in between the two sections with distinctive gray level properties. The goal of the techniques based on edge-detection is used for calculating the local derivative operator which involves, ‘Sobel’, ‘Prewitt’ or ‘Roberts operators. Practically speaking, arranging the pixels got through calculation of edge location, sometimes portrays a limit totally as a result of clamor, softens up the limit and different impacts that present fake force discontinuities [7]. In this manner, edge discovery calculations regularly are used to trail the connecting the identification strategies devised for pixels of edges into important confines. Essential edge discovery, which is said to be the recognition of changes in forces to find edges, can be accomplished utilizing First-request or Second-arrange subordi nates. Edges are computed by utilizing the distinction between comparing pixel forces of the picture.

First-Arrange Subordinate: The First-arrange subsidiary represents angle of 2-D work. Here, the slope of 2-D work (x, y), is characterized in the form of vector [1]

$$\nabla \mathbf{f} = \begin{bmatrix} \mathbf{g}_x \\ \mathbf{g}_y \end{bmatrix} = \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} \tag{1}$$

The vector gradient is given by,

$$\nabla \mathbf{f} = \mathbf{mag}(\nabla \mathbf{f}) = [\mathbf{g}_x^2 + \mathbf{g}_y^2] \tag{2}$$

The angle representing utmost change rate is [1]

$$\alpha(x, y) = \tan^{-1} \frac{\mathbf{g}_x}{\mathbf{g}_y} \tag{3}$$

Second Order Derivative: The second order derivative is normally used to computed the image using the Laplacian of f(x, y)

$$\nabla^2 = f(x, y) = \frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} \tag{4}$$

The Prewitt operator is used to offer two masks: First is to determine the edges in horizontal direction and the second is to determine the edges in a vertical direction. The masks utilized for detecting the edges is called as derivative masks.

	-1	0	1
Vertical	-1	0	1
	-1	0	1
	-1	0	1
Horizontal	-1	0	1
	-1	0	1

C. Image Based Comparison

The comparison between images is based on the calculation of managing highly contrasting focuses which is accessible from the image of fingerprint and subsequently contrasts the use of Matlab scripts to analyze high contrast dabs. Fingerprint impression confirmation is the way toward directing two fingerprints with each other for checking if they has position with equivalent entity. From this point, if a unique mark compete with finger impression of equivalent entity, then it is called genuine acknowledge otherwise it is called false reject. Similarly if unique mark of different individual coordinates, then its called false acknowledges if it rejects them, its called genuine reject. The False Reject Rate (FRR) and False Accept Rate (FAR) represents the rates of mistake that can be used for expressing and coordinating trustability [3]. FAR is characterized by the equation:

$$\text{FAR} = \text{FA} / \text{N} * 100 \tag{5}$$

FA = false accepts count, N = Total verifications count

The FRR can be formulated as:

$$FRR = FR/N * 100 \tag{6}$$

FR = False Rejects count

Alignment Process: The ridge allied to each minutia is expressed as a sequence of x-coordinates like (x1, x2...xn) with respect to the ridge points. The point undergoes sampling based on per ridge length L beginning from the minutia point, where L denote average inter-ridge length. Here n = 10 until the total ridge length is less than 10 * L [3]. Thus, the comparison for comparing the two ridges is

$$S = \sum_{i=0}^m X_i X_i / [\sum_{i=0}^m X_i^2 X_i^2]^0.5$$

where (xi ~ xn) and (Xi ~ XN) denote set of minutia for individual fingerprint, m refers the negligible value between n and N value. If score of similarity >0.8, then move to step 2, else continue with next ridges. Every fingerprint image undergoes translation and rotation for all minutia based on minutia reference using following expression:

$$\begin{pmatrix} xi_new \\ yi_new \\ \theta i_new \end{pmatrix} = TM^* \begin{pmatrix} xi - x \\ yi - y \\ \theta i - \theta \end{pmatrix} \tag{7}$$

where (x, y, θ) denote reference minutia parameters, and TM is given by,

$$TM = \begin{pmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

D. Making Decisions

The Decision making process is performed on the basis of coordinated image level, which is in the event that over 90% coordinated; pictures are coordinated. Under 90% coordinated; pictures is extraordinary. Depending on edge setting for distinguishing proof frameworks, in some cases uses little layouts of reference that is used to match the tryout format, with superior scores relating to best matches. The final match amount with respect to two fingerprints represents the count of aggregate coordinated and is fixed as secluded using the magnitude of particulars of format unique mark. The score represents the 100*ratio ranging from 0 and 100. In the event that the score is greater than predetermined limit (normally 90%), the two fingerprints represents tp the same finger.

7 Results of the Experiments

In this section, the pictorial representations of the simulation results for the two fingerprints matching cases are depicted in Figs. 2, 3, 4, 5. The two sample fingerprints of the same image after applying edge detection algorithm is depicted in Fig. 3. It can be clearly seen from the plots that both the vertical and horizontal edges of the ridges are more visible than the sample images shown in Fig. 5.

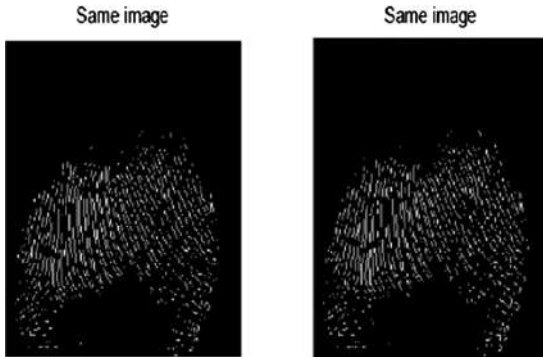


Fig. 2. Same fingerprint images after applying edge detection

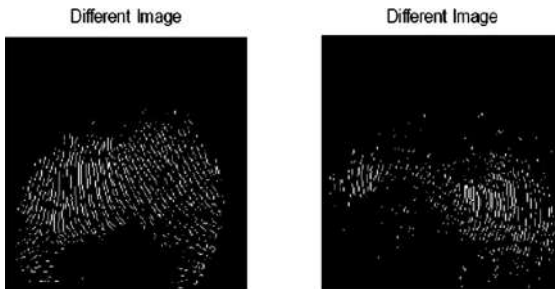


Fig. 3. Different fingerprint images after applying edge detection

It can be seen from the consolidated plots in Fig. 5 that the two fingerprints are indistinguishable. The result of the result additionally demonstrates an aggregate coordinated level of 100; consequently the pictures have been coordinated. With various Fingerprints an aggregate coordinated level of 7.5049 was demonstrated (under 90%); consequently the pictures have not been coordinated.

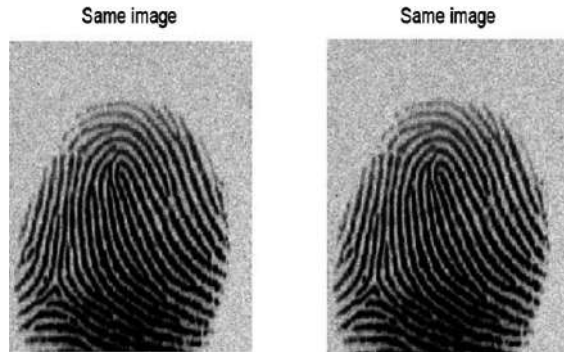


Fig. 4. Same fingerprint images after applying matching technique

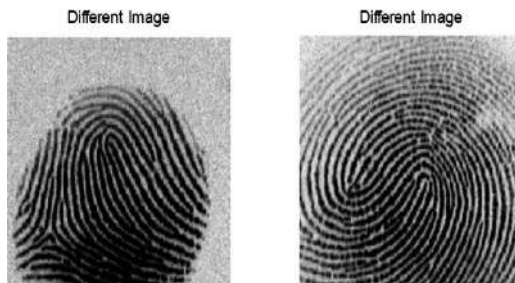


Fig. 5. Different fingerprint images after applying matching technique

8 Conclusion

The above usage was a push to consider and see how a Fingerprint confirmation framework is used as a kind of biometrics for perceiving the behavior of persons. It integrates every stages specified in the previous examination. The result of the examination demonstrates that the proposed method can be received on extensive databases, for example, that of a nation like Nigeria. The unwavering quality of programmed mark checks the structure unambiguously based on the exactness attained by the extraction process of minutia. Different components of the framework are liable to damages minutia's right area. Amongst them, the poor quality of image represents the individual with common bangs. The details harmonizes the computation is equipped for determining correspondences in between details lacking comprehensive research. To promote alterations in terms of adeptness and exactness that is consummated by improving the tools for capturing the images or by improving image upgrading strategies.

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Review of Semantic Web Mining in Retail Management System Using Artificial Neural Network

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Abstract. Now a day, online shopping is being one of the most common things in the daily lives. To satisfy the customers' requirements knowing the consumer behaviour and interests are more important in the e-commerce environment. Generally, the user behaviour information's are stored on the website server. Data mining approaches are widely preferred for the analysis of user's behaviour. But, the static characterization and sequence of actions are not considered in conventional techniques. In the retail management system, this type of considerations is essential. Based on these considerations, this paper gives detail review about a Semantic web mining based Artificial Neural Network (ANN) for the retail management system. For this review, many sentimental analysis and prediction techniques are analyzed and compared based on their performance. This survey also focused the dynamic data on the user behaviour. Furthermore, the future direction in big data analytics field is also discussed.

Keywords: ANN · Sentimental analysis · Big data · Data mining · User behaviour

1 Introduction

The most critical applications for the future generation of distributed systems are big data analytics. Data mining for such kind of claims presently exceeding Exabyte's and fast increasing in size (Kambatla et al. 2014). Recently, in retail management systems, Big Data is mainly used. The data generation in retails databases are related to variety, veracity, velocity, volume, and value. The process and management of these databases have higher capability compared with the conventional mining methods. Most of the E-commerce companies using different approaches to attract consumers away from the retail outlets by providing some offers like cash back, secure exchange and cash on delivery, etc. So, to survive in this competitive business environment, retailers must identify the problems of their consumers and solve these kinds of issues of the consumers. The different trends in the social media also understand by the retailers on a regular basis. This paper review about the prediction techniques used for the prediction of customer behaviour with some machine learning and deep learning methods. Every

transaction made by the customer is stored for analyzing the purchase pattern of the consumer. Purchase pattern played a vital role in the profit policy for promotion besides placement of the products to fulfil the customer in addition to raise the retailer revenue (Verma et al. 2015). Apriori association algorithm is mostly used to detect the standard items in the databases (Verma and Singh 2015). However, this method has many limitations such as nature of resource intensive and requirement of multiple scans database. The extraction of unique patterns for buying from big databases also not capable of this method (Malhotra and Rishi 2017). So, the sentiment analysis and prediction methods are used to compare and analyse based on their performance. Sentiment analysis, correspondingly recognized as opinion mining is an important Natural Language Processing (NLP) task that gets much consideration these years, where deep learning based neural network models have attained huge triumph. Sentiment analysis mentions to the procedure of computationally recognizing as well as classifying opinions communicated in a piece of text, in 5 orders to conclude whether the writer's attitude concerning a specific subject or product is positive, negative, or even neutral. In a sentence, not all the words would convey sentimental data. More precisely, only the adjectives, adverbs, conjunctions and specific nouns are worthwhile for sentiment analysis. For instances, in view of the subsequent three sentences (i) "I feel very happy about the quality of the product" (ii) "I also felt extreme happy after seeing the price of the product". (iii) "Saying the truth, I have not been pleasant since I was bought this particular product". Both of the sentence (i) and sentence (ii) contain the sentiment keyword "happy" which specifies a positive sentiment. The "happy" seems in two dissimilar positions of different sentences. Also, sentence (iii) encloses two sentiment keywords "not" and "pleasant", which are parted by one more word "been". These two keywords together can accurately show the sentiment extremity of a sentence. In this manner, the essential work for grouping the sentiment keyword of a sentence is to find notion catchphrases precisely. Sentiment ways are anticipated by breaking down the assumption of the substance for watchwords for a specific occasion and applying the expectation calculation to the after effects of examination to foresee the consequences of the following conclusion. In spite of the fact that conclusions can be profoundly precisely anticipated when the machine learning calculation is utilized, in situations where information on wistful ways are not adequate, the exactness of the expectation demonstrate rather turns out to be much lower. Due to this issue, we anticipate nostalgic ways through a computation strategy utilizing the weighted qualities as opposed to the machine learning calculation.

As Fig. 1 appears, the idea of time window is utilized for nostalgic way forecast. The measure of the time window can be set in multi day units like 7 days, 14 days, 21 days, and 28 days. We set the window size to 7 days for the analysis. At the point when the time window has been seen as much as the set size, the following estimation is anticipated by the resultant feeling for the pertinent period.

$$(1/window_size) \sum sentimentpos \times cont_weight \quad (1)$$

The condition 1 is utilized for sentiment way forecast. Assessments as much as the set time windows are investigated to separate the methods for positive and negative

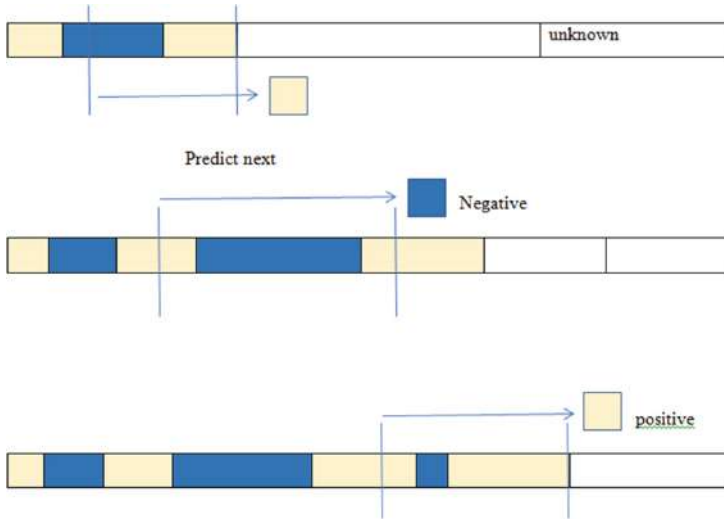


Fig. 1. The concept of time window

estimations. For this situation, the moving midpoints may be acquired by applying weights, and the resultant qualities utilized for an expectation of following conclusions. Weights (*cont_weight*) are values somewhere in the range of 0 and 1 for considering the progression of the notions. Be that as it may, there is an impediment of utilizing moving normal to foresee next slant. Since the normal just creates tallies in window smooth, it can't be receptive to dynamic development of qualities. Subsequently, we attempted expectation utilizing LSTM (Long Short-Term Memory) (Greff et al. 2017). Figure 2 indicates LSTM for supposition expectation. LSTM is a repetitive neural system design. It is appropriate to anticipate long time arrangement information. Likewise, it has leverage over customary RNNs in light of relative lack of care about hole length (Greff et al. 2017; Hochreiter and Schmidhuber 1997). So we directed analyses, and utilized LSTM in our expectation as the trial outcome demonstrated that the technique utilizing LSTM was superior to utilizing moving normal.

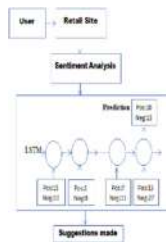


Fig. 2. Retail management system

In Fig. 2, the user gives their suggestion in the retail site and the sentiment analysis are made and the LSTM artificial neural network prediction algorithm are used to predict the positive and negative value of the feedback and based on that the suggestions can be made. Many papers point out the prediction techniques employed for understanding the customer behaviour and reaction on a product which are explained in next section.

Artificial Neural Network (ANN) is a computational model inspired by the structure and functional aspects of biological neural networks (Coello 2006). They are useful to learn complex relationships or patterns hidden in large scale semantic data. Researchers have used ANN to enhance ontology alignment (Chortaras et al. 2005; Mao et al. 2010), ontology enrichment (Chifu and Letia 2010), concept mining (Honkela and Pöllä 2009), automatic ontology construction (Chen and Chuang 2008) etc. Supervised ANNs are extensively useful in learning semantic mappings amongst heterogeneous ontologies. Recursive Neural Network (RNN) model (Mandic and Chambers 2001) was considered to process structured data well appropriate for utilization with ontologies that are in a structured data representation also. RNN was preferred to model automatic ontology alignment (Chortaras et al. 2005). One issue regarding ontology alignment is to discover best configuration that can satisfy ontology constraints, Projective Adaptive Resonance Theory Neural Network (PART) (Cao and Wu 2004), was correspondingly used to support automatic ontology construction from web pages (Chen and Chuang 2008). The PART is accomplished to cluster the web pages which are gathered for the sake of looking for representative terms of every group of web pages. The representative terms are input to a Bayesian. The most representative benefit of CI techniques for the Semantic Web is their ability to tackle difficult issues in an extremely dynamic as well as decentralized setting.

2 Related Works

Yu et al. (2018), demonstrated an online big data-based model for the oil consumption. This model was based on the Google trends. This method also investigated the feasibility of Google trends in the online big data prediction for oil usage. For that, this method involved in two steps namely relationship investigation and improvement in the prediction. Granger causality and co integration test were used to predict the Google trends power in the related study statistically. In the prediction improvement step, for oil consumption prediction many classification techniques were introduced. They are logistic regression, decision trees, Support Vector Machine (SVM) and Back Propagation Neural Networks (BPNN).

Johnson and Ni (2015), presented an approach to influence the online social networks and recommended a dynamic pricing strategy for the variation in the customer estimation. This approach described a mechanism of dynamic pricing that estimates the customer's interest in the vendor's product. This interest partially imitated the sentiment of the customers towards the products because of the social media. Based on this, the emotion aware pricing method utilized the demand in forecasting including the temporary fluctuation in the customer choice parameters. This parameter was taken from the sentimental dynamics of the social media data. This approach successfully

combined with the demand forecasting module of the existing pricing mechanisms. This approach explored the sensitivity of the proposed mechanism performance regarding an error in the sentiment forecasting and simulation. These simulations showed that the forecasting errors underestimated customer sentiment.

Al-Obeidat et al. (2018) presented an Opinion Management Framework with the integration of topic extraction, project management, and sentimental analysis. The comments were placed into the clusters in the topic extraction, and each of the groups was associated with the resolving issues. One or many tasks could be identified from each cluster. The sentiment expression measurement represented the significance of each cluster. This framework recommended the collection of comments about every issue and sentiment was measured from this comments sets. If any subtasks identified within the task, then these also considered. Merchant considered these subtasks and functions and the person who select tasks or subtask was addressed. From these tasks and subtasks, project management features were provided by the vendor. These features were duration and costs, shared resources constraints and earlier start times. This work also considered the task combination and selection of tasks that compensate the performance cost. These optimal selections based on the sentiment improvement in the merchant place value and relation. From this framework, the merchant can immediately respond to the customer's comment online.

Day and Lin (2017), applied a deep learning method for the sentiment analysis and focused the consumer review in the mobile phones. For the evaluation and analysis of the consumer review, deep learning method, opinion dictionary and sentiment dictionary were used in the domain of smart phones. In this approach, consumer reviews were collected based on the polarity analysis for smart phone applications. Deep learning method was used to get higher accuracy. Compared with the general machine learning methods the polarity analysis results were best when using the deep learning method.

Due to the economic uniqueness, the automation in the retail trade is very difficult in many business processes. Consider one business process which is a vending machine formation based on fuzzy sequence algorithm. The main problem with the fuzzy logic-based algorithms is its action. A large number of data needed to form the solution in fuzzy logic systems. Generally, the fuzzy logic algorithm requires the period selection analysis and product information. The product information such as purchasing and selling prices, number of elements sold, number of products in the machine. These types of analysis need many hours for the professional marketer, and it takes considerable time, so it is not acceptable.

Semenov et al. (2017), analyzed these assortments forming problems in the customer demand forecasting. Initially, history of the product was examined then the future behaviour of the product was detected. Finally, the future profit of the machine was predicted using Artificial Intelligence technologies. In this approach, Artificial Neural Network was employed to solve the machine assortment problem.

Wang et al. (2016), compared various predictive methods for house price prediction. ANN performance was compared with the Multiple regression analysis (MRA) with the addition of autoregressive integrated moving average approach. The presented model gave high accuracy in the future prediction of prices. Here, housing prices were mentioned in time series formation. This method was analyzed with

housing prices in different places of the world and financial markets. For relationship modeling between prices and quantities, ARIMA model was used in time series. An autoregressive model was used to find the variable value. The relationship between the variable and past period residual was examined by Moving average models.

Ak et al. (2016), compared, two machine learning methods for the estimation of prediction interval (PI) of time series prediction. For prediction quality measurements PI coverage probability and PI width are taken. Initially, Multi-Objective Genetic Algorithm was used to train multilayer perception NN (MLPNN). This method integrated the PI integration in learning and MLPNN was trained for the minimization of width as well as the coverage probability maximization in PI estimation. The second method was the combination of Extreme Learning Machines (ELMs) including the Nearest Neighbour Approach. The trained ELMs predicted the estimation points. Then, in training dataset depends on the characteristics of the ELM, PIs were quantified. These two methods were selected for consideration due to the different estimation approaches of PI. For the identification of Pareto front solutions in PIW and PICP, a multi-objective optimization framework was used.

Malhotra and Rishi (2018), presented an RV-Map reduce big data analytics outline market basket analysis. By using this framework, the accomplishment of E-commerce websites was easily made based on ranking. This was scalable and robust as well as it was an open-source platform for E-Commerce processing based on big data. Hadoop cluster was described by parallel machines, and big data sets could be easily stored and processed. So, that large number of customers can quickly allow their developments to Hadoop cluster distribution from various locations. This framework recommended that Hadoop and Map-Reduced cloud computing could be preferred for practical deployment in E-commerce ranking system. The primary purpose of the framework was the customer assessment in ranking E-commerce websites and easy searching as well as a perfect ranking of E-Commerce websites.

Chen et al. (2015) proved the need of artificial neural networks in the retail management system comparing with the other methods. However, this approach did not answer the issues related with ANN. Different mixtures of set parameters gave about various resultants such as a structure of input neurons, starting value if height and hidden neurons. Therefore, this proposed method only used the stock closing price as input, and different types of setting parameters were taken for experiments. This paper also enhanced the Back-Propagation Neural Network (BPN) including a new normalized function. BPN minimized the error in the system. MSE and mean absolute percentage error was used for model evaluation. The result provided by this system was better compared with the other systems regarding accuracy.

Lu et al. (2015) analyzed the variable structures of vegetable price including the weight optimization and BPNN threshold values. Particle Swarm Optimization (PSO) algorithm was utilized to predict the retail price of the vegetables. From the investigational outcomes, it was verified that the PSO-BPNN method normalized the over fitting problem well compared with the traditional back propagation method. This proposed PSO-BP efficiently reduced the training error and improved the precision in prediction.

Thakur et al. (2015) presented a combined approach for gas price prediction with ANN and moving average methods. The input layer, activation function, and hidden

layer were employed to achieve output. A neural network trained the neuron numbers which were in the hidden layer. For the measurement of linear and nonlinear series values, neural network and moving average were used. But the neuron in the hidden layer can make an impact in error and reduce the stability as well as over fitting. This model mainly focused on the hidden layer neuron selection, so it resulted in less value in the mean square root value.

Heinrich et al. (2015) showed the dynamic capabilities of big data analytics in the prediction of customer behaviour, adaptive skills, key performance measurement and maintaining the temporary viable advantage of competitors. In this way, the big data value might be deployed for radical and incremental innovations. The additional changes enhanced both the current and existing marketing strategies, and the radical innovations defined a new method for anticipatory shipping strategy. Bekmamedova and Shanks (2014), described the bank social media marketing approach. In this approach, the actions in addition to insights came from big social data were efficiently embedded in the existing business operation and marketing managers' decision-making legacy as well as business analysts.

Dutta and Bose (2015) studied the engrossment of the generic business based on the value from the big data analytics. For this, genetic algorithm and BPNN were used to fulfil the deployment and business model enhancement for nine building blocks. This study highlighted the difficulty of the social big data and requirement for mindset change for marketing heads and employees for any organization. It also presented the application of social big data analytics in the different levels of the production cycle, groundwork identification plan, and strategies in data mining.

Malik and Hussain (2017) investigated the prediction method based on the impacts of negative and positive reviews about a product. From the review content, the positive and negative emotions were predicted using a deep neural network (DNN). This approach also facilitated the E-commerce retailers and managers in the minimization of the processing cost for getting improved reviews. From the results, it was obtained that the DNN based review prediction technique had vital role compared with the existing prediction techniques.

Wang et al. (2018), suggested a technique for the evaluation of economic sustainability in geographic units based on the convolution neural networks (CNN). This method was introduced to fulfil the gap in the little market estimation issues and provided a sustainable business strategy for retail shops. It was based on the estimation of market demand of the retailers over actual sales data and social media., and it formed a market potential map. By the consideration of spatial proximity, a nuclear density method was implemented. The market potential was estimated by the established model without the knowledge of retailers. For the estimation accuracy verification, the presented technique was associated with ANN and least square regression method using cross-validation. The outcomes of proposed technique have greater precision compared with the existing techniques and also it could be applied for the estimation of micro scale market potential.

Krebs et al. (2017), proposed a reaction prediction on the Facebook post by using neural networks. For that, a data set was used to find the Facebook post reaction, and it was useful for both marketing users and machine learners. Then sentimental analysis and emotion mining of Facebook posts was performed by the prediction of user

reactions. Initially, emotion mining techniques and emotional analysis were utilized for the sentimental analysis of Facebook comments and posts. Then, NNs including pre trained word embeddings were utilized to approximate the postre action accurately.

Wehrmann et al. (2018) proposed an innovative approach for sorting the sentiment as well as the language of tweets. The proposed architecture included a Convolution Neural Network (ConvNet) by means of two different outputs, each of which considered to reduce the classification error of either sentiment assignment or else language identification. Outcomes presented that the suggested method outperforms both single-task in addition to multi-task advanced approaches for sorting multilingual tweets.

Jianqiang et al. (2018) introduced a word embeddings technique acquired by unsupervised learning based on large twitter corpora with latent contextual semantic relationships and co-occurrence statistical characteristics between words in tweets. These word embeddings are integrated by means of n-grams features in addition to word sentiment polarity score features to form a sentiment feature set of tweets. The feature set is included into a deep CNN for training and forecasting sentiment classification labels. Experimentally compared the performance of the proposed model through the baseline model that is a word n-grams model on five Twitter data sets, theoutcomesspecified that the proposed model achievedimproved on the accuracy and F1-measure for twitter sentiment classification.

Poria et al. (2017) presented a multimodal data analysis structure. It incorporated the extraction of remarkable highlights, improvement of unimodal classifiers, building highlight and choice level combination structures. The deep CNN-SVM - based sentimental analysis part was observed to be the key component for beating the best in conventional model precision. MKL has assumed a critical part in the fusion experiment. The proposed decision level fusion design was likewise an essential contribution of this research. On account of the decision level fusion experiment, the coupling semantic patterns to decide the heaviness of literary methodology had improved the execution of the multimodal sentimental analysis system significantly. Strangely, a lower precision was gotten for the task of emotion recognition, which may show that extraction of emotions from video might be more troublesome than deducing polarity. While content was the most vital factor for deciding extremity, the visual methodology demonstrates the best execution for feeling examination. The most intriguing part of this paper is that a typical multimodal data analysis structure was well suitable for extraction of emotion and sentiment from various datasets.

The below table shows the summary of different methods involved in big data analytics of retail management system.

From the literature and Table 1, it is understood that compared with the other prediction methods semantic web based Back propagation neural network has better performance for the big data analytics in the retail management system. The proposed S-ANN technique provides less means square value compared with the other predictive tool for big data analytics.

Experiment on Sentiment Analysis:

The suggested sentiment analysis is based on sentiment models. We consider a sentiment analysis model which demonstrates an accuracy of approximately 84% as with the a fore mentioned investigational outcomes. Although training with more information is needed to enhance the accuracy, enhanced sentence analysis outcomes can be

Table 1. Comparison of different big data analytics in retail management System

Authors	Method	Inferences
Verma and Singh (2017)	1. Intelligent Hadoop Distributed Apriori Algorithm 2. Mapreduce architecture	1. Sales improved by understanding customer buying patterns 2. Customer profile analysis and browsing history identified new sales opportunities
Poria et al. (2017)	Deep CNN-SVM	High capability of extracting emotion and sentiment from various datasets
Malik and Hussain (2017)	Deep neural network	Influence of negative and positive emotions in product reviews
Malhotra and Rishi (2018)	Relevancy vector algorithm	Assessed to the customer for easy searching and provided a rank for E-commerce websites based on their opinion
Krebs et al. (2017)	Deep neural networks	Datasets were used to predict the customer reaction from Facebook post and comments.
Day and Lin (2017)	Recurrent neural network 1. Long Short-term memory	DNN was used to sort the relevant polarity analysis and achieved better performance with other methods
Al-Obeidat et al. (2018)	Opinion Management Framework (OMF)	1. OMF was used for the integration of topic extraction, project management, and sentimental analysis. 2. OMF collect the comments in each issue, and from the comments, sets sentiment were measured.
Ak et al. (2016)	1. Multilayer Perceptron 2. Multi-objective Genetic Algorithms	1. Multilayer Perceptron produces less error value than MOGAs 2. Multilayer Perceptron gavethe less error valueand differentvaluation criteria for the best result.
Wang et al. (2015)	1. Artificial Neural Network (ANN) 2. Autoregressive integrated moving average (ARIMA) model.	Lower MSE of the ANN models presented the advantage of ANN over otherpredictive tools.
Lu et al. (2015)	1. PSO-Back Propagation prediction model 2. Particle Swarm Optimization (PSO) algorithm.	1. PSOBP method overcome the overfitting problem and the problem of local minima 2. Efficiently condensed training error 3. Improved the forecasting Precision. 4. BPNN has accurate square root mean value
		1. Provided design

(continued)

Table 1. (continued)

Authors	Method	Inferences
Chen et al. (2015)	Backpropagation neural network (BPN)	Setting parameters in BPN. 2. Better results in the accuracy of prediction compared other systems
Thakur et al. (2015)	1. Backpropagation Neural Network 2. Multilayer Levenberg-Marquardt algorithm.	Neural network showed flexibility between the inputs and outputs.

achieved by allowing for the features of social media contents like social relations. We have investigated along side traditional machine learning methods to authenticate the suggested model. We preferred Naïve-Bayes, SVM, and Random Forest for the traditional machine learning models. We preferred the similar datasets as the suggested model, and trained with the modules of Scikit-learn.

M model	Naïve-Bayes	SVM	Random Forest	Proposed model
Precision	0.76	0.77	0.76	0.839
Recall	0.76	0.77	0.76	0.845
F-I score	0.75	0.77	0.76	0.841

3 Conclusion

This paper presented a complete review of different data mining techniques available in the retail management system. Various methods for predicting the user behaviour was considered for analysis. From the investigation, it was identified that ANN based semantic web mining method has better accuracy and less mean square value compared with the other conventional predictive tool methods. The existing technique generates numerous iterative overhead results in the analysis. The pattern extraction efficiency is also very less in conventional techniques. Most of the existing mining techniques do not consider the feedback from the user in retail management systems. In the literature, an online big data-driven oil consumption predicting model was described which utilizes Google trends, which marvellously reveal different related factors built on a myriad of search results. This model includes two key steps, relationship analysis and prediction enhancement. But the proposed model still has some limitations. Initially, it needs the selection of the most suitable Google trends, and therefore, a complete study of all Google trends associated to the oil market is a significant concern. Next, some currently emerging predicting tools, particularly the decomposition-and-ensemble methods, might also be presented to improve the accuracy of prediction. Third, the relations concerning Google trends and oil consumption will change in extent over time, and could even vanish.

A study of artificial intelligence in the retail management problems is correspondingly deliberated in the collected works. NNs are becoming a significant tool for predicting retail sales. NNs do not work wonders, but if utilized intelligently, they can display startling outcomes. The problems of relearning the NN and the reliance of accuracy and productivity on a hidden layer's number and neurons numbers must be considered.

In one of the paper in the literature, two machine learning approaches namely Multi-Objective Genetic Algorithm-Neural Network (MOGA-NN) and Extreme Learning Machines (ELM) were integrated and associated with the nearest neighbour's method for predicting Prediction Intervals (PIs). This could be mainly advantageous for applications, in which the existing data set is too short to cover all probable patterns or in which the environmental or working conditions vary. Also, MOGA-NN method does not deliberate the systematic study on the influence of the various numbers of hidden neurons on the estimated PIs (e.g., ensemble of NNs). Sustainability study and market demand estimation in the retail industry through a CNN was proposed in the collected works review. Numerous drawbacks also be existent in this study. In the actual situation, the service areas of every retail shops were different. The service area must be well-known and considered to enhance the estimation accuracy. One more important drawback in this study was that the information on social media data was ineffectively used. The spatial locations of social media data were only considered and the semantic information, time, and personal information were overlooked, which were existing and valuable information. To enhance the study outcomes, much data must be considered and the spatial-temporal relationship concerning social media data and region market potential must be determined. Various factors like road connectivity, weather, and purchasing ability, must be added to each geographic cell to achieve precise and exact outcomes.

An intelligent method to Big Data analytics for sustainable retail environment with Apriori-MapReduce framework was discussed in the literature. It is an intelligent HDFS i.e. Hadoop Distributed File System and MapReduce architecture based scalable, parallel next generation Apriori algorithm i.e. MR Apriori algorithm. This study can be prolonged by including support to subsequent generation of big data systems possessing features such as speedy growth in necessary network bandwidth when associated with secondary memory storage necessities, drop in iterative analytics overhead by emerging memory computation models so as to keep intermediate outcomes in memory and therefore to overcome different drawback slinked with conventional HDFS like absence of real-time response as needed by framework based on multiple analytic engines. The accuracy of IRM tool in computation of hit count statistic and so on.

The comparison table verified the efficacy of the proposed method. The future research will be focused on the other deep learning methods for sentimental analysis and customer behaviour prediction in the online environment.

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Real Time Gender Classification Based on Facial Features Using EBGM

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Abstract. Presently a day's face acknowledgment is an effect theme in some of security issues introduces progressively applications. In light of every day utilization gadgets, secure shortage is an escalated application in confront extraction. Generally create Principle Component Analysis (PCA) based face acknowledgment in picture preparing, in this they are utilizing skin shading based approach for include extraction and face acknowledgment to enhance the precision of the application. In any case, is it not available for dimensional component extraction in confronting acknowledgment. So in this document, we propose a new & novel approach i.e. Elastic Bunch Graph Matching (EBGM), in highlight extraction to order tight and wide weed utilizing SIFT key-focuses descriptor. Specifically we break down the SIFT key components of weed pictures and outline a calculation to remove the element vectors of SIFT key-focuses in view of extent and edge course. Scale Invariant Feature Transform (SIFT) turned out to be the most vigorous neighbourhood variable component descriptor. Filter based method for recognizing and extricating nearby component and expressive descriptors which are sensibly changes in enlightenment, picture commotion, revolution & scaling and little changes in perspective. Our experimental results show efficient face recognition for real time image processing applications.

Keywords: Image processing · Recognition of face · Invariant scale feature transform · Analysis of principle component and dynamic and specific algorithms

1 Introduction

In our day by day lives, confront acknowledgment applications that consequently distinguish a person from caught pictures or recordings are all over, for applications, for example, observation, airplane terminal security, law authorization, and outskirt watch. Face acknowledgment calculations examine pictures, separate data, for example, the shape, size and position of the facial highlights (e.g., eyes, nose, mouth), and after that utilization these removed highlights to look through a facial database to find coordinating pictures. The calculations of most astounding precision (e.g., more than 90%) ordinarily require serious calculation.

A face acknowledgment framework, including face identification and face acknowledgment, is a long standing and all around contemplated issue in PC vision.

The execution of the face acknowledgment framework depends on the classifier, as well as on the portrayal of face designs. The point of highlight choice in confront portrayal strategy is to smother the varieties of face pictures and all the while give improved oppressive power. There are a few picture portrayals proposed for confront acknowledgment, for example, Elastic Bunch Graph Matching (EBGM), Local Binary Pattern (LBP), Multi-scale Gaussian Differential Features (MGDF) strategies, and others.

In the EBGM figuring, faces are addressed as charts, with center points arranged at fiducial concentrations and edges set apart with independent vectors. Each center point contains a game plan of Gabor wavelet coefficients, known as a fly. The distinctive evidence of another face contains settling on the created graphs, the one which enlarges the outline closeness work. As opposed to the EBGM approach, an immediate extraction of the face incorporate vector (histogram) is grasped in LBP. In MGDF, multi-scale differential features are made by isolating pictures with Gaussian subordinates at various scales. Differential features are moreover had all the earmarks of being clear. Both adjacent and overall depictions of pictures can be shaped from them.

Starting late, D. Lowe proposed Scale Invariant Feature Transform (SIFT) computation to isolate scale and transformation invariant descriptors from the close-by key-centers that are remarkable and stable for pictures in different goals. It has been shown that SIFT has incredible execution in dissent affirmation and other machine vision applications. Likewise, Bicego et al. used a covering sub-picture organizing framework as the important undertaking to dismember the SIFT approach for go up against approval. In any case, the significance of the sub-picture district in their procedure isn't beneficial for the preliminary affirmation comes to fruition. J. Luo et al. proposed to troupe a K-suggests bundling intend to manufacture the sub-regions normally in light of the zones of SIFT incorporates into planning tests. Notwithstanding the way that the result was promising, the test surveyed by single model isn't convincing. We propose a face affirmation method, which uses SIFT features to manufacture discriminative neighborhood features and Support Vector Machine (SVM) as a classifier for its incredible properties. SVM is a general game plan of parallel class issue. It is addressing plan affirmation issue in light of the way that once a recognize piece is picked, SVM can on a fundamental dimension take in any arrangement set paying little respect to whether the essential data is nonlinearly apportioned. The phenomenal results in the ORL database and the Yale go up against database exhibit the healthiness of our methodology in different conditions. we proposed a SIFT and SVM based procedure to investigate the quality of SIFT features for various planning pictures on stand up to affirmation. We finished examinations on ORL and the Yale database. The results and the solid execution in go up against affirmation show that our procedure can manage the verbalization issues better than various findings.

2 Review of Literature

We existing a program for recognizing singular experiences from singular pictures out of an immense information source containing one picture for every person. The strategy is testing a result of picture contrast with respect to put, measurement, appearance, and

cause. The program breaks a large portion of this distinction by getting brief experience clarifications in the best possible execution of picture graphs. In these, fiducially factors clearly (eyes, oral depression, and so on.) are depicted by sets of wavelet components (planes). Picture outline expulsion is fixated on a novel procedure, the accumulation diagram, which is produced using somewhat set of illustration picture graphs. Recognizable proof is focused on a direct examination of picture graphs. We report acknowledgment tests on the FERET information source and in addition the Bochum information source, including acknowledgment crosswise over reason.

We set ourselves the activity of recognizing people from singular pictures by reference to a gathering, which likewise contained just a single picture for every person. Our issue was to deliver picture contrast because of contrasts in confront appearance, go cause, place, and measurement (to name just the most essential). Our methodology is in this way a run of the mill segregation within the sight of fluctuation issue, where one needs to endeavor to crumple the distinction and to feature perceiving capacities. This is for the most part just conceivable with the assistance of insights about the home of changes not out of the ordinary. Class systems vary extraordinarily with respect to the nature and beginning of their insight about picture changes. Frameworks in Artificial Intelligence [4] and Computer Vision frequently weight specific planner gave components, for example exact kinds of three-dimensional things or of the picture age strategy, though Sensory Network outlines for the most part weight utilization of system from delineations with the assistance of numerical appraisal methods. Both of these extraordinary conditions are costly in their own particular manner and fall shatteringly. Shy of the straightforwardness with which natural systems get basic points of interest from simply a few. Part of the achievement of natural systems must be because of regular characteristics and laws on how thing pictures change under natural conditions. Our program has a fundamental center of structure which demonstrates the way that the photos of predictable things generally change over, range, move, and misshape in the photo air ship. Our fundamental thing reflection is the stamped diagram; sides are set apart with separate subtle elements and hubs are set apart with wavelet responses territorially incorporated into planes. Put away plan diagrams can be printed to new pictures to acquire picture graphs, which would then be able to be consolidated into a gathering and progress toward becoming outline outlines. Wavelets as we utilize them are powerful to normal lighting changes and little changes and distortions. Display diagrams can without much of a stretch be changed over, flaky, centered, or deformed amid the related technique, accordingly paying for the majority of the distinction of the photos. Shockingly, having just a single picture for each piece of the exhibitions does not offer sufficient points of interest to oversee turning definite similarly. Be that as it may, we existing results on acknowledgment crosswise over various presents. This run of the mill system is helpful for dealing with any sort of predictable thing and might be satisfactory for perceiving between basically extraordinary thing composes. Be that as it may, for in-class polish of things, of which encounter acknowledgment is a case, it is important to have subtle elements specific to the home ordinary to everything in the course. In our program, class-particular subtle elements has the correct execution of gathering diagrams, one for each reason, which are heaps of a normal assortment (70 in our Investigations) of various experiences, stream inspected in a proper arrangement of fiducially factors (set

over sight, oral hole, shape, and so on). Cluster outlines are dealt with as combinatorial associations in which, for each fiducially point, a stream from an alternate illustration experience can be chosen, in this way making a very helpful plan. This plan is printed to new face pictures to successfully discover the fiducially factors in the photo. Planes at these variables and their relative parts are delivered and are blended into a photo outline, an impression of the experience which has no residual contrast because of measurement, put (or in-plane arrangement, not connected here). An accumulation outline is made in two phases. Its subjective system as a diagram (an arrangement of hubs in addition to edges) and in addition the task of comparing names (flies and separations) for one starting picture is architect given, though the greater part of the gathering outline is created semi-naturally from illustration pictures by related the embryonic accumulation graph to them, less and less regularly all the encompassing to revise wrongly distinguished fiducially factors. Picture graphs are fairly powerful to little top to bottom changes of the best. Bigger turning points of view, i.e. diverse presents, are taken care of with the assistance of accumulation graphs with an alternate diagram structure and architect gave correspondences between hubs in various presents. After these plans our program can draw out from singular pictures brief invariant experience clarifications in the best possible execution of picture outlines (called configuration diagrams when in a display). They contain all subtle elements applicable for the experience tastefulness system. With the end goal of acknowledgment, picture diagrams can be as opposed to configuration outlines at small handling cost by dissecting the mean stream similarity. We gave a speculatively and computationally simple yet proficient multiresolution technique to grayish range and turning invariant structure grouping fixated on 'uniform' local paired styles and nonparametric class of case and model withdrawals. 'Uniform' styles were perceived to be an essential architecture, as they offer a larger part of local structure styles, relating to structure microstructures, for example, sides. By computing the withdrawals of these microstructures, we blended compositional and scientific structure explore. We built up a general grayish range and turning invariant proprietor LBPP,R riu2, which considers finding 'uniform' styles in round networks of any quantization of the precise zone and at any spatial determination. We additionally gave a simple intends to blending responses of different suppliers for multi-determination examine, by accepting that the proprietor responses are partitioned. Phenomenal preliminary results gained in two issues of genuine turning invariance, where the classifier was prepared at one specific turning position and tried with tests from other turning points of view, show that great tastefulness can be accomplished with the episode research of 'uniform' turning invariant provincial paired styles. Face acknowledgment advancements can fundamentally affect confirmation, following and picture posting applications. This report exhibits a criteria to gauge similarity of experiences all in all. The system is to question an information source utilizing the photo of an ordeal and after that have the program either find out its personality, or recuperate the best indistinguishable matches. All things considered, the system is run of the mill and has already been utilized effectively in picture recuperation assignments, for example, finding indistinguishable minutes, pictures, double shapes and plans. The methodology is focused on the two speculations; first that general look of an ordeal assumes an imperative part in breaking down resemblance and second, multi-scale differential well known elements of the photo

lighting zone compose effective general look capacities. The principal hypothesis is focused on the announcement that general look is a basic sign with which we evaluate similarity. We promptly perceive things that offer a general look as indistinguishable, and without other proof, are probably going to decay those that don't. An exact meaning of general look is testing. The physical and perceptual marvels that decide general look are not outstanding, and notwithstanding when there is understanding, for example, the impact of thing (3D)shape, zone structure, lighting, albedo and point of view, it is non-insignificant to separate a photo along these components.

3 Methodology and Implementation

3.1 Face Recognition Using SIFT

Obviously, getting the product to perceive and take after a face may not be sufficient. For cutting edge human-robot associations, we would ideally have creepy crawlies interface with individuals relying upon whether they remember them. One of the assignments done in past semesters was card acknowledgment utilizing SIFT. Filter, or scale-invariant [5, 6] capacity change over, is a criteria used to perceive works in pictures. I chose to attempt and utilize the gave code to SIFT [7–12] instead of endeavoring to make my own particular program for confront acknowledgment. Be that as it may, in spite of the fact that SIFT [22, 23] worked on the chiara it took a long a risk to process the photos, backing off the chiara for a few seconds. I couldn't completely assess how well SIFT functioned because of absence of your endeavors and exertion, however it could perceive my face. Over past circumstances several years there have been some examination (from the early research, e.g., to later ones), for example, assessing the reasonableness of the SIFT approach for confront acknowledgment. The change of the SIFT methodology for confront acknowledgment can be portrayed as tails: One of the principal attempts to utilize the SIFT criteria for confront acknowledgment was given. The criteria utilized here, fluctuates from one of a kind SIFT criteria in the execution of the related stage. Each SIFT descriptor in quality picture is printed with each descriptor in each training picture. Coordinating is finished utilizing a range focused necessities. A descriptor from quality picture is said to facilitate a descriptor from it picture, if the range between the 2 descriptors is not as much as a particular segment of the range to the following nearest descriptor. The issue with this method is that it is extremely troublesome. Coordinating between two pictures has a computational intricacy of $O(n^2)$, where n is the normal assortment of SIFT descriptors in each photo. The one of a kind SIFT criteria is conveyed better by tailing one of two systems that go for heavenly territorial confinements on the related method: the principal suits just SIFT descriptors acquired picture windows comparing to the mouth and the two eyes, while the second relies upon gridbased related, Local related, i.e. inside a lines or a gathering, obliges the SIFT capacities to organize capacities from near to zones as it were. Nearby related likewise eliminates computational many-sided quality straightly. The computational unpredictability required for related two or three pictures by the local method is $O(n^2/s)$, where s is the assortment of plants or gatherings. Filter capacities are bought the front and half left and right points of interest. An upgraded set of SIFT capacities is then

settled from the blend of capacities from the front and side points of interest of a person, subsequent to taking out capacity repetition. Filter work sets from the subtle elements source and question pictures are printed utilizing the Euclidean range and Point configuration related strategies. Diagram Matching Method utilized on the SIFT descriptors to manage inaccurate couple errand and abatement the assortment of SIFT capacities. Filter capacities are evaluated by a discriminative prerequisites relying upon Fisher's Differentiate Research, so the chose capacities have the base inside class distinction and most extreme contrast between sessions. Both universal and local related strategies are utilized. With a specific end goal to diminish the recognizable proof errors, the Demister-Shafer choice idea is utilized to mix the two related techniques.

3.2 Modules

A. Enrolment Stage

The photo is obtained utilizing a web digicam and held in a subtle elements source. Then, the Human face image is perceived and prepared. Amid training, the Human face image is preprocessed utilizing geometrical and photometric standardization. The alternatives of the head picture are created utilizing a few capacity expulsion strategies. The choices subtle element is then spared together with the client recognizable proof in points of interest source.

B. Recognition/Confirmation Stage

A client's face unique finger impression points of interest is by and by gotten and it utilizes this to either perceive who the client is, or affirm the expressed recognizable proof of the client. While distinguishing proof incorporates assessing the acquired unique finger impression points of interest against formats relating to all clients in the subtle elements source, affirmation incorporates correlation with just those designs comparing to expressed ID. In this manner, distinguishing proof and affirmation are two special issues having their own particular common difficulties. The acknowledgment/confirmation organize incorporates a few portions which are picture buy, confront acknowledgment, and face acknowledgment/check.

C. Picture Acquisition/Face Detection Module

Face acknowledgment is utilized to perceive confront and to draw out the applicable points of interest identified with facial capacities. The photo will then be resized and settled geometrically with the goal that it is sensible for acknowledgment/confirmation. In this part, the foundation or the minutes unessential to manage will be expelled. The program can perceive a face progressively. The human face image acknowledgment item is additionally powerful against lighting contrast and functions admirably with various skin tone and impediments, for example, facial hair, and bacchante and with head cover.

The Human face acknowledgment incorporates picture buy segment. Its goal is to look for and afterward fixings a territory which contains just the head. The program was relying upon the rectangular shape capacities utilizing Adaboost criteria. Its consequences are the rectangular shape which contains confronts capacities, and picture which contains the expulsion of the acknowledgment confront capacities.

D. Face Recognition/Verification Module

The Human face acknowledgment part integrates preprocessing, work evacuation, and classification [20, 21] sub-modules. The criticism to the head acknowledgment/confirmation part is the head picture, which originates from two sources: from you and from the points of interest source. From these assets, each photo is preprocessed to get the geometrical and photometric balanced out type of the head picture. Amid work expulsion, the settled picture is appeared as capacity vectors. The consequence of the class for phenomenal target is driven by related the client index with the client recognizable proof in the database (Fig. 1).

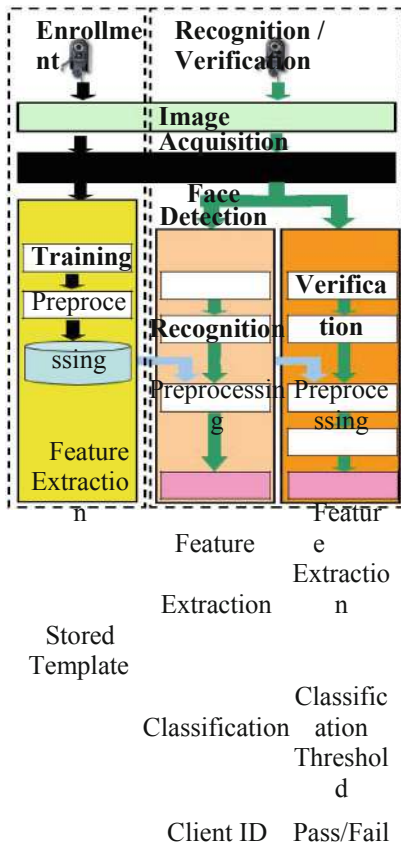


Fig. 1. Block diagram for proposed approach [20]

i. Preprocessing

The reason for the pre-handling module is to diminish or dispense with a portion of the varieties in look because of light. It standardized and upgraded the face picture to enhance the acknowledgment execution of the framework. The preprocessing is pivotal as the vigor of a face acknowledgment framework enormously relies upon it. By performing unequivocal standardization forms,

framework power against scaling, act, outward appearance and enlightenment is expanded. The photometric standardization comprises of expelling the mean of the geometrically standardized picture and scaling the pixel esteems by their standard deviation, evaluated over the entire edited picture. The photometric standardization methods connected are Histogram Equalization, and Homomorphism Filtering.

ii. **Histogram Equalization Stage**

Histogram evening out is the most widely recognized histogram standardization or soft level change, which reason for existing is to deliver a picture with similarly disseminated shine levels over the entire splendor scale. It is generally done on excessively dim or too brilliant pictures keeping in mind the end goal to upgrade picture quality and to enhance confront acknowledgment execution. It alters the dynamic range (differentiate run) of the picture and thus, some imperative facial highlights turn out to be more clear.

E. **Homomorphism Filtering**

The homomorphic sifting calculation is like that of Horn's calculation aside from the low spatial recurrence brightening is isolated from the high recurrence reflectance by Fourier high-pass separating. By and large a high-pass channel is utilized to discrete and smother low recurrence segments while as yet fleeting the high level of recurrence parts in the flag, but the two sorts of signs are combined substance, i.e., the genuine flag is the whole of the two kinds of signs. Be that as it may, in this light/reflection issue low-recurrence brightening is duplicated, rather than included, to the high-recurrence reflectance. To in any case have the capacity to utilize the standard high-pass channel, the logarithm activity is expected to change over the augmentation to expansion. After the homomorphic separating process, $I(x, y)$, the prepared brightening ought to be definitely diminished because of the high-pass sifting impact, while the reflectance $R(x, y)$ after this method should in any case be near the first reflectance.

F. **Feature Extraction**

The motivation behind the element extraction is to extricate the component vectors or data which speaks to the face. The element extraction calculations utilized are Principal Component Analysis (PCA), and Linear Discriminate Analysis (LDA).

G. **Vital Component Analysis (PCA)**

PCA for confront acknowledgment is utilized as a part of [1–3] depends on the data hypothesis approach. It separated the important data in a face picture and encoded as effectively as could be allowed. It recognizes the subspace of the picture space crossed by the preparation confronts picture information and style relates the pixel esteems. The traditional portrayal of a face picture is acquired by anticipating it to the facilitate framework characterized by the important segments. The projection of face pictures into the chief segment subspace accomplishes data pressure, stylistic theme connection and dimensionality diminishment to encourage basic leadership. In scientific terms, the important segments of the appropriation of countenances or the eigenvectors of the covariance lattice of the arrangement of face pictures, is looked for by regarding a picture as a vector in a high dimensional face space. The definite clarification is given in.

H. Linear Discriminate Analysis (LDA)

LDA is utilized as a part of machine figuring out how to locate the straight mix of highlights which best separate at least two classes of protest or occasion, where the subsequent blends are utilized as a direct classifier. It is additionally considered as highlight diminishment, mapping a multidimensional space into a space of less measurements, preceding later arrangement. LDA is utilized as a part of various order related applications. One of these is confront acknowledgment where each face, which comprises of countless, is decreased to a littler arrangement of direct mixes before grouping.

4 Results

This section describes about face recognition results with proposed approach with different real time human facial images. Four types of facial databases are available in outside environment. For verification of faces from real time facial images there are two basic false instances i.e. False Alarm Rate (FAR) and False Resistance rate (FRR). The FAR and FRR are given by:

$$FAR = IA/I, FRR = CR/C$$

where IA is the variety of impostor approved, I am the variety of impostor’s tests, CR is the variety of customer refused and C is the variety of client’s tests.

A. Verification of Different Faces

The main examinations to take a gander at the affirmation execution of the experience place acknowledgment framework utilizing the select experience pictures. The outcome is organized in Table 1, which demonstrates despite the fact that D.E. classifier has the least HTER, N.N. classifier gives the best reason to visit for both PCA and LDA work extractors. In the second examination, we at first utilize a mix of histogram adjustment and homomorphic sanitization to the experience place pictures. The outcome for these examinations is organized in Table 2, which indicates C.N. classifier has the most minimal HTER for both of the work extractors (Graph 1).

Table 1. Image with different verified results [20]

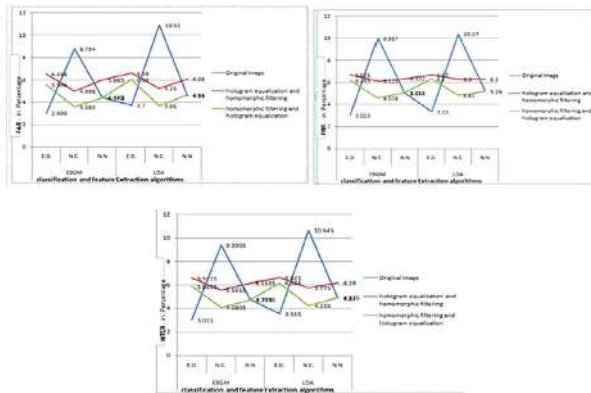
Extractor of feature	Classification methodology	FRR = FAR (%)		HTER (%)
		FAR	FRR	
EBGM	D.E.	3.999	4.023	2.011
	C.N.	9.8752	9.987	8.3905
	N.N	4.443	5.015	4.729
LDA	D.E.	2.700	2.320	4.515
	C.N.	11.920	11.370	11.645
	N.N	5.550	6.190	5.845

Table 2. Homomorphic filter based approach with updated verification results [20]

Feature extractor	Classifier	FRR = FAR (%)		HTER (%)
		FAR	FRR	
EBGM	D.E.	5.488	7.655	6.5715
	C.N.	4.998	7.125	5.5615
	N.N	5.985	7.322	6.1535
LDA	D.E.	7.480	7.726	7.726
	C.N.	6.350	7.635	6.775
	N.N	7.030	7.400	7.290

Table 3. Histogram based filtering results with equalization verification [20].

Extractor of feature	Classification approach	FRR = FAR (%)		Hyper FAR (%)
		FAR	FRR	
EBGM	D.E.	5.566	6.165	5.8655
	C.N.	4.583	4.578	5.0805
	N.N	5.373	5.054	5.7135
LDA	D.E.	7.030	7.400	7.125
	C.N.	4.660	5.810	5.335
	N.N	5.770	6.290	5.394



Graph 1. Comparison between EBGM and PCA (FAR, FRR and HTER percentages)

The third research has been a blend of homomorphic filtration, and histogram levelling to the head pictures. The outcome organized in Table 3 uncovers that N.N. classifier has the least expensive HTER. Along these lines, in general, for experience affirmation N.N. classifier can be viewed as the best classifier among the three classifiers since it works ceaselessly in every one of the tests utilizing both PCA and LDA work extractors.

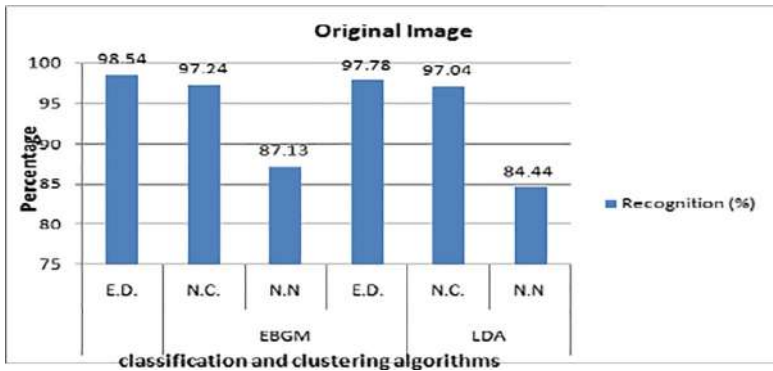
For recognizable proof goal, the effectiveness is investigated focused on astounding sum or accuracy. The ramification for research utilizing the one of a kind picture is arranged in Table 4, which uncovers that D.E. classifier gives the most extreme distinguishing proof sum for both PCA and LDA work extractors. When we utilize a blend of histogram evening out and homomorphic filtration to the head pictures, still the D.E. classifier gives the greatest exactness as organized in Table 5. In any case, in the last research, that is the point at which we utilize a blend of homomorphic filtration and histogram evening out, N.N classifier gives the greatest accuracy utilizing PCA work machine, while C.N. creates the most extreme accuracy utilizing LDA work machine (Graphs 2, 3, 4 and Table 6).

Table 4. Recognition results using original image [20]

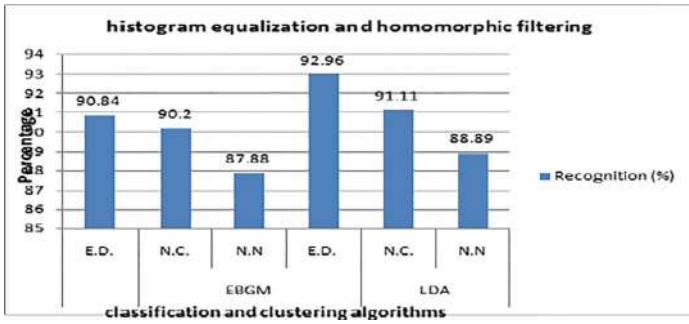
Extractor of feature	Classification approach	Percentage of recognition (%)
EBGM	D.E.	98.54
	C.N.	97.24
	N.N	87.13
LDA	D.E.	97.78
	C.N.	97.04
	N.N	84.44

Table 5. Equalization based homomorphic filtering with updated recognition results [20]

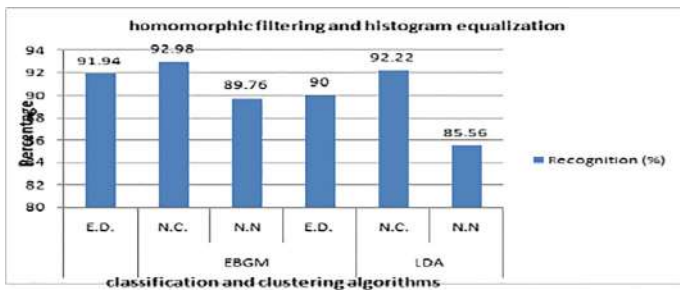
Feature extractor	Classifier	Recognition (%)
EBGM	D.E.	92.84
	C.N.	93.20
	N.N	89.88
LDA	D.E.	94.66
	C.N.	93.22
	N.N	87.87



Graph 2. Recognition results using original image



Graph 3. Performance evaluation of better equalization procedure.



Graph 4. Performance of updated results with equalization filtering procedure

Table 6. Histogram equalization filtering procedure with updated face recognition results [20]

Extraction of feature	Classification approach	Updated recognition results (%)
EBGM	D.E.	92.94
	C.N.	92.98
	N.N.	89.76
LDA	D.E.	90
	C.N.	92.22
	N.N.	85.56

5 Conclusion

This paper provided a context in terms of identification of faces using proposed algorithm (EBGM) for assessment of recognition. The overall results performance of verification using NN is superior to the factors decision (or) rules EBGM and LDA. However, D.E classification gives the best accuracy, compared with other classification algorithms. Thus, related histogram equalization and homomorphic filtration techniques evidently picture do not give much impact to the efficiency of the program if

performed under managed environment. Further enhancement of our suggested approach is to do different machine learning techniques for experience identification immediately programs.

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Integrating Netnographic Analysis and Text Mining for Assessing Satisfaction of Travellers Visiting to India - A Review of Literature

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Abstract. This paper aims to understand and apply an integrated method combining Netnography with text mining to measure or assess the satisfaction/dissatisfaction of consumers using online travel services in India. Study helps us to understand satisfaction and dissatisfaction of consumers with the help of text mining and travel related online ratings from review website, social platforms, various related blogs etc. in India. Considering the growth and popularity of E-commerce in tourism Industry in India, it is possible to have an integration of both this aspect together, which can integrate features of text mining and netnography together in providing benefits to consumers and travel companies in India.

Keywords: E-commerce · Netnography · Tourism · Text mining · RapidMiner · Traveller

1 Introduction and Motivation

1.1 Internet Penetration and E-Commerce Industry in India

India got internet users base of nearly 450 million in July 2017, which is 40% of its total population. Even its second largest userbase in the world, and it is behind China which has 650 million, that's 48% of total population, the overall penetrations of the e-commerce is little low as compared to United States which has 266 million, that's close to 84%, or France having 54 M, 81%) of population and its improving and adding close to 6 million users every month (*Indian e-commerce at inflection point?*, 2010).

1.2 Tourism and E-Commerce in India

Tourism industry in India is very important and also growing rapidly. The World Travel and Tourism Council of India has calculated that tourism created rupees 14.02 lakh crore which is close to 9.6% of the GDP in year 2016 and created 40.343 million jobs, which is 9.3% of total employments. This sector is showing future grow rate of 6.8% to rupees 28.49 lakh crore the year 2027 (10% of Nations GDP). In the month of October 2015, I medical tourism in India was estimated worth US\$3 billion. Further expected to reach \$7–8 billion by the year 2020. In the year 2014, 184,298 foreign

patients visited in India for treatment (“Indian medical tourism industry to touch \$8 billion by 2020”: Grant Thornton - The Economic Times, n.d.).

The Tourism and tourism competitiveness Report of 2017 ranks us as 40th out of 136 countries. Also the report also mentions ranks the price competitiveness of countries tourism industry as 10th of 136 countries. It also mentions that India has good air transport (ranked 32nd), particularly considering India’s stage of development, and good ground transport infrastructure (ranked 29th) (*Travel & Tourism Economic Impact 2017 India*, n.d.).

2 What Is Netnography?

Netnography is a study of Ethnography on Internet. It is also known as performing Ethnographic online.

In regards to digital communications netnography is a Method of online research originated with ethnography which can be applied to understand social interaction. This is also defined as set of research practices of data collection, Data analysis, ethics of research, and representation, originated in participant observation. Internet Ethnography helps with adaptation guidelines of the participant-observation procedures to contingencies involved in online culture and community which is manifest through the computer mediated communication (Kozinets 2010a).

2.1 Why to Use Netnography

Unlike the traditional research methods in market such as surveys, data models, questionnaire and focus groups, netnography is naturalistic, which offers insight on cultural, and also maintains the connect of human with context. The term netnography helps with decision-making in marketing, innovation and also in branding. A very unique, systematic, netnographic studies helps in exposing vital information about consumer behaviors, their tastes, their opinions, their impressions and interactions as well. Netnography is a different form of ethnographic studies, where the consumer observation is done online.

The Netnography Process: Following are the typical steps involved in Netnographic Process (Kozinets 2010a)

1. **Research Planning:** In this the first define the problem, define the research objectives, and translate the objectives in questions which can be addressed later. Considering the huge amount of available data online, focusing on research questions is important for ensuring higher quality, reliable, actionable, interpretable netnography results.
2. **Entree:** Once relevant online communities identified, the researchers must immerge themselves into the communities to get a better understanding. This also consists of periodic reviewing of discussions, also maintaining the complete details of postings and performing recording of observation with the changing nature of the discussions and identification of various themes within the conversation, which can be with respect to context, content and type of interactions.

3. Collection of data: In this kind of studies data collection to be done from internet data, field notes and interviews data.
4. Interpretations or data Analysis: here data analysis technique like analytical coding is carried out in following steps
 - a. coding: coding is a process of labelling to be done in general phenomenon
 - b. noting: noting is identifying reflection on data
 - c. abstracting: in this step identification of sequences, similarities and also differences in interaction
 - d. Checking/refining step: this step helps to return to the place or field to check, confirm and refining of existing understanding or interpretation of patterns, commonalities, differences, etc.
 - e. Generalization/Generalizing: this step elaborate a miner set of the generalization which covers or briefs the consistent nature in the dataset.
 - f. Theorizing results: this is a step which construct or fetch theory from the results or findings.
5. Ensuring of Ethical Standards: the ethical concerns on kind of netnographic studies are whether various online forums to be considered as a private/public site and also what constitutes as informed consent in online/cyber space. Netnography provides set of guidelines about when and how to cite authors, online posters and what has to consider in an ethical online ethnographic representations, also when to ask for permissions and in what case permission is not required or not necessary.
6. Representation of research: The one of application of this type of marketing research is as an important tool to exhibit consumer behavior by the means of understanding them and also by listening to their voice.

3 E-Commerce and Text Mining

The popular term of mining on text is the process of performing analysis of textual data in a manner that identify some patterns and gain some insights from it. This method is widely being used by majorly by retailers in e-commerce to understand more about consumers. To target specific individuals with personalized offers, discounts to improve sales and loyalty it is essential to identify consumer purchase styles or patterns which is very much possible with the help the mining on textual information. Textual mining has become popular field of research because it attempts to discover/explore meaningful information from text which is unstructured in nature, which consist of large amount of information which can't be used for processing by any computers. (Dang and Ahmad 2014) (Fig. 1)

This mining approach is a multidisciplinary which covers various tasks such as retrieval of information, text analysis, information extraction, information categorization, visualization etc.

Following are the basic steps under this approach:

- a. Information collection from unstructured source.
- b. Conversion of information into structured form of data
- c. Identifying the useful patterns from structured form



Fig. 1. Processing of text mining (Dang and Ahmad 2014)

- d. Analysis of the meaningful pattern
- e. Extracting useful information and keeping it in repository.

3.1 Text Mining Using RAPIDMINER

RapidMiner a popularly known data analytics software which is developed by the Rapidminer company. It helps with an integrated type of environment for performing various data science operations i.e. data preparation, mining on text, machine learning, and predictive analytics. This tool is also used for commercial and related applications which also covers fields like research, education, application development etc. The RapidMiner Studio's free version is having 1 logical processor and 10,000 data rows is available freely under AGPL license ("RapidMiner - Wikipedia," n.d.). In this study RapidMiner's Text Mining Extension is being chosen as it is free and handy to use. RapidMiner supports huge set of operators for the purpose of text processing and mining. ("RapidMiner - Wikipedia," n.d.).

3.2 Tokenization and Filtering in RapidMiner

The process in which stream of texts can be decomposed into small words, symbols, phrases, words or else other elements which are meaningful tokens is referred as tokenization process. Textual mining is an interpretation textual information or character blocks. The typical use of process like this is as a mean of identification of useful keywords (Verma et al., n.d.).

4 Review of Literature

Kozinets (1998) introduced literature on research in the market in the field of netnographic studies, which is a method of interpretation used to perform investigation on the behavior of consumers, their cultures and the communities available on the worldwide web.

Kozinets (2002) helps with the guidelines which recognize the online environments, values the inherent flexibility, openness of ethnography and ensures ethics in performing marketing research with the help of online coffee newsgroup example and its implications on marketing.

Langer et al. (2005) comments on suitability of online ethnographic methodology for the better understanding of some of sensitive research topics.

Kozinets (2006) highlights some key features of online ethnographical studies, saying it is faster and less expensive compared to other traditional studies in ethnography.

Tye Rattenbury et al. (2006) presented a new term called ethnomining which is a mixed approach drawing on some of the techniques from data mining and ethnography. It is characterized by iterative looping which integrate the results and the processes used in data mining and ethnographic studies for purpose of interpretation of data.

Sandlin (2007) presented detailed views on methodological tool like netnography which researchers working in the field of educating consumers can use for the purpose of identifying and understanding popular culture and web-based sites of learning and educating. Author discussed how to use tool like netnography and examine arena of culture-oriented consumer education.

Murthy (2008), in this paper author has elaborated on various possibilities and possible problems of some of the new technologies which includes questionnaires, online digital, socially network websites, and various blogs. Author has also highlighted their possible impacts on the form of research relationships.

Nusair and kandampully (2008) their focus is on travel web sites. Author has made attempt to examine some of the commonality within the past studies on travel web sites and their quality dimensions. They have conducted analysis on content of selective travel related web sites. Paper also says that content analysis is one of the efficient ways which helps to understand or examine in what way the online business is performing on various dimensions of quality of service.

Hamilton and Hewer (2009), author explained the methodology which is adopted to get means of the “deep contextualization” which is necessary for the full and rich understanding of the Salsa. The source of material in paper was taken through an analysis of netnographic study of an online forum (<http://www.salsaforums.com>). In this paper, author reveals on experience obtained from study of salsa.

Kozinets (2010a) in this article author has commented on use of netnography in marketing with specific examples of marketers.

Xun and Reynolds (2010) explored various paths better understanding of various characteristics and also effectiveness of electronic word of mouth using online ethnography tool to understand what influence the decision making of the consumers. They also have provided mechanism of assessment of some of the main strengths, weakness and various ethical concerns attached to the appropriate use of the netnographic technique.

Barbier and Liu (2011) explained various techniques in data mining which helps researcher in the form of tools required to analyze data on social media which is frequently changing, large in volume, more complex in nature. Article also puts lights on fundamental topics in data mining, social media reviews, mining data on social media.

Griggs (2011) helped with ethical considerations which cover concerns in the list mining, as another method of collecting data within the subculture of sports. Author raised ethical considerations on internet based electronic communication as biggest Concern.

Kozinets (2012) explored on waves of geographic, academic, that target research audiences which helps for the adoption of new approach known as marketing

netnography. Mkono (2012) mentions that netnography developed by Kozinets could be used in tourism/travel research as internet has been normalized as part of lifestyle. Researchers may find engaging themselves with data collected or contributed from all range participants, in studies which are age range specific (Mkono 2012).

Regan et al. (2012) talks about the opinion mining and relevant algorithm based approaches used for general analysis, it also mentions how accurately it reflecting to interpretation and roles played by online reviews. Paper comments on wide range of the opportunities and its implications in academic research and development of connects or system by practitioners. However, this paper has limitation as samples were taken only from the china.

Belinda et al. (2012) the key objective in study covered in this paper is to prepare and propose innovative and interdisciplinary approach which investigate relationships among various brand, actors in market and also decision-makers in companies. Derya et al. (2013) author has argued that the field, interviews, participant observation and researcher skills are experimented in different ways in ethnographic cases as opposed to another in person ethnography, which in turn calls for the reconceptualizing practices in communities online.

Loanzon et al. (2013) explores netnography as fuzzy front end tool, which has created evolution in computer mediated tools and infrastructure online. Also, it has included more automated and some of applications passive in nature and will evolve as tool to measure online experiences of consumers.

Wu and Pearce (2014) mentions role played by netnography in helping and enhancing understanding of tourist markets which are changing rapidly and new market and its growth, also culturally different groups etc.

Berezina et al. (2016) this article focuses on viewpoints of satisfied and also unsatisfied hotel Customers. In this an approach of text mining followed and also online reviews from customers who are satisfied and dissatisfied also being compared. Final outcome or results indicates that normally satisfied Customers are referring to intangible contexts of hotel stays like, staff members etc. whereas dissatisfied customers are normally mentioning tangible aspects or contexts of their hotel stay which covers finances and furnishing etc.

McKenna et al. (2015) elaborates various challenges while analyzing large amount of data qualitative in nature which is normally collected from online world text and images both). Its further comments on use of images in studies which are qualitative in nature and also proposes innovate way to perform analysis on textual nature of data using a tool named as Leximancer.

Wan and Cecile (2015) briefly commented on social media, social media for CRM and its exploitation. They have also described vizier, the development and functionality of it, which itself a monitoring system in monitoring social media for understanding actual and potential customers.

Deka et al. (2016) article throws lights on various aspects involved doing research in understanding consumer and their behavior, in addition to this author presented framework-based approach which may be adopted to apply netnography in the field of e-commerce and relevant sites in India.

Zhang and Benyoucef (2016) discussed various definitions of social commerce and its scope. Author explained methods used to conduct studies which helps in

understanding consumer behavior in social commerce sites. also, author presented reviews on various studies helping in summarization of findings in various aspects. additionally, author proposed framework which theoretical in nature to help us understand behavior of consumers on social commerce sites.

Hernandez et al. (2017) introduced a logic model named as linear temporal model-based approach for checking results of the analysis obtained as outcome from structured e-commerce sites, Weblogs. It has defined a common way to map log records as per e-commerce structure and further logs can be converted as event logs which contains captured behavior of users.

5 Methodology

An Approach to achieve defined objectives has been divided into the following steps:

- a. Intensive literature survey has been done to understand the research work to be carried out in the field of Netnography, Electronic Commerce, tourism sector and Netnography application using text mining.
- b. To Understand Overall market structure and Consumer base of online travel agents in India
- c. To Perform Netnography on selected online travel services in India
 1. define and formulate research based questions by referring travel related sites.
 2. collecting data by ensuring ethical guidelines from various sources.
 3. performing analysis and drawing interpretation or meanings from findings.
- d. Understanding consumer experience with respect to online travel services in India combining text mining and netnographic analysis.

Competitive Advantage of Proposed Research Framework:

The online travel service providers can gain an advantage of this framework by Mining meaningful information from consumer reviews, comments, which further can be used to derive patterns to understand positive and negative comments. Companies can take corrective actions according to reviews/feedback provided by consumers and gain competitive advantage.

6 Conclusion

One of the limitations of the studies conducted on consumer satisfaction with online travel services in various countries including United States, that it cannot be generalized to all travel services in all countries. This has created scope and opportunity to conduct a similar study in India using text based Mining which was missing in studies conducted earlier, Present framework will help online travel service providers in India to understand voice of consumers, understand their levels of satisfaction and dissatisfaction and help to take corrective measure at appropriate time. Netnographic analysis would be carried out on data collected from various means including Corporate website, Advertisements (sponsored links, News sites, Rating and referral sites (Mouthshut.com), Community sites. Netnographic analysis results integrating with

Text mining would help to identify key tokens using tokenizing process in RapidMiner and further interpretations can be derived from the result to measure level of satisfaction and dissatisfaction of consumers.

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Performance Evaluation of STSA Based Speech Enhancement Techniques for Speech Communication System

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Abstract. Researchers present noise suppression model for reducing the spectral effects of acoustically added noise in speech. Background noise which is acoustically added to speech may decrease the performance of digital voice processors that are used for applications such as speech compression, recognition, and authentication. [6, 7] In proposed paper different types of Short Time Spectral Amplitude (STSA) [1, 17] based methods are explained to decrease the noise. Spectral subtraction gives a computationally efficient, processor- independent approach to effective digital speech analysis. But as a result of artifact, another synthetic noise may be produced by algorithm that is called musical noise. In spectral subtraction methods, there is shown less trade-off between residual and musical noise so the quality and intelligibility of signal is not maximized at required level. [8] To overcome from the problem of musical noise, wiener filter and statistical based model methods are discovered and some proposed modifications [7–11] are suggested in every methods to make it more effective.

Keywords: Speech enhancement · Musical noise · Transient distortion · Wiener filter · Voice activity detector

1 Introduction

Using various algorithms, speech quality and intelligibility can be aimed to improve by Speech enhancement. Background noise is a big problem because it degrades the quality and intelligibility of original clean voice signal [1]. Speech enhancement techniques are single channel and based on the short time discrete Fourier transform (STDFT) and uses various algorithms uses analysis-modify-synthesis approach [8]. The analysis window length is kept fixed and framed based processing is used. It works on that the clean spectral amplitude would be properly captured from the noisy speech signal at general accepted level of quality speech at output and hence it is said that they are called short time spectral amplitude (STSA) based methods [9, 16]. In the enhanced output speech, the phase of noisy speech is adopted. For the synthesis process, the overlap-add method is selected [10]. In proposed paper, the simulation and

performance evaluation of various STSA based algorithms from spectrogram analysis, listening tests and objective evaluation are done by using MATLAB software.

2 Literature Review

The speech enhancement techniques are known as from its two categories which are following as: (i) Single channel and (ii) Multiple channels (array processing) it depends on whether the speech received is from single microphone or multiple microphone corresponding resources [11]. The Short time spectral amplitude (STSA) methods are single channel methods and most well known and well investigated as they doesn't need complexness and huge implementation [8, 9, 14]. STSA methods are transform domain most conventional methods and our assumption is that noisy signal has white noise which is additive and stationary for one frame and it will be changed gradually in comparison with the input speech signal. These methods are based on the analysis-modify-synthesis approach. They use fixed analysis window length and frame based processing [3, 4, 5] (Table 1).

Table 1. List of symbols

Symbol	Meaning
$X(n)$	Degraded input signal
$Y(n)$	Clean output signal
$D(n)$	Additive noise
η	Smoothing factor
K	Discrete frequency bin
$\xi(K)$	SNR before applying algorithm at frequency bin $K = \frac{ \hat{X}(K) ^2}{ D(K) ^2}$
$\gamma(K)$	SNR after applying algorithm at frequency bin $K = \frac{ Y(K) ^2}{ D(K) ^2}$
$\phi_y(K)$	Preserved Phase of signal $Y(n)$ at frequency bin K

2.1 Magnitude Spectral Subtraction

S.F. Boll first proposed Spectral subtraction method [2]. In this method, he subtract an estimate of the average noise spectrum from noisy speech magnitude spectrum signal. It is the basic principal of spectral subtraction. The clean speech signal is given by

$$|\hat{X}(K)| = \begin{cases} |Y(K)| - |\hat{D}(K)| & \text{if } |Y(K)| > \hat{D}(K) \\ 0 & \text{else} \end{cases} \tag{1}$$

Hence, original speech estimate is given by,

$$X(K) = [|Y(K)| - |\hat{D}(K)|] e^{j\phi_y(K)} \tag{2}$$

The original speech estimate is given by preserving the noisy speech phase $\phi_y(K)$.

2.2 Wiener Filtering Methods

The Wiener filter is an optimized and non-causal filter which reduces the mean square error of a input speech [10]. The clean speech equation of Wiener filter is given by

$$|\hat{X}(K)| = \frac{\xi(K)}{1 + \xi(K)} |Y(K)| \quad (3)$$

Decision Direct (DD) Approach: As a solution, the decision directed rule is proposed by Ephraim and Malah [4] to count this ratio and which was used by Scalart et al. [5] with adding Wiener filter. According to Scalart, the algorithmic rule for frame t is given by Eq. 4.

$$\xi^{(t)}(K) = \eta \frac{|\hat{X}^{(t-1)}(K)|^2}{|\hat{D}^{(t)}(K)|^2} + (1 - \eta) \max(\gamma^{(t)}(K) - 1, 0) \quad (4)$$

Where $0 \leq \eta \leq 1$ is smoothing factor and generally it is set to 0.98.

3 Proposed Method (MMSE-LSA Modified/MMSE85 Modified)

The statistical model based methods such as minimum mean square error (MMSE) is given by Ephraim and Malah and its another version MMSE log spectral amplitude (LSA) [1] generally used noise counting methods. They are in favour of modelling spectral elements of speech signal and noise signal processes as they are independent of Gaussian variables [12]. Many of published papers mention that the performance of Wiener filter and MMSE LSA is fabulous in terms of every practical and mathematical evaluation [18].

The method presented over here is Statistical Model based method [1] which is named as minimum mean square logarithmic spectral amplitude modified or MMSE85_modified. Clean speech is given [13] as

$$|X(K)| = \frac{\xi(K)}{1 + \xi(K)} \exp\left(-\frac{1}{2} \int_{V(K)}^{\infty} \frac{e^{-t}}{t} dt\right) |Y(K)| \quad (5)$$

The decision direct rule for frame t for this method is also written as Eq. 4.

Proposed Modification of a Priori SNR: In the equation of given by MMSESTSA-LSA [6], the choice of η is critical. In usual, for every method we are getting value mostly close to 1. It can be seen that if the value of smoothing factor remains near to 1, the synthetic (artifact) noise will be less, but there occurs more “transient distortion” to the output speech signal. To keep balance between these two processes, observed outcomes in the literature always keep a constant value which is in the range of 0.95–0.99 with a few exceptions. But using this constant has some remedies.

Therefore, the algorithmic rule for η is as following,

$$\eta(K)^t = \frac{1}{1 + \left(\frac{\xi(K)^t - \bar{\xi}(K)^{t-1}}{\xi(K)^t + 1} \right)^2} \tag{6}$$

4 Simulation and Performance Evaluation Using MATLAB

NOIZEUS is a noisy speech corpus database which is recorded among researchers of groups of IEEE. The noisy database contains 30 IEEE phonetically balanced sentences were corrupted by three different real-world noises (station, restaurant, street noise) at different SNRs (in our experiment the range 0–10 dB) [11].

4.1 Spectrographic Results of Simulation

Spectrogram of both original speech and noisy speech and enhanced output using MMSE-LSA_modified algorithm are shown in Fig. 1. As it can be seen there is a constant background noise present in the noisy speech.

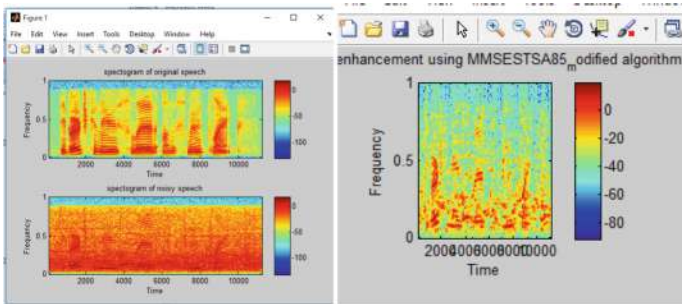


Fig. 1. .

Spectrograms of remaining two methods are shown in Fig. 2. The spectrographic analysis shows that if we compare the results with original spectrogram, MMSE-STSA85(MMSE-LSA)_modified gives best pattern as noisy signal changes in proportion with input speech signal and performance of MSS is good and The Wiener filter method has also a matching pattern but little distortion in spectrograph as compared to MSS and MMSESTSA85 modified methods. The MMSE-LSA_modified algorithm is observed the best from these two from practical point of view (Table 2).

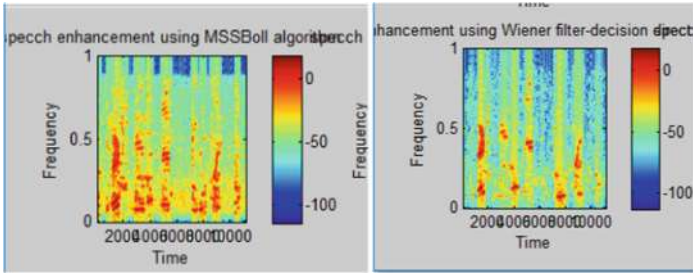


Fig. 2.

4.2 Simulation Based on Objective Quality Measure

The evaluation of STSA based methods are completed as calculating objective quality measures SSNR, LLR, WSS and PESQ. This four measures are analyzed with the help of NOIZEUS database. Segmental signal to noise ratio(SSNR), Weighted spectral slope (WSS), Log likelihood ratio(LLR) and Perceptual evaluation for speech quality (PESQ) are four objective quality measures. The values of the SSNR, LLR, WSS and PESQ are implemented and returned using the MATLAB function [1] and inventors accepted this values broadly at all over the world for quality purpose of their speech enhancement algorithms [12, 13]. This database has the mentioned code for evaluation which is used to keep maintain privacy, consistency and compatibility with results stored by alternative inventors.

Table 2. Objective quality evaluation with street noise, restaurant noise and station noise

	0 dB				5 dB				10 dB			
Street noise												
	SSNR	WSS	LLR	PESQ	SSNR	WSS	LLR	PESQ	SSNR	WSS	LLR	PESQ
MSSBoll79	-1.351	84.6089	1.0555	1.663	0.2108	68.916	0.8763	2.0632	2.1157	56.1325	0.6477	2.4959
WienerScalart96	-0.972	118.2388	1.3972	1.6009	0.2629	95.8322	1.1828	1.9547	1.7746	74.9996	0.8795	2.4198
SSMultibandKamath02	-3.0104	70.6299	0.9921	1.7235	-1.4438	58.6753	0.7972	2.0858	0.2581	47.3427	0.5989	2.4732
Restaurant noise												
MSSBoll79	-2.1791	97.2494	0.9992	1.6782	-0.2867	79.0998	0.7826	2.113	1.8766	62.717	0.6157	2.4885
WienerScalart96	-2.016	122.7877	1.356	1.4891	-0.4357	98.5382	1.0725	1.9893	1.4381	76.1611	0.8663	2.4148
MMSESTSA85_modified	-3.463	101.5653	1.0019	1.7814	-1.6211	84.1034	0.8287	2.0997	0.4594	66.8071	0.6716	2.4786
Station noise												
MSSBoll79	-1.355	87.7056	1.0241	1.6836	0.747	71.2343	0.7916	2.1252	2.8388	59.5597	0.6034	2.553
WienerScalart96	-1.0319	120.2635	1.35	1.5471	0.5771	97.8194	1.0681	1.9713	2.5065	75.8354	0.8545	2.4995
MMSESTSA85_modified	-2.9173	97.0670	1.0052	1.8553	97.8194	1.0681	0.7876	2.2213	0.8399	64.8758	0.6552	2.5271

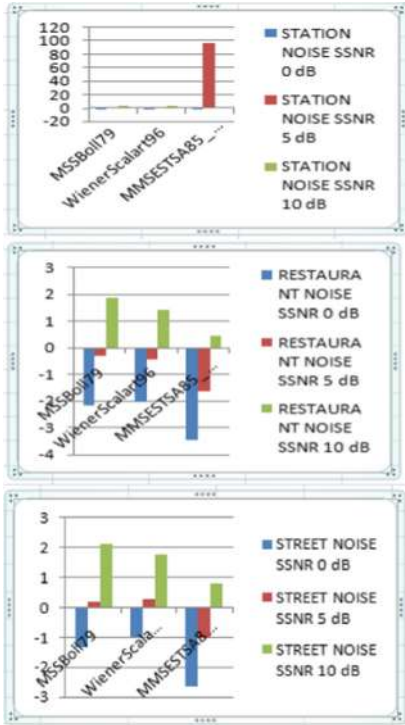


Fig. 3. SSNR comparison

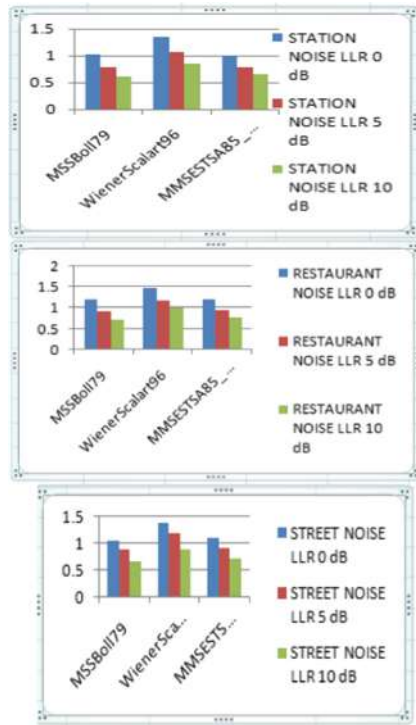


Fig. 4. LLR comparison

For comparison purpose the graphical representation of the results of SSNR, LLR, WSS and PESQ for all conditions are shown in the form of chart in Figs. 3, 4, 5 and 6 respectively. The all results of all methods at different places are relatively concluded. The SSNR value for MSS and Wiener filter is high but in some cases, the value of SSNR is the highest for the MMSE85_modified algorithm. MMSE85_modified algorithm has less spectral distortion but it gives the best WSS results because WSS needs the least value as shown in charts. In some cases the wiener method and MSS methods has lower WSS but they have not high SSNR in compare to MMSE STSA methods. From LLR comparison the MMSE STSA algorithms have value less than one for nearly all cases. Ideally LLR should be zero. The PESQ score above 2.5 is acceptable. In this regards the MMSE STSA85 modified algorithms work satisfactorily.

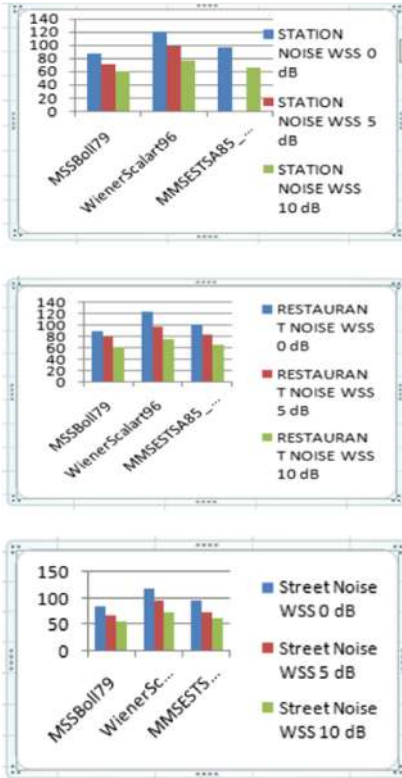


Fig. 5. WSS comparison

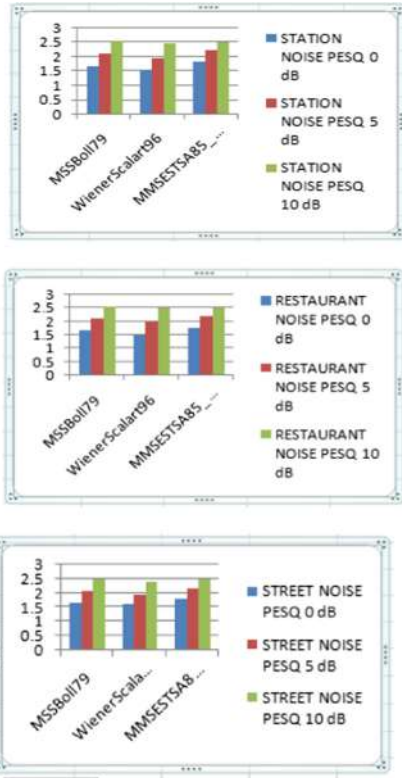


Fig. 6. PSEQ comparison

5 Conclusions

The implementation and simulation of the STSA methods are very simple and done here in MATLAB. According to the Results, the synthetic noise artifact is generated by spectral subtraction methods. The MSS method is not so good as Wiener Filtering methods as shown in the experiment. Also the speech distortion and residual noise trade-off is not fully but at an accepted level solved by MMSE-LSA_modified algorithm. In proposed algorithm, we make smoothing constant adaptive as a result there is less transient distortion. Hence, in future any other parameter can be made adaptive for best results or more enhanced output.

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Optimal Unit Commitment for Thermal Power Systems Using Penguin Search Algorithm

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Abstract. Electricity networks day to day delivers hundreds of giga watts per hour (GWH) to consumers. Those interconnected systems became hard enough challenging to maintain and run in the operating mode. So need arises to generate and supply electricity in a smart methodology which is expected to be highly economical. Unit Commitment, an important economic problem through optimization to be solved for obtaining an optimal cost saving in a specific period of time which is purely based on the determination of the combination of available generators. An electrical industry which deals mainly with meeting the load demand for all the generators. A generating unit has various limitations such as minimum uptime, minimum downtime, minimum and maximum power generation limits, prohibited zones etc. This research implementation paper presents a general idea of scheduling the generating units using the Bio-inspired algorithm PeSOA - Penguin Search Optimization Algorithm. PeSOA is a latest metaheuristic method through penguins collaborative hunting strategies, specially designed for optimizing non-linear systems. Significance of PeSOA is penguins Distribution is balanced through local minima and global minimum. Implementation carried out for various types of systems include problem instances of 10 units - 24 h system, 3 units – 24 h system, 4 units - 8 h system and 4 units – 24 h system, each of all the cases has compared with the results from the literature.

Keywords: Unit commitment · Optimization · Economic dispatch · Bio-inspired computing · Penguin Search Optimization Algorithm

1 Introduction

In the electricity network domain Unit commitment plays an important task, optimizing the operational cost in unit commitment can lead to highly effective, more reliable and best economic operation of power plants. It is considered as an important task to decide the number of time units of generating power before solving the UCP either for a day or a week. After careful planning of the operation schedule of the generators for the chosen time units, the same style of allocation of generators to produce electric power and also cost fixing must be implemented for the whole year of time to achieve economic year plan of running power plants. Pattern of cost calculation is an important factor which must be considered in the operation of power plants especially thermal and hydro power plants. The cost of all generators operation for each hour is calculated

through production and after including cost involved in the unit start-up, the overall operational cost is fixed for the given time unit either day or a week. It is needed to schedule resources of the power systems to ensure proper functioning of the power system and reliable delivery of power. In addition to achieve minimum cost, UC must satisfy a variety of constraints in operating. The Unit Commitment constraints are problem must be satisfied are system power balance, minimal up-time and minimal down-time of the unit, power production limits, spinning reserve etc. There are two variations of UC, (i) Unit commitment for cost minimization, and (ii) Unit commitment for energy production profit maximization, commonly called as Profit based UC (PBUC). UC activity plays an important role in the power system economic plan for performing scheduling of the generators with fuel and cost saving as a goal. Many algorithms were invented for the optimization of UC problem. Some of the popular algorithms solved UC in the literature are mixed integer programming [5], lagrangian relaxation [2], simulated annealing [4], fuzzy logic [8], particle swarm optimization [3], cuckoo search algorithm [7], invasive weed optimization [1], and binary fireworks algorithm [6].

The main motive of this research work is to achieve minimum cost and also by satisfying various technical constraints. This research work proceeded based on 4 benchmark datasets of thermal power generators and compared with the UC problem results in the literature. Benchmark data include no of units, load, maximum power, minimum power and cost calculating constants considered. Minimum cost calculated by the implementation of a Swarm based metaheuristics based on the interesting hunting behavior of penguins and termed as Penguin Search Optimization Algorithm.

2 Unit Commitment Problem

2.1 Objective Function

The Objective functions are articulated as the thermal units cost minimization for scheduled period. Total cost calculated as sum of fuel cost, start-up cost and shut-down cost.

To Minimize, Total Cost = Start - up cost + Fuel cost + Shut - down cost

$$\text{Min} \sum_{t=1}^T \sum_{i=1}^N \{c_i(p_i)u(i, t) + su(i, t) + sd(i, t)\} \quad (1)$$

where,

- $c(p_i)u(i, t)$ – fuel cost of the production units
- $su(i, t)$ – cost incurred in unit start up
- $sd(i, t)$ – cost incurred in unit shut down

Thermal unit Fuel cost is expressed as a second order estimated function of its output P_i [2].

$$p_i = a_0 + a_1 p_i + a_2 p_i^2 \quad (2)$$

Where P_i is the power output for each generator i . a_0 , a_1 , a_2 are the cost fixing constants for calculating the production cost.

Start-up cost: the cost minimum needed to start a generator from the cold state.

Shut-down cost: the cost minimum needed to stop a generator which is in ON state.

2.2 Technical Constraints

The activity of minimizing the overall operating cost is entirely depends on a set of system which generates constraints such as, prohibited operating zones, power balance, initial status, spinning reserve capacity of the generating units and minimum up/downtime constraints.

Initial Status: Initial status of the generating units must be considered before scheduling the unit commitment status (ON/OFF). Initial status is normally represented as integer and positive integer indicates the particular generator is in ON state for certain hours. -ive number indicates the particular unit in OFF state for certain given number of hours. If the unit continuously states OFF for certain hours, then is called cold state.

Power Balance Constraint: Total power generation should be equal to the load which is expected includes loss of power, as given in Eq. 3.

$$\sum_{i=1}^N p_i = P_D \quad (3)$$

Generation Limits: Each generating unit is belonging to its own minimum and also maximum limit of power generation. This constraint is called as generation limits or power limits constraint. It is given clearly in Eq. 4,

$$P_{\min} < = P_i < = P_{\max} \quad (4)$$

Minimum Uptime: This is number of hours (minimum) particular generator should continuously be turned on as like given in Eq. 5.

$$MT_i^{\text{ON}} > = T_i^U \quad (5)$$

Minimum Downtime: Number of hours (minimum), particular generator should continuously be turned off as like given in Eq. 6.

$$MT_i^{\text{OFF}} > = T_i^D \quad (6)$$

Prohibited Operating Zones (POZ): Due to vibration in a shaft bearing or mechanical stress, there are chances of interference also affects input and output performance which is called as prohibited zone.

Fuel Constraints: This constraint tends to explain limited availability of the fuel or burning some amount of fuel.

3 Resolution of Unit Commitment Using PeSOA

Swarm based metaheuristics algorithm based on the penguin birds and their behaviour of performing hunting in an interesting manner. Such algorithm is termed as Penguin Search Optimization Algorithm. The primary equation of the penguin search optimization algorithm is formulated for solving UC as to generate electric power outcome of every generating unit as equal to the already stated load demand. Initially random power output is selected and that selection is based on that output, rest of the power outcomes can be estimated. In each iteration the best output of power is compared and economic outcome is scheduled and selected as the optimal result and based on that the operational cost is calculated and thus cost saving is achieved reasonably (Table 1).

Table 1. I/O of UC using PeSOA

Input variables	Output variables
X_{best} , X_{id}	The optimal power outcome for each unit X_{new}

Initially random power output is selected from any generator and cost is computed. The selected random power outcome is considered as X_{id} , then by using X_{id} and rand() function n number of costs are calculated for given many generators. From that, X_{best} is selected among all based on the selected minimum cost. The selected value is considered as the cheap cost (best minimum cost value) for the particular iteration. Then by computing and substituting X_{best} value in the primary equation X_{new} should be computed. Finally X_{best} provides the optimal cost value. These step by step procedures of calculating cost value should be implemented for all the iterations and final cost value can be computed or estimated.

X_{id} - Initial random power output or outcome (in Megawatts) for any power generator

Rand () - it is a Function used for generating random numbers

X_{best} - A best power output or outcome of the current generation

X_{new} - Final optimal output of power

The algorithm tends to choose the best power must be scheduled for all the generators. Power output schedule solving all the important technical constraints, must be selected and that schedule is an economic dispatch of the available power generating units. This implementation is performed on 10 generators and 24 h Data set. So power output is likely to be scheduled as $10 * 24$ for calculating for the whole day. Then also for the selected schedule cost value should be calculated for the 24 h. After calculating or estimating the operational cost for all the 24 h, given start up cost must be added and finally total operating cost must be computed.

Start up costs should be added to the particular generator in such a case of situation where its initial status is in cold state and it need to be converted from cold state to normal state, i.e., start up cost must be added to the case of a situation in which a particular generator is bringing to ON state. For considering other cases no need of including values of start-up costs. Including spent shut down activity cost is also a part task of the UC. Usually shut-down cost is considered as 0. Finally after calculating or fixing the optimal schedule of the electric power dispatch, cost value must be calculated parallel for all given hours.

The implementation flow of the PeSOA is depicted in the Fig. 1, step by step process of selecting optimal holes by sending multiple penguin groups for hunting. At last optimal minimum cost value must be calculated by solving primary constraints including prohibited operating zones. According to the flow graph, initially random power output is generated. And by implementing the primary equation three different solutions should be computed or calculated and updated as a result set of every iteration.

4 Results

The study shows, various UCP systems were taken for implementation. Implementation was performed with the Penguin Search Optimization Technique (PeSOA). The implementation for solving UCP is based on the pre fixed data instances, including number of power generators, number of units of time (either a day or a week), cost fixing co-efficients (a_0 , a_1 , a_2), Initial status, minimum down time, load limit for each power generator, the start-up cost value for each generator, and minimum up time.

Number of units is nothing but the total number of power generators taken work for a day or week. Number of units of time is based on the given hours or days manipulation like 24 units of time if its taken for solving for a day, 7 days as a unit of time if it is taken as solving for a week basis. For calculating the cost value, UCP is primarily and entirely depends on the cost fixing co efficient constants expressed as a_0 , a_1 , a_2 . Cost value co-efficients or constants must be included each time for calculating production cost value for each power generator. In any timely hour, a particular power generator is turned to ON from OFF state, then as for that hour start-up cost value calculated, must be added in addition with the production cost value and the final calculated cost value is termed as an operational cost. Aim of Unit Commitment to minimize some from operational cost value of the power plant system.

It is then important to frame a pattern setting like considering minimum down time and minimum up time of every generator, so that any power generator can be used effectively. This minimum down time and minimum up time differs from one generator to other generator based on the capacity of each generator. So it is important to keep in mind that the minimum up time and minimum downtime before deciding which power generator is set to be ON state and which power generator is set to be OFF for certain number of given hours. Such selection procedure, also termed as the optimum dispatch of the power generators. It is also tends to be an important part of solving the UCP.

```

Pseudocode of PeSOA:
Random Population Generation of P solutions in groups;
Probability initialization of fish existence in holes;
For i=1 to Generations(no. of)
For individual i belongs to P do
While reserved oxygen not depleted do
- Choose Random
-Penguin position improvement through Eqs (1)
-Quantities of eaten Fish Updation for penguin.
EndWhile
EndFor
-Quantity Updation of eaten fish in holes, levels and best group.
- Probabilities of penguins in holes and levels are redistributed (based on eaten fish)
-Best Solution Updation
EndFor
    
```

Fig. 1. Pseudo code of PeSOA

Normally, generator dispatch is encoded as binary combinations to represent whether the generator is OFF or ON in particular time unit. After framing the generator dispatch, power outputs (MW) can be generated as per the load demand for each hour. Then cost for an each hour time of the work allotted generators is estimated as a production cost value and including the start up costs, total operational cost value is calculated.

The algorithm PeSOA is implemented here for solving the UC problem for **24 t-hour system 10 g-unit**. Generator dispatch must be generated initially and based on the generators schedule, power generation must be generated by all the allotted generators or units. In this particular given test case, power output values of 10 different generators must be generated that should satisfy the given or fixed load demand for twenty four hours (Table 2).

Table 2. Schedule of generators for 24 t-hours 10 g-units system

Hour/Unit	UN1	UN 2	UN 3	UN 4	UN 5	UN 6	UN 7	UN 8	UN 9	UN10
HR1	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
HR2	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
HR3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
HR4	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
HR5	ON	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
HR6	ON	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
HR7	ON	ON	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
HR8	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
HR9	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF
HR10	ON	ON	ON	ON	ON	ON	OFF	ON	OFF	OFF
HR11	ON	ON	ON	ON	ON	ON	OFF	ON	OFF	OFF
HR12	ON	ON	ON	ON	ON	ON	OFF	ON	ON	OFF

(continued)

Table 2. (continued)

Hour/Unit	UN1	UN 2	UN 3	UN 4	UN 5	UN 6	UN 7	UN 8	UN 9	UN10
HR13	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	ON
HR14	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF
HR15	ON	ON	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
HR16	ON	ON	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF
HR17	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
HR18	ON	ON	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
HR19	ON	ON	ON	ON	OFF	ON	ON	OFF	OFF	OFF
HR20	ON	ON	ON	ON	OFF	ON	ON	ON	ON	ON
HR21	ON	ON	ON	ON	OFF	OFF	ON	OFF	OFF	ON
HR22	ON	ON	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
HR23	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
HR24	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

The power dispatch is generated as based on the listed technical constraints including, minimum uptime, minimum downtime, load limit, initial status etc. After generating this dispatch, power output (MW) for each allotted generator should be generated. Such Generation of power for all the unit generators be produced to satisfies load limit stated for every hour for all 24 h operation to solve the Commitment problem. Then the cost value is computed for every hour which including start-up cost, the overall operation cost. PeSOA is successfully implemented for the test data set-1. The results are depicted in Table 3 below.

Table 3. Power output (MW) for 10 g-units-24 t-hour system

H/U	UN1	UN 2	UN 3	UN 4	UN 5	UN 6	UN 7	UN 8	UN 9	UN10	Total limit (MW)	Fuel cost (\$)	Startup cost
HR1	450	250	0	0	0	0	0	0	0	0	700	13634	0
HR2	410	340	0	0	0	0	0	0	0	0	750	14491	0
HR3	455	395	0	0	0	0	0	0	0	0	850	16249	0
HR4	455	365	0	130	0	0	0	0	0	0	950	18585	560
HR5	455	424	0	96	25	0	0	0	0	0	1000	19985	900
HR6	455	455	0	130	60	0	0	0	0	0	1100	21807	0
HR7	455	455	0	130	110	0	0	0	0	0	1150	22826	0
HR8	455	455	130	130	30	0	0	0	0	0	1200	24097	550
HR9	455	455	130	130	120	10	0	0	0	0	1300	26517	340
HR10	455	455	130	130	162	50	0	18	0	0	1400	29427	60
HR11	455	455	130	130	162	80	0	28	0	0	1450	30384	0
HR12	455	455	130	130	162	70	0	50	28	0	1500	32158	240
HR13	455	455	130	130	162	48	0	0	0	20	1400	28253	60
HR14	455	455	130	130	120	10	0	0	0	0	1300	26517	0

(continued)

Table 3. (continued)

H/U	UN1	UN 2	UN 3	UN 4	UN 5	UN 6	UN 7	UN 8	UN 9	UN10	Total limit (MW)	Fuel cost (\$)	Startup cost
HR15	455	455	130	130	0	30	0	0	0	0	1200	24097	0
HR16	445	445	110	0	0	0	0	50	0	0	1050	21475	0
HR17	435	425	100	40	0	0	0	0	0	0	1000	20228	0
HR18	455	355	130	130	0	30	0	0	0	0	1100	22371	0
HR19	437	434	127	90	0	75	37	0	0	0	1200	25242	580
HR20	455	455	130	130	0	80	48	53	10	49	1400	31251	580
HR21	455	455	130	130	0	0	80	0	0	50	1300	27921	0
HR22	455	445	100	80	0	0	20	0	0	0	1100	22554	0
HR23	455	445	0	0	0	0	0	0	0	0	900	17125	0
HR24	450	350	0	0	0	0	0	0	0	0	800	15379	0

Based on the result obtained from the implementation of PeSOA in test data set-1, the total production cost obtained is **552573**. Total start-up cost obtained is **3870**. The total cost for 10 generators- 24 t-hours is **556443**. By comparing the results of PeSOA with those obtained with other implementations in the literature, it can be observed that the total operational cost is minimized considerably. This is being justified by the following comparison Table 4.

Table 4. Operational cost comparison of PeSOA with other algorithms

Techniques	Year of implementation	Operational cost
GA[16]	1996	563446
IGA [21]	2002	565825
SPL[52]	2006	565872
EACO[61]	2011	566404
PSO[53]	2011	564212
MILP[66]	2013	563938
BNFO[11]	2013	565827
LR[21]	2014	563865
GSA[76]	2014	564950
RMO[63]	2017	558578
PESOA	2017	556443

The implementation of many algorithms for solving the unit commitment by using the same benchmark data instances as in case study-1, is being compared with the proposed implementation using PeSOA. Researchers are trying to reduce the operational cost of the thermal power plant for many years. Various techniques were implemented to solve UC, as Genetic algorithm, Particle swarm optimization, Lagrangian Relaxation, Stochastic priority list, ant colony optimization, extended

priority list, modified radial movement optimization, binary neighbourhood field optimization, Mixed integer linear programming, gravitational search algorithm, radial movement optimization etc. (Fig. 2).

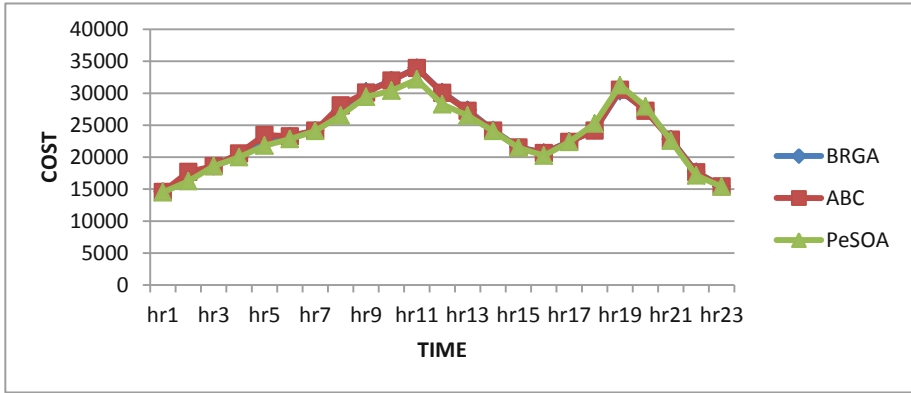


Fig. 2. Operational cost comparison of PeSOA with ABC, BRGA

From the above comparison chart, it is the operational cost acquired by the implementation of the Penguin search optimization algorithm for the dataset-1 is compared with the Artificial bee colony algorithm implementation [81] and Binary real coded genetic algorithm [82] with the same data instances-1. Cost for each hour in PeSOA is compared with the rest two implementations and found that there is reasonable reduction in some hours of PeSOA implementation for fuel cost computation, comparatively (Table 5).

Table 5. Consolidated Results of PeSOA based UC

Sno	Case tested	Cost in literature -technique	Cost obtained in PeSOA
1.	3 unit- 24 h	199097 – Dynamic Programming	197174
2.	4 unit- 8 h	74658 - PSO	73796
3.	4 unit- 8 h	45080 – Fuzzy Logic	43767

From the above table the implementation results done in this paper is compared based on the case studies done in the research. Costs obtained by implementing PeSOA is being compared with the works implemented already in the literature for the similar set of benchmark data. From above table its clear that PeSOA obtains reasonable low cost.

5 Conclusion

In this research work, the operational works of the generators of thermal power plant are economically scheduled by the proposed implementation of penguin search optimization algorithm for unit commitment optimization. This technique was used to fix the operational cost of the allotted generators for each given time unit. Different test cases were tested here and also compared with the results of Dynamic programming, Particle Swarm Optimization and fuzzy logic found in the literature. The proposed implementation is successfully demonstrated with varying test ranges from 10 unit, 3 unit with 24 h system 4 unit with 8 h system. Test cases were taken from various works in literature for implementation and the results obtained were optimal. The optimal results obtained were compared with many implementations of solving UCP for several years from the literature. It is clear from the results obtained for the benchmark tests, PeSOA is the best performer of solving UCP and the results of the above proposed approach are compared to some other methods of algorithms too. An effective attempt can be done to improve PeSOA with other aspects in future for other problems.

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Privacy Preserving Location Monitoring System Using Score Based K-Anonymity

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Abstract. In LBS, providing privacy to the user's location information is a major concern. Location Privacy is an emerging area where a lot of research is being carried out focusing on the anonymous location information. K-anonymization is a traditional and popular privacy preserving technique that generates Cloaked Region (CR) where the query issuer cannot be distinguished among the k-1 other users in the CR. Cloaking is a technique which blurs the user location into a Cloaked Region (CR) that satisfies the privacy parameter specified by the user at query time. This paper provides a method for generating best minimized cloaked region for transfer of the data between the users. By updating the trajectory and location information of the users, Location Privacy can be further improved.

Keywords: Cloaking · Location Anonymizer · LBS · Location Privacy · K-anonymity

1 Introduction

With the technological growth of increase in demand for the Location based Services, analyzing the user location data is more important where it includes sensitive information. Importance in hiding the user sensitive data is becoming an emerging paradigm in networking [1]. Providing security and privacy to the users utilizing the services offered by the LBS is treated as a major issue.

When a user requests for a service with the help of a trusted third party, the user and the Trusted Third Party Server along with the Location based Server are to be validated by using proper security measures. Here the physical location of the user when submitted to the Location Provider has to be protected from other malicious users. And also the users must get their own location information from the Location Provider. Thus the dynamic data generated by the location based devices is to be collected repeatedly by a trusted third party server, which poses a serious threat on the user's privacy.

The privacy of the user location information along with the query information is a concern that is to be addressed while sharing the data. Hence it is an important area which deals with the leakage of sensitive information of the users, known as Location Privacy.

Several research is being carried out for addressing the issue of location privacy where user anonymity is important. Spatial Cloaking along with k-anonymity had been widely considered to achieve privacy where the user locations are supposed to be distorted by creating cloaked regions [5]. This technique uses location cloaking algorithms to generate cloaked regions and there are several existing location anonymization algorithms to achieve this. But there are other important parameters to be considered along with privacy such as overhead cost, query response time, accuracy of the result and so on [2]. Thus the main aim of this paper is to minimize the size of the cloaked region by reducing the transmission overhead.

2 Related Work

Several methods are proposed for preserving privacy in Location based Services. Among those Anonymization is the popular technique, the state of performing certain activities without revealing identity, also known as the technique of hiding the user identity. A traditional anonymization technique for protecting privacy is proposed by Sweeney, known as k-anonymity. This method uses generalization and suppression techniques [8]. K-anonymity is a technique which is defined as the user location information is made indistinguishable by at least k-1 users by defining a set of quasi identifiers. To achieve privacy using k-anonymity, a trusted third party is to be incorporated which is called as Location Anonymizer [11].

K-Nearest Neighbors' is an anonymization technique which partitions the user locations into spatial cloaks of arbitrary polygon shape. Another method suggested is by using dummy location selection using entropy to find k-1 users [4, 9]. Gruteser and Grunwald proposed a quad tree based spatial and temporal cloaking algorithm to reduce the risk of location information by defining a set of quasi variables for the users in Location based services [6]. By creating k number of queries from k different users it becomes difficult to identify a specific record from a set of k records to predict the actual user. The higher the k value yields the higher anonymity where the user is safe. But the disadvantage is that with the increase in the anonymity level leads in the reduction of the query accuracy and thus reduces the Quality of Service [3]. Among all the location anonymization techniques, the most widely used technique is spatial cloaking. Several location anonymization algorithms exist and the purpose of those existing techniques is to hide the actual location of the user by sending the information about the CR instead of the exact location of the user.

A Location anonymizer is available where the size of the cloaked regions are calculated by considering the minimum and maximum distance between the user nodes within that region. Doohee Song et al. proposed Anonymized Motion Vectors method that uses distance vectors to construct smaller cloaked region to reduce the query processing time [12]. Later he proposed an Adaptive Fixed K-Anonymity method which calculates all the path movements of the user nodes to minimize the query processing time [1]. But cost overhead is more and accuracy of the query results is not much guaranteed. All these factors affecting the performance of the network also depends on the capability of the devices such as low power, storage and connectivity among the other users.

3 Proposed Score Based Location K-Anonymity

K-anonymity is a technique which is defined as the user location information is made indistinguishable by at least $k-1$ users by defining a set of quasi identifiers. To achieve privacy using k-anonymity, a trusted third party is to be incorporated which is called as Location Anonymizer [11].

A location anonymizer is a trusted third party server that acts as a middle layer between the user and the LBS Server. Cloaking is a process where a spatial cloak or a region is constructed around the exact location of the user [1]. Location cloaking blurs the user's location into a Cloaking Region (CR) which satisfies the privacy metric specified by the user at the time of issuing query. The anonymizer is responsible for creating the cloaked region by making the exact location of the user uncertain with respect to the other users by using the location anonymization algorithms. But the main limitation with most of the techniques is to maintain the accuracy of the location information which is provided in the form of a query result [12]. In this paper, we have proposed a score based method for calculating k-anonymity to solve the problem of accuracy in the location information which aims on generating minimized cloaking regions. Here the query issuer is fixed where as the user devices or nodes are non-fixed.

To address the user privacy issue, a location based k-anonymity technique using score function is proposed. This method can generate minimized Cloaked Regions by choosing the nearest neighbors and can also protect the location and trajectory privacy of the query issuer. Using these smaller cloaked regions, energy consumption will be reduced and delay time between the user and the query issuer can also be minimized.

While deploying the nodes in the network, connectivity among the other nodes and the energy consumption of the nodes is considered. Initially all the nodes are allocated with an initial energy and there will be a change in energy levels accordingly with the change in the positions of the nodes within the Cloaked Region. The query issuer node transmits messages to the nearest neighbors in the Cloaked Region, where at some point of time there may be a chance of information leakage among the nodes in the Cloaked Region. In this method, the minimized cloaked regions are computed by considering the average locations reported by the user nodes. The lesser the area, the better the correctness of the aggregate location. The distance between two nodes within the Cloaked Region is computed based on weighted euclidean distance:

$$D = \sqrt{\sum_i w(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad (1)$$

The Proposed Location based k-anonymity technique solves the problem of accuracy in the location information by generating minimized cloaked regions based on the score function. The best path is obtained by calculating the score value for two different paths which results in same distance among the nodes. Thus to analyze the best cloaked region among the user nodes, a score function can be computed as follows:

$$\text{score} = w_{i1}E + w_{i2}C + w_{i3}I \quad (2)$$

Here, E is the residual energy, C is the node connectivity and I is node identifier. w_{i1} , w_{i2} , w_{i3} are the weights of the node at i th iteration. The best score value after subsequent iterations is considered as the optimum value and thus finds the nearest node and transmits the message. Hence the location based k -anonymity technique calculates the best cloaked region using a score function which is calculated relatively by considering the energy level of the nodes, connectivity among the nodes and node identifier value.

Thus the proposed approach is given in the following steps (Fig. 1):

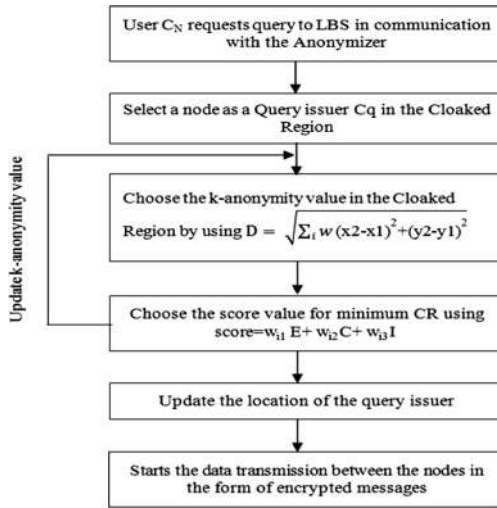


Fig. 1. Work flow of the proposed approach

4 Experimental Analysis

In this section, we evaluate our proposed algorithm based on the anonymity value ranging from $k = 2$ to $k = 10$ (a maximum value) to achieve the privacy. The simulation of the data is implemented in MATLAB to test its efficiency. The criterion for evaluating the efficiency of the system is measured using the following parameters such as Transmission Overhead, Size of the Cloaked Region and Query Accuracy.

The figure below shows the variation of transmission overhead over the proposed technique in comparison with Adaptive Fixed k -anonymity, Anonymized Motion Vector (AMV) and Minimum Cycle Region (MCR). The proposed work shows the improvement of decrease in the overhead i.e., time taken to transmit the data across the network in Fig. 2.

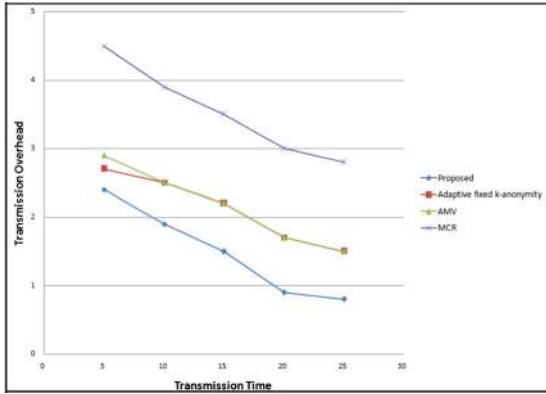


Fig. 2. Comparing transmission overhead

Figure 3 shows the generation of Cloaked Regions with respect to the anonymity level. The graph is analyzed with respect to the proposed work and the existing techniques

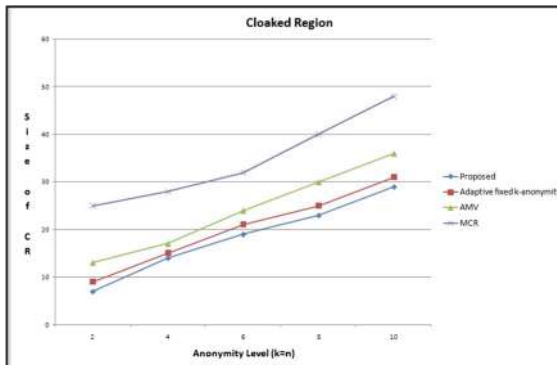


Fig. 3. Cloaked region size

With the inclusion of score function in the proposed work, the size of the cloaked region is minimized. There is also an improvement in the accuracy of the query information while compared and analysed with the previous existing techniques as shown in Fig. 4.

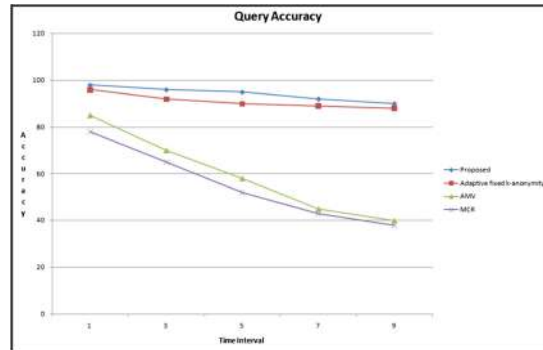


Fig. 4. Query accuracy

5 Conclusion

In this paper, a score based location k -anonymity technique approach is proposed to protect the privacy of the user locations. The location information is analyzed for every iteration in collaboration with the Location Anonymizer which contains the list of all the mobile user nodes. The factors such as transmission overhead, size of the cloaked region and accuracy of the query information are considered as measures which help in achieving privacy to protect the user location. But this technique may be vulnerable to query tracking attacks, where the malicious node can infer the query issuer [10]. The future work concentrates on optimizing the identified malicious node in the CR thus improving the performance of the system.

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(2, 3) - Remoteness Association of Corridor Network P_n Under IBEDE and SIBEDE Loom

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Abstract. This article deals with Incident Binary Equivalent Decimal Edge (IBEDE) graceful labeling and Strong Incident Binary Equivalent Decimal Edge (SIBEDE) graceful labeling of (2,3) remoteness network of path network. These approaches endow with many applications in complex network traffic to identify sensible type of traffic jams.

Keywords: BEDE · Binary · Remoteness network · Graceful · IBEDE · Incident · Labeling · SIBEDE

1 Introduction

Network labeling [1, 2, 9] plays a vital role in area of research in network theory which has wide range of applications in coding theory, communication networks, Mobile, telecommunication systems, optimal circuits layout, network decomposition problems, designing ambiguities in X-ray crystallographic analysis.

2 Binary Equivalent Decimal Edge Graceful Labeling

2.1 Incident Binary Equivalent Decimal Edge Graceful Labeling

2.1.1 Definition

Let $G (V(G), E(G))$ be a network with n vertices is said to be Incident Binary Equivalent Decimal Edge (IBEDE) Graceful labeling [3, 5–8], if there corresponds a $V \times E$ matrix called incident matrix and f is a bijective mapping from vertices to the set of integers $\{0, 1, 2, \dots, (n - 1)\}$ such that the induced map f^* from edge set to integers which is defined as

$$f : V(G) \rightarrow \{0, 1, 2, \dots, (n - 1)\}$$

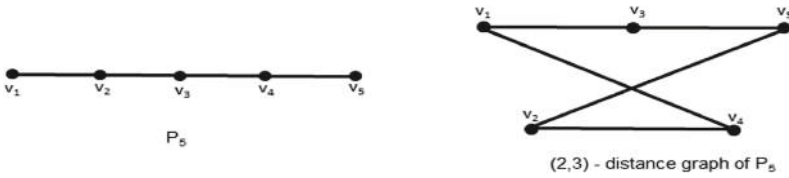
$$f^* : E(G) \rightarrow \{1, 2, 3, 4, 5, \dots, m\} \text{ (where } m \text{ is finite)}$$

such that the edges are labeled with the values obtained from binary equivalent decimal coding. It is also equivalent to $f^*(e_k = ij) = 2^{n-i-1} + 2^{n-j-1}$ where $k = \{1, 2, 3, \dots, q\}$ and i, j are finite positive integer labeled for the vertices of edge e_k , n is the number of vertices in G .

2.1.2 Definition

Let $G(V(G), E(G))$ be a connected network. A network G' is a (p, q) - remoteness network of G [4], if $V(G) = V(G')$; for $v, w \in V(G)$ and v and w are adjacent in G' if $d(v, w) = \text{either } p \text{ or } q$.

2.1.3 Example



2.1.4 Example

		Incident Binary Equivalent Decimal Edge Graceful Labeling						
		0	1	2	3	4	5	
e_1		1	0	1	0	0	0	40
e_2		0	0	1	0	1	0	10
e_3		0	1	0	1	0	0	20
e_4		0	0	0	1	0	1	5
e_5		1	0	0	1	0	0	36
e_6		0	0	1	0	0	1	9
e_7		0	1	0	0	1	0	18

2.1.5 Theorem

Every $(2,3)$ - remoteness network of P_n is IBEDE graceful labeling network if $n > 4$ where n is number of nodes

Proof:

Let the vertices of $(2,3)$ - remoteness network of P_n be v_1, v_2, \dots, v_n . The labeling of vertices of $(2, 3)$ - remoteness network of P_n is as follows, A bijective mapping of vertex set is $f : V (P_n) \rightarrow \{0, 1, 2, \dots, (n - 1)\}$

$$f(v_1) = 0$$

$$f(v_i) = f(v_{i-1}) + 1 \text{ for } i = 2, 3, \dots, j, j + 1, \dots, n$$

The vertices of (2, 3) - remoteness network of P_n are labeled with integers from 0 to $n-1$ which are distinct.

Now we define an induced edge function $f^* : E(P_n) \rightarrow \{1, 2, \dots, m\}$ (where m is finite)

The binary equivalent decimal coding obtained from the incident vertex are labeled for the edges of (2, 3) - remoteness network of P_n . It is also equivalent to

$f^*(e_k = ij) = 2^{n-i-1} + 2^{n-j-1}$ where $k = \{1, 2, 3, \dots, (2n - 5)\}$ and i, j are finite positive integer labeled for the vertices of e_k .

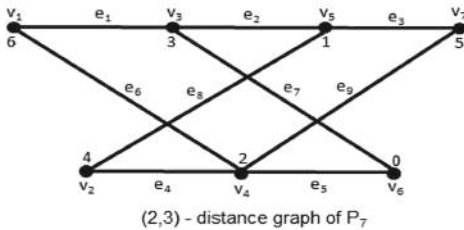
This vertex labeling of (2, 3) - remoteness network of P_n induces a edge labeling which are distinct.

\therefore every (2,3) - remoteness network of P_n is IBEDE graceful labeling network if $n > 4$ where n is number of nodes.

2.2 Definition

A network G is said to be Strong Incident Binary Equivalent Decimal Edge Graceful Labeling (SIBEDE) [5–8] if the vertices of G are labeled with distinct positive integers from $\{0, 1, 2, \dots, (n - 1)\}$ such that the label induced on the edges by binary equivalent decimal coding are distinct from the vertex labeling.

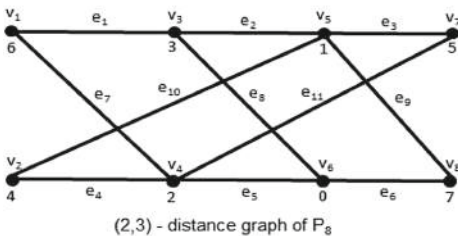
2.2.1 Example



Strong Incident Binary Equivalent Decimal Edge Graceful Labeling

	0	1	2	3	4	5	6	
e_1	0	0	0	1	0	0	1	9
e_2	0	1	0	1	0	0	0	40
e_3	0	1	0	0	0	1	0	34
e_4	0	0	1	0	1	0	0	20
e_5	1	0	1	0	0	0	0	80
e_6	0	0	1	0	0	0	1	17
e_7	1	0	0	1	0	0	0	72
e_8	0	1	0	0	1	0	0	36
e_9	0	0	1	0	0	1	0	18

2.2.2 Example



Strong Incident Binary Equivalent Decimal Edge Graceful Labeling

	0	1	2	3	4	5	6	
e_1	0	0	0	1	0	0	1	18
e_2	0	1	0	1	0	0	0	80
e_3	0	1	0	0	0	1	0	68
e_4	0	0	1	0	1	0	0	40
e_5	1	0	1	0	0	0	0	160
e_6	1	0	0	0	0	0	1	129
e_7	0	0	1	0	0	0	1	34
e_8	1	0	0	1	0	0	0	144
e_9	0	1	0	0	0	0	1	65
e_{10}	0	1	0	0	1	0	0	72
e_{11}	0	0	1	0	0	1	0	36

2.2.3 Theorem

Every (2, 3) - remoteness network of P_n is SIBEDE graceful labeling network if $n > 4$ where n is number of nodes.

Proof:

Let the vertices of (2, 3) - remoteness network of P_n be v_1, v_2, \dots, v_n .

The labeling of vertices of (2, 3) - remoteness network of P_n is as follows, bijective mapping of vertex set is $f : V(P_n) \rightarrow \{0, 1, 2, \dots, (n - 1)\}$

Case (i) When $n \neq 0 \pmod{2}$

$$f(v_1) = (n - 1)$$

$$f(v_i) = f(v_1) - i \text{ for } i = 2, 3, \dots, j, j + 1, \dots, (n - 1)$$

$$f(v_n) = (n - 2)$$

Case (ii) When $n = 0 \pmod{2}$

$$f(v_1) = (n - 2)$$

$$f(v_i) = f(v_1) - i \text{ for } i = 2, 3, \dots, j, j + 1, \dots, (n - 2)$$

$$f(v_{n-1}) = (n - 3)$$

$$f(v_n) = (n - 1)$$

Now the vertices of (2, 3) - remoteness network of P_n are labeled with integers from 0 to $n-1$ which are distinct.

Now we define edge induced function as $f^* : E(P_n) \rightarrow \{1, 2, \dots, m\}$ (where m is finite)

The binary equivalent decimal coding obtained from the incident vertex are labeled for the edges of (2, 3) - remoteness network of P_n . It is also equivalent to

$f^*(e_k = ij) = 2^{n-i-1} + 2^{n-j-1}$ where $k = \{1, 2, 3, \dots, (2n - 5)\}$ and i, j are finite positive integer labeled for the vertices of e_k .

This vertex labeling of (2, 3) - remoteness network of P_n induces a edge labeling in which both labeling are distinct.

Therefore every (2, 3) - remoteness network of P_n is SIBEDE graceful labeling network if $n > 4$ where n is number of nodes.

3 Observation

(2, 3) - remoteness network of Cycle network C_n is not strong incident binary equivalent decimal edge graceful labeling for some n and $n \geq 6$, where n is number of nodes in C_n .

4 Conclusion

In this paper (2,3) - remoteness network of path network P_n are proved as incident Binary Equivalent Decimal graceful labeling network and strong Incident Binary equivalent decimal edge graceful labeling if $n > 4$ where n is number of nodes with examples.

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Cultivar Prediction of Target Consumer Class Using Feature Selection with Machine Learning Classification

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Abstract. Recently, Industries are focusing on cultivar prediction of customer classes for the promotion of their product for increasing the profit. The prediction of customer class is a time consuming process and may not be accurate while performing manually. By considering these aspects, this paper proposes the usage of machine learning algorithms for predicting the customer cultivar of Wine Access. This paper uses multivariate Wine data set extracted from UCI machine learning repository and is subjected to the feature selection methods like Random Forest, Forward feature selection and Backward elimination. The optimized dimensionality reduced dataset from each of the above methods are processed with various classifiers like Logistic Regressor, K-Nearest Neighbor (KNN), Random Forest, Support Vector Machine (SVM), Naive Bayes, Decision Tree and Kernel SVM. We have achieved the accurate cultivar prediction in two ways. Firstly, the dimensionality reduction is done using three feature selection methods which results in the existence of reasonable components to predict the dependent variable cultivar. Secondly, the prediction of customer class is done for various classifiers to compare the accuracy. The performance analysis is done by implementing python scripts in Anaconda Spyder Navigator. The better cultivar prediction is done by examining the metrics like Precision, Recall, FScore and Accuracy. Experimental Result shows that maximum accuracy of 97.2% is obtained for Random Projection with SVM, Decision Tree and Random Forest Classifier.

Keywords: Machine learning · Dimensionality reduction · Feature selection · KNN · SVM · Naïve Bayes · Decision Tree and Random Forest

1 Introduction

In machine learning classification problems, the final classification results are based on number of input features. Since most of the features are correlated, they may be redundant. This redundant feature increases the storage space and reduces the computation time. Also, when the number of features is high, it is hard to visualize the data to prior analysis of data. This ensures the need of dimensional reduction algorithms. The classification performance using machine learning algorithms depends on various

factors. The independent variables in the dataset are called features. If the numbers of features are high, it is difficult to visualize the training set. Also the majority of the features may be redundant and are correlated. This necessitates the requirement of dimensionality reduction algorithms.

The paper is organized in such a way that Sect. 2 deals with the existing works. Section 3 discuss about Dimensionality Reduction. The system architecture is discussed in Sect. 4 followed by implementation and Performance Analysis in Sect. 5. The paper is concluded with Sect. 6.

2 Related Work

Reuters-21578 corpus dataset [1] is subjected to backward elimination to optimize the number of variables which outperforms clustering process compared to the conventional selection techniques. Gaussian process [2] is combined with the backward elimination to speed up the process of feature selection. Intrusion Detection [3] is done by applying the PCA to the packet header data KDD99 which decreases the detection time with respect to time and accuracy. Detection of [4] cardiac arrhythmia is done by ECG Signal data using dimensionality reduction methods. Independent Dual Space Reduction [5] minimizes the number of features followed by predictive regression which reduces the computation learning time.

Land sat 4–5 dataset obtained from GIS is subjected to [6] dimensionality reduction technique for the detection of water bodies. Backward elimination is applied to cancer dataset to perform the dimensionality reduction [7]. Feature selection methods are analyzed with various regression methods like OLS, LASSO and Ridge for analysing the performance [8]. Handwritten digital identification [9] dataset is subjected to reduction methods to improve classification accuracy. Thyroid disease diagnosis is done with [10] backward elimination and performance is analyzed for thyroid dataset.

3 Dimensionality Reduction

Dimensionality reduction attempts to transform high dimensional data to lower dimensions without much loss of information. Feature selection and Feature Extraction are the two categories in dimensionality reduction. Feature selection aims at keeping only relevant variables in the given data set whereas feature extraction concentrates on finding an optimal set of variables usually a combination of input variables without loss of information.

4 Proposed Work

In our proposed work, machine learning algorithms are used to predict the customer cultivar of wine access. Our contribution in this paper is folded in two ways.

- (i) Firstly, the dimensionality reduction is done using three feature selection methods which results in the existence of reasonable components to predict the dependent variable cultivar.
- (ii) Secondly, the prediction of customer class is done for various classifiers to compare the accuracy.

4.1 System Architecture

The system architecture (Fig. 1) of our proposed work is shown below.

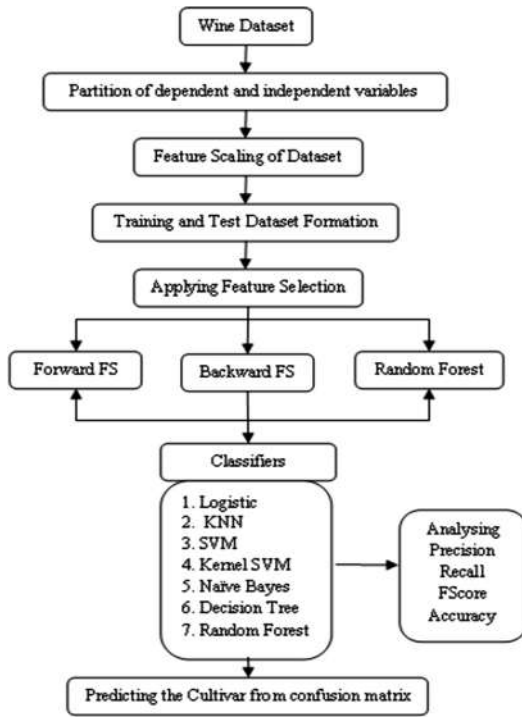


Fig. 1. System architecture

4.2 Backward Elimination Method

The stages in the Backward Elimination are as follows,

- Step 1: Choose the significance level (SL) to enter in the model
- Step 2: Construct the model using all independent variables.
- Step 3: Examine the independent variable having highest P value. If P is greater than SL then go to step 4. Else “model is stabilized to use”.
- Step 4: Eliminate the independent variable
- Step 5: Rebuild the model by omitting removed independent variable and goto step 3

4.3 Forward Selection Method

This method is the reverse of Backward Elimination. It starts constructing the model with single independent variable and grows by the addition of independent variable till the model becomes robust. The stages in the Forward selection are as follows,

- Step 1: Choose the significance level (SL = 5%) to enter in the model
- Step 2: Construct all regression model. Select model with lowest P value.
- Step 3: With this model in step 2, create all possible linear regression models with one extra independent variable added.
- Step 4: Among the constructed models in step 3, Choose the independent variable with lowest P value. If $P < SL$, then goto step 3, Else “model is stabilized”.

4.4 Random Forest Method

Random forest is the feature selection method which selects the variables based on the importance of weights. The resulting independent variable preserves the pairwise weights between any two variables in the dataset. In this method, the original R dataset is projected to a S subspace ($S \ll R$) through the origin using random $R \times S$ matrix Q whose columns have length of unit 1. Let $J_S \times N$ is the original dataset of N S-Dimensional data and is shown as,

$$X_{S \times N}^{QP} = Q_{S \times R} X_{S \times N}. \quad (1)$$

5 Implementation and Performance Analysis

5.1 Performance Evaluation of Feature Selection

The Multivariate Wine dataset {Alcohol, Malic_Acid, Ash, Ash_Alcalinity, Magnesium, Phenols, Flavanoids, Non Flavanoids, Proanthocyanins, Color Intensity, Hue, OD280, Proline, Cultivar} from UCL ML Repository is used for implementation with 13 independent attribute and 1 Cultivar dependent attribute. Wine dataset is applied to backward elimination. The P Value of each variable is shown in Tables 1 and 2 depicts the status of removed variable in the backward elimination with respect to each iteration. The Wine dataset is implemented in python and applied with forward selection and the optimized variables are shown below (Fig. 2a). The obtained optimized variables after implementing by Random forest are shown below (Fig. 2b).

Table 1. P value of variables in backward elimination.

Variables	P value in each iterations					
	First	Second	Third	Fourth	Fifth	Sixth
Constant	0.000	0.000	0.000	0.000	0.000	0.000
X1 – Alcohol	0.052	0.051	0.044	0.035	0.070	XXX
X2 – Malic Acid	0.133	0.132	0.060	0.074	XXX	–
X3 – Ash	0.344	0.333	0.344	XXX	–	–
X4 – Ash Alcanity	0.000	0.000	0.000	0.000	0.000	0.000
X5 – Magnesium	0.958	XXX	–	–	–	–
X6 – Phenols	0.001	0.001	0.001	0.001	0.001	0.001
X7 – Flavanoids	0.000	0.000	0.000	0.000	0.000	0.000
X8 – Non Flavanoids	0.051	0.033	0.024	0.015	0.020	0.013
X9 – Proantho	0.113	0.092	0.087	0.056	0.043	0.015
X10 – Color	0.000	0.000	0.000	0.000	0.000	0.000
X11 – Hue	0.427	0.426	XXX	–	–	–
X12 – OD280	0.000	0.000	0.000	0.000	0.000	0.000
X13 – Proline	0.000	0.000	0.000	0.000	0.000	0.000

Table 2. Variable removal in backward elimination.

Iteration	R-Squared	Adjusted R squared	Removed variable with P value
1.	0.919	0.911	X5 – 0.958 Magnesium
2.	0.919	0.912	X11 – 0.426 Hue
3.	0.919	0.912	X3 – 0.344 Ash
4.	0.918	0.912	X2 – 0.074 Malic_acid
5.	0.916	0.910	X1 – 0.70 Alcohol
6.	0.914	0.909	Process stops

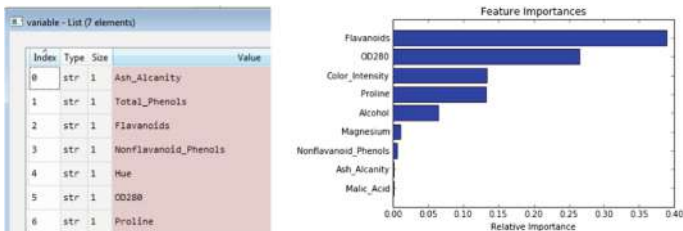


Fig. 2. Selected variables from (a) Forward selection (b) Random forest

5.2 Performance Evaluation of Classifiers

The Optimized Wine Dataset {Ash alcanity, Phenols, Flavanoids, NonFlavanoids, Proanthocyanins, Color, OD280, Proline} from backward elimination is implemented with 7 classifiers and the obtained confusion matrix is shown below (Fig. 3).

The Optimized Wine Dataset {Ash alcanity, Phenols, Flavonoids, NonFlavonoids, Hue, OD280, Proline} from Feature Selection is implemented with 7 classifiers and the obtained confusion matrix is shown in Fig. 4. The Optimized Wine Dataset {Flavonoids, OD280, Color, Proline, Alcohol, Magnesium, NonFlavonoids, Ash alcanity, Malic Acid} from Random Forest is implemented with 7 classifiers and the accuracy details are viewed in confusion matrix confusion matrix is shown in Fig. 5.

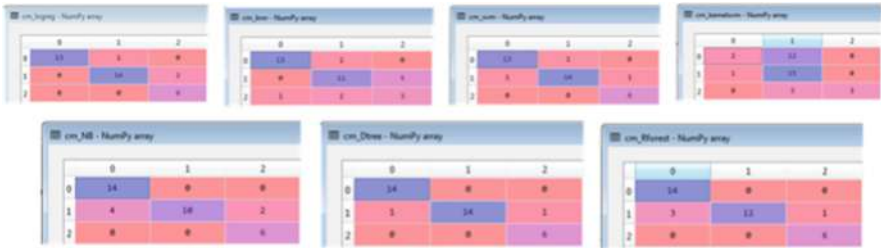


Fig. 3. Confusion matrix of classifiers with backward elimination

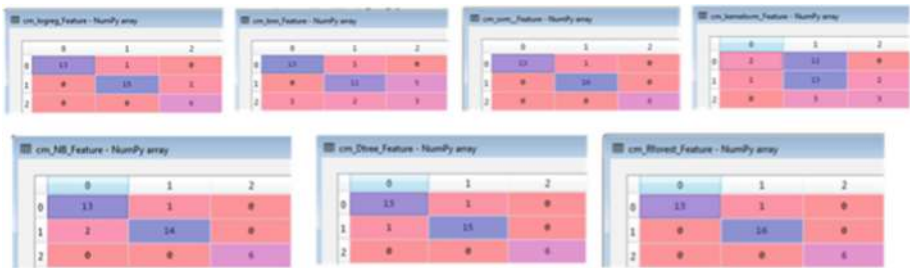


Fig. 4. Confusion matrix of classifiers with forward feature selection

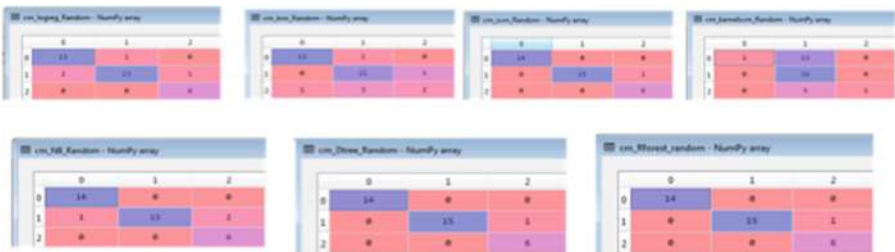


Fig. 5. Confusion matrix of classifiers with random forest

The performance metrics like Precision, Recall, FScore and Accuracy for each of the forward selection method are shown in Tables 3, 4 and 5. The Performance of different classifiers is accessed and is compared using the metrics such as Precision, Recall, F-Score and Accuracy and the details are shown in Fig. 6.

Table 3. Performance metrics for backward elimination.

Classifier	Backward elimination			Accuracy
	Precision	Recall	F score	
Logistic regression	0.93	0.92	0.92	0.916
KNN	0.77	0.75	0.76	0.750
SVM	0.92	0.92	0.92	0.916
Kernel SVM	0.65	0.56	0.49	0.555
Naïve Bayes	0.87	0.83	0.83	0.830
Decision Tree	0.95	0.94	0.94	0.940
Random Forest	0.91	0.89	0.89	0.888

Table 4. Performance metrics for feature selection.

Classifier	Forward feature selection			Accuracy
	Precision	Recall	F Score	
Logistic regression	0.95	0.94	0.94	0.940
KNN	0.71	0.75	0.76	0.750
SVM	0.97	0.97	0.97	0.972
Kernel SVM	0.57	0.50	0.45	0.500
Naïve Bayes	0.92	0.92	0.92	0.916
Decision Tree	0.94	0.94	0.94	0.944
Random Forest	0.97	0.97	0.97	0.972

Table 5. Performance metrics for random forest.

Classifier	Random forest			Accuracy
	Precision	Recall	F Score	
Logistic regression	0.89	0.89	0.89	0.888
KNN	0.73	0.72	0.73	0.720
SVM	0.98	0.97	0.97	0.972
Kernel SVM	0.76	0.50	0.38	0.500
Naïve Bayes	0.93	0.92	0.92	0.916
Decision Tree	0.98	0.97	0.97	0.972
Random Forest	0.98	0.97	0.97	0.972

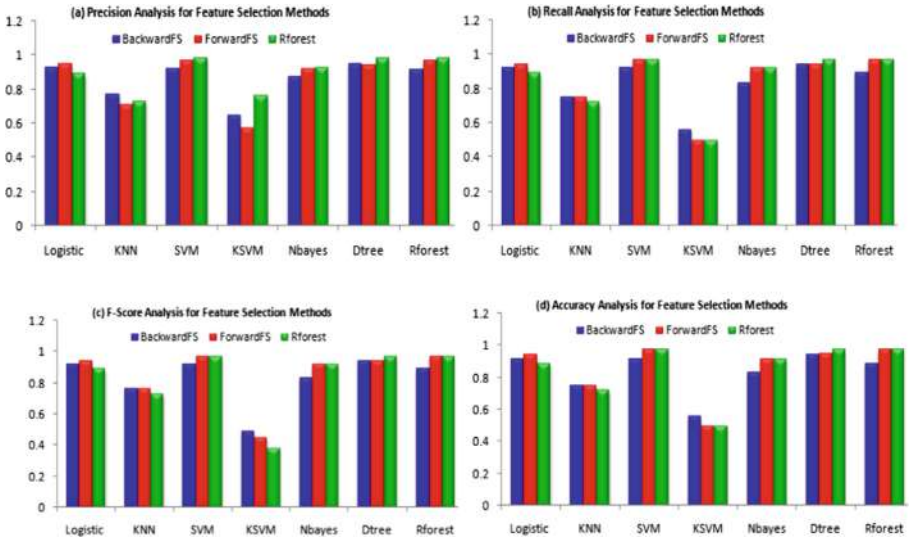


Fig. 6. Performance metric analysis (a) Precision (b) Recall (c) F-Sore (d) Accuracy of feature selection for various classifiers

6 Conclusion

This paper proposes to predict the customer cultivar for the Wine dataset which decreases the manual computation time thereby increase in Accuracy. An attempt is made to implement the dimensionality reduction for the Wine dataset using Feature selection methods like Forward Feature selection, Backward Elimination and Random forest projection. The obtained optimized dataset from each of the above mentioned feature selection is trained with different classifiers like Logistic Regressor, Random Forest KNN, SVM, Naive Bayes, Decision Tree and Kernel SVM and the accuracy is viewed from the confusion matrix generated after predicting the cultivar from the test data set. The Experimental Result shows that maximum accuracy of 97.2% is obtained for Random Forest Projection with SVM, Decision Tree Classifier and Random Forest Classifier.

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Prediction of Customer Attrition Using Feature Extraction Techniques and Its Performance Assessment Through Dissimilar Classifiers

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Abstract. Dimensionality reduction is the process of identifying insignificant data variables and dropping them. The process culminates in obtaining a set of principal variables. Dimensionality reduction not only removes the redundant features, also reduces storage and computation time. Feature Selection and Feature extraction are the two components in dimensionality reduction. This paper explores techniques used for feature extraction and analyzes the results by applying the techniques to customer churn dataset. The performance of these techniques in different classifiers is also compared and results are visualized in graphs.

Keywords: Machine learning · Dimensionality reduction · Feature extraction · PCA · Factor analysis · Singular Value Decomposition (SVD) · ICA

1 Introduction

In machine learning classification problems, the final classification results are based on number of input features. Since most of the features are correlated, they may be redundant. This redundant feature increases the storage space and reduces the computation time. Also, when the number of features is high, it is hard to visualize the data to prior analysis of data. This ensures the need of dimensional reduction algorithms. Dimensionality reduction is the process of minimizing the dimensions of the data while preserving the information.

The generation of datasets has exponential growth in recent days. For example in the biological domain, the standard microarray datasets have more than thousand variables in the instances. Explosion of variables are also found in the fields of image processing, time series analysis, automatic text analysis and internet search engines. Statistical and machine learning algorithms used for the above domains face challenges in handling high dimensional data.

This paper discusses four techniques in feature extraction in detail: PCA, SVD, ICA and FA and compares its performance using different classifiers. Section 2 surveys the application of the techniques in various domains followed by the details of feature extraction techniques in Sect. 3. The experimental setup and the results are discussed in Sect. 4 and the research findings are concluded in Sect. 5.

2 Related Work

Intravascular ultrasound is used in risk assessment of coronary artery disease. A work on risk assessment based on plaque morphology has been proposed and PCA is used for reducing the dimensions of the features [1]. Machine learning approaches are used in prediction of solar irradiance. Regression tree, random forest and gradient boosting are used in this context of prediction [2]. A distributed SVM has been applied to detect this attack. In addition to minimization of data dimensions, PCA reduces the computational time [3, 14]. Features are extracted from eigen image analysis (PCA) and gives appreciable results [4].

The exploration suggests that PCA improves prediction performance for large spectral data [5, 13]. The further developments of PCA and their extensions are detailed [6]. An empirical demonstration and evaluation of dimensionality reduction on multiple datasets are experimented [7]. A study on several visualization systems for dimensionality reduction have been performed and summarized in [8]. An approach for automated artifact elimination by extracting ICA-based features and applying machine learning algorithms has been proposed [9]. Machine learning-based approach to detect five classes of ECG arrhythmia beats has been described [10]. An integration of PCA, nonlinear PCA, and Multiple Correspondence Analysis (MCA) with its application has been discussed briefly [11]. PCA and locally linear embedding falls under Unsupervised learning methods and the classification performance with Logistic Regression, Random Forest, Gradient Boosting Decision Tree, K-Nearest Neighbor and Support Vector Machine are explored on handwritten digital identification dataset [12].

3 Feature Extraction Techniques

3.1 Factor Analysis

This technique aims at grouping the variables by their correlations. Members in a particular group will have high correlation among them compared to the members of other groups. Each group is termed as a factor. The objective of this technique is to construct factors that are small in number when compared with the original dataset dimensions.

3.2 Independent Component Analysis

This is the statistical method for reliable signal separation. ICA can separate independent signals from linear mixtures with no prior knowledge on the signals. Hence this method is also known as Blind Source Separation. The process in ICA can be mathematically formulated as follows:

- (i) Observed data $X_i^{(t)}$ can be modeled using source variables $s_i^{(t)}$

$$X_i^{(t)} = \sum u_{ij}s_i^{(t)}, i = 1, 2, \dots, n \quad (1)$$

- (ii) Alternatively it can be represented as matrix decomposition

$$X = US \quad (2)$$

- (iii) Matrix of u_{ij} is called “mixing matrix”

- (iv) Source factors $s_i^{(t)}$ are called “independent components”.

- (v) The objective is to examine u_{ij} and $s_i^{(t)}$ by observing only $X_i^{(t)}$

3.3 Singular Value Decomposition

SVD is the most popular unsupervised learning algorithm contributing to the dimensionality reduction. Basically SVD factorizes the input as 3 matrices and represented as

$$A = UDV^T \quad (3)$$

where A is an $r \times c$ matrix, U and V are the orthogonal matrices of order $(r \times r)$ and $(c \times c)$ respectively. D is an $(r \times c)$ positive rectangular diagonal matrix. The process of SVD construction is given below.

- Compute the transpose A^T and $A^T A$
- Find the eigen values of $A^T A$ and arrange them in descending order. The Square root of these gives the singular values of A
- Place the singular values along its diagonal to form the diagonal matrix S. Evaluate the inverse of S and it is S^{-1}
- Find the eigenvectors of $A^T A$ and use these eigenvectors as the columns of V and find its V^T .
- Compute $U = AVS^{-1}$. To verify, check $A = USV^T$

3.4 Principal Component Analysis

PCA is a dimensionality reduction method which extracts a new set of independent variables from an existing set of independent variables. The newly extracted independent variables are termed as Principal Components. This method is the linear combination of input variables. The first extracted principal component depicts the maximum variance in the dataset. The successive component extracted from the dataset has no relation with the preceding principal component.

From m dimension dataset, PCA finds p dimensions that have the most variance in the dataset regardless of dependent variable. PCA projects m dimensional dataset into p -dimensional subspace ($p < m$). It identifies the patterns in data and detects the correlation between variables. The process involved in PCA is explained below.

- (i) Normalize the data
- (ii) Compute covariance matrix and find the eigen vectors and eigen values from them.

- (iii) Arrange eigen values in the non increasing order and select ‘p’ eigen vectors that correspond to m largest eigen values where $p < m$
- (iv) The projection matrix W is constructed from the ‘p’ eigen vectors
- (v) Original dataset X is transformed to W to obtain the new feature subspace Y

4 Analysis of Feature Extraction Techniques

4.1 Implementation Dataset

The performance of feature extraction techniques are analyzed for customer churn dataset. Customer churn is used to predict the existence of customers with a company or service. Customer attrition refers to loss of customers over a period of time. Predicting this loss is useful in banking and telecom industry to assess the retention rate of the customers. For the implementation a real time European bank database with ten thousand customer details has been taken. The purpose of the dataset has been used to analyze the churn rate of the customers. The Churn dataset with the attributes {CustomerId, Name, Credit Score, Georaphy, Gender, Age, Tenure, Balance, NumofProducts, Hascard, IsActiveMember, EstimatedSalary, Exited} has been used for customer churn analysis.

4.2 Component Analysis

Four different dimensionality reduction techniques have been applied and analyzed on the collected churn dataset. The principal components in the reduction are considered as 3 and the resulting visual transformation of data to components for each reduction technique has been shown in (Fig. 1a–d). PCA has been implemented using python and dataset is transformed for 3 principal components as shown in (Fig. 1a). The amount of variance in each component is visualized in the graph (Fig. 2). The graph is plotted with component-wise variance against cumulative variance. By inferring the graph, it is observed that 35% variance in the dataset can be explained using 3 components. ICA is implemented with the churn dataset with the number of components in the transformed data taken as three. The distribution of the component can be visualized in (Fig. 1b). The transformed variables using SVD can be visualized (Fig. 1c). In Factor Analysis, the number of factors is decided as per the user requirement. The churn dataset is applied over factor analysis with 3 factors. The components of the factor analysis for the churn dataset can be visualized (Fig. 1d).

5 Implementation and Performance Analysis

5.1 Performance Evaluation of Feature Extraction

The Churn dataset with 8000 instances is used for implementation. The reduced components from each feature extraction technique are applied to 6 different classifiers (Logistic, KNN, Kernel SVM, Naïve Bayes, Decision Tree, Random Forest) and the accuracy details are viewed in confusion matrix shown in (Fig. 2).

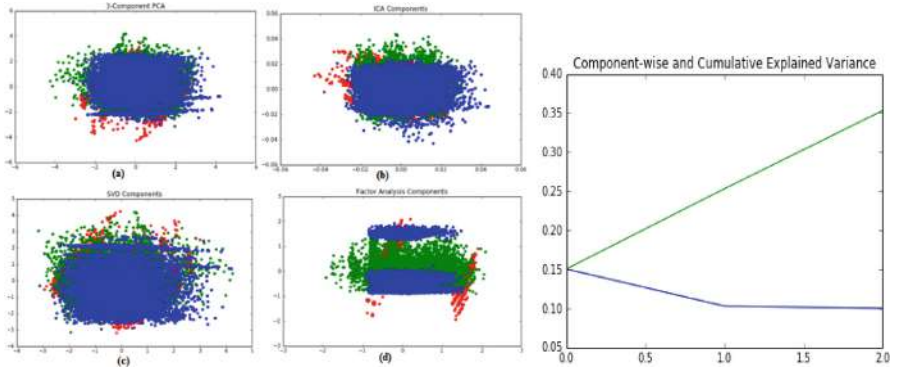


Fig. 1. Component analysis of feature extraction and PCA based variance

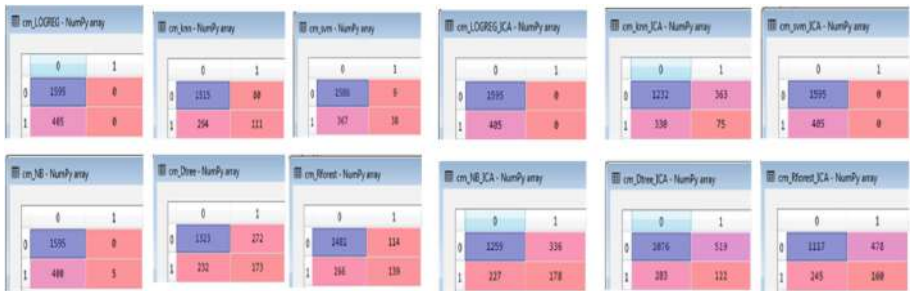


Fig. 2. Confusion Matrix of PCA, ICA for various classifiers

The performance metrics like Precision, Recall, FScore and Accuracy for each of the forward extraction method are shown in Tables 1, 2, 3 and 4.

Table 1. Performance metrics for FA.

Classifier	Factor analysis			Accuracy
	Precision	Recall	F Score	
Logistic Regression	0.64	0.80	0.71	0.797
KNN	0.69	0.78	0.71	0.780
Kernel SVM	0.64	0.80	0.71	0.797
Naïve Bayes	0.64	0.80	0.71	0.797
Decision Tree	0.66	0.48	0.54	0.485
Random Forest	0.70	0.70	0.70	0.704

Table 2. Performance metrics for ICA.

Classifier	Independent Component Analysis			Accuracy
	Precision	Recall	F Score	
Logistic Regression	0.64	0.80	0.71	0.797
KNN	0.66	0.65	0.66	0.653
Kernel SVM	0.64	0.80	0.71	0.797
Naïve Bayes	0.75	0.72	0.73	0.718
Decision Tree	0.67	0.60	0.63	0.599
Random Forest	0.70	0.64	0.66	0.638

Table 3. Performance metrics for SVD.

Classifier	Singular Value Decomposition			Accuracy
	Precision	Recall	F Score	
Logistic Regression	0.64	0.80	0.71	0.797
KNN	0.66	0.65	0.66	0.653
Kernel SVM	0.64	0.80	0.71	0.797
Naïve Bayes	0.75	0.72	0.73	0.718
Decision Tree	0.67	0.60	0.63	0.599
Random Forest	0.70	0.64	0.66	0.638

Table 4. Performance metrics for PCA.

Classifier	Principal Component Analysis			Accuracy
	Precision	Recall	F Score	
Logistic Regression	0.64	0.80	0.71	0.797
KNN	0.79	0.81	0.79	0.813
Kernel SVM	0.81	0.81	0.75	0.812
Naïve Bayes	0.84	0.80	0.71	0.800
Decision Tree	0.76	0.75	0.75	0.748
Random Forest	0.79	0.81	0.79	0.810

The Performance of different classifiers is accessed using the metrics such as Precision, Recall, FScore and Accuracy and the details are shown in (Fig. 3). The Classification Result of different classifiers on the test dataset is visualized for PCA Components and is shown in (Fig. 4).

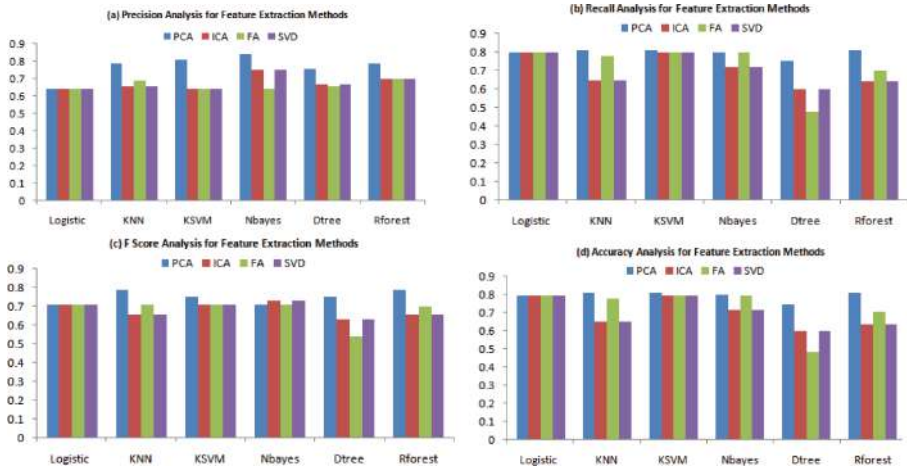


Fig. 3. Performance metric analysis of feature extraction for various classifiers

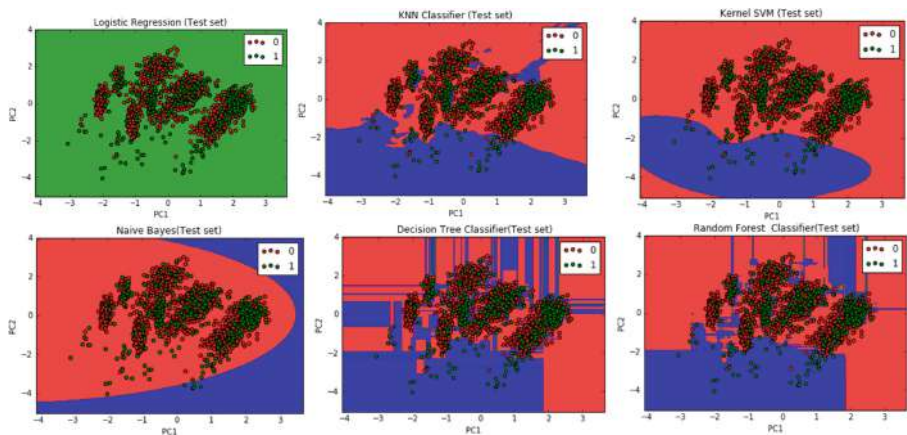


Fig. 4. Visualization of classifiers performance on test data set

6 Conclusion

This paper explores feature extraction techniques for dimensionality reduction. The procedures in applying these techniques are discussed in detail. The performance of these techniques is tested using customer churn dataset. The dataset has 12 independent variables and these are transformed into 3 components using FA, ICA, SVD and PCA independently. These reduced components of each feature extraction technique are fed to six different classifiers to evaluate their performance. Performance metrics such as Precision, Recall, F-Score and Accuracy are used for final assessment. Results show that dimensionality reduction using PCA performs well compared to other techniques for the implemented dataset. The performance of PCA on test dataset for every

classifier is visualized using scatterplots. The above work exhibits the retention rate of customers in a bank. The above technique can be extended for other applications in different domains.

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An Appraisal on Assortment of Optimization Factors in Cloud Computing Environment

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Abstract. Computers play essential roles in variety of fields to make their timely work efficient, with the help of high-performance computing architecture like Distributed Computing, Grid architecture, Cluster and Cloud technology. Cloud Computing is experiencing rapid development in both Academic and Industry. A Cloud Environment is a computing model with diverse capabilities which enables users with appropriate and need based access to reciprocated pool of computing resources like networking facility, storage servers, application servers and other services. Essential part of Cloud environment is proficient allocation of resources to user with suitable task. The Cloud Computing Environment has anthology of uncountable nodes, variety of resources, with potential challenges in task scheduling and execution. This paper presents a systematic study on Cloud Computing Environment with an assortment of optimization factors and its functionality in Cloud Computing.

Keywords: Cloud Computing · Task scheduling · Optimization factors · Task allocation

1 Introduction

The terms Cloud or Internet, a metaphor of technologies, shifts the computing from individual application server to Cloud of Computers or Resources [1]. In Cloud Environment, resources are placed on geographically distributed linked through network to create natural cloud with vast amount of computing capacity to solve complex problems. Several work in the world are processed through Internet, the name 'Cloud' referred in Cloud Computing means Internet, in turn called as computing through Internet. Cloud computing has come into view as to satisfy high performance computing with large number of varied computing resources. "A Cloud is a Computational environment, type of Distributed System collection of interconnected, virtualized computers, are dynamically provisioned, presented as one or more unified computing resources based on service level agreements through conciliation between the service provider and consumers" [2]. Storing data in ordinary desktop machine or in local network system cant access anywhere in world so can't provide timely solution; storing

data in Cloud has meaningful, efficient and timely responses. The users of Cloud can avail the resources through pay and use with services through their demand and needs. The National Institute of Standards and Technology (NIST) gives the prescribed specification for Cloud Computing as “Cloud can be termed as a type of computing architecture, which enables on-demand and convenient services in assortment of resources by providing computing capabilities like Storage, Processing Servers, Network connection and application to contact, which can be provisioned and released rapidly with minimal effort and integration from the service provider” [3].

2 Cloud Architecture

Cloud is a mixture of Grid Computing Technology and Cluster Computing Technology which has a collection of distributed and parallel processing systems, and contains multiple domains through nodes. The Cloud architecture is a layered architecture as shown in Fig. 1.

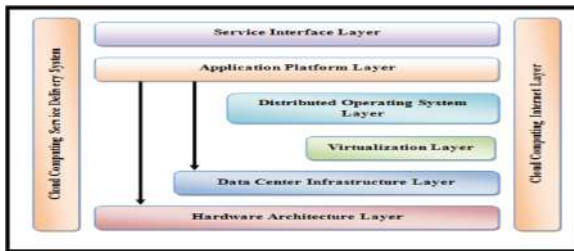


Fig. 1. Cloud layered architecture

2.1 Hardware Architecture Layer

Hardware layer serves as a mediator for various resources, represents different categories of resources available in Cloud Environment; it contains a pool to define resources.

2.2 Data Center Infrastructure Layer

Cloud has collection of data centers with more servers on site, with associated applications. Manages every data request, referred as information accessing and storing data.

2.3 Virtualization Layer

Cloud contains various Physical machines, a single machine in Cloud is used for multiple requests. As there is an increase in user requests, Cloud uses Virtualization technique to solve multiple requests. In a single physical machine, multiple virtual machines are created dynamically as per user requests [4].

2.4 Distributed Operating System Layer

Distributed Operating System is a computer model, gathers different application that runs on lot of computers connected over network. A major feature of Cloud Computing is resource sharing, single resource shared by multiple users, though uses distributed fashioned operating system to provide higher degree of communication and integration of requests.

2.5 Application Platform Layer

Collection of user applications for utilizing the services at the user level and provides interface.

2.6 Service Interface Layer

Conscientious for global service management and interaction with a collection of service requests, which equips discovery of service, brokering services for resources, scheduling and co-allocation of tasks with resources.

3 Cloud Optimization Factors

Cloud Optimization is concerning of automating and refining the homogeneity of infrastructure, also about easy to provision resources in cloud. The Cloud optimization [5] involves different tasks that are to be optimized by assigning them to various Virtual Machines in Cloud Data Center.

3.1 Scheduling

Major work of Cloud computing environment is Scheduling. Scheduler is a component which contains resources and request from user, and major work of scheduler is to allocate jobs to its associative resources. Scheduling of job takes place in various layers like Platform, Application and Virtualization. Application layer Scheduling takes place in user side. The basis of Cloud environment is anywhere and anytime, and hence when demands arise from huge number of users, scheduling also has become necessary to process the user jobs. The next layer scheduling is at Virtualization, which focusses on mapping virtual resources into physical resources. Scheduling in virtual layer also necessary to map request effectively. Next level of scheduling is at infrastructure layer, concerned with optimal and strategic infrastructure.

3.2 Load Balancing

Next major optimization factor of cloud computing environment is Load Balancing, which requires effective and efficient utilization of resources that are globally distributed over network. Load balancing [6] reallocates entire load to distinct nodes to make effective resource utilization and to progress the latency of response time. Continuation of load balancing is Resource Utilization, the task of mapping the resources to cloud entities on demand basis effectively [7].

3.3 Energy

The next key issue in Cloud Computing is energy consumption. Cloud Computing uses large number of Hosts with different Computers with high configuration specification, so consumption of energy will also be high for single data center. \$40 billion are spent annually for Consumption of Energy by enterprises [8] including waiting time of resources. It is essential to improve efficient load balancing, scheduling and resource utilization, to reduce the operational cost and energy usage.

4 Review on Cloud Optimization

No	Authors	Year	Objective	Techniques used	Experimental environment	Type of data	Comparison algorithm	Outcome
1	Haihua Chang et al. [9]	2010	Resource Scheduling	Load Balance d based Resource Scheduling	3 Computers 2 GB Memory, 2.10 GHz CPU	Author Generated Tasks: 1–12	Random Selection	Selects best node to fulfil the Task
2	Kun Li et al. [10]	2011	To provide end user with facilities such as Virtualization, Distribution and Resource Elasticity	Ant Colony Optimization feature with Load Balancing	Cloud Sim: VM: 250–2000, Bandwidth: 500–1000	No of Task: 100–500 No of Ant: 8 Iteration: 50	1. FCFS 2. ACO	Balances the entire system Load effectively
3	Hadi Goudarzi et al. [11]	2012	Minimization of Power and Migration Cost	Algorithm Proposed using Dynamic Programming Techniques with Convex Optimization	Servers - 10, Arbitrary number of servers placed in Data Center	Num of Clients form 250–4000	1. SPMCM 2. FFDP 3. PMAp	Minimize Operational Cost
4	Weiwei Lin et al. [12]	2012	Task Scheduling in Heterogeneity of Computing Sources	Task Scheduling performed using Bandwidth aware algorithm	CloudSim	3Experiment: 5VM [3000–1000], 25VM [5000–1000], 200VM	1. FBTS 2. COTS 3. BOTS	BATS have Minimum execution time
5	Wei Wang et al. [13]	2012	Scheduling through Dynamic Trusted	Cognitive Trusted Model proposed using Bayesian Method	PlanetHub based on Cloudsim	Task: 10–1000, with applications: LT, PCA, SM, KM, RI, SS.	1. Cloud DLS, 2. BSA	Secured Task Execution and Lower Time Cost
6	Vignesh. V et al. [14]	2013	Resource Allocation and Scheduling	Analysis of Scheduling Algorithm		Data Input: Request, Request Submission Time, Request Priority, Execution Time	1. RRS 2. Preemptive Scheduling 3. SRTF	Good Throughput in RRS
7	Chaima Ghribi et al. [15]	2013	Dynamic Resource Scheduling	Proposed Linear Integer Program	Intel Cloud	Request Size 50–500	1. Best Fit Algorithm 2. Exact Allocation Algorithm	Reduces Energy Consumption
8	Xiaonian Wu et al. [16]	2013	Dynamic Batch Mode QoS Scheduler	Berger Model feature proposed in Job Scheduling	50 Virtual Machine: Processor: [500, 600], Bandwidth [5, 10], Storage [500, 1000]	Task Long [40000, 60000], Common [10000, 20000]	1. TS-QoS 2. Min-Min 3. Berger Model	QoS is achieved using effective Load Balance

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No	Authors	Year	Objective	Techniques used	Experimental environment	Type of data	Comparison algorithm	Outcome
9	Thiago A.L. Genez et al. [17]	2015	Scientific Workflow in Public Cloud	PSO based Procedure is proposed	Developed a Simulator	Cybershake, Sphit, Ligo	Naive Approach	Reduces Makespan of Workflow
10	Atul Vikas Lakra et al. [18]	2015	Task Scheduling	Multi Objective Task Scheduling	Cloud Sim 3.0.2	Author Generated Data Workload: 1–6, VM: 3–10, Tasks: 20–100	1. FCFS 2. Priority Scheduling	Minimum overall Execution Time
11	Nindhi Bansal et al. [19]	2015	Task Scheduling	Proposed Quality of Service Driven Scheduling	Cloud Sim 3.0 Host Configuration: Bandwidth: 10000, RAM: 16384, Storage: 1000000	VM Size: 10000, Task Length: 40000 File Size: 300	Traditional FCFS	Algorithm gives good performance, Resource Utilization
12	Awad. A.I et al. [20]	2015	1. Task Scheduling, 2. Search for Optimal and Predictive Scheduler	Mathematical Model used with Particle Swarm Optimization for Load Balancing	CloudSim	6 Data Center, Host: 3–6, VM: 50, Task: 1000–2000	LCFP	Model provides high Makespan, and saves Transmission Cost and Roundtrip time
13	Stelios Sotiriadis et al. [21]	2015	Focused on Optimization of IaaS Performance	Inter Cloud Meta-Scheduling	Simulating the Inter-Cloud (SimIC)	Different Case		Makespan and Turn Around Time are improved
14	Piotr Bryk et al. [22]	2016	1. Focused on Data Intensive Workflow 2. IaaS Cloud Scheduling	Workflow aware Dynamic Provisioning Dynamic Scheduling (DPDS)	Cloud Workflow Simulator	Cybershake, Sphit, Montage, Epigenomics	Static Provisioning Static Algorithm (SPSA)	Reduces File Transfer during execution
15	Xiao-Lan Xie et al. [23]	2016	Trust in Scheduling	Proposed Particle Swarm Simulated Annealing	Cloud Sim CPU Core: 2.50 Hz, HD: 500 GB, Memory: 6 GB	Virtual Nodes: 150, Task: 100–600	1. Genetic Algorithm, 2. TD Min-Min	Reduces total Task Completion Time
16	Mohammed Abdullahi et al. [24]	2016	Task Scheduling in Cloud	Symbiotic Organism Search proposed using discrete fashion	Cloud Sim	Data Instance: 100, 500, 1000	1. PSO, 2. SA- PSO,	Minimum Makespan
17	Weiwei Kong et al. [25]	2016	Resource Scheduling	Dynamic VM Resource allocation and Supply based on Auction	Cloud Sim	CPU: 2.4 GHz, Memory: 4 GB, Hardisk: 512 MB, VM: 40000, Client: 20000	1. Fixed Price VM Resource Allocation, 3. VM Resource Dynamic Scheduling	Proposed Algorithm effectively enhance Quality of Service
18	Woo-Chan Kim et al. [26]	2016	Cost Optimization	Minimizing Price of IaaS Service	Author Developed Simulation Tool	60 month instances with six classes of data	1. Optimal, 2. Basement	Cost Saving
19	Suwendu Chandan Nayak et al. [27]	2016	Lease Scheduling	Uses Analytical Hierarchy Process (AHP)	MATLAB R2010	Experiment: 1–10, VM: 4,6,8, No of Lease: 5–50	1. Back Filling Algorithm, 2. Back Filling Algorithm using AHP	Minimizing the lease rejection
20	Shafi Muhammed Abdulhamid et al. [28]	2016	Fault Tolerance aware Scheduling	Dynamic Clustering League Championship Algorithm	Cloud Sim 3.0.3 on Eclipse IDE	First Scenario: 5 brokers, 2 Data Centers and 10 VMS.	MTCT, MAXMIN, Ant Colony Optimization, Genetic Algorithm	Producing Lower Makespan

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No	Authors	Year	Objective	Techniques used	Experimental environment	Type of data	Comparison algorithm	Outcome
				(DCLCA) Scheduling		Second Scenario: 10 user, 10 brokers, 5 Data center 25VMS		
21	Isreal Cases et al. [29]	2017	Work flow, Task Allocation and Scheduling	Balanced with File reuse and replication technique Scheduling Algorithm	VMWare-Esxi based Private Cloud	1. Montage, 2. Cybershake, 3. Epigenomics, 4. Ligo	Provenance	BaRRS proves superior performance
22	Hancong Duan et al. [30]	2017	Optimizing Power Consumption	Proposed PreAntPolicy	Author Simulator - Light and Powerful Simulator reference Cloudsim	Production Compute Cluster of Google	1. MM 2. FF 3. RR	Exhibits excellent energy efficiency and resource Utilization
23	Weihong Chen et al. [31]	2017	Satisfying Budget Constant	Minimizing Scheduling Level using Budget Constraint (MSLBL)	Simulator in Java	Task: 77, 299, 665, 1175, 1829, 2627	1. HBCS, 2. DBCS	Obtains shorter Schedule length with Budget Constraints
24	Ladislaw Boloni et al. [32]	2017	Scheduling Cloud Resources	Proposed Computation Scheduling VOL		Amazon EC2	1. No Cost Approach, 2. Data Center, 3. Cloud Computing,	VOL out performs other approaches
25	Wei Zhu et al. [33]	2017	Energy Saving, Virtual Resource Scheduling	Virtual Resource Scheduling through three dimension	Simulation Experiment based on CloudSim	VM: S1 - S4, CPU: 500-2500, RAM: 613, 1740, 870, Bandwidth: 100Mbps	1. MVBPP, 2. HVRAA	TVRSM effectively reduce Energy Consumption
26	Hend Gamel El Din Hassen Ali et al. [34]	2017	Jobs/Task Scheduling	Proposed Grouped Task Scheduling	3 Simulation Programs in Java	4 task: Urgent User, Urgent Task, Long Task, Normal Task, 200, 400, 800, 1200, 2400 Task	1. TS, 2. Min-Min Algorithm	Minimum Execution Time
27	Shymaa Elsherbiny et al. [35]	2017	Work Flow Scheduling	Proposed Extended Natural-based Intelligent Water Drops	1. CloudSim, 2. WorkflowSim	1. Sphit, 2. Inspirial, 3. Cybershake, 4. Montage, 5. Epigenomic, 6. Workflow100	1. FCFS 2. MCT 3. MIN-MIN 4. RR 5. MAX MIN	Enhancements in performance and cost in most situations
28	Tom Guerout et al. [36]	2017	Quality of Service Optimization	Proposed Multiobjective optimization of four relevant Cloud QoS Objective		Host - 5 to 110, VM - 15 to 400, Instance - 1-9	1. Genetic Algorithm - 7 Generations, 2. Mixed Integer Linear Programming	Effective Response Time
29	Dinh-Mao Bui et al. [37]	2017	E2M	Orchestrating the Cloud Resource using Energy Efficient	1. Google Trace, 2. Montage Workflow	16 Homogeneous Servers, 29day period of Google Trace, montage	1. Default Scheme, 2. Greedy First Fit Decreasing, 3. E2M, 4. Optimal Energy Aware	Reduces Energy Consumption by System Performance

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No	Authors	Year	Objective	Techniques used	Experimental environment	Type of data	Comparison algorithm	Outcome
30	Preeta Sarkhel et al. [38]	2017	Task Scheduling Algorithm	Minimum Level Priority Queue (MLPQ) Algorithm, Min Median, Mean-Min-Max Algorithm	Core i3 processor with Windows and Dev-C ++ IDE	N Clouds C = {C ₁ ,C ₂ ,... C _N },M Applications A = {A ₁ ,A ₂ ,... A _N } DAG Representation	Minimum Completion Cloud (MCC) Scheduling, Cloud List Scheduling (CLS)	Higher Resource utilization with minimum makespan
31	Yibin Li et al. [39]	2017	Dynamic Task Scheduling, Power Consumption for Smart Phones,	Novel Energy-aware Dynamic Task Scheduling (EDTS)	CPU: 1.7Ghz, RAM: 2 GB, Mobile Device Emulator: Android Software Development Kit (SDK)	Benchmarks: WDF, 2D, MDFG, BR, Floyd, ALL Pole	1. Dynamic version Parallelism-based (PS) Algorithm 2. Critical Path Dynamically Scheduling (CPDS)	Reduces Energy Consumption
32	Hongyan Cui et al. [40]	2017	Task/Service Scheduling in Cloud	Combined Ant Colony Optimization and Genetic Algorithm	Core i3 Processor with 2.10 GHz, and 10 GB RAM	Data Center: 1 Cloud Network Nodes: 20–100 Task Size: 10–100 Task Length: 500–1000	ACO, GA	Objective Function and Convergence Speed are given Optimal result
33	George-Valentin Iordache et al. [41]	2017	Service Level Agreements in Cloud Scheduling	SLA_and_Weight_Aware_Broker_Based Scheduling	Cloud Simulator - CloudSim	30 Cloudlets-100.000 MIPS 3 Virtual Machines - Processor Capacity (2000, 3000, 6000)	First Fit Scheduling, Weight aware Broker based Scheduling, SLA aware broker based Scheduling	Achieved Profit Optimization
34	Fredy Juarez et al. [42]	2018	Parallel Task Scheduling through Energy aware	Real Time Dynamic Scheduling System	DAG Representation	Dell Notbook, Intel i7-2760QM 2.40 GHz, 8 GB Memory, 800tasks, DAG and Resources	EP, MT, GT, SG	Aims to Minimizing normalized bi-objective function, Minimize Energy Consumption
35	Bhavin Fataniya et al. [43]	2018	Multi Objective Task Scheduling	RR scheduling algorithm using dynamic time quantum		Different Case with Different Arrival Time	Round Robin Algorithm, MRRA	Reduce Waiting Time, Turnaround time
36	Stelios Sotiriadis et al. [44]	2018	Virtual Machine Scheduling	Real time Virtual Resource Monitoring through Self managed VM Placement	MangoDB, YCSB, Elasticsearch node	Time Stamp: 2000–10000	OpenStack	Major improvements in the VM placement process

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No	Authors	Year	Objective	Techniques used	Experimental environment	Type of data	Comparison algorithm	Outcome
37	Sukhpal Singh Gill et al. [45]	2018	Cloud Resource to Cloud Workload	Scheduling and Resource Provisioning in Cloud Environment	Cloud Sim	First Resource with 160 GB HDD, 1 GB RAM, Core 2 Duo and Windows. Second Resource with 160 GB HDD, 1 GB RAM, Core i5 and Linux. Third Resource with 320 GB HDD, 2 GB RAM, XEON and Linux	PSO-HPC PSO-SW PSO-DVFS	Execute workloads effectively on available resources
38	Sayantani Basu et al. [46]	2018	Scheduling Cloud Task for IoT Applications	Coalesce Genetic Algorithm & Ant colony algorithm	No of Processors: 1–10	DAG Representation	GA, ACO	Minimize Total Execution Time (Makespan)
39	Zong-Gan Chen et al. [47]	2018	Cloud Workflow Scheduling	Multiobjective Ant Colony System (MOACS)	Amazon EC2 Cloud Platform	Workflow Instances	HEFT	Proposed Algorithm have proven better search ability
40	Sathya Chinnathambi et al. [48]	2018	Byzantine fault tolerance	Workload Sensitive Server Scheduling (WSSS), Tactical Coordinated Checkpointing (TCC)	Cloud Sim using workflowSim-01 Supported in Java Versions	800 Hosts 1052 VMs	Most Efficient Server First (MESF)	Fault Tolerance reduced through TCC Effective Virtual Resource allocation through WSSS

5 Optimization Parameters [49]

S.No	Parameter	Description
1	Response Time	Time calculated with waiting time and submission time
2	Cost	Amount paid to Cloud Providers by Cloud Users
3	Consumption of Energy	Energy consumed as per Resource usage
4	Makespan	Maximum time taken for task completion
5	Reliability	Task completion frequency in a specific period of time
6	Availability	Determines tasks or resources that are accessible
7	Throughput	No. of tasks completed in unit time
8	Latency	Total Waiting Time: Number of Task
9	Bandwidth	Rate of Data Transmission or Execution in certain time

6 Conclusion

Cloud computing is equivalent to high performance computing towards Super Computing and it is a Computing Environment is accessible anywhere in World; user can gain Computing Power, Storage, Software services by using assortment of applications. An Optimization is a mathematical factor which finds minimum or maximum value for an objective function with several variables and a set of constraints. Cloud environment also contains various issues to apply plenty of optimization factors includes Scheduling, Load Balancing and Energy, to bring best ever, efficient, faster solutions to its customer. This paper brings out the study and analysis on various research activities taken place in Optimization of Cloud Computing with its work environment and its associated data.

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A Modified LEACH Algorithm for WSN: MODLEACH

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Abstract. Communication has its roots right from the beginning of the human race. As humans evolved the need for communication increased tremendously and as well the technology of communication progressed. The era of communication from analog to digital has further advanced to wireless with Sensor networks occupying the most of area in communication nowadays. Communication community is highly depending upon wireless sensor networks and they are the key technology in communications. Even though these networks are widely used they are still need for research such that its full features and the advantages can be fully utilized in the field of communication. The basic concern of these networks is energy and security as the energy is limited and the networks are wireless. Hence more algorithms have been developed for the energy efficiency. The popular among these networks is the Low Energy Adaptive Clustering Hierarchy (LEACH) algorithm. In this paper, a modification of MODLEACH with cluster based routing is developed as Modified LEACH(MODLEACH) in which the energy efficiency is increased considerably. The method of alternate cluster head is introduced by allotting threshold power levels. The results of this paper are studied along with LEACH and found to be appreciably good. The network metrics of cluster head formation, energy efficiency throughput and network life. An analysis is done with hard and soft threshold levels of the cluster head are studied.

Keywords: Wireless sensor networks · Routing protocol · Cluster head · Throughput · Network lifetime

1 Introduction

Data transmission regarding various tasks is needed in our day to day life in a faster and rapid manner. While data is being transmitted the user wants it to be secure and efficient. The security personnel wants to transmits the data at high speeds, efficiently and in a secured fashion as no intruder should access the information passed. Similarly for circuit designing data is passed regarding various quantities between different workbench to develop and simulate any design step by step. The rapid changes in climate and their by hazards can be averted with the fast data transmission to avoid any damage. Hence the fast data transmission has become a part of the routine life. Right from the technology development many networks are being developed for fulfilling the need of data transmission effectively right from the classic method networks like

Analog transmission systems to Digital mode of Telephone then to Cellular and mobile networks. As the need demand of the data transmission is increasing parallel networks and ad hoc networks are developed for rapid transmission with infra structure less networks. In a network where the movement of data is liberal it is preferred and multi hop networks are more suited for this purpose. As technology progressed further the data transmission between machines was introduced where data was acquired and processed in a manner which is understandable and was presented to humans. The mote also termed as sensor or node is the basic unit in wireless sensor networks, which performs the basic operations of sensing the data, processes it out and also communicates. For the operation of nodes power is needed and which is a limited source in wireless sensor networks. Hence the resource of power has to be designed such that it will be utilized fully and give maximum life to the sensor in the network. Since power is one of the constraints in the wireless sensor networks more and more algorithms are being developed for increase of the life time of the nodes. More emphasis is being given on protocols of the network and sophisticated circuits are being developed to overcome the power constraint. Multi hop networks carries a lot of data and as this is being transmitted and received by the sensors present in the network, algorithms which involve data fusion and data aggregation has to be evolved along with the features of multi hop transmission algorithms and cluster based algorithms.

As wireless sensor networks has to handle a lot of data and being communicated between number of nodes present in the network, there is a need for the efficient utilization of the routing protocols such that the network metrics like throughput, mean life time and efficiency in the network can be increased keeping in view of power consumption. In this paper an algorithm is proposed in which the power consumption by the nodes in the network are considerably decreased and also comparison is made with the existing LEACH algorithm by taking the network parameters.

2 Literature Survey

As the field of wireless sensor network has almost driven into the worlds communication technology, in the market already many types of sensor nodes are available at low cost and which are capable of fast transmission and reception with little power consumption. As the number of nodes increases in the network and so the power required for operation also increases but as already discussed power is in wireless sensor networks is limited it has to be utilized precisely which in turn can increase the life of the node in the network. Hence the routing protocols chosen plays a vital role not only in utilization of power effectively but also in increase of throughput as well as the security of the data. A study survey has been made to understand the disadvantages of direct transmission algorithm in which the data is directly read and sends to the base station. In this transmission the power consumption is high which reduces the life time of the sensor if the base station is far away from the source [1]. If the power is not sufficient and the base station is very far the node may die while propagating, decreasing the networks efficiency. As this was major concern in the network, multi hop technology of transmission was evolved in which the minimum transmission energy concept is used. By the use of this concept the advantage is, the nodes which are

far away from source remained alive than the nodes which are near to the base station. This is because all the data is being routed to the base station and hence the nodes near the base station were not alive. Also the transmitting of large amount of data sensed from every node is consuming a lot of power. Hence to overcome this problem the concept of hierarchal clustering which deals with asymmetric communication in wireless sensor networks is introduced and had a considerable effect on power consumption. Also the data process and dissemination methods using direct diffusion concept were introduced in networks [2, 3]. A further improved version of data transmission in wireless sensor networks is done using cluster based routing protocol (CBRP) in which a two hop cluster method is used where all the nodes are covered [4]. This method form the basis for the clustering algorithms using hierarchy even though it is not a energy efficient algorithm. Later the hierarchal clustering algorithms developed were found to be energy efficient like LEACH [5, 6]. In these algorithms, clusters are formed of sensor nodes and a cluster head is formed among them which will be responsible for receiving the sensed data from other nodes in the network. Whatever the data is received by the cluster head is aggregated and then further transmitted to the base station. This method improves the networks throughput and also the mean life time of the sensors increases [7]. Another method of data transmission in wireless sensor networks is communication of nodes with other cluster nodes called inter cluster communication [8]. In this method the aggregated data is being transmitted in multi hop from one cluster head to other cluster head and reaches the base station. In this principle the networks life time is improved appreciably. With the help of above discussed algorithms numerous protocols with enhanced features.

As we have seen that the basic concept behind developed algorithms and effective utilization of protocols of the network is to enhanced the life time of the network by effectively utilizing the limited energy available. Models having been developed where a cluster is divided into minimum energy regions and some as idle and operational mode sensors [21, 22]. If the network is heterogeneous then the algorithm is developed making one of the node as high energy cluster head applying initial conditions [9, 10]. Referring to the papers [11–13] a node with mean life time which is in the cluster can be selected as the cluster head by the principle of election Protocol which gives weighted probability depending upon the energy possessed by the node selects in becoming a cluster head [11]. In Protocol DEEC [12] existing energy in node are election criteria of a node to become a cluster head. The various predominant available routing protocols existing are LEACH [1], TEEN [14], SPIN [11], AODV [12] and PEGASIS [15] for wireless sensor networks. LEACH algorithm has given the basic principle of selecting a node as cluster head and modifications on this algorithm has given way to SPIN, TEEN and DEEC by the concept of threshold levels and also making the nodes reactive. By the concept of threshold in routing protocols the performance and the efficiency of the network can be enhanced. In LEACH algorithm has the data flow in three phases as advertising phase, Cluster Set up phase and Scheduling phase. In homogeneous wireless sensor networks the algorithm which optimizes the energy and life time is Q-LEACH algorithm [16]. The comparison of different LEACH variant algorithms used in wireless networks is done in the paper [18] which compares performance parameters of the network such as throughput and efficiency in different applications. A similar comparison analysis between LEACH, Multi level Hierarchal

LEACH and Multi hop LEACH is shown in the reference paper [23]. How the SEP algorithm enhances the features of the heterogeneity network is referred in paper [17]. In the papers [19] and [20] models have been proposed with modifications previous versions of protocols which have enhanced results compared to that of SEP and DEEC stability, throughput and mean life time of the nodes.

3 Principle of Hierarchy Algorithms

The protocol LEACH, got due importance in sensor networks and many of the variants or modifies forms of LEACH have been developed. This algorithm is well suited for homogeneous networks as it is compact and well defined in the network. In this protocol, while transmitting of data a new cluster head is elected in every round there by giving rise to cluster formations. In doing so the energy which is limited is being extensively used. The procedure of selecting cluster head depends upon the usage of the energy in round. The nodes with low energy utilized in current round may become cluster heads in the next round. Hence energy is wasted in every round due to the formation of cluster heads. Therefore an energy efficient algorithm is to be evolved such that there is no wastage of energy. Many of the protocols such as LEACH, the nodes uses amplification energy for transmission of data irrespective of the distance between source and sink. The level of energy required for transmission of packets to the cluster head should be different when they are at different distances. If the same level of power level is maintained then there is surely wastage of power. To avoid such a situation there should be global knowledge about the network and there should be decision taken by the nodes itself that how energy level is required for transmission and to amplify. As it is cumbersome to have the knowledge of all the nodes located in the network and calculating of energy levels for efficient energy utilization. In this paper an efficient cluster head election and transmission of power at two different levels is propose which will overcome the above mentioned problems and increases the efficiency. The functioning of protocol for different models is shown in Fig. 1.

4 Proposed Algorithm

The proposed MODLEACH algorithm is a modified form of LEACH algorithm and it can also be implemented in the other algorithms such as SPIN. The principle used in this algorithm is to increase the mean life time and throughput of the network. In LEACH protocol the cluster head is always changing for every round and the same cluster head will not be selected for the next round. As cluster head is changing so the clusters in the network changes. As mentioned earlier it is wastage of energy. To overcome this, a threshold energy level is defined in our paper for cluster head formation. In this regard if the cluster head has not utilized much of the energy in the current round and the energy level is still above the threshold value it remains the cluster head for the next round in the network and avoids the formation of new cluster. Hence it can be termed as efficient cluster head replacement. Hence energy can be saved which was being wasted for routing new cluster heads. In this proposed method

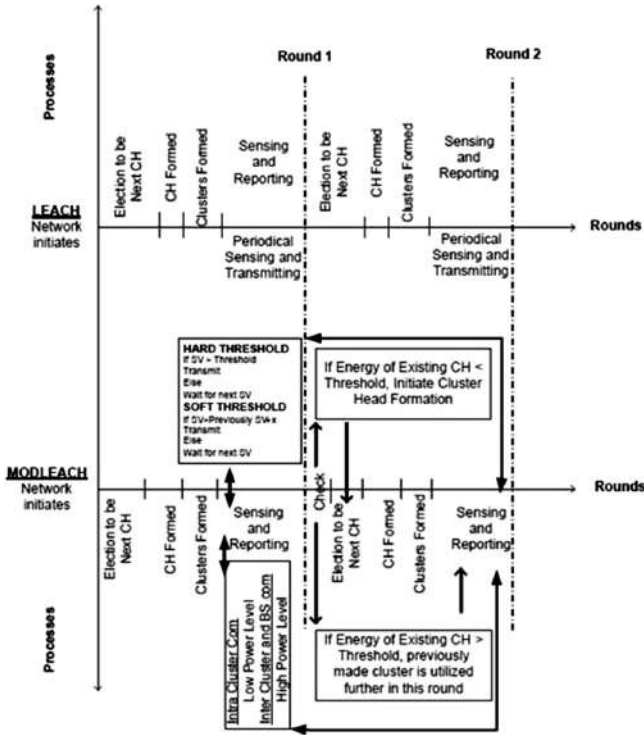


Fig. 1. Protocol processes

along with effective utilization of energy for by selecting head in the cluster the level of power is changed at different levels depending upon the data transmission.

In wireless sensor networks which uses cluster based protocols there are different types of transmission taking place. They can be classified as Transmission within the cluster, transmission in different clusters and from cluster head to the base station.

The sensors in the sensor network environment senses the data through nodes and transmits to the cluster head with in the cluster which is termed as Intra cluster transmission that is within the cluster. The other type of transmission in which the collected data by the cluster head is transmitted from one cluster to the other cluster head in the other cluster is called inter cluster transmission. Transmission and reception takes place between cluster heads. The other way in which communication of sensors takes place is cluster head to base station transmission. Except for intra cluster head transmission the minimum energy is required for the inter cluster or cluster head to base station transmission. But in LEACH, amplification energy required is same for all the three kinds of transmissions. As the energy is lowered and a threshold is made in intra cluster transmission the energy can be much saved as compared to other modes of transmissions. The advantage of using multi hop transmission is that the efficiency of the network can be increased as the packet drop ratio and collisions are reduced. For simulation in our model an area of $15 \times 15 \text{ m}^2$ is taken. A field area of $120 \times 120 \text{ m}^2$ is

considered. The routing protocol switches the nodes as cluster heads depending upon the energy levels in each round. A node will become cluster head and uses high amplification of power and in the next round it switches to low energy levels. In this way soft and hard threshold schemes are employed in this model thereby increases the efficiency of power.

5 Simulation and Results

The designed model is simulated using MATLAB (R9a). The network performance parameters such as Throughput, mean life time; dead nodes and live nodes in the network are calculated. It is found that the networks throughput, efficiency and cluster head formation at optimal level has considerably improved when compared with other algorithms (Table 1).

Table 1. Network parameters and their values

Network parameters	Values
Size of the sensor network	$120 \times 120 \text{ m}^2$
Sensor node initial energy	0.6 J
Size of the Packet	3000 bits
Energy consumption (idle state)	40 nJ/bit
Energy consumed for aggregation	4 nJ/bit
Amplification Energy (Cluster to Base station) $d_i \geq d_0$	$E_{fs} = 12 \text{ picoJ/bit/m}^2$
Amplification Energy (Cluster to Base station) $d_i \leq d_0$	$E_{mp} = 0.0013 \text{ J/bit/m}^2$
Amplification Energy (Intra cluster Communication) $d \geq d_1$	$E_{fs}/5 = E_{fs}1$
Amplification Energy (Intra cluster Communication) $d \leq d_1$	$E_{mp}/5 = E_{mp}1$

Mean Life Time of the Network: The mean life time of any network is defined as the time during which the network is dedicatedly operational and it can be possible with more number of nodes are alive. Using the proposed algorithm MODLEACH it is found that due the cluster head changing scheme at threshold levels and designing of dual transmission of power levels the mean life time has been increased appreciably compared to that of other algorithms like LEACH. In the figures shown i.e. Figs. 2 and 3, shows an increase in mean life time as number of live nodes is increased and dead nodes are decreased. The soft threshold concept helps the network in maintaining more life time of the nodes as it is done in MODLEACHST when compared to other protocols. Another advantage is less number of transmissions occurs in this protocol. This concept helps it for transmission of data both in intra and inters cluster transmission with usage of energy efficiently. As we know that the energy of sensor depends on number of transmission and also it is inversely related to transmissions as the number of transmissions decreases the life time of the increases as the nodes preserve the energy in each round.

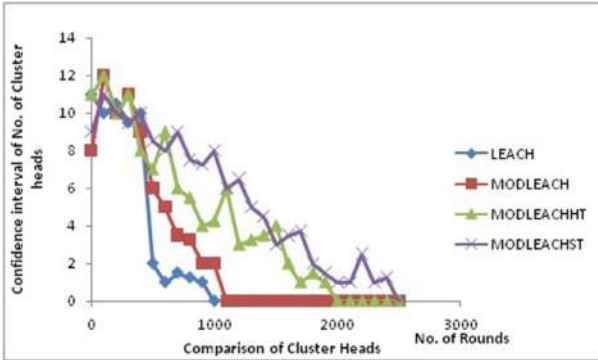


Fig. 2. Comparison of cluster heads

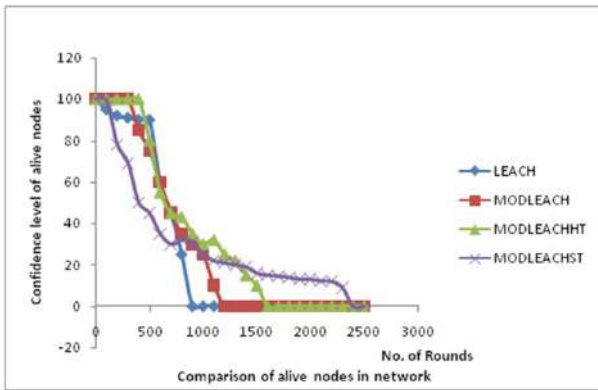


Fig. 3. Comparison of alive nodes in network

Throughput: Throughput is one of the basic performances metric in sensor networks for assessing the networks efficiency depending upon the protocol. It mostly depends upon the sensors life time and it can be defined as the number of nodes reaching the base station per number of nodes transmitted in the network. As the life time increases more and more nodes reaches the base station thereby increase the efficiency, In the proposed algorithm due to the threshold level of energy concept power is saved for the nodes and hence the life time increase also the efficiency. Results are shown that using the MODLEACH algorithm throughput is increased compared to other algorithms as shown in Fig. 4. Due to the cluster head selection scheme used in MODLEACH the energy is considerably saved. The dual power amplification of energies has also increased the throughput due to decrease in packet drop ratio. MODLEACH is a proactive protocol which transmits the data periodically where as other studied protocols are reactive that is they are event driven. This feature of MODLEACH also increases the throughput of the network.

Cluster Head Selection: Cluster head has to be selected in each round. The basic difference between LEACH and MODLEACH as discussed is that the cluster head in

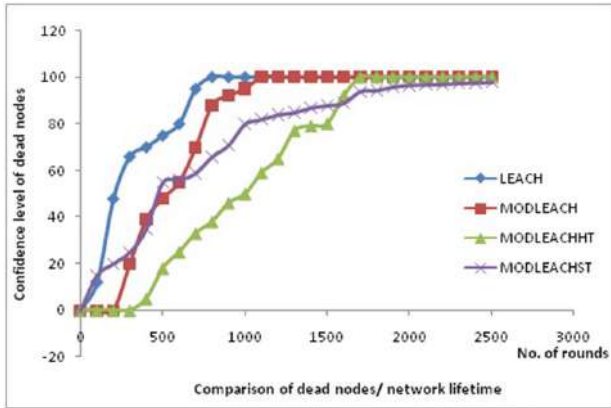


Fig. 4. Comparison of dead nodes/network lifetime

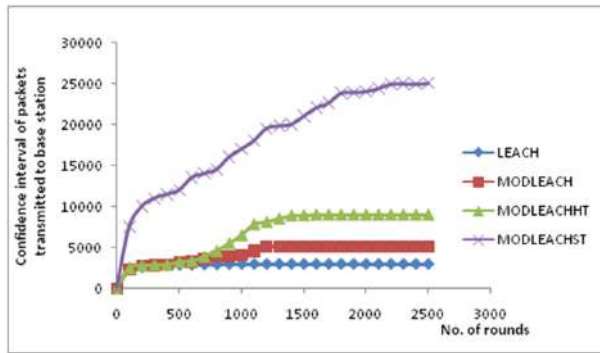


Fig. 5. Packets transmitted to basestation

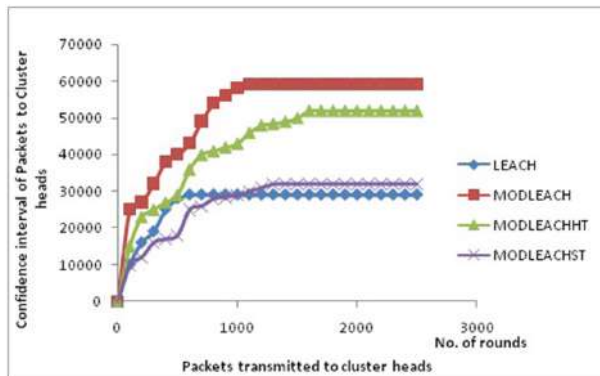


Fig. 6. Packets transmitted to cluster heads

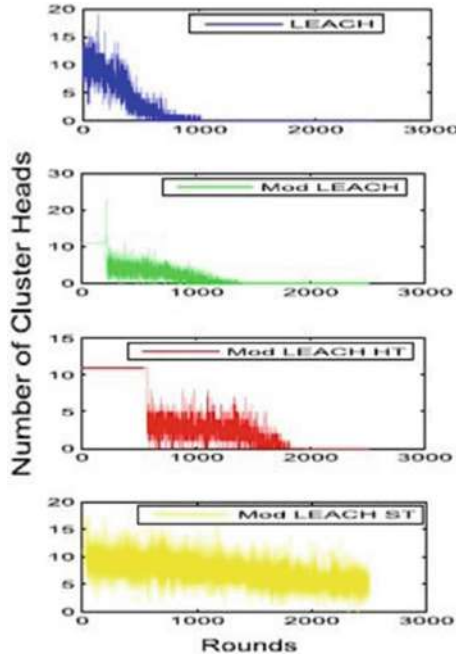


Fig. 7. Cluster head formation per round

each round may or may not change depending upon the threshold energy level where as in LEACH algorithm every round a new cluster head is selected and there is lot of energy wastage compared to that of MODLEACH as shown in Figs. 6 and 7, The cluster heads are stable in MODLEACH (Fig. 5).

6 Conclusion

This research paper is mostly focused on the modified form of LEACH algorithm. A separate cluster head selection in each round can be avoided using the threshold energy level is depicted. Using the network performance metrics like throughput, life time of nodes and packet drop ratio it is shown that a better model is designed compared to that of basic LEACH model. Using MODLEACH the energy is efficiently utilized which is the basic advantage in this proposed model. The dual transmission of power has also considerably increased the throughput of the network by decreasing the packet drop ratio. This mechanism can also be implemented in other routing protocols of the wireless networks.

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A Hybrid Approach of Wavelet Transform Using Lifting Scheme and Discrete Wavelet Transform Technique for Image Processing

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Abstract. Now a modern time many area such as company, medical, research and file require large number of image for general-purpose application to solve the complex problem. Image contain more information that require more storage space and transmission bandwidths, so the image compression is required to store only important information and reduce the different types of redundancy of image for storing and transmission in an efficient manner, because uncompressed image required more data storage capacity and transmission time. In the present work the storing space used is very less because it help in reducing the processing time. For image compression, different transform technique is used. Image can be represented as a matrix of pixel values and after compression by applying different method there is no change or little change between pixel values. This present work is uses haar method and Lifting Wavelet Transform for image compression for increase the efficiency of Discrete Wavelet Transform (DWT).

Keywords: Discrete wavelet transforms (DWT), and lifting wavelet transform (LWT) · Adaptive lifting wavelet transform

1 Introduction

Uncompressed images require large storage space, but storage space and transmission time (resource requirement) is limited. So the solution is that compress the image for quickly transmission. Image compression is an application of digital image processing performed on digital image to reduce the size of image on the way to eliminate the redundancy from it devoid of devours the excellence of the image to an undesirable level [1].

Original images can occupy a huge amount of memory in both RAM and storage area. Due to this the probability of loss of image while sending is increased and it takes a lot of time. So for these reasons, we prefer image compression method and it is requisite. Across a network, this method is preferred to remove the undesirable storage space.

Now there are various types of redundancy in images and all these redundancies are removed for efficient storage and transmission. Image compression is depend on degree of redundancy are present in image [2].

- (a) Coding Redundancy: - A code contains number of symbols to represent information body and every information defines a sequence of code. Number of symbol present in it defines the length of code word.
- (b) Spatial and Temporal Redundancy: - All adjacent data points and intensity pixels are spatially correlated and temporal correlated pixel contain duplicate information. Temporal redundancy means image frames are correlated.
- (c) Irrelevant Information: - Human visual system ignores the 2-D intensity array. It is mostly not used because it is redundant.

As the image is formed by many pixels and since all pixels are correlated by each other so they contain lots of redundant information or details which occupy lots of memory unnecessarily. Therefore, to avoid this redundancy and irrelevancy, we utilize the different techniques.

There are two parts to the compression:

- Finding properties of image data such as grey-level histogram, image entropy, correlation functions etc.
- Finding an appropriate compression technique for an image.

There are two types of image compression are used [3–5].

(a) Lossy Image Compression

An image can be compressed with the preamble of few errors or loss in data is considered as lossy compression. It is based on irrelevancy reduction strategies (some information are ignored by HVS) but will usually also employ some redundancy strategies. In this type of compression, required bits are reduced for transmitting, storing without emphasis on resolution of image. Image is compressed, and after compression, it produces the less information than the original image.

(b) Lossless Image Compression

An image or file is compressed without the preamble of errors or loss in data, but only up to certain extents, is considered as lossless compression. It is based on redundancy reduction and mainly concentrates on the encoding of image.

An image compression system needs to have at least the following two components [6, 7]:

- a. Encoding System
- b. Decoding System

Both Encoding and Decoding is used for compression and decompression of image (Figs. 1 and 2).

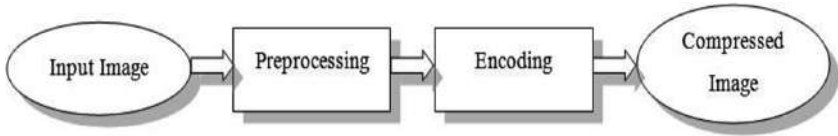


Fig. 1. Image compression

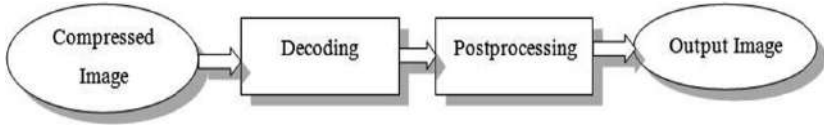


Fig. 2. Image decompression

At the time of transmission and acquisition, images are often corrupted through the noise. Denoising is therefore the common issue in application of image processing. The denoising purpose is then to decrease level of noise, while image features preserving likes textures and edges and so on as accurately as possible [9, 10]. To eliminate noise in the picture area, picture coordinating is utilized in the spatial filtering technique or the frequency filtering strategy. These techniques can rapidly and precisely evacuate noise. Be that as it may, the shape-based picture coordinating considering the incomplete commotion causes overwhelming calculation overhead in light of finding and evacuating the fractional clamor in a limit picture [11]. Thus, due to highly sensitive texture edges, directional wavelets and geometric for image denoising have become famous subject, So that multidirectional-wavelet-based denoising approaches can create an improved visual feature for highly structured image patterns. In this paper, we propose to use a new DWT technique based on lifting. The proposed new technique is more efficient representation for sharp features in the given image [12].

2 Proposed Methodology

Problem Identification process involves the identification of all the shortcomings, drawbacks and problems related to the work done previously. It has been mentioned: Problems related to use the simple discrete wavelet transform for efficient image compression. Image compression is a key area in image processing. Various approaches are used till now for image compression and various method proposed in previous section. The basic problem that the previous image compression technique suffers is accuracy (Figs. 3, 4, 5).

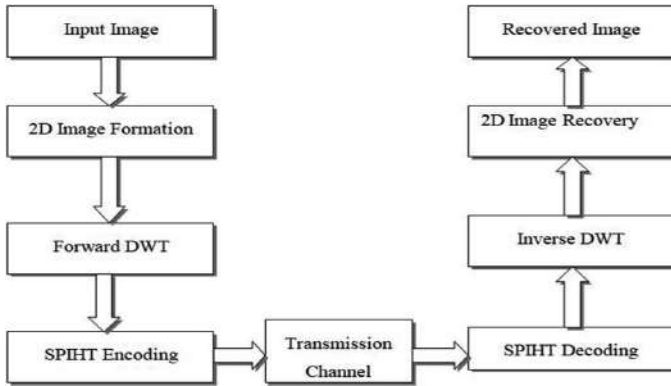


Fig. 3. Image compression process of DWT.

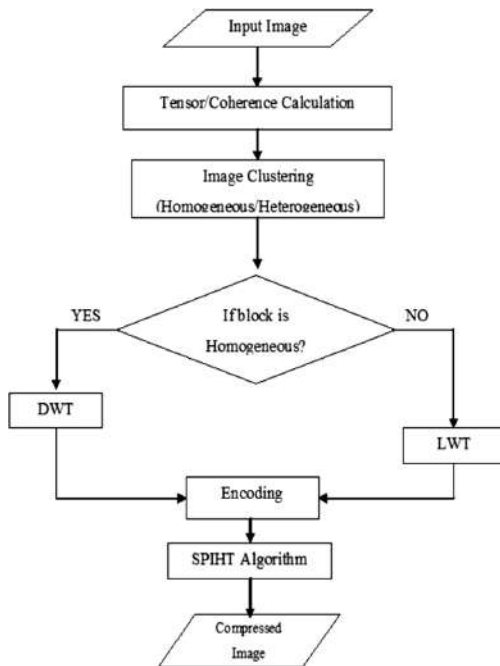


Fig. 4. Flowchart for image compression

After the collection of this large image set, experiments are performed. For better performing and understanding, Graphical User Interface (GUI) is created. In this project, different types of button are provided for better utilization. The below images of screenshots is the picture of main experiment more clear. In this experiment, input image is inserted (Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14).

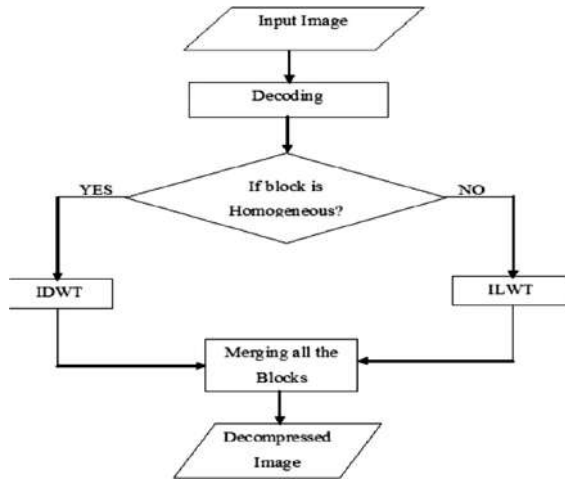


Fig. 5. Flowchart for image decompression

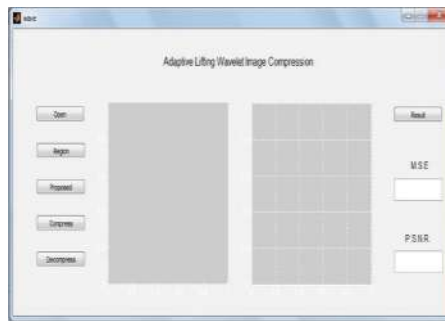


Fig. 6. Opening of G.U.I for performing experiment (G.U.I for adaptive lifting wavelet image compression is made, here six buttons are there that is open, region, proposed, compress, decompress and result.)

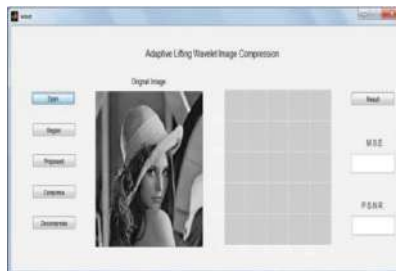


Fig. 7. Original image are displayed through browsed database (input image are display that are all ready in the database)

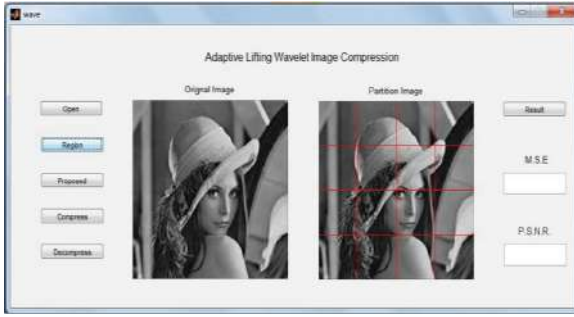


Fig. 8. Partition of image in 4x4 mode (selected image are partition in 4x4 mode)

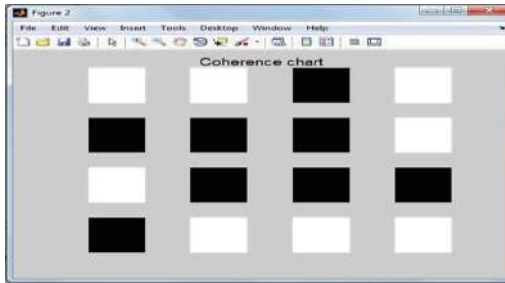


Fig. 9. Coherence chart (images are divided into blocks and coherence chart define which block is homogeneous and which block is heterogeneous.)

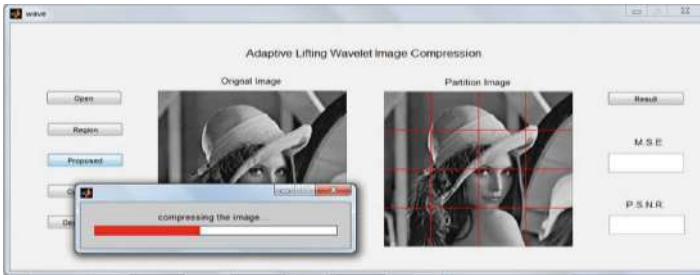


Fig. 10. Compressions by proposed algorithm (proposed algorithm (Hybrid) are apply for compression.)

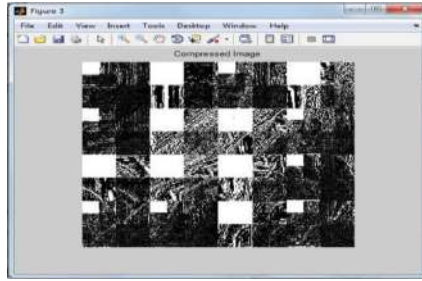


Fig. 11. Compressed image (compressed image of original image are displayed.)



Fig. 12. Processing of decompression (decompression are processed for making recovered image.)

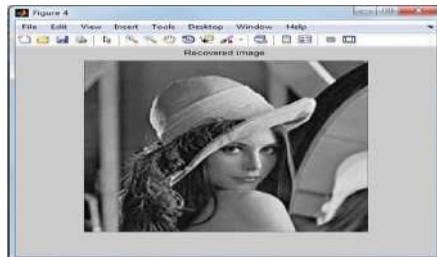


Fig. 13. Recovered image (recovered image is displayed from original image)

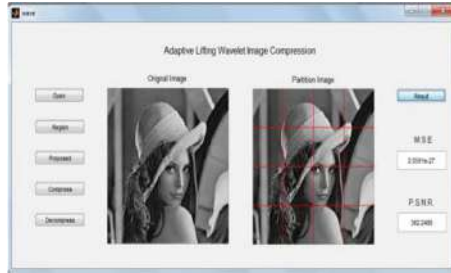


Fig. 14. Recovered image with MSE and PSNR value (recovered image is displayed from original image with value of MSE and PSNR.)

3 Conclusion and Further Scope

For further study, Discrete Wavelet Transform with different method is used for better transmission on network in field of computer vision. The developed algorithm has to be very flexible. It means it not only works with present research problem but also can be beneficial for other research problems also. Present work can also be applied using hybrid algorithm for better image compression. In future, it can further analyze the image characteristics and image status for proper compression. By using proper threshold computation to estimate the directional information of image. In future, we will further increase the PSNR value for efficient image compression with less transmission bandwidth.

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Proportional Cram on Crooked Crisscross for N-Hop Systems

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Abstract. Computer network is converted to a grid and is illustrated with a program dependence graph. Both maximum and minimum level degree based program dependence graph is generated and a proportional study is made on irregular grids. Additionally, graph coloring procedure is also incorporated into it to amplify the recital of the network.

Keywords: Graph theory · N-Hop · Network · Program dependence graph · Shortest trail

1 Introduction

A computer network can be easily described by a graph in terms of nodes (or vertices) and edges [1]. Graph theory [2] and Graph coloring can be applied to a network in order to optimize [4] the performance of the network.

Preliminary and Definitions:

1. Graph:

A graph [3] is an ordered pair $G = (V, E)$ where, V is the set of vertices or nodes of the graph and E is the set of edges or connections between vertices.

2. Undirected Graph:

An undirected graph is a graph in which edges have no orientation i.e., the edge (a, b) is identical to (b, a) .

3. Irregular Graph:

Irregular graph is a graph in which for every vertex, all neighbors of that vertex have distinct degrees.

4. Degree:

The degree of a vertex of the graph is the number of edges incident to the vertex.

5. Chromatic Number:

The chromatic number of a graph is the smallest number of colors needed to color the vertices of the graph so that no two adjacent vertices share the same color.

6. Program Dependence Graph (PDG):

Program dependence graph in computer science is a representation of graph that makes data dependencies and control dependencies explicit.

The rest of the paper is organized as follows, Sect. 2 illustrates the block diagram, Sect. 3 presents the examples of Irregular graph, Sect. 4 describes the propositions and Sect. 5 ends up with the conclusion and future work.

2 Impediment Sketch

Figure 1 Explains the block diagram of the irregular graph approach for N-hop networks.

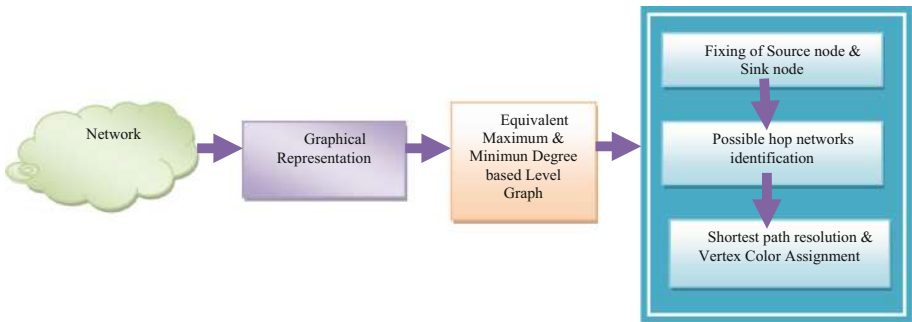


Fig. 1. Block diagram

3 Study on Probable N-Hop Networks in Irregular Grid (N >= 1)

Example: 1 Consider the following graph G_1 with 11 vertices and 12 edges as given below in the Fig. 2.

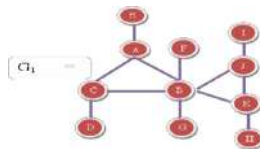


Fig. 2. Set-up G_1

Corresponding Program Dependence Graph [5] for G_1 starting with a node of maximum degree is shown in Fig. 3.

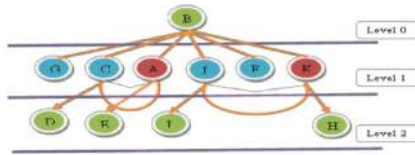


Fig. 3. Max PDG of G₁

Now, fixing B as the source node (since it is at the 0th level) and D,E,I & H as the sink nodes (because it is at the nth level), the possible N-hop networks (required level) are listed as below in Table 1.

Table 1. Required hop networks of G₁

Levels	Nodes	1-Hop	2-Hop
0	B	BCD	BCAE
1	G,C,J,A,F,K	BJI	BACD
2	D,I,E,H	BAE	BJKH
		BKH	BKJI

Another way of representing corresponding Program Dependence Graph for G₁ starting with a node of minimum degree is shown in Fig. 4.

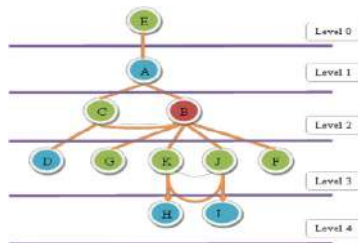


Fig. 4. Min PDG of G₁

Similarly, fixing E as the source node (since it is at the 0th level) and H & I as the sink node (because it is at the nth level), the following Table 2 explains different levels of nodes [4] identified along with the n-hop networks.

Observation:

Here, we observed from Figs. 3 and 4 that is a three colorable network since there is a odd circuit.

Example: 2 Consider the following graph G₂ with 11 vertices and 12 edges as shown in Fig. 5.

Figure 6 shows the Maximum level degree based Program Dependence Graph (PDG) or level based structure of G₁.

Table 2. Required hop networks of G_1

Levels	Nodes	1-Hop	2-Hop	3-Hop	4-Hop
0	E	EAC	EACD	EACBG	EABKJI
1	A	EAB	EABG	EABCD	EABJKH
2	C,B		EABK	EABKH	
3	D,G,K,J		EABJ	EABJI	
4	H,I		EABF		

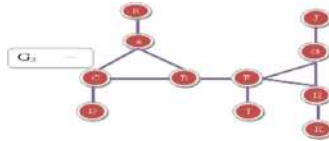


Fig. 5. Organization G_2

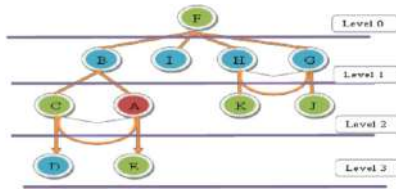


Fig. 6. Max PDG of G_2

Now, fixing F as the source node (since it is at the 0th level) and E & D as the sink node (since it is at the nth level) the possible n-hop networks are as follows in Table 3.

Table 3. Obligatory hop networks of G_2

Levels	Nodes	1-Hop	2-Hop	3-Hop
0	F	FBC	FBCD	FBCAE
1	B,I,H,G	FBA	FBAE	FBACD
2	C,A,K,J	FHK	FHGJ	
3	D,E	FGH	FGHK	

Figure 7 shows the Smallest amount level based Program Dependence Graph (PDG) or level based structure of G_1 .

Now, fixing E as the source node (since it is at the 0th level) and K & J may be the sink nodes (since it is at the nth level) the possible n-hop networks are as follows in Table 4.

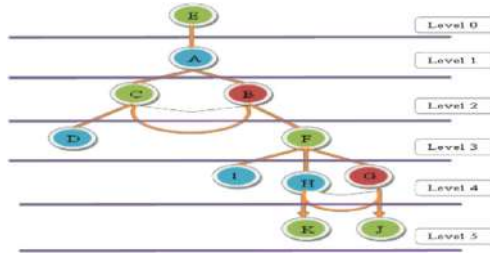


Fig. 7. Min PDG of G₂

Table 4. Required hop networks of G₂

Levels	Nodes	1-Hop	2-Hop	3-Hop	4-Hop
0	E	EAC	EACD	EABFI	EABFHK
1	A	EAB	EABF	EABFH	EABFGJ
2	C,B			EABFG	
3	D,F			EACBF	
4	I,H,G			EABCD	
5	K,J				

Observation:

It is observed from the Figs. 6 and 7 that the network is 3-colorable since it has odd circuit.

Example: 3 Consider the following graph G₃ with 15 vertices and 16 edges as shown in Fig. 8.

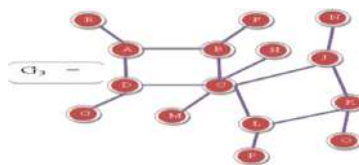


Fig. 8. Network G₃

Figure 9 shows maximum degree level based PDG for G₂:

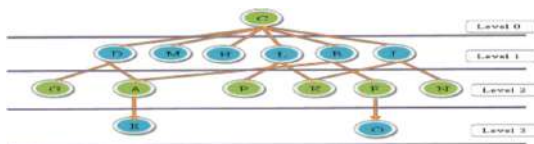


Fig. 9. Max PDG of G₂

Now, fixing C as the source node (since it is at the 0th level) and E & O as the sink node (since it is at the nth level) the possible 1-hop, 2-hop and 3-hop networks are shown in Table 5.

Table 5. Required hop networks of G₃

Levels	Nodes	1-Hop	2-Hop	3-Hop
0	C	CDG	CDAE	CDABF
1	D,M,H,L,B,J	CDA	CJKO	
2	G,A,P,K,F,N	CLP	CDAB	
3	E,O	CLK	CBAD	
		CBF		
		CJN		

Figure 10 shows minimum degree level based PDG for G₃:

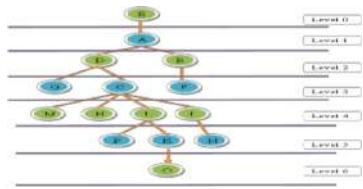


Fig. 10. Min PDG of G₃

Now, fixing B as the source node (since it is at the 0th level) and O as the sink node (since it is at the nth level) the possible 1-hop, 2-hop and 3-hop networks are shown in Table 6.

Table 6. Required hop networks of G₃

Levels	Nodes	1-Hop	2-Hop	3-Hop	4-Hop
0	E	EAD	EADG	EADCM	EADCLP
1	A	EAB	EADC	EADCH	EADCLK
2	D,B		EABF	EADCL	EABCLP
3	G,C,F		EABC	EADCJ	EABCLK
4	M,H,L,J			EABCM	EABCJN
5	P,K,N			EABCL	EABCJK
6	O			EABCH	EADCJK
				EABCJ	EADCJN

Observation

It is observed from the Figs. 9 and 10 that the network is 2-colorable since it has even circuit.

Example: 4 Consider the following graph G_4 with 15 vertices and 16 edges as shown in Fig. 11.

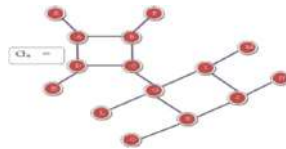


Fig. 11. Network G_4

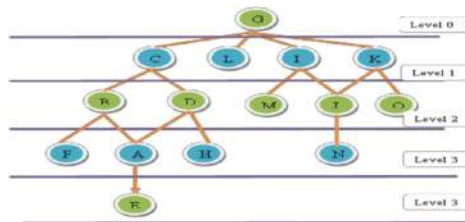


Fig. 12. Max PDG of G_4

Maximum level degree based PDG of G_4 is shown in Fig. 12.

Now, fixing G as the source node (since it is at the 0th level) and F as the sink node (since it is at the nth level), the possible n-hop networks is shown in Table 7.

Table 7. Required hop networks of G_4

Levels	Nodes	1-Hop	2-Hop	3-Hop	4-Hop
0	G	GCB	GCBF	GCBAE	GCBADH
1	C,L,I,K	GCD	GCBA	GCDAE	GCDABF
2	B,D,M,J,O	GIM	GCDH		
3	F,A,H,N	GIJ	GCDA		
4	E	GKJ	GIJN		
		GKO	GKJN		

Minimum degree level based PDG of G_3 is shown in Fig. 13.

Now, fixing E as the source node (since it is at the 0th level) and N as the sink node (since it is at the nth level), the only possible n-hop networks is shown in Table 8.

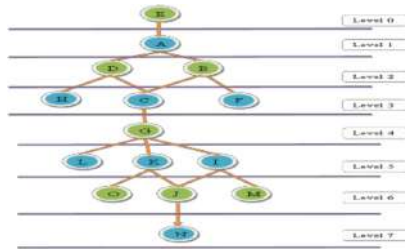


Fig. 13. Min PDG of G_4

Table 8. Required hop networks of G_4

Levels	Nodes	1-Hop	2-Hop	3-Hop	4-Hop
0	E	EAD	EADH	EADCG	EADCGL
1	A	EAB	EABC	EABCG	EADCGK
2	D,B		EADC		EADCGI
3	H,C,F		EABF		EABCGL
4	G				EABCGK
5	L,K,I				EABCGI
6	O,J,M				
7	N				

Observation:

It is observed from the Figs. 12 and 13 that the network is 2-colorable since it has even circuit.

4 Inference

To sum up, it is observed that, even though the number of vertices and edges in a grid increases grid coloring can be done efficiently with at most a maximum of three colors. The comparative analysis of maximum and minimum degree level based dependence graph implies that the difference in maximum hop count differs.

5 Propositions

1. In a given Irregular system if there are n levels in Level degree based program dependence graph then, at most (n-2) hop network can be constructed.
2. In a given uneven network,
If there are odd number of circuits in a level degree based program dependence graph then it is three colorable.
If it has even number of circuits, then it is two colorable.
3. There is difference in maximum hop count between maximum degree level based program dependence graph and minimum degree level based program dependence graph.

6 Conclusion and Future Work

Proportional study on maximum and minimum level degree based program dependence graph for irregular networks is carried out. In future, the work can be extended to analyze some connected ancestor graphs.

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Assessment of Cardiovascular Disorders Based on 3D Left Ventricle Model of Cine Cardiac MR Sequence

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Abstract. The assessment of cardiovascular disorder acuteness is of great concern worldwide to provide appropriate therapeutic interventions. 3D models aid the examination of complex heart anatomy and orientation that could improve surgical planning. In this work, an attempt is made to develop a computationally efficient framework for reconstruction of 3D left ventricle (LV) models to assess the severity level of cardiovascular abnormality from segmented cardiac magnetic resonance (CMR) images. The novelty of this work relies on the reconstruction of 3D LV models in different dimensions to measure the significant variations in cardiac abnormality. The short-axis view CMR images for healthy, mild, moderate and severe abnormal subjects are obtained from second Annual Data Science Bowl database. Initially, the LV is segmented in all the slices and 3D models are reconstructed. Here, 600 surface models of ventricle have been created from 9600 2D slices of 20 subjects. The measured end-diastole and end-systole volume is correlated with the manual volumes provided in the database. It also presents the assessment of cardiovascular disorder severity based on variations in ventricular volume over a cardiac cycle. It is observed that, the calculated volumes correlates with the manual volumes. The performed study reveals that variation in cardiac volume indicates the level of deformation in ventricular chamber in a cardiac cycle. This study shows the potential usefulness of 3D reconstructed LV models in the understanding of heterogeneous ventricle anatomy and discrimination of different categories of cardiac abnormality. Thus, this proposed frame of work can assess the heart functionality that could assist the radiologist in the diagnosis of severity of cardiovascular disorder.

Keywords: Cardiovascular disorder · Magnetic resonance images · 3D reconstruction · Volume tracking · Segmentation

1 Introduction

Cardiovascular disease (CVD) is one among the leading reasons of mortality in India [1]. Among the spectrum of CVDs, ischemic heart disease and stroke are the primary disorders. In recent years, premature mortality as a result of these diseases has increased rapidly; hence more emphasis is required to provide appropriate therapeutic

interventions. The reduced ejection fraction in many cases indicates that the heart does not squeeze properly to pump blood. This reduction can be caused due to various pathologies such as coronary artery disease, cardiomyopathy and aortic stenosis. These subjects suffer from fatigue, nausea, loss of appetite and shortness of breath. In clinical routines cardiac function is assessed with imaging modalities such as echocardiography, computed tomography and cardiac magnetic resonances (CMR) imaging [2]. However, CMR technique is non-invasive and provides better soft tissue contrast [3]. Hence, it can be utilized to analyse the vitality of myocardium and the contraction ability of heart.

The evaluation of functional parameters such as ventricular volume plays a significant role in prognosis of CVDs [4]. The quantitative cardiac MR measures such as end-diastole volume, end-systole volume, stroke volume, and ejection fraction of left ventricle (LV) are important predictors of cardiac abnormalities. Further, the LV volume variation over a cardiac cycle provides the extent of abnormal behavior in CVDs [5].

1.1 Related Study

Generally, the quantification of LV requires appropriate segmentation. In the literature, various automatic and semi-automatic methods have been used to segment the same in 2D CMR images [6–9]. However, variable anatomy of the heart chamber specific to pathology increases the complexity of analysis. In various 2D images based studies, the chamber volumes have been measured from the segmented 2D slices using the methods provided in the literature [10]. However, segmentation and surface reconstruction provides better reproducibility of the results. In addition, 3D models of ventricular chamber aid the efficient planning of surgical procedures.

The cardiac functionality has been analysed from the reconstructed 3D LV wall motion [11]. The 3D CMR models have been adopted to study the diastolic dysfunction from morphometric analysis [12]. The patient specific 3D models can assist cardiovascular interventions [13].

The 3D-Doctor has been explored in the creation and reconstruction of 3D models in various medical fields. Wu et al. explored the 3D modeling capability in analysis of prostate cancer [14]. This method has been also utilized to measure splenic volume from 3D reconstruction of abdominal CT scan images [15]. A surface model has been developed for male urogenital organ to assist the urologists [16]. It has also provided way for 3D printing that is extremely useful in healthcare domain [17]. The determination of periapical lesion through 3D dental models has assisted endodontic treatment process [18].

In this work, an attempt has been made to reconstruct 3D LV models from CMR images to analyse the severity of cardiovascular disorder. Initially, the stack of 2D CMR images is segmented by appropriate tuning of threshold value. Later, surface rendering is performed to create 3D models. The efficacy of the volume estimation is validated by correlating with manual volume. Further, the changes in the evaluated LV volume over a cardiac cycle has been analysed to study the diastolic and systolic functioning of heart under different severity levels of cardiovascular abnormality.

2 Materials and Methods

2.1 Image Database

The images used in this study are obtained from second Annual Data Science Bowl (ADSB) database (<https://www.kaggle.com/c/second-annual-data-science-bowl>) that includes normal, mild, moderate and severe categories. The level of abnormality has been categorized based on ejection fraction. The original T1 weighted cardiac MR images in short-axis view are used for this analysis. The topographic details about the subjects is provided in the database. The pixel spacing varies from subject to subject in the range of 0.6490 mm/pixel to 1.7969 mm/pixel. Here, 30 frames have been acquired per cardiac cycle. The age of the subjects considered for this analysis ranges from 50 years to 70 years. The representative CMR images for different categories of subjects have been given in Fig. 1. The 3D Doctor software, version 2012 (Able Software Corp.) is used in this study for processing of the cine cardiac MR images.

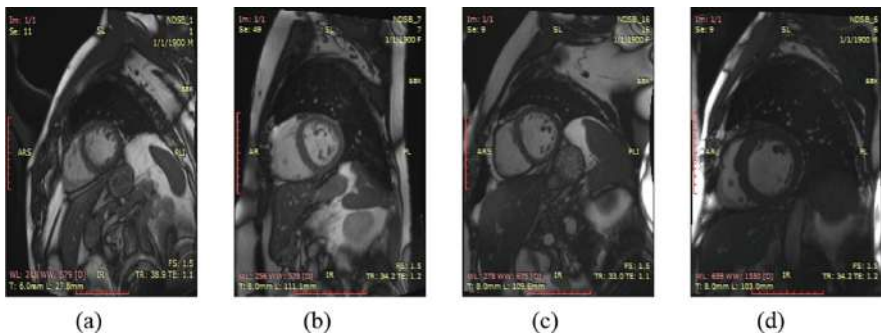


Fig. 1. Representative short-axis view CMR images: (a) Normal, (b) Mild, (c) Moderate, and (d) Severe

2.2 3D LV Model Creation and Volume Estimation

The different stages involved in the proposed framework are shown in Fig. 2. The major contribution of this study is the reconstruction of 3D ventricular models from stack of 2D CMR images to assess the cardiovascular disorder. The analysis involves short-axis view CMR image stack whose length varies from subject to subject based on the length of the heart chamber.

The overall analysis of the left ventricle includes a series of steps such as segmentation, reconstruction of 3D model, volume estimation, analysis of LV based on ejection fraction and diagnosis of severity level. The entire image stack for individual time frame in a cardiac cycle is considered in this study. Subsequently, the number of objects to be segmented is defined. The left ventricle is identified in the CMR slice and the region of interest is selected. The LV is segmented using interactive thresholding. The threshold values are selected manually based on careful review of DICOM images specific to individual subject. The segmented contours are improved by adjusting the

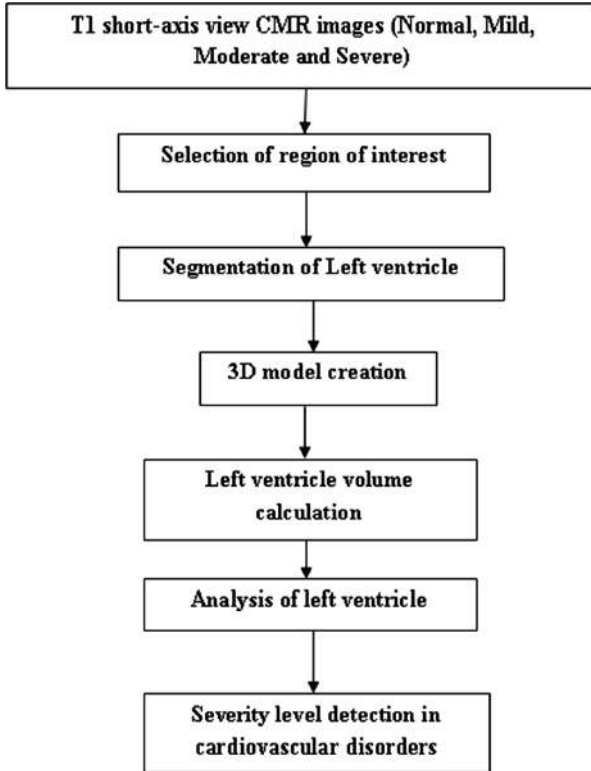


Fig. 2. Block diagram of the proposed framework

boundary. Here, the 3D left ventricle structure is reconstructed based on the segmented region in the stack. This is followed by 3D reconstruction using polygon surface rendering technique that utilizes marching cubes algorithm. Here, neighboring eight locations of a pixel are considered by the algorithm at a time while proceeding through the scalar field to form a cubic structure. Further, polygons that are required to represent the division of isosurface that passes through this cube are found. These separate polygons are then combined into the desired surface. The surface of the 3D reconstructed LV is smoothed. The pixel resolution, slice thickness and other such relevant information about the DICOM images are taken into consideration for 3D reconstruction. The surface model can also be viewed at random angles and different dimensions. Finally, the volume is calculated from the 3D reconstructed structure. The entire procedure is reported for every time frame of a cardiac cycle. Hence, for every individual subject 30 volumes are estimated over the entire cardiac cycle. The volume at the start of contraction and relaxation phase in a cardiac cycle denotes end-diastole (EDV) and end-systole volume (ESV) respectively. The ejection fraction (EF) is calculated from the EDV and ESV for every individual as follows.

$$\text{Ejection fraction} = (\text{EDV} - \text{ESV})/\text{EDV} \quad (1)$$

The LV is analysed based on the EF. The degree of abnormality in LV is categorized as mild (54%–45%), moderate (30%–44%) and severe (<30%) using EF [19]. The normal subjects have an EF from 55% to 65%. Further, the volume variation over a cardiac cycle is studied in detail to study the severity level of the cardiovascular disorder. The volume change in a cardiac cycle indicates the rate of contraction and relaxation of the heart. The normal subjects have the highest volume variation whereas severe subjects have the least deviation in volume. The visual results and its analysis are discussed in the following section.

3 Results

The experiment is carried out on a i7 - 7700 CPU @ 3.60 GHz, 16 GB RAM. Totally, 20 subjects have been considered for this work that includes normal, mild, moderate and severe category. The segmented left ventricle using threshold technique is shown in Fig. 3 for different slices of a representative subject. Here, ventricle has been segmented in 9600 slices of 20 subjects available in the dataset.

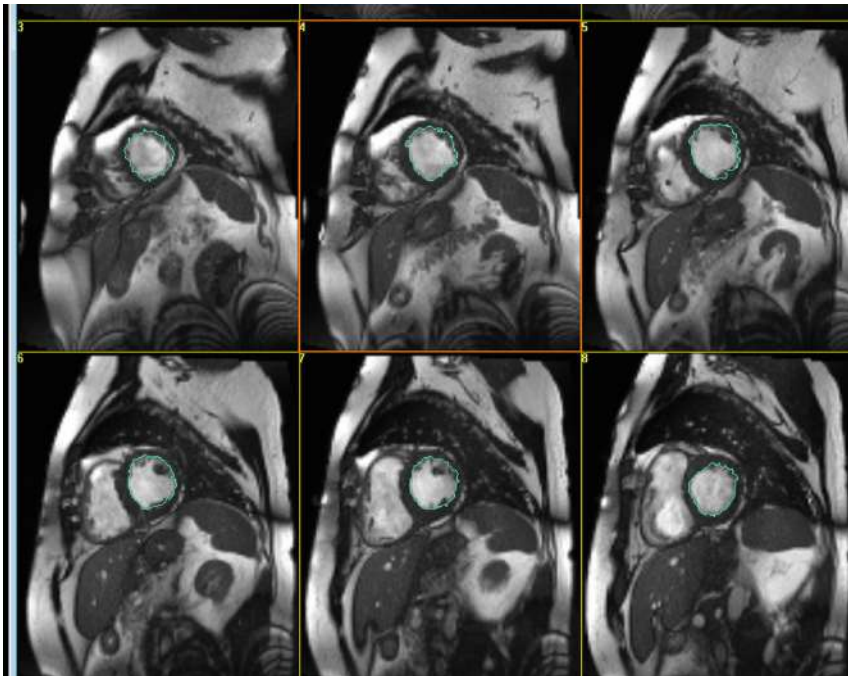


Fig. 3. Segmentation of left ventricle in different slices

These segmented regions from different slices are reconstructed to create the 3D model as shown in Fig. 4. Here, 30 surface models of left ventricle are created per subject to cover a cardiac cycle. Hence in total, 600 LV surface models have been created in this study. The developed ventricle surface models for a representative subject at different angles of rotation are illustrated in Fig. 5. This enables the examination of the ventricular geometry in diverse dimensions that assist the effective planning of surgical executions.

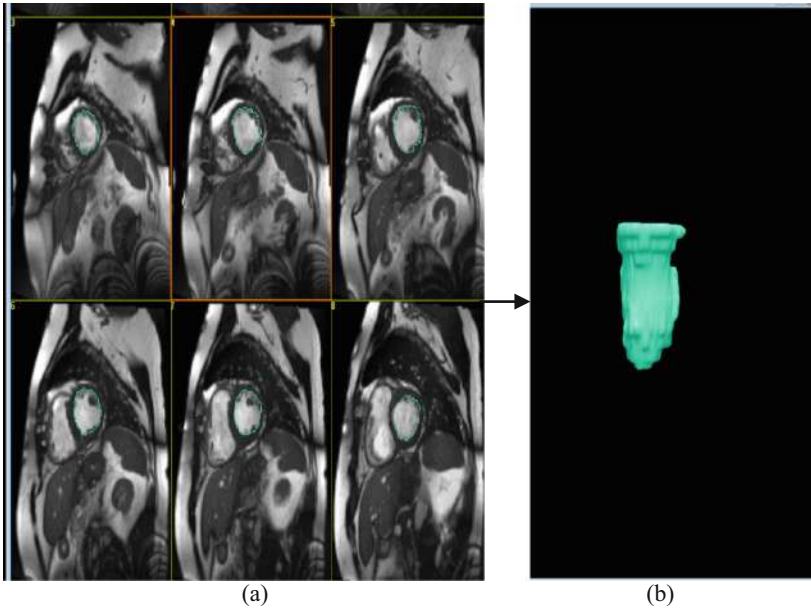


Fig. 4. Reconstruction of 3D LV model from stack of slices: (a) segmented stack of slices, (b) 3D LV model

These models reflect the possible shape of the left ventricle in 3D view. The end-diastole (EDV) and end-systole (ESV) volume calculated by surface rendering is correlated with the manual volumes provided in the database. It is discovered that EDV and ESV significantly correlates with the manual volumes. Further, residual analysis has been carried out to validate the quality of the calculated volume. Figure 6 (a) and (b) shows the residual plot for EDV and ESV of LV respectively. Here, the difference between the measured and manual volume is plotted against the manual volume. The residual plot follows a constant variance pattern. The calculated EDV varies only about (-1.7 ml to +3.9 ml) with respect to the manual volume. Similarly, the calculated ESV deviates approximately (-4.2 ml to +3.9 ml) related to manual volume. Tan et al. have used convolutional neural network for segmentation of LV [20]. The absolute difference for EDV and ESV has been obtained as 11.8 ± 9.8 ml and 8.7 ± 7.6 ml respectively. Khened et al. have utilized residual DenseNets for cardiac segmentation and obtained a mean standard deviation of ± 5.501 ml for EDV [21]. However, in the

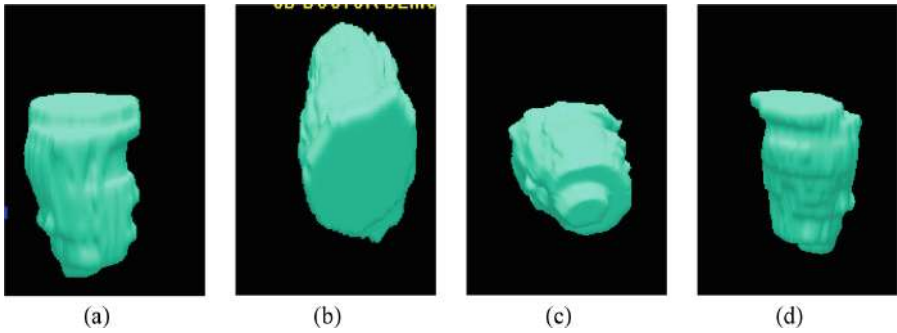


Fig. 5. Surface models of left ventricle in different dimensions: (a) Anterior long-axis, (b) Basal, (c) Apical, and (d) posterior long-axis

performed study a maximum deviation of ± 3.9 ml and ± 4.2 ml has been obtained for EDV and ESV respectively. Hence, the considered framework performs better as the volume is estimated directly from the reconstructed 3D models.

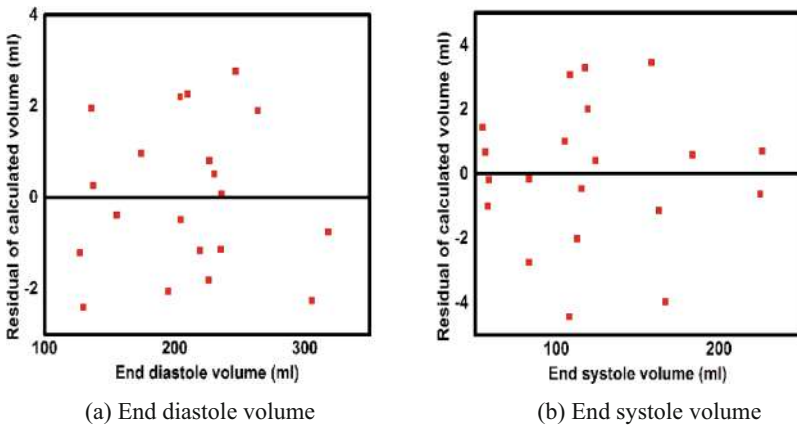


Fig. 6. Residual plot for 3D Doctor calculated left ventricle volume

Further, the variation of calculated left ventricle volume over a cardiac cycle is analysed to predict the severity of cardiovascular dysfunction. In general, there is a decrease in LV volume during systolic phase and an increase in diastolic phase. The rate of inflation and decline can be used to predict the level of abnormality. Figure 7 shows the variation of LV volume for the considered normal, mild, moderate and severe subjects. The plot depicts the variation of left ventricle volume over a cardiac cycle for each individual subject. The top and bottom most ends of each box plot represent the EDV and ESV of each subject. The normal subjects have shown lower ventricular volumes compared to the abnormal. It can also be observed that the relaxation and contraction is the highest in normal subjects indicating the best possible LV deformation during a cardiac cycle.

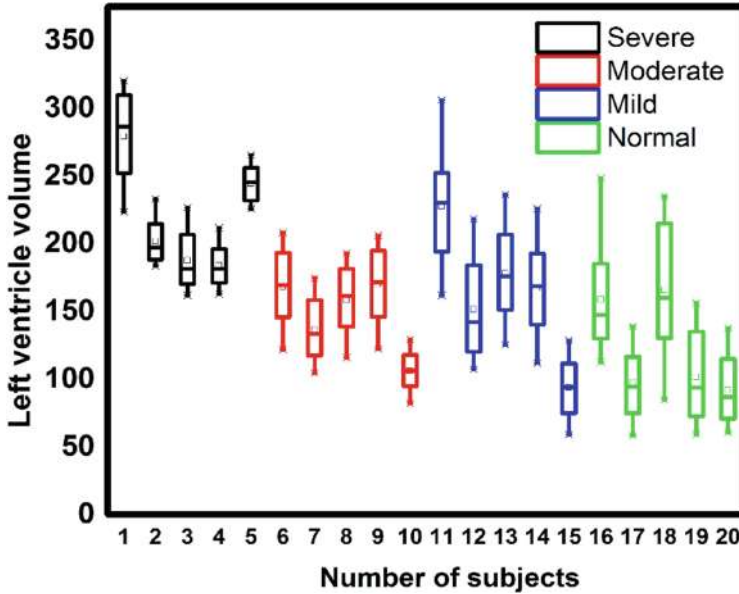


Fig. 7. Variation of left ventricle volume for normal and abnormal subjects

A lower ESV indicates better contraction by LV and hence efficient blood pumping by the heart. Though the volume change is better in mild than moderate, it can be noted that it is slightly lower with respect to normal. On contrary, the plots also suggest that the change in volume from ED to ES frame is minimal in moderate subjects compared to mild. However, it is visible from the plots that in moderate subjects there is significant change in LV volume in consecutive frames compared to severe categories. It is examined that severe subjects have a higher volume at ED and ES as the heart muscles weaken and elongate as the disease progresses. The contraction is the lowest in severe subjects. Though, a slightly higher contraction is observed in one subject, maximum level of ventricular contraction is not observed. This is noticeable from the higher ESV for all the severe subjects.

Hence in summary, a considerable LV volumetric variation has been observed among the mild, moderate and severe categories. Normal and severe subjects have distinct deviation in volumes. On the other hand, the volumetric discrimination between moderate and normal is more prominent compared to mild.

Thus effective LV surface models created through 3D reconstruction results in improved detection of severity in cardiac abnormalities. This is also obvious from the higher accuracy achieved in the estimated LV volume. The created 3D LV model helps in better understanding of complex anatomical structure. This methodology can also be used for visualization and analysis of other biological structures in medical diagnosis.

4 Conclusion

In this work, 3D LV models have been created to study the severity in cardiac abnormalities. A total of 600 surface models of LV have been created to analyse the heart functionality over a cardiac cycle. The calculated diastolic and systolic volumes significantly correlated with the manual volumes. It is perceived that the deviation between the measured and manual volume is also minimum. The outcomes show that the rate of variation in LV volume over a cardiac cycle is able to better differentiate the severity levels of the cardiovascular abnormalities. A noticeable volumetric deviation has been observed between normal and moderate subjects. The developed 3D LV models enhance the understanding of anatomical variations in cardiac. Thus, the 3D reconstructed surface models of LV could aid the diagnosis of different types of cardiovascular disorders.

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Task Scheduling Performance Evaluation of Unreliable Virtual Machines and Cloudlets

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Abstract. For load balancing in cloud computing environment, scheduling algorithm are used. This paper analyses the research on scheduling algorithms. Further, using cloudsim simulation tools, evaluation of performance of the three algorithms i.e. First Come First Serve (FCFS), Generalized Priority (GP) and Shortest Job First (SJF) was carried out. Three algorithms were compared by varying both virtual machines (VM) and cloudlets, keeping constant VM and increasing Cloudlets, varying the nature of tasks. For all the three algorithms, as the number of cloudlets increases, execution time increases. Generalized Priority algorithm (GP) has lower execution time than both First Come First Serve (FCFS) and Shortest Job First (SJF) algorithms. For homogeneous type of tasks, execution time of FCFS is lower and for heterogeneous type of tasks, execution time of GP is lower. Homogeneous tasks required less execution time than Heterogeneous tasks.

Keywords: Cloud computing · Scheduling algorithm · Load balancing · First Come First Serve · Shortest Job First · Generalized Priority

1 Introduction

Cloud computing is an emerging technology in the field of IT. Also, it provides to users on-demand services, scalability, multitenant technology, self-service computation, storage resource and reliability. Load balancing, resource scheduling, data lock in problem, energy consumption and performance monitoring are major challenges in cloud computing [1]. Load balancing is one of the main challenges in cloud computing [1]. To overcome this, researchers proposed many scheduling algorithms. To control the order of work, set of policies are referred. To achieve a high performance computing and system throughput, scheduling algorithm is used. This paper compares three scheduling algorithms viz. First Come First Serve (FCFS), Shortest Job First (SJF), Generalizes priority (GP). Performance parameters used to evaluate these algorithms are execution time. The paper is structured as follows: the introduction to scheduling is presented in Sect. 2. Related work done is presented in Sect. 3. Analysis of existing scheduling algorithm is presented in Sect. 4. Experimental setup is presented in Sect. 5. Performance analysis of algorithm is presented in Sect. 6 and Sect. 7 concluded the work carried out.

2 Introduction to Scheduling

Scheduling is the technique of mapping set jobs to available resources [3]. System throughput, load balance, maximize resource utilization is the aim of scheduling. In scheduling architecture, data center broker is like sender between datacentre and user. In datacentre, there are number of hosts. On each host, there are number of virtual machines. First, user submits task to the data center broker. The datacentre broker communicates with cloud controller and schedule submitted task. According to the scheduling polices, tasks are scheduled on VM. VM-level and Host-level are two level where scheduling is performed. Using task/job scheduler, tasks are mapped to VMs in VM-level [4], also refer as task scheduling. In task scheduling, for specific time, each task is assign to node (VM). This ensures that all tasks are executed in a minimum span of time [5]. Task scheduling focuses on effectively mapping tasks to appropriate VM [4]. At Host-level, VM scheduler is used to schedule the VM request to the physical machine of particular datacentre. This is also called as VM scheduling. Space Shared scheduling policy and Time-Shared scheduling policy are two types of scheduling policies. For host level, one VM is assigned at time to CPU core in space shared policy. After the completion of its task, it schedules another VM. For VM level, one task is scheduled at a time to VM. After completion of this task, it schedules another task to VM. Space shared scheduling policy behave like First Come First Serve scheduling algorithm [3]. For host level, at the same time all VM are scheduled on CPU core in time shared policy. For VM level, all tasks are scheduled on VM at same time. Time shared scheduling policy behaves like Round Robin scheduling algorithm [3]. In existing systems, there are various type of scheduling algorithm such as Multilevel Queue, Multilevel Feedback, Shortest Job First, Round Robin, First Come First Serve, Priority Queue etc. This paper analyses First Come First Serve (FCFS), Shortest Job First (SJF) and Generalized Priority (GP) scheduling algorithms using performance parameters such as execution time. The analysis of existing scheduling algorithm by considering execution time, throughput, resource utilization, make span, waiting time and response time are describe in next section.

3 Related Work

In this section, work done of task scheduling is described. Based on load balancing, two level task scheduling is proposed by Sudha Sadhasivam [6]. This will provide high resource utilization. Based on genetic simulated annealing, optimized task scheduling algorithm is proposed by G. Guo-Ning [7]. Various evaluation parameters were considered for QoS requirement. In genetic algorithm, annealing is implemented after the selection, crossover and mutation. Rajkumar Rajavel [8] presented hierarchical scheduling. By executing high priority job first, response time is achieved. High priority is estimated by job completion time. Based on Activity Based Costing (ABC) optimized task scheduling is proposed by Q. Cao [9]. In this algorithm, for each task priority and user cost drivers is assign. Object cost and performance of activity is measured by ABC. For allocating incoming jobs to virtual machines Medhat A. [10] proposed an Ant colony optimization. Positive feedback mechanism is used. Monica

Gahlawat [11] analyses CPU scheduling algorithm in cloudsims and test performance of different scheduling policy. Priority based resource allocation is proposed by Pawar C. [12]. For resource utilization, various SLA parameters were considered. It provides dynamic resource provisioning. M. Kumar [13] proposed a new algorithm which finds out makespan based on priority of task.

4 Analysis of Existing Scheduling Algorithm

In this section, scheduling algorithms available in cloud computing are analyzed. Major parameters considered for analyzing scheduling algorithms are task length, task deadline and resource utilization.

A priority-based job scheduling algorithm: This algorithm reduces an important performance parameter viz. make span. In this algorithm priority are considered for scheduling. Each job requests resource according to some priority. In addition to make span, other performance parameters such as consistency and complexity are also considered [14].

A priority-based scheduling strategy for VM allocation: This algorithm maximizes the benefit of service provider and improves resource utilization. It proposes, scheduling of virtual machine on the basis of priority. In this strategy, according to profit the request have, ranking of request are assigned. In this approach, it has been observed that it can increase the benefits [15].

Generalized Priority Based Algorithm (GP): This algorithm reduces execution time required to complete the tasks. As per the million instructions per second (MIPS) VMs priorities are assigned and according to size and length of task, task are prioritized. Highest priority task is scheduled on VM which has highest priority. In this algorithm, Cloudlet size and priority are also considered as a scheduling parameter [16].

Improved Priority based Job Scheduling Algorithm using Iterative Methods: This algorithm reduces make span. For making decisions and task execution, Analytic Hierarchy Process (AHP) is used because tasks are different in nature [17].

Priority Based Earliest Deadline First Scheduling Algorithm: By combining two scheduling algorithms viz. earliest deadline first and priority-based scheduling average waiting time of task is reduced. The main focus of this algorithm is to improve resource allocation and to reduce memory utilization [18].

Round Robin (RR): This algorithm improves response time and resource utilization. This algorithm maintains queue to store the jobs with same execution time and it will execute one after another. If a job is not completed, it will store back in a queue and wait for its next turn. The drawback of round robin algorithm is that largest job takes more time for completion [19].

Modified Round Robin: This algorithm reduces response time. It is based on divisible load balancing theory in which master-slave relationship is maintained. Jobs are subdivided into smaller jobs by master processor and VMs are initialized. Smaller jobs are assigned to VM for execution. After execution, jobs are dispatched to user and new jobs are assigned to VM for execution [20].

First Come First Serve (FCFS): This algorithm improves scalability and reliability. In this algorithm, as per the arrival time, jobs are executed [21].

Modified First Come First Serve: This algorithm improves response time, throughput and resource utilization. It is based on two level scheduling viz foreground VMs and background VMs. On the bases of FCFS, VMs are scheduled in foreground VMs. On the basis of SJF, VMs are scheduled in background VMs. If current allocation of process is less than threshold, it will accommodate new process [22].

Shortest Job First (SJF): This algorithm improves resource utilization, throughput and response time. By checking the length of request, load is maintained. The smallest size request is executed first. Smallest size job is having highest priority in SJF [23].

Opportunistic Load Balancing Algorithm: This algorithm improves resource utilization and the performance. This is a static load balancing algorithm in which current workload of VM is not considered. In this algorithm, unexecuted task can be handled in a random order [22].

From above analysis, it is observed that execution time and throughput are not handled by many of these algorithms. Therefore, this paper considered the experimental analysis of three algorithms viz. FCFS, SJF and GP by using execution time as an evaluation parameter.

5 Experimental Setup

This section, provide a details of simulation procedure used to compare three algorithms viz. FCFS, SJF and GP. The three algorithms are compared for both homogeneous and heterogeneous tasks. Simulator used for the implementation of the algorithm is Cloudsim 3.0.3. In a CloudSim, tasks are considered to be the cloudlets and nodes are considered as a Virtual Machines (VM). A set of parameters varied to perform simulation for Virtual machine, Datacentre and Cloudlets are as shown in Table 1.

Table 1. Parameter considers for analysis

Simulation parameter		Cloudlet details	
Parameter	Value	Parameter	Value
No. of users	1	Cloudlet Length	4000
No. of VMs	20	File Size	300
No. of Cloudlets	20	Output Size	300
No. of Datacentre	2	No. of CPUs	1
Virtual machine details		Datacentre details	
Parameter	Value	Parameter	Value
Name of VM	Xen1	No. of Datacentre	1
RAM	512	RAM	102400
Bandwidth	1000	MIPS	102400
MIPS	250	Bandwidth	200000
No. of CPUs	1	Storage	1000000

Simulations were performed by varying VM and cloudlets (Case 1), Keeping constant VM and varying cloudlets (Case 2), (Case 3), varying task type i.e. homogeneous and heterogeneous (Case 4).

6 Performance Analysis

Case 1: In simulation, the number of VMs set was change to 15,25 and 45 for all algorithm. Number of cloudlets were changed to 10, 30 and 60. Figure 1a–c shows a comparison of execution time required for the three algorithms with a variation in the number of cloudlets at different VMs.

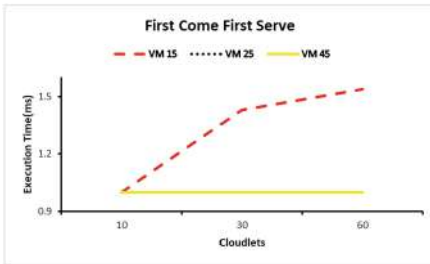


Fig. 1(a). FCFS

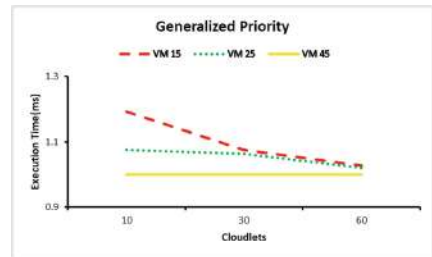


Fig. 1(b). GP

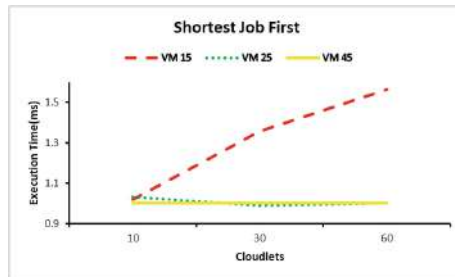


Fig. 1(c). SJF

In case of FCFS algorithm, for all the VMs, as the number of cloudlets increases, execution time increases, see Fig. 1a. It is also observed that, for VM 15, execution time of FCFS is in increasing order at three cloudlets. For the VM 25 and 45, execution time of FCFS algorithm is almost similar, at three cloudlets. In case of shortest job first, for all the VMs, as the number of cloudlets increases, execution time increases, see Fig. 1c. It is also observed that, for VM 15, execution time of SJF is in increasing order at three cloudlets. No variation in execution time is observed for VM25 and VM45, at three cloudlets. In case of Generalized Priority algorithm and at VM15, at lower number of cloudlets, execution time is higher, see Fig. 1b. However, at a higher number of cloudlets, it decreases. At VM 25, execution time observed is higher than that at VM45.

Case 2: Here, for all the algorithms, 20 numbers of VMs were set as a constant and number of cloudlets varied to 20, 40, 60, 80 and 100. It is observed that for all the three algorithms, as the number of cloudlets increases, execution time increases.

Case 3: In this case, for all the three algorithms, variation in the execution time at the number of cloudlets of 20 and 100 is presented. Figure 2a and b shows a plot of change in execution time for the three algorithms at various cloudlet numbers.

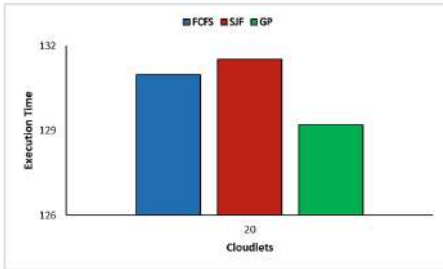


Fig. 2(a). Comparison for cloudlets 20

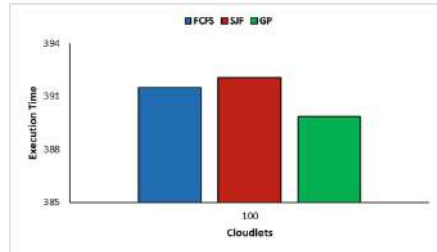


Fig. 2(b). Comparison for cloudlets 100

Of the three algorithms, generalized priority algorithms have least execution time (ms) for all the range of cloudlets (20 Nos. to 100 Nos.). This is because, tasks are executed as per the priority assigned to jobs. On the other hand, shortest job first algorithm has highest execution time (ms) for all the range of cloudlets as the length of jobs is considered and not the priority. The execution time of first come first serve algorithm lies in between the other two viz. shortest job first and generalized priority algorithm because as per the arrival time of jobs, jobs will be execute and not on the basis of length of jobs and priority of jobs.

Case 4: This case gives a comparison of three algorithms with change in nature of cloudlet viz. homogeneous and heterogeneous. Figure 3a and b shows comparison graph of execution time vs number of cloudlets for homogeneous and heterogeneous tasks.

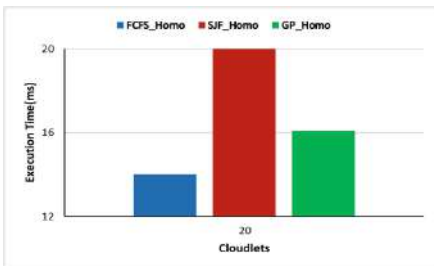


Fig. 3(a). For homogeneous task

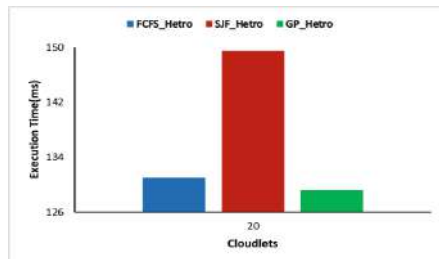


Fig. 3(b). For heterogeneous task

It is observed that for homogeneous type of task, FCFS have least execution time and SJF has highest execution time. Whereas, GP has execution time (ms) that lies in between the other two. In case of heterogeneous type of task, it is observed that, GP have least execution time (ms) and SJF has highest execution time (ms). Whereas, FCFS has execution time (ms) that lies in between the other two.

7 Conclusion

All the three algorithms viz. FCFS, SJF and GP were compared with considering variation in both VM and cloudlets, keeping constant VM and increasing Cloudlets, varying nature of tasks. Comparison among three algorithms shows that, as the number of cloudlets increases, execution time increases for all the three algorithms. Generalized Priority algorithm (GP) has lower execution time than both First Come First Serve (FCFS) and Shortest Job First (SJF) algorithms. For homogeneous type of tasks, execution time of FCFS is lower and for heterogeneous type of tasks, execution time of GP is lower. Homogeneous tasks required less execution time than Heterogeneous tasks.

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Safety Assessment with SMS Approach for Software-Intensive Critical Systems

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Abstract. Definitely, software is harmless in isolation. However, software becomes blemish if it contains faults when software is applied in system functions critical in nature, where catastrophic incidents may result. Alternatively, there's chance to bring the performance of software-intensive systems to function within adequate risk limits. A rigorous safety assessment, and effective risk management would be advantageous. An effective Safety Management System (SMS) is an efficient way to managing safety assessment and risk management. This paper mainly focuses on safety and risk reduction in software-intensive systems. An attempt is made to develop an approach towards safety management of software on the model techniques prevalent in the literature such as Software Failure Modes and Effect Analysis together with a risk management to implement safety. The proposed methodology would be helpful for building resilient, straightforward safety assessment of software, and usable by industrial safety managers in the field of software-intensive systems and applications.

Keywords: Safety Management System (SMS) · Risk management · Safety assessment

1 Introduction

Those systems prone to incidents and accidents, controlled or driven by, triggered by intrinsic errors within and external to software are regarded as software-intensive critical systems. In other words, also called as safety-critical computer systems, viz. bio-medical devices, airplanes, and nuclear power plants, when controlled by software are expected to function in a safe manner even in cases of leading to serious individual or multiple simple or complex failures; as humans as well as significant financial assets are involved. Any sort of error or failure or mistake resulting in malfunctioning can end with events like catastrophic accidents, the span across and include life, environment and property.

As reiterated, software is harmless in isolation, however, software is applied across varying domains, in most of the industries to control, operate and monitor various critical activities, where safety is bound to play an important role. The problem persists

at this juncture that how safety pertaining to software be identified, measured and scaled, which has an indirect effect on safety whelm of the system, though practicing safety professional makes efforts to cope up with the scenarios, but focus on software contribution to safety is a little consideration. The software presently utilized in computers has itself turned out to be composite that it isn't responsible and has caused human damage and demise as a result [1, 3] With the expanding reliance on software to acknowledge complex functions in the cutting edge aeronautic systems, the software has turned into the real determinant of the systems reliability and safety [13]. In general, the Software-Intensive essential systems address the applications during which failure will result in serious injury, important property injury, or injury to the atmosphere. The planning of those systems ought to fulfill the meant useful necessities further as non-functional necessities that outline qualities of a system like safety, reliability, and execution time. System safety represents the most non-functional demand for the software-intensive embedded system. It's outlined by MIL-STD-882D commonplace [2] as "Freedom from those conditions which will cause loss of life, harm, loss of kit, or injury to the environment". Therefore, several style techniques, concepts, safety strategies, and standards are planned and wont to cowl the event life cycle and to boost the non-functional necessities of such safety-critical systems [12]. In managing protective problems, the planet community has worked on and continues to figure on definitions, techniques, tools, guidelines, methodologies, and standards so as to satisfy the strain for additional advanced systems like software system controlled medical systems, weapon systems, and craft systems. With a frequently increasing penetration of IT into business and repair sectors, numbers of essential systems square measure increasing and there's additional demand for safer systems [4, 5]. Usually, safety analysis techniques swear completely on the talent and experience of the security engineer. software system safety analysis is also drained various ways in which the two commonest fault modeling techniques referred to as Failure Mode and Effects Analysis (FMEA) and Software system Failure Mode and effects analysis (SFMEA) [3]. These techniques measure the finding problems and of constructing plans to deal with failures, as in probabilistic risk assessment. FMEA is in fact, associate degree erring technique as "human is to err" and has limitations to investigate the security issues [6, 16] FFMEA and SFMEA may be used standalone while not a mixture of different safety techniques for roaring and complete analysis of safety-critical systems [8, 14, 15]. By applying the SFMEA procedure together with the various phases of a product's lifecycle, the approach offers associate degree economical system for staring at all the routes during which a software will fail. SFMEA may be a normally used methodology to boost the security of software system [11]. Within apply of associate degree SFMEA, analysts gather lists of module failure modes and check out to deduce the results of these failure modes on the system [7]. Experimental platforms measure key components for the sensible approach of hypothesis and theories up to the mark systems. One amongst the most contributions of this experiment is that the indisputable fact that they're the most tool for technological transfer and therefore the innovation method. the method of SFMEA has three main focuses on acknowledgment and assessment of potential failures

and their effects. It's used to differentiate potential style shortcomings specified they'll be qualified within the early phases of a style program. In OSEL annual report [9] describes software failures. Early researches represented restricted experimental ideas. They delineate additional theoretic ideas. This paper depicts however Safety is assessed? for Software-Intensive essential Systems.

The remaining sections in this paper are organized as follows. Section 2 discusses proposed Safety Management System (SMS). The experimental setup and implementation are described in Sect. 3. Section 4 gives the conclusion.

2 Overview of Safety Management System (SMS)

Software is sometimes accustomed implement the utility of safety systems as a result of it's going to be designed to handles difficult utility, is correct and repeatable, and might be cheaper than hardware solutions. However, there are many samples of safety systems that have unsuccessful due to code connected faults. The factors that may light-emitting diode to an error, that is triggered will cause a system levels failure, or peculiar to systematic errors, each concerning their introduction and detection. The distinctiveness and quality of code based totally safety system's mean there could also be an outsized array of things influencing the success or failure of such developments. There are steps that are typically effective at reducing the risks related to developing software system safety systems. These steps turned around safety assessment, i.e. the approaching ups with, development, verification and configuration management processes that make sure the software system meets its safety objectives. Characteristic software system errors in safety systems don't seem to be straightforward, however the appliance of targeted safety assessment processes ought to facilitate manage the associated risks to a suitable level. It's never attainable to form a really safe system. There is an incident to bring the behavior of these systems within acceptable limits. At the system level, the security analysis is geared toward uncovering potential style gaps referred to as software system faults.

An effective Safety Management System (SMS) may be a systematic approach to managing safety ought to embody risk management methods and safety assessment. Below Fig. 1 depicts the working of SMS. The safety assessment method involves complicated phases and activities reaches to minimize potential hazards throughout this method. Software failure modes and effect analysis is performed in parallel with system style for making certain incidence of potential hazard things of the system should be unlikely. As a result, safety needs area unit introduced within the ranking and system style, considering safety aspects. This paper depicts however safety is assessed with the danger management in conjunction with safety analysis technique for software-intensive systems. At purposes the purpose once fittingly dead SFMEA at the proper point within the software development lifecycle, it makes wants, style and code review a lot of viable. It likewise acknowledges single purpose failures due to software.



Fig. 1. Safety Management System (SMS)

2.1 Risk Management

Most software system engineering comes are risky due to the vary of severe potential issues that may arise. Risk Management is that the key method of the SMS. The key advantage of risk management is to contain and mitigate hazards to software system success. Risk management includes the identification and classification of technical risks, that become a part of an inspiration that links every to a mitigation strategy. When cataloguing risks accords to sort the software system development project manager crafts an inspiration to observe these risks and risk management strategies. Risk management determines hazards, analyze safety risk and assess safety risk. If the danger isn't accepted, management safety risks all the method through system analysis.

2.2 Risk Management Methods

Systematic approach is essential for achieving acceptable levels of safety risks and reducing those risks. The risk management provides the simplest way to initiate and follow a risk management method. The subsequent strategies wide used for risk management. Failure Mode Effects Analysis (FMEA), software system Failure Mode Effects Analysis (SFMEA), Preliminary Hazard Analysis (PHA) etc., There are several risk assessment tools and techniques that may be used. Altogether cases, the danger management and safety assessment ought to be accomplished for any activity before the activity begins. Table 1 shows the instance for risk management and safety assessment.

2.3 Risk Management Methods

The major benefit of Safety assessment system is Performance monitoring, internal safety assessment, Management review. In safety assessment a range of hazards will be identify and plan for the further actions. Table 1 depicts all accomplishments and deliverables in safety assessment.

Table 1. Risk management and safety assessment

S. No	Accomplishment	Deliverable
1	Identify hazards and risks and their potential for inflicting harm	A Range of hazards
2	Rank hazards by category	This list are helpful in coming up with additional action
3	Determine hazard elimination or risk management measures	A record of hazard elimination or risk control measures at various locations Adequacy of hazard elimination or risk control measures. A list of controls required or recommended by legislation, standards, best practices, or organizational policies
4	Remove the hazard, or implement risk controls	Controls are in place and functioning appropriately
5	Measure the effectiveness of the controls	Monitor periodically to verify controls continue to function
6	Make changes to improve continuously	Monitor for enhancements

3 SFMEA for Embedded Computer Based Ball Position Control System (BPCS)

The goal of this research work is to edify the utilization of SFMEA for an embedded control system through the advancement of an experiment with a laboratory prototype. Goddard talked [10] about the methodology for SFMEA together with perceiving the sorts of variables and their failure modes. Experimentation of the proposed procedure depends on the ball position controller system, which is appeared in Fig. 2. The control objective of this work is to direct the stream of air into a plastic tube to keep a little lightweight ball suspended at a predetermined height called the set-point. Expanding the flow raises the ball and diminishing the flow brings down it. The BPCS test comprises of 2-feet long white plastic tube, lightweight ball, Dc engine fan, and infrared sensor circuit and 89S52 microcontroller. The vertical 2-feet long clear plastic tube joined to a stand, which contains a lightweight ball inside, a Dc engine fan at the base to lift the ball, and an infrared sensor at the top to sense the ball's height. The tube is associated with the Dc engine fan deltas by means of an input manifold which has a channel at the base as demonstrated. There is an output manifold at the highest point of the plastic tube with an outlet as appeared. The presence of the manifolds is a key part of the experiment.

The infrared device hardware identifies the position of the light-weight ball and therefore the microcontroller directs the facility provide connected to the Dc engine fan so as to manage the air flow into the white plastic tube, keeping the light-weight ball at a certain height.

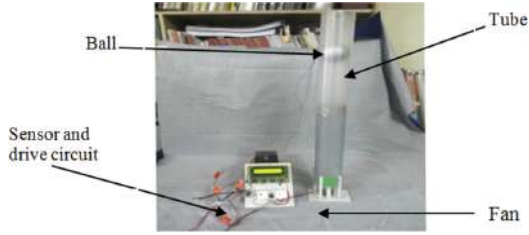


Fig. 2. Ball Position Control System (BPCS)

BPCS Explanation

The light-weight ball position system experiment could be a system created out of five modules, wherever one amongst them includes a Dc engine fan to blow air into the white plastic tube moving a polystyrene light-weight ball within it. A diagram of the BPCS system seems in Fig. 3. Each module is combined with the others by a typical complicated. The bottom box compares to the input manifold. The airflows into the manifold by the distinctive input situated at the left facet of the box. The air within the input manifold is circulated over each module in an exceedingly parallel method. Looking on the force connected by the dc engine fan and therefore the input facet of the manifold, the air flux yield with its direction moving the ball within it. The air from the plastic tube is consolidated once more within the output manifold and shot out through the output, within the right 1/2 the case. This reconfigurable structure possesses input and output manifolds in individual boxes that may be related to them by their style as a playing piece. The BPCS reascent model contains a vitality exchange via flow from the dc engine fan to the light-weight ball. This exchange is often nonlinear.

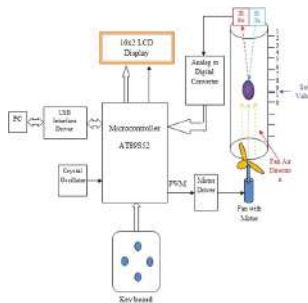


Fig. 3. Block diagram of Ball Position Control System (BPCS)

SFMEA FOR BPCS

During the time spent an SFMEA, analysts incorporate lists of modules failure modes and try to gather the impacts of those failure modes on the system. In Table 2, if the output pin stays high, the duty cycle goes to 100 percent and therefore the fan blows at the complete speed. This ends up in ball shooting to the highest of the plastic tube, presumably damaging the device. If the output pin stays low, the duty cycle goes to

zero, and therefore the dc motor fan speed decreases and stops. This ends up in the ball falling to very cheap of the plastic tube. If there’s no output, the impact is that the same as if the signal is low and therefore the system loses response, stops, and therefore the ball falls to very cheap of the plastic tube. The purposeful SFMEA views failure modes, element impact, connected hazards impact and class shaped by the software system [17]. The observation section recommends putting in is that the redundant device to observe the ball’s location and restart the system.

Table 2. SFMEA for Ball Position Controller Module

Module	Risk mode	Component effect	Hazards impact	Rank hazards by category
Ball Position Controller	Output signal too high	Dc motor fan runs too fast	Light weight ball is shot to the top of the plastic tube and possibly damages sensor	A
	Output signal too low	Dc motor fan runs too slow	Light weight ball falls to the bottom of the plastic tube	B
	Loss of output signal to drive circuit	Dc motor fan does not run or system does not respond	Light weight ball falls to the bottom of the plastic tube	B

4 Conclusions

There has been continuous research in this arena to build a completely safe system and is in vain. Alternatively, there’s every possibility to bring the behavior of software-intensive systems to function within acceptable risk limits. A rigorous safety assessment, safety analysis and effective risk management would be advantageous. This paper is mainly focus on techniques available for safety analysis and risk reduction in software-intensive critical systems. An attempt is made to develop an approach towards safety assessment of software on the model techniques prevalent in the literature such as Software Failure Modes and Effect Analysis (SFMEA) together with risk assessment to implement safety. The proposed system would be helpful for building resilient, straight forward safety assessment of software, and usable by industrial safety practitioners in the field of software-intensive critical systems and applications.

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Lung Cancer Detection with FPCM and Watershed Segmentation Algorithms

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Abstract. Lung malignant growth drives the causes among disease related passing around the world. WHO information showed 1.69 million passing away in 2015. An early disease investigation can enhance the viability of therapy and also upgrades victim's possibility of exist. The Precision of disease investigation, Rate and Computerization levels decides the achievement of CAD frameworks. In this paper, we worked with the few effectively existing frameworks and discovered the best methodology for recognition of tumors. This article talks about the division with FPCM and Watershed Transform calculations. Computer-aided design includes six stages – a. Image Acquisition, b. Image Pre-processing, c. Lung Region Extraction, d. Segmentation, e. Feature Extraction and f. Classification. Firstly, RGB picture is transfers to dark scale thus the picture clamour is a greater distanced from original picture. Next essential job is division which is performed by utilizing Watershed Transform display. Watershed method characterizes the dark scale picture. After division, highlight extraction is dissected by mean of the fragmented lung region lastly delineation of lung lumps classifies with the help of SVM method. By using this method we accomplished precision: 99% and the time are less than 2 s. The proposed frameworks were executed in MATLAB programming.

Keywords: FPCM · Watershed Transform · Segmentation · SVM (Support Vector Machine)

1 Introduction

Malignancy is a trauma of the cells, which is said to be the body's basic building squares. The packaging always makes new cells to make, replace depleted tissue and patch wounds regularly cells increment and fails deliberately [8]. In some instances cells don't construct segment and kick the can inside the standard way. This may in like manner in addition perspective blood or lymph fluid inside the body to move closer unpredictable or shape a bunch called a tumor. A tumor can wind up good or destructive. The ailment that at first evolved in a body tissue or organ is implied as the principle for the most part developments [10].

To vanquish those bothers, the creators suggested a CAD gadget for handling lung area [6]. This look at first take over the intriguing picture getting ready with the following 8 methods together: a. Bit-Plane Slicing, b. Erosion, c. Median Filter, d. Custom Filter, e. Dilation, f. Outlining, g. Lung Border Extraction and h. Flood-Fill counts for gist of lung zone. For division, Fuzzy possibilistic C-Mean (FPCM) set of tips are utilized for understanding and Support Vector Machine (SVM) were used for characterizing.

Watershed Segmentation is some other division framework used to confiscate the bounds of absorption in this delineation tumor from the spread MRI picture. This division system is incredibly useful to partition objects while they may contact each exceptional. This count helps in discovering the catchment basin and edge follows in the image. In this representation, the edge line addresses the height that separates two catchments bowls. For this, `bwdist ()` method is for poll the partition from each pixel to each non-zero pixel. Watershed estimation is utilizes for watershed () trademark.

The term watershed decamps to an edge, those allotment areas exhausted with the guide of indisputable conduit systems. A catchment basin is the ground precinct evacuating accurately into a stream or supply. Workstation examination of picture contraptions starts with discovering them production feeling of which pixels has a place with everything. This is known as photo division. The direction of operation is isolated gadgets from establishment despite to everything.

2 Literature Review

Armato et al. (2001) proposed prototype that many dark phase limits are done to divide lung stage to make succession of edge lung volumes. An 18-factor availability conspire is utilized to bordering 3D structures, inside each ceiling lung quantity and discrete framework fulfils degree foundation are settled on starter lung knob candidates. The modified structure imparted a common handle region affectability of 70% with a conventional of 1.5 false-positive distinctive bits of verification concerning stage when finished for the total forty three-case database [1].

Armatur et al. (1992) used Lung most malignant growths are one of the common site sorts perpetrating high mortality cost. The fantastic method for assurance from lung, mainly sarcomas is its first identification and expectation. The site of lung majority malignant growths in early degree is a hard issue, because of the state of the syndrome cells; where in major of the cells are covered with one another. In this Histogram Equalization is utilized for pre-preparing of the photos and highlight extraction way and Support Vector Machine classifier to test the circumstances of an affected individual in its initial degree regardless of whether it is standard or unconventional [2].

Cheran et al. (2005) proposed a model that a pneumonia handle is the best customary sign of lung threat. Lung handles are about round regions of particularly extra depth, which can be perceptible in X-pillar sneak peeks of the lung. Considerable (regularly described as more important than 1 cm in separation over) critical handles can be without trouble associated to conservative imaging apparatus and may be perceived by needle biopsy or bronchoscope strategies [3].

Wiemker et al. (2002), PC-aided prognosis for chest radiography is a continuous hobby. For this cause they appraisal is to catalogue and briefly re-evaluated studies on PC assessment of chest photos over 150 papers posted in the remaining 30 years. Unsolved task instructions are indicated for future research [4].

In the field of logical recognizable proof an inside and outside variety of imaging coordination in a straight line to be held, comprises of radiography, X-radiation and reverberation imaging (RI). In nastiness of the fact that the first FCM set of creed yields enthralling impacts for splitting trouble separated photos, it abandons to part photos spoiled by means of clangour, anomalies and other imaging relic. This paper provides the following snapshots: (a). Dissection tactic the exercise of personalized Fuzzy C-Means (FCM) set of tenets and (b). Fuzzy Possibilistic C-Means (FPCM) Calculations.

3 Materials and Methods

Image Acquisition: For a disease, right off the bat picture of inner slices of the body anything to be required. CT check otherwise called X-beam processed tomography makes utilization of X-beam for catching the pictures from dissimilar edges and unification of these films to form cross sectional tomographic picture of specific regions of examining tissues. i.e. it enables the individual to see the status inside the body without non-obtrusive strategies (Fig. 1).

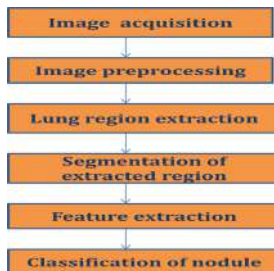


Fig. 1. Proposed method

Image Pre-Processing: CT imaging procedure may contain different commotions. These pictures are not spotless in order to use directly accordingly we have to decommotion these pictures. For this we are utilizing middle outlet which is a nonlinear programmed channel used to remove some uproar in the picture. To identify some edge in the picture, initially commotion ought to be expatriate up to some bound admiration and that edge recognition is performed. Subsequently the middle channel is set before edge indicator. Its primary element is evacuates commotion without edge expulsion.

Grayscale Image: In the processing method, a gray scale image is a computerized image, in which the estimation of every pixel is an individual example. The explanation for alternative gray scale image is also negligible pixel strength is additionally useful in distinguishing changes in the cells.

Lung Region Extraction: The underlying stage is the excerpt of lung locale from CT test picture. Central photo handling systems are connected to this thought process. The snapshot conduct systems did within projected course of actions is: a. Bit-Plane Slicing, b. Erosion, c. Median Filter and d. Dilation. The basic objectives of this technique are: i. identification of lung area and ii. CT scan Regions of Interest (ROIs).

Lung Region Segmentation: After the respiratory organ area is recognized, future technique is distribution of respiratory limb district in order to explore out the malignancy knobs. This progression can decide Region of Interest (ROIs) that assists in significant malignant growth locale. During this examination following 2 calculations are connected: a. Fuzzy Possibility C-Mean (FPCM) and b. Watershed Transformation [12].

1. **FPCM (Fuzzy Possibilistic C-Means):** It is a bunching computation which consolidates traits of fluffy and possibilistic C-implies.

Therefore, a target work in the FPCM relying upon the two enrollments and normality’s can be appeared as:

$$J_{FPCM}(U, T, V) = \sum_{i=1}^c \left(u_{i,j}^m + t_{i,j}^n \right) d(X_j, V_i) \tag{1}$$

Constraints:

$$\sum_{i=1}^c \mu_{i,j} = 1, \forall_j \in \{1, \dots, n\} \tag{2}$$

$$\sum_{j=1}^n t_{i,j} = 1, \forall_j \in \{1, \dots, c\} \tag{3}$$

An answer of the target capacity can be gotten via an iterative practice where the degree of enrolment is:

$$u_{ij} = \left[\sum_{k=1}^c \left(\frac{d(X_j, V_i)}{d(X_j, V_k)} \right)^{\frac{2}{n-1}} \right]^{-1}, 1 \leq i \leq c, 1 \leq j \leq n \tag{4}$$

Normality:

$$t_{ij} = \left[\sum_{k=1}^n \left(\frac{d(X_j, V_i)}{d(X_j, V_k)} \right)^{\frac{2}{m-1}} \right]^{-1}, 1 \leq i \leq c, 1 \leq j \leq n \tag{5}$$

And the group focuses are refreshed by means of:

$$V_i = \frac{\sum_{k=1}^m (u_{ik}^m + t_{ik}^m) X_k}{\sum_{k=1}^n (u_{ik}^m + t_{ik}^m)}, 1 \leq i \leq c \tag{6}$$

FPCM produces enrolments and openings concurrently, during the edge of standard factor methods or group communities for every bunch. FPCM routinely maintains a strategic distances from different issues. Basically this method is combination of following 2 methods: a. hybridization of Possibilistic C-Means (PCM) and b. Fuzzy C-Means (FCM) [9].

2. **Watershed Transformation:** Watershed change is a typical procedure for picture division. Utilizing past kind information has incontestable tough upgrades to medicinal picture division calculations. We will in general propose an exceptional system for civilizing watershed dissection by using ancient frame and come across in sequence. In watershed, interior markers to get watershed lines of the angle of the picture to be metameric. Utilize the gained watershed lines as outer markers. Every locale delineated by the outside markers contains one inward marker and a piece of the foundation. In watershed areas, even as not markers terrain component allowed to be found (Fig. 2).

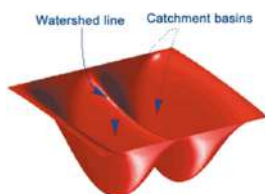


Fig. 2. Basic watershed

SVM for classification: SVM is a valuable methodology for substance class. Without a doubt, even in spitefulness of the way that it's thought about that Neural Networks are less tangled to use than this, in the meantime, from time to time unsatisfactory outcomes are obtained. The purpose of SVM is to make a frame which predicts target estimation of information cases in the taking a gander at locate which can be known handiest the characteristics [5]. Arrangement in SVM is an instance of Supervised Learning. A phase in SVM portrayal includes lifestyle as which are allied with the recognized bearings. Feature decision and SVM gathering together have use despite when the desire for cloud precedents has been never again key. They may be used to wind up aware of key components which might be related with something systems perceive the arrangement.

Feature extraction: The abilities which utilized in this inspection in command to create finding directions:

- a. Candidate place Area
- b. Candidate Area mean intensity price
- c. Candidate vicinity Area
- d. Elimination of remote pixels

The mean intensity cost of candidate vicinity: this element suggest profundity esteem for claimant area is resolute which allows dismissing progress locales which doesn't at any time conclude nasty expansion lump. The mean profundity charge shows the basic power expense of the widely held pixels that comprise a place with the identical place and is resolute employing the segments:

$$Mean(j) = \frac{\sum_{i=1}^n intensity(i)}{n} \tag{7}$$

Where, j describes the place of file and degrees from 1 to full wide assortment of applicant regions inside the whole photograph. Power (I) demonstrates the CT profundity estimation of pixel I which organize from 1-n, where n is a general mixture of pixels possess a place with j.

4 Experimental Results and Scrutiny

In this paper, we have actualized two calculations, i.e., FPCM (Fluffy Plausibility C Means) and Watershed Transformation calculations. We have observed that watershed is providing desirable outcomes above FPCM as far as exactness, mean approximation of fractured region, condition of lung malignancy tumors, preparing time and speed of execution. FPCM is setting aside much opportunity to execute which is over 30 s while watershed is proceeding under 2 s of time to execute the entire procedure. FPCM isn't precise since it has high false positive rates and low affectability. A Watershed is delivering more precise outcomes. We have investigated 50 CT pictures and proper assessment is vaulted watershed is the best reasonable method for the condition of lung lumps in the inception period (Figs. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13).

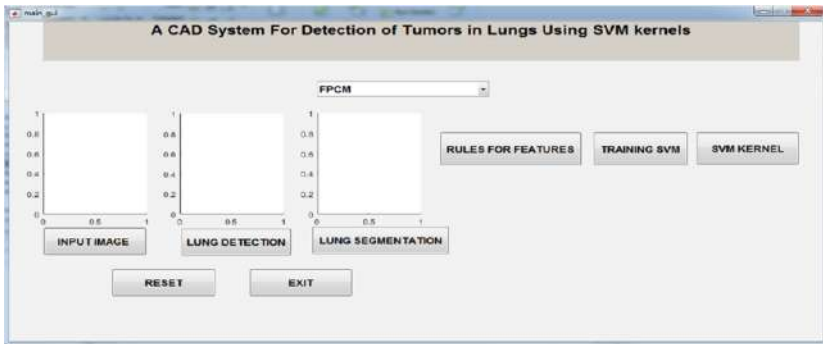


Fig. 3. User interface of the proposed system

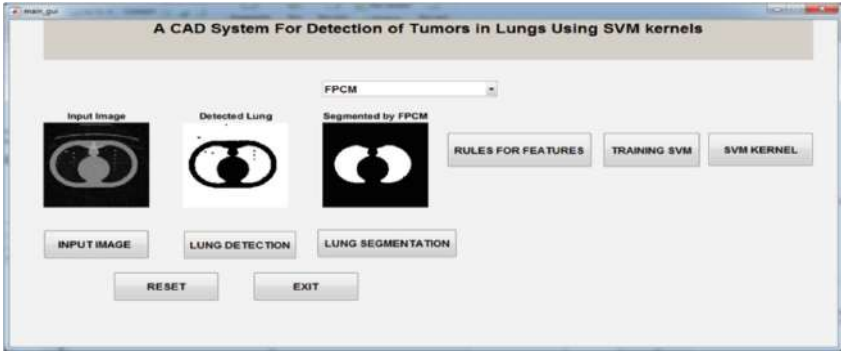


Fig. 4. Segmentation by FPCM algorithm

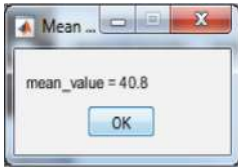


Fig. 5. Mean value, accuracy for the segmented image by FPCM and SVM training

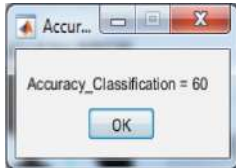


Fig. 6. Mean value, accuracy for the segmented image by FPCM and SVM training

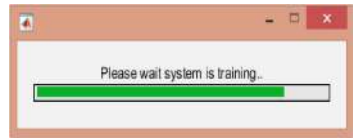


Fig. 7. Mean value, accuracy for the segmented image by FPCM and SVM training

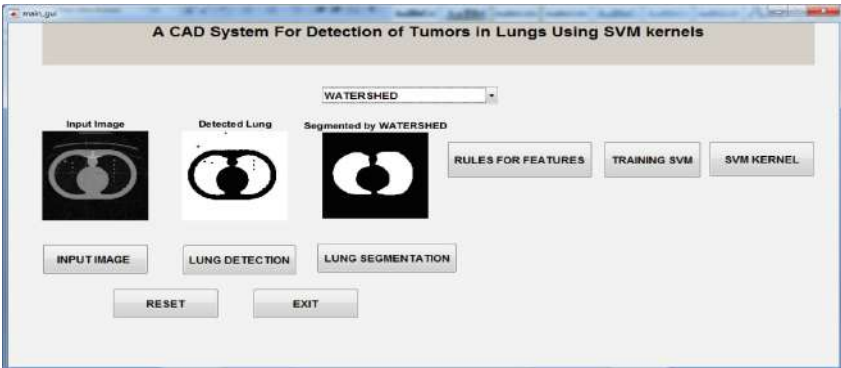


Fig. 8. Segmentation by watershed algorithm

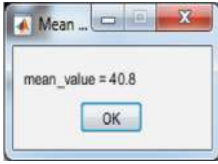


Fig. 9. Mean value, accuracy for the watershed segmented image and SVM training

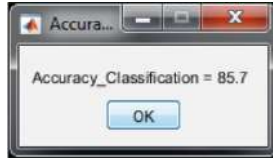


Fig. 10. Mean value, accuracy for the watershed segmented image and SVM training



Fig. 11. Mean value, accuracy for the watershed segmented image and SVM training

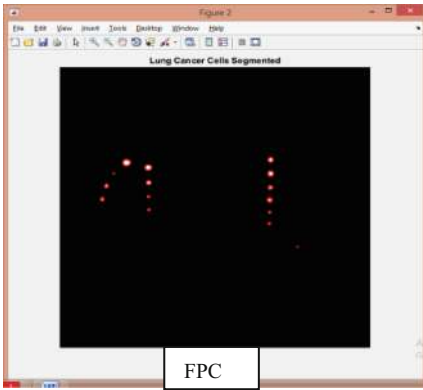


Fig. 12. Cancer cells (nodules) detected using FPCM and watershed algorithms

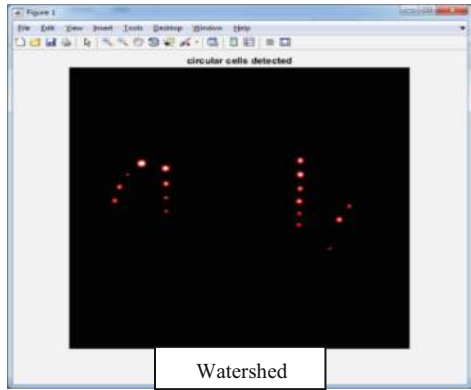


Fig. 13. Cancer cells (nodules) detected using FPCM and watershed algorithms

5 Conclusion

In this article, we are proposing a best technique to distinguish the lung malignancy. The primary strategy is to recognize lung malignant growth is applying channels to CT check pictures. Next, lung zone distinguished division practiced with assistance of Fuzzy Possibility C-Means gathering figuring and watershed change calculation. These characteristics are isolated and examination controls made. This deals with aid of Support Vector Machine. A Watershed is best suitable process for observation of lung tumors in starting periods. Moreover the Support Vector Machine improves precision of diversion plan and it handles most developments. The proposed technique can likewise be connected to some other malignant growth types like bosom disease, skin malignant growth and so on. Additionally, it discovers applications in medicinal research also.

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Early Prediction of Non-communicable Diseases Using Soft Computing Methodology

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Abstract. Even though non-communicable diseases (NCDs) are deadly diseases, the curing and survival rate of them can increase with early prediction. But identification of NCD in the early stage is difficult due to complex clinical attributes and genetic factors. This task can be simplified with the aid of data mining and soft computing techniques. Initially dataset is pre-processed to enhance data quality and then disease prediction model is developed with soft computing methods to identify the disease stage. Later association rules are generated after applying fuzzy clustering to predict the probability of getting the disease in the future and risk factors associated with it individual wise.

Keywords: Non-communicable diseases · Early prediction · SVM · Neural network · Fuzzy clustering · Association rules · Soft computing

1 Introduction

Non-communicable diseases (NCDs) are the leading cause of death globally and nearly 68% of all deaths worldwide are due to them in 2016 [1]. NCD is a non-infectious disease that does not spread directly from one person to another and sustain for the longer period without curing. Most of the NCDs may not be curable and leads to death. However, with the advancement of technology and medical research especially in the domain of NCDs prediction and treatment, these diseases can be controlled or cured completely if they are detected at an early stage. When NCD recognized in the beginning stage, it is more likely to respond to effective treatment and can result in a higher likelihood of surviving, less morbidity and more affordable treatment cost. The living nature of NCD patients can be significantly improved by providing adequate and effective treatment at the right time.

The major five categories of NCDs are cardiovascular diseases, different cancers, Respiratory diseases, Digestive diseases and Diabetes. Cardiovascular diseases and cancers are the world's biggest killers, accounting for a 44.84% of all deaths in 2016. These diseases have remained the leading causes of death globally in the last two

decades. Respiratory diseases death rate dropped approximately 30% and digestive diseases death rate increased 42% in the last 15 years. Even though Diabetes mortality rate is 4.29% in 2016, it was increased approximately 150% as compared to year 2002. The growth percentage is notably important and precautions to be taken to control it; otherwise, diabetes can become number one killer after 50 years (Table 1).

Table 1. Top 5 Non-communicable diseases in 2016 [1]

Cause	% Deaths in 2002	% Deaths in 2016	% Change
Cardiovascular diseases	29.34	31.36	6.88
Malignant neoplasms (cancers)	12.49	13.48	7.89
Respiratory diseases	6.49	4.53	-30.27
Digestive diseases	3.45	4.91	42.32
Diabetes mellitus	1.73	4.29	148.23

Cardiovascular diseases (CVDs) are a group of disorders affecting the heart and blood vessels. Ischemic heart disease and stroke are the major death cause diseases in the category of CVDs. Ischemic heart disease also called as coronary artery disease, occurs when the blood vessels that supply blood to the heart become narrowed and interrupt blood flow and lead to chest pain, heart failure, arrhythmias and cause death. A stroke occurs when an artery in the brain is blocked or leaks. As a result, brain cells die within minutes due to loss of oxygen and nutrients. A stroke is a medical emergency that require immediate prompt treatment to minimize brain damage and potential complications.

Cancer is a disease where a few of the cells within the body become abnormal, divides exponentially without any control, and form tumor cells and spread to nearby cells. Breast cancer in women and lung cancer in men are the most death causing diseases under this category. Once upon a time, there is no survival other than death for the cancer. However, due to advancement in cancer research and medicine, it can be cured when recognized in the early development stage. Knowing the cancer stage is very important as it helps doctors to fully understand patient condition and to work out the best possible treatment options.

Diabetes is one of the most prevalent chronic diseases around the world. Diabetes is a group of diseases that influence insulin production and usage. Insulin is a hormone produced by a gland called the pancreas. Insulin balance blood sugar levels, keeping them in the narrow range that our body requires. Glucose or sugar is the source of energy for the functioning of body cells. Glucose comes from the food we eat, observed into the blood and moves through bloodstream and enter into body cells with the help of insulin. Long-term diabetes includes type 1 diabetes and type-2 diabetes. In type 1 diabetes, the pancreas does not generate insulin. Due to lack of insulin, sugar not transported into the body cells and builds up in the bloodstream. This results in higher sugar in the blood and can lead to serious health problems. In type 2 diabetes, the pancreas does not have enough insulin production, or insulin cannot be used effectively. Body cells are resistant to insulin action and pancreas is unable to produce

enough insulin to overcome this resistance. As a consequence, sugar builds up in bloodstream. If the patient suffering from diabetes for a long period and the blood sugar is not controlled, then the risk of complications is high. Eventually, diabetes can lead to cardiovascular disease, Kidney damage, Alzheimer's disease and other health problems which cause death.

The basic organization of the paper is arranged in 6 sections as follows: Sect. 2 presents the review of literature related to prediction of non-communicable diseases, Sect. 3 describes data mining preprocessing techniques and soft computing methods, Sect. 4 presents the proposed model for early prediction of disease, Sect. 5 presents results and analysis and the conclusions are given in Sect. 6.

2 Review of Literature

Many studies have been done that have focus on prediction of non-communicable diseases. Researchers have applied different data mining and soft computing techniques for predicting NCDs. Khera et al. [2] developed polygenic risk score to identify likelihood of developing non communicable diseases such as coronary artery disease, breast cancer and type 2 diabetes well before any symptoms appear in a person using genome analysis. Cinetha et al. [3] proposed a decision support system for predicting coronary heart disease using fuzzy rules generated from decision tree by clustering the dataset. This system compares normal and coronary heart disease patients to predict the possibility of heart disease in a normal patient for the next ten years. Anderson et al. [4] developed Framingham prediction equation for CVD mortality risk in next 10 years. Dolatabadi et al. [5] used Heart Rate Variability (HRV) signal extracted from electrocardiogram (ECG) for the prediction of Coronary Artery Disease. They applied Principal Component Analysis (PCA) to reduce the dimension of the extracted features and later Support Vector Machine (SVM) classifier has been utilized. Kahramanli et al. [6] proposed hybrid prediction model by combining artificial neural network (ANN) and fuzzy neural network (FNN) to predict diabetics and heart disease. Adalı et al. [7] developed a nonlinear empirical model with Back-Propagation Multi Layer perceptron to predict cancer by using micro-array data. Geman et al. [8] proposed a hybrid Adaptive Neuro-Fuzzy Inference System (ANFIS) model for prediction of diabetes.

3 Data Mining and Soft Computing Techniques

Data mining is about the process of searching hidden information that can be turned into knowledge, thus could be used for strategic decision making or answering fundamental research question. It aims at discovering knowledge out of data and presenting it in a form that is easily compressible to humans. Data mining in health care has become increasingly popular because it offers benefits to Doctors, patients and healthcare organizations. Doctors can use data analysis to identify effective treatments and best practices. By comparing causes, symptoms, treatments, and their adverse effects, data mining can analyze which courses of action are most effective for specific patient groups.

When the dataset contain missing, irrelevant, noisy and redundant data, the knowledge discovery is not trustworthy. Data preprocessing methods are applied to enhance the data quality. Missing values in health datasets may exist mainly because sometimes doctors feel few of the medical test attributes are not required. The simplest way to deal with missing values is to ignore tuples with them. However, this approach is not much beneficial, as eliminating instances may introduce a bias in the learning process, and sometimes most useful information are often lost. The best method to handle the missing values is by using imputation methods [9]. Each missing values in a tuple is imputed by approximation of most similar tuples exist in the dataset. Simple mean-mode imputation, cluster based imputation methods, probabilistic based imputation methods, regression based imputation methods and machine learning approaches can be used to handle missing values.

A disease can be identified with the help of a set of symptoms (attributes) and these symptoms from person to person vary among patients with same disease but the main symptoms are common in all the patients. Attribute subset selection methods are used to identify these main set of symptoms. The main objective is to obtain a subset of attributes from the original dataset that still appropriately describe it. It removes irrelevant and redundant attributes which might induce unintentional correlations during the process of learning; there by diminishing their generalization abilities decrease the chances of over-fitting of the model and making the learning process faster and also less memory consuming.

Machine learning methods can be used to classify, recognize, or distinguish disease stages. In other words machine learning models can assist the doctors in disease diagnosis and detection [10, 11]. Despite for the most skilled clinician, this job is not easy due to complex molecular, cellular and clinical parameters. In these situations, human perception and standard statistics may not work but rather machine learning models can. Machine learning is a branch of artificial intelligence that utilizes a variety of statistical, logical, probabilistic and optimization tools to “learn” from past data (training data) and to then use this knowledge to classify new data, identify new patterns or anticipate novel trends. Machine learning methods can employ Boolean logic (AND, OR, NOT), decision trees, IF-THEN-ELSE rules, conditional probabilities, artificial neural networks, support vector machines and unconventional optimization strategies to model data or classify patterns.

3.1 Artificial Neural Network

An artificial neural network (ANN) is a mathematical model based on structure and function of biological neural networks. In ANN, artificial neurons called processing units are organized into layers which are interconnected among nodes between consecutive layers. The nodes in the first layer (input layer) accept input data, while the output of last layer (output layer) nodes represents the class labels. There may be zero or more hidden layers between input and output layers. A weight is associated with every interconnection and these weights are adjusted in order to predict the correct class label by providing all the data samples to the network one at a time. The weight adjustment is done in iterative process until all the input data samples gets the correct class label.

3.2 Support Vector Machines

Support vector machines (SVM) handles classification by defining a separating hyper-plane. When the two classes are linearly separable, there may exist an infinite number of linearly separable hyper-planes. SVM attempts to choose one among them such that the distance from the hyper-plane to the nearest points in either class is maximized [12]. These nearest points in the two classes are called as support vectors. If the two classes are non-linearly separable, SVM uses $\varphi(\cdot)$ functions to transform the data of two classes from original space R into a much higher - dimensional space to make linear separation is possible in that space. The use of kernel function reduces computational power.

4 Proposed Model

Every disease has a set of symptoms and by the sign of these symptoms in the human being, a deadly disease can be identified in the early stage and curing can be done with minimum risk. But unfortunately all the symptoms of a disease may not appear in the primary stage of disease. Only a few of the symptoms appear in the beginning and remaining symptoms appear in the later stages. Additionally, symptoms of a disease vary based on geographical locations and also differ from person to a person in rare cases. Under these circumstances identification of a disease becomes difficult. Data mining and soft computing techniques can be applied to make the task simpler.

By studying datasets collected from UCI repositories [13], other public sources available on internet and also from nearby hospitals, a model has to be developed. This model identifies the primary symptoms of a disease (attributes), intensity raise of attributes from primary stage to the final stage of the disease and generate rules for identifying the disease in the early stage. The early prediction of the deadly disease model is developed in three stages by giving the disease dataset as input. In the first stage the dataset is to be pre-processed. The initial step in our dataset preprocessing is to identify the missing values and fill them with suitable values. Handling missing values are very crucial because existence of missing values can influence the model developed. There exist many ways to handle missing values, we need to study all those missing value handling techniques and the best one for disease dataset is to be selected and impute the missing values with it. Most probably cluster based imputation technique is used. The final step in our pre-processing stage is to apply attribute subset selection method. It generates the subset of attributes that are crucial in disease development. Different attribute subset selection methods such as Filter methods (LDA, ANOVA, chi-square), Wrapper methods (forward selection, backward selection, recursive feature elimination) and Embedded Methods (Lasso regression, Ridge regression) are studied and applied on disease dataset.

In the second stage, the pre-processed disease dataset is given as input to the classification. From the previous literature it was found that SVM and Neural Network methods are predicting disease more accurately than other methods. Hence SVM and Neural Network classification techniques are applied independently and the best one for our dataset is chosen. The importance of the classifier in the model is to predict the disease stage for a newly diagnosed patient.

In the third stage, the pre-processed dataset combined with almost idle condition healthy data and clustered using fuzzy clustering. When a new person (unknown disease stage) data is given to these fuzzy clusters, the fuzzy value of this new data belongs to each cluster is calculated. The more the fuzzy value belongs to unhealthy cluster, then more chances of getting the disease in the future. In other words, the calculated fuzzy values determine the probability of getting the disease in the near future. Next, association rules for each fuzzy cluster are generated. Based on fuzzy values, these association rules are analyzed to identify the risk factors (attributes) that lead to affect with disease. So that it can warn the person to minimize these risk factors. The intensity level changes in the data of primary attributes (risk factors) and their dependent attributes from beginning stage to last stage are studied. In this process variation in the data of key attributes and its pattern is analyzed. Once the increasing pattern is understood, then disease primary causes are identified. Finally, the basic symptoms for identifying disease are obtained. The model for early prediction of disease is given below (Fig. 1).

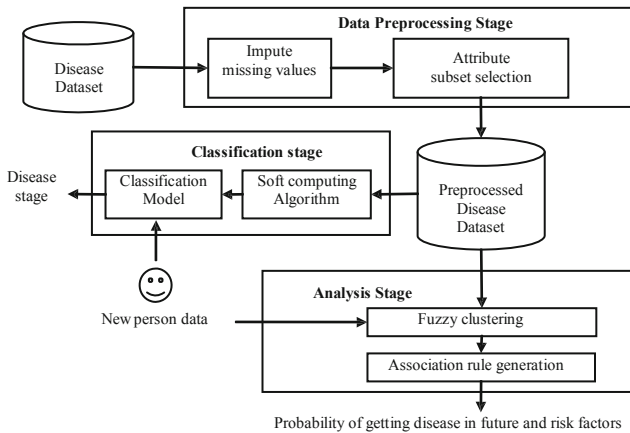


Fig. 1. Model for identifying disease in the early stage

5 Experimental Results and Discussion

The experiments are conducted using python on Cleveland heart dataset (CHD) collected from UCI repositories [13]. In the Initial stage, CHD is pre-processed by handling missing values and generating attribute subset. The missing values in CHD are imputed with k-nearest neighbor imputation method choosing k as 5. But, the usage of this method created gender reorder problem in the dataset. To overcome this problem, the CHD is divided into groups based on gender and then the missing values in each group is imputed with samples from the same group with Weighted K-Nearest Neighbor imputation method choosing k as 5. Latter, Principle Component Analysis is applied on CHD to simplify the data set complexity while retaining trends and patterns. It simplifies CHD by obtaining 8 attributes {age, sex, blood pressure, ST depression, vessels, thal, fasting blood sugar, Chest Pain and num or class} out of 14 attributes.

In the second stage, soft computing methods such as Neural Network (NN) and Support Vector Machine (SVM) are applied separately on the pre-processed CHD to develop disease prediction model. Scikit-Learn library [14] is used to implement SVM with Gaussian kernel in python. The NN is implemented with NumPy library [15] using sigmoid activation function. The prediction accuracy of the model developed with SVM and NN are 92.6% and 94.5% respectively. NN model is giving better prediction as compared to SVM model. This prediction model predicts the disease stage.

In the final stage, fuzzy clustering is performed to predict the possibility of getting heart disease. The nominal attributes in the dataset are converted into numerical values to simplify the graphical analysis. The pre-processed CHD is divided into 5 cluster groups using fuzzy cluster. Latter 20 new persons' data is collected and each person data is plotted in the fuzzy cluster space to get fuzzy values associated with each of it. A person with attribute values such as {41, male, 124, 1.0, 1.0, normal, false, atypical angina} got the fuzzy values as {healthy, stage1, stage2, stage3, stage4} = {0.632, 0.174, 0.094, 0.056, 0.043}. The first fuzzy value in the set shows the probability of person belongs to healthy group and sums of the remaining fuzzy values shows the probability belongs to unhealthy group. As in the above case, it shows 37% belongs to unhealthy group; the chances of getting heart disease may increase when the attribute values changes. The changes in risk factors (attributes) that lead to heart disease are identified by varying one attribute value and keeping other attributes as fixed for all the cases. This can be used to find fuzzy values associated in each case. If the fuzzy value belongs to unhealthy group increases, then the chances of getting heart disease also increase. The following observations are made by varying each attribute value.

- As bigger is blood pressure as higher is the heart disease stage.
- When ST depression increases then the heart disease stage also increases.
- If fasting blood sugar is false, then the probability of heart disease is high.
- As bigger is vessels as higher is the heart disease stage.
- The probability of getting Heart disease in men is higher than in women.
- When chest pain is asymptotic, then probability of heart disease is high.

Finally, other supporting attributes that influence the above observed attributes are to be identified. For example, blood pressure increases due to supporting attributes such as Smoking, obesity, sedentary life, too much salt in the diet, too much alcohol consumption and stress. If these supporting attributes are present in a person and these are in a stage to influence the observed attributes, then we can predict the person may get heart disease. When the unhealthy fuzzy value $> 30\%$, periodic health checkups need to be conducted and the generated time series data is analyzed to predict the probability of getting heart disease. This early prediction can alert the person to nullify these supporting attributes to decrease the chances of getting heart disease in future.

6 Conclusion

Non-communicable diseases and their risk factors pose a serious threat to global health. The mortality rate due to NCDs can be reduced by predicting in the early stage. The proposed model predicts the probability of getting disease in the near future and also identifies risk factors that lead to disease. The threat of NCDs can be minimized by maintaining balanced diet, regular exercise, reducing obesity, quitting smoke and alcohol. Future enhancements can be done by conducting experiments on the proposed model using other NCD datasets.

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High Throughput VLSI Architectures for CRC-12 Computation

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Abstract. This paper presents high speed VLSI architectures from serial architectures to parallel architectures with improved throughput and low latency. This paper introduces IIR filter based design architecture for implementation of parallel CRC and comparison is done for the implementations of CRC-12 polynomial equation. A LFSR is used as main component for these implementations. The proposed design consists of parallel architectures of Single and multi level. These architectures had been implemented using verilog language code and simulated using Xilinx tool 14.1.

Keywords: CRC · LFSR · Look ahead approach · IIR filter design

1 Introduction

LFSR is one of the major components to compute CRC in many DSP and communication systems [1]. To find the transmission data errors CRC is used in communication receivers. Cyclic Redundancy Check operations were performed by LFSR. CRC is a very useful technique in finding errors and easily implemented technique using LFSR component to obtain data correctly [2]. In CRC, a common Generating Polynomial (GP) is used for both encoding and decoding operations at transmitter and receiver respectively [3]. CRC implementation using serial architectures is not suitable for practical high speed communications, due to distribution of the clock. In order improve the throughput by reducing the latency, a serial to parallel transformation is the best solution [4]. However, parallel architectures may cause to increase the critical path [5–7]. Another disadvantage with parallel processing techniques requires more XOR gates and delay elements, which needs to be reduced [8, 9]. Various researchers proposed different designs to get good performance inters of latency and throughput [9–15]. The proposed architectures start from LFSR, which is generally used for serial cyclic redundancy check.

The paper is planned as follows. The brief analysis of serial and proposed parallel implementations is presented in Sect. 2. Section 3 contains the RTL schematic diagrams, output wave forms of CRC-12 serial and level of parallel architectures, and the comparison of proposed architectures. Finally Sect. 4 concludes the paper.

2 Analysis of Serial and Parallel Implementations

2.1 CRC-12 Serial Architecture and Single Level Parallel Architecture

The GP for CRC-12 is given by $y(n) = y_{12} + y_{11} + y_3 + y_2 + y_1 + 1$

The Fig. 1 shows CRC-12 serial architecture. Here D represents a delay element, $u(n)$ is the input binary data stream, $w(n)$ is the feedback variable and $y(n)$ is the finally computed CRC. The serial architecture takes 12 clock cycles to produce an output. From Fig. 1, the throughput of the circuit is 1 and critical path for serial architecture is $2 T_{XOR}$ (Fig. 2).

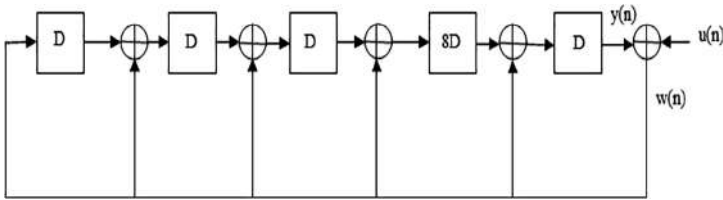


Fig. 1. CRC-12 computation with serial architecture

The output equation of CRC-12 generator polynomial can be represented as

$$y(n) = y(n - 12) + y(n - 11) + y(n - 10) + y(n - 9) + y(n - 1) + f(n) \quad (1)$$

Where

$$f(n) = u(n - 12) + u(n - 11) + u(n - 10) + u(n - 9) + u(n - 1) \quad (2)$$

The critical path of single stage parallel architecture is $2 T_{XOR}$ and the latency and throughput is 12 clock cycles and 1 respectively.

2.2 Two Stage Parallel Architecture

Taking an unit delay for the Eq. (1) the equation can be framed as

$$y(n - 1) = y(n - 13) + y(n - 12) + y(n - 11) + y(n - 10) + y(n - 2) + f(n - 1) \quad (3)$$

Substituting Eq. (3) in Eq. (1) the equation can be framed as

$$y(n) = y(n - 13) + y(n - 2) + y(n - 9) + f(n - 1) + f(n) \quad (4)$$

Loop update equations (Fig. 3)

Loop update equations for two level parallel architecture Substituting $n = 3k$ in Eq. (1) and $n = 3k + 1$ in Eq. (4) we get Loop update equations (Fig. 4).

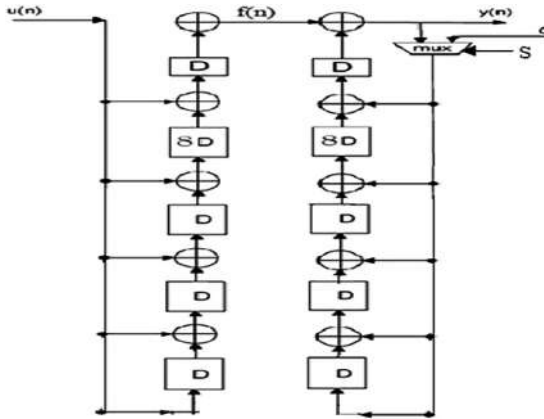


Fig. 2. Proposed single stage parallel architecture

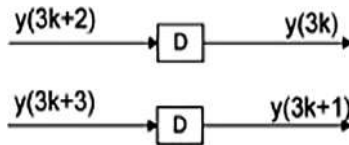


Fig. 3. Loop update equations for CRC-12 two level parallel architecture

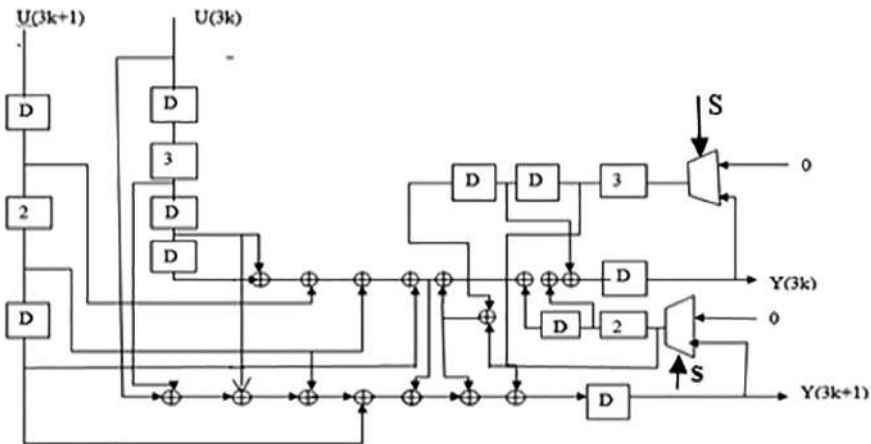


Fig. 4. Two stage parallel architecture

$$y(3k + 2) = y(3k - 10) + y(3k - 9) + y(3k - 8) + y(3k - 7) + y(3k + 1) + f(3k + 2) \quad (5)$$

$$y(3k + 3) = y(3k - 10) + y(3k - 6) + y(3k + 1) + f(3k + 2) + f(3k + 3) \quad (6)$$

Where

$$f(3k) = u(3k - 12) + u(3k - 11) + u(3k - 10) + u(3k - 9) + u(3k - 1) \quad (7)$$

$$f(3k + 1) = u(3k - 11) + u(3k - 10) + u(3k - 9) + u(3k - 8) + u(3k) \quad (8)$$

The critical path, latency and throughput for two stage architecture are $10T_{xor}$, 6 clock cycles and 2 respectively.

2.3 Three Stage Parallel Architecture

Taking an unit delay for the Eq. (1) the equation can be framed as

$$y(n - 1) = y(n - 13) + y(n - 12) + y(n - 11) + y(n - 10) + y(n - 2) + f(n - 1) \quad (9)$$

Taking an unit delay for the Eq. (3) the equation can be framed as

$$y(n - 2) = y(n - 14) + y(n - 13) + y(n - 12) + y(n - 11) + y(n - 3) + f(n - 2) \quad (10)$$

Substituting the Eqs. (9) and (10) in Eq. (1) final equations for $y(n)$ can be framed as

$$y(n) = y(n - 13) + y(n - 9) + y(n - 2) + f(n - 1) + f(n) \quad (11)$$

$$= y(n - 14) + y(n - 12) + y(n - 11) + y(n - 9) + y(n - 3) + f(n - 2) + f(n - 1) + f(n) \quad (12)$$

$$= y(n - 12) + y(n - 11) + y(n - 10) + y(n - 9) + y(n - 1) + f(n) \quad (13)$$

using a look ahead technique the loop update equations are (Fig. 5)

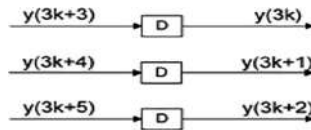


Fig. 5. Loop update equations for CRC-12 two level parallel architecture

Substituting $n = 3k + 3, 3k + 4, 3k + 5$ in Eqs. (11), (12), and (13) the final equations can be framed as

$$y(3k + 3) = y(3k - 10) + y(3k - 6) + y(3k + 1) + f(3k + 2) + f(3k + 3) \quad (14)$$

$$y(3k + 4) = y(3k - 10) + y(3k - 8) + y(3k - 7) + y(3k - 5) + y(3k + 1) + f(3k + 2) + f(3k + 3) + f(3k + 4) \quad (15)$$

$$y(3k + 5) = y(3k - 7) + y(3k - 6) + y(3k - 5) + y(3k - 4) + y(3k + 4) + f(3k + 5) \quad (16)$$

Where

$$f(3k + 3) = u(3k - 10) + u(3k - 6) + u(3k + 1) \tag{17}$$

$$f(3k + 4) = u(3k - 10) + u(3k - 8) + u(3k - 7) + u(3k - 5) + u(3k + 1) \tag{18}$$

$$f(3k + 5) = u(3k - 7) + u(3k - 6) + u(3k - 5) + u(3k - 4) + u(3k + 4) \tag{19}$$

The critical path for three stage parallel architecture is $10T_{xor}$. Latency and throughput for three stage architecture are 4 cycles and 3 (Fig. 6).

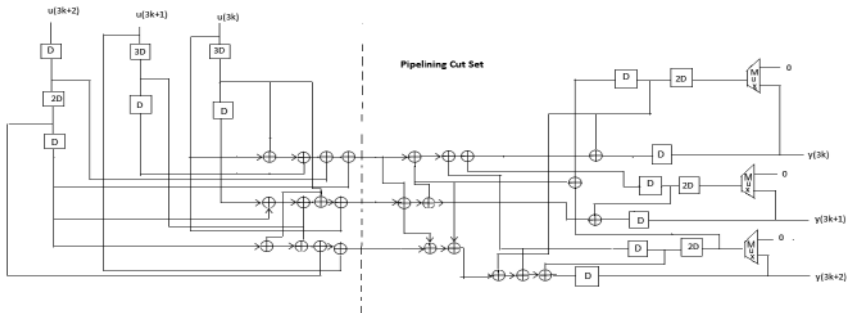


Fig. 6. CRC-12 Three level parallel architecture

3 Simulation Results

The results which are presented in this section are simulated using Xilinx 14.1; the detailed analysis of all architectures along with the simulation results are shown below.

3.1 CRC-12 Serial Architecture Simulation

The Figure 7 represents the CRC-12 serial architecture simulation waveform in which the output sequence is obtained after 12 clock cycles and status signal get high in the simulation waveform once output is obtained.

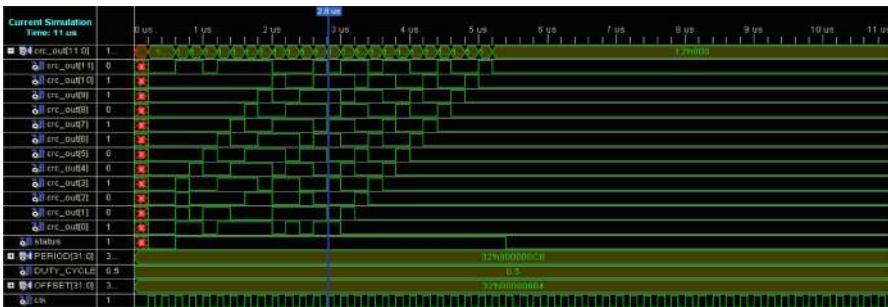


Fig. 7. CRC-12 serial architecture output waveform

The Figure 8 represent the CRC-12 single level parallel architecture simulation waveform in which the output sequence is obtained after 12 clock cycles In the above single level parallel architecture latency is 12 and throughput obtained from this architecture is 1.

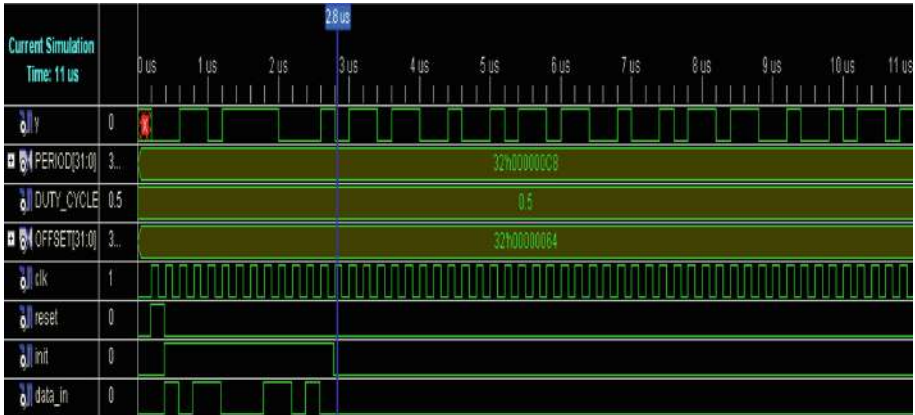


Fig. 8. Computation of CRC with Single stage parallel architecture

3.2 Modified Single Stage Parallel Architecture

3.3 Proposed Two Stage Parallel Architecture

The Figure 9 represent two stage parallel architecture simulation waveform in which the output sequence is obtained after 6 clock cycles In the above single level parallel architecture latency is 6 and throughput obtained from this architecture is 2.

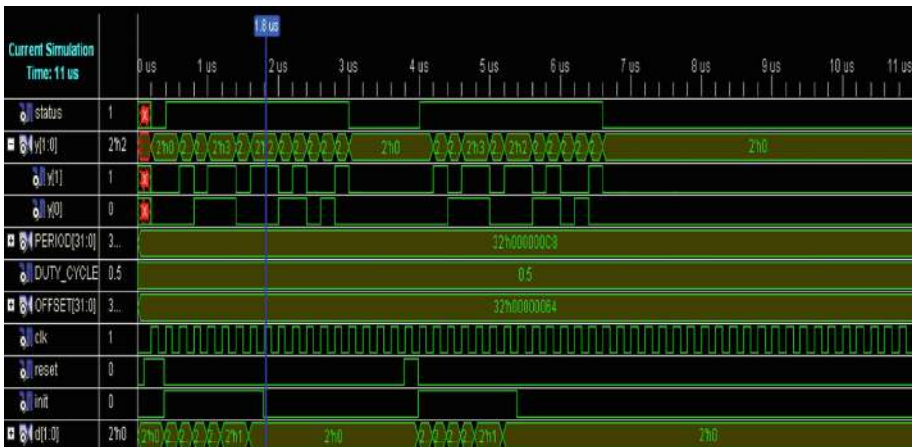


Fig. 9. Computation of CRC with proposed two stage parallel architecture

The Fig. 10 represents the CRC-12 three stage parallel simulation waveform in which the output sequence is obtained after 4 clock cycles. In three level parallel architecture latency is 4 and throughput obtained from this architecture is 3.

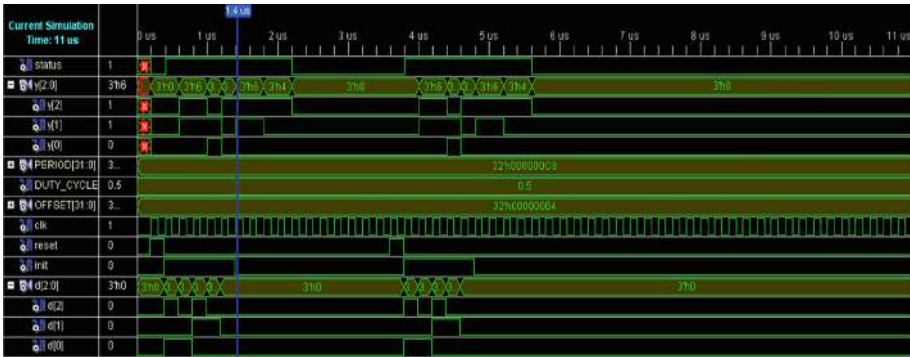


Fig. 10. Computation of CRC with proposed three stage parallel architecture.

The performance comparison of various proposed architecture is shown in Table 1. The proposed three stage parallel architecture has superior performance than other architectures in terms of throughput and latency.

Table 1. Performance of proposed parallel structures

Level of architectures	No. of check sum bits	No. of gates	No. of delay elements	CP	Throughput	Latency
Serial architecture	12	5	12	2	1	12
Single level parallel architecture	12	10	24	2	1	12
Two level parallel architecture	12	16	24	10	2	6
Three level parallel architecture	12	16	24	10	3	4

4 Conclusion

This paper has proposed new high speed VLSI architectures from serial architectures to parallel architectures with improved throughput and low latency. From the simulations and synthesis reports the proposed three stage parallel architecture has an improved performance over other structures. In future, the performance can be improved further with retiming and unfolding techniques along with the folding transformation.

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Software Application Test Case Generation with OBDM

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Abstract. Software Testing is the one of the indispensable bustle to guarantee software quality. Exhaustive software testing is not probable at any point of time but optimized testing is practicable. Test case generation is very imperative in attaining the optimized testing i.e. with minimal number of test cases uncovering maximum number of errors. Software experts are following deferent methods for engendering test records; now this tabloid researcher explained generation of the test records centered on OBJECT BEHAVIORAL DEPENDENCE MODEL (OBDM).

Keywords: Testing · OBDM · Error

1 Introduction

Testing is a movement of evaluating the framework or its segments with the resolved to discover whether it satisfies the measured necessities or not. This action outcome in the unmistakable likely and fluctuation between their outcomes in some cases it can be characterized as “movement of researching programming thing to recognize the contrasts amongst existing and required conditions and to assess the elements of the product thing”.

Importance of Testing

Amid configuration and development programming is tried to reveal mistakes [13]. The realm has seen numerous fiascos in light of the disappointment of programming items. Presently in productiveness, guaranteeing the eminence and dependability of programming items takes turned into a vital issue. Along these lines, to guarantee programming dependability testing is extraordinary and most requesting errands in programming progress. It finds issues and guarantees quality, agreeableness. The objective of testing is to discover issues, not to demonstrate rightness. And importance of the testing was explained in the article [13].

1.1 Testing Types

Hands on Testing: This write contains the testing of the Software. Herein write the analyzer take responsibility rheostat in excess of the part of culmination patron. Programmer use test arrangement, research or test circumstances to experiment the Software to ensure the breadth of taxing [11, 12].

Motorization Testing: It be present likewise outstanding as “Test Automation”. This development take account of computerization of a guidebook process, is make use of to re-outing the test state of affairs that done actually, promptly and more than once [13].

When to Automate: It is best suited in the following:

- Hefty and acute projects.
- Chucks are stable.
- Retrieving the application with numerous users. [11]
- Unchanging Software.
- Convenience of stint.

Step by Step Instructions to Automate: Mechanization is done by using a concerned computer language, lot of tools open for the purpose of automation cursives. The procedure is:

- Ascertaining regions.
- Appropriate tool assortment.
- Inscription of scripts.
- Test suits development.
- Accomplishment of scripts
- Creating outcome information.
- Recognizing impending bug or recital issue.

Some of the tools used for Mechanization testing [13]:

- HP Quick Test Proficient
- SELINIUM
- RR serviceable Tester
- SILK Test
- Test Comprehensive
- Testing Anywhere
- WinRunner
- LoadRunner
- Visual Studio Professional
- WATIR

It encompasses the credentials of relics which should be established throughout the testing of Software. It contain

- Test Proposal
- Scenario
- Test Case
- Traceability Matrix

It skeletons the approach that will be used to test an application, Stereotypically the Eminence Guarantee Team Lead is accountable for writing Proposal. A test proposal will contain

- Introduction of proposal
- Assumption conditions
- List of Test cases
- The features to be tested
- Type of Approach
- What are the Deliverables
- Resource allocation
- Risks assessment
- Tasks and milestones

Test Scenario

It clarifies what locale will be tried; guarantee that all method floats are tried from end to end. The term test situation and experiments are utilized. At the point when seen from this observation test situations are experiments [15].

Test Case

It includes the arrangement of steps, conditions and commitments which can be utilized while execution the testing undertakings [16]. There are various sorts of experiments alike Functional, undesirable, botch, sensible, lustful, UI experiments and so on. Moreover test cases are engraved to keep way of testing scope of Software. More often than not, there is no legitimate layout which is utilized through the experiment composing, the principle segments are:

- Test case ID.
- Invention Segment
- Merchandise variety
- Amendment antiquity
- Determination
- Molds
- Pre-Conditions.
- Stages.
- Predictable Outcome.
- Authentic Outcome.
- Pole Circumstances

Test case Design Practices

Following are the distinctive design practices

1. Test case generation form the requirements. This includes:

- Frontier Rate Study
- Sameness Apportioning
- Pronouncement Stand Taxing
- State Transition Diagrams
- Use Case Testing

2. Test case derivation from structure:

- Declaration Exposure
- Division Exposure
- Track Exposure

3. Test case derivation based on experience:

- Fault Predicting
- Probing Testing

What Is a Test Suite? [14]

It is a compartment that has a lot of tests which helps analyzers in executing and announcing the test execution status. It can take any of the three conditions in particular Active, in advancement and finished. A Test case can be added to different test suites and test plans. In the wake of producing a test plan, test suites are molded which thusly can have any number of tests. Test suites are shaped dependent on the succession or dependent on the likelihood. It can contain any kind of tests, viz - practical or Non-Functional (Fig. 1).

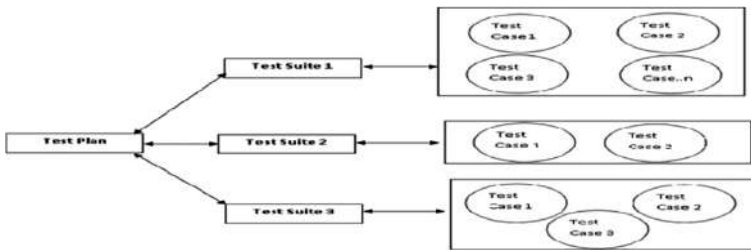


Fig. 1. Suite of the test cases.

1.2 Random Testing

Arbitrary testing was specified chief specialty of taxing programming taxing time of Glen portage J. Myers. It is easiest procedure of very top quality experiments, picked indiscriminately. Arbitrary testing is the four stage methodology [15].

- The input zone is distinguished
- Test information sources are chosen self-sufficiently on or after the space
- The framework further down test (SUT) is accomplished on sources of info make an irregular test set
- The results are contrasted with the framework necessity.

Primary sorts of irregular testing strategies:

- Random input information era
- An arbitrary succession of information
- Random information choice from in effect file.

Why arbitrary testing is unsystematic deliberately in selecting test information

For the reason that genuine open door surrounded by test centers grant quantifiable desire of significance in the watched comes to fruition why would it be advisable for us

to go for arbitrary testing? Gives us a simple method for confirming the test outcomes, test sources of info are arbitrarily produced as pre-operative profile. Data sources may spare some time and exertion through mindful test input determination techniques

1. Can use to gauge the unwavering quality
2. It is extremely valuable in discovering low recurrence bugs
3. It can ready to give 80% exactness of the item for consumption item

2 Object Behavior Dependence Model (OBDM)

In sequence diagram set of nodes representing objects (K_b) and set of edges that indicate the function (J). Where, $J \in S_j$ represents the synchronous function. Function has the following 6 attributes.

$J_{source} \in K_b$ - Basis of the function, $J_{dest} \in K_b$ - Journey's end of the function and where $J_{source} \neq J_{dest}$ J_{name} - Name of the function, $J_{BW} \in S_j$ - Backward navigable function and where, $J_{BW} \neq J$ it is denoted as "-".

J_{ER} - Probabilistic carrying out rate of a function in a Sequence Diagram and where, $0 \leq J_{ER} \leq 1$ and the failure to pay value is 1.

J_{EER} - Expected carrying out rate of a function in a Sequence Diagram and where, $0 \leq J_{EER} \leq 1$ and the failure to pay value is 1.

Researcher considers a control structure of a source code, in which the carrying out rate of a function may perhaps be affected. Think through a function an alt united splinter only when the circumstance in fragment stands contented. If the function is accomplished within this circumstance fragment, then the likelihood of carrying out rate of a function is 0.5. Otherwise, defaulting value is 01. Probable implementation proportion of a function is a probability of the execution rate of a sequence illustration. In other words, it is the odds of the carrying out time for the total number of functions in a particular class to the implementation time for the entire amount of functions in the whole input application. The function in a sequence diagram is accomplished only when it is make active. The failure to pay value of J_{EER} is also 01 (Fig. 2).

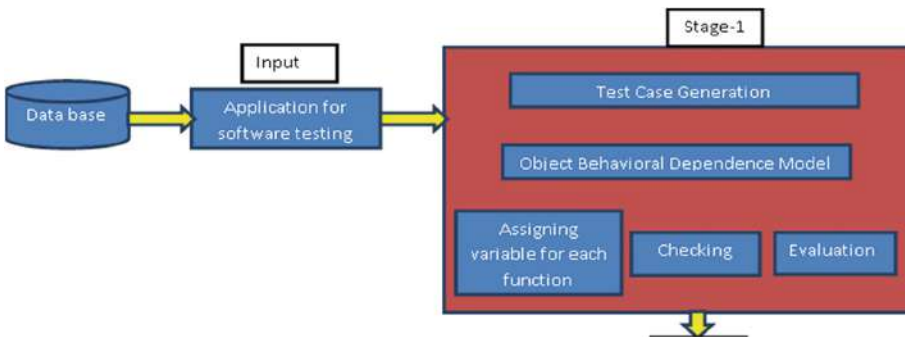


Fig. 2. Block diagram

3 Test Case Generation

The suggested method produces the test cases based on the OBDM which is one among the efficient test case generation techniques. Here any software application code can be taken whereas researcher took banking application code. The software application which is meant for checking, takes as an input for object behavior dependence model in software taxing.

Apiece solicitation has the number of classes, function specifically employed for generation of test case. The recommended OBDM method principally single-mindedness on the functions, coverage metrics of the submission applied for the test case generation. This will avoid generating duplicate and insignificant test cases. The function designation is represented as a fickle in accomplished method. In flowchart overall process of test case generation. is illustrated and specifically made it cleared below with input application and resulting values.

Figure 3 illustrates the Generation process of test case. Reflect on each function as foundation function. Apiece foundation function, a mutable designation is specified, then everyone function is verified to discovery whether is previously to be paid for

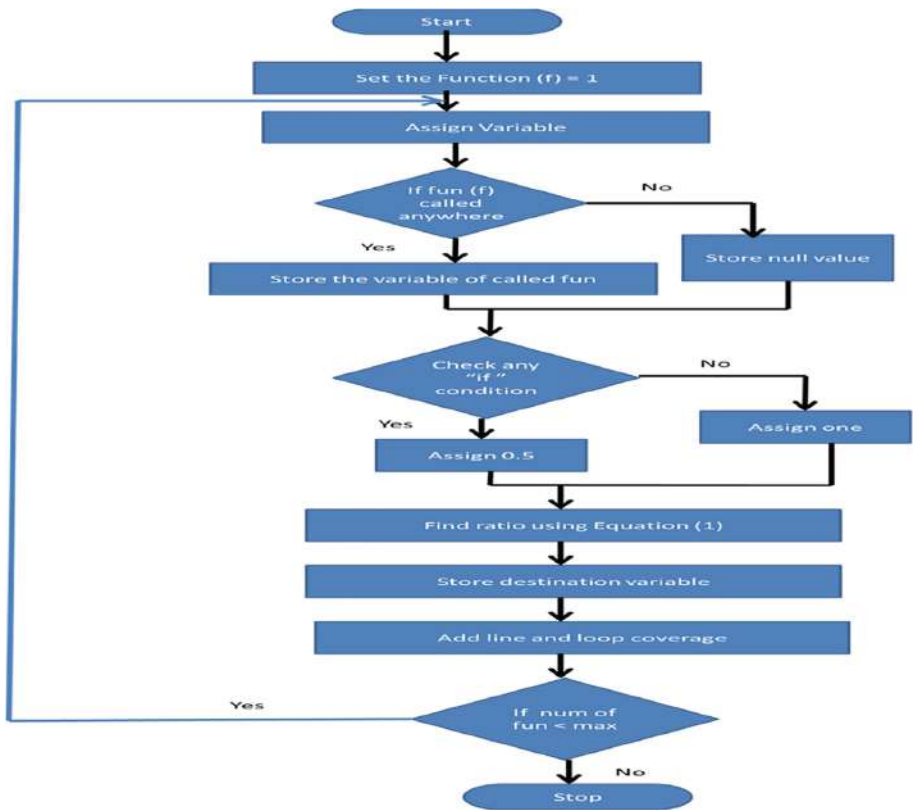


Fig. 3. Work flow of OBDM

some auxiliary task. Doubt it is previously be situated allocated, subsequent the interrelated variable name should be assigned in the test case, or else, allocate as illogical. If any function comprehends “if” state then allocates .5 values in the test case or else consign one. In lieu of the given function ratio value spirit be toiled out and at last signify the destination function. Attached together the test case to coverage metrics. Here the probability value, any functions consist “if” condition as 0.5 values otherwise one. The procedural results of the test case generation for input application is as follows when we are executing.

**3.1 Displaying Total Number of Classes in the Application Run:
I/PSOLICITATIONCONDUIT: Skc.\Univ.**

List of total classes::48

1: skc\univ.\ABak1.java 2: skc\univ.\Ater.java 3: skc\univ.ADeletAc.java4 :skc\univ.\ADp.java.....:

3.2 Finding Total Functions of Classes

Here we can see functions and corresponding functions

Add univ.\ABak1.java Deluniv.ADeletAc.java

3.3 Outcome If Value

In the source code of the application any function contains If statement then assign 0.5 else 1.0

1.0 :: add, 1.0 :: ABak1, 1.0 :: dispy, 1.0 :: balis, 1.0 :: deis, 1.0 :: wiis.....
1.0: erroad, 1.0: cah, 1.0: cath, 1.0: fo, 0.5: wdis

3.4 Finding Ratio Values

RV can be calculated for function and to finish represent destination function. Then add all the test case to the coverage metrics.

$$RV = \frac{\text{by what means much time call the other function}}{\text{Total function}} \tag{1}$$

0.07121:skc\univ.\Abak1.java ,
 0.045789::skc\univ.\Ater.java
 0.053123:: skc\univ.ADeletAc.java

0.0876 :skc\univ.\ADp.java

3.5 Discovery OBDM Significance

```
J1 -->Abak1 (- ,1.0, 0.07561) --> J1, J1 -->Adp.(- ,1.0, 0.058301) --> J5
#####
.....
J2 -->Abak1 (- ,1.0, 0.07561) --> J2, J3 --> Adp.(- ,1.0, 0.058301) --> J5
```

3.6 Displaying OBDM Values as Per Syntax

[SID FN PN IFV RV DID CN]

[J1 -->Abak1 (- ,1.0, 0.07561) --> J1], [J2 -->Abak1 (- ,1.0, 0.07561) --> J2]

.....
[J2 -->Abak1 (- ,1.0, 0.07561) --> J2], [J3 --> Adp.(- ,1.0, 0.058301) --> J5]

3.7 LC Coverage

It is as in good health documented as the proclamation exposure or section reportage. This one as well procedures quality of enigma and makes sure flow of poles apart path

$$\text{line coverage} = \frac{\text{No. of lines execr.}}{\text{total no. of lines}} \quad (2)$$

[CN FN LC BY IF PART S LC BY ELSE PARTS]

[Abk1, dep, 0, 0], [Abk1, wdl, 0, 0], [Abk1, dispy, 0, 0], [Abk1, bais, 0, 0]

3.8 LP Coverage

This inclusion measurements reports whether every one circle body is actualized multiple times, decisively once or more than once. This measurement reports whether circle body is actualized absolutely once or more than once for do-while circles. What's more, also, while-circles and for-circles perform more than once. This information isn't accounted by other inclusion measurements. For instance, ponder one application; it has two classes with four capacities here the capacity names are symbolized as a variable one. The specified process illustrated in Table 1.

Table 1. Functions specifications in class A, B

Class A	Class B
A1 If { A2 B1 } A2 { C1 }	B1 { B2 C1 } B2 If { A1 }

FINDING LOOP COVERAGE

CN FN LN BY LP STMT TOT NO. LINS IN FUNN

[ABak1, mn, 0, 8][ABak1, Aank1, 0, 51][Avank1, dispy, 0, 5][Anank1, bais, 0, 8] [Aank1, deps, 0, 6][ABank1, witdis, 0, 16][Aank1, minimt, 0, 40][Acoter, cout, 3, 30] [Aank1, man, 0, 1][Aank1, ABnk1, 0, 1][Aank1, dilay, 0, 0][Aank1, bais, 0, 0][Aank1, dedis, 0, 0] [Aank1, witis, 0, 0][Aank1, minimt, 0, 0][Aounter, cont, 0, 0.1]

3.9 Coalescing LC and LP Exposure Standards

In proposed method, the test case contains source function name, probability value, ratio value, destination function name, line coverage and loop coverage. Test case generation process with the corresponding example is given below,

Test case 1: [F1, -, 0.5, 2/5 = 0.4, F2] + line coverage + loop coverage

Test case 2: [F1, -, 0.5, 2/5 = 0.4, F1] + line coverage + loop coverage

The actual generated test cases for the input bank application

3.10 Final Test Case Generation for Stage 1

ENGENDERING TC BY MINGLING OBDM STANDARDS LC AND LP C STANDARDS

[J1, min, -, 1.0, 0.02165421481, J1, min, 0, 0][J1, min, -, 1.0, 0.01251672, J5, min, 0, 0] [J1, min, -, 1.0, 0.02341823453452, J10, min, 0, 0]

.....

[J46, man, -, 1.0, 0.0234561, J45, firf, 0, 0] **.TOTAL NUMBER OF TESTCASES: 661**

4 Conclusion and Future Work

Now this exertion the researcher took the bank application as input and applied the procedure of OBDM as stated above in the methodology. Here in the results for the software banking application with size of 48 classes and 108 functions the total numbers of generated test cases are 661, in which there may contain redundant, illegal, similar, failure test cases i.e. Interactive faults (influencing errors). In order to overcome these issues in future we will give these OBDM generated test cases to GA, AGA, PSO to generate optimal test cases i.e. reducing the interactive fault proneness in software application.

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Health Care Using Machine Learning-Aspects

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Abstract. In this IT world people are working day and night in jobs and busy life, people are using gadgets, smartphones, Due this hectic schedules people are getting so many health issues These days, vast measure of information is accessible all over the place. Hence, it is essential to break down this information so as to separate some helpful data and to build up a calculation dependent on this examination. This can be accomplished through information mining and machine learning and it is a vital piece of man-made brainpower, which is utilized to plan calculations dependent on the information patterns and authentic connections between information. Machine learning is utilized in different fields, for example, bioinformatics, interruption location, Information recovery, amusement playing, showcasing, malware discovery, picture DE convolution, etc. This paper explains how machine Learning applicable in health care issues with different application territories.

Keywords: Machine learning · Algorithm · Health care

1 Primer

ML is the logical investigation of calculations and measurable models that PC frameworks use to dynamically improve their execution on a particular errand. AI calculations assemble a scientific model of test information, known as “preparing information”, so as to settle on expectations or choices to play out the undertaking. AI is a subclass of Artificial Intelligence (AI). Artificial intelligence can be accepted of as an utilizing a PC framework to perform undertakings that regularly require human insight, for example, visual discernment, discourse acknowledgment, basic leadership, and interpretation between dialects [1].

Sorts of ML:

ML assignments are characterized into a few general classes. They can be distanced into sorts as indicated by their motivation and the fundamental classifications are the accompanying [8]:

1. Supervised Learning
2. Unsupervised Learning
3. Semi-supervised Learning

4. Reinforcement Learning
5. Supervised Learning

1.1 Supervised Learning

Directed learning with the idea of capacity harsh count, where essentially we train a calculation and toward the finish of the procedure we pick the capacity that best depicts the info information, the one that for a given X makes the best estimation of y ($X \rightarrow y$). The vast majority of the occasions we are not ready to make sense of the genuine capacity that dependably make the right expectations and other reason is that the calculations depend upon a supposition made by people. Here the human Experts goes about as the tutor where we grain the PC with preparing information containing the information/indicators and we demonstrate to it the right answers (yield) and from the information the PC ought to almost certainly ingest the examples. Directed learning calculations attempt to demonstrate connections and conditions between the objective expectation yield and the info highlights to such an extent that we can estimate the sum created values for new information dependent on those connections which it gained from the past information sets [9].

The principle sorts of regulated learning issues incorporate relapse and order issues. Rundown of Common Algorithms are

1. Nearest Neighbor
2. Naive Bayes
3. Decision Trees
4. Linear Regression
5. Support Vector Machines (SVM)
6. Neural Networks

1.2 Unsupervised Learning

The PC is prepared with unlabeled information. Here there is no educator by any means, really the PC may almost certainly encourage you knew things after it learns designs in information, these calculations an especially valuable in situations where the human master does not realize what to search for in the information. The group of AI calculations which are for the most part utilized in example recognition and engaging demonstrating. Be that as it may, there are no yield classes or sticky name here fixated on which the calculation can wound to demonstrate connections. These calculations attempt to utilize procedures on the information to dig for standards, recognize designs, and typify and bunch the information focuses which help in determining significant bits of knowledge and portray the information better to the clients. The fundamental kinds of unsupervised learning calculations incorporate Clustering calculations and Association rule learning calculations. Rundown of Common Algorithms are [10].

1. K-means clustering
2. Association Rules
3. Neural networks
4. K-medoids

1.3 Semi-supervised Learning

In the past two kinds, either there are no marks for all the perception in the dataset or names are available for every one of the perceptions. Semi-directed learning falls in the middle of these two. In numerous viable circumstances, the expense to mark is very high, since it requires talented human specialists to do that. Thus, without names in most of the perceptions yet present in few, semi-directed calculations are the best contender for the model structure. These techniques misuse the possibility that despite the fact that the gathering participations of the unlabeled information are obscure, this information conveys noteworthy information about the group parameters [1].

1.4 Reinforcement Learning

This technique goes for utilizing perceptions assembled from the connection with the earth to take activities that would expand the reward or limit the hazard. Support learning calculation (called the operator) constantly gains from nature in an iterative design. All the while, the operator gains from its encounters of the earth until it investigates the full scope of conceivable states [2].

RL is a kind of Machine Learning, and as such in like manner a piece of Artificial Intelligence. It empowers machines and programming authorities to thus choose the ideal direct inside a specific setting, in order to help its execution. Essential reward input is required for the administrator to get acquainted with its lead; this is known as the bolster banner. AI administrations empower constructing, sending, and overseeing AI and AI models utilizing any Python instruments and libraries [3].

2 Examples of Machine Learning in Healthcare

Analytic radiology: Think about the activity of an analytic radiologist. These doctors consume a proportion of time breaking down many images to perceive inconsistencies in patients and significantly more. They are frequently basic in making an analysis, and their decisions depend on what they find—for instance, distinguishing a tumor. Simulated intelligence can be reused to help an analytic radiologist. For instance, Project Inner Eye depicts itself this way [4].

Venture Inner Eye is an examination based, AI-fueled programming device for arranging radiotherapy. This is composed by Microsoft Research. Undertaking Inner Eye creates AI methods for the programmed outline of tumors just as sound life systems in 3D radiological pictures. This empowers: (1) extraction of focused radionics estimations for quantitative radiology, (2) quick radiotherapy arranging, (3) exact medical procedure arranging and route.

The product helps the radiologist via naturally following the framework of a tumor. Radiology creates an extensive number of outputs of a region (for example start to finish of a mind). The radiologist commonly experiences each sweep and follows the framework of the tumor. After this is done, a 3D composite of the tumor can be delivered. This undertaking takes hours. Utilizing ML, Project Inner Eye does this in minutes [5] (Fig. 1).

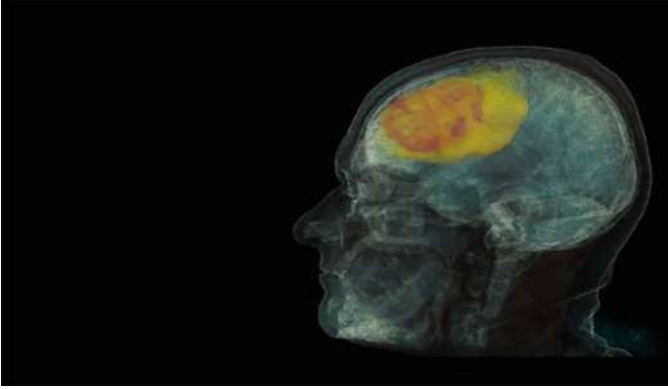


Fig. 1. Inner brain image

Eye transforms multi-dimensional radiological pictures into estimating gadgets. These activities are driven by calculations created by specialists, information researchers, designers and others. The exactness of expectation or acknowledgment relies upon two factors: the information and highlights used to prepare the model, and the calculation used to gain from that information. That is the reason individuals in the ML/AI space are so worried in the part of calculations that can be utilized today [6].

2.1 Using Directed Learning to Predict Cardiovascular Disease

Suppose we want to predict whether someone will be affected with heart attack in the future! We have data on previous patient's characteristics, including lab test results, clinical history, drug prescriptions [7].

Importantly, your data requires the truth whether or not the patient did in fact have a heart attack (Fig. 2).



Fig. 2. Heart image

2.2 Phenotyping Calculations Through AI for Diagnosing the Sicknesses

These can be actualized on EHR information on the illness tests from the medical clinics to analyze the infections. The unstructured information contains vast measure of

writings from the doctors' notes, diagnostics, and essential signs records. A Phenotyping calculation is an extraordinary procedure that filters through number of clinical information focuses through the coding frameworks with specific charging codes, radiology domino impact, and common language allotting of the huge measure of writings from the doctors. AI calculations with upheld vector machine can be connected in perceiving the rheumatoid joint pain with the mix of medicament records of the patients to improve the precision of prescient models of disease [8].

Choice trees in social insurance field: Decision trees are intensely utilized in the finding of sicknesses in human services field. In specific cases, the finding requires consistent checking of autonomic neuropathy. In the medicinal services field, sensors continually gather the huge information from the subject to recognize the examples in the lumps of informational collections and for further handling of this information through AI calculations. Recognizable proof of cardiovascular autonomic neuropathy through sensors information is the way to comprehend the essential indications of diabetes [9].

Worldwide order of illnesses: World Health Organization keeps up coding gauges formally as a major aspect of United Nation's endeavors to group number of unending infections, pandemics, dismalness insights and infections through associated arrange frameworks and fit in emergency clinic frameworks from corner to corner the globe [10].

Information mining of sensor information in medicinal data frameworks: In the therapeutic field, substantial scale huge information is created through the sensor information. There are a few wellsprings of such sensor information streaming into the medicinal data frameworks, for example, logical sensors, wearable's, physiological sensors, and human sensors. The devices and strategies for diagnosing the illnesses through the information mining of sensor information can be characterized into more extensive classes, for example, information accumulation, pre-handling of the information by isolating the clamors from the signs, information change through ETL, and information demonstrating by applying affiliation rules, learning disclosure calculations, characterization models, grouping techniques, relapse models, and last rundown of the KPIs got through the information mining by executing the outcomes.

Bayesian systems: Big information examination can help in recognizing the world-wide episodes, for example, influenza dependent on the anonymized electronic well-being narratives of those.

Advantages and Disadvantages of Machine Learning

a. Preferences of ML

- i. As ML has numerous wide applications. For example, banking and monetary area, social insurance, retail, distributing and so forth.
- ii. Google and Facebook are utilizing AI to push applicable promotions. Those commercials depend on clients past hunt conduct.
- iii. It is utilized to deal with multi-dimensional and multi-assortment information in powerful situations.
- iv. It permits time cycle decrease and productive usage of assets.

- v. If one needs to give persistent quality, expansive and complex procedure conditions. There are a few apparatuses present in light of AI.
- vi. As there are such a large number of things that go under the useful advantage of AI. Additionally, they include the extension of independent PCs, programming programs. Henceforth, it incorporates forms that can prompt the mechanization of errands.

b. Inconveniences of ML

- i. AI has the real test called Acquisition. Additionally, in view of various calculations information should be handled. What's more, it must be prepared before giving as contribution to particular calculations. In this manner, it substantially affects outcomes to be accomplished or got.
- ii. As we have one more term understanding. That it results is likewise a noteworthy test. Those requirements to decide the viability of AI calculations.
- iii. We can say employments of machine calculation are constrained. Additionally, it isn't having any surety that it is calculations will consistently work for each situation possible. As we have seen that much of the time AI comes up short. Along these lines, it have need of some thoughtful of the current issue to put on the right calculation.
- iv. Like profound learning calculation, AI additionally wants a great deal of preparing information. Luckily, there are great deals of preparing information for picture acknowledgment drives.
- v. One outstanding impediment of AI is its vulnerability to blunders. That when they do make mistakes, diagnosing and remedying them can be troublesome. As in light of the fact that it will require experiencing the fundamental complexities.
- vi. There are less conceivable outcomes to make quick forecasts with an AI framework. Likewise, remember that it learns through verifiable information. Accordingly, the greater the information and the more it needs to open to these information, the better it will perform.
- vii. Lack of changeability is another AI constraint.

c. Limitations

Despite the fact that AI has been transformative in certain fields, viable AI is troublesome in light of the fact that discovering designs is difficult and frequently insufficient preparing information are accessible; subsequently, many AI programs regularly neglect to convey the normal esteem. Explanations behind this are various: absence of (reasonable) information, absence of access to the information, information predisposition, protection issues, gravely picked assignments and calculations, wrong devices and individuals, absence of assets, and assessment issues.

In 2018, a self-driving vehicle from Uber fails to distinguish an individual by walking, who was killed after an accident. Attempts to use AI in human administrations with the IBM Watson structure fail to pass on following a long time of time and billions of theory.

AI approaches explicitly can encounter the evil impacts of different data tendencies. In social protection data, estimation bumbles can much of the time result in tendency of AI applications. An AI system arranged on your present customers simply will in all

probability be unfit to predict the necessities of new customer groups that are not addressed in the planning data. Exactly when arranged on man-made data, AI is presumably going to get a comparable secured and un-mindful inclinations successfully present in the open field.

3 Future of ML

AI is an innovator innovation that right now shapes a basic part of various thriving and set up ventures. This innovation enables PCs to get to shrouded bits of knowledge and anticipate results, prompting surprising changes to organizations. Here are five key estimates about the fate of AI. Inclination of machine learning applications. A machine learning framework prepared on your present clients just will most likely be unable to foresee the requirement of new client bunches that are not spoken to in the preparation information. At the point when prepared on man-made information, machine learning is probably going to get a similar protected and oblivious predispositions effectively present in the public arena.

3.1 Improved Unendorsed Algorithms

In AI, unsupervised calculations are utilized to make forecasts from datasets when just info information is accessible without relating yield factors.

Though in regulated learning the yield of the calculation is as of now known, its unsupervised partner is intently connected with genuine computerized reasoning the idea that a machine can figure out how to distinguish confused procedures and examples with no immediate human mediation.

At the point when calculations are disregarded to scour and present the intriguing examples with regards to a dataset, shrouded examples or groupings can be found, which could have been hard to get utilizing administered techniques.

In the coming years, we are probably going to see enhancements in unsupervised AI calculations. The movements in growing better calculations will result in more quickly and increasingly honest AI expectations.

3.2 Enhanced Personalization

AI personalization calculations are utilized to offer suggestions to clients and allure them to finish certain activities. With such calculations, you can incorporate the data in information and make fitting determinations, for example, an individual's advantages.

For instance, a calculation can surmise from an individual's glance through action on an online retail site and find that he is keen on acquiring a cutter for his greenhouse. Without that understanding, the purchaser could have left the site less making a buy. Currently, some of such suggestions are incorrect and irritating, which cripple client's encounters. Nonetheless, in the yet to come, the personalization calculations are to be required to be tweaked, prompting unquestionably progressively valuable and fruitful encounters.

3.3 Increased Taking on of Quantum Computing

Quantum AI calculations have the capability of changing the field of AI. For instance, these calculations can use the advantages of quantum calculation to improve the capacities of traditional strategies in AI. In the event that quantum PCs are incorporated into AI, it could prompt quicker handling of information, which could quicken the capacity to combine data and draw experiences and that is what's on the horizon for us. Quantum-controlled frameworks will give an a lot quicker and all the more uncompromising. Calculation to both regulated and unsupervised calculations. The expanded execution will open astonishing AI abilities, which might not have been acknowledged utilizing established PCs.

Improved subjective administrations: Subjective administrations comprise of a lot of AI SDKs, APIs, and administrations, which enable designers to incorporate wise abilities into their applications. With such administrations, designers can engage their applications to do different obligations, for example, vision acknowledgment, discourse identification, and discourse understanding. As this innovation is proceeding to advance, we are probably going to observe the improvement of profoundly keen applications that can progressively talk, hear, see, and even reason with their environment.

Consequently, designers will most likely form all the more captivating and discoverable applications that can viably decipher clients' needs founded on characteristic correspondence methods.

Ascent of robots:

As AI is winding up increasingly complex, we will see expanded use of robots. Robotization relies upon AI for achieving different purposes, including robot vision, self-administered learning, and multi-specialist learning. Before long, we anticipate that robots should turn out to be progressively astute at achieving errands. Automaton, robots in assembling places, and different kinds of robots are probably going to be utilized progressively to make our lives less demanding.

4 Conclusion

Machine learning is a standout amongst the most troublesome innovations of the 21st century. Despite the fact that this innovation can at present be viewed as beginning, its future is brilliant. The over five expectations have quite recently touched the most superficial layer of what could be conceivable with AI. In the coming years, we are probably going to see further developed applications that extend its abilities to incomprehensible dimensions.

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Pipelined Learning Automation for Energy Distribution in Smart Grid

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Abstract. The process of learning automation is an intelligent learning model which controls the flow control without any wastage. In the proposed work, a pipelined LA (PLA) model of energy distribution in the smart grid tree network is employed to enhance the efficiency of the distribution process. The PLA employs three phases of operation: (i) load request evaluation phase, (ii) learning automation phase, and (iii) energy calibration phase. First phase evaluates the load request at various levels; energy distribution to various levels is evaluated during the second phase. Finally, calibration of energy adjustment is performed during the third phase to improve the efficiency of the grid network.

The simulation results show that, the proposed technique yields high efficiency and fairness of the smart grid network. PLA simplifies the hardware architecture, reduces processing and control delay, makes flow control easy and improves the accuracy of the DSM.

Keyword: Automation · Energy distribution · Fairness index · Tree network · Smart grid

1 Introduction

Smart Grid is a technological revolution in this century, helps in reliable, sustainable, secured and efficient energy transmission by integrating energy generation at various micro grids [1, 2]. The smart grid technology provides more stable, sustainable, efficient distribution by minimizing the outage failures at various levels in the grid.

The LA is used for in diversified fields; an overview of various LA techniques was described in [3]. The LA based efficient power management in smart grid was investigated in [4]. The domestic shiftable load scheduling using LA in smart grid was given in [5]. The LA with a pipelined based approach can be used to improve the speed, efficiency, simplifies the architecture, and reduces the computational complexity of a system. The parallel LA helps to improve the speed of convergence of a system and was described in [6]. The energy distribution in grid using Thermometer approach with high efficiency and fairness was described in [7, 8].

In this work, energy distribution in a grid using a pipelined architecture based LA approach is proposed. The main objectives of this work are:

- To develop PLA model of energy distribution in smart grid

- Efficient energy distribution using PLA model
- To evaluate the performance of smart grid using PLA model.

The remaining work is organized as follows. The smart grid tree network model, LA model of energy distribution is described in Sect. 2 and Sect. 3. The PLA model of energy distribution is developed in Sect. 4. The load request evaluation in PLA is described in Sect. 5. The energy distribution during LA phase is described in Sect. 6, and energy calibration phase is given in Sect. 7. The simulation results are analyzed in Sect. 8, and final conclusions are drawn in Sect. 9.

2 Smart Grid Tree Network Model

Grid is a collation of ‘M’ micro grids. At each micro grid ‘ m_i ’, the energy $E_G^i(m_i)$ can be generated by using primary or secondary sources or both [9]. Total energy generated at grid during a timeslot ‘ t_i ’ in a day [9] can be expressed as

$$E_G^i = \sum_{i=1}^M E_G^i(m_i). \tag{1}$$

The generated energy from the grid is transmitted and distributed via substations [10]. The energy distribution in grid to users is unidirectional via lines, and can be modeled as a tree network model [11, 12] as shown in Fig. 1. In the Fig. 1, micro grids are represented by $m_i, i = 1$ to M ; ‘G’ is grid; P_p is primary substations under grid, $p = 1$ to P where P is the number of primary substations; $S_{p,s}$ is secondary substations, $s = 1$ to S , where S is the number of secondary substations under p ; $U_{p,s,u}$ indicates users under each ‘ s ’, $u = 1$ to U , where U is the number of users. The users with different load can be represented as $\{C_1, C_2, \dots, C_C\}$. The entire tree network is connected via wireless communication systems [10], and DSM handles energy distribution.

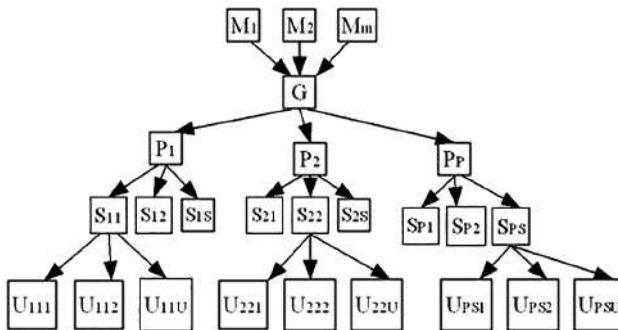


Fig. 1. Smart grid tree network (SGTN) model

3 Learning Automata Model of Energy Distribution in Smart Grid

The learning automation (LA) is an intellect learning model and determines future actions through the acquired knowledge. The energy distribution of smart grid can be modeled by using LA (Fig. 2). It has a random environment, learning automation, and reward or penalty structure. The load request from the users at substations, and at the grid is to be computed by the smart grid environment. The demand varies dynamically, and the smart grid environment passes these responses to the LA unit. After adequate interactions, LA seeks to grasp optimal actions provided by the random environment. The reward or penalties related to actions are assumed to be ‘0’ and ‘1’ respectively. In LA, $\langle Q, A, R, T, O \rangle$ is quintuple, $Q = \{q_1 \ q_2 \ \dots \ q_{|Q|}\}$ are internal states, $A = \{a_1 \ a_2 \ \dots \ a_{|A|}\}$ are actions performed, $R = \{r_1 \ r_2 \ \dots \ r_{|R|}\}$ are responses from the environment, $T : QXR \rightarrow Q$ is transition function which maps current state and respond to automation next state, $O : QXR \rightarrow A$ is output function which maps current state and response to automation next action. The environment can be abstracted by the triple $\langle A, R, P' \rangle$, $P' = \{p'_1 \ p'_2 \ \dots \ p'_{|P'|}\}$ is penalty probability set, $p'_i = \Pr[r(t) = r_{p'} | a(t) = a_i]$, $p_i \in P$ corresponds to an input action a_i .

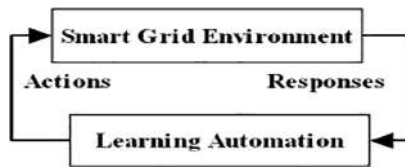


Fig. 2. Learning automata model of energy distribution in a smart grid

4 Pipelined Learning Automata Model of Energy Distribution

The pipelined LA (PLA) model of energy distribution in smart grid is shown in Fig. 3. The LA is divided into various parallel blocks to reduce the computation complexity, equipment complexity, and computational delay. This PLA model has learning automation blocks on each level. The LA block at secondary substation represented by LA(pp, ss), at each level, primary substation is LA(pp), at the grid is LA_G and is shown in Fig. 3. In Fig. 3, Ss indicates secondary substation environment, Pp is primary substation environment, and ‘G’ is a grid.

The entire process of energy flow control in smart grid using PLA is divided into three phases. They are: (i) load request evaluation phase, (ii) learning automation phase, and (iii) energy calibration phase. The operation of each phase is explained below.

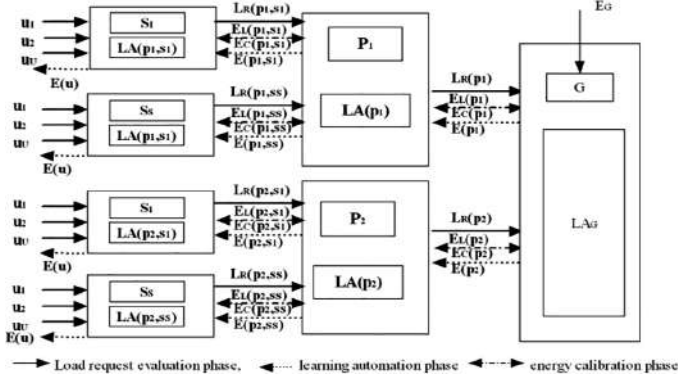


Fig. 3. Pipelined LA model of energy distribution in smart grid

5 Load Request Evaluation Phase in PLA Model

The control system evaluates the load request from the users at various levels during load request (LR) evaluation phase. Let $L_R^i(p_j, s_k, u)$ is LR from a user under secondary substation s_k , $L_R^i(p_j, s_k)$ is requested from s_k to primary substation p_j , $L_R^i(p_j)$ is request from p_j to the grid. The total LR at s_k from users can be given by:

$$L_R^i(p_j, s_k) = \sum_{n=1}^U L_R^i(p_j, s_k, u_n). \quad (2)$$

The LR at a primary substation can be given by:

$$L_R^i(p_j) = \sum_{k=1}^S L_R^i(p_j, s_k). \quad (3)$$

The LR at grid can be evaluated as:

$$L_R^i(G) = \sum_{j=1}^P L_R^i(p_j). \quad (4)$$

The demand on the grid is evaluated [21] by:

$$E_D^i = \begin{cases} E_G^i < L_R^i(G), & \text{High Demand} \\ E_G^i \geq L_R^i(G), & \text{Low Demand} \end{cases}. \quad (5)$$

6 Learning Automation Phase in PLA Model

In learning automation phase of PLA model, the LA has first performed at a higher level (grid), than at primary substation, and lastly at secondary substation. The grid has two internal states. They are: (i) high demand state, and (ii) low demand state. The internal states at various levels are represented by $Q = \{q_H, q_L\}$.

$$q_H^{t_i} = \begin{cases} 1, & \text{when } E_G^{t_i} < L_{RG}^{t_i} \\ 0, & \text{when } E_G^{t_i} \geq L_{RG}^{t_i} \end{cases} \tag{6}$$

$$q_L^{t_i} = \begin{cases} 0, & \text{when } E_G^{t_i} < L_{RG}^{t_i} \\ 1, & \text{when } E_G^{t_i} \geq L_{RG}^{t_i} \end{cases} \tag{7}$$

Penalty probability set $Pr_X^{t_i} = \{pr_{H_X}^{t_i} \ pr_{L_X}^{t_i}\}$. The probability of low demand $pr_{L_X}^{t_i} = 1$, probability of high demands $pr_{H_X}^{t_i}$ at LA_X block, $0 \leq pr_{H_X}^{t_i} < 1$ and

$$pr_{H_X}^{t_i} = \frac{E^i(X)}{L_R^i(X)} \tag{8}$$

The next state depends on $E_G^{t_i}$ and LR from primary substations and is given by

$$T^{t_i} = f(Q^{t_i}, R^{t_i}) = f(E_G^{t_i}, L_{RG}^{t_i}) = f(E_D^{t_i}) \tag{9}$$

Output functions O^{t_i} depend on demand, input responses R_X at LA block and

$$O^{t_i} = f(Q^{t_i}, R_X^{t_i}) = f(E_D^{t_i}, R_X^{t_i}) \tag{10}$$

LA Phase at Grid {LAG block}: The LA triple at grid (LA_G block) is represented by $\langle A_G^{t_i}, R_G^{t_i}, P_G^{t_i} \rangle$. The responses of the grid environment to LA_G block is given by $R_G^{t_i} = \{E_G^{t_i} L_{RG}^{t_i} L_R^{t_i}(p_1) L_R^{t_i}(p_2) \dots L_R^{t_i}(p_p)\}$. During the LA phase of the grid, the energy distributed to primary substations under grid are evaluated based on the responses. The actions from LA_G block is given by $A_G^{t_i} = \{E^{t_i}(p_1) \ E^{t_i}(p_2) \ \dots \ E^{t_i}(p_p)\}$. The actions from grid $E^{t_i}(p_j)$ represent the energy distribution to primary substations and can be evaluated as follows.

$$E^{t_i}(p_j) = \begin{cases} [Pr_G^{t_i} \cdot L_R^{t_i}(p_j)], & \text{for } j = 1 \text{ to } P - 1 \text{ when } q_H^{t_i} = 1 \\ E_G^{t_i} - \sum_{j=1}^{P-1} E^{t_i}(p_j), & \text{for } j = P \text{ when } q_H^{t_i} = 1 \\ L_R^{t_i}(p_j), & \text{when } q_L^{t_i} = 1 \end{cases} \tag{11}$$

$$\text{Penalty probability at grid, } Pr_G^{t_i} = \begin{cases} 1, & \text{for low demand} \\ \frac{E_G^{t_i}}{L_{RG}^{t_i}}, & \text{for high demand} \end{cases} \tag{12}$$

After LA phase at the grid, $LA(p_j)$ blocks start their automation process in parallel.

LA phase at primary substation {LA(p_j) block}: The LA triple at LA(p_j) block is $\langle A_{p_j}^{t_i}, R_{p_j}^{t_i}, P_{p_j}^{t_i} \rangle$. The responses from primary station ' p_j ' environment to LA(p_j) block is given by $R_{p_j}^{t_i} = \{E^{t_i}(p_j) L_R^{t_i}(p_j) L_R^{t_i}(p_j, s_1) \dots L_R^{t_i}(p_j, s_S)\}$. During the LA phase of LA (p_j) block, the energy distributed to secondary substations under p_j are evaluated based on its input responses. The actions from LA(p_j) block is given by $A_{p_j}^{t_i} = \{E^{t_i}(p_j, s_1) E^{t_i}(p_j, s_2) \dots E^{t_i}(p_j, s_S)\}$. The actions from a primary substation $E^{t_i}(p_j, s_k)$ represent the energy distribution to s_k and is given by

$$E^{t_i}(p_j, s_k) = \begin{cases} \left[\Pr_{p_j}^{t_i} L_R^{t_i}(p_j, s_k) \right], & \text{for } k = 1 \text{ to } S \& q_H^{t_i} = 1 \\ E^{t_i}(p_j) - \sum_{k=1}^{S-1} E^{t_i}(p_j, s_k), & \text{for } k = S \& q_H^{t_i} = 1 \cdot \\ L_R^{t_i}(p_j, s_k), & \text{when } q_L = 1 \end{cases} \quad (13)$$

$$\text{Penalty probability at } p_j, \Pr_{p_j}^{t_i} = \begin{cases} 1, & \text{for low demand} \\ \frac{E^{t_i}(p_j)}{L_R^{t_i}(p_j)}, & \text{for high demand} \end{cases} \quad (14)$$

Such type of distribution in (13) improves the fairness of the system. Once, the learning automation phase at the primary substation is completed, all the secondary substation LA blocks under it starts their automation process.

LA phase at secondary substation {LA(p_j, s_k) block}: The LA triple at LA(p_j, s_k) block is $\langle A_{p_j, s_k}^{t_i}, R_{p_j, s_k}^{t_i}, P_{p_j, s_k}^{t_i} \rangle$. The responses of s_k environment to LA(p_j, s_k) block are given by $R_{p_j, s_k}^{t_i} = \{E^{t_i}(p_j, s_k) L_R^{t_i}(p_j, s_k) L_R^{t_i}(p_j, s_k, u_1) \dots L_R^{t_i}(p_j, s_k, u_{1U})\}$. During the LA phase at secondary substation, the energy is distributed to category of users based on the responses. The actions or automation outputs from LA(p_j, s_k) block is given by $A_{p_j, s_k}^{t_i} = \{E^{t_i}(p_j, s_1) E^{t_i}(p_j, s_2) \dots E^{t_i}(p_j, s_S)\}$. The actions from secondary substation $E^{t_i}(p_j, s_k, C_c)$ where $c = 1$ to C represents the energy distribution to the different category users and can be derived as follows.

$$E^{t_i}(p_j, s_k, C_c) = \begin{cases} \left[\frac{\Pr_{p_j, s_k}^{t_i} \sum_{n=1}^U L_R^{t_i}(p_j, s_k, u_n \in C_c) + E_c^{t_i}}{C_c} \right] C_c, & \text{for } c = C \text{ to } 2 \\ E^{t_i}(p_j, s_k) - \sum_{c=2}^C E^{t_i}(p_j, s_k, C_c), & \text{for } c = 1 \end{cases} \quad (15)$$

The energy remained at high category is adjusted among next category user to minimize the energy wastage. The adjustment factor E_c is given by

$$E_c^{t_i} = \begin{cases} 0, & \text{for } c = C \\ \left[\Pr_{p_j, s_k}^{t_i} \sum_{n=1}^U L_R^{t_i}(p_j, s_k, u_n \in C_{c+1}) + E_{c+1}^{t_i} \right] & \\ -E^{t_i}(p_j, s_k, C_{c+1}) & \text{for } c = C - 1 \text{ to } 2 \end{cases} \quad (16)$$

Penalty probability at s_k ,

$$Pr_{p_j, s_k}^{t_i} = \begin{cases} 1, & \text{for low demand} \\ \frac{E_L^t(p_j, s_k)}{L_R^t(p_j, s_k)}, & \text{for high demand} \end{cases} \quad (17)$$

7 Energy Calibration Phase in PLA Model

In energy calibration phase, the energy left at each ‘s’ under ‘p’ is evaluated and distributed to other ‘s’ under it. Later, if still some energy is left at primary substations under grid, which will be adjusted among other primary stations, which occurs very rarely. In calibration phase, the computations are evaluated from secondary substations to the grid.

$$E_L^t(p_j, s_k) = E^t(p_j, s_k) - \sum_{c=1}^C E^t(p_j, s_k, C_c). \quad (18)$$

The total energy left at all substations connected to a primary substation is given by

$$E_L^t(p_j) = \sum_{k=1}^S E_L^t(p_j, s_k). \quad (19)$$

Adjust this energy to the users under s_k from $c = 1$ to C until $E_L^t(p_j) = 0$ and evaluate energy left after this adjustment if any denoted by $E_{LA}^t(p_j)$.

$$\text{The energy left at grid, } E_{LG}^t = \sum_{j=1}^P E_{LA}^t(p_j). \quad (20)$$

Adjust this energy to the secondary substations under grid from $j = 1$ to P until $E_{LG}^t = 0$. This minute adjustments further improve efficiency of the system.

The fairness index [11] of the system is given by

$$\text{Fairness Index} = \frac{\left(\sum_{q=1}^Q Eq \right)^2}{Q \sum_{q=1}^Q E_q^2}. \quad (21)$$

where Eq = Energy distributed to child nodes from a node, Q = number of child nodes.

8 Simulation Results

A smart grid tree network with a number of primary substations $P = 2$, secondary substations $S = 3$, each substation has 100 number of users with high demand scenario is considered for simulation using MATLAB [13]. The users of four different categories of 1KWh, 2KWh, 5KWh, and 10KWh are considered for implementation.

Load Request Evaluation Phase in PLA Model: During load request evaluation phase, the total load request at various levels is evaluated via communication and control system [8], and is given in Sect. 5. The total load request from different users at various ‘s’, load request of ‘s’ at each ‘p’, and load request from ‘p’ at the grid are shown in Fig. 4. The total load request at the grid is 2590 KWh, available energy on the grid is 2100 KWh, a high demand scenario is considered.

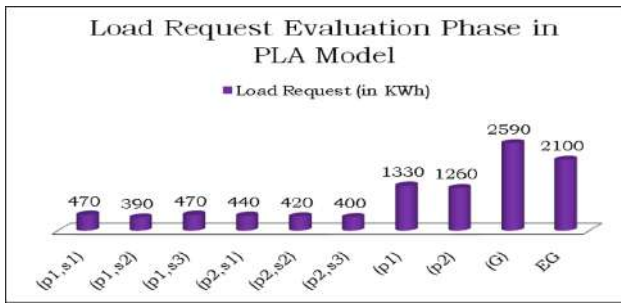


Fig. 4. Load request evaluation phase in PLA model

Learning Automation Phase in PLA Model: During learning automation phase at grid & primary substation, the energy distributed to ‘s’ and ‘p’ is evaluated and is described in Sect. 5. The penalty probability at grid or primary substations is evaluated based on the demand. Later, energy distribution during learning automation phase at grid and primary substation is evaluated and is shown in Fig. 5.

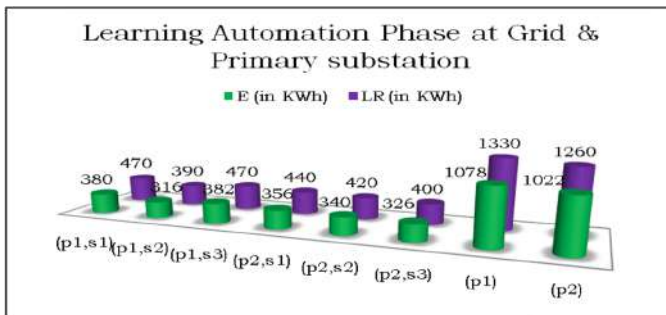


Fig. 5. Energy distribution and load request during LA phase at grid and primary substation

Similarly, the energy distributed during learning automation phase at secondary substation is shown in Fig. 6. The actual energy allotted at the secondary substation by considering without adjustment factor E_c , with an adjustment factor E_c is shown in Fig. 6. The actual energy distributed ‘E’ by considering adjustment factor ‘ E_c ’ is shown in Fig. 6. The energy wastage can be minimized by considering adjustment factor, and can be clearly observed from Fig. 6. The energy allotted to each category users will be increased with E_c which improves the energy distributed to the users.

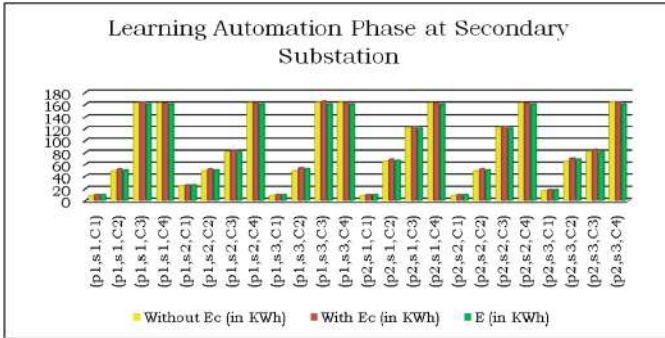


Fig. 6. Energy distributed during learning automation phase at secondary substation

For more clarity, the total energy wastage at each substation without E_c is shown in Table 1. This wastage is unified by considering adjustment factor ‘ E_c ’. The total energy distributed to the users with and without E_c is shown in Table 1. The energy distributed to the number of users is increased with adjustment factor ‘ E_c ’, and no energy is left which yields 100% system distribution efficiency.

Table 1. Energy left, allotted and distributed; number of users allotted with and without E_c

	Energy left without E_c	Energy distributed to number of users without E_c	Energy distributed to number of users with E_c	Total energy distributed with E_c / Total energy allotted
(p1,s1)	3.76	80	83	380/380
(p1,s2)	3.9	80	83	316/316
(p1,s3)	5.64	80	84	382/382
(p2,s1)	3.96	80	83	356/356
(p2,s2)	3.78	72	75	340/340
(p2,s3)	6	80	84	320/320

Energy Calibration Phase in PLA Model: With E_c , no energy is left at ‘s’ and all the energy is distributed to the users based on the demand. During the calibration phase, if any energy is left at ‘s’ then it is adjusted among other secondary substation. Similarly, if any energy is left at the ‘p’ will be adjusted among other primary substations, and total wastage is minimized to zero, which leads to 100% distribution efficiency.

Fairness Index of a smart grid: The fairness index at the grid is given in Table 2. From the Table 2, it is observed that the proposed system results high fairness index at various levels, which results fair energy distribution.

Table 2. Fairness index at grid

	Fairness index
Grid	0.999
(p ₁)	0.992
(p ₂)	0.998

9 Conclusion

The energy distribution in a grid can be modeled as a tree network. In this work, a pipelined architecture based LA approach for energy distribution is developed. It simplifies the energy distribution flow, pipelines the process, reduces the awaiting time, and speed up the process. The load request is evaluated during the evaluation phase; energy distribution to primary and secondary substations is calculated based on penalty probability. The energy distributed to a different category, users using adjustment factor such that energy remained at high category is adjusted to the lower category user which minimize the energy wastage to zero.

From the simulation results it is observed that, the proposed pipelined architecture based LA approach minimizes the energy wastage, yields high fairness and high distribution efficiency.

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Extracting Buildings from Satellite Images Using Feature Extraction Methods

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Abstract. Extracting buildings in a satellite image is of paramount important for urban planning, detecting changes of landscape and analysis. Extracting building in the satellite image is complex as its micro features are difficult to infer on the image. Feature extraction techniques readily available to extract the built up areas. In this paper, the five feature extraction techniques which include edge detection, grey scale morphological operation, haralick texture extraction, morphological classification and local statistics methods are introduced and compared. The satellite image is registered and geometric correction has performed for further processing. The image is applied with filtering algorithm to remove noises and then these five feature extraction algorithms are applied with the image. The results are more promising and the buildings are extracted from the test images.

Keywords: Satellite images · Texture extraction · Segmentation · Edge extraction

1 Introduction

Satellite technology coupled with the human life in many ways such as critical analysis, planning, decision making and preparedness. Analyzing and interpreting satellite images is paramount important as its features are very complex in nature. Extracting buildings from a satellite image is interesting which helps for planning, analysis and estimation. With the help of segmentation algorithms, these spatial features can be extracted from the image. Extracting the buildings in a satellite image helps for urban planning, 3D viewing and construction, restoration and change detection, analyzing the built-up areas, vegetation cover, bare soil, drought etc. Furthermore, we can analyze and quantify the level of coverage of each attribute in the image. In this paper, five feature extraction algorithms are applied with the satellite images and their performance is compared.

1.1 Literature Survey

Numerous works has been presented in literature for extracting buildings in a satellite images. In [1], buildings in a satellite image are detected and classified. The Histogram

Oriented Gradient (HOG) and Local Binary Pattern (LBP) method used to detect the buildings. The SVM classifier is used to classify buildings and non buildings. The output of HOG-LPB is again refined to extract by the segmentation algorithm to extract the building regions in the image. Xin et al. proposed a morphological building index (MBI) framework for detecting building in satellite images [2]. In [3], an integrated approach for extracting building in a satellite image is presented. The SVM approach is used to identify the building region in the image and threshold approach is used to extract the buildings. Tahmineh et al. presented a framework for extracting the built-up areas in the satellite image. The geometrical features of the building is classified by SVM classifier and Scale Invariant Feature Transform (SIFT) algorithm is used to extract the primitive features of the image [4]. In [5], a DSM interpolation algorithm is proposed to retain the grid features in the image. The method employed with a graph cut algorithm and neighbor contexture information which enhances the accuracy in building extraction. Shaobo et al. presented a framework for extracting buildings in a mobile LiDAR data. It make use of localization then segmentation method to extract the buildings in the image [6]. In [7], neural network CNN based architecture is proposed to extract the buildings and roads in a remotely sensed image. The post processing employs Simple Linear Iterative Clustering (SLIC) is applied with the image to detect the continuous region of the road network. Mustafa et al. presented an integrated model for detecting rectangular structure and circular type buildings with the help of SVM classifier, Hough transform and perceptual grouping. The building patches are classified by SVM classifier and the boundaries of buildings is extracted by edge detection, Hough transform and perceptual grouping methods [8].

2 Feature Extraction Methods

Extracting the build-up areas in the satellite image is complex due to the fact that it contains hidden features. Satellite image is considered for processing is taken as input. Figure 1 shows the flow diagram of extracting the buildings in the image.

The image contains speckle noise as default and it should be removed. The image is registered, calibrated and geometrically corrected. The image is applied with feature extraction techniques such as edge extraction, grey scale morphological operation, haralick texture extraction, morphological classification and local statistics extraction.

2.1 Edge Extraction

The image is applied with edge feature extraction techniques using Gradient, Sobel and Touzi algorithms. The Gradient method filters the gradient magnitude of the image in each pixels. The sobel technique makes use of sobel operator to find image gradient and then filter the gradient magnitude of each pixel. The Touzi method is mainly applied for radar images. It concerned with speckle noise and micro edge will be compromised.

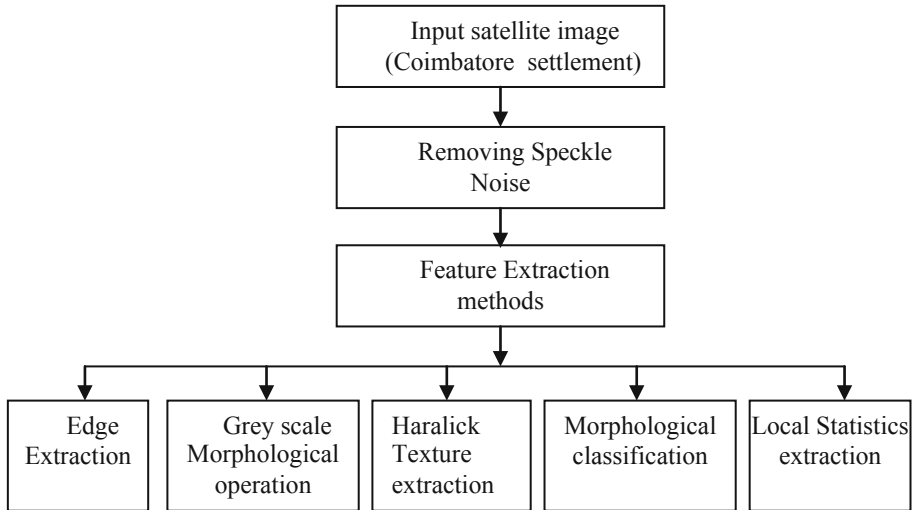


Fig. 1. Flow of extracting feature in a image

2.2 Grey Scale Morphological Operation

The grey scale morphological operation with the input image is applied. The structuring element type ball and cross is applied with the image. The operations such as dilate, erode, opening and closing are applied with the image. The input channel is set as the value one and the radius of structuring elements x and y is set as one.

2.3 Haralick Texture Extraction

Haralick texture extraction is one of the feature extraction techniques which extract the three set of haralick features such as simple, advanced and higher. In simple extraction, the features are extracted based on eight attributes. In advance techniques, there are ten attributes are used to extract the texture of the image. In higher order haralick feature extraction, there are 11 attributes are defined to extract the features of the image [9].

2.4 Morphological Classification

The morphological classification is one of the important segmentation technique used to apply for remote sensed images. The technique classified images with three different values such as flat, convex and concave. The structuring elements like ball and cross are supported by this method. The structuring element of radius is set to 5 and the level of tolerance sigma value is set to 0.5 [10].

2.5 Local Statistics Extraction

A local statistics extraction technique is based on applying four statistical parameters of each pixel with the help of neighborhood pixels. The statistical parameters that include

mean, variance and skewness and kurtosis are considered for computation. Therefore, the output image comprising four features for each band. The red, blue, green and yellow bands are representing built up structure, road, soil and building edges.

3 Experimental Results

This work considers Coimbatore settlement as a test image for experiment. The image is openly available and downloadable from Bhuvan website [11]. Figure 2(a) shows the original image of Coimbatore settlement. The image is applied with four of the feature extraction techniques. Edge extraction, Grey scale morphological operation, haralick texture extraction, morphological classification and local statistic extraction methods. For edge extraction techniques, the three edge extraction operations gradient, Sobel and Touzi are applied with the image and the result of these methods is shown in Fig. 2(b) to 2(d). The gradient operator detects the line edges in the image and the sobel operator fine tunes the edges in the image. The Touzi operation enhances the edges in the images and gives the better visualization of edges in the image. The output of the image is better to visualize to a human eye comparing with the other two operations.

The grey scale morphological operation of the image is shown in image 2(e) to 2(f). In Fig. 2(e), the Dilate operation is applied with the image and the output is shown. The erode operation is applied with the image and the output is shown in Fig. 2(f). The opening and closing operation is applied with the image and the output is shown in Fig. 2(f). The haralick texture extraction technique is applied with the image and the output is shown in Fig. 2(j) to 2(l). Figure 2(j) shows the output of simple haralick operation applied with the image. The building structure is extracted and shown in green segments. Figure 2(k) shows the advanced haralick operation. The edges of the buildings are extracted and outlined in a yellow color. The clear separation of buildings and other is shown as the output. The higher order haralick operation is applied with the image and the outcome is shown in Fig. 2(l). The buildings are identified as red color and are demarcated. The morphological classification techniques is used and applied with our image. Figure 2(m) shows that the output of the classified image using morphological classification. The ball structure is opted as a structural component and the features are extracted. Figure 2(n) is the classified image of Coimbatore settlement using morphological classification. The cross feature is selected as a structural component for classifying the image. Figure 2(o) shows the output of the local statistical extraction method. The statistical features such as mean, variance, skewness and kurtosis are computed for each pixels in the image along with its neighborhood pixels. The four band image is the outcome of this extraction method and is shown. The built-up area, vacant land, road and vegetation are clearly demarcated in the image.

3.1 Performance Analysis

This work tests the image of Coimbatore settlement and the five feature extraction algorithms are applied. The five feature extraction methods are applied with the image and the performance is analyzed. The Mean Absolute Error (MAE) and Peak Signal to Noise Ratio (PSNR) value is computed for the original image with the output image.

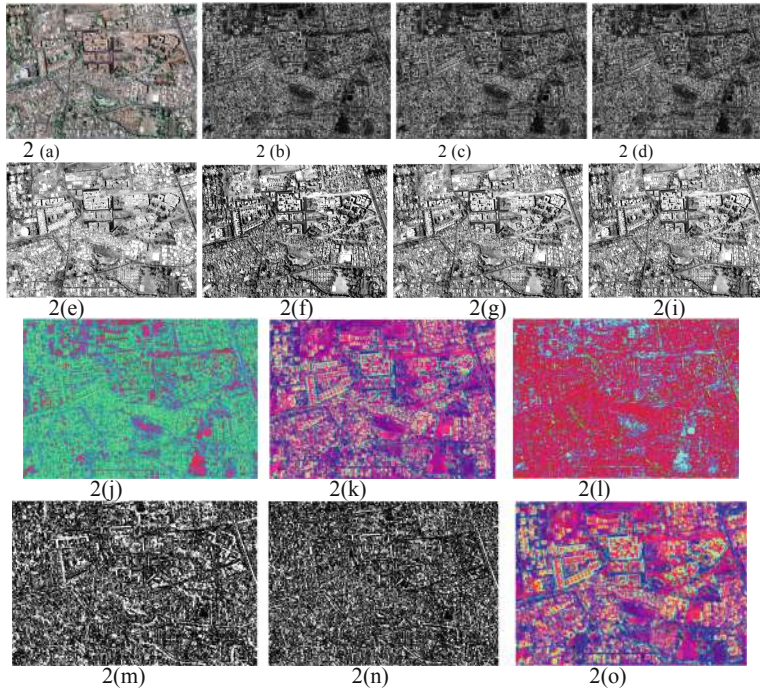


Fig. 2. (a) original image (Coimbatore settlement) 2(b)–2(d) edge detection operations 2(b) gradient 2(c) Sobel 2(d) Touzi 2(f)–2(i) grey scale morphological operations. 2(f) Dilate 2(g) Erode 2(h) opening 2(i) closing 2(j)–2(l) Haralick texture extraction. 2(j) Simple 2(k) Advanced 2(l) Higher order. 2(m)–2(n) Morphological classification – ball structure and cross structure. 2(o) local statistics extraction.

Table 1 shows the comparison of MAE and PSNR value of the given image with the resultant image. The metric MAE value concern, lower is better is good. For PSNR value comparison, more the higher, and more the better accuracy. In edge detection method, the operations with gradient, sobel and Touzi are compared. The Touzi is better performance compared with other two operations. Comparing grey scale morphological operations, we compare the operations like dilate, erode, opening and closing. The closing operation is result as better performance comparing with other four operations. Haralick texture extraction is compared with three of it operations namely simple, advanced and Higher order. The haralick advance method is the higher the performance with the other two methods. The Fig. 2(k) clearly shows the extraction of buildings in the image. Morphological classification method is applied with the image. The ball structure returns better results comparing with the other cross structure classification. Finally, the local statistics extraction performance is given.

The feature extraction techniques are compared and shown in Table 1. All these algorithms are comes under feature extraction category. According to this kind of image is concern, the advanced method of haralick texture extraction returns better results comparing with all other algorithms. The MAE value of 80.30 is lower than

Table 1. Comparison of five feature extraction methods with their MAE and PSNR values.

Feature extraction methods	Operations	MAE	PSNR
Edge detection	Gradient	95.19	7.23
	Sobel	95.27	7.22
	Touzi	94.98	7.24
Grey scale morphological operation	Dilate	81.35	8.20
	Erode	86.30	7.82
	Opening	82.21	8.14
	Closing	80.34	8.28
Haralick texture extraction	Simple	102.04	6.78
	Advanced	80.30	8.30
	Higher order	85.88	7.86
Morphological classification	Structure – ball	129.12	5.19
	Structure – cross	129.22	5.18
Local statistic extraction	Default	80.75	8.27

other methods and the PSNR value of 8.30 is higher comparing with all the other methods. The haralick texture extraction shows that 80 percent of the built-up areas in the image.

4 Conclusion

Extracting building in a satellite image is a complex process as its features are different with other images. This work concentrated on applying five feature extraction algorithms with the satellite image and successfully implemented. The satellite image of Coimbatore settlement from Tamilnadu is taken for feature extraction. The algorithms are working well again the images and its performance is compared and shown. Haralick texture extraction algorithm works well against the image and the building features are rightly extracted from the image. The algorithms are tested against the mobile LiDAR images also.

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Congestion Control Algorithms for Traffic and Resource Control in Wireless Sensor Networks

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Abstract. Applications in the wireless sensor network (WSNs) associated with increased traffic, demand performance assurance as a vital issue considering parameters like power, reliability, and delay. When the occurrence of an event takes place in the network, high traffic is determined specifically at this instance congestion appears in the network. In such WSN congestion is controlled by minimizing the load or by maximizing the resource. In WSNs when convergence hotspot traffic control is applied and at hotspot resource control. In this paper, several algorithms for controlling congestion in WSN are studied based on their key ideas, benefits, and drawbacks to increasing the capacity of network lifetime.

Keywords: Congestion detection · Congestion control ·
Wireless sensor networks · Traffic control · Resource control

1 Introduction

A Wireless sensor network (WSN) is a network consists group of wireless sensor nodes with resource constraints such as battery power and inadequate communication. The nodes are have ability of sensing an event, converting the analog information to digital and transmitting them to destination node such nodes are usually called as sink. Every sensor node wirelessly communicate with each other node within a radio communication range. Wireless sensor nodes have less battery power, and they are regularly deployed in areas where it is difficult to replace and restore their power source [1]. Therefore, the transmission of data from a source to the sink receives data through hop by hop approach. To extend the maximum network life time for WSNs the design and algorithm must be constraints.

To control congestion in WSNs it is categorized into two control methods that is traffic control and resource control. Traffic congestion control is controlled by adjusting the incoming traffic rate, weather rate is increased or decreased based on the condition of the congestion. While, to increase the network capacity the nodes which are not participated in transmitting the packets at initial in the network such nodes are considered as additional resources and it is called resource control method [2]. Traffic and resource control methods have some advantages and disadvantages depend upon certain condition.

2 Congestion Control in Wireless Sensor Networks

Congestion in WSNs is categorized with reference to where and how packets are lost in the network.

2.1 Regarding the Reason of Congestion Where the Packets Are Lost [4]

Source (transient) Hotspot: The network with large number of sensor nodes generates information through a critical point which produces persistent hotspot near the source within one or two hops. During this state, from the point of congestion it provides backpressure to the source which would give effective results.

Sink (persistent) Hotspot: The network with less number of sensor nodes that cause low data rates are capable to form transient hotspot anywhere in the sensor field but probably from source to the sink.

Intersection Hotspot Congestion: In a sensor network which has more than one flow from sink to source and this flow crisscrosses with each other thus, area around the crisscross will probably cause a hotspot. At a tree like communication the nodes at each crisscross experience forwarder congestion. Comparison with source and sink hotspot, intersection hotspot is demanding as a result it is hard to predict intersection points because of network dynamics.

2.2 Regarding the Reason of Congestion How the Packets Are Lost

Node level congestion: congestion takes place once the packet arrival rate exceeds over packet service rate within the node level and due to this there is packet loss, delay, and increase in queuing. Due to packet loss retransmission appears which leads to additional energy loss. This occurs at sink node due to more upstream traffic.

Link level congestion: It is generated due to contention, interference and bit error rate. In WSNs, the nodes communicate through wireless channels by CSMA protocols which are shared by several nodes, collision takes place at several active sensor nodes which can lead to seize the channel at the same time.

3 Control Methods

In WSNs the algorithms that handle congestions can be differentiated into congestion control, congestion avoidance and reliable data. Congestion mitigation algorithms take reactive actions. These algorithms are considered at MAC, network and transport layers. Algorithms that are considered to avoid congestion occurrence are called congestion avoidance, these algorithms usually take place at MAC and network layer. Further, reliable data transmission tries to attempt recover all or part of the lost data.

4 Congestion Control Algorithms in Traffic and Resource Control

4.1 Traffic Control

In WSNs few well know traffic control mechanisms are discussed based on the year of publication following protocols are stored considering there advantages and disadvantages.

CADA Fang et al. (2010) Congestion Avoidance Detection Alleviation (CADA) in WSN [11] is considered on energy efficient and utilizes the data features for resolving lost data problems, when an event occurs the nodes are selected by such area as data source by this outcome source traffic is reduced and controlled.

ECODA Tao and Yu et al. (2010) Enhanced Congestion, Detection and Avoidance [12] detects congestion based on three mechanism (1) weighted buffer difference dual buffer thresholds used to detect congestion (2) packet priority considered on flexible queue scheduler (3) Source transmission rate to control methods for bottleneck node of persistent congestion. In contrast ECODA for transient congestion uses hop by hop congestion method.

WFCC LiG, et al. (2012) Weighted Fairness guaranteed Congestion Control protocol (WFCC) [13] consider weight node and congestion metric based on packet ratio of inter arrival time to the packet service time. Depending on node factor like congestion metric and weight, WFCC divides period sequence into axis time and closed loop control method use to reduce congestion by achieving the income data rate of each node periodically.

DCC Brahma et al. (2012) Distributed Congestion Control algorithm [14] is considered based on tree communication in WSNs, is an efficient transmission rate at each node. Further, each node is controlled and observed its aggregate by the difference between traffic input and output rate, thus by aggregate result node decides whether to minimize or maximize the bandwidth.

CCRT Hua S, et al. (2014) Congestion Control based on Reliable Transmission (CCRT) [15] is a fusion of queue length of buffer and approximate the degree of congestion the node are divide into different state and different bandwidth allocation, which assure the reliable transmission for emerging data. CCRT establish the queue model with priorities which divides the services into dissimilar data.

DACC M. Joseph Auxilius Jud et al. (2017) Dynamic Agile Congestion Control is effective for multiple traffic WSNs [16] which overcome the drawback of First In First Out depend on sensor nodes at gateways. DACC algorithm is divided into two parts one is used at initial stage at gateway which detect congestion and another vigorously change the duty cycle that depend on packet marking field. this algorithm is examined and confirmed based on real time sensor test bed, thus result shows enhancement in stability, distinguish between preemptive and non preemptive information and also reduce congestion.

Bio-Inspired scheme Muhammad Royyan et al. (2018) [17] this algorithm is used for wide range of congestion control using C-LV (Competitive Lotka Voltera) model. C-LV model reduce congestion by maintaining fairness among nodes. further, Particles

Swarm Optimization (PSO) is used to improve C-LV by minimizing the end to end delay the quality of service is improved is verified by simulation result.

4.2 Resource Control

To overcome the drawbacks of traffic control, resource control is used as a substitute method. In the network when congestion occurs at buffers, data packets are redirected into alternative pathway. This is the main benefit that overcomes the traffic drawback and hence the data packet reaches to sink successfully. In contrast [2], few parameters such as time, avoidance of loop etc. has to be concern in order to reach performance requirement.

Flock-CC Antoniou et al. (2013) apply on the behavior of birds which is designed to built a self adaptive congestion [21], it uses swarm intelligence paradigm to detect the behavior of birds. in Flock-CC the logic is considered to guide packets as birds. Which forms a group called GOP Flock and later packet flows towards sink. When there is moment of packet in particular direction it avoids certain obstacles or congested area. which can be done by repulsion, magnetic pole is considered as sink which attracts the forces between the packets. Minimal informal information is exchanged at individual nodes is required at Flock-CC. the main advantages of Flock-CC it is global self property and behavior accomplished with minimum information are formed into individual packets.

HTAP Sergiou et al. (2013) Hierarchical Tree Alternative Path (HTAP) [22] is the algorithm determine topology control method depend on LMST (Local Minimum Spanning Tree). In LMST where every node builds its own LMST [22] independently using Prim's logarithm and keep track neighbors in the tree which are closer to the sink and away by one hop. HTAP also include a feature of indentifying the deadlocks by using "negative-ACK" packet (NACK) which forward to the sink. HTAP algorithm detect congestion occurrence by the indication of buffer occupancy and the data is triggered to the alternative path. Therefore, HTAP is examined to establish the algorithms that uses "resource control method".

UWSNS Domingo et al. (2013) is proposed for Underwater WSNS (UWSNS) is proposed for underwater monitoring application. Under Water Sensor Nodes [24] equipped with sensing, storing, processing which communicates wireless and monitor the events at underwater. UWSN determine congestion by link error rates caused by packet loss. The channel detects the shadow area and channel fading is restored by throughput from different nodes at receiver.

WCCP. MahdizadehAghdam et al. (2014) WMSN Congestion Control Protocol (WCCP) [23] algorithm is considered for multimedia content, which is formed by SCAP (Source Congestion Avoidance Protocol) at source node and intermediate node by RCCP (Receiver Congestion Control Protocol). SCAP estimate congestion in the network and adjust source node transmission rate by group of pictures (GOP) size. RCCP identify congestion by queue length of intermediate nodes at monitoring and event driven traffics. WCCP keeps I frames to refine the quality of video received at base station. furthermore, WCCP achieve quality of video received at sink and efficiency at network performance.

RAHTAP Luha AK et al. (2014) Redundancy Aware Hierarchical Tree Alternative Path (RAHTAP) algorithm [25] it is extension of Hierarchical Tree Alternative Protocol. it reduces the similar data from multiple sensor nodes. the algorithm at every node detect redundancy at each packet received. The received packet crosses check whether already same id packet received earlier or not, if it is found than it discard the packet. Thus the simulation results shows comparative study with HTAP, RHTAP gave more received packet ratio then HTAP and duplicate packets are discarded. RAHTAP consume less energy in contrast to HTAP.

DAIPaS C Sergiou et al. (2014) Dynamic Alternative Path Selection this is one of the popular algorithm for congestion control using resource control method. DAIPaS algorithm [20] uses resource control method by alternative paths that divert congestion. It tries to assure the performance under any circumstance without reducing any data load which injected to the network. This algorithm is best for core based tree which starts from sink, thus it reduces the delay from source to sink. While DAIPaS algorithm considers on “flag decision” in order to find the best path.

TRCCTP Dr. Trilok Chand et al. (2015) Traffic Redirection based Congestion Control Transport Protocol consider a Technique for Order Preference by Similarity to Ideal Solution [27] (TOPSIS) which redirect the traffic to an alternative path whenever congestion occurs. Thus, simulation result show that less energy, minimum delay with packet drops in contrast with existing protocols.

CCOR Ding W et al. (2016) this optimizing routing algorithm based on congestion control [28] algorithm is constructed based on two functions depend on node location at service rate of packets and link gradient. the route selection possibilities of each path is allocated by link flow rates. the outcome result shows energy is efficient under various traffic load and also decrease the packet loss.

CcEbHW enguangchen, et al. (2017) Congestion Control and Energy balanced scheme based on the hierarchy [29] the network model is initialized base on hierarchical topology where neighbor nodes divides explicitly into three categories at similar hierarchical, upstream and downstream nodes are congested, congestion avoidance method is used for lower hierarchy neighbor nodes to proceed the data. Therefore, congestion control method detects congestion.

5 Comparative Studies of Protocols

The main scope of this study gives the result whether all data packets, created during crisis state can be forwarded to sink without reducing the data rate of the source. Performance metrics compare according to their congestion control such as traffic rate control (Table 1), resource management (Table 2) with respect to key ideas, advantages and disadvantages. Significant and characteristic metrics used by the congestion protocol like throughput, packet delivery ratio, delay, end to end delay, energy node consumption, packet loss and network lifetime.

Table 1. traffic control protocols and characteristics

Protocol	Key point	Pros	Cons
CADA (Fang et al. 20110)	Buffer occupancy and utilization of channel is considered by aggregation of congestion level.	Efficiently energy consumption, utilize of data features for resolving information loss problems by this traffic controlled proactively, end to end delay.	Unfairness
ECODA (Tao and Yu, 2010)	Congestion is detected on mechanism like weight buffer difference, dual buffer threshold and packet priority	packet priority based flexible queue scheduler, source transmission control method for bottleneck node at persistent congestion reduced delay	Inadequacy of packet recovery in the network
WFCC (LiG, et al. 2012)	Based on the node factor congestion metric and node weight	Network is maintained overall by throughput	AIMD method is used for rate adjustment at sink node, this does not control congestion effectively. Overhead feedback at each interval
DCC Brahma et al. (2012)	Tree like communication in WSNs, is an efficient transmission rate at each node	Algorithms allocate efficient transmission	Cannot assure globally fair allocation of goodput
CCRT (HuaS, et al. 2014)	Combination of buffer queue length and approximate the degree of congestion	Fair bandwidth allocation ensures reliable transmission of emergent information	Lack of recovery mechanism undefined. it's not efficient for dynamic nodes
DACC (M. Joseph Auxilius Jude et al. 2017)	Defeat the limitation of FIFO depend on sensor motes and packet marking field	Algorithm differentiate preemptive and non preemptive data and reduce congestion	Limited resource
Bio-Inspired scheme (Muhammad Royyan et al. 2018)	Employ congestion control for large scale by Competitive Lotka Volterra and end to end delay is reduced by PSO	Improves fairness at each node and better quality of service	Inadequacy of packet recovery in the network

Table 2. Resources control protocols and characteristics

Protocol	Key point	Pros	Cons
Flock-CC (Antoniou et al. 2013)	Apply on the behavior of birds which is designed to built a self adaptive congestion, it uses swarm intelligence	Improve at different traffic loads through parameters like Energy consumption, delay and packet loss.	Cannot assure the fairness.
HTAP (Sergiouet al. 2013)	The Source based trees scheme identify deadlocks using “negative ACK”	Performance improvement due to maximum overhead.	Energy consumption is excessive
UWSNS (Domingo et al. 2013)	Determine congestion by link error rate caused by packet loss underwater in WSNs	It provides flow fairness and removes flow starvation	Cannot assure reliability
WCCP (Mahdizadeh Aghdam et al. 2014)	SCAP is utilized at source node and RCCP at intermediate nodes	Achieve the quality of video relieved at sink and efficiency at network performance	Does not provide energy efficient.
RAHTAP (Luha AK, et al. 2014)	Extension of HTAP reduces the similar data receiving from different sensors	Redundancy detection at each node which eliminates duplicate packets	Does not provide energy efficient
DAIPaS (C Sergiou et al. 2014)	Algorithm reduces delay from source to sink	Efficient network performance under different condition without reducing data load	Energy consumption with hop count and propagation delay is does not take into account.
TRCCTP (Dr. Trilok Chand et al. 2015)	TOPIS technique uses to redirect the traffic for selecting the optimal alternative paths.	Reduce packet drops with reduced delay	At critical situation reducing data rate is not applicable.
CCOR (Ding W et al. 2016)	It is constructed on two functions link gradient and node location	Provides basic route function and distribute the traffic load to decrease the average routing hops	Energy is consumed by number hop counts
CcEbH (Wenguangchen, et al. 2017)	Scheme is based on hierarchical topology where neighbor nodes divides explicitly into hierarchical,upstream and downstream nodes	Balance energy consumption using remaining energy in the nodes	Unfairness

6 Future Work

Future work can be the hybrid algorithm that combine the advantages and avoid disadvantages of traffic and resource control method. Concerning algorithms; it is interesting to study whether mobile nodes can appear to the point where alternative paths are needed. Mobile nodes can be a solution to be become very effective in congestion control problems.

7 Conclusion

In this paper the congestion control problem in WSNs are outlined based on their merits and demerits with different protocols. The main objective study of this paper is to extend the network lifetime in WSNs and reduce the end to end delay. All algorithms are aimed to control congestion and extend the network lifetime by effectively utilizing the limited available resource. However, the idea of improving congestion control mechanism is an open issue.

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EHR Model for India: To Address Challenges in Quality Healthcare

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Abstract. In this paper there is a discussion on providing a standard system for health care service providers and patients. We have carried out the detailed study of guidelines provided by ministry of health and family welfare to adopt the electronic health record system. The major aim is to eliminate the conventional health record system. The major focus in this research is to propose the inter-operable electronic health Record system (IEHR), and test the feasibility and acceptance of the EHR. Further there is a scope to promote the services in select locations such as hospitals and primary health centers. Medical centers can store patient's health information with minimal efforts. This paper is an overview of how Electronic Health Record (EHR) standards can be adopted by various organizations. EHR systems implementation scope is very well discussed. In this there is a short description of such standards.

Keywords: Electronic Health Record · Patient · EHR standards · SNOMEDCT · ICD10 · HL7 · Health care

1 Introduction

India is among high population nations. There are various conventional and non-conventional as well as advanced medical practices carried out by huge number of medical practitioners and health centers. Health care is a challenging issue in India. In our country, due to high population most of the regions even though they are near to cities are lacking the medicinal facilities. Medical data is generated in various forms by large number of medical practitioners and hospitals. Health related information itself has witnessed exponential growth. The traditional data applications are not appropriate to analyze and process this huge amount of data. Data is being generated from various sources. Data capturing, analysis, searching, sharing, storage, data visualization and security are emerging as major challenges. New techniques are emerging to counter these challenges and to use data for improved decision making. Data stored in most text databases are semi structured data in that they are neither completely unstructured nor completely structured. For example, a document may contain a few structured fields, such as Patient Name, Age, and Gender Physician Information; and so on, but also contain some largely unstructured text components, such as Medical History, Treatment, Reports and Precautions. There have been a great deal of studies on the modeling and implementation of semi structured data in recent database research. Moreover,

information retrieval techniques, such as text indexing methods, have been developed to handle unstructured documents.

It is a need of time to implement and use “EHR” as per the guidelines framed by Ministry of Health and Family Welfare [20]. It is a major task to provide a suitable architecture for Electronic Health Record System along with an acceptance model for EHR system. Towards the betterment of medicinal services in India; additional efforts are there to provide a solution with a sub system to use IOT for Medicinal facilities [8].

2 Scope of Work

In this section we have focused on major areas such as early use of computer system to maintain treatment channel using Medical Transcription, Health Service Infrastructure in India. Organizational challenges in India, Efforts taken by Government, Some issues of EHR, Importance of standards, Few Success stories about adoption of EHR System and finally we have discussed about the tasks that need to be carried out for successful adoption of EHR in India.

2.1 Early days and Medical Transcription

Medical records are stored since ancient era as few carvings are found that is a evidence of medical record keeping (Fig. 1)



Fig. 1. Carving related medical treatment

Earlier the patient record was maintained in paper format and preserved in huge cabinet and used whenever required for reference or verification. It is necessary to preserve the treatment plan to be used for future use and also to keep track of patient health. In most of the super specialty hospitals there is a practice of creating clinical notes based on case papers or treatment plans given by Doctors. There is also a practice that doctors are sending their dictation in sound files and that is converted into computer file by medical transcription team.

2.2 India's Health care Infrastructure

We already know that Indian Health care system has also various sectors. Rural, Semi-Urban, Urban are these various sectors. Major of Indian population is concentrated in rural area and following is the structure of health care in India (Fig. 2).

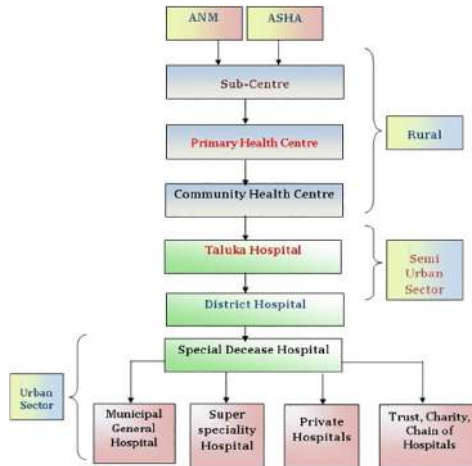


Fig. 2. Indian health care system

Apart from above mentioned Health Care System in each sector there are general practitioners who are providing their services through personal dispensary, through government polyclinic or private polyclinics. Health records are generated at every health service encounter. Most of the records are either lost or just lying in physical form with medical service unit or with the patient. Some records are destroyed after certain period.

OPD record is normally handed over to patients, even if it is maintained with hospital it is destroyed after 5 Years. IPD records are destroyed after every 5 Years and some units retain it for 10 Years. As per the Deesha Act Expired patient data and data of Medico legal cases are retained for Life Time. This method executed only in properly set hospitals.

General practitioners are normally not keeping the records. There are some successful cases of properly framed treatment. If record is not maintained; most of the data cannot be made available for extra ordinary research. Patient referral is critical. To make it varied purpose EHR is necessary in India. It can be made available for various users for various purposes. It can also be made available for all direct and indirect stakeholders.

2.3 Organizational challenges in India [18]

Ministry of Heath government of India has already proposed guidelines towards implementation of EHR system but till date there is no any concrete solution in this

regard. In the recent article from Hindustan Times it is mentioned that in India there are 1 Million doctors of Modern medicine to treat 1.3 Billion of its Population. There are hardly 1.5 Lacks of Doctors in Public service to serve patients. There is absolute non existence of patient centric care in our Country. All private hospitals and medical facility centers have their own computer system but it is limited to registration of patients and collection of fees towards the treatment. The interoperability is not provided in any of these systems. While having a discussion on “Future of Healthcare and Medical Records” that digital medical records make it possible to improve quality of patient care in numerous ways. The similar system is being adopted by various central organizations for their employees and it is a success in the area of healthcare system. Following is the CHSS adopted by BARC.

CHSS Stands for Contributory Health Service scheme where Employees contribute depending upon their level of cadre to this scheme. They are provided with a CHSS membership Number. They can avail this membership to provide healthcare for themselves as well as their family members. They can avail medical facility at dispensary, primary Health centers as well as Hospitals of BARC. The all hospitals and dispensaries are linked with a dedicated network and all medical transactions are recorded in central server. Doctors at BARC can refer the patient if extraordinary healthcare is essential. All Expenses are taken care by EHSS scheme. There is a central EHSS administration office to manage all necessary procedures in this regard.

There is still need to make the storage system compatible with Health Level 7 (HL7) which is a internationally recognized health record system. HL7 is discussed further in this paper. While implementing the EHR System we look forward to focus on various ways Technology can help to transform health care [3].

1. Better diagnosis and treatment: Doctors could potentially rely on Computer system to keep track of patient history, stay up-to-date on medical research and analysis of treatment options.
2. Helping doctors communicate with patients: patients who don't understand medicinal terms speak or have hesitation to communicate will help doctors to create a dialogue.
3. Linking doctors with other doctors: Doctors may need to refer patients to specialist in the treatment of diseases that can be made easier by creating interoperability of the medical information.
4. Connecting doctors and patients: It is always beneficial to create dialogue among patients and doctors. Effective communication system is suggested by the author
5. Helping patients stay healthy: Trends in technology may add value to help patients to stay healthy by promoting awareness systems.

After a detailed literature review we have identified various areas in “Information Technology to provide quality health care [4] (i) Mobile Health Care (ii) Cloud computing and Virtualization. (iii) Big Data Analytics. (iv) Medicinal Standards (v) Meaningful use of Technology. Healthcare IT will have lot of opportunities and various skill sets such as Privacy, Data Security, Infrastructure, Legal Practices. Analytics will have huge scope for IT professionals to provide technologies for Healthcare. Maintaining Quality of data towards acceptance of the technology is also vital factor. Major problems [8] with respect to scalability, heterogeneity, verification

and authentication should also be considered while deciding the EHR System. Big data analytics in healthcare is evolving into a promising field for providing insight from very large data sets and improving outcomes while reducing costs. Its potential is great; however there remain challenges to overcome.

Health data volume is expected to grow dramatically in the years ahead. In addition, healthcare reimbursement models are changing; meaningful use and pay for performance are emerging as critical new factors in today's healthcare environment. Although profit is not and should not be a primary motivator, it is vitally important for healthcare organizations to acquire the available tools, infrastructure, and techniques to leverage big data effectively. Electronic Health record is hand in hand [9] with characteristics of big data such as volume, variety, velocity and, with respect specifically to healthcare, veracity. By digitizing, combining and effectively using big data, healthcare organizations ranging from single-physician offices and multi-provider groups to large hospital networks and care organizations stand to realize significant benefits. Scientists have discussed about the minimum elements of the EHR and presented their work related to meet the requirements of EHR [11]. The systems standards like open EHR and HL7 (Health Level 7) are analysed along with sample patient data is specified in their research project. EHR has futuristic approach towards better diagnostics, treatment decisions and assure the healthcare. It also provides quality in other services in healthcare.

3 Literature Study: Existing Systems and Related Efforts

It is necessary to study the work done so far by various professionals since historical period till date. This section speaks about efforts taken by various countries and countrymen in the field of EHR.

3.1 My Health Web Portal

Government of India has launched a website for Indian citizens who can put their medical records. This can be considered for initial adoption of interoperability of health records. This system allows patients to provide access of their medical records to other doctors. This system does not use any specific standards as it is meant for general users who are unaware of the medical standard terms. Following is the initial log in page (Fig. 3) of the MyHealthRecord.

After logging inn to the system one can input the personal information, this gathers basic data of the patient.

After entering the basic information there is a facility to upload reports and prescriptions given to patient and patient can give details of the doctors to whom patient want to ask queries or second opinion.

Patient can provide details of the doctor to whom it want to share the medical records, Doctor receives the OTP to access the record and can give his responses to the patient. Once the doctor send response to patient's query, patient is also intimated about the same.



Fig. 3. Web portal MyHealthRecord from Govt of India

Limitations of the system:

- The facility is suitable for single user and not the multiple users.
- The system discussed here is not using any systematic medical record standards.
- The system cannot be considered for interoperability.

Some countries do have a success record in implementing EHR for the citizens, from these success stories an acceptable model can be identified. Next section discuss about few success stories.

3.2 Discussion on some Existing Health Record Systems

3.2.1 National EHR System in Singapore [10]

Singapore is the prime nation to implement national EHR System. In the early phase following factors are considered

1. Manage data from multiple resources: some data may be structured or some data may be unstructured. One organization may have well populated data whereas other may have partially organized manner
2. Engaging Clinicians: By conducting screen mock ups the team involved in NEHR Singapore was able to identify need of real time that help to identify references
3. Address Functional Technical and operational Implications: Apart from involving clinicians and end users in the requirement gathering process NEHR tried to identify Functional operational and technical terms to shape the final solution for design decision.

Importance of governance:

In The governance major areas include Patient enrolment, Privacy Policy, and data sensitivity consideration and meaningful use of data. The goal of One person One record was recommended to accelerate sectoral transformation through ICT enabled personalized health care delivery system to achieve high quality clinical care, service, cost effective clinical research. The Outcome of the same is well integrated quality health care, cost effective solution and greater ability to manage Health.

What information is in NEHR?

The NEHR includes information such as: Admissions and visit history, Hospital inpatient discharge summaries, Laboratory results, Radiology results, Medication history, History of past operations, Allergies and adverse drug reactions, Immunizations.

To summarize we can say that National Electronic Health Record (NEHR) is a patient data exchange system that enables clinicians and healthcare professionals to view patient health record across the national healthcare network, to support them in clinical decisions while treating patients.

3.2.2 Norway [10]

The Norwegian Directorate of Health did a strategic study on EHR strategies in the Norwegian Health Sector 2005. The study pinpointed the need of “a better decision base for further development of EHR systems”. More documentation on the diffusion of existing EHR systems and also their usage and potential benefits in comparison to paper based systems was requested. Diffusion of EHR systems among General Practitioners The first EHR systems for Norwegian GPs were in use as early as in the late seventies. This was the PROMED-system.

Another system was installed in Balsfjord in 1980. The development of the Balsfjord system was financed by research grants and government funding. The system did only have a limited number of users in Northern Norway. The GPs outside the Balsfjord-project did not get any subsidies or incentives from the government when the new EHR systems were introduced. They had to buy the systems themselves, but found the new systems so useful that they were worth the investment. Later EHR systems in general practice have all been developed without any subsidies or incentives. The first systems were based on use of the operating system MS-DOS. The market leader during the first decade was Infodoc. When new systems that used MS-Windows were introduced, many of the users did not only change version of their system, but also vendor.

Diffusion of EHR systems in Norwegian hospitals

The diffusion of EHR systems in hospitals has been much slower than in primary care. As per the experts in the field of ICT and Medical both, to establish EPRs in hospitals, especially the larger ones, has been notoriously difficult. The increase in organizational, institutional, political and technological complexity was seriously underestimated during the first years. Before the introduction of EHR systems in hospitals, patient administrative systems had been available in hospitals for a decade.

3.2.3 Sweden's NPO

Sweden has National IT Strategy for e-Health. They have system called NPO that includes major areas with respect to data interoperability in healthcare. It facilitates the module to create a common technical infrastructure. This help to communicate with patients. NPO also help to create interoperable IT systems for exchanging/maintaining the nationwide EHR framework. The system also assures easy and instant access when and wherever required.

Clinical Process Model for NPO (Sweden) [10]

The major part of treatment need to be maintained in digital form. The conventional pattern for treatment is (1) Investigate then (2) Diagnosis and (3) Decide the treatment.

Based on this conventional pattern Structured Architecture for Medical Business Activities (SAMBA) was carried out for modeling business processes in Sweden. Sweden's system describes the process of patient care in a three-layer process model. In this three layer model processes interact with different refinement objects. They include:

1. Identification of health issue.
2. Procedure to be applied and also procedure that needs to be controlled.
3. Sharing of health related information using some communication.

Based on these core processes, the project describes how health information can be stored and secured for future use in Sweden.

4 Future Scope

4.1 Ethical Issues in EHR

Health care institutions, insurance companies and others will require access to the data if EHRs are to function as designed. The key to preserving confidentiality [6] is to allow only authorized individuals to have access to information. This begins with authorizing users. Hence assigning user privileges is a major aspect of medical record security. EHR system may be also beneficial for primary Health Centres. Patient's basic information about diagnosis, hospital Management and disease analysis can also made available. Cloud based EHR System [14] can be adopted for supporting the privacy protection.

Sharing of healthcare [20] data is one essential step to make healthcare system smarter and improve the quality of healthcare service. The same can be protected and with assurance of ownership of the data from different category. Data Lake [22] will be a solution for the same. It may be used as a development platform for Electronic Health Record (EHR). Limitations of data lake need to be identified and test need to be focused its ability for implementation of EHR.

4.2 Recommended EHR Standards

The generated data can be further classified into various categories such as 1. Disease. 2. Age Group. 3. Locality. 4. Treatment category or any other category after discussion with medical practitioners and analytics team.

Major focus is to adopt the standard and convert the data in a universally accepted EHR Standard. These standards will help to specify the health record in systematic form and that can be easily shared in prescribed format. These standards are namely: SNOMED CT, LOINC, DICOM, HL7 and openEHR etc. Here is a brief description for the same.

SNOMED CT: Stands for Systematic Nomenclature of Medicine Clinical Terms [10].

ICD: International Classification of diseases [10].

LOINC: Logical Observation Identifiers Names and Codes is a database and universal standard for identifying medical laboratory observations. First developed in 1994, it was created and is maintained by the Regenstrief Institute, a US non profit medical research organization.

DICOM: Digital Imaging and Communications in Medicine is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol.

HL7: Health Level 7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers.

openEHR: This is a virtual community working on means of *turning health data from the physical form into electronic form* and ensuring *universal interoperability* among all forms of electronic data. The primary focus of its endeavour is on *electronic health records (EHR)* and related systems.

4.3 Need for Standards

India is witnessing phenomenon/growth in health care segment, huge human data is generated, but it is in paper form. Data should be used, generated and stored based on industry standard [31].

Standard is a framework of specifications that has been approved by registered organization or accepted and widely used throughout an industry.

Interoperability refers exchanging standard based data within different parties or entities. Healthcare Information Management System Society (HIMSS) says interoperability means ability of Health information system to work together with and across organization boundaries.

Concepts for interoperability are

- (1) Syntax: structured format on how data should be exchanged
- (2) Services: ensures that system understand data i.e. being exchanged usually by use of appropriated data.

In medical sciences classification denotes groups of similar objects.

For e.g. reports: Blood, Urine, MRI, USG etc. and Ontology denotes relationship (hierarchy) i.e. random fasting, PP etc. Trends of grouping are moving from classification to ontology.

Different vendors use different standards; so it becomes complicated when more and more data is gathered.

In medical terminology same disease can be written in many ways. For e.g. common cold can be called as acute coryza or doctor may only write CC or ACT.COR or any other locally identified name which can be coded in following ways as

<diagnosis> common cold </diagnosis>

<diagnosis> acute coryza </diagnosis>

If someone search for string common cold then patient data with acute coryza may be ignored.

Technology standard will help to identify whole record as similar category record. Users must be provided with pick list or drop down menu that will help to insert a health related information in the form of standard.

Interoperability will facilitate improved data exchange for patient safety in clinical decision support and analysis. Further model will be transformed into cloud based system with user interface customised to Mobile as well as web app. The patient's data will be made accessible against patient's consent. The research test bed can be created from easy to use system platforms.

5 Proposed Model

It is observed that most of the general practitioners are not maintaining the Patient's information and they are also using locally identified names for the diseases. Patient's health information record will play vital role in deciding the treatment plan. Patients or citizens demographic as well as treatment history need to be maintained in electronic form and also should be made available to authorized persons (patient themselves and attending doctors). Major aim is to have practice of recording information at root level.

In our proposed model the first phase comprises of data collection module. This module consists of a EHR system either a cloud based mobile app or a web portal. A state of an art user interface will be made available. All stakeholders can enter the data in the specific format suggested by National Electronic Health Authority (NeHA). In the system there is a facility to there is a facility that will first register all the stakeholders who will be using the system and who are authentic users of the system. The users will be assigned with access rights that will assure the privacy and security. Whole patient information will be transferred to cloud in secured form.

5.1 The Primary Stake Holders Identified Are

1. Physician or attending Doctor. 2. Patient or Patient representative. 3. Hospital Staff. (Nurse/Medical Recorders/Billing section staff etc.) 4. Pharmacist. 5. Pathologists. 6. Insurance service provider (or TPA).

All above stakeholders will be considered as authentic players of the system and they should be provided a role based access.

The generalized format has Patient's details, Patient's Health parameters, current diagnosis and medication. Patient details can be entered either by patient itself or any authorized person appointed to enter the information. All necessary efforts will be taken to assure the confidentiality of the patient's record as well as ownership. Security and accessibility will be assured from standard protocols.

In the first level of data collection there is no any Electronic Health Record standard is considered. To motivate the key players in the medical service for using the digital system it is necessary. This will help to create a dialogue with the major stakeholders about adoption of computer system. All users will be allowed to enter the information about patient's health or information relevant to their role in the system. Locally Identified names for the diseases are allowed to be used and recorded.

5.2 Major Outcomes of EHR System

Doctors can make better clinical decisions with ready access to full medical histories for their patients including new patients, returning patients, or patients who see several different providers. The structure to implement the same need to be provided that will claim the effective health care with the help of Health records in Electronic form. There is a wide scope for research in Health Informatics and Data science to address the issues in need to adopt the means for EBM [19] and reduce the cost of healthcare. One can also adopt Business intelligence and analytics in Healthcare. Addition to this security and privacy issues should not be ignored over growing demand in healthcare data.

The Human Machine interaction will play a major role in menu-driven, user-friendly and transparent. Real-time big data analytics [5] is a key requirement in healthcare. The lag between data collection and processing has to be addressed. The important managerial issues of ownership, governance and standards have to be considered. And woven through these issues are those of continuous data acquisition and data cleansing.

There is definitely a need of interoperability to address various activities such as insurance, Pharmacy, Pathology, post medical healthcare using some strong architecture. The data transfer using HL7 parser is highly adopted by most of the leaders in healthcare worldwide towards interoperability.

It is also recommended to handle the ethical issues in EHR. Ethical issues such as ownership, access rights, security and privacy can be handled effectively with the help of recent trends in computing.

6 Conclusions

In this paper we have identified initiations that can be taken to provide model to record health data with minimum efforts. The cost benefit system is intended and will be the major expected outcome. Government of India has taken initiative towards EHR by providing the National Health Portal and various web services to upload and store patient information. Following are few areas there is a scope for improvement and that will help to identify objectives of this research.

1. There is a need to test the existing system with respect to HL7 compliance and other standards specified by ministry of health and family welfare.
2. A health information system that has a patient centric approach needs to be developed.
3. It is also necessary to build communication Portals, Connecting to various platforms and Help aid for the patients.
4. There is a wide scope to adopt Business intelligence and analytics in Healthcare [15]. There is need to apply intelligence along with the Analytics to assure quality in Health care.
5. Security and privacy issues should not be ignored over growing demand in healthcare data. The challenges of EHR are Privacy, Security, user friendliness, portability and interoperability need to be addressed.

6. The important managerial issues of ownership, governance and standards have to be considered.
7. New EHR Framework in more suitable and acceptable form need to be provided. Interoperability of EHR as well as Acceptance model pertaining to Cost benefit results need to be introduced and trust building is required.
8. There is a need of proper decision support system or an expert system that will minimize the human efforts to maintain health care data.
9. There is definitely a need of interoperability to address various activities such as insurance, Pharmacy, Pathology, post medical healthcare using effective architecture.

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A Hybrid Mining Approach: Gender Prediction from Handwriting

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Abstract. Although after many current technological achievements, there is still not any methodology which will allow a computer to perfectly copy the content of any complex handwritten document.

The handwriting recognition problem presents many difficulties as

1. The cursive nature of handwriting
2. Use of different pen types or the presence of paper with noisy background etc.
3. The individuality of handwriting has been studied and determined with specific precision.

There are two variants of the handwriting recognition problem

- a. Online
- b. Offline

Online recognition problem deals with handwriting written with some electronic device that means it deals with real-world problems. whereas offline handwriting problem deals with handwriting which has been written previously and is kept stored. In the field of Human and Computer Interaction, if the gender of a user can automatically be predicted, just by using his or her signature, the system could offer him/her a more personalized interaction and care.

In spite of the fact that the facts confirm that females composing is alluring and neater than male one, this isn't valid for every one of the cases. There are numerous precedents where we can discover ladylike appearance in manly penmanship. we intend to investigate the connections between the penmanship of various sexual orientations. To foresee the sexual orientation of people from examined pictures of their penmanship. This is finished by removing the arrangement of highlights from composing tests and preparing classifier to learn and separate between them. Highlights which is utilized for arrangement is tortuosity, shape, heading, chain code, and edge bearing. In this article, we mean to break down the connections between the penmanship of various sexual

orientations. In this examination utilized, half breed classifiers are utilized and dissected their resultant. Furthermore, the resultant demonstrates the half and half classifiers give better outcomes.

Keywords: Data mining · Feature extraction · Data cleaning · Hybrid classification methods

1 Introduction

The reason for sexual orientation forecast from content is to anticipate the sex of people from the examined pictures of their contents. The procedure which is utilized in this task analyzes the content as per some geometrical, basic and textural highlight of the content. The sexual orientation forecast is finished by extricating the highlights from composing tests and preparing classifier to learn and separate between them.

In this venture there are 3 modules utilized for foreseeing the sexual orientation from penmanship:

- Highlight Extraction
- Information Cleaning
- Grouping

Highlight Extraction: [1] Images are first changed over into twofold configuration utilizing Otsu thresholding calculation. On account of sex distinguishing proof of author, a likelihood dispersion work (PDF) is created from the penmanship pictures to recognize essayist's uniqueness. **Bearing Feature:** This component can gauge the digressive heading of focal pivot of content. Here it utilizes a Probability thickness capacity of 10 measurements. **Ebb and flow Feature:** This quality is typically acknowledged in measurable science examination which thinks about the ebb and flows as separating highlight. It utilizes a Probability thickness capacity of 100 measurements which speak to the estimations of the arch at the blueprint pixels. **Tortuosity Feature:** This element makes it conceivable to separate between the two kinds of journalists, one whose penmanship is mind-boggling and composes gradually and another whose penmanship is great and composes quick. For every pixel in the frontal area, we search for the longest straight line conceivable incorporated into the closer view. **Chain Code Feature:** We can create chain code just by checking the blueprint of the given penmanship and after that by appointing a number to every pixel as indicated by its area as for its last pixel. For executing this procedure, we will consider 8 pixels around a given pixel and think about its area as for these pixels. **Edge Direction Feature:** Edge-based directional features surrender a summed setup of orientation and this can in like manner be associated at a couple of sizes by modifying a window centered at each outliner pixel and counting the occasions of each heading. This component has been handled from size 1 to gauge 10.

2 Related Work

In 2012, AI Maadeed et al. [13] has proposed QUWI: An Arabic and English handwriting dataset for offline writer identification in the dataset of Arabic and English handwriting which evaluate the offline writing identification system. It shows handwriting is used for identification of the gender and handedness of specific writer and as well as his or her age and nationality. On the same year, Hassaïne et al. [14] has proposed a set of geometrical features for writer identification. Author has described different geometrical feature like directions, curvatures and tortuosities can characterize writers. In a 2015 survey, M. Patel and S. Thakkar [Patel 2015] showed out that a 100% success rate is still unreachable in the problem of connected handwriting identification. Holistic approaches reduce the obligation to do complicated segmentation operations on handwriting. In 2016, Blucher and his partners introduced a system that utilizes a modification of a Long Short-Term Memory (LSTM) neural network that implements the processing and identification of whole paragraphs. However, these systems restrict the vocabulary that may arise in the text. For these reasons, only certain identification results are received in cases of restricted vocabularies. To break this chain of lessened vocabularies, some authors are successfully using recurring networks such as Connectionist Temporal Classification (CTC). In 2017, Morera et al. [17] has proposed a research article on gender and handedness prediction from offline handwriting using convolutional neural networks. Author has presented an experimental study based on a neural network to several automatic demographic classifications based on handwriting. [7] Sah et al., In the computation of normal act, weighted average is technique is used. Weight values are calculated according to the distances between the given data and each selected cluster. [4] Sah et al., Data mining offers various algorithms for the purpose of mining. The bucket of data mining technique is association rule mining, clustering, classification and regression. Padhy et al. [11] discussed the cost effective and fault-resilient reusability prediction model by using adaptive genetic algorithm based neural network for web-of-service applications and proposed the algorithms and models. Authors' primary focus was reusability prediction by taking 100 Web service projects.

3 Proposed Structure for Data Mining Modeling

Today, special workplaces encourage accommodating affiliations information utilizing institutionalized investment funds data framework; as the structure contains a goliath degree of information, used to expel tied down data for making the sharp helpful end. The standard focal point of this examination is to make shrewdly. To build up this structure, for the demand of helpful applications client download in a minute and there total rating, for example, we have taken open dataset from open space The information mining demand approaches viz. Naïve Bayes, Support Vector machine, AdaBoost and Random Forest are utilized [6, 8] (Fig. 1).

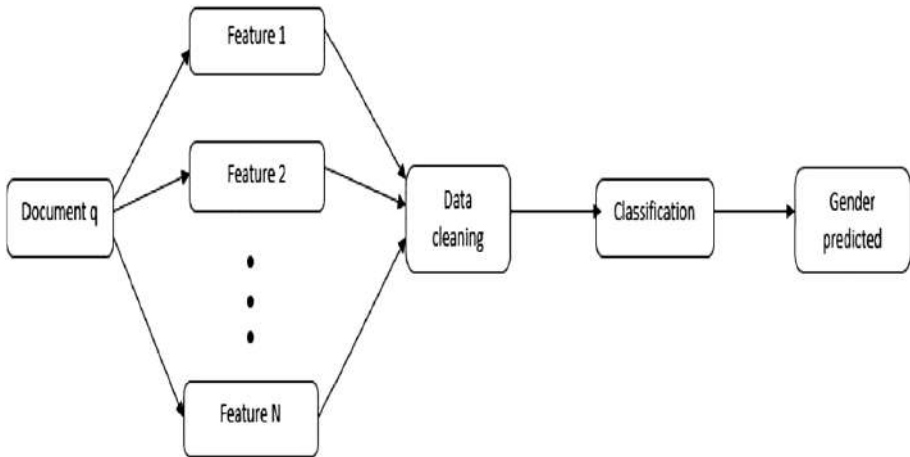


Fig. 1. Structure for data mining modeling

The proposed framework displays the examination to anticipate sexual orientation of people from the checked duplicate of their penmanship styles [1]. The proposed framework depends on separating the arrangement of highlights from composing tests of male and female journalists and preparing classifiers to figure out how to separate between the two. Pictures are separated utilizing Otsu thresholding calculation. The accompanying highlights have been considered. Composing properties like inclination, ebb, and flow, surface and risk are assessed by registering neighborhood and worldwide highlights. In the straightforward word, Hybrid Classification (making a group of naive Bayes, SVM, Adaboost, and Random Forest) to construct a choice model wellness of anticipating one gathering falls into the other. Bolster vector machine orders the pictures on the test dataset. Hybrid Classifiers are utilized to register hyperplane with a most extreme edge. The calculation for the yield of a given SVM. In the straightforward word, an SVM arrangement endeavors to assemble a choice model fit for anticipating one classification falls into the other. Bolster vector machine orders the pictures on the test dataset [2, 3]. SVM is utilized to figure hyperplane with the greatest edge. The calculation for the yield of a given SVM. In the basic word, an SVM arrangement endeavors to fabricate a choice model fit for anticipating one classification falls into the other. Hybrid Classify the pictures on the test dataset. SVM is utilized to register hyperplane with a most extreme edge. The proposed framework depends on removing the arrangement of highlights from composing tests of male and female scholars and preparing classifiers to figure out how to separate between the two. Pictures are separated utilizing Otsu thresholding calculation. The accompanying highlights have been considered. Composing traits like inclination, bend, surface, and obligation are assessed by processing neighborhood and worldwide highlights.

4 Methodology

There are three main methodologies are used for predicting the gender from handwriting.

4.1 Feature Extraction

Pictures are first converted into binary format using Otsu thresholding algorithm. In the case of gender identification of the writer, a probability distribution function (PDF) is generated from the script pictures to identify the writer’s individuality. The following features have been contemplated in this study

4.1.1 Direction Include (f1)

This component is utilized in essayist acknowledgment. This element can quantify the digressive course of the focal hub of content. Here it utilizes a Probability thickness capacity of 10 measurements. Ventures for ascertaining the bearing component (Fig. 2):

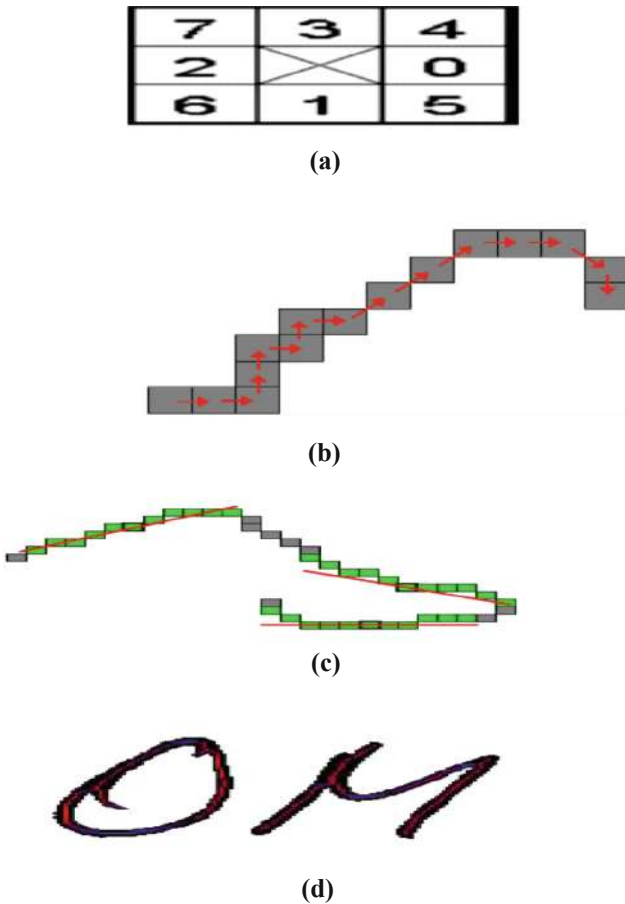


Fig. 2. (a) Predefined order of traversing shape. (b) Example of an ordered shape. (c) Estimating directions by its neighboring pixel. (d) Binary image and its corresponding Zhang election

- Calculate the Zhang skeleton of the binarized picture.
- Skeleton is fragmented at its intersection pixel.
- Traversing the pixel of the portion of the skeleton utilizing the predefined request.
- For every pixel 'p', consider the '2N + 1' neighboring pixel focused at 'p'.
- A straight relapse of this pixel gives a decent estimation of the digression at the pixel 'p'.

4.1.2 Curvatures Feature (f2)

This attribute is usually accepted in forensic science examination which studies the curvature as discriminating feature. It uses a Probability density function of 100 dimensions which represent the values of curvature at the outline pixels. The following method is used for extracting the curvature feature: For each pixel 'p' belonging to contour, consider a 't' sized neighboring window.

Calculate the number of pixels 'n1' and the number of pixels 'n2' belongs to the background and foreground respectively. The difference between 'n1' and 'n2' is positive at the point where the contour is convex, and negative at the point where concave (Fig. 3).

Estimate curvature, $C = (n1 - n2)/(n1 + n2)$



Fig. 3. (a) Computing curvature. (b) Curvature highlighted on the binary.

4.1.3 Tortuosity Include (f3)

This element causes us to separate between two kinds of authors, one whose content is perplexing and composes gradually and another whose content is great and composes quick. In the gave informational collection, for every pixel 'px' in the content, we consider 20-dimensional highlights identified with its tortuosity and 10-dimensional Probability thickness work speaks to the length of the longest queue section which crosses 'px' and finished inside the content and 10-dimensional Probability thickness work means the bearing of the content line divide. This element makes it conceivable to separate between quick journalists and a moderate author, quick essayist's content is good (smooth) and moderate essayist's content is unpredictable. To gauge tortuosity, for every pixel in the frontal area we search for the longest portion line conceivable incorporate the closer view (Fig. 4).



Fig. 4. (a) Longest traversing segment for 4 different pixels, (b) Length of maximum traversing segment: red corresponds to the maximum length and blue to the minimum one.

4.1.4 Chain Code Feature (f4 to f7)

We can generate chain code just by checking the outline of the given script and then by assigning a number to each pixel according to its location with respect to its last pixel.

For implementing this process, we will consider 8 pixels around a given pixel and consider its location with respect to these pixels. Chain code can be applied at many different orders:

f4: the PDF of ‘i’ patterns in the chain code where i belongs to 0, 1, 2, ...,7. This PDF is a size of 8.

f5: the PDF of (i, j) patterns in the chain code where i, j belongs to 0, 1, ..., 7. This PDF is a size of 64.

Similarly, f6 and f7 to the PDF of (i, j, k) and (i, j, k, l) in the chain code and size of 512, 4096 respectively (Fig. 5).

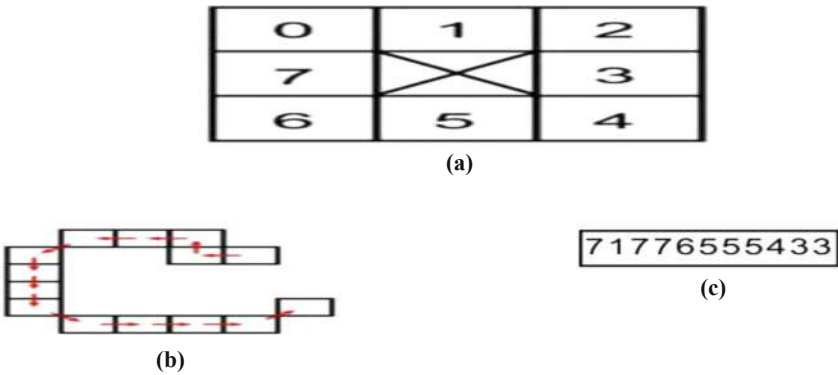


Fig. 5. (a) Order followed to generate chain code. (b) Example shape. (c) Corresponding chain code of the example

4.1.5 Edge-Based Directional Element (f8 to f26)

Edge-based directional highlights give a summed up arrangement of bearings and this can likewise be connected at numerous estimations by adjusting a window centered at each outliner pixel and figuring the occasion of every course. This component has been processed from size 1 to size 10. We utilized crossover classifiers, for example, SVM, Random Forest, Naïve Bayes and Adaboost calculations to test and Score better

precision for the picture and foresee the sexual orientation of the User. For the previously mentioned reason, we will use all the above attributes and will generate some new attribute to enhance the efficiency of the existing system.

- f1: DirectionPerpendicular5Hist10
- f2: CurvatureAli5Hist100
- f3: tortuosityDirectionHist10
- f4: chaincodeHist_8
- f5: chaincode8order2_64
- f6: chaincode8order3_512
- f7: chaincode8order4_4096
- f8: directions_hist1_4
- f9: directions_hist2_8
- f10: directions_hist3_12
- f11: directions_hist4_16
- f12: directions_hist5_20
- f13: directions_hist6_24
- f14: directions_hist7_28
- f15: directions_hist8_32
- f16: directions_hist9_36
- f17: directions_hist10_40
- f18: directions_hist1a2_12
- f19: directions_hist1a2a3_24
- f20: directions_hist1a2a3a4_40
- f21: directions_hist1a2a3a4a5_60
- f22: directions_hist1a2a3a4a5a6_84
- f23: directions_hist1a2a3a4a5a6a7_112
- f24: directions_hist1a2a3a4a5a6a7a8_144
- f25: directions_hist1a2a3a4a5a6a7a8a9_180
- f26: directions_hist1a2a3a4a5a6a7a8a9a10_220

[14–16] All the features are listed above is used for a specific purpose. Feature f1 is used for calculating the direction of the text that is in which direction text is aligned. Feature f2 is used for calculating the curvature of the handwritten text. Feature f3 is used for calculating tortuosity of the handwritten text. This feature is used when the handwritten text is twisted or complex. Feature f4–f7 is used for calculating chain code of the handwritten text. There are four features are used for four different directions. We can generate chain code just by checking the outline of the given script and then by assigning a number to each pixel according to its location with respect to its last pixel. For implementing this process, we will consider 8 pixels around a given pixel and consider its location with respect to these pixels. Feature f8–f26 is used for calculating the edge-based direction of the handwritten text. Edge-based directional features give a generalized configuration of directions and this can also be applied at many measurements by aligning a window focused at each outliner pixel and computing the event of each direction. This feature has been computed from size 1 to size 10.

5.1. Data cleaning remove and detect the corrupted data from the data set, we used the data cleaning process. Basically, data cleaning is belonging to data quality. Data quality is used to check the following features of the data:

- Accuracy
- Completeness
- Uniqueness
- Timeliness
- Consistency

Binning: This method is used to smoothen the sorted data to take advice by its' neighbors. Then the values are shared into a number of buckets. For examples, dataset

$D = \{4, 8, 9, 15, 21, 24, 25, 26, 28, 29, 34\}$

Equal frequency (equal depth) bins:

Bin1: 4, 8, 9, 15

Bin2: 21, 23, 24, and 25

Bin3: 26, 28, 29, 34

Smoothing by bin means:

Bin1: 9, 9, 9, 9

Bin2: 23, 23, 23, 23

Bin3: 29, 29, 29, 29

Smoothing by bin boundaries:

Bin1: 4, 4, 4, 15

Bin2: 21, 21, 25, 25

Bin3: 26, 26, 26, 34

5.2. Dataset

We use the dataset which is publicly available from Qatar University. This data set is basically based on the script to forecast the gender. The dataset stores the scripts of 282 writers. This dataset stores the script in both English and Arabic language. All the writers are producing text in each language one text that is the same for all the writers and one text which distinct for all the writers. Writers in this data set are from distinct gender like and female. we take 3 distinct data sets in one dataset stores the test dataset of 282 writers in this male dataset the script which is written by the writers are distributed in 7070 columns in different features like direction, curvature, tortuosity, chain code, edge direction. The second dataset has the training data of 200 writers. In this dataset, a script which is written by the writers is distributed in 7070 columns in different features like direction, curvature, tortuosity, chain code, edge direction. In this dataset there are many columns are present for writer's id, page id, language, same text or different text, and many other features. In the third dataset, it stores the answer to the

Table 1. Deployment of data of English and Arabic writers

AB											
1	writer Jpage	_id language	same_tex tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tori
2	201	1 Arabic	O	0.391039	0.008961	0	0	o	0	0	
3	201	2 Arabic	1	1	O	o	0	o	o	0	
4	201	3 English	O	1	o	o	0	o	o	0	
5	201	4 English	1	1	o	o	0	o	o	0	
6	202	1 Arabic	O	1	o	o	0	o	o	0	
7	202	2 Arabic	1	1	o	o	o	o	o	o	
a	202	3 English	O	1	o	o	0	o	o	0	
9	202	4 English	1	1	o	o	0	o	o	0	
TO	203	1 Arabic	O	1	o	o	o	o	o	o	
11	203	2 Arabic	1	0.946078	0.006696	0.006287	0.0008	o	0.021111	0.003125	o.<
12	203	3 English	O	0.896102	0.009869	0.009373	0.022108	0.001461	0.032997	0.02809	
13	203	4 English	1	1	O	O	O	o	o	o	
14	204	1 Arabic	O	1	O	o	0	o	o	0	
15	204	2 Arabic	1	0.991575	0.008425	o	0	o	o	0	
16	204	3 English	O	1	O	o	o	o	o	o	
17	204	4 English	1	1	o	o	0	o	o	0	
IS	205	1 Arabic	O	1	o	o	0	o	o	0	
19	205	2 Arabic	1	1	o	o	o	o	o	o	
20	205	3 English	O	1	o	o	0	o	o	0	
21	205	4 English	1	1	o	o	0	o	o	0	
22	206	1 Arabic	O	1	o	o	0	o	o	0	
23	206	2 Arabic	1	1	o	o	0	o	o	0	
24	206	3 English	O	1	o	o	0	o	o	0	
25	206	4 English	1	1	o	o	0	o	o	0	
26	207	1 Arabic	O	1	o	o	0	o	o	0	
27	207	2 Arabic	1	1	o	o	0	o	o	0	

test
(+)

test dataset. In this dataset, the two columns are present the first column has the writer’s id and the second column have the binary number 0 & 1. Binary number 0 shows that the writer is female and the binary number 1 shows that the writer is male. We compute all the features on the dataset [5, 6]. Each feature is combining using the different grouping method. We use two grouping method for predicting the gender from the script is a random forest grouping method and gradient boosting grouping method. Gender grouping, it is the grouping method has the winning probability of a single writer is 50%. According to the dataset is there is two types of gender are obtainable to instruct the dataset, Male and female. Hence, we have to predict the writer is male or female.

Table 2. Writer of English and Arabic represented by their Gender

AI ~ :		fir writer		F	G	I	K	L	M	N	O
A	A	language	same_text	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity	tortuosity
1	1	Arabic	0	0	0	0	0	0	0	0	0.099
3	1	Arabic	1	0	0	0	0	0	0	0	0.1488
4	1	English	0	0	0	0	0	0	0	0	0.2447
5	1	English	1	0	0	0	0	0	0	0	0.2990
6	2	Arabic	0	0	0	0	0	0	0	0	0.208
7	2	Arabic	1	0	0	0	0	0	0	0	0.219(
8	2	English	0	0	0	0	0	0	0	0	0.2572
9	2	English	1	0	0	0	0	0	0	0	0.2706,
10	3	Arabic	0	0	0	0	0	0	0	0	0.1342
11	3	Arabic	1	0.92875	0.004071	0.001876	0	0.018031	0.025427	0.003687	0.018159
12	3	English	0	0	0	0	0	0	0	0	0.2900*
13	3	English	1	0	0	0	0	0	0	0	0.3100*
14	4	Arabic	0	0	0	0	0	0	0	0	0.1738
15	4	Arabic	1	0	0	0	0	0	0	0	0.1747(
16	4	English	0	0.982517	0	0.017483	0	0	0	0	0.2282.
17	4	English	1	0	0	0	0	0	0	0	0.2516*
18	5	Arabic	0	0	0	0	0	0	0	0	0.1608*
19	5	Arabic	1	0	0	0	0	0	0	0	0.1251*
20	5	English	0	0	0	0	0	0	0	0	0.2008
21	5	English	1	0	0	0	0	0	0	0	0.2247\$
22	6	Arabic	0	0.982517	0	0.017483	0	0	0	0	0.1044
23	6	Arabic	1	0	0	0	0	0	0	0	0.1079
24	6	English	0	0	0	0	0	0	0	0	0.2311.
25	6	English	1	0	0	0	0	0	0	0	0.2707*
26	7	Arabic	0	0	0	0	0	0	0	0	0.1881
27	7	Arabic	1	0	0	0	0	0	0	0	0.1654
train											
©											
i [±n											

5.3. Result

Table 3. Multi classifiers run time results

Method	AUC	CA	F1	Precision	Recall
Hybrid classification (SVM, Random Forest, Naive Bayes, AdaBoost)	1.000	0.993	0.993	0.993	0.993
	1.000	0.993	0.992	0.993	0.993
	0.973	0.968	0.968	0.968	0.968
	1.000	1.000	1.000	1.000	1.000

5.4. Conclusion

According to run time experimental results shows 4 types of ensemble classifiers are used and shows the overall accuracy is 50%. Handwriting recognition can also help in biometric security enhancement. The most common binary problems are user's gender prediction, and to predict whether the user is left handed or right handed. A property of all the above-mentioned problems is that they can be either balanced or unbalanced. For example, It is balanced in the case of gender prediction and unbalanced in the case of handedness prediction. Technically these problems are too complex, even for a human, since it is quite difficult to predict which handwriting features properly identify each affected class. Above table showed the multi classifiers/methods [12] SVM, Random Forest, Naïve Bayes, and Adaboost executed the better results compared to any single classifier.in the resultant table multiple methods have been taken and passed through, then the method AUC, SVM. Random Forest and Adaboost –1.000 and Naïve Bayes is 0.973 CA-SVM, Random Forest 0.993 Naïve Bayes 0.968 and AdaBoost 1.000 the precision and recall value are same so after the classification techniques overall AdaBoost, SVM, and Random Forest Precision is higher than other.

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An Implementation on Agriculture Recommendation System Using Text Feature Extraction

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Abstract. Improvement of organizations on the web is extending ordinary as needs be benefits related data end up being too tremendous to even think about even consider preparing by traditional data taking care of systems. In the midst of the period of broad volume of data, there happens a potential for making quicker advances in different savvy teaches and updating the favorable position and accomplishment of different undertakings through better assessment of the general volumes of information that are persuading the chance to be accessible. Early strategies like substance based recommendation lost its significance and the model setting pleasing separating approach gets its suitability in all spaces. To play out a predominant quality information recommendation on agribusiness, information based shared detaching techniques are being utilized in the midst of the present days. The work prompts the decay of tremendous instructive run-down into littler illuminating record in which the majority of the tendencies take after each other. In this paper a blend revamp recommender structure subject to client information is proposed which diminishes the general include time in generous data suggestion. Unmistakable obstructions in standard recommender structures like information sparsity, cool begin issue have been overwhelmed in this proposed framework.

Keywords: Recommender framework · Substance based sifting · Client · Stemming · Preference

1 Introduction

Recommender frameworks are structures that channel through data. They give item and association proposals changed to the client's needs and propensities. Recommender frameworks are wise adjusted applications that propose information items or tendencies, or considerably if all the more as rule data "interests", which best suit the client's needs and inclinations, in a given circumstance and setting [1, 2]. The authentic errand of a recommender structure is to foresee the examining a client will suit a fervour utilizing distinctive reasonable models. These models misuse the evaluations given by customers for recently noticed or obtained interests and produce necessary proposals.

The most fundamental and needful proposal plans are synergistic based separating and substance based sifting. Synergistic based frameworks foresee thing appraisals for present client subject to the evaluation given by different clients, who have propensities

exceedingly connected with the present client [3]. Substance based structures imagine examinations for a secured intrigue subject to how much its portrayal (content) takes after interests which the client has remarkably evaluated in the past [4]. Different issues are associated with the utilization of the various recommender structures methodologies. The most exceptional issues are good fortune related with substance based recommender structures, degree dispersing related with substance and shared recommender frameworks and addition related with normal recommender frameworks.

Good fortune is an issue that creates when clients are offered interests like the ones they have seen as of now while having a poor opinion of new ones that they may like. The issue of proportion spread ascents when the present client appropriates don't organize with different clients proportions. Addition grows either in light of the route that there are no enough position proportions for another client or there is no enough arranging on an item. To address these issues, it is speaking to set the recommender structure methods to use on the focal points given by individual systems so as to redesign suggestion exactness; subsequently the essential for a hybrid approach which is the likelihood of this work.

2 Methodology

The new framework uses both client and interest based rationalities. In the client based reasoning, the clients play out the urgent movement. On the off chance that greater bit of the clients has a near taste, they joined into one get-together. Proposition are given to clients subject to assessment of interests by different clients from an equivalent social event, with whom the individual ideas no matter how you look at it or unremitting inclinations [5]. In Interest-based methodology, taste of clients may stay unwavering or change decently. Relative interests manufacture neighbourhoods subject to thanks of clients. Later the framework produces recommendations with interests in the domain that a client would lean toward. The structure is a half breed framework which joins both substance based and normal sifting strategies for recommendation. This is done to deal with the issue of karma in substance based recommender frameworks and the issue of pound up in total recommender structures. The arrangement of the structure is appeared in Fig. 1. It has two sorts of client, those getting to the framework through the web front and those getting to the structure from mobile phones. Deals from the two interfaces are guided by strategies for a typical host running a web server, extraordinary to the two interfaces. Information sources are gotten from the client and besides the database, the half and half recommender framework makes the most ideal suggestion as reaction through the web server back to the individual advantageous and web customers.

2.1 Implementation

Prescribing recommendation to clients with basically having a recommender estimation isn't agreeable. The tally needs an illuminating record to work. Different recommender structures, in both academic and business settings, acquire information by having clients unequivocally express their propensities for things [6]. These imparted

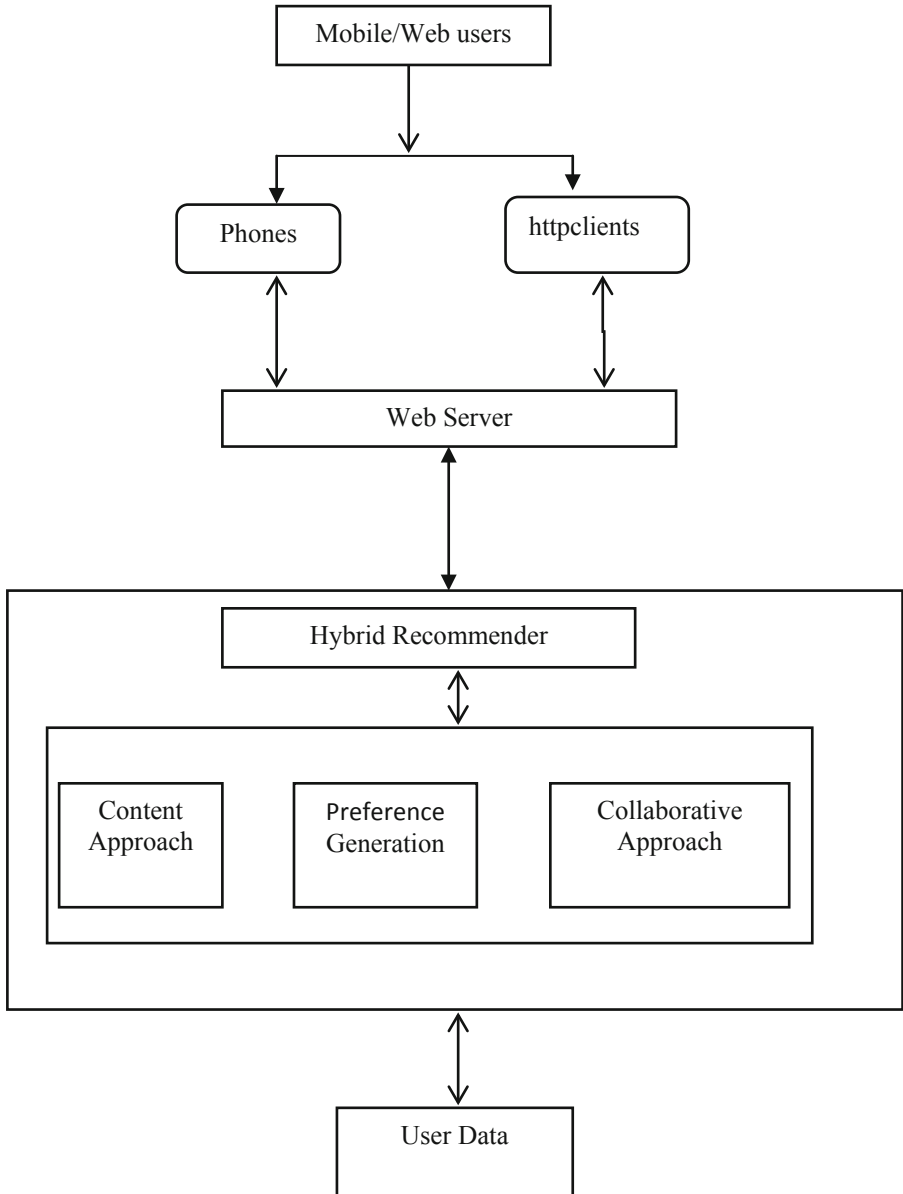


Fig. 1. Hybrid recommender framework

propensities are then used to check the client's inclination for things they have not evaluated. From a structure building point of view, this is a quick technique and keeps away from conceivably troublesome initiating issues for client propensities. It endures, in any case, from the damage that there can, for specific reasons, be a goof between what the clients state and what they do. In the Usenet zone, this has been examined by

utilizing newsgroup enlistments and client works out. For example, time spent investigating, sparing or answering, and duplicating content into new demand and related answer (Fig. 2).

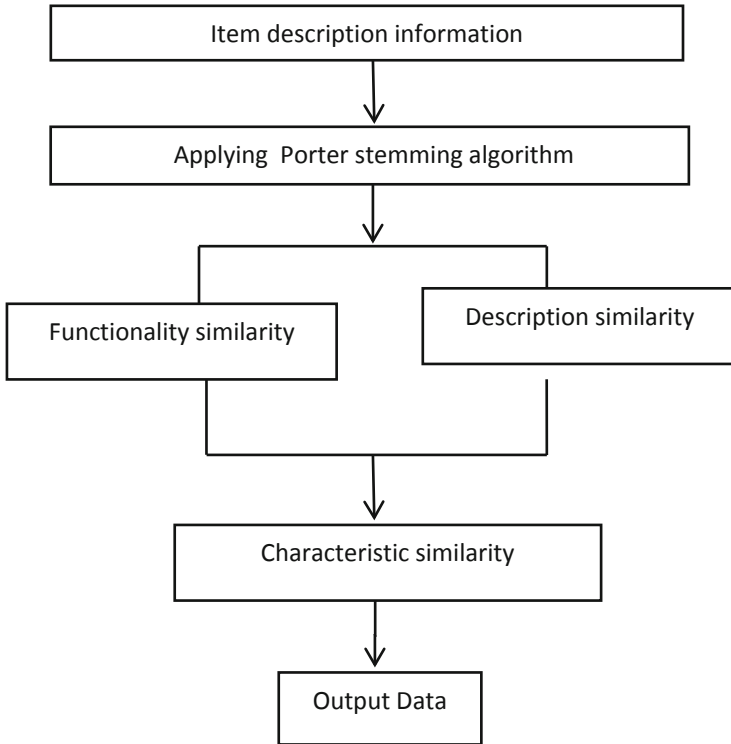


Fig. 2. Text extraction algorithm

2.2 Pre Processing Phase

2.2.1 Stemming Words Using Stemmer

Different individuals may utilize obvious packaging words to depict relative associations. In like way, portrayal words ought to be formally dressed before further use. Truly, morphological relative words are clubbed together under the uncertainty that they are in addition semantically close. For instance, ‘recoup’, ‘recuperation’, ‘recuperates’ and ‘recuperating’ are sorts of the equal lexeme, with ‘recoup’ as the morphological root plot. To change particular word structures to their conventional root called stem, differing sorts of stemming calculations, for instance, Lovins stemmer, Dawson Stemmer, Paice/Husk Stemmer, and Porter Stemmer, have been proposed [7]. Among them, Porter Stemmer is a boss among the most overall utilized stemming calculations. It applies fell change infers that can be run rapidly and don’t require the utilization of a word reference [8].

2.2.2 Characteristic Similarity Calculation

Depiction resemblance and worthwhile likeness are both arranged by Jaccard Similarity Coefficient (JSC) which is a genuine degree of closeness between tests sets [9]. For two sets, JSC is portrayed as the cardinality of their crossing point separated by the cardinality of their alliance. Decidedly, portrayal similarity among an and b is figured by utilizing the condition in relative way the convenience equality is settled as looks for after.

$$D_{sim}(a, b) = \frac{|D_a \cap D_b|}{|D_a \cup D_b|} \tag{1}$$

It will when all is said in done be gotten from the Eq. (1) that the more prominent $D_a \cap D_b$ is, the more close to the two associations are. Allotting by $D_a \cup D_b$ is the scaling factor which guarantees that outline likeness is some spot in the extent of 0 and 1.

$$F_{sim}(a, b) = \frac{|F_a \cap F_b|}{|F_a \cup F_b|} \tag{2}$$

Characteristic likeness among a and b is registered by the weighted aggregate of depiction closeness and function comparability.

$$C_{sim}(a, b) = \alpha x D_{sim}(a, b) + \beta x F_{sim}(a, b) \tag{3}$$

In the Eq. (3), $\alpha \in 0, 1$ is the weight of depiction closeness, $\beta \in 0, 1$ is the weight of function similarity and $\alpha + \beta = 1$, the weights express the relative hugeness between these two. In the recommender structure, for the total services gave, the characteristic resemblances of each pair of services calculated and $n \times n$ characteristic comparability matrix M is formed. An entry $m_{a,b}$ in M represents the characteristic similarity.

Table 1. Experimental results

User context	Preferred terms	Finding context	Temporal context
Rice is an oat grain has a place with the grass group of Graminae and local to the deltas of extraordinary Asian waterways. Rice plant develops from 2 to 6 ft tall with round, jointed stem, since a long time ago pointed leaves. Rice is a standout amongst the most developed grain crop in India. Rice when secured by the dark colored corridor is known as paddy Climatic Requirements for Rice development Basically, rice crop	Rice Gramineae Plant India Cultivated Requirements Paddy Rice cultivation Climatic Requirements Requires Ploughing	Rice Gramineae Plant India Cultivated Paddy Rice cultivation Climatic Ploughing Sowing Seeds Fertility	Rice Paddy cultivat Rice cultivat Plough Sow Seed Fertilit Yield Product Crop

(continued)

Table 1. (continued)

User context	Preferred terms	Finding context	Temporal context
<p>requires hot and damp climatic conditions for its fruitful development. The perfect temperature required for the existence time of the harvest ranges from 20 0 C to 40 0 C</p> <p>Soil prerequisites for Rice development Rice can be developed on wide assortment of soils, for example, sediments, topsoils and rock. Profound rich clayey or loamy soils are viewed as perfect for developing rice crop</p> <p>Development strategies in Rice Farming</p> <p>1. Communicate strategy Seeds are sown by hand and is appropriate in regions where soil isn't fruitful and lands are dry. Requires least work and information sources Gives less yielding</p> <p>2. Penetrating strategy Furrowing of land and sowing of seeds can be done by 2 people</p> <p>3. Transplantation technique Where soil has great fruitfulness and plentiful precipitation/water system. Paddy seeds are sown in nursery beds. Seeds are developed and Uploaded (following 5 weeks) and these seedings can be transplanted in the primary field. Overwhelming work and sources of info. Best yielding</p> <p>4. Japanese technique High yielding assortments can be incorporated into this strategy and require overwhelming portion of composts. Seeds ought to be sown on raised nursery beds and should transplant the seedings in columns. Valuable for high yielding half breed crops</p> <p>Real Rice Production states West Bengal, UP, AP, Telangana, Punjab, Haryana, Bihar, Orissa, Assam, Tamil Nadu, Kerala</p>	<p>Sowing Seeds Transplantation Fertility rainfall/irrigation germinated seeds sown nursery beds yielding High</p>	<p>rainfall/irrigation yielding High Labour Heavy Seedings Production Hybrid crops</p>	

3 Conclusion

This work proposed a hybrid strategy for suggestion. The framework was utilized in the suggestion of giving rural related data modified to the customer needs and inclinations by consolidating both cooperative and substance approaches. Recommended framework additionally makes dependent on proposals given by the accomplished users and horticultural innovation specialists and furthermore dependent on the client intrigue demonstrate recovering the data from the database and check for the greater comparability dependent on expanded inclinations utilizing closeness computation strategy to give fitting and best suggestion to the users.

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Identification of Natural Disaster Affected Area Using Twitter

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Abstract. Any social network activity can be posted now a days in Twitter. People reach out to twitter during natural disasters for help by tweeting the areas that are affected with the natural disaster and the type of natural disaster that has occurred. As, Social media is greatly relied at the times of natural disasters, this makes it very important that there must be an efficient method to analyze the disaster related tweets and find out the largely affected areas by the natural disaster. In this paper we classify the natural disaster-based tweets from the users using classification machine algorithms like Naïve Bayes, Logistic Regression, KNN, Random Forest and determine the best machine learning algorithm (based on metrics like accuracy, kappa etc.) that can be relied to ascertain the severity of the natural disaster at a desired area.

Keywords: Sentimental analysis · Machine learning algorithms · Twitter · Natural disasters

1 Introduction

Lots of information of different types is generated due to the advent of new technologies. To handle these huge amounts of data we need to follow some big data analysis techniques rather than traditional methods for analysis. Data mining is one of such technique which is used to discover interesting knowledge from large amounts of data. This project is to identify the natural disaster effected area using real-time tweets by finding the locations' latitude and longitude and then mapping the location on to the graphical map.

The twitter data regarding the natural disaster affected areas is obtained by first creating a twitter app and by requesting authentication from R studio using the consumer key and consumer secret key of the created twitter app. Then the keywords which are synonyms of the natural disaster keyword are grouped and then all the tweets having those keywords are obtained. Only the tweet texts are obtained by removing the re tweet entities, people, HTML links, punctuations, numbers and unnecessary spaces from the twitter data.

The locations from the twitter text are obtained by mapping the text to the locations that exist and then the locations latitude and longitude is saved in excel format.

Then the latitude and longitude are mapped over the graphical map with the percentage effect of the natural disaster on that location which will also be obtained through the tweets. This graph will be helpful in identifying the most prone areas of a natural disaster, so that the areas can be alerted, and the less prone areas of a natural disaster can also be found which could turn into most prone areas, so that the areas can be kept under observation.

The identification of natural disaster affected area is helpful in minimizing the loss which could be occurred during natural calamities and the effect of natural disaster over people can also be minimized. Even after the natural disaster occurred over a certain location, people over there need to know about it so that relief operations can be done with more efficiency and the medical facilities can be provided over those areas. The visual representation of the affected areas is more efficient as that help in easily identifying the affected areas of natural disaster with more ease.

2 Related Work

Recent literature provides methods about how natural disasters can be notified to the users through social media. Several authors used twitter as media to develop such models using machine learning and deep learning algorithms.

Himanshu Shekhar et al. [1] explained disaster analysis using various attributes such as user's emotions, frequency and geographical distributions of various locations. The article categorizes users' emotions during natural disaster by building a sentiment classifier.

Tahora H. Nazer et al. [2] experimented and developed a model which will detect requests of twitter content based on certain features such as URL's, hashtags and mentions. The requests identification efficiency of the algorithms used (SVM, Random Forest, Ada Boost, Decision Tree) is measured by comparing the Precision, Recall and F-Measure of the algorithms.

Andrew Ilyas et al. [3] explained the usage of micro filters which is a system designed to scrape the tweets and the links in the images in the twitter image data and then machine learning is used to classify them, in which classification eliminates the images that does not show the direct damage of the places due to the disaster which are not useful for the rescue efforts. This paper also makes a point on the technical problems involved like data sparseness, feature engineering, and classification.

Himanshu Verma et al. [4] explained disasters effected areas by collecting tweets from users. After preprocessing task those will be evaluated by using Naïve Bayes classifier. To identify best features among the tweets given by various users Chi-Square test is conducted which will be used to generate polarity score.

Nikhil Dhavase et al. [5] used the geoparsing of twitter data which will be used to identify location of disaster or crisis situations through social media using twitter analysis. The article make use of Natural Language Processing (NLP) methods, methods and ZeroR, Filtered Classifier, Multi Scheme, Naïve Bayes Multinomial text classifiers are used to classify the tweets to obtain the event occurred and then the accuracies of the algorithms was compared in which the Naïve Bayes Multinomial text classifier resulted in the best accuracy.

Harvinder Jeet Kaur et al. [6] experimented a model for sentiment analysis by Part of Speech (POS) tagging features that are implemented by the model called Naïve Bayes classifier to classify areas based on severity. The author achieved 66.8% of accuracy which can be improved further.

Mironela Pirnau et al. [7] considered word associations in posts of social media for analyzing the content of tweets. The article make use of apriori algorithm: a data mining technique which is used to identify most frequently prone earthquake point on the earth.

Nicholas Chamansingh et al. [8] developed a sentiment analysis framework where Naïve Bayes classifier and Support Vector Machines (SVM) are used. The experimental results are compared by reducing the feature set in each experiment.

Arvind Singh et al. [9] evaluated a framework using a linear and probabilistic classifier for sentiment polarity classification over the tweets obtained from twitter and the algorithms Naïve Bayes, SVM (Support Vector Machines), Logistic regression were compared using accuracy metric. SVM had produced the highest accuracy of the three algorithms compared.

Lopamudra Dey et al. [10] uses hotel review dataset and movie review dataset to compare Naïve Bayes and K-NN classifiers using the metrics accuracy, precision, recall values. Naïve Bayes gave better results for movie reviews whereas for hotel reviews both the algorithms gave similar results.

Saptarsi Goswami et al. [11] given extensive & in-depth literature study on current techniques for disaster prediction, detection and management and summarizing the results disaster wise, they have proposed a framework for building a disaster management database for India hosted on open source Big Data platform like Hadoop in a phased manner as India is in the top 5 countries in terms of absolute number of the loss of human life.

Hyo Jin Do et al. [12], investigates people's emotional responses expressed on Twitter during the 2015 Middle East Respiratory Syndrome (MERS) outbreak in South Korea. They had first presented an emotion analysis method to classify fine-grained emotions in Korean Twitter posts and conducted a case study of how Korean Twitter users responded to MERS outbreak using their emotion analysis method. Experimental results on Korean benchmark dataset demonstrated the superior performance of the proposed emotion analysis approach on real-world dataset.

Comparative Accuracy of Different Classification Algorithms for Forest Cover Type Prediction by Rahul R. Kishore, Shalvin S. Narayan, Sunil Lal and Mahmood A. Rashid is directed towards examining all of the machine learning based classifiers coupled with feature selection and attribute derivation in order to evaluate which one is best suited for forest cover type classification. Numerous training classifications were performed on each of the classifiers with different sets of features. Amongst the three classifiers evaluated in this work, the Random Forest classifier is exhibiting the best and highest accuracy over others. Feature selection also played a significant role in demonstrating the accuracy levels obtained in each of the classifiers.

Rahul R. Kishore et al. [13] explained the usage and analysis of twitter during 2015 chennai floods towards disaster management.

Meera R. Nair et al. [14] given a study regarding how people of Chennai used social media especially twitter, in response to the country's worst flood that had occurred recently. The tweets collected were analysed using machine learning algorithms such as Random Forests, Naive Bayes and Decision Tree. By comparing the performances of all the three it was found that Random Forests is the best algorithm that can be relied on, during a disaster. This paper also targeted the sources of the Twitter messages to explore the most influential users of Chennai flood.

M. V. Sangameswar et al. [15] explained how natural disasters like Tsunami, floods and earth quakes can be identified using social media i.e. twitter and they have used geoparsing to find the location from which the tweet has been tweeted. They have used a method which uses single keyword at a time to search twitter.

3 Proposed Method

3.1 Data Source and Dataset

The data is requested from the twitter with a dictionary of keywords that are city names and a dictionary of keywords that are the natural disaster names, to retrieve the data that contains the mentioned keywords using twitter API with the use of API keys and access tokens that are given while creating a twitter app.

3.2 Classification

The data that is obtained from twitter is processed or cleaned by removing the html links, retweet entities, new lines etc., this data is then classified using the sentiment package which contains emotions' classifier and polarity classifier.

The dataset is classified with respect to four different machine learning algorithms namely, Random Forest Classifier, K Nearest Neighbours, Naive Bayes Classifier and Logistic Regression. The accuracy of classified datasets is determined to detect the best algorithm in the classification. The dataset of the best algorithm is considered to find severity of the natural disaster based on the negative polarity of each city in the dataset.

3.3 Algorithm

3.3.1 Algorithm for Extraction and Cleaning Data

```

Create a twitter application
Get the API keys and Access Tokens
Authenticate using the API keys and Access tokens
Keyword search to access twitter data
for city in cities
  for disaster in disasters
    tw ← SearchTwitter with the keywords city, disaster with a separator '+' upto
5000 lines
  clean_tweets function
    remove retweet entities of tw
    remove people of tw
    remove punctuation of tw
    remove numbers of tw
    remove html links of tw
    remove unnecessary spaces of tw
    remove emojis or special characters of tw
    convert all the text of tw into lower case letters
    remove new line an carriage return of tw
  tw_vector ← concatenate an empty vector with the tweets tw passed to
clean_tweets function

```

3.3.2 Algorithm for Classification

```

Emo_df ← classify_emotion function is passed with tw and an algorithm name
pol_df ← classify_emotion function is passed with tw and an algorithm name
tw_df ← emo_df and pol_df data frames are concatenated with tw to form a data frame

```

3.4 System Model

The Fig. 1 shows the system model of the proposed technique. It shows the creation of a twitter application and getting the API keys and access tokens which are used to authenticate the twitter to get access of the twitter data. The data is retrieved from twitter by searching the twitter using the required keywords. The data is then cleaned, and the emotion and polarity of the data is found using classification algorithms one after the other. The data of the best algorithm is considered, and the negative polarity is found and plotted over histogram against cities and plotted over map based on location.

3.5 Visual Representation

The severity is obtained by finding out the negative polarity of each city on the dataset that is classified by the best algorithm, selected according to the accuracy of classification. The negative polarity is plotted on the map based on location, which determines the severity of the natural disaster at that location.

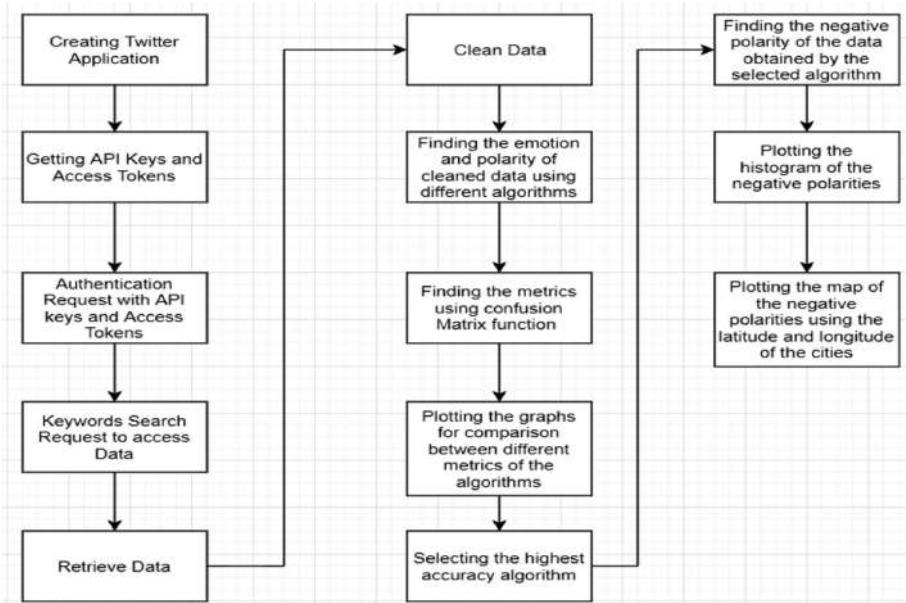


Fig. 1. Depicts the system model for the proposed methodology.

4 Environmental Setup

Here, we are using various tools used to identify the natural disasters.

R: This paper uses R as scripting language.

twitterR: twitter, R package is used to get access to the twitter API.

sentiment: sentiment package is used to obtain the opinions of the dataset.

plotly: It is used to convert graphs into interactive web-based versions.

leaflet: This package is used for the usage of map plot.

stringr: It is used for string manipulations while cleaning data

R OAuth: It is used for the authentication request to twitter.

Stringr: this is an easy function for String functions in R. These functions can handle characters of zero length and NA's also.

ggplot2: Graphics in R can be implemented by using ggplot2 functions. It supports multiple data sources and is useful for both base and lattice graphs.

RColorBrewer: This package can be used for drawing nice maps shared according to a variable through palettes.

Devtools: Devtools helps the developer in providing functions for simplifying many common tasks.

Caret: The caret package contains tools for data splitting, pre-processing, feature selection and model tuning using resampling.

5 Results

The metrics like Precision Score, Accuracy Score and Recall are used to find the best model among the four models that were used to predict the natural disasters. The results of accuracies of the different models are as follows (Table 1):

Table 1. Shows accuracy scores obtained by running different machine learning algorithms on the data.

S. No.	Name of the algorithm	Highest accuracy obtained
1	Random Forest Classifier	0.735891648
2	K Nearest Neighbors	0.732505643
3	Naïve Bayes	0.581828442
4	Logistic Regression	0.735891648

From above Table inferences that the highest accuracy is obtained by the Random Forest Classifier and Logistic Regression. The data of any of the above two algorithms can be considered to calculate the negative polarity of the cities i.e. the effect of natural disasters over the considered cities (Figs. 2, 3, 4, and 5).

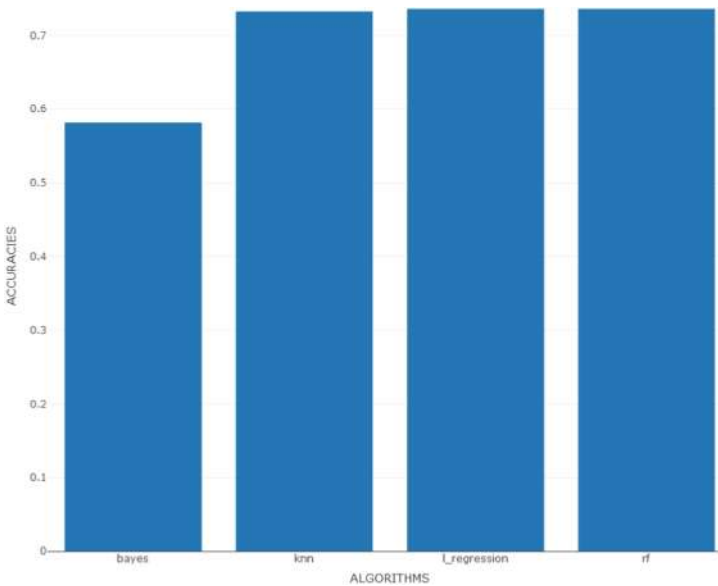


Fig. 2. Comparison of accuracies between the algorithms.

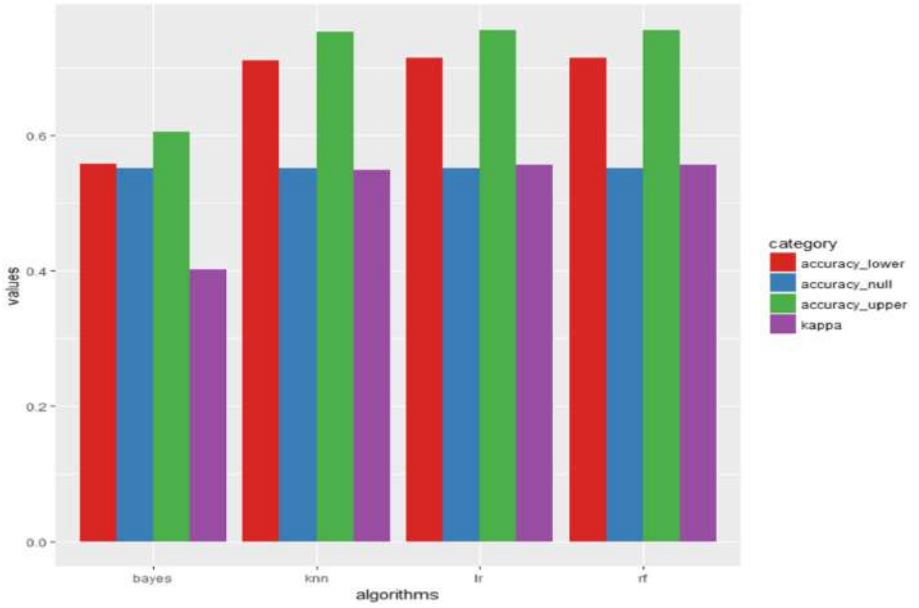


Fig. 3. Comparison of the overall variables of the considered algorithms

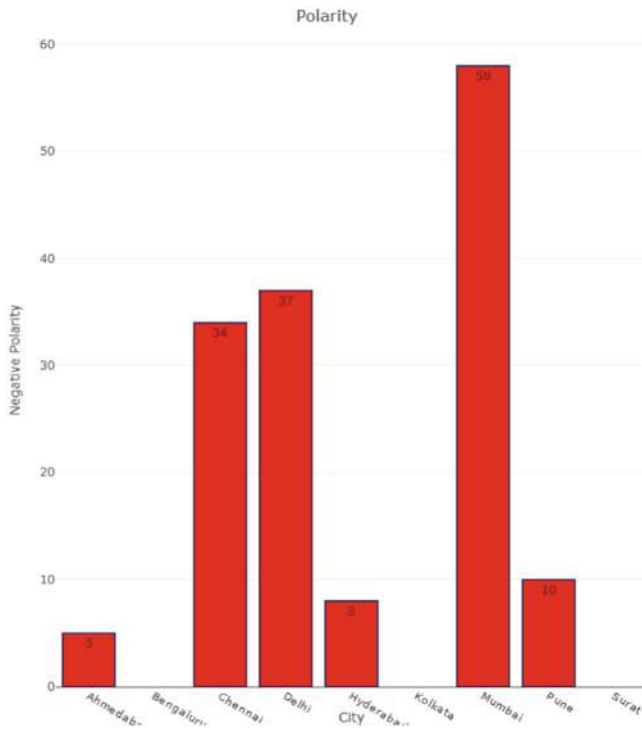


Fig. 4. Depicts the negative polarity values of each considered city



Fig. 5. Depicts the negative polarity values of each considered city over a map based on latitude and longitude

6 Conclusion

In the article the experimentation attained an accuracy of 0.735891648 using Random Forest classifier and Logistic Regression. So, any of the both algorithms can be used to classify the twitter data for best results i.e., accurate severity of the natural disasters over the considered locations. The improvement done in the article over an existing method is, considering a dictionary of city names and datasets rather than manually searching each natural disaster one at a time and also an efficient algorithm for the data set classification is also proposed, which the existing method lacks.

7 Future Scope

This research can be further improved by also including data that is geo parsed for the required location where natural disasters have occurred.

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Correction to: Developing Social-Media Based Text Corpus for San’ani Dialect (SMTCS D)

Mohammed Sharaf Addin and Sabah Al-Shehabi

Correction to:

Chapter “Developing Social-Media Based Text Corpus for San’ani Dialect (SMTCS D)” in: S. C. Satapathy et al. (Eds.): *Advances in Decision Sciences, Image Processing, Security and Computer Vision*, LAIS 3, https://doi.org/10.1007/978-3-030-24322-7_60

In the original version of the book, the affiliations of the author group of the chapter “Developing Social-Media Based Text Corpus for San’ani Dialect (SMTCS D)” have been changed.

The correction chapter has been updated with the changes.

The updated version of this chapter can be found at https://doi.org/10.1007/978-3-030-24322-7_60

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Academic Interest of the Under Graduate College Students of Dharmapuri

P. Robert Ramesh Babu*

Abstract

Every individual has a tendency to deal with something in their environment, if it gives something good to them, possible, they will have interest to it. Interest motivates people to choose the best and the most interesting activity in their life. Because each activity has own characteristic, people always select activities and things those are interesting. Lester D. Crow and Alice stated that: "an interest is a motivating force that impels an individual toward participation in one activity rather another. It indicates that interest provide a strong motivation to learn". Colloquially, being interested in something can mean that we care about it, that it is important to us, and that we have (mostly) positive feelings towards it. We often say things like, "I'm interested in the well-being of my child," I am interested in becoming a Doctor or Professor. John Dewey once described interest as "being engaged, engrossed, or entirely taken up with" an activity, object, or topic (Dewey, 1913, p. 17). More contemporary interest theorists have divided interest into two components: individual interest and situational interest (Hidi& Baird, 1988; Renninger, 2000). According to Hidi and Renninger, three factors contribute to the development of interest: knowledge, positive emotion, and personal value. As individuals learn more about a topic, they become more skilled and knowledgeable and increase in knowledge. Interest is often thought of as a process that contributes to learning and achievement. That is, being interested in a topic is a mental resource that enhances learning, which then leads to better performance and achievement. Interest in learning, could most probably be a very powerful affective psychological trait and a very strong knowledge emotion as well as an overwhelming magnetic positive feeling, a sense of being captivated, enthralled, invigorated and energized to cognitively process information much faster and more accurately in addition to most effective application of psychomotor traits like self regulatory skills, self-discipline, working harder and smarter with optimum persistence (Kpolovie, 2010). The researcher aims to study the academic interest of the college going students of Dharmapuri. He has taken samples from the students of B.Com Department, Don Bosco College, Dharmapuri. The sample size is 50. The researcher used Descriptive Research design. He has used Survey Method to collect the data and used standardized questionnaire constructed by TharaSebastin as a tool to collect the data. The results are, among the respondents, Male were 54 percent and 46 percent were Female. The mean age of the respondents was 19.78. More than half of the respondents were belonging to MBC community. While analyzing the data 74 percent of the respondents were having low academic interest while the remaining 26 percent had high academic interest.

Key Words: Academic Interest; Students; Individual interest; Situational interest;

1. Introduction

Interest motivates people to choose the best and the most interesting activity in their life. Because each activity has own characteristic, people always select activities and thing those are interesting. Lester D. Crow and Alice stated that: "an interest is a motivating force that impels an individual toward participation in one activity rather another. It indicates that interest provide a strong motivation to learn." Interest describes the cognitive and affective relationship between a student and particular classes of subject matter. However, one student's effort to master Latin, mathematics, or lacrosse is not likely to be the same as another student's efforts. Moreover, how a student approaches different subjects can be expected to vary, just as the background and basic abilities that each student brings to each subject will vary.

Interest is defined and whether it be described as a cause of attention, an aspect of attention or as identical with attention, its special significance lies in its intimate connection with the mental activity or attention. Interest is the focusing of the sense organs on or giving attention to some person, activity, situation or object. It is an outcome of experience rather than a gift. It could either result or cause motivation. It could also be regarded as a predeterminant of one's perceptions that is, what aspect of the world one is mostly likely to see always (McCInermey, Dowson, Young and Nelson, 2005).

Review of literature

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Interest is a motivational power behind the growth towards expertise (Alexander, 1997). It is a directive force that explains and predicts academic achievement. Interest is also linked to quality: research shows that learning based on interest leads to high-quality learning results(Hidi&Renninger, 2006). Hence, it is important to understand the role interest currently plays in the university environment and possible ways for enhancing its role as a student motivator.

Interest is one of the basic terms within the motivation literature associated with the study of academic development (Brophy, 2004; Eccles). Recently, research has been directed at integrating interest with different theoretical perspectives in the field of motivation (e.g. Harackiewicz, Durik, Barron, Linnenbrink-Garcia, &Tauer, 2008;Hulleman, Durik, Schweigert, &Harackiewicz, 2008; Senko & Miles, 2008).

Most interest theorists concur that interest is a phenomenon that emerges from individuals' Interaction with their environment as declared by Hidi and Harackiewicz (2000, p.152). Hidi and Renniger (2006) contend that personal interest emanates from an intrinsic desire to understand particular subjects or topics,and is usually associated with high levels of knowledge and value, positive emotions and increased reference value (Krapp, Hidi&Renninger, 1992). Some of the psychological processes which are active when students demonstrate interest in classroom activity, according to Krapp et al., (1992), may include increased attention, greater concentration, pleasant feelings of applied effort, and increased willingness to learn. Sansone and Morgan (1992) add that features such as engaging in an activity freely, with persistence, energy and intensity are the important hallmarks of active interest.

2. Research methodology

The aim of the study is to find out the level of academic interest among the undergraduate students of Private College, Dharmapuri.

Objectives

- To find out the socio demographic details of the undergraduate students
- To find out the level of academic interest among the undergraduate students
- To find out the difference between gender, place of domicile and family type with academic interest

Null hypothesis

1. The majority of the respondents would have high level of academic Interest
2. There is no significant difference between gender and academic interest.
3. There is no significant difference between family type and academic interest.
4. There is no significant difference between domicile of the respondents and academic interest

Research design

The research design refers to the overall strategy that you choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data. The present study is to find the level of academic among the undergraduate students the researcher used Descriptive research design.

Sample

The researcher collected data from undergraduate students of a private college in Dharmapuri. The researcher used purposive sampling method to choose the samples. The sample size is 50.

Data collection

The researcher collected the data through the standardized questionnaire from the respondents by using the Academic Interest Inventory by Thara Sebastin.

Statistical techniques used

To analyse and interpret data, the statistical techniques such as mean, standard deviation and 'z' – test were used.

3. Analysis and interpretation of data

For analysis and interpretation of data, the relevant input and analytical findings and inference derived have been presented in different tables and diagrams.

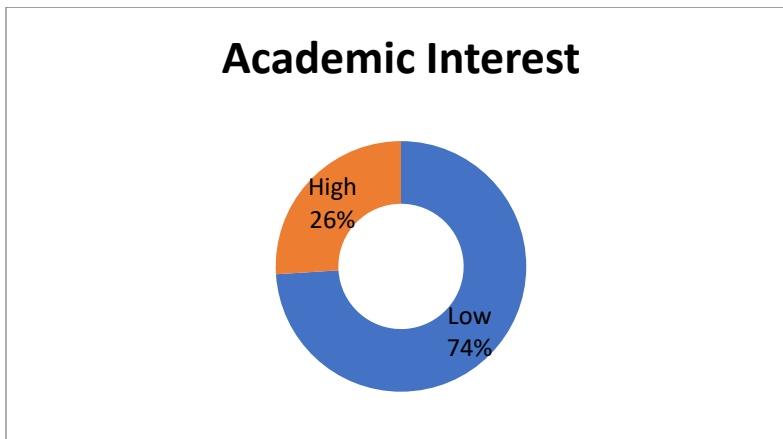


Figure1. Distribution of the respondent's level of academic interest

The above diagram presents the level of academic interest among the graduate students. 74 percent of the respondents have low academic interest and 24 percent of respondents have high academic interest. Hence the hypothesis 1 is disproved. Majority of the students have low level of academic interest.

Table 1. 'Z' test between the gender and level of academic interest

Particulars	Gender	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Academic Interest	Male	27	40.66	10.56	2.03	Z= 0.270 Df= 48
	Female	23	44.30	12.50	2.60	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the gender with the level of academic interest of the respondents. Hence hypothesis 2 is proved that gender has no significant difference in the level of academic interest of the respondents. While analyzing the mean score it is observed that female respondents have more academic interest than male respondents.

Table 2. 'Z' test between the family type and the level of academic interest

Particulars	Family Type	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Academic Interest	Nuclear family	36	41.94	10.40	1.73	Z= 0.701 Df= 48
	Joint family	14	43.35	14.42	3.85	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the family types with the level of academic interest of the respondents. Hence hypothesis 3 is proved that family type has no significant

difference in the level of academic interest of the respondents. While analyzing the mean score it is observed that respondents from joint family have better academic interest than those from the nuclear family.

Table 3. 'Z' test between the places of living and the level of academic interest

Particulars	Family Type	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Academic Interest	Rural	33	43.90	8.90	1.55	Z= 0.183 Df= 48
	Urban	17	39.29	15.27	3.70	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the places of living with the level of academic interest of the respondents. Hence hypothesis 4 is proved that place of living has no significant difference in the level of academic interest of the respondents. While analyzing the mean score it is observed that respondents from rural areas have better academic interest than those from the urban areas.

Findings of the study

- The mean age of the respondents is 19
- 54 percent of the respondents are male while the remaining is female.
- 66 percent of the respondents are from rural areas
- 72 percent of the respondents are from nuclear families.
- 60 percent of the respondents are the eldest among the siblings of the family.
- 74 percent of the respondents have low academic interest and 24 percent of respondents have high academic interest.
- There is no significant difference between the gender with the level of academic interest of the respondents
- There is no significant difference between the family types with the level of academic interest of the respondents
- There is no significant difference between the places of living with the level of academic interest of the respondents.

4. Discussion, Suggestions and Conclusion

Discussion

Majority of the (74 percent) respondents have low academic interest and it is of big concern for the educational institution to make them to get involved in order to get interested in the academic interest. While analyzing the mean score it is observed that female respondents have more academic interest than male respondents. From the mean score it is observed that respondents from joint family have better academic interest than those from the nuclear family. Probably the family environment helps them to realize their responsibilities and then to do their academics well. While analyzing the mean score it is observed that respondents from rural areas have better academic interest than those from the urban areas.

Suggestions

- More of practical oriented learning can be given
- Organize conferences, seminars on practical usages of the theory the students learn in the educational institutions.
- Conduct more exhibitions and make students to participate in them
- Organize more of educational tours and give the students different experiences.
- Motivational programmes can be organized to help them
- Understanding the subjects can be given more importance than relying on memory power alone.

Conclusion

Low interest in academics is becoming very common. The education system of the Tamil Nadu has to seriously think and modify the system from the elementary school onwards. Graduate students of this generation look for technology combined knowledge. May be it is high time that faculties adapt different methodologies to help the students to get interested in the academics. Of course the students have to take personal interest to get motivated to do their academics. The students have to be helped to understand and study rather than giving importance to only the memory power. It is better that they learn most of the concepts in the school through the regional languages.

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Breast Cancer Awareness among the Graduate Students

P. Robert Ramesh Babu*
Sushmita Kerketta**

Abstract

Breast cancer is the malignant tumour (a tumour with the potential to invade other tissues or spread to other parts of the body) that starts in the cells of the breast. It occurs both in men and women. However male breast cancer is rare. Breast cancer is the commonest cancer in women worldwide. The developed countries with a small proportion of the world population account for almost 50% of breast cancers diagnosed worldwide. Breast cancer is the most common cancer in women in India and accounts for 14% of all cancers in women. The incidence rates in India begin to rise in the early thirties and peak at ages 50-64 years. Overall, 1 in 28 women is likely to develop breast cancer during her lifetime. In urban areas, 1 in 22 women is likely to develop breast cancer during her lifetime as compared to rural areas where 1 in 60 women develops breast cancer in her lifetime. For every 2 women newly diagnosed with breast cancer, one woman dies of it in India. In 2018, 1,62,468 new cases and 87,090 deaths were reported for breast cancer in India. Breast cancer awareness programs are more concentrated in the cities and have not reached the remote and rural parts of the country. Women often do not present for medical care early enough due to various reasons such as illiteracy, lack of awareness and financial constraints. Owing to the lack of awareness of this disease and in absence of a breast cancer screening program, the majority of breast cancers are diagnosed at a relatively advanced stage. The aim of the study is to find the level of awareness among college students of Dharmapuri, about knowledge on breast cancer, its risk factors, Self-examination methods, screening procedures and treatment methods.

Keywords: Breast Cancer; Self-examination; Mammography; Graduate students; Awareness

1. Introduction

According to the statistical report of *Globocan database 2018*, an estimate of 162 468 (14%) annual incidences and mortality of 87 090 females of breast cancer were reported in India. Breast cancer today has become the 1st cancer type to effect Indian women of all ages .Many low and middle income countries now face a double burden of breast and cervical cancer which represent top cancer killers in women over 30 years old.

Breast cancer awareness is an effort to raise awareness among people about the unique characteristics of the cancer, causes, symptoms, prevention and treatment to reduce the stigma related to it. Rising general public awareness on the breast cancer problem and the mechanism to control are the key strategies for breast cancer control (WHO). Most studies have also revealed that greater knowledge can help the society be socially aware about the disease and thus decrease the mortality rate.

As early detection is the main key to cure breast cancer, it's the sole responsibility of the individual himself/ herself to identify the early signs of the disease. Breast Self-examination makes a women more "breast aware" which in turn may lead to an earlier diagnosis of breast cancer .Although the cancer usually develops after the age of 45 years, the age of onset is decreasing and more young women's are affected(Gwarzo et al.,).Young women's cancer is generally more progressive and results in lower survival rates which again indicate the aspect of early detection is even more important (Cancer Council, Australia).

In the present scenario breast cancer awareness campaigns have been initiated by lot of agencies and organisations all over the world. The month of October is celebrated as Breast cancer month indicated by the colour pink. A Pink ribbon is usually taken as its symbol which is associated with the use of the pink ribbon.This study on awareness of breast cancer among graduate students mainly attempted to understand the level of awareness about breast cancer and draw necessary inferences to look for new avenues of social work intervention.

2. Research methodology

A study was carried in a group of graduate students in Dharmapuri to determine the awareness of breast cancer among both the male and female. The study area contained graduate students from the background of arts and humanities. The researcher used descriptive research design. A structured and pretested

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questionnaire was adopted and used consisting of both open-ended and closed-ended questions. The research data's were collected through questionnaire method. The samples were chosen by convenience sampling method. The sample size is 77. The main domains of the study were Socio-demographic details, Knowledge on breast cancer awareness, Breast cancer prevention, Knowledge on Breast self-examination and Clinical breast examination and Mammography

3. Findings of the study

Socio-demographic details

A total of 77 respondents participated, the mean belonged to the age group of 19-29 years and 34% were male and 43% were female. 85% of the participants belonged to rural background while only 15% belonged to urban background.

Knowledge on Breast cancer

Out of 77 participants, 72%(n=56) of the participants have heard about breast cancer. The source of information of 54% of the respondents was through media and 40% the respondents got knowledge through lecture. There were also 3% of the respondents whose family members were diagnosed with Breast cancer.

Breast self-examination knowledge and practise

Out of all the participants 54% of them have heard of Breast self-examination and also agrees that it is a useful tool for early detection of cancer. Only 22 % of them have been taught to do Breast self-examination. 17% of the respondents knew that BSE had to be done monthly.

Clinical breast examination

60% of the respondents have not heard of clinical breast examination out of which 45% of the respondents have no idea on how it's done.

Knowledge on mammography

Only 44% of the participants have heard about mammography. 65% of them had no idea of how frequently and from which age it should be done. Only 1% of the respondents knew that mammography has to be done yearly after 40 years of age.

Discussions

From the above statistical data it is clear that 72%of the respondents are aware of breast cancer. But when proceeding further to a breast screening, Clinical breast examination and mammography the level of knowledge is very low where only 54% respondents are aware of breast self-examination. While only 15% practise BSE monthly. The study revealed that there is a huge gap between the level of awareness and their level of education. Huge disparity can also be seen among the respondents who know Breast self-examination but don't practise it. Breast cancer is the abnormal development of cells in the breast tissue. Also known as carcinoma of breast, the cancer not only affects the females but also the males. However male breast cancer is very rare.

The breast is an integral part of the body. The main function of the breast is to produce milk. A mature breast is mainly made up of connective tissues, fat and lobules which produce milk. In the normal breast tissue there consist millions of cells which forms, divides and dies in an orderly manner. The process is called apoptosis. But when the cells are affected by abnormal cell development the cell become cancerous and becomes insensitive to the growth inhibitors resulting in uncontrolled growth of cells of its kind. When cancerous cells starts to grow the most common and simple symptom usually is a formation of tumour which may not be painful. Hence it's very important for a person to be aware of one's breast and examine it often. Tumours whether benign or malignant can easily be detected through Self-examination of the breast. Most of the breast cancers are invasive or metastasis which means it has the ability to spreads quickly to neighbouring as well as. If not aware of the tumour it can increase its size and may spread to the armpit, collar bone and other parts of the body.

Social work intervention

The requirements to prevent the disease and the role of social workers fit very appropriately. Social workers

- ✓ Translation of information's on breast cancer into regional language and distribute to the people to create more awareness.
- ✓ Organise conferences, seminars and interactive sessions on Breast cancer in educational institutions. This can be started from the undergraduate student group onwards
- ✓ Identification of women groups and self-help groups, working women hostels and workplaces to educate them on breast cancer.
- ✓ Door to door campaigns can be arranged to create awareness with the help of the student volunteers.
- ✓ Through the usage of social media reach as many people possible to spread the awareness.

4. Conclusion

Indian women need a lot of awareness about breast cancer. They need to be given more knowledge on the risk factors so that preventive measures can be undertaken. There is an urgency that we need to give breast cancer awareness to nationwide, state wise, district wise and community wise. It has to join hands with Ngos, CBOs and volunteers to take this awareness to every part of India. Many training centres have to be established. More of informations about the risk factors have to be put in the regional languages and distributed to people to work on preventive measures. Through colleges and schools the breast cancer literacy has to be given. Better health care has to be established in every state and districts. Students of nursing and medicines have to be given the option to go to the rural areas to spread awareness on health issues. If all of us put our heart, mind and energy to fight against breast cancer definitely one day we can achieve breast cancer free India. Let everyone join together to spread awareness on breast cancer.

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General Well-Being Among Female College Going Students, Dharmapuri

B. Kayiphro Lydia¹, Robert Ramesh Babu. P² & Sushmita Kerketta³

Abstract

Well-being generally includes global judgements of life satisfaction and feelings ranging from depression to joy. In simple terms, well-being can be described as judging life positively and feeling good. Shin and Johnson (1978), “a global assessment of a person’s quality of life according to his own chosen criteria.” Goode (1985) studied general well-being, specifically a health behavioural database among students in selected predominantly black colleges and universities. The results indicated that there was no significant relationship between age with well-being and health behaviour. Moorjani and Geryani (2004) conducted a study on college students of different faculties as science, commerce and arts. Results revealed that students of different faculties have a significant difference in their life satisfaction and general well-being, but there is no significant gender difference regarding life satisfaction and general well-being. The present study explores factors that influence the general well-being of college-going women students. The study is descriptive in nature. The sample of this study comprised of 100 college students, of a homogeneous group. Tools used for data collection is Well-being Scale developed by Jag Sharanbir Singh and Dr. Asha Gupta, (2001). It is a 5- point scale containing 50 statements with five dimensions namely Physical Well-being, Mental Well-being, Social Well-being, Emotional Well-being and Spiritual Well-being.

Keywords: Well-being, College Students, Physical Well-being, Mental Well-being, Social Well-being, Emotional Well-being and Spiritual Well-being.

Introduction

The concept of well-being originated from positive psychology. The term ‘well-being’ specifies the diversity of goodness e.g. to live in a good environment, being worthy, and how we are doing as individuals, being happy etc. (Singh and Shyam, 2007). Sociologist uses the word ‘well-being’ mainly in the sense of ‘good living conditions’; ecologists and biologists in a sense of ‘survivability’ and politicians and social reformers refers to consideration of what a good living environment is like, such as high life satisfaction, a sense of meaning and purpose and social fairness (Veenhoven, 2004). It is a progressive state characterized by the quality of life and prosperity, of agreement between an individual’s capacity, requirement and belief, environmental demands and a chance to grow and change (Levi, 1987).

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Archer, Probert and Gage (1987) define well-being as the process and state of the search for highest human functioning that involves overall well-being of body, mind and spirit. Hatfield and Hatfield (1992) view well-being as the intentional and mindful process by which people are actively involved and increase their overall well-being - intellectual, physical, social, emotional, occupational and spiritual. General well-being is defined as the personal feeling of satisfaction, pleasure, the fulfilment of life accomplishment and of one's part in duty, success, usefulness, acceptance with no anxiety, discontentment, disturbance etc. (Verma et al., 1989). General well-being refers to the friendly working of the physical as well as psychological part of the personality, giving contentment to self and advantage to the community (Siwach, 2000). In general well-being, the main importance is given to the health because health is the concerning factor of a person in every aspect. It is a level of working and the organic process, absolutely human.

REVIEW OF LITERATURE

Kaur (2007) found that university students have an average level of well-being and there are no notable gender dissimilarities in their well-being.

Moorjani and Geryani (2004) carry out a study on college students of various departments such as science, commerce and arts. Results revealed that students of various departments have a significant difference in their life satisfaction and general well-being, but there is no significant gender difference regarding life satisfaction and general well-being.

Harri (1993) inspect the mental well-being of a nurse instructor at work. He used a self-assessment questionnaire to assess the mental well-being of 83 female nurses. 68% of subjects claimed that they were highly valued or quite fairly at work. Age, marital status, type and length of education and professional experience were not related to mental well-being assessment.

Wood et al. (1991) describe that men and women differ in emotional/affective measures of subjective well-being; women are reported to have higher emotions.

Archer et al. (1987) discover that physical proportion of health was considered as having the greatest effect on overall wellness.

Koonce (1986) examine the effects of a form wellness programme on the physical and mental well-being of public faculty. He observed that there were no significant differences for any mental well-being measure.

Andrews and Parks (1985) demonstrate that psychological and physical well-being are interdependent. If one gets worse, the other will ultimately be affected. Sound psychological well-being is necessary for good physical well-being and viceversa.

Turbow (1985) aimed to study to discover the connection of exercise to academic attainment and sense of well-being among college students at California State University. He notices that exercise was not, however, notably related to satisfaction with various aspects of life to an overall sense of well-being. But students who were engaged in aerobic exercises (e.g. jogging and swimming) were considerably higher than others to be highly satisfied with themselves and their lives and have a higher overall feeling of well-being.

Jodhoda (1958) propose that the existence of overall well-being is a function of occurrence in all significant features of life such as family, community, vocation and work.

METHODS AND MATERIALS

Examining the general well-being among female college going students of Dharmapuri was the major aim of this study. Describing the socio-demographic characteristics of the respondents, measuring the general well-being among the respondents and to find out whether the discipline of education of the respondents affects their general well-being were the objectives of the study

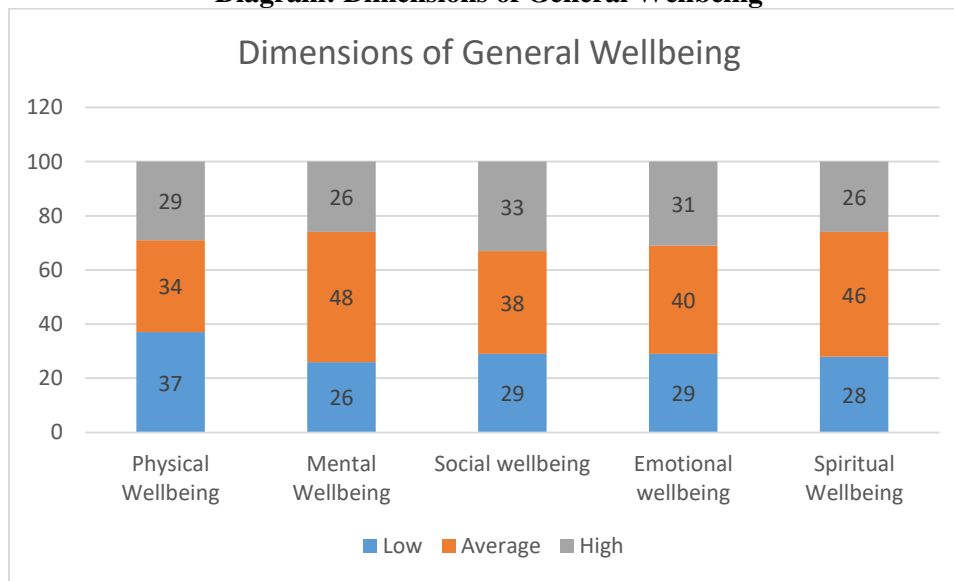
Descriptive survey method was used for this study. The investigator has selected a sample of 100 female college-going students out of 332 female college going students of a private college in Dharmapuri, from both undergraduate and postgraduate by simple random sampling using the lottery

method. For collecting the data, well-being scale was used which was constructed and standardized by Jag Sharangir Singh and Dr. Asha Gupta (2001). The scale consists of 50 items represented by five subscales: physical well-being, mental well-being, social well-being, emotional well-being and spiritual well-being. It is a five-point scale ranging from ‘not so much’, ‘to some extent’, ‘average’, ‘rather so much’, ‘very much’. The collected data were analyzed by using SPSS.

ANALYSIS OF DATA

The research analysis reveals that the mean age of the respondents is 18 years, the majority (80 percent) of the respondents were undergraduate students and meagre (20 percent) of the respondents were postgraduate students. More than half (52 percent) of the respondents were from arts streams and less than half (48 percent) of the respondents were from science streams. The vast majority (86 percent) of the respondents were unmarried while meagre (14 percent) of the respondents were married. The majority (72 percent) of the respondents were from the nuclear family and remaining more than one fourth (28 percent) of the respondents were from joint family. The majority (63 percent) of the respondents were Hindu while less than half (36 percent) of the respondents were Christian and remaining meagre (1 percent) of the respondents were Muslim. Less than half (46 percent) of the respondents belong to MBC, while less than half (39 percent) of the respondents belong to BC and meagre (8 percent) of the respondents belongs to SC/ST. The remaining meagre (7 percent) of the respondents belong to OC.

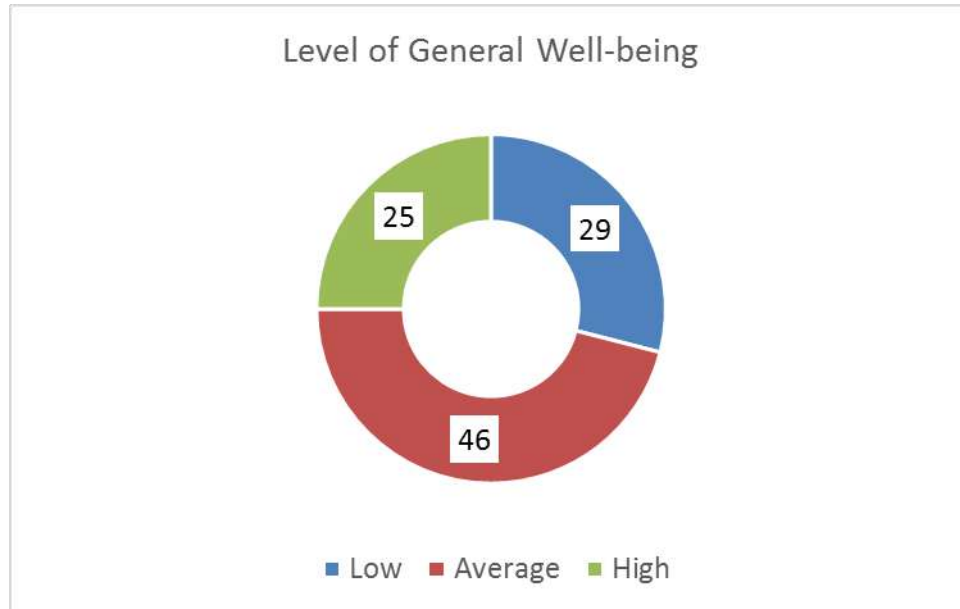
Diagram: Dimensions of General Wellbeing



While analyzing the dimension of general well-being, less than half (37 percent) of the respondents have low level of physical well-being whereas less than half (34 percent) of the respondents have average level of physical well-being and remaining more than one fourth (29 percent) of the respondents have high level of physical well-being. Less than half (48 percent) of the respondents have an average level of mental well-being whereas more than one fourth (26 percent) of the respondents have a high and low level of mental well-being. Less than half (38 percent) of the respondents have an average level of social well-being and less than half (33 percent) of the respondents have a high level of social well-being and remaining more than one fourth (29 percent) of the respondents have a low level of social well-being. Less than half (40 percent) of the respondents have an average level of emotional well-being whereas less than half (31 percent) of the respondents have a high level of emotional well-being and more than one fourth (29 percent) of the respondents have a low level of emotional well-being. Less than half (46 percent) of the respondents have an average level of spiritual well-being while more than one fourth

(28 percent) of the respondents have a low level of spiritual well-being and remaining more than one fourth (26 percent) of the respondents have a high level of spiritual well-being.

DIAGRAM: RESPONDENTS LEVEL OF WELL-BEING



The overall general well-being reveals that less than half (46 percent) of the respondents have an average level of general well-being while more the one fourth (29 percent) of the respondents have a low level of general well-being and remaining one fourth (25 percent) of the respondents have a high level of general well-being.

FINDINGS RELATED TO KEY VARIABLE

Table: Student T-Test between the Respondents Discipline of Education and Various Dimensions of General Well-Being.

Dimension	Discipline of education	N	Mean	Std. Deviation	Statistical inference
Physical well-being	Arts	52	33.0385	4.57170	t=0.321 Df=98 P > 0.05 Not Significant
	Science	48	33.4585	3.83688	
Mental well-being	Arts	52	29.2692	5.99057	t=0.882 Df=98 P > 0.05 Not Significant
	Science	48	30.6667	5.11291	
Social well-being	Arts	52	36.8654	4.28417	t=0.185 Df= 98 P>0.05 Not Significant
	Science	48	36.2917	4.57541	

Emotional well-being	Arts	52	30.2115	6.67549	t=0.04 Df=98 P<0.05 Significant
	Science	48	27.2292	5.87544	
Spiritual well-being	Arts	52	38.7308	7.22228	t=0.635 Df=98 P>0.05 Not Significant
	Science	48	40.2917	4.58470	
Overall well-being	Arts	52	168.1154	15.64264	t=0.926 Df=98 P > 0.05 Not Significant
	Science	48	167.9375	14.08697	

There is a significant difference between the discipline of education and emotional well-being. When the mean scores are compared arts students (M=30.2115) are better than science students (M=27.2292) in their emotional well-being. This may be due to the fact that their education system helps them to boost their emotional well-being. There is no significant difference between the discipline of education in their general well-being and its dimensions such as mental well-being, social well-being, spiritual well-being and overall general well-being.

FINDINGS AND DISCUSSION

The study reveals that the overall general well-being of the female college students is average and while analyzing the different dimensions separately it is found that the mental well-being, social well-being, emotional well-being and spiritual well-being are average whereas the physical well-being of the students is found to be low. So, certain methods must be taught to the students to take care of the physical health like regular health check-up to be given importance to understand their physical health status, emphasis to be given on intake of proper diet and healthy food, personal hygiene, regular exercise and sufficient sleep. Certain measure must also be initiated to increase the mental, social, emotional and spiritual well-being through building of self-confidence by helping them to participating in various activities and programs, teaching them how to initiate conversation with people in and around, boosting up their self-esteem by recognizing and appreciating their effort, teaching how to cope up with daily stressors of life. The management must also take up program regarding well-being for college students to increase a better understanding of the importance of well-being to improve their general well-being.

CONCLUSION

College students and general well-being are interrelated. The student's in order to do well in college need to have good well-being and without having good well-being there is no college for the students. Students faced lots of stress and pressure with regard to studies, competition, getting into good universities and meeting the expectation of parents and if they are not able to meet all the demands it affects their well-being. So colleges must not only focus on educating the students but also taught them how to maintain a balance between student's life and their overall well-being.

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Exploring Secure image transmission techniques in Cloud-IoT

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Abstract - With the advancement in technology and internet everywhere, a large number of user data is getting generated everyday from fields such as social networking sites, health care, e-commerce etc. Enterprise software has seen a considerable growth with the Government agencies, banks and other organizations adopting them for their operations. The data getting generated is then used for data analytics in many cases to study the behavior of the business and predict the future. Especially the multimedia data are the most outsourced one to the cloud server rapidly. This paper presents the analysis of secure image transmission techniques proposed by different authors and summarizes the scope for the research area.

Keywords - Steganalysis, Cloud-IoT, HSC, PSNR, FUSPN

1. INTRODUCTION

The huge data that is getting generated is causing many security issues as well. A major concern is about the private data, especially multimedia data (video, audio, image) because of its large size and rich semantics. As a result concerns regarding security, scalability and manageability of existing systems become more acute as current solutions may not satisfy the demands of multimedia communications. On the other hand in the last few years large volumes of multimedia data are outsourced to the cloud to better serve mobile applications. Along with this trend, highly correlated datasets can occur commonly, where the rich information buried in correlated data is useful for many cloud data generation/dissemination services. To meet such demands cloud computing technology has emerged as a potential solution. The exponentially up surging demands have revitalized the use and further exploration in cloud computing technologies. A large amount of data are uploaded and stored in remote public cloud servers which cannot fully be trusted by users. Especially, more and more enterprises would like to manage their data by the aid of the cloud servers. However, when the data outsourced in the cloud are sensitive, the challenges of security and privacy becomes urgent for wide deployment of the cloud systems. Cloud assisted information sharing and/or communication has become the source of billion dollar investment and multibillion dollar income. Enforcing proper security measures on the information has therefore become vital. Once the information or the content is acquired by miscreants, it can be easily modified by employing some specific software tools and further, can be claimed by them as their own work which is definitely an unbearable act. It is following this idea that many security algorithms have mushroomed to the occasion in a considerable quicker period of time. The scope of data security is so vast because of the huge amount of multimedia data that are generated every day. Social media and entertainment, surveillance footages, consumer multimedia data etc. are all in need of security measures and policies in place to protect their data from unauthorized access. As a result, data security needs a lot of research and development. On the other hand, in the last few years the emergence of Wireless communication technologies and allied BigData paradigm has given rise to a new horizon called Internet of Things (IoTs). Thus, the strategic and well planned employment of Cloud Technology and IoT has broadened the horizon of multimedia data communication.

However, IoT devices or sensors collect real-time data such as images or video data often remains vulnerable to get manipulated during transmission, and therefore developing certain robust and efficient secure (image) data communication paradigm is must. It can be stated as one of the key driving force behind the current research proposal and allied intends. There are some security approaches in existence, such as location-based access control, encryption, cryptography, classical steganography etc. However, these approaches as standalone technology can't achieve success in enabling optimal security to the data communication over uncertain network channels, which is common these days, especially in IoT ecosystems where there can be numerous autonomous operating nodes or sensors. Numerous literatures have revealed that unlike classical standalone systems (i.e., either cryptosystem or steganography) the use of multiple security paradigms or the combination of both Steganography and Cryptosystem can be of utmost significance to augment security feature. Here, cryptosystem can function as a supplementary level

of security thus making overall system robust and seamless during communication. However, very fewer efforts have been made on optimizing trade off amongst security, computational complexity, time and performance. In addition, there is not efficient effort made so far to enable Hybrid-Crypto-Steganography model robust to alleviate attack like perception or entropy sensitive secret data sensing (one example is in-channel RS attack). Such attacks can make overall communication system limited.

On the other hand, real-time image data communication across IoT ecosystem though Cloud infrastructure or components requires optimal Quality communication and processing efficiency for which the enhanced technologies such as low-bit demands cryptosystem, lightweight cryptosystems, loss less and high performing wavelet transformation techniques, entropy resilience model etc are must. With these all motivations, the intention is to propose a research on a novel Hybrid Crypto-Steganography system (enhanced Secret-Key-Steganography) for real-time data communication. Unlike classical approaches the focus is made on augmenting multiple level processes (optimization) by applying an enhanced lightweight cryptosystem, efficient wavelet transform (for Quality-perseverance and effective reversible data hiding (RDH) for privacy preserving), and entropy (say, cloud attack resilient) resilient pixel adjustment process. This system could accomplish not only optimized security provision for the multimedia data, but can also achieve optimal trade-off between performance and computation, which is inevitable for real-time applications such as multimedia data communication over cloud infrastructure. The rest of the paper is structured as follows: section 2 discusses the related works; Section 3 explores the critical analysis of the literature. Finally, Section 4 concludes the paper.

2. RELATED WORKS

The existing works in secure image communication in cloud and networks are summarized in this section. (Xue, X. Li, & Z. Guo, 2015) proposed the SDCS-based content adaptive steganography in which the noisiest pixels are first determined according to an iterative noise-level estimation mechanism and then, the secret data is embedded into these noisy pixels using SDCS steganography. Further, Vipula et al (Wajgade, I 2013) proposed the combination of different data security approaches with encryption and steganographic techniques for secret communication by hiding it inside the multimedia files and even implemented AES algorithm to make the steganography more secure and robust.

Similarly, Duluta et al (Duluta, S. Mocanu, & R. Pietraru, 2017) highlighting the different limitations of encryption proposed a combination of encryption with image based steganography in order to offer similar robustness as offered by advanced encryption algorithms such as RSA, AES or DES but with lower resource needs. Further, (Panchal, 2015) proposed a two-phase security of images by using encryption & steganography. In phase-I, encryption is used for converting the input image into cipher image with the help of encryption key in conjugation with Chirikov mapping for encryption of image. In phase-II, steganography is used for hiding the encryption key of phase-I into cipher image. (Leung & Hou., 2015,) proposed a method called unequal security encryption, which applies multiple encryption methods (with different security strength and processing time) to encrypt different parts of the media (with different importance). This method can provide better security protection subject to the given computing resources for encryption. Discussing the video fingerprinting (Li, X. Guo, Y. Yu, Q. Tu, & A. Men, 2014) proposed an efficient and robust video fingerprint based on region of interest (ROI) and clustering. ROI is extended as basic unit for extracting video fingerprints.

Unlike the above approaches implementing steganography, Ahmed (Ahmed & O. O. Khalifa, 2014) proposed a scheme that allows the sender to select a suitable cover and secret message that decidable to transmit through unsecure channel and then encrypt the message using (ECC) and embed it by (LSB) into selected cover. Further, with an aim to achieve high secure level and high non-perceptibility level Hajduk, (Hajduk, M. Broda, O. Kovac, & D. Levicky, 2016) proposed image steganographic method that is responsible for embedding of encoded secret message using Quick Response Code (QR) code into image data. Mukhedkar (Mukhedkar, P. Powar, & P. Gaikwad, 2015) discussed the different algorithms associated with cryptography such as DES, 3DES, AES, Blowfish Algorithm etc. and performed image encryption using Blowfish Algorithm as it is faster and has good performance and for image hiding exploited LSB technique as it is faster, simple and Bit manipulated. They also proposed a hybrid approach of image encryption and image hiding in order to provide higher security.

Similarly, Alam (Alam, 2017) addressed the security and privacy of user and wireless infrastructure and proposed McEliece cryptosystem to encrypt or decrypt the data to improve the security and privacy. Further (Kumar & S. Agrawal, 2014) stated that there are many cryptographic algorithms for securing multimedia data like images, but they have some advantages and disadvantages and hence proposed a symmetric key cryptography algorithm for color 3D images; this algorithm employs a different type of key generation method. (Sharma & D. Sharma, 2016)

proposed a secure and speedy technique for the cryptography of the speech signal and also performed steganography of the key pairs generated while encrypting the speech signal which is then sent to the receiver. (Wang, J. Liu, W. Wan, J. Sun, J. Bo, & Y. Liu) stated that watermark can be embedded into the videos when they are uploaded to the server in order to protect the copyright. Such embedded watermark is able to be extracted on the client to determine copyright information after requiring a video from the server and playing it. (Zaher, 2015) developed a technique for secure communication that aims on augmenting classical Chaotic Shift Keying (CSK) methods. The secret data are hidden within the chaotic transmitter states that can change among four different chaotic attractors such that binary information is effectively diffused. They also implemented a cryptography algorithm to change the transmitter parameters such that they have a quadruple form; thus, breaking into the public communication channel using return map attacks will fail. (Hossain, M. T. Rahman, A. B. M. S. Rahman, & S. Islam, 2014) stated that there are a lot of image encryption algorithms based on chaotic maps have been proposed some of them are time consuming and complex some have little key space and hence proposed a non-linear 3D chaos based simple encryption technique where for the first time 3D chaos is used for position permutation and value transformation technique. To protect multimedia information system (Saxena, D. Shahane, S. Rai, & R. Boghey, 2017) proposed an image data protection technique using the combination of data security such as encryption technique and digital watermarking.

(Gupta & R. Jain, 2015) applied Discrete Wavelet Transform (DWT) on input image to divide it into four sub band, working on low frequency band and stated that after hiding the text information the picture was compressed for reducing the memory using DWT and for recovering the original image the Inverse Discrete Wavelet Transform (IDWT) was used to get a secret code back which we use Decryption technique. Taking into consideration the uniqueness of combining cryptography with steganography Torvi (Torvi, K. B. ShivaKumar, & R. Das) proposed an Unique Data Security using Text Steganography (UDSTS) to build a system that is able to transmit and receive encrypted messages embedded in rich text Format: *.DOC, *.RTF, EMAIL /Message Body/, etc. (Rashmi & K. Jyothi, 2018) stated even though methods, cryptography and steganography provide security, to add multiple layers of security it is always a good practice to use Cryptography and Steganography together. Phadte (Sarairoh, 2013) proposed to provide security to 24 bit color images, by combining Steganography and Cryptography. They exploited randomized LSB based method to hide an image in another image and then encrypted the resulting stego image using chaotic theory. Further, Sarairoh (G. Sateesh, March 2016) proposed a system employing cryptographic algorithm together with steganography using the filter bank cipher to encrypt the secret text message, followed by DWT based steganography to hide the encrypted message in the cover image by modifying the wavelet coefficients. (G. Sateesh, March 2016) developed secure key steganography model by integrating cryptography and steganography along with the exploitation of SDES algorithm in Cryptography for data Encryption and Decryption, LSB cipher text embedding into image. (Laskar, September 2012) stated that the main purpose in cryptography is to make message concept unintelligible, while steganography aims to hide secret message and proposed a method of combining steganography and cryptography for secret data communication. They proposed a high-performance JPEG steganography along with a substitution encryption methodology and exploited the discrete cosine transform (DCT) technique which is used in the frequency domain for hiding encrypted data within image. However, authors could not address the increased entropy scenario that could provide a broadened horizon for cryptanalysis and allied attack probability.

Highlighting the difference between cryptography and steganography, (Kumar L., 2012) stated that the contents of secret message are scrambled in cryptography, where as in steganography the secret message is embedded into the cover medium and hence presented a generalized model by combining cryptographic and steganography technique. For cryptography they exploited advanced encryption standard (AES) algorithm to encrypt secret message and then alteration component method to hide encrypted message. (Saleh, A. A. Aly, & F. A. Omara, 2015) to design stego-crypto model modified the Advanced Encryption Standard (AES) algorithm to be used for encrypting the secret message which was then processed for hiding in the cover image (J. Joshi, K. Nair, M. Warde, & V. Rawalgaonkar J, 2016). Ashwini (. & P. S. Venugopala, 2017) and Joshi too used a hybrid approach of cryptography, compression and steganography, all three together for performing data security. Further, Joshi worked on audio data security and revealed that Packet Forger generates multiple packets with scrambled and modified encrypted content present in all of these packets can confuse the attacker and hence provides an additional level of security. (S. Pleshkova & Kinanev, 2017) proposed a special methodological approach to design and implement Public Key Infrastructure (PKI) in order to secure the transmission of audio information and protect it from unauthorized access through encryption. Emphasizing on the video security, Pai, (Pai, M. E. Raghu, & K. C. Ravishankar, 2014) proposed the usage of encryption methodologies to encipher video file in a time and space efficient manner. They applied region permutation techniques followed by application of AES and DES on the mp4 video files.

3. CRITICAL ANALYSIS ON LITERATURE REVIEW

In this section the critical analysis of the literature review is presented.

Author	Description	Limitation
Xue (Xue, X. Li , & Z. Guo, 2015)	SDCS-based content adaptive Steganography	Anyone Can't be suitable for high rate data transmission which is vital for major current day applications. In addition, it applies single layer of security which often has the risk of attack.
Vipula (Wajgade, 1 2013)	Encryption and steganographic techniques	Could not address the key issues of signal quality and imperceptibility which is must for current day applications.
Duluta, (Duluta, S. Mocanu, & R. Pietraru, 2017) Sharma [12] Torvi [18]	Secure Key Steganography for image data	Authors focused only on image type of data; though it needs further verification for computational efficacy and performance trade off under different test conditions
Panchal (Panchal, 2015)	Two-phase security of images by using encryption and steganography	Authors focused only on image type of data; though it needs further verification for computational efficacy and performance trade off under different test conditions. Didn't address imposed-entropy and histogram distortion cases.
Leung (Leung & Hou., 2015.)	Unequal security encryption, which applies multiple encryption methods	Primarily focuses on augmenting only cryptosystem and hence required further enhancement in signal preservice in steganography.
Li (Li, X. Guo, Y. Yu, Q. Tu, & A. Men, 2014)	video fingerprint based on region of interest (ROI) and clustering	Not suitable for high rate data transmission under uncertain channel condition.
Ahmed (Ahmed & O. O. Khalifa, 2014)	ECC assisted LSB embedding	Was mainly focused on image data hiding
Hajduk (Hajduk, M. Broda, O. Kovac, & D. Levicky, 2016)	Image steganographic method using Quick Response Code (QR)	Could have augmented to make effective for multimedia data
Mukhedkar (Mukhedkar, P. Powar , & P. Gaikwad , 2015)	Blowfish Algorithm	Main focus was made on cryptosystem enhancement and other aspects of real-time multimedia transmission were not addressed.
Alam (Alam, 2017) Kumar et al (Kumar & S. Agrawal, 2014) Ashwini Joshi (J. Joshi, K. Nair, M. Warde, & V. Rawalgaonkar J, 2016; . & P. S. Venugopala, 2017)	McEliece cryptosystem Symmetric key cryptography algorithm for color 3D images	Main focus was made on cryptosystem enhancement and other aspects of real-time multimedia transmission were not addressed.
Wang (Wang, J. Liu, W. Wan, J. Sun, J. Bo, & Y. Liu)	Embedded watermark	Watermark based approaches are confined and can't be recommended for real time streaming data communication.
Zaher (Zaher, 2015)	cryptography algorithm	Main focus was made on cryptosystem enhancement and other aspects of real-time multimedia transmission were not addressed
Hossian (Hossain, M. T.	Non-linear 3D chose based simple	Could not address the key problem of

Rahman, A. B. M. S. Rahman, & S. Islam, 2014)	encryption technique	computational overheads and signal quality preserving, especially for video or audio.
Saxena (Saxena, D. Shahane, S. Rai , & R. Boghey, 2017)	Encryption technique and digital watermarking	Watermark based approaches are confined and can't be recommended for real time streaming data communication
Gupta (Gupta & R. Jain, 2015)	DWT and Inverse DWT	Here, authors focused mainly on enhancing image decomposition and further compression. Imperceptibility could not be addressed which is important for multimedia communication over cloud infrastructure
Saraireh (G.Sateesh, March 2016)	Cryptographic Algorithm together withsteganography,followed by filter bank cipher and DWT	It required major optimization especially for cryptosystem and then signal quality preservance as their applied method might
Sateesh (G.Sateesh, March 2016)	Integration of cryptography and steganography along with SDES algorithm	Requires optimization, especially in cryptosystem (higher computational efficiency while preserving signal quality over uncertain attack prone channels or cloud infrastructures).
Laskar (Laskar, September 2012)	Integration of cryptography and steganography accompanied with JPEG steganography and DCT techique	Unlike DWT based wavelet transform authors applied DCT. Though, its use for real time streaming multimedia data as usual found in cloud infrastructure seems limited
Kumar (Kumar L. , 2012)	Combination of cryptograph and steganography along with AES algorithm.	Here, authors applied AES as cryptosystem even though it requires optimization in computational efficiency for multimedia data types.
Pleshkova et al (S. Pleshkova & Kinanev, 2017)	Public Key Infrastructure (PKI)	Focus was made mainly on the PKI development; though data security under uncertain network or channel condition could not be addressed
Pai (Pai, M. E. Raghu , & K. C. Ravishankar, 2014)	encryption methodologies	Main focus was on cryptosystem for data security,

4. CONCLUSION

The critical analysis has intended to emphasize on accomplishing a novel and robust secure image data transmission scheme to be incorporated over Cloud-IoT under network or channel uncertainty conditions. To achieve it numerous augmentation efforts have been targeted to be made such as augmentation or optimization of the classical steganography techniques for secure image data transmission, RDH enhancement, enriching steganography with a supplementary layer of security provision such as cryptosystem, EC assisted steganalysis to avoid Cloud attack types such as RS attack, and the development of a robust light weight cryptosystem to enable optimal multimedia data transmission over Cloud-IoT ecosystem. On the other hand, considering the use of security models for cloud based infrastructures, the focus is made on maintaining an optimal tradeoff between computational cost as well as overall efficiency. Summarily, the ultimate goal is to develop a robust and efficient Crypto-Steganography mechanism for image data transmission over Cloud-IoT infrastructure.

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Lightweight Feistel structure based hybrid-crypto model for multimedia data security over uncertain cloud environment

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Abstract

The exponential rise in software computing and internet technologies have broadened the horizon of cloud computing applications serving numerous purposes like business processes, healthcare, finance, socialization, etc. In the last few years the increase in security breaches and unauthorized data access has forced industry to achieve computationally efficient and robust security system. The increase in multimedia data communication over different cloud applications too demands an efficient security model, which is expected to have low computational complexity, negligible quality-compromise and higher security robustness. Major conventional security-systems like cryptography and steganography undergo high computational overhead, thus limiting their potential towards cloud-communication where each data input used to be of large size and a gigantic amount of multimedia data is shared across the network. To alleviate above stated problems and enable a potential solution, in this paper a highly robust Lightweight Feistel Structure based Substitution Permutation Crypto Model is developed for multimedia data security over uncertain cloud environment. Our proposed model applies substitution permutation crypto concept with Feistel structure which performs substitution-permutation over five rounds to achieve higher confusion and diffusion. To retain higher security with low computation, we applied merely 64-bit block cipher and equal key-size. MATLAB based simulation revealed that the proposed lightweight security model achieves better attack-resilience even maintaining low entropy, high-correlation, and satisfactory computation time for multimedia data encryption. Such robustness enables our proposed security model to be applied for real-world cloud data security.

Keywords Multimedia data security · Cloud computing · Hybrid cryptosystem · Feistel structure · Substitution and permutation network

1 Introduction

The exponential rise in software technologies and sophisticated hardware platforms has broadened the horizon for highly integrated services and solutions to serve varied socio-industrial demands. In the last few decades, multimedia communication and allied information exchange has

gained wide-spread attention. Similarly, the fast-increasing internet technologies too have broadened the horizon for new computing environment like cloud computing, internet-of-things (IoTs), etc. Undeniably, the large numbers of internet enabled applications or the communication systems are generating huge data everyday to provide corresponding solutions such as social networking sites, healthcare purposes, e-commerce, scientific communities, financial sectors and other industrial demands like surveillance and security systems. Social media and entertainment, surveillance footages [1–3], consumer multimedia data, IoT assisted communication environment [2, 4–7] demand potential security solution and policies to protect their data from unauthorized access. Similarly, enterprise software has also witnessed significant growth across the industries, government agencies, banks and other organizations, which generates and communicates data

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(including multimedia data) in large volume. On the contrary, in the last few years, the adversarial efforts have increased significantly forcing industries to achieve secure data communication over the different ecosystems including IoT and cloud-infrastructures [1–5, 8–10]. Functionally, the amalgamation of the different data sources and allied voluminous data aggregation has given rise to the technology named cloud computing. Cloud computing enables different stakeholders to access data, making real-time computation and decision using cloud infrastructure irrespective of location or geographical boundaries. The prominent concern in cloud computing is the data security [2, 8]. More importantly, ensuring data security with low computational complexity, high time-efficiency with uncompromised multimedia data quality has been the key driving force for research communities [1, 2, 5, 6]. To avoid security breaches a number of efforts have been made; however, the major at-hand approaches function either by introducing data-access security models or infrastructure security or by implementing certain on-data security features [8]. Researchers have proposed security models in which the user requires getting authenticated before accessing the data (access-control), or the data itself is processed in such manner that it is communicated as a hidden content without revealing to the unauthorized users (Ex. Steganography).

Towards major multimedia data security approaches, steganography and cryptosystems are the most used methods [9, 10]; however, their robustness as standalone solution has remained questionable. Majority of the classical cryptosystems like RSA, AES, ECC, homomorphic models etc., consume significantly high computation due to higher key size. Though, higher key size hypothesizes to have higher attack-resiliency; however, at the cost of increased computational overhead. On the other hand, the recent events of the attacks like brute-force attack, impersonation attack etc., have put question on their robustness. Though, a few researches have suggested applying high bit-size to confuse the attacker, the computational cost of such approaches can't be denied. These facts alarms requirement of a more robust and computationally-efficient (say, lightweight) security system. With this motive, in this paper a highly robust and lightweight cryptosystem is developed which amalgamates the robustness of substitution-permutation (SP) concept and Feistel structure. The use of Feistel structure enables better confusion and diffusion while maintaining equivalent encryption and decryption which eventually helps retaining lower computational cost with higher attack-resiliency. The proposed Lightweight Hybrid SP-Feistel Crypto-Model embodies symmetric key-block cipher constituting 64-bit key size, which makes it computationally more efficient even without compromising with the level of security. Additionally,

we introduced a novel Key-Expansion Block Function (KEBF) which helped in retrieving five distinct keys over five rounds to introduce higher level of confusion and diffusion towards higher attack-resilience. To process confusion and diffusion (CDF) our proposed model executed KEBF for five rounds where for each round 4-bit of data was processed at a time. It enabled computational efficiency to handle multimedia data even of the large size and volume. The overall proposed model was developed using MATLAB 2019b, where its efficiency was assessed over the multimedia data of the different sizes. The performance assessment was made in terms of histogram analysis, correlation assessment, entropy, computation-time, Number of Changing Pixel Rates (NPCR) and the Unified Average Channel Intensity (UACI). Additionally, we examined robustness of the proposed security model qualitatively, where it was found suitable to avoid attacks like weak-key combination attack, square attack, regular and singular attacks (say, steganalysis), etc.

The remaining sections of the presented manuscript are given as follows. Section II discusses the related work, which is followed by the discussion of problem formulation in Section III. Section IV presents the overall proposed system and its implementation, while the simulation results are discussed in Section V. Conclusion of the overall research is given in Section VI.

2 Related work

Xue et al. [11] proposed content adaptive steganography, where the secret data was embedded into the noisiest pixels. Vipula et al. [12] combined AES crypto-algorithm with steganography to hide secret data within the cover multimedia images. Unlike [11], Lokesh [13] used alteration component method to hide AES encrypted message within the cover image. Saleh [14] applied modified AES algorithm for encrypting the secret message to be hidden in the cover image. M.E. Saleh et al. [15] proposed a new image steganography enhancement method for the pixel value difference (PVD) method and achieved maximum hiding capacity and image quality. Duluta et al. [16] found that the classical encryption algorithms have numerous limitations which can confine its suitability for cloud computing environment. Pancha [17] encrypted the input image to retrieve cipher image by applying encryption key in conjugation with Chirikov mapping. Subsequently, they applied steganography to hide cipher image within the cover image. To introduce higher level of confusion, Leung et al. [18] applied multiple encryption techniques to encrypt different parts of the media for the best security protection subject to the given computing resources. Mukhedkar [19] too applied different cryptosystems such

as DES, 3DES, AES, Blowfish Algorithm to encrypt the secret data before embedding within cover image. Li et al. [20] applied region of interest identification and clustering concept for video fingerprinting-based multimedia security. Ahmed [21] applied elliptic curve cryptography (ECC) based (text) encryption, followed by LSB embedding to safeguard the data over uncertain channel. To further strengthen their approach, authors [21] transmitted data over the different channels to the same target. Undeniably, this approach could undergo significantly large computational overheads. To achieve non-perceptibility over steganography, Hajduk [22] performed secret message encryption using quick response code (QR). The embedding process was additionally protected by AES algorithm. Alam [23] applied McEliece cryptosystem for data encryption to improve the security and privacy. Kumar et al. [24] proposed a symmetric key cryptography algorithm for secure three-dimensional color image security. Sharma [25] performed speech-signal encryption followed by steganography to secure data over communication channels. Wang et al. [26] applied watermark concept for multimedia data transmission over unsecure channel transmission.

Zaher [27] enhanced classical chaotic shift keying (CSK) method where the secret data were hidden within the chaotic transmitter states that could change among four different chaotic attractors in such manner that the binary information could effectively diffused. Authors applied cryptography to change the transmitter parameters in such manner that they have a quadruple form and therefore breaking into the public communication channel using return map attacks will fail. Realizing time-exhaustion due to chaotic map-based encryption, Hossain et al. [28] proposed a non-linear 3D chaos based simple encryption technique by applying 3D chaos for position permutation and value transformation technique. Saxena et al. [29] combined encryption and digital watermarking to enhance the image security. Gupta [30] recommended using discrete wavelet transform (DWT) to split input image into four sub band, followed by data hiding within the splits. Hiding the text-data within the image, authors performed compression to achieve transmission efficiency. Authors [31–37] combined cryptography and steganography; however, it could not guarantee computational efficiency over cloud infrastructure. Torvi [38] proposed unique data security using text steganography (UDSTS) framework that can transmit and receive encrypted messages embedded in a rich text format. Sarairoh [35] used filter bank cipher to encrypt the secret text message, followed by DWT based steganography to hide the encrypted message within the cover image. Towards imperceptibility, Laskar et al. [37] applied discrete cosine transform (DCT) method to perform data hiding (in cover image) in frequency domain. Pleshkova

et al. [39] proposed a mathematical concept for public key infrastructure (PKI) to secure the audio-data transmission from unauthorized access. Pai [40] encrypted video data and generated video-ciphers in a time and space efficient approach. Authors found that region permutation followed by application of AES and DES can enhance security of video files. However, such systems were found computationally costly [13].

Cui et al. [41] developed encrypted data sharing environment for secure image service for mobile devices with privacy assurance over cloud environment. Usman et al. [42] developed a privacy preserving security model for internet of multimedia things (IoMT). Zheng et al. [43] developed an encrypted cloud model with secure de-duplication for secure video transmission. Authors exploited the concept of scalable video coding (SVC) and secure de-duplication to achieve multimedia security over Azure platform. However, it could not be assessed in terms of data reconstruction quality and computational overhead. Abdul et al. [44] developed biometric security model with visual encryption technique. Though the use of visual cryptography and Zero-watermarking helped protecting the ownership of multimedia content, it was found computationally exhaustive. X. Li et al. [45] assessed different security models for cloud computing, where he found that cloud computing requires maintaining a fair balance in between the computation as well as attack-resilience. It indicates towards the need of certain lightweight solution. Q. Li et al. [46] proposed privacy preserving access control concept for multimedia data security over cloud platform. Authors applied ciphertext-policy attribute-based encryption (CP-ABE) that enabled cloud-assisted mobile multimedia data sharing. Hamid et al. [47] developed privacy preserving model with pairing based cryptography for medical data security for cloud computing. To achieve computational efficiency authors applied a tri-party one-round authenticated key agreement model. Khedr et al. [48] developed SecureMed a GPU accelerated homomorphic encryption concept for medical data security.

Zhu et al. [49] developed image encryption technique using non-uniform sampling to introduce more attack-resilience. As standalone multimedia security, Zhang et al. [50] developed ECC based image encryption with Diffie-Hellman public key sharing concept. Tawalbeh et al. [51] applied two ECC-based encryption algorithms for secure multimedia communication. The first algorithm performed selective encryption on the transform coefficients during compression, whereas the second algorithm achieved perceptual encryption based on selective bit-plane encryption before compression. Guan et al. [52] developed frequency domain DNA coding based chaotic image encryption model for multimedia data security where both the amplitude and phase components in frequency-domain

were diffused and scrambled. J.He et al. [53] developed a bit stream-based JPEG image encryption. Hamza et al. [54] focused on key-frame confidentiality and developed hash-based encryption for key-frame of diagnosis hysteroscopy. Authors [54] designed local sensitive hash (LSH) to strengthen data security. Xia et al. [55] suggested a content-based image retrieval (CBIR) privacy-preserving scheme that enables the data owner to outsource the image database and CBIR service to the cloud, without exposing the actual database content to the cloud server. Xu et al. [56] applied hamming embedding algorithm to generate binary signatures for image security. This method achieved the balance between security, accuracy and efficiency of safe large-scale image retrieval in public clouds. Fawaz et al. [57] have suggested a scheme for image encryption based on two rounds of substitution—diffusion. They applied it in a block by block manner to attain the avalanche effect in overall image level, and ensured a high level of security and randomness.

Noura et al. [58] developed an effective image encryption scheme based on a dynamic structure. The proposed cipher structure consists of two distinct lightweight rounds (forward and backward chaining blocks) and a block permutation mechanism. Furthermore, the development of a dynamic key based on a secret key and a nonce was proposed as a key derivation feature. This key can be modified for each validate period (session), or for each new input image, depending on its configuration. Then the cipher layers were generated on the basis of this key, which were an integer or a binary diffusion matrix and an S-box substitute table, together with a P-box permutation table. The image was divided into blocks by Visalakshi et al. [59], and then transformed by moving the columns from left to right and right to left. After that, Blowfish algorithm was applied. A new lightweight secure cryptographic scheme for secure image communication was proposed by Mondal et al. [60]. In this scheme the plain image was permuted first using a sequence of pseudo random number (PRN) and encrypted by deoxyribonucleic acid (DNA) computation. The scheme was proposed for gray label images but the scheme can be extended for color images and text data. However, in order to make it applicable to the internet of things, there is potential for more developments in encryption techniques. In order to secure medical images, Noura et al. [61] proposed a cipher scheme with three variants (selective, middle-full and full). For each input image the scheme was based on primitive dynamic diffusion and/or confusion, which ensured good cryptographic efficiency with reduced rounds.

Belguith et al. [62] proposed a lightweight encryption algorithm consisting of a combination of symmetric algorithms to encrypt data and asymmetric ones to distribute keys. This work can be improved by proposing a new key

distribution system that aims to offer the encryption key to any approved user without the involvement of the cloud provider. Daniel et al. [63] combined hashing and symmetric encryption with improved distributed hash table data structure to reduce overhead communication and computation for integrity verification and also to allow efficient operations of the data. The storage cost was drastically decreased by deduplication using the combined techniques of convergent encryption and filters. Rad et al. [64] introduced the concept of extending the capabilities of cloud file storage from just storing images to also performing encryption and analytics by moving and executing user-defined programs close to the data within an object cloud. The proposed PFCC algorithm provides a new parallel scheme for image encryption for cloud file sharing environment. One of the main differences between the existing transform-based encryption schemes and the proposed algorithm was the dual encryption method, which introduces a large amount of encryption complexity. Jinbo Xiong et al. [65] proposed a role symmetric encryption (RSE) algorithm and an RSE-based Proof of Ownership (RSE-PoW) scheme for secure deduplication in hierarchical heterogeneous environments, based on the role of symmetric encryption, proof of ownership and bloom filter. Aljawarneh et al. [66] proposed a resource-efficient encryption method for encrypting multimedia big data in IoT. The proposed framework took advantage of Feistel Encryption Scheme, advanced encryption standard (AES) and genetic algorithms. Alassaf et al. [67] analyzed the efficiency of the SIMON cryptographic algorithm and suggested a SIMON-based lightweight cryptography algorithm to minimize encryption time and preserve the realistic trade-off between security and performance in an IoT-driven setup for its potential use. The modified SIMON with 32, 48, 64, 96-bit block sizes showed interesting speed-up compared to the original SIMON, where some of them were found to be slower than AES. A lightweight selective encryption scheme was introduced by Amna Shifa et al. [68] in which encoder syntax elements were encrypted with the revolutionary EXPer (extended permutation with exclusive OR). A hybrid encryption algorithm for lightweight data stored in a cloud has been proposed by Liang et al. [69]. By increasing the key size to produce large prime numbers, this hybrid algorithm strengthens the RSA algorithm and then combined it with the AES algorithm. The authors of [70] proposed a one-round cipher (implemented on static images) for IoMT (Internet of Multimedia Things) in which the substitution and permutation principles were selected for the encryption.

3 Problem formulation

Majority of the at-hand image security models apply classical cryptosystems or steganography concepts, whose limited attack-resiliency and increased computational overhead can't be denied [45]. As standalone solution, most of the cryptosystems propose encryption with higher key-size (Ex. AES-256, RSA-256, homomorphic computation, etc.). Though, increasing key-size can increase the level of security and complexity towards unauthorized decryption, it significantly increased large computational overheads and processing-time. Such limitations confine their efficacy to meet real-world cloud computing demands. Steganography as an alternate too is found computationally exhaustive due to overheads imposed by wavelet transform, cipher embedding, compression etc. Additionally, the major steganography concepts don't address imperceptibility objective, which is must in the contemporary cloud communication environment. This is because majority of the statistical assessment-based attackers like steganalysis with sophisticated decryption tools can sense the hidden data and can eventually retrieve the same.

Addressing above stated problems and to achieve a novel and robust multimedia data security model, in this paper a lightweight cryptosystem has been developed. Unlike classical cryptosystem, our proposed model intends to maintain lower bit size or key-size (here, only 64-bit key) and lower computational while maintaining higher level of confusion to avoid any attack over cloud network. Our proposed security system can be considered as a hybrid model which exploits robustness of block cipher technique like substitution and permutation network (SPN) and Feistel architecture (a type of symmetric block cipher technique) to inculcate higher level of attack-resiliency even with lower computational overheads. Functionally, our proposed model consists of three consecutive steps, key generation, encryption and decryption. Here, at first, we apply SPN block cipher with iterative and alternating rounds of substitution and permutation (say, transposition) while ensuring that it fulfills the demands of Shannon's Confusion and Diffusion characteristics. To achieve it, we have developed a novel key-expansion block function (KEBF) which intends to assure that the cipher has been manipulated in pseudo random manner. To introduce more level of confusion and security-structure KEBF has been applied over five rounds, where in each round it intends to fulfill above stated Shannon's confusion and diffusion conditions. In this manner the proposed model ensures maintaining higher confusion with lower computation (Note, unlike classical AES cryptosystem which applies 15 rounds of encryption with 256-bit key size, our proposed

model applies merely 5-round of computation with merely 64-bit key size. It can reduce overall computation to a great extent). The proposed model enables manipulating cipher text in such manner that it can avoid easy exposure of the original data to the intruder. To further strengthen the efficiency, we applied Feistel architecture with SPN to perform encryption and decryption of the input image data. Noticeably, the application of Feistel architecture enables decryption in the same way as encryption and hence reduces additional computational-exhaustion. Unlike other ciphers such as DES, Camelia, Blowfish etc., our proposed Feistel architecture can enable swift and more efficient encryption-decryption over large data size.

4 System model

As indicated in the previous section, the proposed security model can be stated as a hybrid cryptosystem functional on the basis of a symmetric key block cipher constituting 64-bit key and plain-text. In any symmetric key model, our proposed encryption method applies 5-rounds iterative mechanism which is also called encryption-rounds. In this process each round operates over certain predefined mathematical functions (here, KEBF) to generate confusion and diffusion matrix. Though, higher rounds assure better level-of-security; however, at the cost of increased computational overheads. The typical cryptographic methods apply an average of 10–20 rounds to encrypt the target data, which can cause significantly huge computational overhead and time-exhaustion. To avoid such complexity and time-exhaustion we performed KEBF merely for five rounds (Fig. 1) so as to enhance computational time, resource, redundancy etc. without compromising with the level-of-security. In other words, we performed only five-round of encryption where each encryption round processes over a 4-bit of input data. When encrypting the input data, the encryption function is executed in such manner that it creates sufficient confusion and diffusion to avoid any possible attack. To achieve it, we applied Feistel architecture to perform substitution and diffusion. The detailed discussion of the key-generation and expansion unit is given as follows. Some notations used in the explanation are shown in Table 1.

4.1 Key-generation and expansion

Considering the fact that in cloud computing environment each node behaves like a key generator as well as decoder, it is vital to maintain minimum possible computations. To achieve it, we designed a mathematical model by using XOR and XNOR logical function and data concatenation. The key task during encryption and decryption is the key

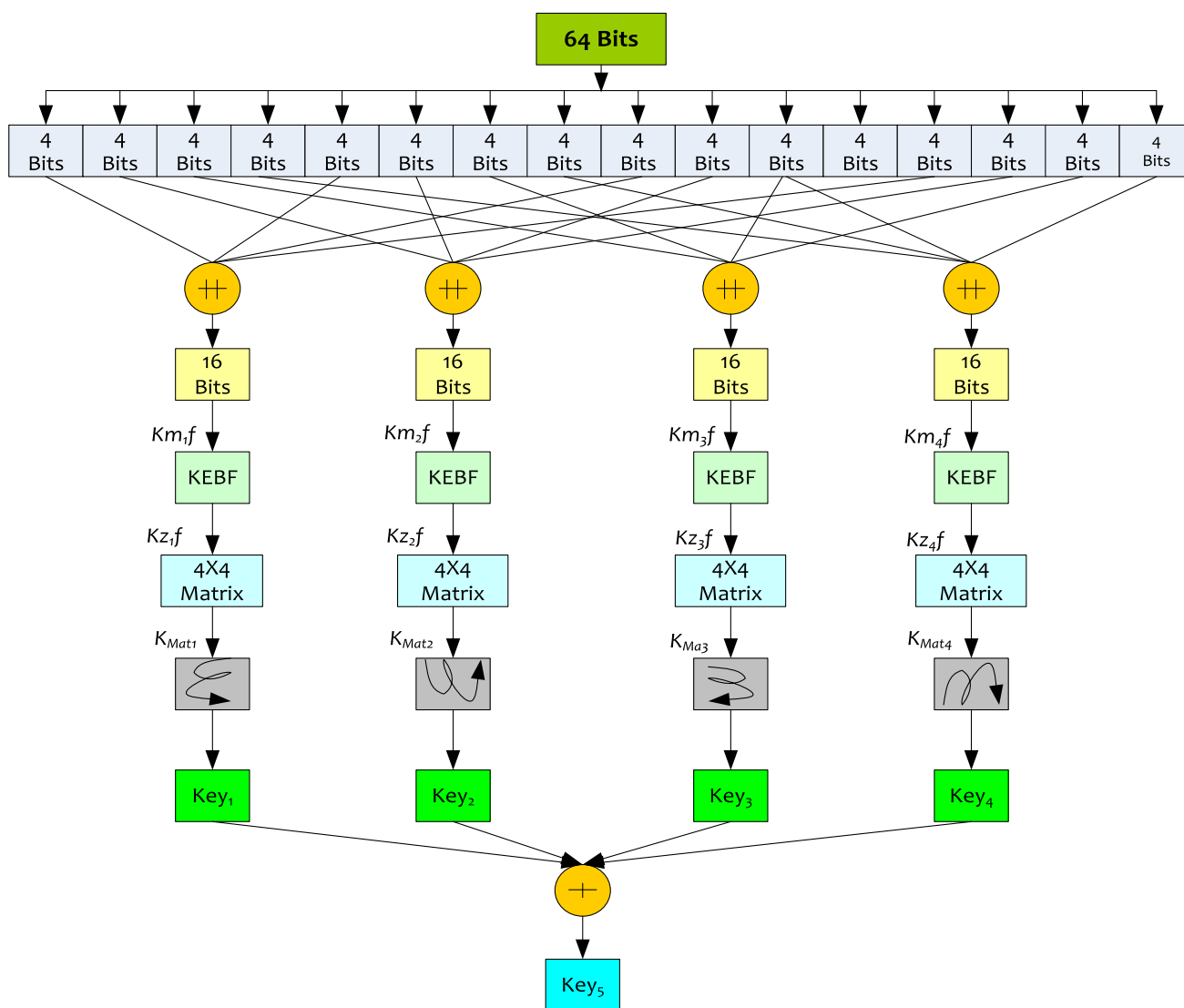


Fig. 1 KEBF assisted key expansion mechanism

Table 1 Notations

Notation	Function
\oplus	XOR
\odot	XNOR
$++$, $ $	Concatenation

generation and therefore key-generation is the most essential component of the key-generation and expansion step. To accommodate it, we applied Feistel architecture-based encryption, which has been performed in multiple rounds (here, five), where each round requires distinct key (i.e., five distinct keys). To achieve it, we developed a

function called “key-expansion block function (KEBF)”. Noticeably, KEBF intended to strengthen attack-resilience towards any search-based attack which is common in online environment, by maintaining sufficiently large key size k_t that made it impossible for the intruder to perform 2^{k_t-1} encryption/decryption to gain key information for data retrieval. We designed our security model as a 64-bit block cipher that means, it demands 64-bit key to perform encryption of the 64-bit input data. In our proposed model, we applied 64-bit’s cipher key k_c which has been further used as the input of the KEBF block that executes mathematical function to generate confusion and diffusion and eventually retrieves five distinct keys. Thus, it obtained five distinct keys for each round of encryption, which are subsequently applied for encryption and decryption process. Thus, unlike classical cryptosystems where single key is used for encryption, our proposed model presents more

robustness and attack-resilience due to five-distinct key-based encryption.

A snippet of the KEBF model and allied key-expansion mechanism is illustrated in Fig. 1. As depicted in Fig. 1, KEBF block applies a function “F” (say, KEBF Function) which has been developed as per the suggestions made for block-cipher generation in [71]. Factually, Khazad cipher as discussed in [71] doesn’t represent the Feistel cipher and hence employs broad-trial-mechanism (BTM), where it (i.e., BTM) executes multiple linear and non-linear transformations. Though, this process assures the definite relationship and inter-dependency amongst the output cipher bits and the input bits in a predefined complex approach [72]. As depicted in Fig. 1, the 64-bit input data is at first split into 16 distinct chunks of 4-bits each. The subsequent four distinct chunks of 4-bits are concatenated, thus constituting 16-bit of data for which Feistel network obtains the keys (Fig. 1). As illustrated in Fig. 1, once executing KEBF over the 16 bits of the concatenated input, it generates a matrix of 4-bits each. The overall process of KEBF encompasses the following steps:

4.2 Step-1

Take the 64-bit input cipher k_c from the user and split it into four distinct segments of 4-bits.

4.3 Step-2

As depicted in Fig. 1, initiate the KEBF Function over each split component (i.e., 16-bit data). Noticeably, with 4-bits distinct segments, we obtained 16-bits data for each block on which KEBF was applied. Obtaining the 16-bits data after processing KEBF, execute the initial substitution of the blocks or segments of k_c using (1), similarly we obtained 16-bits for each KEBF Function.

$$Km_{i \in \{1,2,3,4\}f} = \parallel_{(j=1)}^4 Kn_{4(j-1)+i} \tag{1}$$

In (1), the variable $i = 1$ to 4 for first 4 round keys.

4.4 Step-3

Once obtaining the values for $Km_{i \in \{1,2,3,4\}f}$, it has been further processed to give rise to Ka_{if} for each 16-bit blocks. Mathematically, Kz_{if} is obtained using (2).

$$Kz_{if} = f(Km_{if}) \tag{2}$$

4.5 Step-4

We designed KEBF Function as a strategic combination of dual functions PF and QF, as illustrated in Fig. 2. The functional schematic as illustrated in Fig. 2 states a linear (i.e., PF) and non-linear (i.e., QF) functions, respectively. The transformational mechanisms for both PF and QF are

Fig. 2 KEBF function

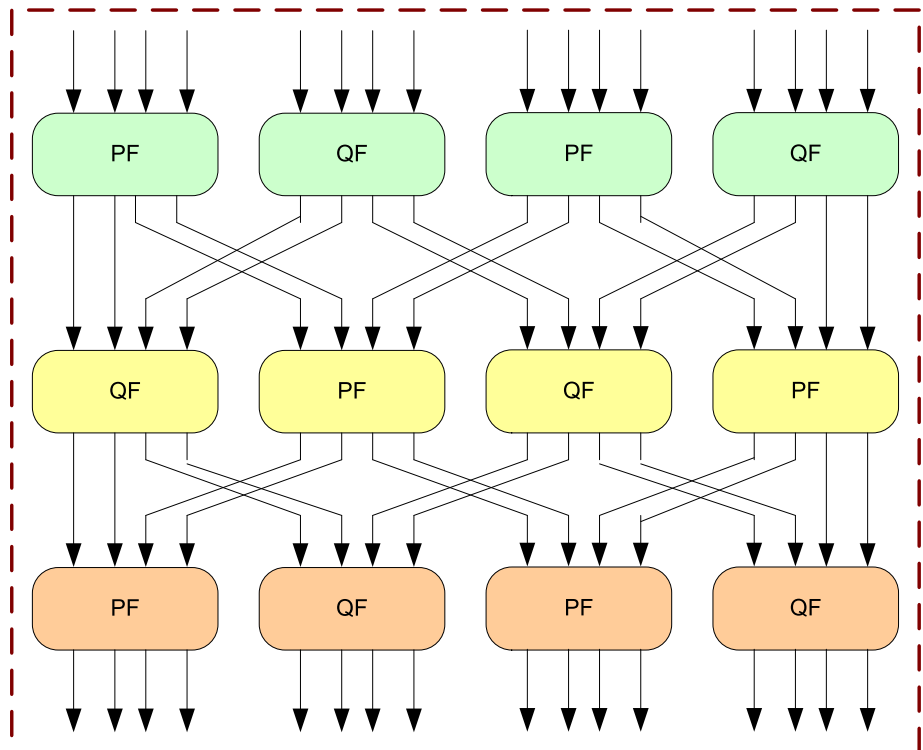


Table 2 PF function

$k_{n,i \in \{1,2,3,4\}}$	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
$p(k_{n,i \in \{1,2,3,4\}})$	3	F	E	0	5	4	B	C	D	A	9	6	7	8	2	1

Table 3 QF function

$k_{n,i \in \{1,2,3,4\}}$	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
$p(k_{n,i \in \{1,2,3,4\}})$	9	E	5	6	A	2	3	C	F	0	4	D	7	B	1	8

given in Tables 2 and 3, respectively. Thus, obtaining values of PF and QF functional blocks as illustrated in Fig. 2, KEBF has been applied the same way as shown in Fig. 1 to perform encryption.

Once obtaining the KEBF Function for each 16-bit block, the output (of KEBF Function) was re-sampled in 4×4 matrix. Mathematically,

$$K_{Mat1} = \begin{bmatrix} Kz1f_1 & Kz1f_2 & Kz1f_3 & Kz1f_4 \\ Kz1f_5 & Kz1f_6 & Kz1f_7 & Kz1f_8 \\ Kz1f_9 & Kz1f_{10} & Kz1f_{11} & Kz1f_{12} \\ Kz1f_{13} & Kz1f_{14} & Kz1f_{15} & Kz1f_{16} \end{bmatrix} \quad (3)$$

$$K_{Mat2} = \begin{bmatrix} Kz2f_1 & Kz2f_2 & Kz2f_3 & Kz2f_4 \\ Kz2f_5 & Kz2f_6 & Kz2f_7 & Kz2f_8 \\ Kz2f_9 & Kz2f_{10} & Kz2f_{11} & Kz2f_{12} \\ Kz2f_{13} & Kz2f_{14} & Kz2f_{15} & Kz2f_{16} \end{bmatrix} \quad (4)$$

$$K_{Mat3} = \begin{bmatrix} Kz3f_1 & Kz3f_2 & Kz3f_3 & Kz3f_4 \\ Kz3f_5 & Kz3f_6 & Kz3f_7 & Kz3f_8 \\ Kz3f_9 & Kz3f_{10} & Kz3f_{11} & Kz3f_{12} \\ Kz3f_{13} & Kz3f_{14} & Kz3f_{15} & Kz3f_{16} \end{bmatrix} \quad (5)$$

$$K_{Mat4} = \begin{bmatrix} Kz4f_1 & Kz4f_2 & Kz4f_3 & Kz4f_4 \\ Kz4f_5 & Kz4f_6 & Kz4f_7 & Kz4f_8 \\ Kz4f_9 & Kz4f_{10} & Kz4f_{11} & Kz4f_{12} \\ Kz4f_{13} & Kz4f_{14} & Kz4f_{15} & Kz4f_{16} \end{bmatrix} \quad (6)$$

4.6 Step-5

Once obtaining the key matrix, to further retrieve the keys for each 16-bit block (i.e., $K_{Mat1}, K_{Mat2}, K_{Mat3}$ and K_{Mat4}), it has been converted into four distinct arrays of 16 bits. Here we call these arrays as ‘‘per-round-key (PRK)’. The four distinct keys and allied attribute arrangement is depicted in Eq. (7) to Eq. (10). Noticeably, in below equations the operator # signifies the concatenation.

$$Key_1 = a_4 \# a_3 \# a_2 \# a_1 \# a_5 \# a_6 \# a_7 \# a_8 \# a_{12} \# a_{11} \# a_{10} \# a_9 \# a_{13} \# a_{14} \# a_{15} \# a_{16} \quad (7)$$

$$Key_2 = b_1 \# b_5 \# b_9 \# b_{13} \# b_{14} \# b_{10} \# b_6 \# b_2 \# b_3 \# b_7 \# b_{11} \# b_{15} \# b_{16} \# b_{12} \# b_8 \# b_4 \quad (8)$$

$$Key_3 = c_1 \# c_2 \# c_{32} \# c_4 \# c_8 \# c_7 \# c_6 \# c_5 \# c_9 \# c_{10} \# c_{11} \# c_{12} \# c_{16} \# c_{15} \# c_{14} \# c_{13} \quad (9)$$

$$Key_4 = d_{13} \# d_9 \# d_{52} \# d_1 \# d_2 \# d_6 \# d_{10} \# d_{14} \# d_{15} \# d_{11} \# d_7 \# d_3 \# d_4 \# d_8 \# d_{12} \# d_{16} \quad (10)$$

Now, estimating the key values, we have performed XOR logical operation amongst the four distinct keys (each for one round) as obtained above (7–10) to get a Fused-Key (11).

$$Key_5 = \bigoplus_{i=1}^4 Ki \quad (11)$$

4.7 Data encryption

Once retrieving the keys per round, data encryption was performed. For confusion and diffusion over encryption process, we applied different logical functions such as shifting (left–right), entity-swapping and substitution. The overall encryption process is illustrated in Fig. 3. As illustrated in Fig. 3, for the first round of operation the 64 bit plain text (Pt) is split into four chunks containing 16 bits distinctly, (i.e., $Px_{0-15}, Px_{16-31}, Px_{32-47}$ and Px_{48-63}). Progressing over bits operation in each round, the proposed model performs swapping to reduce the data originality by means of bit’s order-alteration. It increased confusion in cipher text. Meanwhile, it performs bitwise XNOR logical operation in between the corresponding round key Key_i and Px_{0-15} . This process is repeated between K_i and Px_{48-63} to generate Ro_{11} and Ro_{14} , respectively. Once obtaining the output from XNOR logical operator it is fed to the KEBF block (Fig. 3), and generates two distinct outputs Ef_{11} and Ef_{r1} . Noticeably, KEBF applied for encryption is same as used for KEBF (say, key expansion function), with

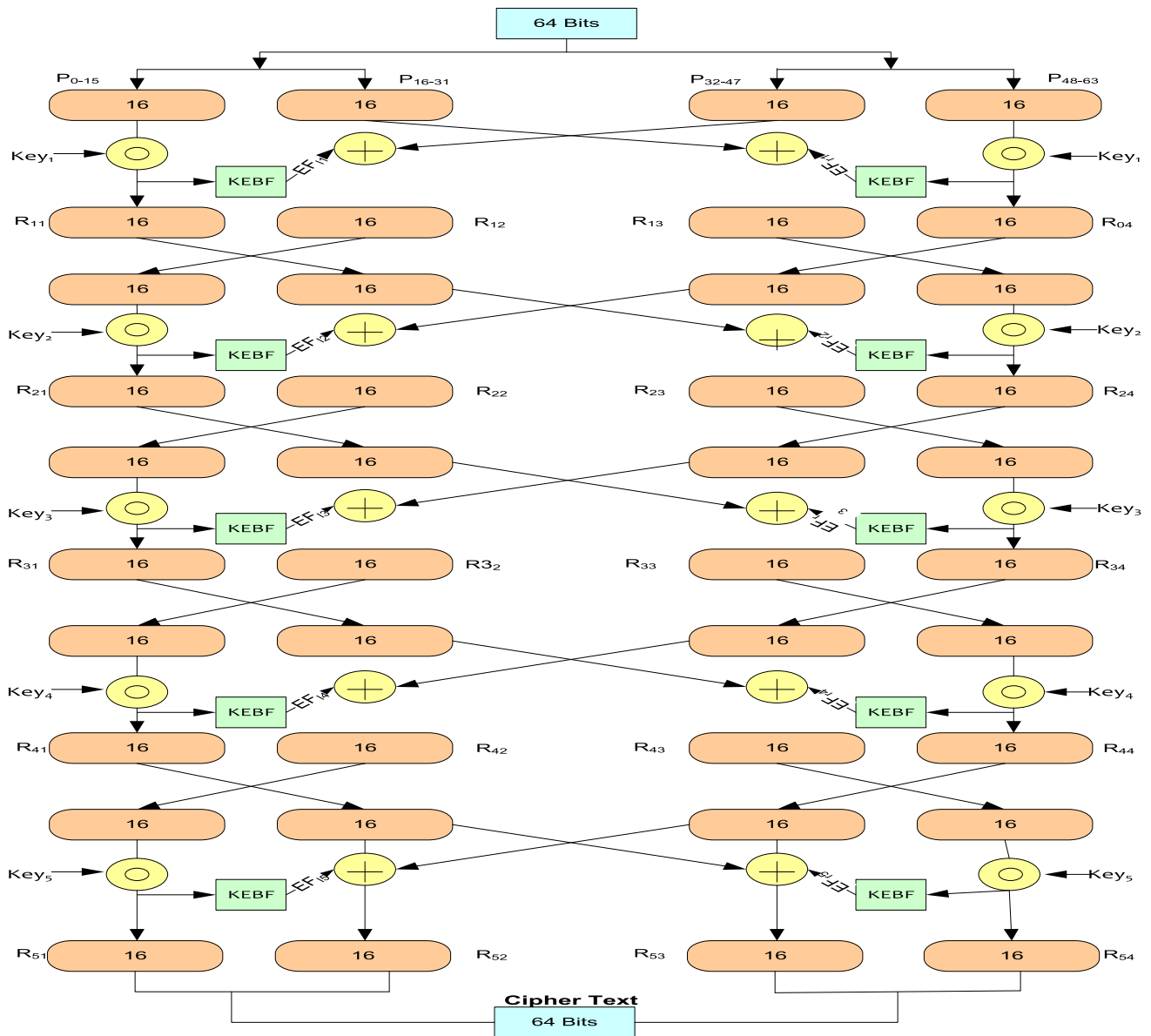


Fig. 3 Feistel network assisted data encryption

processes like swapping and substitution. Now, with the obtained Ef_{11} & Px_{32-47} , we performed bitwise XOR to obtain Ro_{12} , while the same in between Ef_{r1} and Px_{16-31} provided Ro_{13} (Fig. 3).

$$Ro_{i,j} = \begin{cases} Px_{ij} \odot K_i; & j = 1 \text{ and } 4 \\ Px_{i,j+1} \oplus Ef_{li}; & j = 2 \\ Px_{i,j-1} \oplus Ef_{ri}; & j = 3 \end{cases} \quad (12)$$

Thus, after processing above methods, a transformation process was executed in such manner that for each subsequent round Ro_{11} turns out to be Px_{16-31} , while Ro_{12} becomes Px_{0-15} , Ro_{13} as Px_{48-63} , and Ro_{13} as Px_{32-47} . This process is continued for all remaining rounds as per (12), and thus the eventual result of final round are

concatenated to form the final cipher text (CT) to be used for further communication (13).

$$CT = R_{51} \# R_{52} \# R_{53} \# R_{54} \quad (13)$$

The detailed discussion of the simulation results and its inferences is given in the sub-sequent section.

Noticeably, with Feistel structure our proposed (block cipher) model exhibits decryption in the same way as encryption, though the structural sequence reverses the earlier (i.e., encryption). It reduces overall computation significantly making it lightweight and more cost-efficient.

5 Results and discussion

Considering the significance of a robust and lightweight security model for multimedia data security over cloud, in this research we focused on exploiting the efficacy of the advanced crypto-concepts such as Substitution and Permutation based diffusion to enable robust image encryption-decryption for attack-resiliency. To further strengthen the robustness under uncertain cloud environment we applied diffusion concept based on the well-known Feistel structure that performed Substitution Permutation based data encryption. To maintain lower computational overhead, our proposed model applied merely five rounds with 64-bit encryption. We applied Feistel structure to perform Substitution Permutation over multiple rounds so as to perform high level confusion and diffusion. As already stated, unlike classical RSA 256 bit or AES-256 models, we applied merely 64-bit block cipher and equally key-size which retained high computational efficiency with augmented security. The proposed crypto-model was developed using MATLAB 2019b tool, which was tested with both generic multimedia data as well as biomedical datasets such as diabetic retinopathy, glaucoma, MRI data etc. The performance of the proposed security model was examined qualitatively as well as quantitatively or empirically by simulating over benchmark datasets. The overall proposed model was simulated over Microsoft Operating System (OS) Windows 2010, with processor Intel – i3, with 8 GB RAM. Though, the computation time (Table 8) may be higher with better or more advanced processors like Intel i5 or i8. The detailed discussion of the performance assessment is given in the subsequent sections.

5.1 Quantitative assessment

To assess efficacy of the proposed multimedia data security model, we at first examined it for statistical performance parameters such as cipher generation, entropy, correlation and histogram results. To perform this assessment, we tested performance with different input images pertaining to normal life as well as biomedical significances such as fundus images, Magnetic Resonance Imaging (MRI) etc. As normal (daily) life images the standard images like Lena, Baboon, Panda, which are the well-known benchmark data for image analysis were tested. Noticeably, before executing our proposed crypto-model at first input images were converted into Gray from standard RGB data. Though, certain sophisticated pre-processing could have enabled better input environment; however since the focus of this research was to design security model, no pre-processing such as resizing, intensity equalization etc. was performed. As statistical performance assessment, we

obtained key features like key sensitivity, image entropy, correlation, image histogram etc. Before discussing the simulation results, a snippet of the above stated statistical parameters is given as follows

To assess performance of the proposed multimedia data security model, we have considered images of the different types, encompassing general images as well as medical images as these two different types of inputs have distinct demands. In other words, the normal life data such as object data, person's images etc. can have certain (limited or definite) image quality trade off after communicating over the cloud platform. On contrary, image data demands seamless and quality-centric communication as even a minute difference in image spatio-temporal feature might decisively impact assessment and eventual decision. Such miss-location or min-information might force professionals to make wrong telemedicine decision. Considering these facts, in this paper we considered different types of inputs encompassing benchmark images like Lena, Baboon, Panda, Cameraman, three different fundus images retrieved from DRISTI-GS datasets and Medical Resonance Imaging (MRI) data available online. The input images were at first processed for pre-processing where those were converted from RGB to Gray form, and were resized to 256×256 dimension. Noticeably, the considered images were in *.PNG and *.JPG formation; though the proposed algorithm could process any form of input image data. Once exhibiting pre-processing, the images were processed for respective encryption and decryption hypothesizing communication to be made over uncertain cloud framework or platform. Thus, with the simulated results we obtained performance outcome in terms of entropy, correlation, NPCR and UACI along with the corresponding histogram outputs. Before discussing the simulation results, a snippet of the different statistical as well as visual assessment parameters used in this research is given as follow.

5.1.1 Entropy

As multimedia security process undergoes cipher generation which can significantly increase the disturbances across the image input. This as a result can cause increase in image entropy which not only degrades (image) quality but also broadens horizon for intruders to attack specific data. On the other hand, encryption imposes additional information to the multimedia data so as to make it complex for the intruder to distinguish the encrypted data and the original multimedia information. In such cases, maintaining the optimal entropy with the data under transmission is must. With this motive, in this paper we estimated entropy for each encrypted data to retain quality-centric multimedia data security (14).

$$ENT(I) = - \sum_{i=1}^{2^8} P(I_i) \log_b P(I_i) \quad (14)$$

In (14), $ENT(I)$ states the entropy of an image, where I signify the intensity, and $P(I_i)$ signifies the probability of the intensity value I_i .

5.1.2 Correlation

Correlation being a statistical parameter signifies the dependencies, inter-relationship or correlation between two distinct values. Typically, a data element or point possessing significant dependency signifies significant correlation. Towards multimedia security it is important to remove dependency of the cipher information from the original image. With such minimal dependency, no significant information can be extracted, which strengthens the data security feature. In this paper, we obtained the correlation coefficient γ in between the original multimedia data and encrypted data using (15). For an optimal condition γ must be maintained either equal or near zero. Correlation coefficient of one signifies the worst cipher condition.

$$\gamma_{x,y} = \frac{cov(x,y)}{\sqrt{D(x)}\sqrt{D(y)}} \quad (15)$$

In (15), $cov(x,y)$ states the covariance value, while $D(x)$ and $D(y)$ states the variances for the variable x and y , correspondingly. In general, the distribution of the variance of any single dimension arbitrary variable is obtained using (16).

$$D(x) = \frac{1}{N} \sum_{i=1}^N (x_i - E(x))^2 \quad (16)$$

In (16), $D(x)$ states the variance value for random variable x . To estimate covariance between two distinct arbitrary values x and y , we apply (17).

$$cov(x,y) = \frac{1}{N} \sum_{i=1}^N (x_i - E(x))(y_i - E(y)) \quad (17)$$

In (17), $E(x)$ and $E(y)$ states the expected values for x and y random values. Expectation values can be obtained as per (18).

$$E(x) = \frac{1}{N} \sum_{i=1}^N x_i \quad (18)$$

In (18), N signifies the total number of pixels in the image, which is usually estimated as $N = Row \times Column$, and x states the N -dimensional vector. x_i refers the i th intensity value of the original multimedia data or image.

5.1.3 Image histogram analysis

Histogram variation analysis enables examining visual effect of the cipher so as to encrypt an image and assess the randomness it causes in the original image after encryption. We applied image histogram analysis model to visualize the introduced randomness within the original image. Here, we intend to maintain minimum or negligible histogram difference after encryption to retain better security and visual perception based attack probability.

5.1.4 Number of changing pixel rates (NPCR) and the unified average channel intensity (UACI)

NPCR and UACI are the randomness test measures often applied to assess differential attack resilience by an image encryption technique. Higher NPCR signifies more resilience towards differential attacks. The details of these randomness tests can be found in [73].

Table 4 presents the simulated results for the different input images and respective visual outcomes in the form of image histograms. Table 4 depicts the original inputs, histogram of the original inputs, encrypted image and its (encrypted) histogram results. As depicted (Table 4), we considered a total of nine images with different natures (normal, MRI and Fundus (for diabetic or Glaucomatic detection)). As depicted in the results (Table 4), after encryption the histogram of the cipher data is quite different making it imperceptible for an attacker to gain cipher access.

Table 5 presents the entropy level of the original images as well as corresponding encrypted image. As observed through the results (Table 5), the entropy level increases for encrypted images which helps introducing confusion to avoid easy detection of the original data. Noticeably, there are the different approaches advocating maintaining either low negligible entropy (such as steganography based approaches) or high entropy which is often considered in cryptography methods. The results affirm suitable entropy condition to avoid any detection by attacker over uncertain cloud conditions. In our proposed model, we considered 8 bits gray scale image which can have the highest entropy of 8 bits. Observing Table 5, it can be found that the highest entropy obtained over test cases is 7.99 (for encrypted images), which is fulfilling the above stated entropy condition for a quality-centric and secure multimedia data communication.

The correlation analysis of the proposed multimedia security model is given in Table 6. As already stated that for any encryption model achieving higher correlation difference can enable high-imperceptibility and hence high attack-resilience. As depicted through the results (Table 6), the proposed model shows significantly large correlation

Table 4 Histogram analysis


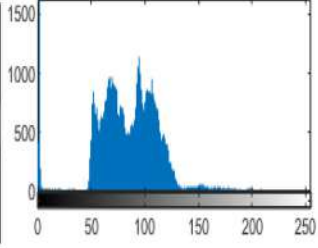
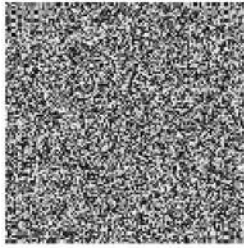
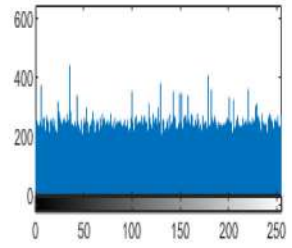
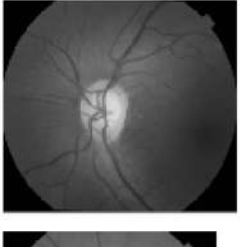
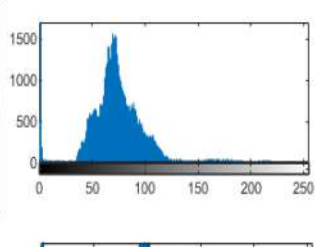
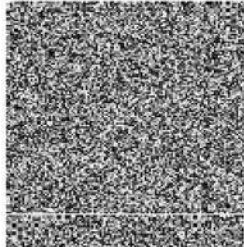
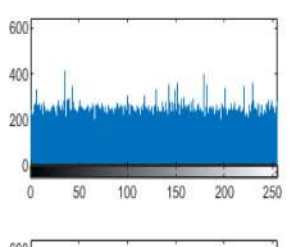
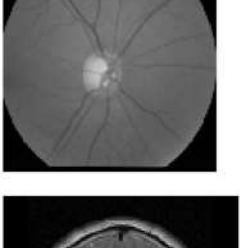
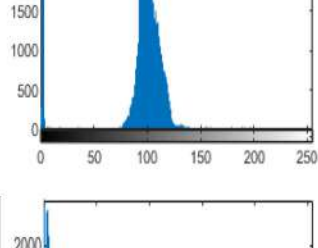
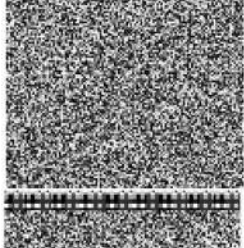
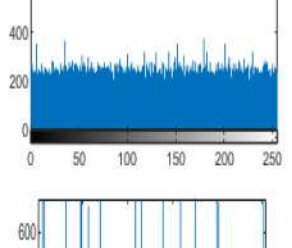
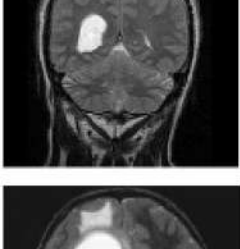
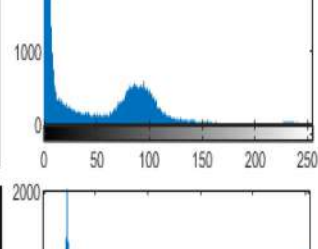
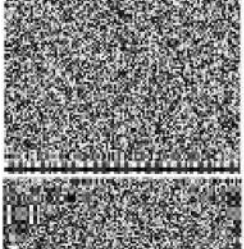
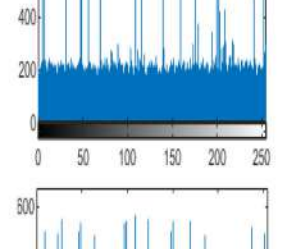
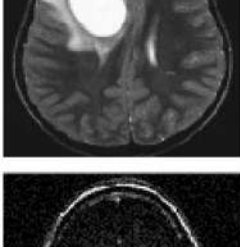
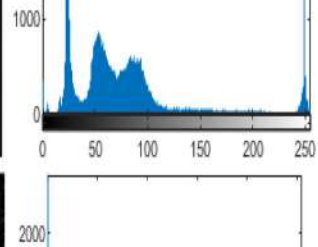
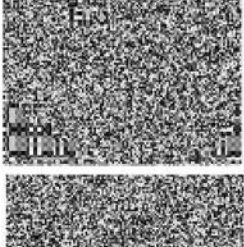
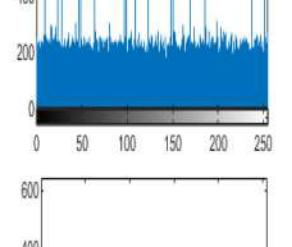
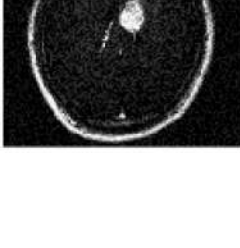
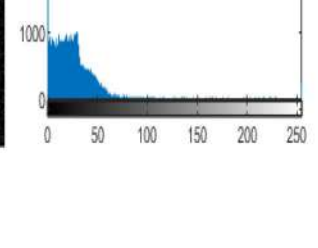
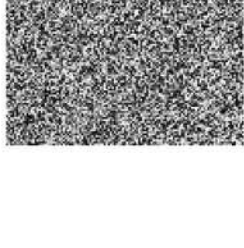
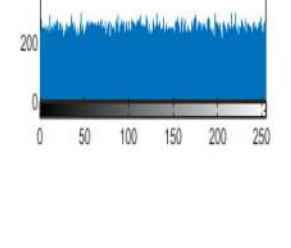
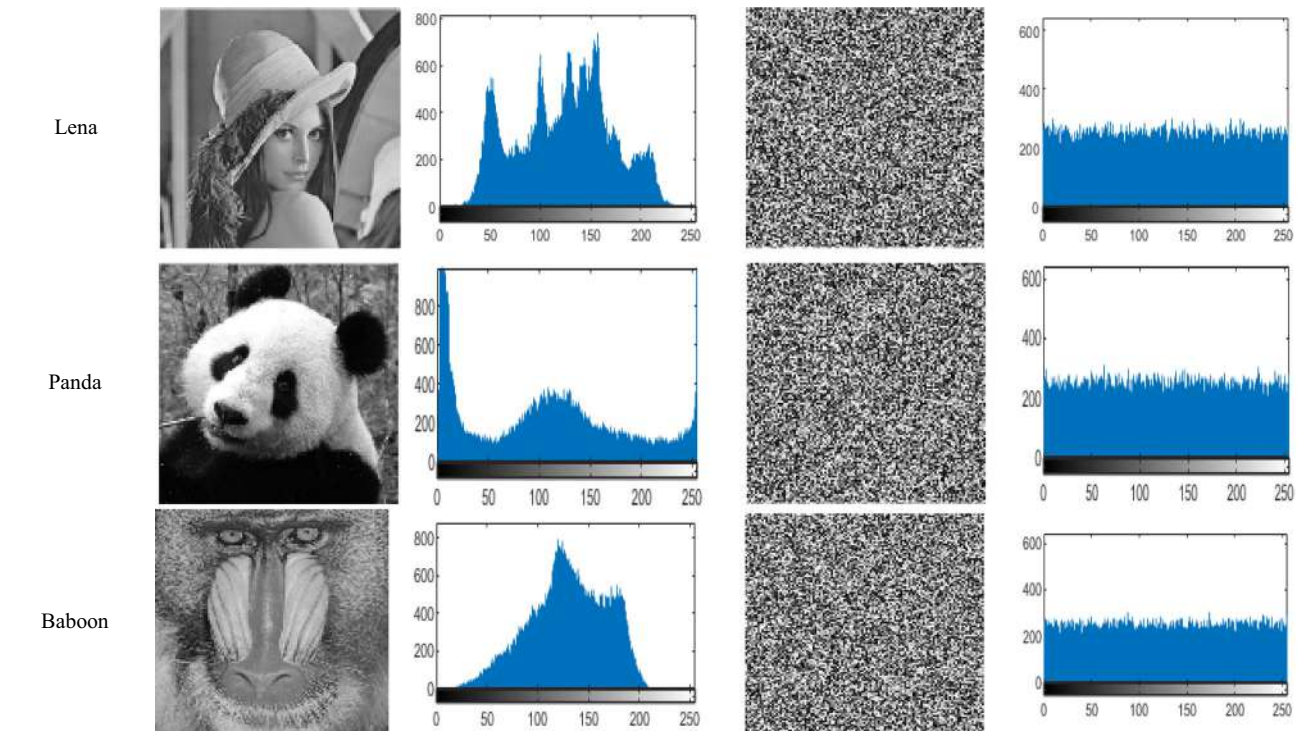
Dataset	Original Image (8 Bits gray scale image with 256×256 size)	Image Histogram	Encrypted Image	Encrypted Data Histogram
Fundus1				
Fundus2				
Fundus3				
MR11				
MR12				
MR13				

Table 4 continued



difference, signifying its robustness towards high attack resilience.

In addition to the above discussed visual and statistical characterization we have examined the efficacy of our proposed multimedia (data) security model in terms of the Number of Changing Pixel Rates (NPCR) and the Unified Average Channel Intensity (UACI) in Table 7. Typically, high values of NPCR and UACI signify higher randomness and hence high resilience against any differential attack probability [73]. The randomness test results with higher values of NPCR back up the attack resiliency nature of the proposed system. Similarly, UACI too confirms satisfactory performance. The detailed discussion of NPCR and UACI conditions for image randomness during encryption can be found in [73]. Thus, the above discussed robustness confirms the suitability of the proposed security model for any real-time multimedia communication, including our intended cloud communication purposes.

The encryption time is depicted in Table 8. Noticeably; the proposed model can be executed over more advanced processors such as Intel-i5 and i8 to achieve better time efficiency.

5.2 Qualitative assessment

In the previous section, the performance of the proposed security system was examined in terms of different statistical as well as visual parameters. The simulation results affirmed that the proposed model accomplishes optimal performance while retaining high security with low visual perception and entropy, confirming the suitability of the proposed security system for a cloud computing environment. Now, realizing the need to characterize efficacy in terms of attack-resiliency, we performed a qualitative assessment, where the proposed model has been examined for its robustness towards any breach-probability caused due to linear and differential cryptanalysis (Ex. RS analysis), Interpolation attacks, Weak key combination, square attacks and related key attack conditions.

Typically, the prime objective of a cipher in a security system is to ensure attack-resiliency and protection of the plaintext. In a classical cloud environment, an attacker often intercepts the cipher-text being transmitted through or over multimedia data and intends to extract or recover the text, though the target data or information can be in other forms as well such as image bits or multimedia-specific text presentation. Functionally, a cipher can be stated to be breached in case the attacker gets access or becomes able to retrieve the secret key. The situation when an attacker

Table 5 Image entropy analysis

Dataset	Original image entropy	Encrypted image entropy
Fundus1	6.3510	7.9898
Fundus2	6.2515	7.9913
Fundus3	5.4312	7.9936
MRI1	6.0468	7.1053
MRI2	6.3670	7.9514
MRI3	6.1031	7.8990
Lena	7.3904	7.6730
Panda	7.4938	7.9968
Baboon	7.1020	7.8993

Table 6 Correlation analysis

Dataset	Original image correlation	Correlation post-encryption
Fundus1	0.9920	0.0076
Fundus2	0.9918	0.0072
Fundus3	0.9883	0.0036
MRI1	0.9763	0.0336
MRI2	0.9929	0.0100
MRI3	0.8628	0.0031
Lena	0.9743	0.0041
Panda	0.9811	0.0003
Baboon	0.8198	0.0039

Table 7 NPCR and UACI randomness test

Dataset	NPCR (%)	UACI (%)
Fundus1	99.60	25.77
Fundus2	99.63	28.32
Fundus3	99.63	23.81
MRI1	99.59	36.61
MRI2	99.43	28.60
MRI3	99.63	41.06
Lena	99.52	14.87
Panda	99.62	13.31
Baboon	99.62	22.62

becomes capable enough to decrypt the cipher-text without estimating the secret key, the cipher is hypothesized to be breached partially. Considering cloud communication environment, we hypothesize that the attacker possesses unobstructed access of the data under transmission across the channel. Additionally, the attacker can also have key

Table 8 Execution time (system configuration Intel dual core)

Dataset	Time (ms)
Fundus1	87.97
Fundus2	72.60
Fundus3	70.63
MRI1	89.45
MRI2	71.06
MRI3	77.64
Lena	89.40
Panda	88.48
Baboon	82.26

information; however to assess the security of a cipher, it is significant to consider computational efficacy of the attacker. Unlike classical crypto-models, our proposed model inherits the strength of both Uniform Substitution and Permutation model as well as Feistel structure (with multiple rounds) it strengthens attack resilience. The robustness of the proposed model can be characterized in terms of its efficacy to avoid the following attack conditions.

5.2.1 Differential and linear (regular and singular) cryptanalysis

As already discussed in the previous section the KEBF function is developed based on the suggestions provided in [73], which itself justifies its robustness to avoid any kind of Differential and Linear (Regular and Singular) Cryptanalysis, our proposed security model can be considered to be robust enough to avoid any aforesaid attack probability. Moreover, as depicted in above discussion the correlation in between the original image data and the cipher data is significantly large even if the linear approximation is performed for two rounds. Since, we performed five distinct rounds of computation; it strengthened the proposed model to exhibit high correlation and hence more attack resilience. Additionally, since the (each) round transformation is maintained uniform which enables treating each bit similar and hence facilitates resilience to the differential attack. The results obtained in terms of NPCR and UACI, as discussed above reveals that the proposed security model can have sufficient resilience to avoid any kind of differential attacks problems in cloud environment. To be noted, correlation test, NPCR and UACI assessment are especially designed approach for differential attack analysis. The comparative performance assessment of the proposed security system as well as other existing approaches is given in Section C (Inter-Model Performance Assessment).

5.2.2 Weak key combination

In cloud computing environment users make a common mistake by keeping poor or weak key combination that helps attacker to get easy access to the ciphers. On contrary, the cipher information where the non-linear operations usually rely on the key value maps the block cipher in such manner that it causes detectable weakness. On the other hand, looking into the proposed security model where it avoids using the same (actual) key in the cipher (due to multiple round key manipulation and/or exchange by XORing the actual key followed by KEBF for five rounds). It makes proposed system robust enough to avoid any kind of weak-key attack probability. On the other hand, in the proposed KEBF function non-linearity is fixed significantly and thus there becomes no limitation on the key-selection.

5.2.3 Related keys combination trial attack

This is the matter of fact that the attack can be made with the help of certain partially known or unknown keys as well. The related keys primarily depend on either slow diffusion or possessing symmetry in key expansion block, as discussed in the previous section. In our proposed security model, we crafted the key expansion mechanism in such manner that it retains fast computation and non-linear diffusion, especially for the cipher key difference in comparison to the round keys that makes significant confusion to assess related key for data attack.

5.2.4 Square-attack

To assess efficacy of a security model, different attack modules are applied to investigate attack-resiliency by the proposed approach. Some of the key approaches applied in cloud-sensitive security models are the RS-Analysis and Square Attack. Considering Square Attack condition, it is capable enough to retrieve one byte of the last key combination and intends to retrieve or recover rest of the keys by repeating the attack iteratively. Let, such repetition be eight times, then also to achieve above stated information, the attacker needs to identify 28 keys precisely by 28 plaintexts which is equivalent to 216- S-box lookups. This becomes highly complicate and thus our proposed model avoids such attack probability.

5.2.5 Interpolation attack

In general, such kinds of attacks primarily rely on the generic architecture of the cipher components which could generate certain rational expression with relatively low complexity. However, as already discussed the S-box expression of the proposed security system with diffusion

characteristics strengthen it to avoid such limitations and thus makes it impracticable enough to avoid attack.

5.3 Inter-model performance assessment

Though, the proposed multimedia data security model encompasses novelties at the different level of computation, to assess its relative performance we considered some researches functional on the same motive “lightweight-encryption”. To achieve it, we referred a work done by Noura et al. [58], who applied dynamic structure based lightweight encryption system, titled “A new efficient lightweight and secure image cipher scheme”. As dynamic structure solution, authors applied forward and backward chaining block (FBC) that in conjunction with a permutation block enabled image encryption. In their proposed model, authors enabled change of the key for each input, which were applied subsequently to generate cipher layer. Noticeably, their proposed cipher layer comprised a binary diffusion matrix, substitution box and permutation box, in sequence. Authors [57, 58] stated that their proposed model with binary diffusion matrix, substitution and permutation table could achieve better performance (with two-rounds). Considering a common test case of “Lena.jpg” image data, which has been considered in our proposed model as well, we examined peak signal to noise ratio (PSNR) performance for the proposed security model as well as the existing [57] one in Table 9. Mathematically, we estimated PSNR using function.

$$PSNR = 10 \log_{10} \frac{M \times N \times 255^2}{\sum_{i,j} y_{ij} - x_{ij}^2}$$

In (19), the variable M and N states the image dimensions, while x and y are the before and after encryption positions. To assess performance, we considered maximum (Max) PSNR to assess relative performance.

Observing the result, it can easily be found that our proposed multimedia security model retains higher PSNR than the both existing methods [57, 58]. Similar to [58, 59], authors [61] developed a dynamic approach for a lightweight and secure cipher for medical images. Authors at first identified sensitive region as well as non-sensitive regions over the target image based on average of the sub-matrix in reference to a predefined threshold level.

Table 9 PSNR assessment

Data	PNSR		
Lena.jpg	[57] 9.2604	[58] 8.6054	Proposed 9.8610

Towards encryption of the image, authors applied dynamic structure-based concept. In fact, most of the key contributions of this work was same as [58]; though authors assess performance over different medical images. In their simulation, authors could achieve NPCR between the original and the cipher image as 50.1029, while UACI for the same sample was obtained as 99.6460. Entropy performance was found to be within the range of 7 to 7.3. Observing these results, our proposed system seems to be superior with lower entropy and differential attack resilience. Similar to the work in [57, 58], authors developed a dynamic structure-based encryption model for fingerprint security [59]. In this method, authors [59] where applied shifting concept for image encryption. Since, the exiting work [59] and our proposed model applied different data, direct comparison can't be done; however as relative performance analysis it can be found that the entropy of our proposed security model (Minimum observed entropy = 7.1053) is lower than the existing method ([59], 7.6448). In [60] as well authors claimed their approach as "light-weight" where chaos and Deoxyribo Nucleic Acid (DNA) computing (it states a dynamic structure model) for image encryption. Authors [60] considered benchmark Lena.jpg image for system test, where they obtained performance outcome in terms of NPCR, UACI and entropy (characterizing differential attack assessment).

Observing above results (Table 10) it can easily be found that the proposed image encryption model outperforms existing approaches by maintaining lower entropy with satisfactory higher correlation performance to avoid differential attack condition over cloud platforms. The NPCR and UACI results affirms the robustness of the proposed multimedia data (image) security model towards (differential) attack-resilience. Thus, observing overall performance and corresponding inferences, it can be affirmed that the proposed multimedia encryption model is more efficient than the other existing approaches. It enables our proposed security model to be applied in real-world cloud computing environment.

The overall research inference and conclusion is given in the subsequent section.

Table 10 Comparative assessment

Data	Method	Entropy	Correlation	NPCR	UACI
Lena.jpg	[60]	7.9992	0.0011	99.7570	0.3912
	Proposed	7.6730	0.0041	99.5200	0.1487
Baboon.jpg	[60]	7.9993	0.0015	98.0961	0.7702
	Proposed	7.8993	0.0039	99.6200	0.2262

6 Conclusion

Considering the significance of a secure multimedia communication environment over cloud environment, which has gained widespread attention globally, this research focused on designing a lightweight and robust "multimedia data security system". Unlike classical researches where to enhance security level authors have either increased key size or have exploited hybrid cryptosystems. Unfortunately, such approaches impose significantly high computational overheads and complexity. On contrary, cloud computing demands lightweight and computationally efficient security solution, especially for multimedia data transmission. Considering it as motive, in this research paper a robust multimedia data security model was developed by exploiting efficacy of the block cipher approach using substitution and permutation network (SPN) and Feistel structure. Similar to the block-cipher approaches such as AES, Grasshopper, SAFER, SHARK and Square attack methods etc., our proposed model employs SPN network in which the use of multiple-round or iterative substitution and transposition enabled Shannon's confusion and diffusion conditions. It enabled changing the cipher text in certain pseudo-random paradigm. To achieve it, this method applied Feistel architecture, which performs both encryption as well as decryption in similar manner. Thus, the use of Feistel architecture and SPN network provided a hybrid security system which applied 64-bit key processing with most robust attack-resiliency for multimedia data communication over cloud. The qualitative and quantitative assessment of the proposed security model affirms its suitability towards secure multimedia data communication over cloud computing environment while assuring low computational overheads and complexity. The proposed model also ensures different attack resiliency and hence is robust enough to be used under uncertain cloud environment.

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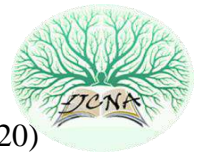


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Evolutionary Computing Assisted Visually-Imperceptible Hybrid Cryptography and Steganography Model for Secure Data Communication over Cloud Environment

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Abstract – The exponential growth of communication technologies and related application environments has broadened the cloud computing ecosystem horizon to meet major communication needs. However, in-parallel upsurge in online attacks, security breaches or allied intrusion events has alarmed industries to ensure optimal data security. Unlike text data transmission, image, or other multimedia communication over the cloud requires computational efficiency, imperceptibility, etc. to meet attack-resilient transmission. Amongst the major available security systems, the combination of cryptosystems and steganography has been identified as an augmented security model for data transmission. However, it demands enhancement in both stages to meet cloud-specific communication efficiency. Considering it as motivation, in this paper an efficient Visually Imperceptible Hybrid Crypto-Steganography (VIHCS) model is developed using Hybrid Cryptosystems followed by Adaptive Genetic Algorithm assisted Least Significant Bit (LSB) embedding process. We developed a novel Hybrid Cryptosystem by strategically applying Advanced Encryption Standard (AES) and Rivest–Shamir–Adleman (RSA) algorithms to secure secret data to be embedded in a cover image. In addition, the use of the Adaptive Genetic Algorithm based Optimal Pixel Adjustment (AGA-OPAP) strengthened the Least Significant Bit embedding while retaining the best possible image quality and visual imperceptibility. The proposed model achieved higher security, high embedding capacity as well as image quality, which is vital for cloud communication. To perform LSB embedding we applied 2D-Discrete Wavelet Transform (2D-DWT-2L) method with 8×8 dimensional block-wise embedding. It helps to achieve better embedding efficiency in conjunction with the AGA-OPAP model. Simulation results and respective visio-statistical assessment revealed that the proposed VIHCS model can accomplish better performance and reliable secure data communication over the cloud environment. Thus, the VIHCS model achieves maximum possible

imperceptibility and hence can avoid attacks- such as steganalysis based attack or RS-attacks.

Index Terms – Secure Data Transmission, Cloud Environment, Hybrid Cryptography-Steganography Model, Evolutionary Computing, Encryption and Decryption, Adaptive Genetic Algorithm (AGA), Least Significant Bit (LSB).

1. INTRODUCTION

The exponential growth of software and advanced hardware systems has expanded the scope to fully integrated services and solutions that meet diverse socio-industrial demands. Data communication and allied forces of the exchange of knowledge have gained broad popularity around the world among the largest emerging applications. On the other hand, high speed development in internet technology and related applications has resulted in different innovations such as cloud computing, Internet-of-Things (IoT), etc. However, ensuring secure communication across these application environments has always been a challenge for industries [1-8]. Various uses, including social networking sites, medical services industry, e-commerce, scientific societies, the financial sector, other industrial needs, such as monitoring and security systems, etc have been met daily by vast numbers of communication systems enabling the Internet.

Social networking and entertainment, tracking footages [3, 4, 5], user data and an IoT communications support environment [2], [4], [6-12] all have to be secured from unauthorized access to their data by protection measures and policies. Undeniably, corporate software has also seen a substantial increase in vast volumes of data generation and collaboration through the industry, government departments, banks, and other organizations. In practice, such data are used for certain targeted analysis or observation to make a suitable decision.

RESEARCH ARTICLE

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A Study of Existentialism in John Barth's *The End of the Road*

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Abstract

John Barth is one of the postmodern writers in American literature. Barth's complicated, greatly self-conscious, and comic texts as well as applauded essays have clearly established the author's status as a dynamic defender of North American literary Postmodernism. John Barth is one of the major novelists of American postmodernism. Barth's contribution to the practice and theory of postmodernism is in this sense undisputable. However, much of the criticism dealing with his work in relationship to postmodernism is prompted by Barth's own theories of "exhaustion" and "replenishment," leaving his writing relatively untouched by theories of postmodernism in general. This study aims to change that. What is of particular interest here is the relationship between Barth's aesthetic and the ideology critical work of the historical avant-gardes, which were the first to mobilize art against itself and its institutional practices and demands.

Barth's second novel, *The End of the Road*, gives similar characteristics with its precursor. Like Todd, Jake (Jacob Homer) is a nihilistic protagonist who cannot get meaning in the world and who exists in isolation and separation from the rest of society. He also takes on a similar superior position with regards to the rest of humanity as does Todd and virtually all of Barth's characters. Indeed, Barth's protagonists distinguish themselves from society through their emotional coldness and self-conscious "philosophical" - or, rather "existential" power. All consider themselves as "open minded" beings who are entitled to evaluate others and to treat them as objects because of their knowledge of the ultimate meaninglessness of anything and, thus, of the absurdity of human life. As a consequence, in *The Floating Opera* Todd has no second thoughts about attempting to demolish the whole ship with hundreds of people in it. In *The End of the Road*, Jake treats Miss Rankin and Rennie with utter contempt, even shamelessly denying his duty in the death of the latter at the end of the novel. Hence, the major purpose of this article is to expose that neither extreme interpretation of the author's texts and creative intentions are fully analysed and Barth pursues a comparable goal with his writing to move from the absurdity of life by engaging in comical text and conferring artistic validity to his existence. moreover, Austria's literary and academic tradition and Barth's similarly strong connects to and

conditioning by the literary principle taught at North American universities explain that even though Postmodernism's assertion toward national history, universality and history still play a major part in the definition of contemporary fiction .

Keywords: **Existentialism, nihilism, black humour, metafiction and travesty**

A Study of Existentialism in John Barth's *The End of the Road*

Barth as Literary Creator

The term 'existentialism' was broadly defined to identify a major movement of the Twentieth-century thought during the mid-1940s, instantly after the end of the World War II. Although the term 'Existentialism' gives much attention after the World War II, it has been employed by the philosophers like Nicola Abbagnano, Gabriel Marcel, Karl Jaspers and Martin Heidegger. Gabriel Marcel, a devoted Christian thinker, employed the language of existentialism in the 1920s. The Italian philosopher Nicola Abbagnano extended an adaptation of it in his *La struttura dell'esistenza* in 1939. Both Martin Heidegger and Karl Jaspers used the word 'Existentialism' in the style of the most appropriate English translation of *Existenzphilosophie*. Subsequently the term was investigated by both the theist, Soren Kierkegaard, and the surveyor of the implications of the 'death of God,' Friedrich Nietzsche, as 19th century existentialist antecedents.

Existentialism is a philosophical development that regards human existence, having a series of main themes and characteristics, such as freedom, dread, anxiety, consciousness of death, and awareness of existence. Existentialism has its originated in Denmark, France, Germany, and Italy in the early period of movement. The result against Hegelian 'Rationalism', the Industrial Revolution in Europe, physical and economic annihilation caused by the World War II, consequence after the two World Wars and the nuclear age and the beginning of the Cold War are the main reasons of the spread and development of this philosophical movement. After the World War II, existentialism has emerged at the towering position as the latest style in literature and philosophy.

Even though the selected authors—J. D. Salinger, Walker Percy, John Barth, Chuck Palahniuk, Bhalchandra Nemade, John Gardner, Bhau Padhye, Kamlesh Walawalkar, Vilas Sarang and Kamal Desai—belong to different countries, different literary customs, cultures and languages, they have some uniqueness. All the writers are important in their literary traditions, and their select novels are the delegate existentialistic novels. Man's real existence in the world is less important than some pre existing effect is the general theme in all the select novels. Thus, for the present study analyses the novels of John Barth.

Existentialism is a famous literary movement in Europe and America in the Twentieth Century. The socio-cultural movement of the contemporary world has widely appeal of the movement. It reacts the spiritual predicament of the world. Alienation, the loss of sustaining religious customs, the feeling of anxiety, the absurd, and guilt are the views of the movement. All these senses and approaches are given powerful and open voice in existentialist context. In this context the first objective of the present study is to explain the concept

of Existentialism. Tough, the major objective of the study is to make a comprehensive statement create the existentialism portrayed in the select novels of Marathi and American Novelists, to claim at a broad way.

Biographical sketch

John Simmons Barth is the one of the famous American writers in literature. He is best known for his postmodernist and metafictional fiction. Barth began his career with *The Floating Opera* and *The End of the Road*, two short realist fictions that deal humorous with controversial topics, suicide and abortion in that order. They are directly realistic stories; as Barth presently remarked, they "didn't know they were novels". *The Sot-Weed Factor* (1960) was basically intended as the entire novel of a trilogy comprising his first two "realist" novels, but, as a result of Barth's developed as a writer, it established into a different project. The novel is important as it showed Barth's discovery of Postmodernism. John Barth's second book, *The End of the Road* was praised as a term novel of ideas. A special form of as *The End of the Road* called as an ideological travesty. In this novel discussed a conflict between two college teachers, a nihilist who teaches English and an existentialist who teaches history; they deviate on the true meaning of human nature.

Joe Morgan, the existentialist, was an incidentally worthless space in the end; the one meaningful reality is man's conscious. The individual human existence can be denoted by an orderly. But Morgan rejected worthless for cultural task that con man into feelings the meaning of identity and existence. David Kerner remarked that Joe walked on the meadow let the ways be walked not other way. He felt that he has taken off all unintentional values from himself. Since he has been arriving the rock of his important self so far Morgan's view is plainly typical contemporary philosophy. As one who takes over of the Enlightenment, We thought in original denies not original sin. We are executed to the idea of a society that will allow each man to become himself. We think in an ultimate culture, these are our heaven and our spirit. But Morgan alienated him from others, though they were no human being but only fully different natures. David Kerner explored that there are only significant values, Morgan's point of view a man ever did right from his view, When Morgan' wife asked to neighbours for their lack of furniture. He defended and hit her on the mouth about their lack of home needs. So his wife's requesting for apologize is absurd. His most essential value is his God –is his idea of consciousness.

If *The Floating Opera* is a paper on ethical nihilism, the companion novel [that is what *The End of the Road* is] is a detailed discourse on the existentialism assumed by Sartre and Camus. Both novels are essentially cynical. Jacob Horner in *The End of the Road*, as does Todd in *The Floating Opera*, shows a typical existentialist bound. He stirs from what Martin Heidegger calls "Fear" to "Angst." The first, Heidegger investigates, takes on the physical action of escape from somewhere to take retreat in something; in other

terms, it is a choice one creates in the place of discouragement. For the existentialist, "Anxiety" has no definite source nor is it focussed toward person or circumstance; it is simply the sense of nothingness experienced by all humans and thus creates us feelings of with life. Barth's heroes, then, must identify some way out of their problem.

In *The Floating Opera*, Todd first commits suicide and then disagree that idea, rejecting it with his continuous inquiry which befalls *The Floating Opera*. For Jacob Horner, entrapped like his autograph in the corner, the "to be or not to be" question never rises. In lieu, when taking decisions, he severs from paralysis, an illness to act one place or the other, and, seem Todd again, and his only key is in writing. It appears though Barth thinks that new creation can be a flee from life's insignificant and absurdity. Barth looks also comprised by the end of 1955 that two important principles of existentialism are fact: (1). Every human action and reaction is in the end absurd, and (2). no amount of fantasy, masks, or immobility can cover the basic absurdity of existence (of. Camus's *Myth of Sisyphus*, *Essay of absurdism*, and Sartre's *Being and Nothingness* and *Nausea*).

The early two realist novels, the spins that exist for Todd and Jacob are sealed models in that they end in boundary. The "calm down" responses of both characters start by questioning that if all values are virtual, how does man ultimately analyze anything? Discovering no reasons for living, Todd commits suicide but ultimately identifies that the lack of encouragements for living are exactly linked by the lack of motives for dying; however, like Bartleby, he does not perform. Jacob Horner ends in his execution (the last word in the novel), his place, by discovering that all choices are equal; therefore, alternative simply portrays an artistic set of ambiguous questions. The key to Jake's dilemmas survives in mythotherapy, and this is what grasps the two sets of novels together. The rather inability doctor in *The End of the Road* analyses Jake as suffering from "cosmopsis," the feeling of the absurdity of everything, or cosmic neutrality. As this paper has already mentioned, Eben Cooke in *The Sot-Weed Factor* undergoes from the same inability, and the reflections of Jacob and Eben, logically distinct as they are, take the reader two possible Medicare for this view of the world. Mythotherapy, Jake's medications, becomes the role play of developing self. The game is played by bearing new identities, guessing masks, and assuming simple reasons for making difficult situations; existence, then, becomes concluded by a man's awareness of motion, the series of action and reaction that explains and hones existence.

The doctor speaks Jake to

act impulsively; don't let yourself get stuck between alternatives, or you're lost.... If the alternatives are side by side, choose the one on the left; if they are consecutive in time, choose the earlier. If neither of these applies, choose the alternative whose name begins with, the earliest letter of the alphabet; these

are the principles of Sinistrality, Antecedence, and Alphabetical Priority— there are others, and they're arbitrary, but useful.(*ER* 30)

Barth's second novel, *The End of the Road*, gives similar characteristics with its precursor. Like Todd, Jake (Jacob Homer) is a nihilistic protagonist who cannot get meaning in the world and who exists in isolation and separation from the rest of society. He also takes on a similar superior position with regards to the rest of humanity as does Todd and virtually all of Barth's characters. Indeed, Barth's protagonists distinguish themselves from society through their emotional coldness and self-conscious "philosophical" - or, rather "existential" power. All consider themselves as "open minded" beings who are entitled to evaluate others and to treat them as objects because of their knowledge of the ultimate meaninglessness of anything and, thus, of the absurdity of human life. As a consequence, in *The Floating Opera* Todd has no second thoughts about attempting to demolish the whole ship with hundreds of people in it. In *The End of the Road*, Jake treats Miss Rankin and Rennie with utter contempt, even shamelessly denying his duty in the death of the latter at the end of the novel.

Hence, the major purpose of this article is to expose that neither extreme interpretation of the author's' texts and creative intentions are fully analysed and Barth pursues a comparable goal with his writing to move from the absurdity of life by engaging in comical text and conferring artistic validity to his existence. Moreover, Austria's literary and academic tradition and Barth's similarly strong connects to and conditioning by the literary principle taught at North American universities explain that even though Postmodernism's assertion toward national history, universality and history still play a major part in the definition of contemporary fiction .

Finally, his float becomes malady because all alternatives in the end become equally meaninglessness.

I left the ticket window and took a seat on one of the benches in the middle of the concourse to make up my mind. And it was there that I simply ran out of motives, as a car runs out of gas. There was no reason to go to Cincinnati, Ohio. There was no reason to go to Crestline, Ohio. Or Dayton, Ohio; or Lima, Ohio. There was no reason, either, to go back to the apartment hotel, or for that matter to go anywhere. There was no reason to do anything. (*ER* 37)

Joe cannot perceive these anti-rationalist principles. When he tells Jake why he chose adultery with Rennie, Jake's reply is that he simply sensed it; and he doesn't know why he believed like it either. Joe cannot believe the fact that some people act without cause, that some actions have no intention, so he stresses that Rennie and Jake meet again until they can discuss their rationale. Since there is absurd, the ending is tragic. Rennie is pregnant with neither man knowing for sure who is responsible. She does not want pregnancy, and Jake, for

the first time, takes responsibility and goes to meet a doctor. During the abortive operation, Rennie dies, disgusting in her own vomit of sauerkraut and hot dogs. It is, possibly with the exception of the act of Rabbit Angstrom's wife hiding her child in John Updike's *Rabbit*. Run, the most strongly horrible set piece in modern American literature.

In *The End of the Road* here is one other character who justifies more mention. The doctor, Jake's mythotherapist and Rennie's abortionist, has no equal in *The Floating Opera*. He presents Jake existential advice, and, at one view, he even asks Jake to read Sartre and become an existentialist. He first requests Jake to make changes, the first existential action. He then initiates Jake to mythotherapy which he explains as follows:

Mythotherapy is based on two choices: that human life leads human essence, if either of the two terms really indicates anything; and that a man is free not only to choose his own effect but to assume it at will. (*ER* 38)

These are experimental instructions, but the doctor is not an existentialist; indeed, Jake tells him a super-pragmatist. Truth does not concern him, only values and results. The pragmatic remedy to Jake's problems is to select the action which will result in the least amount of disastrous actions. He lacks to do this because his cosmopsis keeps him from expecting results, and his acceptance of responsibility comes too late to create any variations. The doctor, then, becomes yet another juxtapose between the two closed models, *The Floating Opera* and *The End of the Road*, and the two open or "twisty" novels, *The Sot-Weed Factor* and *Giles Goat-Boy*. He is the first in a set of metaphysical scam-men, Henry Burlingame in *Sot-Weed* and Harold Bray in *Giles*, who will both be discussed with at length later.

Barth understood for his first two novels to be companion pieces (of. Gerhard Joseph and David Morrell). The end of *The Floating Opera* is the beginning, the other enquiry, of *The End of the Road*. The similarities are obvious. Both use first person narration by a hero who wants to write. Both main characters are cynical, bachelors who are strongly searching for existence and value. Both play roles in order to make life. All of the major characters in both novels are representations of a philosophical point. What is less true and more significant is the polyphonic nature of the books considered as a set. Jake can identify nothing in life of the most importance while Todd is forced to find some reason for every moment. Another contradiction involving Todd and Jake is that the masks that Todd costumes are unconsciously selected; Jake selects his intentionally as a part of his psychological therapy (the mask of the authoritative grammar teacher, for instance). The distinction between Harrison Mack and Joe Morgan, the equals for the two major figures, are important as well. Both remain thoroughly to developed principles, but Harrison is immature in thinking that his values are

fixed while Joe understands that his personal code is realistically vulnerable and subjective; therefore, insight in *The Floating Opera* becomes intellectual thoughts in *The End of the Road*.

Conclusion

The End of the Road is about the end of the road. Joe withdraws his job at the university, his greatest mistake having been that though he recognized Sartre and Camus's idea that there are no values, he made a value of reason and neglect to accept haphazard chance. Rennie is disappearing, and Jake's life is tragic. If we read the last word in the novel, terminal, literally, it is his final depot from choices, from existence itself. It is a very irritating and unpleasant novel to read, but if this closed technique is to alter there should be some witness of possibilities at the end, and there is. Finally, and most important moment in this book, Jake's end of the road arises when the intellectualization of his absurdism faces Rennie's human desire, love, and loss. Rennie had affectionate both Joe and Jake. That love abides after terminus, after both the end of the road and *The End of the Road*.

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A Study of Literary Devices in John Barth's Fiction

John Barth, in full John Simmons Barth, (born May 27, 1930, Cambridge, Maryland, U.S.), American writer best known for novels that combine philosophical depth and complexity with biting satire and boisterous, frequently bawdy humour. Much of Barth's writing is concerned with the seeming impossibility of choosing the right action in a world that has no absolute values.

John Barth is the most important an academic-oriented literary character. The Post Modernist period in American Literature is called as "Post Apocalyptic". The word 'Apocalypse' referred here to represent a Second World War and its tragic effect on American society. Post Modernism defends the glory, the splendor and success of twentieth-century American fiction. In other terms, it should be attempted as an advancement of the first renaissance produced by Nathaniel Hawthorne, Herman Melville, and Walt Whitman. While recognizing general aspects of Post World War novelists such as Saul Bellow, Norman Mailer, John Barth and Thomas Pynchon, Frank D Mc Connell creates the following observation which can be described as a general introduction to John Barth. Their fiction meticulously examined represents not very much of an extension of the post modernist region of artifice and society, but rather a reversion from the version. It is an attempt to find within the very important of the contemporary wasteland mythologies of mental pressure and social, political health. (7)

Twentieth Century American literature is expanded an exploration, innovation and experimentation brought out on the subject of American postmodern fiction. An antagonist, Fabulation, Anti- novel, Mythmaking and Black humour considered the writing of postmodernists including those of Barth. Postmodern American literature becomes qualified by the progress that excited the early part of our century including cubism, futurism, Dadaism, surrealism, suprematism, and constructivism. Some of the essential features of postmodernist fiction do not have of plot structure subtle and vastly distracted events, least developments of character, inevitable experiments with words, punctuation and syntax and the general use of changeable ending and beginnings. Any serious literary pursuit into the different aspects of American postmodernism should get a brief account of the birth, life, and death of American literature after the revolution of the century agrees with the growth of capitalism and offers a literary response to the American social and economic structure.

This observation has a direct attitude on Barth's close concern with form and content. And whole Barth's writings cover complicated frame devices , obscure plot structures, filled with mythical quotations, philosophical expression, and wordplay.

The thesis entitled **A STUDY OF LITERARY DEVICES IN JOHN BARTH'S FICTION** tries to study the concept of literary themes in the works of representative Postmodern American writer, namely, John Barth. A close study of this writer reveals that the idea of literary device is a common preoccupation for the author, and hence, the choice is not arbitrary. My thesis consists into six chapters such as;

- I. Introduction
- II. Black Humour and Restructure
- III. Nihilism and Satirism
- IV. Parody as a Literary Device
- V. Use of myth
- VI. Conclusion

The first chapter Introduction gives an outline of Barth's life and literary achievement in the postmodern milieu along with an account of the shaping influences of his literary career. It also divides Barth's fiction into two phases and justifies the choice of Barth's first four novels and a short story for this study. The researcher's critical attitude towards Barth's early fiction and his interpretation of the same are clarified in this introductory chapter. Barth remarks that his first novel, *The Floating Opera*, reflects the influence of French existentialist thought in post-World War II American culture. In his first novel, *The Floating Opera*, it

finds its expression in Todd Andrews's despairing reflection over his inability to exclude any fact from the vast research he has amassed in preparation for the writing of his own narrative. For Andrews, every fact has significance, but none has any ultimate importance because the world itself is finally without any absolute principle of order.

Chapter II discusses about the author's literary elements of 'Black Humour and Restructure' in his writings. *The Floating Opera* is an excellent introduction to John Barth's career as a black humour novelist and as a parodist. Restored to its original ending in the revised edition of 1967, the novel firmly establishes Barth as a black humorist. The novel's title is from the name of showboat that used to travel around the Virginia and Maryland tidewater areas with the banner reading "Adam's Original and Unparalleled Floating Opera". Todd Andrews the narrator, the hero of the novel gives the following reason for choosing the part of the name of the showboat as the title of the book in the page number seven. Once it was tied up at Long Wharf, this is changed his mind in 1937. That is the root cause to choose it as a title *The Floating Opera*. This dark and miserable view of life imbues the whole view of a novel which is very comedy. The most famous of black humour novelists are immersed with the idea of life. The idea of death is a major asset for the dark view in their novels. While other present writers dealing with death in a dark way as the seriousness of the matter, the black humour writers employ the fear of death from an ironic and comic view. They analyze that death is the great absurdity which rejects all meaning from human existence. If all the sort of human beings direct to nowhere else but death besides which there is nothing, then all human acts get contradicted. As a result, the black humour writer shows a very dark and somber view of a human end. He believes that death is an absolute reality.

The main attitude moves through almost all black humour novels. The heroes of the novels are always visited by the fear of death; they also form strategies for survival. Thus Le Clair notes: Laughter does not remove the death, but it does make for the reader a literary circumstance in which death can be shown. (84)

The remedy of sex has prescribed the black humour novel its reputation. The black humour writers have broken all restraints about sex in their works. One of the attitudes adopted by the black humour novelists for distracting the reader is to collapse them. With regard to obtain this effect, they always take up such extreme measures. All sorts of sexual abnormality are discussed in the novels to disturb the readers. Barth's novel makes an appeal that Barth does not mock much value to sex as a value of satisfaction. For him, sex is no inspiring act which helps man attains the anxious situation in which he is placed. Todd's affair with Jane, the wife of his friend, is largely sexual. It does not assist him to conquer his

dread of death. Jacob Horner's false relationship with Rennie Morgan in *The End of the Road* also has a terrible act. It not only depicts Jacob Horner act less but runs Rennie to the horrible death. Barth hardly mocks at the animalistic urges of human sexual activities. Todd has his first sexual affair with his girlfriend Betty Jane on his birthday of seventeen years. The absurdity of human and animal is a strong piece of humour in *The End of the Road*. Todd giggles at "mating animals" and "Double cross" because they repeat him of his first effort to create love to Betty Jane as a youth.

Indeed a famous black humorist John Barth horribly funs at the fallacy of sex and illustrates his points it through Todd. Thus he said that nothing is constantly, deeply, comically in the act of "mating animals." According to Readers point of view if you are young you fall in love; if the extreme of sex act you sense that you and your lover are examples for a Greek sculptor Phidias, For a mirror can show what it looks, and what it looks is absurd.(124

Chapter III summarizes the discussion of *The Floating opera* and *The End of the Road* portray the same nihilistic heroes (Todd and Jacob) who are designed by their philosophical insecurity. Reflecting the existential angst of this author, these protagonists reserve in the art of artfulness (or in the search of an intellectual work) with regard to achieving the feel of control they cannot achieve in real experience. In the same context, Barth gives a real happiness in the effort of the text (and of the reader) which quits their clear nihilism.

Satirism expresses the idea of nihilism in *The End of the Road* by applying the actors to analyses their absurdity; in a device, it signifies the unreality of literature, but not to another theme of nihilism. Even though Barth's aim is to degrade the regulations which the novel concludes he does this to contribute a more valuable image of reality through a more reasonable narrative form. And so he is doing in the common of fiction, as Frank Kermode so clearly says that it is like new laws and forms as the novel makes have them to be routinely violated under the applications of an altered reality. The story of the novel is the history of customs denied or altered by parody, disregard as absurd. Generally we also aware of the difference between inherited laws and our own reality.

In addition, the grotesque view and the overdone, as well as contrary points of view are also to be found in John Barth's first two novels. Here, Barth's treatment of the grotesque is underlined the parody of human existence, that is the violence of life and the ridiculing attempts of humankind to alter them. The best explanation for the grotesque in the two novels is Harrison Mack, Sr. who creates seventeen characters and protects his manure and nail cutting in jars. Barth absurdly joins Mack, Sr.'s pickle business with his unstable quest for

power, by combining the estate and fortune with beakers containing his manure. Thus doing, the containers will continue to agitate and death. *The End of the Road* is also filled with absurdity and grotesque circumstances and descriptions, such as Jack and Rennie's illegal contact of Joe masturbating and touching his nose at the same time as well as an absurd list of all, the ridiculous therapies the doctor gives for various diseases. In the same effect, Todd's designation that authorizing even as well to contradict prepositions has never disturbed him. Since Barth believes in the absurdity and dilemma of the world, there cannot be any reality. As Jacob Horner asserts for the writer that exists not only leads essence; in the act of human beings, it rather holds effect. Thus all ideas base on the view in which he is reached and Barth knows that his view is relative.

In this chapter IV discusses about 'Parody' is a literary device in literature. It is generally written to copy, imitate or make fun of an original literary work, and it's another, subject, technique, or some other elements with ironic or imitation. As Linda Hutcheon, a literary theorist asserts that parody is counterfeit, not always the use of the imitated work. It may be identified in art and culture, along with literature, music, gaming, animation, and film. Another critic John Gross marks that Parody showed to develop on domain somewhere between burlesque and imitation.

The most famous work *The Sot-Weed Factor* is written by John Barth published in 1960 and revised in 1967. This novel is a parody of the picaresque novel; it is taken from a satirical poem the same title *The Sot-Weed Factor* written in 1708 by Ebenezer Cooke, who is the hero of Barth's fiction. This work's black comedy is extracted from its cautious of general literary creation. The novel *The Sot-Weed Factor* shows the beginning of Barth's literary postmodernism. The English poet Ebenezer Cooke's *The Sot-Weed Factor or A Voyage to Maryland: A Satyr* acknowledged many biographical particulars in this poem. Mock epic sets in the 1680s – 90s in Colonial Maryland. It expresses of a falsified Ebenezer Cooke, who is referred the subtitle "Poet Laureate of Maryland" by Charles Calvert. He is the third nobleman to create a Maryland to recite the glory of the colony. He experiences adventures on his travelling to and within his virginity. In the context, *Tom Jones* character is mixed with many diversions and tales within tales and is made in all original style on the creation of eighteenth-century writers. Like as Henry Fielding, Laurence Sterne, and Tobias Smollett.

Barth's *The End of the Road* gives parallel characters like Todd, Jacob Horner is an experiential hero who cannot discover meaning in the world and who exists in seclusion and alienation from the rest of society. He also attains on an alike higher position with regards to

the rest of society as does Todd. Obviously, Barth's protagonists analyze themselves from society through their emotional dullness and self-satisfied experimental or, rather philosophical superiority. All acknowledge themselves as "learned" beings that are named to evaluate others and to treat them as things because of their judgment of the absolute meaninglessness of anything and the inefficacy of human life. As a result, they are fully insensible to the affairs and concerns of others and distinguish their contacts according to the great model. This is also the crisis for Todd and Jack, who are both fully secluded and threatened in their mental health at the end of both stories. Similarly, Todd and Jack show human beings as animals that are directed by the most prime impulses and urges such as fear, sex, search for power, depression, etc. Since Barth believes in the absurdity and dilemma of the world, there cannot be any reality. As Jacob Horner asserts for the writer that exists not only leads essence; in the act of human beings, it rather holds effect. Thus all ideas base on the view in which he is reached and Barth knows that his view is relative.

Chapter V deals with mythical concepts and characters in Barth's novels. 'Mythos' the term is derived from Greek. The word 'Myth' signifies any story or plot, whether true or false. Most of the myths involve rituals – prescribed forms of sacred ceremonial but social anthropologists disagree as to rituals generated myths or myths generated rituals. If the central character is a man rather than a supernatural being, the story is not called myth but legend. The term mythology does not believe in any religion. The word has also explained to signify the supernatural tales which are intentionally used by their authors. Many writers have also stated that fuse mythology, whether heredity or made up is important to literature. James Joyce's *Ulysses*, Eliot's *The Waste Land*, O'Neill's *Mourning Becomes Electra*, John Barth's *The Sot-Weed Factor* and *Chimera* and many other authors have thoughtfully produced their works in the form of ancient myths. Now Myth is one of the most famous terms in contemporary literature, furthermore myth, is firmly imagined place in which a work of art appears in Faulkner's myth of yoknapatawpha country' and 'the mythical worlds of Moby Dick.

The Sot-Weed Factor and *Giles Goat Boy* can be presented, partially for the purpose of this analysis, as the preface to John Barth's the greatest works with myth, for they are not truly involved with a re-worked and reaction of myth through the course of creative work as a resemblance for universal restoration and regeneration. *The Sot-Weed Factor* and *Giles Goat-Boy* are generally the same work, a lengthy mock-epic account of a child like young hero. *The Sot-Weed Factor* has some mythical acts and concerns –con man, dual, the heroic

inquiry, for example –it incurs distant more to Fielding and Cervantes themselves to the mythical view of Virgil or Homer.

This chapter enables to understand the multi-access of mythology in John Barth's *Chimera* will scrutinize this subject from distinguished perspectives. This chapter is based on the author's kinship as well as controversy with the typical philosophical tendency and literary theories, which can be described in *Chimera*. The aim of the chapter is to reveal both external source of Barthian myth and its internal references within the fiction. The meaning of myth, analyses chiefly relating to storytelling so as to come out with the postmodern perception of human existence, established by one of the most popular American storytellers.

In the last chapter Conclusion, Barth is fairly exploratory about the link between art and life. Barth's novels are remarked on theories of the novel. But his fictions are connected to live. So the effect is the movement of creative self-consciousness to the forefront of the artefact. Conclusion sums up all the points and inferences, arrived at to show Barth as a great thinker of modern times. It ends with a note for further research on the influence of Eastern thought on Barth's writings.

Postmodern art is often a creation of 'doubt' and 'disorder'. It burdens the reader and audience to involve in the way of ridiculing the assuming indifference and the desirable functionalism of language. Value is often a question of relationship, of words within sentences; of sentences within texts; within discourse and its concepts. But since meaning usually aims away from its own essential elements, one rarely understands the way that determines what is said. To create discourse proof is the main approach of postmodernism, literature, and art.



Impact of calcination temperature on structural, optical, and magnetic properties of spinel CuFe_2O_4 for enhancing photocatalytic activity

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Abstract

Variation in temperature during synthesis is a favorite aspect to get enhanced structural, optical, magnetic, and catalytic properties. Here, in this work, Spinel (CuFe_2O_4) ferrites were formulated with various calcination temperatures. The method used is a simple, economical, and eco-friendly microwave combustion method. Impact of annealing temperature on structural analysis is confirmed by XRD analysis. Under the following parameters, the structural changes are discussed: diametrical size, lattice parameter, strain, tetrahedral and octahedral hopping length, and bond length, respectively. HR-TEM results assure the spherical-shaped morphology. The average diametrical size calculated is in good agreement with the XRD results. The EDAX spectrum confirms the composition of sample and its purity. A FT-IR study exemplifies the ferrite characteristic peaks available as synthesized sample. The UV-Vis analysis and Tauc's plot of the samples give us the optical bandgaps as 2.2, 2.1, and 2.08 eV, respectively. An increase in calcination temperature exhibits an enhancement in saturation magnetization (M_s), remnant magnetization (M_r), and coercivity (H_c) at room temperature. Degradation activity of methylene blue (MB) studied by catalyst CuF-MW, CuF-500, and CuF-600 expresses the degradation efficiency of the catalyst. CuF-MW exhibits an excellent result than other samples, due to large surface area and the small diametrical size.

1 Introduction

Nowadays, spinel nanostructured ferrites are on the increase of interest in the realm of nanotechnology and nanoscience, because of their importance in the fundamentals of electrical, optical, catalytic, and magnetism [1, 2]. Spinel-type magnetic nanostructure is a technologically essential material in different industrial processes [3–5]. Moreover, spinel ferrites are cubic and have the chemical structure MFe_2O_4 , where M^{2+} -cations and Fe^{3+} -cations have occupied the tetrahedral (A-) and octahedral (B-) sites, respectively [6–8]. Additionally, diametrical size, structure, morphology, and distribution of cations between A- and B- sites of spinel

ferrites are highly based on the chemical and physical properties [9–13].

Nanosized spinel ferrites (MFe_2O_4) are produced through sol-gel, hydrothermal, co-precipitation chemical reduction, and micro-emulsion methods [14, 15]. In the above methods, microwave synthesis is found to be the finest promising method, since its easiness, production, and control of a number of factors such as size, morphology, agglomeration of the particles [16–18]. In modern times, spinel-type magnetic samples act as a Nano-catalyst in the field of eco-friendly applications, for their chemical stability, non-toxicity, commercial accessibility, and reusability. CuFe_2O_4 is a normal spinel structure with high-saturation magnetization M_s , and coercivity H_c which makes these materials apt for various applications such as magnetic storage, MRI, and magnetostrictions.[19, 20]. There are many works carried out for moderating properties of spinel copper ferrite with various dopant cations such as magnetic, non-magnetic, and rare earth.

However, so far no, work is undertaken to reorganize the properties of spinel copper ferrite by calcination temperature in microwave technique. Innovatively, the high-quality CuFe_2O_4 products are obtained by this method in different

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calcination temperatures, and investigated the changes in structural, optical, and magnetic properties in accordance with the temperatures. Characterization of the catalysts is extracted from XRD, HR-SEM, HR-TEM, EDAX, PL, and VSM studies. In conclusion, the catalyst was tested for their Photocatalytic activity towards Methylene Blue solution and the gotten results were elaborately inspected.

2 Experimental procedure

2.1 Synthesis of CuFe_2O_4 nanoparticles and photocatalytic (PC) degradation procedure

The metal salts of iron nitrate $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ (99%) and copper nitrate $\text{Cu}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (99%) act as metal precursors, urea as a reducing agent, and fuel for adjusting the agglomeration of particles and deionized water as a solvent. All metal reagents were supplied by Sigma-Aldrich. In detail, 1 M of copper nitrate and 2 M of iron nitrate were added in 50 ml of deionized water and then 3 M of urea solution was mixed with the above solution; the solution was stirred until the solution completely dissolved. The solution is gathered in a silica crucible and then positioned in a 300 W microwave oven at 150 °C for 20 min, and after combustion reaction, products were formed. It was labeled as CuF-MW. Later, these powders were sintered additionally at 500 and 600 °C at 2 h with heating rate of 5 °C/min in air furnace and sample materials were considered as CuF-500 and CuF-600, respectively. The final products CuF-MW, CuF-500, and CuF-600 were cleaned several times using distilled water and pure ethanol. At 70 °C for 1 h before subjecting it for characterizations, it was dehydrated. The CuF-MW, CuF-500, and CuF-600 photocatalysts were used for studying the degradation of MB. The photocatalytic procedure is detailed in our previous work [21].

3 Results and discussion

3.1 Structural analysis

Figure 1 shows the powder X-ray diffraction (XRD) patterns of CuF-MW, CuF-500, and CuF-600 samples, respectively, which tell the formation of nanostructure in crystalline phase. In XRD patterns, all (hkl) plane values of copper ferrite (220) (311) (222) (400) (422) (511) (440) (533) are indexed and well matched with the JCPDS file no: 72-1174, and indicate cubic spinel structure along with $Fd\bar{3}m$ space group [21]. The XRD peaks are sharp and increase in peak intensity with upsurge of calcination temperatures. This specifies intensification in crystallinity, corresponding to enlargement dimension of the nanoparticles.

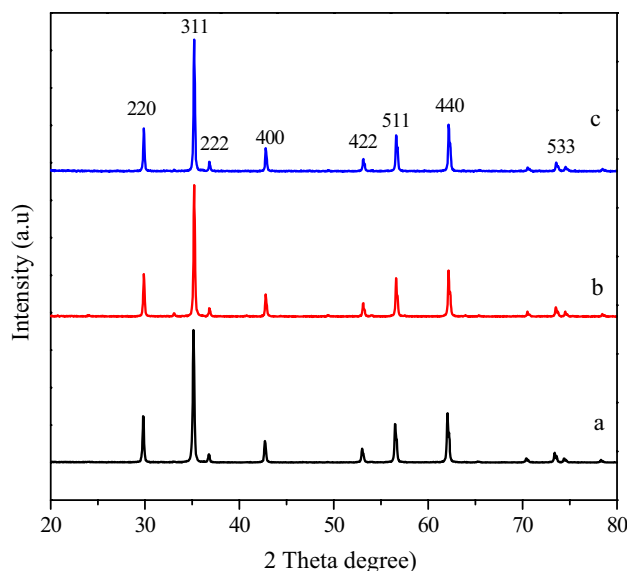


Fig. 1 Powder XRD patterns of (a) CuF-MW, (b) CuF-500, and (c) CuF-600 samples

The average diametrical size of the particle is calculated using Scherrer formula given in Eq. (1):

$$D = 0.89\lambda / \beta \cos \theta \quad (1)$$

where D is referred as average diametrical size, λ is X-ray wavelength (1.5406 Å), β is full width -half maximum (FWHM), and θ is the Bragg angle of the plane (311). The average diametrical size of the samples CuF-MW, CuF-500, and CuF-600 was found to be 17.5, 21.4, and 25.9 nm, respectively. The observed increment in diametrical size is due to long time and higher calcinations temperature (500 and 600 °C samples for 2 h), respectively. In this study, the calcination temperature plays a key factor for adjusting the size of the particles.

Lattice parameter of cubic crystal lattice ($a = b = c$) was calculated using the following formula:

$$a = d(h^2 + k^2 + l^2)A^\circ \quad (2)$$

The obtained lattice parameter is listed in Table 1. The lattice parameters of the magnetic samples CuF-MW, CuF-500, and CuF-600 were 8.337, 8.342, and 8.345 Å, respectively. The difference in lattice parameter is according to the different calcination temperatures [22]

The obtained lattice parameter is corrected using Nelson–Riley Plots, which give the most accurate values of lattice parameter [23]. The function plots between the obtained ‘ a ’ values from different planes Vs (N–R) exploitation function $F(\theta) \rightarrow 0$. The function $F(\theta)$ is calculated from Eq. (3),

Table 1 Calculated parameter from XRD patterns of CuF-MW, CuF-500, and CuF-600, respectively

Parameter	CuF-MW	CuF-500	CuF-600
Average diametrical size (D)nm	17.5	21.4	25.9
W-H Method (D) nm	20.9	24.5	25.6
Strain	0.00376	0.00359	0.00381
Volume (a ³)	575.72	576.55	577.38
Lattice parameter (a±0.001) Å	8.337	8.342	8.345
Corrected lattice parameter values using N-R plot (Å)	8.319	8.323	8.327
Tetrahedral hopping length L _A (Å)	3.602	3.601	3.598
Octahedral hopping length L _B (Å)	2.941	2.940	2.938
Tetrahedral bond length d _{AX} (Å)	1.873	1.872	1.870
Octahedral bond length d _{BX} (Å)	2.022	2.021	2.019

$$F(\theta) = 1/2 (\text{Cos}^2\theta / \sin \theta + \text{cos}^2 \theta / \theta) \tag{3}$$

The function $F(\theta)$ to zero gives the reevaluated lattice parameter ‘a’, respectively. Figure 2a–c shows the N–R plots of the samples CuF-MW, CuF-500, and CuF-600 and the corrected values are listed in Table 1.

The W–H method is used to calculate the crystal size and strain [16, 21], so the strain-induced line broadening β_s is given by the relation

$$\beta_s = 4\epsilon \tan \theta \tag{4}$$

But

$$\beta_{hkl} = \beta_s + \beta_D \tag{5}$$

Therefore

$$\beta_{hkl} = k\lambda / (D \cos \theta) + 4\epsilon \tan \theta \tag{6}$$

Rearranging Eq. 5

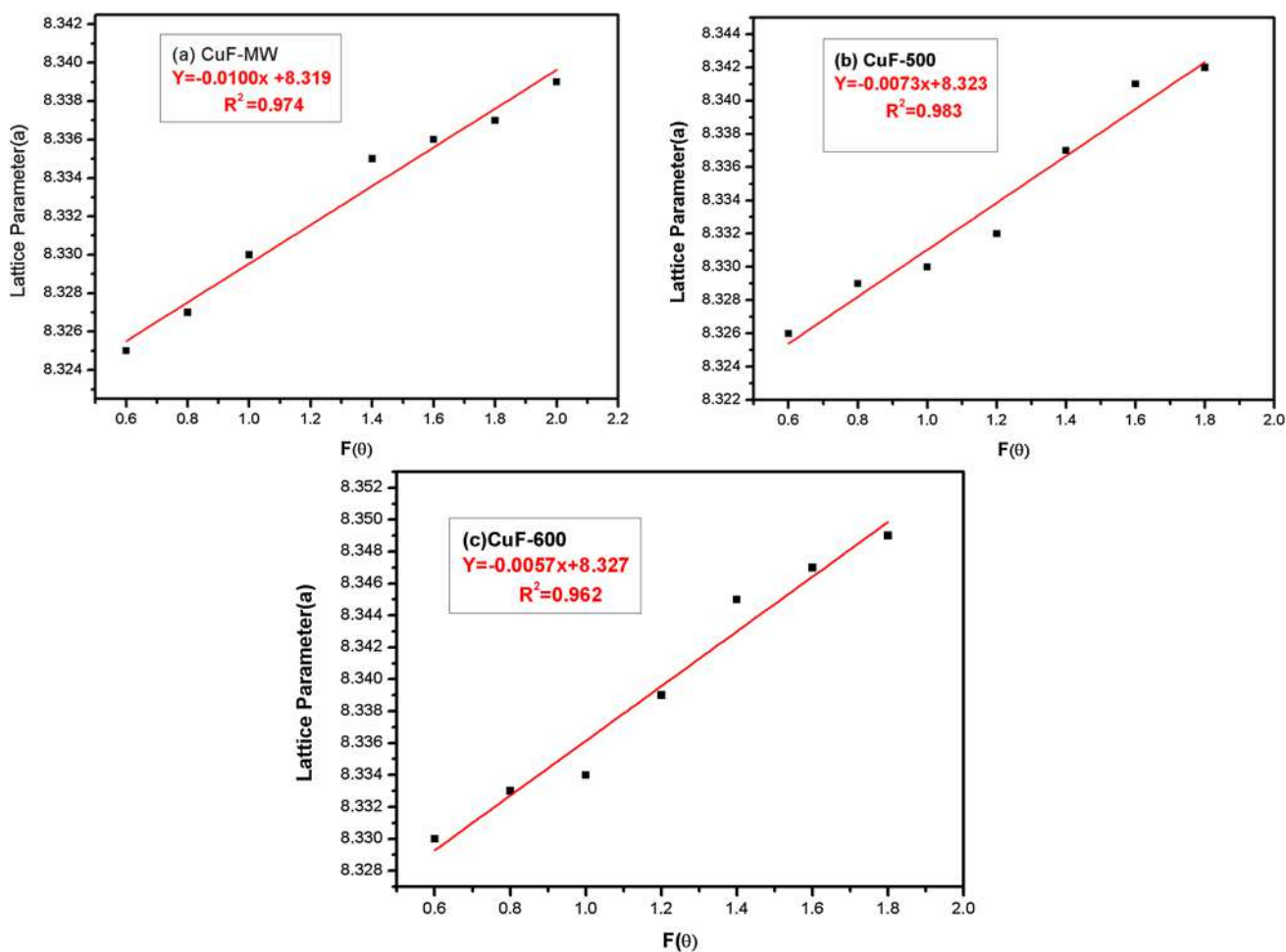


Fig. 2 a–c shows the N-R plots of CuF-MW, CuF-500, and CuF-600 samples

$$\beta_{hkl} \cos \theta = k\lambda/(D) + 4\varepsilon \tan \theta \quad (7)$$

Equation 5 is obtained by adapting the uniform deformation model (UDM), and a plot between $4 \sin \theta$ and $\beta_{hkl} \cos \theta$ is shown in Fig. 3a–c. From the slope and intercept in the plot, the strain and the diametrical size values are taken out. The obtained parameters using W–H method are listed in Table 1. In ferrite structure, tetrahedral (d_A) and octahedral (d_B) hopping lengths can be calculated from Eqs. 8 and 9

$$d_A = a\sqrt{3}/4 \quad (8)$$

$$d_B = a\sqrt{2}/4 \quad (9)$$

The calculated hopping lengths of samples are listed in Table 1, which shows no considerable change in

hopping length with the impact of calcination temperature, respectively.

The tetrahedral (d_A) and octahedral (d_B) bond lengths are calculated from Eqs. 10 and 11

$$d_{AX} = a\sqrt{3}(u - 1/4) \quad (10)$$

$$d_{BX} = a\sqrt{3}[3u^2 - 11/4]u + 43/64]^{1/2} \quad (11)$$

where ‘ u ’ is oxygen ion positional parameter. The calculated bond lengths are listed in Table 1. The value of ‘ u ’ is taken from Eq. 12

$$u = (r_a + r_o)(1/3a - 2) + (1/4) \quad (12)$$

where r_a is ionic radii of A site, r_o is radius of oxygen ion, and a is lattice parameter. The impact of calcination

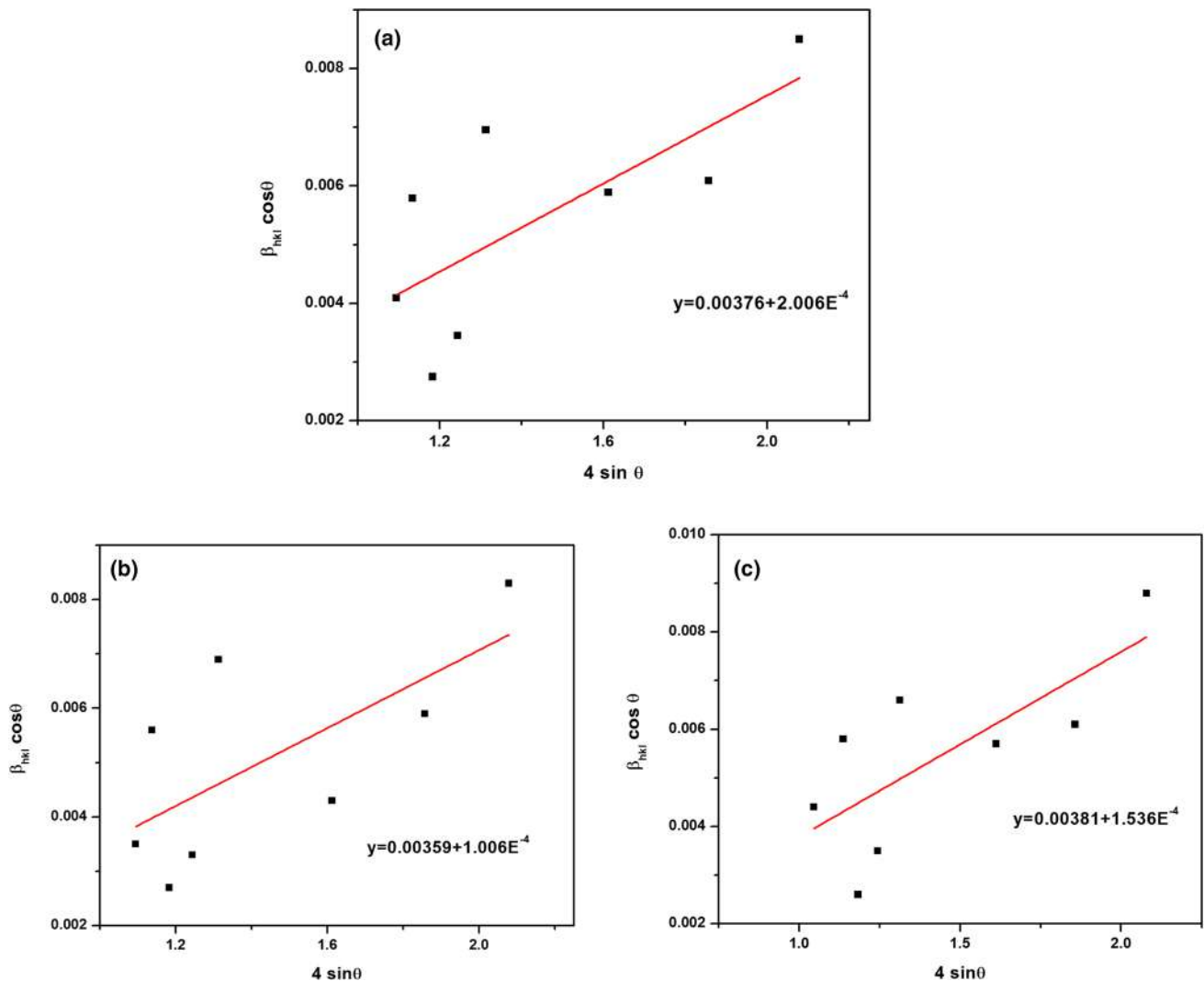


Fig. 3 a–c Williamson–Hall method graph of CuF-MW, CuF-500, and CuF-600 samples

temperature did not bring any significant modification in the bond length.

3.2 Morphological analysis

The surface morphology and the appearance of the samples were determined by analyzing the HR-SEM. Figure 4a–c

shows the HR-SEM images of CuF-MW, CuF-500, and CuF-600, respectively. The surface morphology concedes the agglomerated coalescence performance of the sphere-shaped nanoparticle-like structure. The interfacial surface tension phenomenon of the samples resulted in agglomeration. The sphere-shaped particle-like morphologies of the samples were further confirmed by analyzing the high-resolution

Fig. 4 a–c HR-SEM images of CuF-MW, CuF-500, and CuF-600 samples

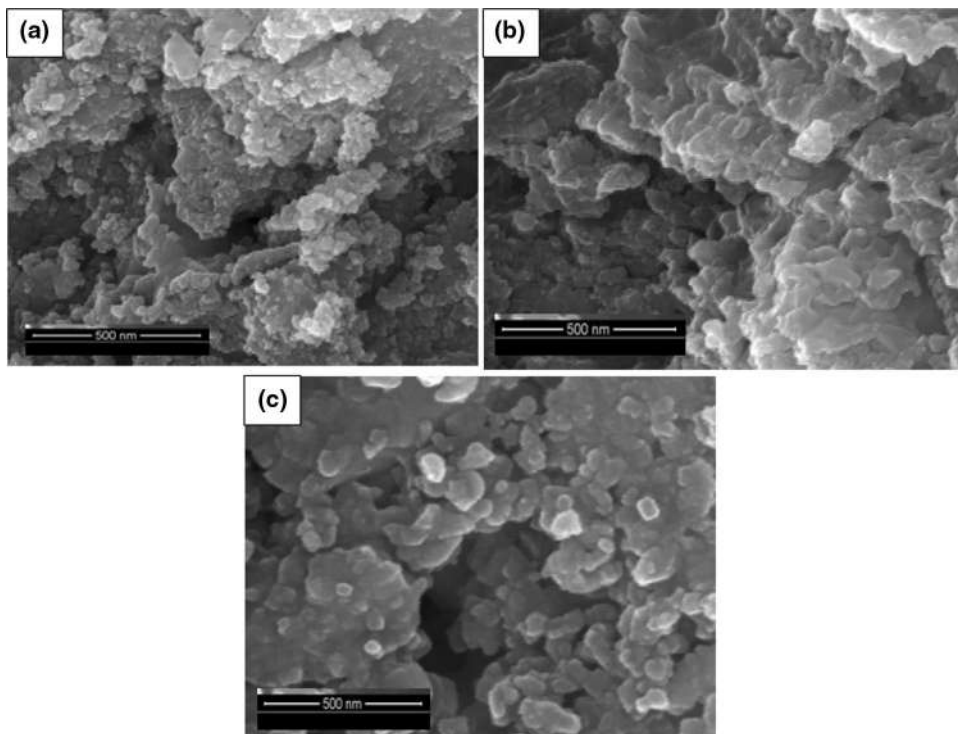


Fig. 5 a–c HR-TEM images of CuF-MW, CuF-500, and CuF-600 samples

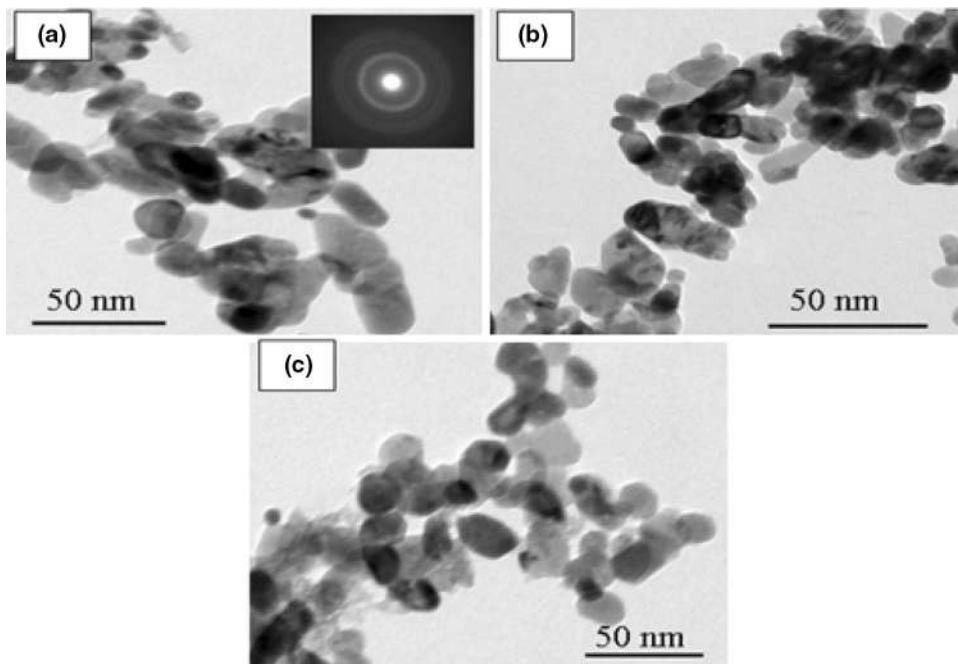
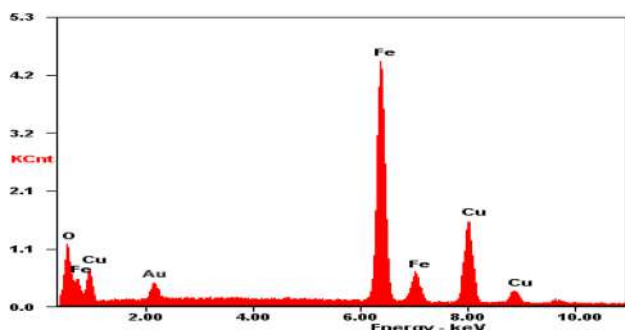


Table 2 Particle size comparisons between XRD and HR-TEM analysis

S.no.	Average diametrical size	CuF-MW(nm)	CuF-500(nm)	CuF-600(nm)
1	XRD analysis	17.5	21.4	25.9
2	HR-TEM analysis	15.8	20.5	26.7

**Fig. 6** EDAX analysis of CuF-MW sample

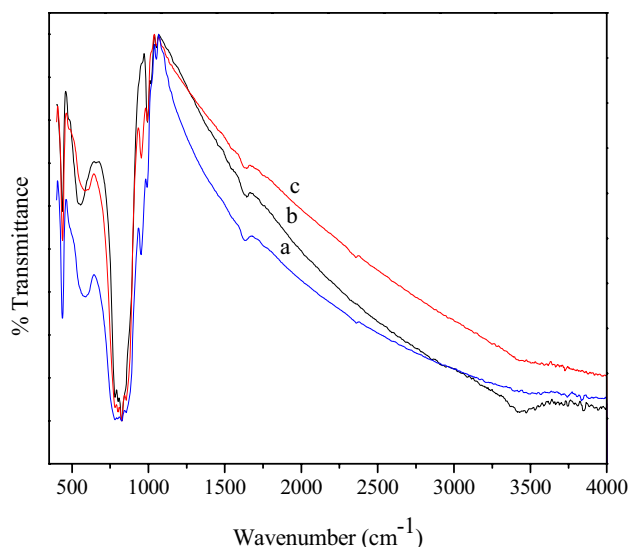
transmission electron microscopy (HR-TEM). Figure 5a–c shows the HR-TEM images of CuF-MW, CuF-500, and CuF-600, respectively. From the HR-TEM images, the samples exhibit particle-like morphology. The diametrical size from HR-TEM analysis and the average diametrical size obtained from the power XRD results were also in similar range (Table 2). Figure 5a inset shows the selected area electron diffraction pattern (SAED) of CuF-MW, which implies that the synthesized sample is highly crystalline in nature. SAED result shows the observed spotty ring characteristic of synthesized spinel nanostructure without any supplementary diffraction spots and rings.

3.3 EDAX analysis

By EDAX, the sample elemental composition and purity were confirmed. Figure 6 shows the EDAX spectra of CuF-MW consisting peaks of Fe, Cu, and O elements and no other peaks present, which confirm that the samples are pure and immune to other impurities. The EDAX results proposed that the obtained single-phase CuF product gets through only the chemical reaction. A short Au (gold) peak was observed at 2.1 keV, because gold is used as a sputter coating for the enhanced visibility of the surface morphology, while synthesizing the sample for HR-SEM analysis.

3.4 Fourier transform infrared (FT-IR) spectroscopy

The formation of surface functional group was confirmed by (FT-IR) spectroscopy. Figure 7 shows the FT-IR spectra

**Fig. 7** FT-IR spectra of CuF-MW, CuF-500, and CuF-600 samples**Table 3** FT-IR absorption and assigned stretching vibrations

Absorption peak cm^{-1}	Vibration cm^{-1}
~400	Octahedral site metal–oxygen stretching vibration
~600	Tetrahedral site metal–oxygen stretching vibration
~1605	C–O stretching vibration
~3400	Hydroxyl group

of CuF-MW, CuF-500, and CuF-600 samples, respectively. Generally, the stretching vibration 400 cm^{-1} (ν_2) and 600 cm^{-1} (ν_1) is common vibration in Ferrite structure. The vibration (ν_1) at 600 cm^{-1} corresponds to the metal at A-site, $M_{\text{tetra}} \leftrightarrow \text{O}$ vibrations, whereas the vibrations (ν_2) at 400 cm^{-1} correspond to metal B-site $M_{\text{octa}} \leftrightarrow \text{O}$ stretching. The variation between these ferrite absorption peaks is due to the adjustment of tetrahedral and octahedral bond length (Fe–O), respectively [24]. In this study, the above-mentioned band stretching is expected in FT-IR spectrum of CuF-MW, CuF-500, and CuF-600 samples, respectively. We observed a band at $575\text{--}570 \text{ cm}^{-1}$ assigned as (ν_1) $M_{\text{tetra}} \leftrightarrow \text{O}$ stretching of tetrahedral lattice, whereas the band at $482\text{--}488 \text{ cm}^{-1}$ is assigned as (ν_2) $M_{\text{octa}} \leftrightarrow \text{O}$ stretching of octahedral lattice, which is a normal behavior of ferrites. A vibration band at $\sim 3400 \text{ cm}^{-1}$ is associated with the O–H stretching of water (H_2O) molecules, indicating higher amount of surface OH, while those at $\sim 1605 \text{ cm}^{-1}$ due to their C–O stretching vibration. In Tables 3 and 4, the band positions of CuF-MW, CuF-500, and CuF-600 samples are listed. As seen from Table 4, the band stretching (ν_1) and (ν_2) slightly shifted to

Table 4 M–O stretching vibration of tetrahedral and octahedral sites

S. no.	Sample	Tetrahedral mode vibration (ν_1) cm^{-1}	Octahedral mode vibration (ν_2) cm^{-1}
1	CuF-MW	575	488
2	CuF-500	572	485
3	CuF-600	570	482

lower frequencies due to calcination temperature indicates the as-prepared sample is highly crystalline in nature.

3.5 UV–Vis analysis

The UV–Vis spectra have been measured to examine the optical absorption assets of the magnetic samples CuF-MW, CuF-500, and CuF-600, respectively. As an effect of the enhancement of calcination temperature, comparing with CuF-MW, the samples CuF-500 and CuF-600 show a shift towards higher wavelength, and enhancement of light absorption in the spectrum is identified. The extension of light absorption of the sample CuF-600 is extended to visible region when compared to CuF-MW, CuF-500 samples which indicates the narrowing energy bandgap of magnetic samples due to calcination, conformed by Tauc plot function vs the energy of exciting light. The calculated bandgaps of the samples were 2.2, 2.13, and 2.08, respectively. With the increase of the particle size of the sample, there is a decrease in the bandgap energy [22]. The extension of light absorption suggested that the CuF-MW, CuF-500, and CuF-600 could have higher optical activity. Figure 8a and b shows the UV graph and energy bandgap of CuF-MW, CuF-500, and CuF-600, respectively.

3.6 PL spectra

The optical properties of the spinel CuF-MW, CuF-500, and CuF-600 samples were studied by photoluminescence (PL) spectroscopy. It is well known that the determination of PL spectra strongly depends on surface morphology and synthesized type of nanoparticle, and the photoluminescence emission of the magnetic samples shows a broadband emission assigned to charge transmission between Fe^{3+} at B- sites and its surrounding O^{2-} ions [25, 26]. Figure 9 demonstrates the room temperature PL spectra recorded at $\lambda_{\text{ex}} = 395$ nm of CuF-MW, CuF-500, and CuF-600 samples, respectively. A small band detected at 412 nm denotes the availability of the NBE (Near Band-Edge) emission of magnetic samples. A sharp peak at 442 nm may be recognized to the oxygen vacancies surface defects of the samples [27, 28]. The PL band position is highly reliant on the calcination temperature. Small emissions centered at 481, 495 and 529 nm,

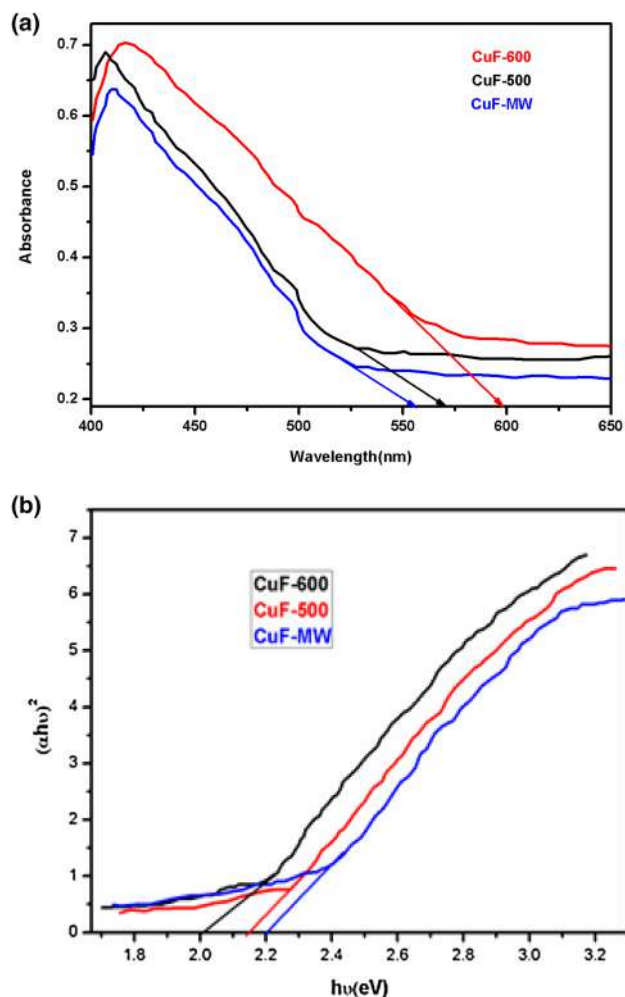


Fig. 8 a UV-Vis spectra of CuF-MW, CuF-500, and CuF-600 samples. b Energy bandgap of CuF-MW, CuF-500, and CuF-600 samples

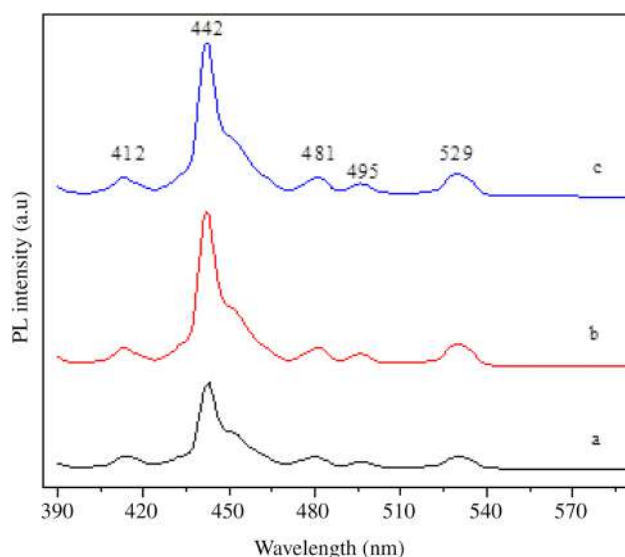


Fig. 9 PL spectra of CuF-MW, CuF-500, and CuF-600 samples

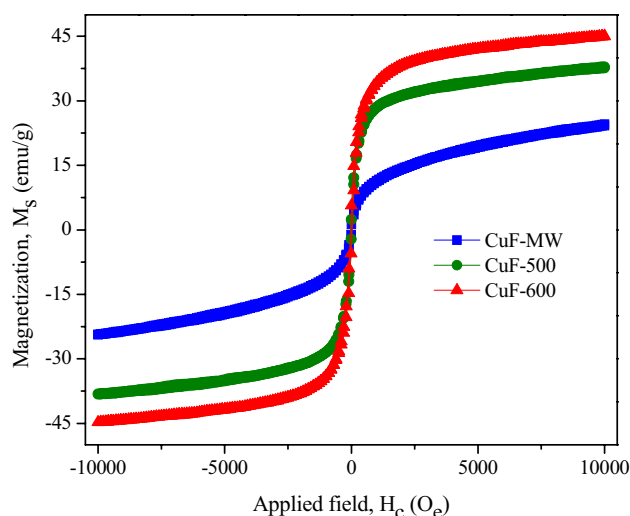


Fig. 10 Magnetic hysteresis loops of CuF-MW, CuF-500, and CuF-600 samples

Table 5 Magnetic properties (H_c , M_r , M_s , and M_r/M_s) of CuF-MW, CuF-500, and CuF-600 samples

Samples	H_c (O _e)	M_r (emu/g)	M_s (emu/g)	M_r/M_s
CuF-MW	8.45	0.185	28.83	0.008
CuF-500	9.02	0.246	37.68	0.006
CuF-600	9.43	0.292	45.62	0.006

due to the radiating defects are related to the interface traps existing at the grain boundaries [29, 30]. The surface oxygen vacancy and defect of the diametrical size incur the increase in excitation PL intensity of the magnetic samples. The emission intensity order is CuF-600 > CuF-500 > CuF-MW. From the above PL result, all the emission bands of CuF-MW, CuF-500, and CuF-600 nanoparticles expose the visible region of optical spectra.

3.7 VSM measurements

Magnetic measurements of the samples were carried out by vibrating sample magnetometer (VSM) to identify the magnetic behavior of the samples. The VSM analysis of as synthesized samples taken out by room temperature. Figure 10 shows the hysteresis loop of the CuF-MW, CuF-500, and CuF-600 samples, respectively. The size and structure of the hysteresis loops strongly depend on the preparation method as well as on the calcination temperature of the samples [31, 32]. The samples exhibit a normal (s molded) hysteresis loops, and the important magnetic factors such as saturation magnetization (M_s), remnant magnetization (M_r), and coercivity (H_c) increase due to calcination temperature and there is no abundant change in squareness ratio (M_r/M_s).

The calculated magnetic factors are listed in Table 5. In the literature, CuFe_2O_4 is a normal spinel structure and the distribution of cations is Cu^{2+} occupying the tetrahedral (A) and Fe^{3+} octahedral (B) sites. Additionally, spinel ferrites consume two crystallographic sub lattices, A- and B- sites, respectively [33, 34]. Low magnetic moment Cu^{2+} ions have a strong inclination to occupy A-site, and also Fe^{3+} ions have a stronger attraction to occupy the B-sites [35–38]. The value of coercivity (H_c) is in proportion to the increase in particle size which may depend on the increasing temperature. As mentioned, difference in coercivity may affect several magnetic aspects such as crystallinity, micro-strain, size distribution, and magnetic domain size. In this case, diametrical size towards single domain nature is proved by remanence ratio of the samples (0.008, 0.006, and 0.006). Ferromagnetic single domain nature causes increase in coercivity. The low coercivity in CuF-MW sample owing to the existence of super paramagnetic behavior [51] and the lower value in remnant magnetization (M_r) conformed that the as-synthesized magnetic samples are isotropic.

In the literature, ferromagnetic material has magnetic domains in which all the spins align together in the field of magnetic moments. The net magnetization of the samples is the sum of magnetic moments in domain surface [49]. In this study, all the magnetic samples act like a single domain and the particle magnetized uniformly so that the value of saturation magnetization (M_s) increases as increasing particle size. The increasing particle size leads to strong exchange interaction (A–A) and super exchange interaction (A–B) between Cu^{2+} and Fe^{3+} ions. This leads to decrease in the size of hysteresis loop and enhancement of saturation magnetization (M_s). CuF-MW shows less M_s than others due to small diametrical size of the nanoparticles, which formed unordered spins along the field direction, and acts like inactive layer resulting in a decrease in M_s and coercivity.

3.8 Photocatalytic degradation of methylene blue

Generally, magnetically responsive photocatalysts can be improved and recycled readily, due to their infinite applications in the area of interdisciplinary sciences over the conventional photocatalysts [39, 40]. The catalytic performances of spinel CuF-MW, CuF-500, and CuF-600 samples were estimated by the photocatalytic degradation (PCD) of methylene blue (MB). It is known that the particle size and surface area play a key factor in PCD activity. The observed PCD results were summarized in Table 6 (Fig. 11). In particular, catalyst CuF-MW degrades the entire MB dye within 120 min and achieves a PCD efficiency ~96.25% hence CuF-500 and CuF-600 could also degrade almost all the dye with PCD efficiency ~92.54% and 89.48%, respectively. Typically, the electrons (e) are removed from valence band (VB) to conduction band (CB) under nonstop light irradiation. The

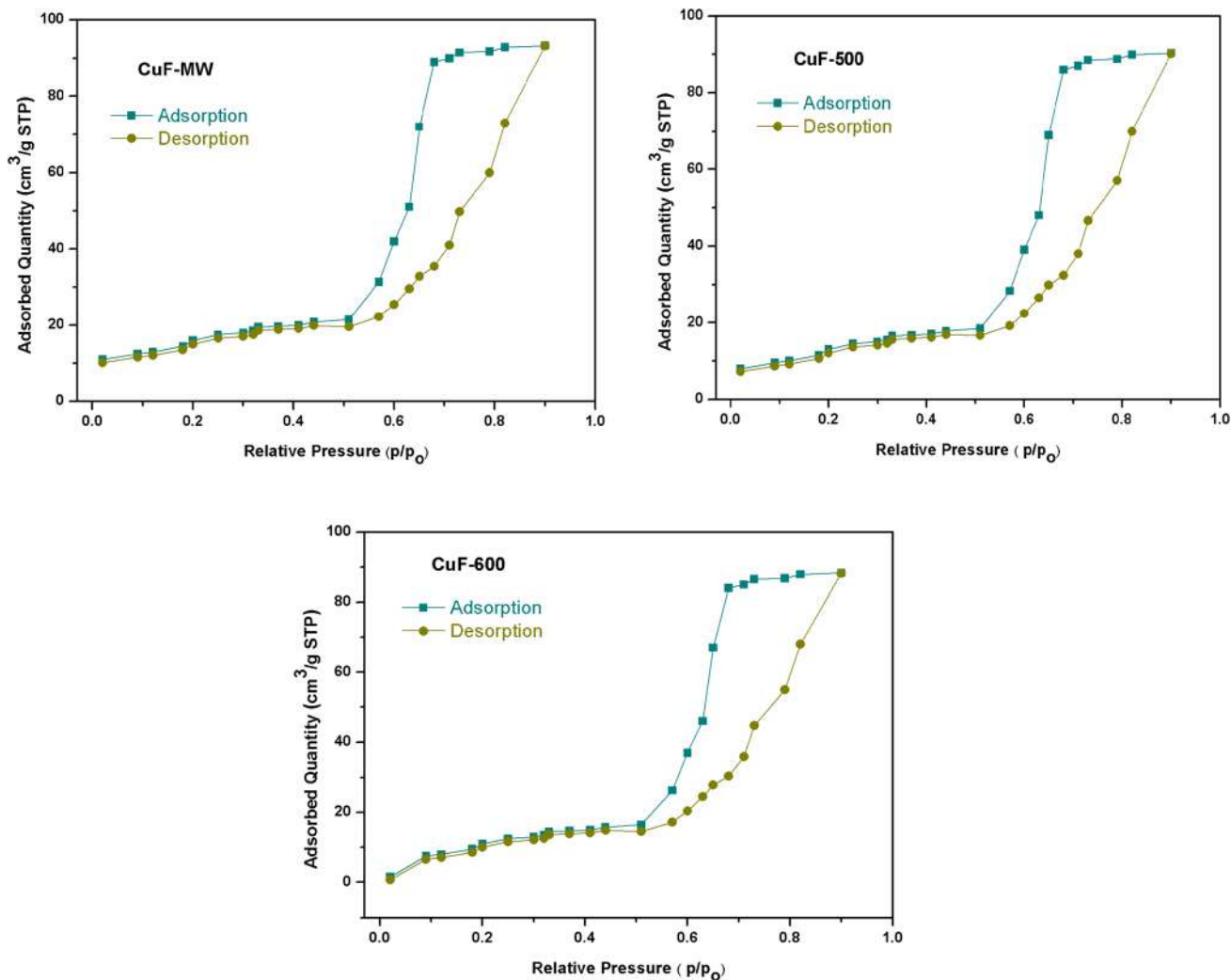
Table 6 Surface area, pore volume, pore diameter, and Conversion efficiency of CuF-MW, CuF-500, and CuF-600 samples

Samples	Surface area (m ² /g)	Pore volume (cm ³ /g)	Pore diameter (nm)	Conversion efficiency (%)
CuF-MW	52.47	0.1088	7.090	96.25
CuF-500	48.55	0.0982	7.084	92.54
CuF-600	46.28	0.0955	7.079	89.48

holes (h) in the VB create ·OH radicals. The generated ·OH radicals initiate the oxidation and degradation of the MB. The resultant catalysts prepared by microwave method and followed calcinations temperature exposed a clear difference in PCD efficiency of MB. Generally, a high specific surface area has a favorable effect on the activity for heterogeneous catalysis.[41–45]. In this work, due to the calcination temperatures, the catalyst has different surface area. In order

to have an idea of the absorbance capability of CuF-MW, CuF-500, and CuF-600 samples, they are examined by BET analysis. Figure 11 shows N₂ adsorption–desorption isotherms of CuF-MW, CuF-500, and CuF-600 samples.

BET surface area was analyzed using N₂ adsorption/desorption studies and the observed values are given in Table 6. The prepared magnetic samples show a mesoporous structure and controlled hydrolysis type IV isotherm. The surface area of catalyst CuF-MW, CuF-500, and CuF-600 is 52.47 m²g⁻¹, 48.55 m²g⁻¹, and 46.28 m²g⁻¹; the pore volume is 0.1088 cm³g⁻¹, 0.0982 cm³g⁻¹, and 0.0955 cm³g⁻¹; and the pore diameter is 7.090 nm, 7.084 nm, and 7.079 nm, respectively. The catalyst CuF-MW shows higher surface area and pore volume than the other samples due to smaller particle size and indicates the formation of fine mesoporous which is confirmed by powder XRD, HR-SEM, and HR-TEM analyses. In addition, when the catalyst has high surface area, the amount of distribution of particles per volume in the solution will increase

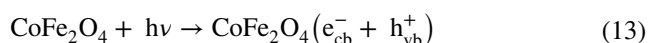
**Fig. 11** N₂ adsorption–desorption isotherms of CuF-MW, CuF-500, and CuF-600 samples

[46, 47]. In this case, high surface area, small diametrical size, uniform distribution, and reduced electron–hole recombination through electronic interaction in CuF-MW catalyst lead to achieve maximum photocatalytic efficiency [48–50]. For catalysts CuF-500 and CuF-600, the PCD efficiency became lower compared with CuF-MW catalyst (Fig. 12) due to lower surface area of CuF-500 and CuF-600 samples.

4 Mechanism of photocatalytic degradation of dye molecule in copper ferrite

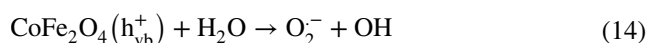
4.1 Step-I: Photoexcitation of free electron (e^-) and hole (h^+)

Magnesium ferrite molecule absorbed the photon ($h\nu$) energy to excitation of electron from valence band to conduction band to create a hole in a ferrite molecule.



4.2 Step-II: Formation of hydroxyl (OH^\cdot) radical

The formation of hydroxyl radical (OH^\cdot) is in two ways, the first way is splitting of water molecule and another way is reaction of the hydroxyl anion (OH^-)



The oxidation potential (E_0) of hydroxyl radical is very high and the value is +3.06 V, so all the hydroxyl radicals are not absorbed by the surface of dye molecule. This hydroxyl radicals forms impurities on the surface of dye molecule.

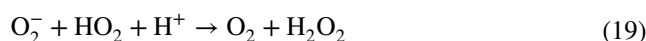
4.3 Step-III: Conversion of adsorbed oxygen to form a superoxide radical ($\text{O}_2^{\cdot-}$)



4.4 Step-IV: Neutralization of superoxide radical ($\text{O}_2^{\cdot-}$) by protonation of HO_2



4.5 Step-V: Degradation of MB dye of valence bond hole (h_{vb}^+)



An important parameter in heterogeneous photocatalysis is recyclability of the catalyst. Therefore, additional set of study was carried out to check the recyclability of the catalyst. For this determination, the catalyst was set magnetically at the bottom of the flask, and the solution was changed after each cycle [51–53]. The remaining solid was cleaned numerous times with ethanol and dried at 120 °C in an air oven for 30 min. Then, the flask containing the system is allowed to continue for next runs under similar identical circumstances. The catalyst could be recycled five times with no significant loss in activity (Fig. 13).

5 Conclusion

Spinel CuFe_2O_4 nano-catalysts were synthesized by a simple microwave combustion method. For comparative study, the samples were calcined at 500° and 600° C, respectively. The impact of calcination temperatures has brought significant improvement on the structural, morphological, optical, magnetic properties, and photocatalytic activity. From XRD pattern, the formation of single-phase spinel cubic lattice was confirmed. The average diametrical size calculated using Scherrer formula was found to be 17.5 to 25.9 nm. The lattice parameters, and average diametrical size of the nanocomposites are increased due to calcination temperature. FT-IR band at 478 cm^{-1} and 690 cm^{-1} confirmed the formation of single-phase cubic structure. The extension of light absorption suggested that the synthesized samples show higher optical activity. PL studies reveal that emission bands of CuF-MW, CuF-500, and CuF-600 nanoparticles

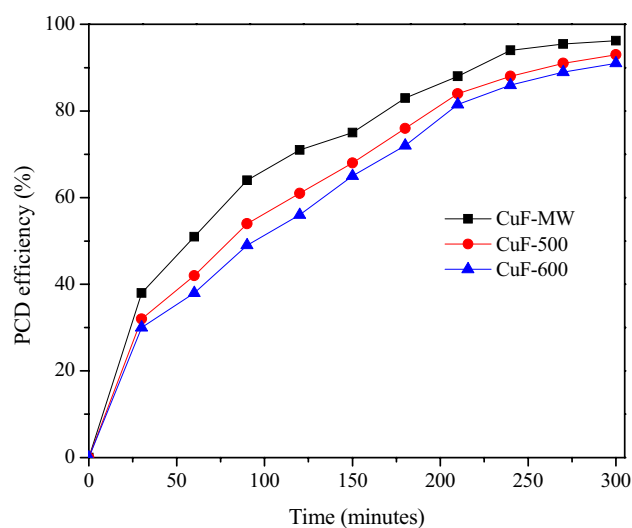


Fig. 12 Effect of calcinations on the photocatalytic degradation efficiency of CuF-MW, CuF-500, and CuF-600 samples

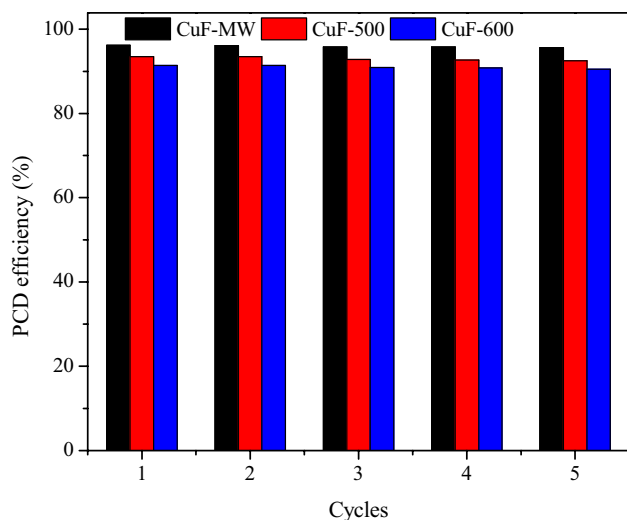


Fig. 13 Reusability of synthesized photocatalyst

expose the visible region of optical spectra. Impact of calcination temperature in copper ferrite has influenced saturation magnetization, coercivity, and remnant ratio. Microwave method establishes a great advantage to prepare magnetic ferrite materials possessing desirable photocatalytic activity. In conclusion, high surface area of copper ferrite with enhanced photocatalytic activity can be achieved with lower diametrical size. The synthesized magnetic nanocatalyst provides efficient and environment friendly method for degradation of MB with higher PCD efficiency. It was observed that the sample CuF-MW shows higher PCD of MB than other samples, which may be due to the smaller particle size and higher surface area of CuF-MW.

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Embellishing the bandgap of neodymium (Nd^{3+}) doped TiO_2 for the fabrication of high efficiency DSSCs

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ABSTRACT

Nd^{3+} doped TiO_2 and undoped TiO_2 were produced by the complication free hydro thermal synthesis process. The doping has reduced the bandgap of the tailored material compared to its purest form. The UV-vis spectroscopy and Photo Fluorescence spectroscopy are employed to study the characteristics of the synthesized material and the results drawn from the characterization vouch that the gap between the CB and VB has minimized. The absorption peak calculated using the spectro-fluorometer asserts that Nd^{3+} doped TiO_2 can be utilized well in the UV-A and UV-B regions along with the visible region of the solar light. This expansion in the area will enhance the efficiency of the solar cells.

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1. Introduction

An apt photo anode for the fabrication of DSSCs is one of the indispensable needs of the present PV energy conversion process [1]. TiO_2 inherits a strong oxidation and reduction efficiency when it is photo-excited. TiO_2 shows higher activity and chemical stability in the UV and Visible light region [2]. Storage of energy, its conversion, ecofriendly manufacturing of energy materials and advanced techniques of nanotechnology are the need of the world to make the usage of renewable energy sources prevalent [3]. In the next five decades one of the greatest challenges poised in front of the human society, for its survival, is the production of clean and renewable energy [5].

Rare earth elements are a group of seventeen chemical elements that occur together in the periodic table. The group consists of yttrium and the 15 lanthanide elements. Doping methods have been extensively utilized for modifying the electronic structures of TiO_2 nanoparticles to achieve new or improved catalytic, electro-optical, magnetic, other chemical and physical properties [2]. Large band gap semiconductors are typically doped in order to enhance their photocatalytic and photovoltaic characteristics by reducing their bandgap significantly [4].

1.1. Synthesis

Pure TiO_2 and (Nd^{3+}) doped TiO_2 was prepared by a simple hydrothermal method. Titanium (IV) isopropoxide and acetic acid are taken in the molar ratio of 1:4. To obtain the solution, Distilled water (20 M) was added drop wise under the magnetic stirring. For a day (24 h) the obtained solution was kept in 100°C after transferring it into a Teflon autoclave. The obtained powder was ground in a mortar pestle. The well ground product was calcinated at 400°C for 3 h using a heating rate of $5^\circ\text{C}/\text{min}$ to obtain TiO_2 nanoparticles. Similarly Nd^{3+} doped TiO_2 samples were synthesized by introducing Neodymium (2 wt%) to the above synthesis.

2. Result and Discussion

X-Ray Diffraction, Energy Dispersive X-ray Analysis, Selected Area Electron Diffraction, UV-Vis Spectroscopy and Spectrofluorescence are some of the characterizations utilized and explained in this paper for the tailored analyte Neodymium doped TiO_2 .

Crystallographic structure and morphology of the synthesized sample is characterized by XRD. The size of the doped particle is measured to be 9.2 nm. The size of the particle has changed without much structural modifications compared to the size 15.3 nm of the undoped TiO_2 . Fig. 1 shows the XRD pattern of undoped TiO_2 and Nd^{3+} doped TiO_2 samples.

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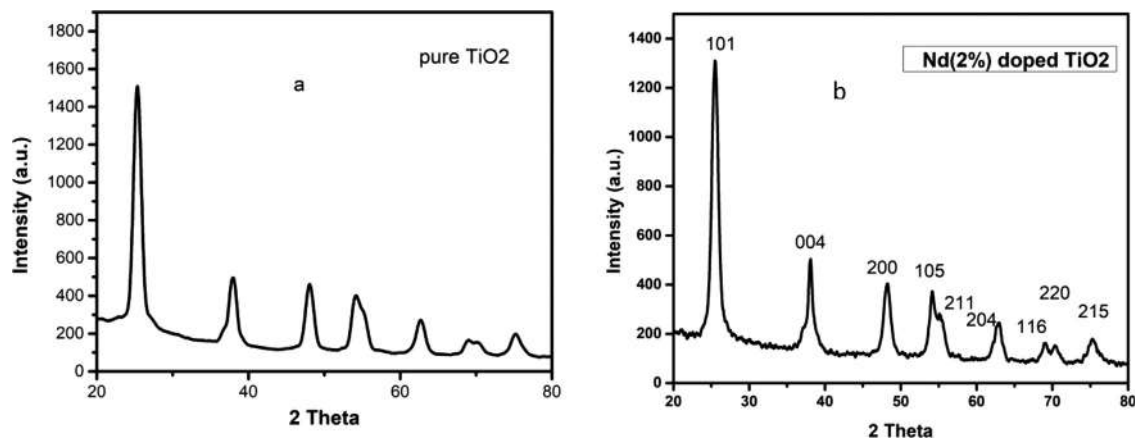


Fig. 1. (a) XRD pattern of Pure TiO₂ (b) XRD Pattern of Neodymium doped TiO₂.

Table 1
Atomic and Weight percentage of Neodymium doped TiO₂.

Element	Weight %	Atomic %
Ti K	66.7	41.21
O K	31.64	58.46
Nd L	1.59	0.33
TOTAL	100	100

The XRD pattern of both samples show good crystallinity. The peaks for Nd³⁺ doped TiO₂ are indexed at various 2θ are attributed to the reflections from (101), (004), (200), (105), (211), (204), (116), (220), (215) planes of anatase phase of TiO₂. The experimental XRD pattern agrees with the JCPDS card no. 21-1272 (anatase TiO₂) and the XRD pattern of TiO₂ nanoparticles other literature.

The Table 1 and Fig. 2 expound that the synthesized material has Ti, O and Nd as the constituent elements. The weight ratio given there provides the details about the amount of dopant present in the doped TiO₂ sample which is of expected value. Selected Area Electron Diffraction (Fig. 3) provides the information about the indices based on which we can calculate the d-spacing of the element and the size of the material from that d spacing. This also has proved that the material possess properly formed poly crystalline structure. The planes are clear and distinct and easy

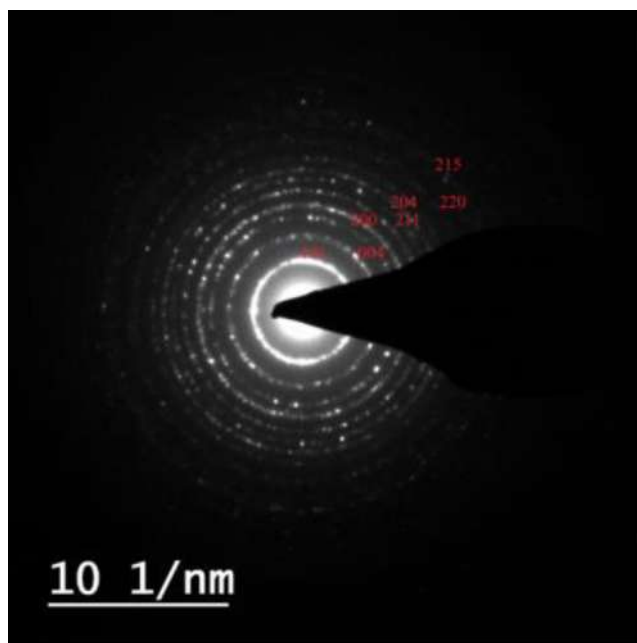


Fig. 3. SAED Pattern.

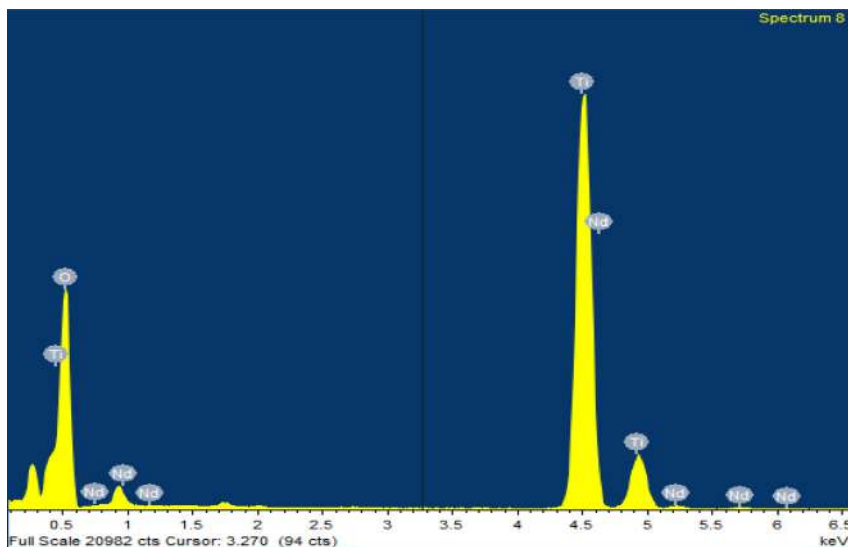


Fig. 2. EDAX spectrum.

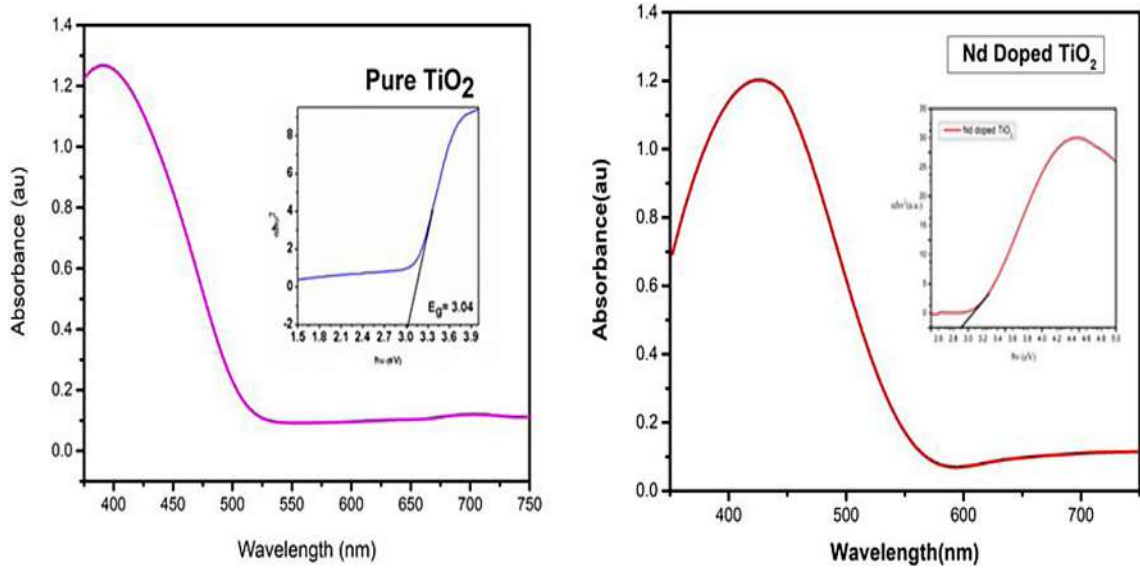


Fig. 4a. Undoped TiO₂.

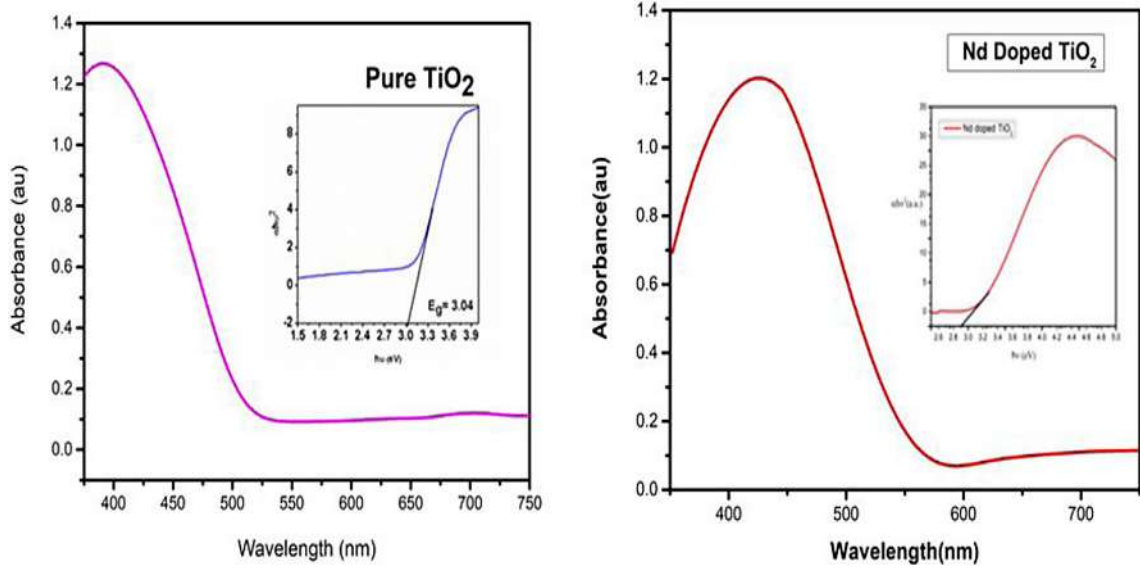


Fig. 4b. Nd doped TiO₂.

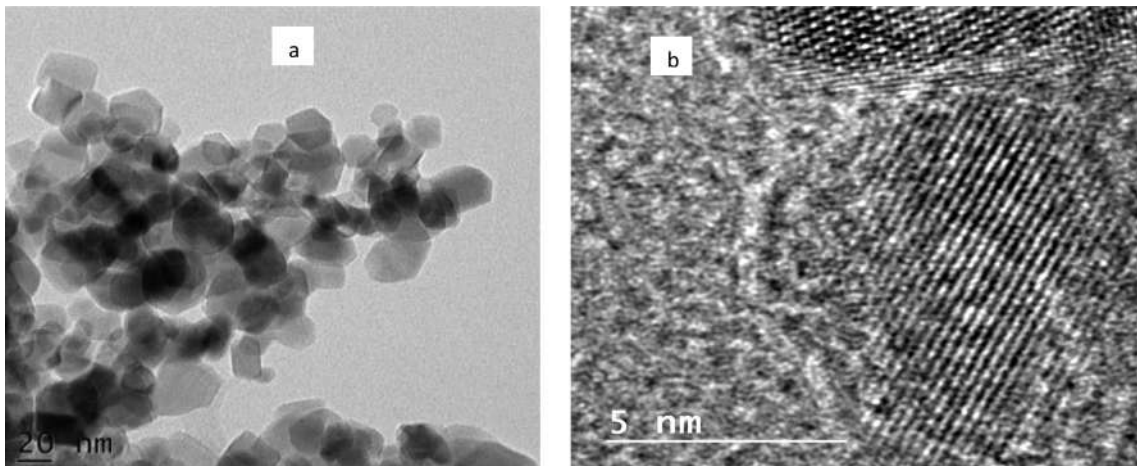


Fig. 5. HRTEM images of a) Pure and b) Nd³⁺ doped TiO₂.

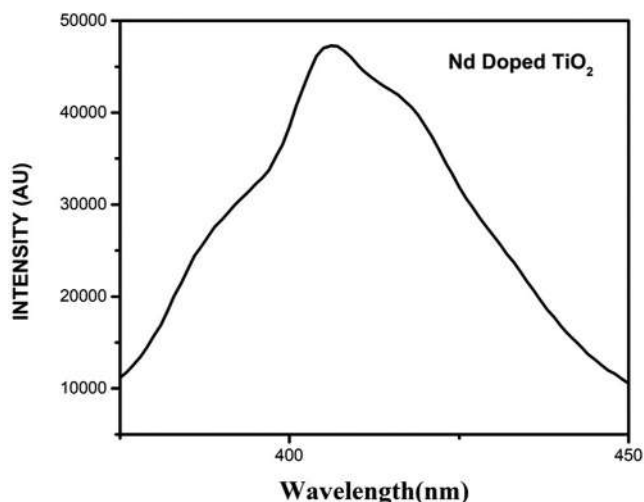


Fig. 6. Spectrofluorometer peak for Nd^{3+} doped TiO_2 .

to identify from the image. However, they are in perfect agreement with the various planes present in xrd pattern.

The UV studies have been measured to examine the optical absorption properties of the procured samples. Figs. 4(a) and (b) show the UV absorption spectra of the undoped TiO_2 and Nd^{3+} doped TiO_2 analytes respectively. The inset in Fig. 4(a) gives the optical bandgap value of the synthesized pure TiO_2 which is measured as 3.04 eV. Fig. 4(b) has the inset diagram of Tauc plot drawn for the obtained Nd^{3+} doped TiO_2 and tauc gap or optical bandgap is calculated as 2.92 eV. The results show that the activity of the analyte is wide spread in UV-A, UV-B and visible spectrum region which in turn provide the information that the subjected analyte is active in all necessary regions to absorb the light. Fig. 6 provides the spectro-fluoro graph of Nd^{3+} doped TiO_2 and the absorption peak observed elucidates that the absorption is very much active in UV-A and UV-B regions.

The TEM images are obtained using the instrument Jeol 200 kv Jem 2100 is a multipurpose, 200 kV analytical electron microscope. Fig. 5 display the typical HR-TEM images of as synthesis samples. The figure reveals that the nanoparticles are in spherical in shape. Fig. 5 indicates that the small amount of doping (Nd^{3+}) ions covers on the TiO_2 surface to form some uneven surface morphology. From HR-TEM results, the particle size is calculated 9.2 nm for Nd^{3+} doped TiO_2 which is in good agreement with XRD results. In conclusion, anchoring of Nd^{3+} ion with TiO_2 NPs has produced an expected stimulus on the crystallite structure and morphology of TiO_2 NPs.

3. Conclusion

The undoped TiO_2 and Neodimium doped TiO_2 was synthesized in a systematic manner and the resulted product was subjected various characterizations. The nature, size and morphology of the material are revealed through the X-ray diffraction analysis which proves that the material is the nano particle of size 9.2 nm possessing anatase structure. The HR-TEM images also prove that the material has an essential doping which stimulates the activity of the reduction of bandgap and the structural and morphological details of the analyte. The SAED pattern authenticates the proper polycrystalline nature of the material. The EDAX analysis propounds that the doping has taken place and the dopant is sufficiently present in the core material. From the UV-Vis analysis the material is covering the non-hazardous UV-A, UV-B and Visible light regions. Thus by observing the reduction in the distance between the CB and VB and spreading of active absorbance over the UV and Visible spectrum Neodymium doped TiO_2 could serve as a potential material for the fabrication of DSSCs.

CRedit authorship contribution statement

S. Bharathi Bernadsha: Conceptualization, Methodology, Investigation, Writing - review & editing, Writing - original draft. **V. Anto Feradrick Samson:** Formal analysis, Writing - review & editing. **J. Madhavan:** Supervision. **M. Victor Antony Raj:** Resources, Project administration. **S. Prathap:** Software.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Analysis of optical and structural properties of Sm³⁺ doped TiO₂: A potential composition for the fabrication of efficient DSSCs

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Analysis of Optical and Structural Properties of Sm^{3+} Doped TiO_2 : A Potential Composition for the Fabrication of Efficient DSSCs

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Abstract. The Lanthanum series (sm^{3+}) doped semiconducting metal oxide nanoparticles have gained significant attention due to their trustable optical properties. Herewith, TiO_2 and Sm^{3+} doped TiO_2 are prepared by utilizing the facile one-pot hydrothermal method. Structural and morphological studies of the samples are obtained by XRD and HR-TEM. The anatase phase and spherical size morphology of the samples are assured from these above mentioned analyses. From UV analysis it is noted that the band gap decreases (positive shift) due to the doping of Sm^{3+} ions on the surface of TiO_2 . Photo and dark conductivity of both samples linearly increase with applied field which confirms that the positive conductivity of the sample. Comparing to pure TiO_2 , Sm^{3+} doped TiO_2 sample exhibits higher conductivity. Hence, Sm^{3+} doped TiO_2 sample could be a potential photo anode for DSSCs applications.

INTRODUCTION

In this era of technology we human beings most of the times worry about the efficiency than the sustenance. Thus sustainable energy production to replace the depleting fossil fuel and other environmental hazardous fuels we need to identify the suitable material. Exploiting the solar energy, converting it into useful modes and storing them up are some of the laudable choices for the sustainable energy utilization [1,2,3]. This work concentrates on employing the rare earth elements (REEs), especially, Samarium (Sm^{3+}) to influence the structure and morphology of the low cost and efficient TiO_2 . To discern the efficiency of Sm^{3+} doped TiO_2 , its properties are to be investigated to identify its potentiality to be an efficient material to fabricate DSSC as a sustainable energy producer. This present work focuses on the comparative study of structural, optical and photo conducting properties of pure and Sm^{3+} doped TiO_2 nanoparticles.

PREPARATION OF TIO_2 NANOPARTICLES

TiO_2 and (Sm^{3+}) doped TiO_2 was prepared by a facile one-pot hydrothermal method. In briefly, Titanium (IV) isopropoxide and acetic acid taken in the molar ratio of 1:4, after that 20M of distilled water was added drop wise under the magnetic stirring to obtain a transparent solution. Then the obtained solution was transferred into Teflon autoclave and it was kept in 180°C for 24h. The obtained powder was ground in a mortar pestle. The obtained product was calcined at 400°C for 3 hours using a heating rate of 5°C/min to obtain TiO_2 nanoparticles. Similarly Sm^{3+} doped TiO_2 samples were synthesized by adding samarium oxide to above synthesis. The material is characterized by X-ray diffractometer (XRD),HR-SEM, UV-DRS spectrometer and KEITHLY 6517A electrometer.

STRUCTURAL ANALYSIS

Crystallographic structure and morphology of the synthesized sample is characterized by XRD and HR-TEM. Fig.1 shows the XRD pattern of TiO_2 and (Sm^{3+}) doped TiO_2 samples. The XRD pattern of both samples show good crystallinity and the peaks are indexed at $2\theta \approx 25.2^\circ, 37.9^\circ, 48.1^\circ, 54.1^\circ, 54.9^\circ, 62.7^\circ, 68.9^\circ, 70.1^\circ$ and 75.1° should be attributed to the reflections from (101), (004), (200), (105), (211), (204), (116), (220), and (215) planes of anatase phase of TiO_2 [4]. While compared with TiO_2 nanoparticles, (Sm^{3+}) doped TiO_2 sample shows a minimal difference in diffraction angles were observed, indicating that the incorporation of (Sm^{3+}) ion into the TiO_2 phase. The Debye Scherrer equation was used to calculate the average crystallite size is found to be 18.38 nm TiO_2 and 21.62 nm for (Sm^{3+}) TiO_2 doped respectively. Figure 2(a) and (b) display the typical HR-TEM images of as synthesis samples. The figure reveals that the nanoparticles are in spherical in shape. Figure 2(b) indicates that the small amount of doping (Sm^{3+}) ions covers on the TiO_2 surface to form some uneven surface morphology. From HR-TEM results, the particle size is calculated 15.62 nm for TiO_2 and 19.71 nm for (Sm^{3+}) TiO_2 which is in good agreement with XRD results. In conclusion, anchoring of Sm^{3+} ion with TiO_2 NPs has produced an expected stimulus on the crystallite structure and morphology of TiO_2 NPs.

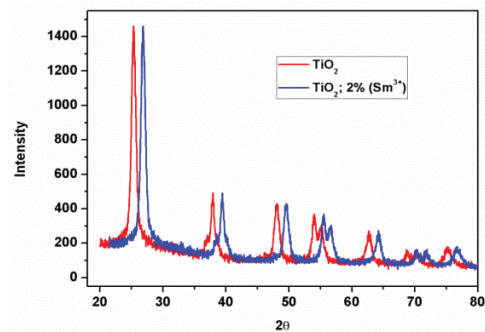


FIGURE : 1 XRD pattern of TiO_2 and (Sm^{3+}) doped TiO_2 samples

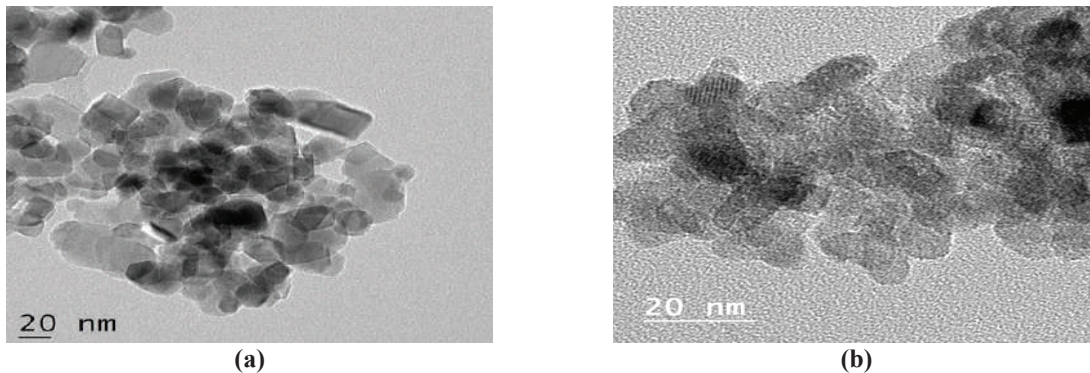


FIGURE: 2 (a) HR-TEM image of TiO_2 and (b) HR-TEM image of (Sm^{3+}) doped TiO_2

UV-ANALYSIS

The UV studies have been measured to examine the optical absorption assets of as synthesized samples. Figure 3 (a) and (b) show the UV absorption spectra of the TiO_2 and (Sm^{3+}) doped TiO_2 samples respectively. It is observed that the spectrum of (Sm^{3+}) doped TiO_2 shifted towards higher wavelengths and an enhancement of visible light absorption due to the doping of (Sm^{3+}) . The extension of light absorption shifted to visible-region compare to pure TiO_2 which indicates that narrowing band gap energy of TiO_2 , which is confirmed by Tauc-Plot function vs the energy of exciting light [5]. The calculated band gaps were 3.04 eV for TiO_2 and 2.98eV for (Sm^{3+}) TiO_2

respectively. The narrowing band gap must be credited to the incorporation of (Sm^{3+}) ion into the TiO_2 surface. The extension of light absorption suggested that the (Sm^{3+}) doped TiO_2 could have higher optical activity.

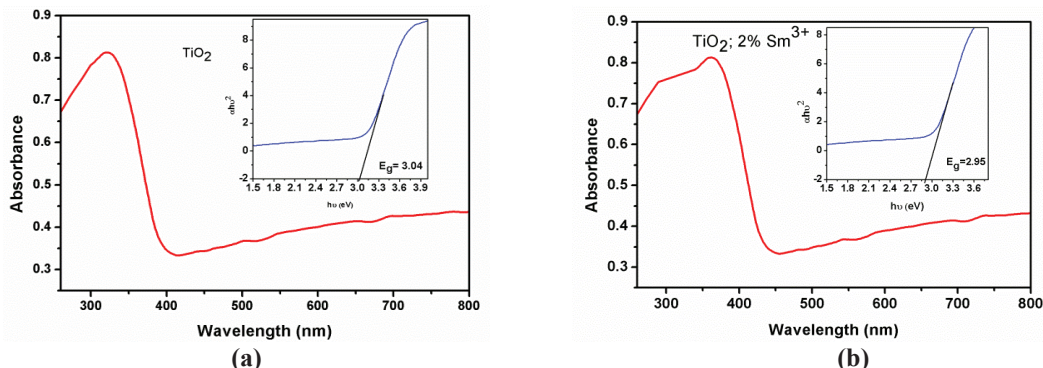


FIGURE: 3(a) UV graph of TiO_2 and (b) (Sm^{3+}) doped TiO_2

PHOTOCONDUCTIVITY STUDIES

Photo conductivity is an essential study to determine the conducting nature and gain or loss of charge carriers within the sample under the presence of light with applied electric current (V) [6]. The conductivity studies of the as synthesized TiO_2 and (Sm^{3+}) doped TiO_2 samples were carried out in the presence and absence of light respectively. Figure 4 (a) and (b) show the dark and photocurrent measurements of the TiO_2 and (Sm^{3+}) doped TiO_2 samples respectively. With an increasing electric field, rise in both photo and dark current of the synthesized samples confirms the ohmic nature positive photoconductivity of the samples. This observed linear increase in current mainly due to photo generation of charge carriers within the sample. The conductivity of the (Sm^{3+}) doped TiO_2 samples exhibits higher conductivity than pure TiO_2 which due to lower bandgap of the material. Since lower band gap materials has transfer of electron from the valence band to the conduction band easier. Therefore as synthesized (Sm^{3+}) doped TiO_2 would be a potential photoanode material for DSSCs

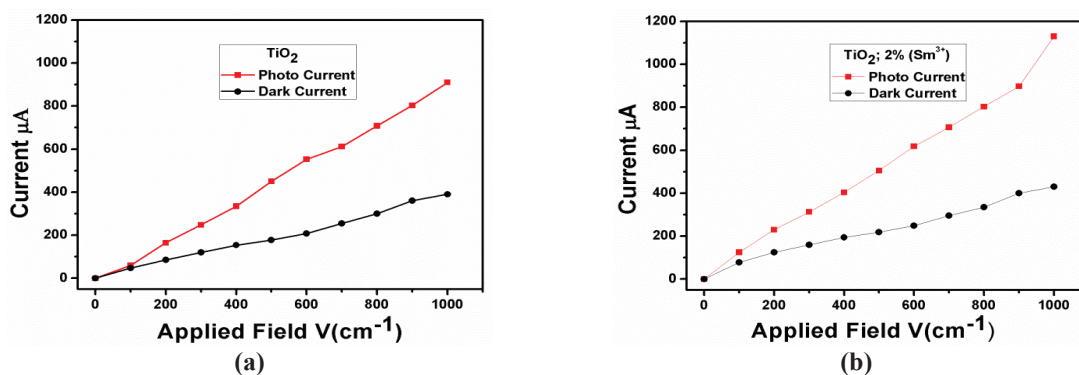


figure: 4 (a) Photo conductivity of TiO_2 and (b) (Sm^{3+}) doped TiO_2

CONCLUSION

In summary, both TiO_2 and (Sm^{3+}) doped TiO_2 nanoparticles are successfully prepared via simple hydrothermal method. XRD analysis exhibits that as-synthesized nanoparticles are good in crystallinity and possess anatase structure. The HR-TEM images exhibit that the nanoparticles are spherical in size morphology and the results are in good agreement with XRD results. The extension of light absorption in the higher wavelengths of Sm^{3+} doped TiO_2

indicates that the samples have higher optical activity. Linear increase in current vs applied field reveals that the samples host positive photoconductivity (positive shift of CB).

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One pot hydrothermal synthesis and characterization of NiFe₂O₄ nanoparticles

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ABSTRACT

Simple phase cubic spinel type NiFe₂O₄ ferrite nanoparticles was synthesized by simple hydrothermal method. The synthesized sample was characterized by X-Ray FT-IR, HR-TEM and FT-Raman analysis. XRD results confirm the formation of cubic spinel type nanoparticles. FT-IR spectra confirm the vibration of tetrahedral and octahedral modes which confirms the metal-oxygen stretching bands in cubic structure. HR-TEM images exhibit the spherical size morphology of the samples. FT-Raman results show the presence of major Raman modes which are active and confirm the presence of spinel type ferrite structure.

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1. Introduction

Recently, ferrite Nanoparticles have been extensively considered in nanotechnology and nanoscience, because of their essential applications in photo catalysis, delivery of drugs sensors and supercapacitor electrode materials. Ferrites materials have concerned huge interest globally by researchers due to their low cost, excellent chemical stability, moderate saturation magnetism and high surface area induce their importance. Generally, spinel ferrites MFe₂O₄ (M = Co, Mg, Zn, Ni) has become an important material in various interdisciplinary areas [1]. Among the spinel system, Nickel ferrite (NiFe₂O₄) has been widely investigated, due to its potential importance in controlled signal transformation, storage devices, batteries and solar cells [2]. Furthermore, different synthesis method enhances Saturation magnetization and Susceptibility, Cation Distribution, Particle size and Shape distribution in their physical and chemical properties. The physical and chemical properties of the nano particles can be effectively controlled by synthesis method employed. Different approaches are available to synthesize nanoparticles such as sol-gel method, hydro-thermal method, co-precipitation method, combustion and thermal decomposition methods, etc. Among the above said methods, hydrothermal is an easiest, non-toxic and low-cost method to get more desirable yields [3,4]. In this Work, spinel type NiFe₂O₄ ferrite

nanoparticles were synthesized by simple hydrothermal method. The synthesized samples were characterized by X-Ray diffraction, Fourier Transformer Infrared Spectroscopy (FT-IR), High Resolution- Transmission Electron Microscope (HR-TEM) and FT-Raman analysis. The obtained results from above studies are discussed below.

2. Experimental

Nickel (II) Nitrate Hexahydrate (Ni(NO₃)₂·6H₂O) and iron III nitrate nonahydrate (Fe(NO₃)₃·9H₂O) are mixed in the ratio of 1:2 Then the precursors are added with 40 ml of deionized water and thoroughly mixed by stirring. Then the stirred solution is added with NaOH solution until the pH value exceeds above 10. Then the solution was taken in an autoclave and kept in the furnace for about 6 h at 180^o. Then the sample was taken in the crucible and dried for about 6 h at 80 °C. Then the sample was centrifuged and washed for several times to remove the impurities. Then the sample was grinded and powdered for further studies.

3. Results and discussion

3.1 Structural analysis

The X-ray diffraction was employed to investigate the phase and structure of the as synthesized sample. Fig. 1 shows the XRD

* Corresponding author.

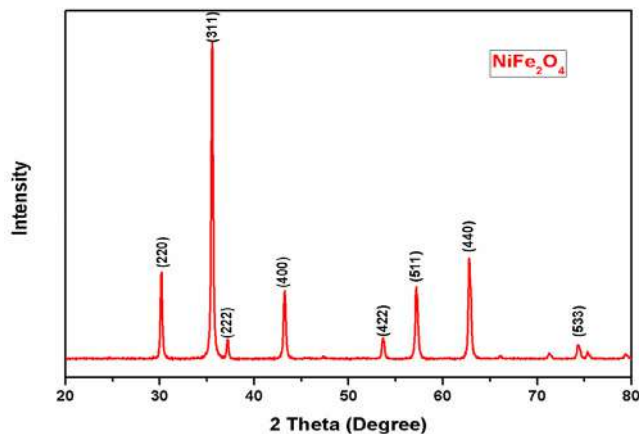


Fig. 1. XRD Pattern of NiFe₂O₄ nanoparticles.

pattern of NiFe₂O₄ Nanoparticles. The X-ray diffraction pattern confirmed the formation of simple cubic spinel structure of NiFe₂O₄ nanoparticles. The sharp edged peaks (*hkl*) planes such as (220), (331), (222), (400), (422), (511), (440), (533) confirms the formation of NiFe₂O₄ Nanoparticles without any impurities [3]. Average particle size of the nanoparticles were calculated using Debye's Scherer formula,

$$D = k\lambda / \beta \cos\theta$$

here, '*D*' - average size; '*λ*'- X-ray wavelength (1.5406 Å); '*β*'- FWHM and '*θ*'- the Bragg angle (*hkl*) plane.

Using this equation the obtained average particle size is 47.62 nm.

XRD results are not only influenced by crystallite size and also possibly by lattice strain and defects. W-H method is a simple method to differentiate size induced and strain induced peak by considering the peak width as a function of 2 theta [4–6]. Line broadening induced by strain (*β_s*) is,

$$\beta_s = 4\epsilon \tan\theta \quad (3)$$

But bragg reflection line can be expressed as

$$\beta_{hkl} = \beta_s + \beta_D \quad (4)$$

Therefore,

$$\beta_{hkl} = (k\lambda / D \cos\theta) + 4\epsilon \tan\theta \quad (5)$$

Rearranging Eq. (5).

$$\beta_{hkl} \cos\theta = (k\lambda / D) + 4\epsilon \sin\theta \quad (6)$$

where *β_s* and *β_D* are denoted as width due to size-strain. Fig. 2 shows the W-H plot between 4 sinθ and *β_{hkl}*cosθ. Here, the value of *D* and *ε* correspond to the value of crystallite size and micro strain. The strain and particle size values are taken from Y-intercept and using the slope in the plot. Using W-H method the obtained particle size and strain is 44.71 nm and 0.0242 respectively.

3.2. FT-IR spectroscopy

The vibrations of surface functional groups were confirmed by FT-IR spectroscopy. Fig. 3 shows the FT-IR spectra of NiFe₂O₄ nanoparticles respectively. The peaks observed at 450 cm⁻¹ and 590 cm⁻¹ show the metal oxygen vibrations occur at octahedral and metal oxygen vibrations occurs at tetrahedral sites which confirms the cubic structure of the nickel ferrite [7]. The peak that occurs at 1384 cm⁻¹ is due to the stretching vibrations of C-O

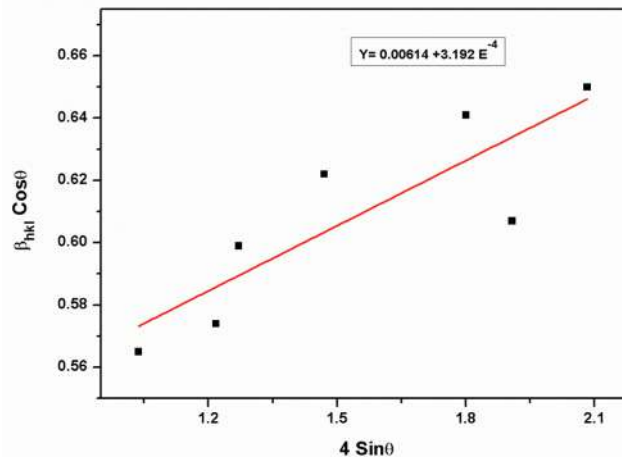


Fig. 2. W-H plot of NiFe₂O₄ nanoparticles.

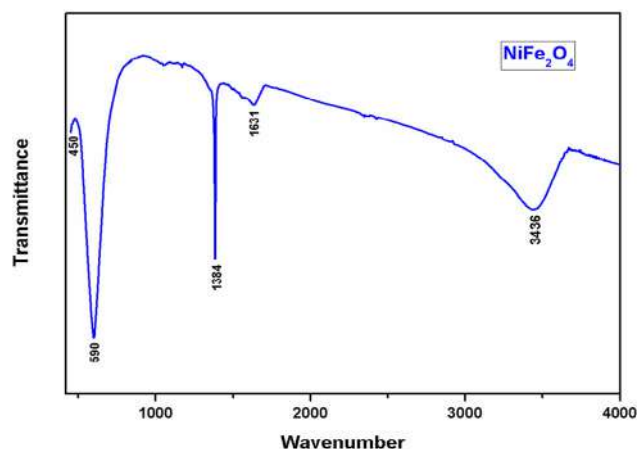


Fig. 3. FT-IR Spectra of NiFe₂O₄ nanoparticles.

bonds. The peak occurs at 1631 cm⁻¹ are due to N-O stretching respectively. The broad peak occurs at 3436 cm⁻¹ the bending and stretching of water molecules on the surface of the nickel ferrite during synthesis respectively.

3.3. HR-TEM analysis

The as synthesized NiFe₂O₄ nanoparticles surface morphology was examined by HR-TEM analysis. Fig. 4a shows the HR-TEM images of NiFe₂O₄ nanoparticles. HR-TEM image of as-synthesized NiFe₂O₄ nanoparticles exhibits spherical shape in morphologies with smaller agglomeration. The average particle size of the NiFe₂O₄ nanoparticles is found to be 48–60 nm. It is evident that the average particle size obtained from XRD results is also in the good agreement with HR-TEM Results. Fig. 4b inset shows the selected area electron diffraction pattern (SAED) of NiFe₂O₄ nanoparticles respectively, which exhibits that well crystalline nature of the sample.

3.4. FT-Raman analysis

Raman spectroscopy is used to examine the molecular and crystal lattice vibration of as synthesized Nanoparticles. Raman modes of vibration were examined in the region between 200 cm⁻¹ to 1000 cm⁻¹. Fig. 5. Shows the Raman spectra of NiFe₂O₄ nanoparticles respectively, From FT-Raman results, the major Raman modes

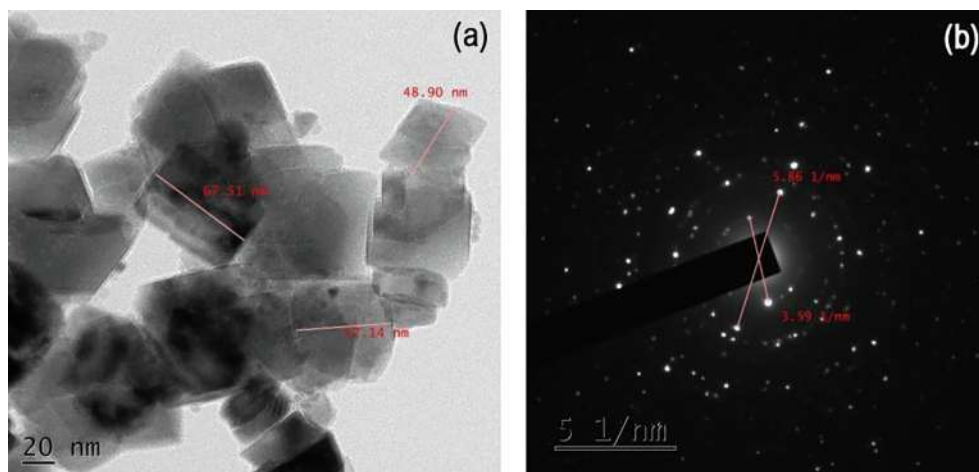


Fig. 4. a,b HR-TEM images and SAED Pattern of NiFe₂O₄ nanoparticles.

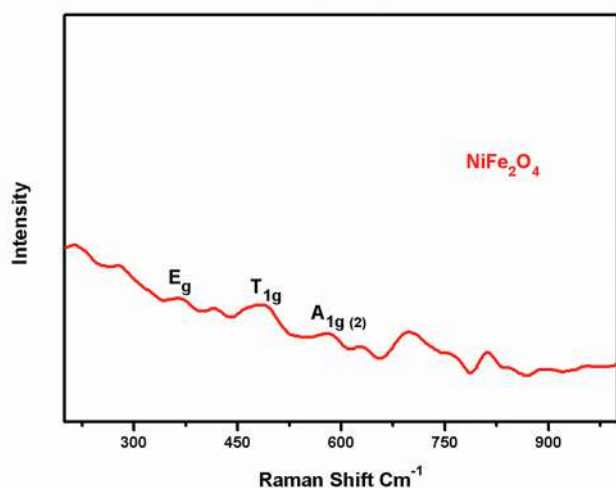


Fig. 5. FT-Raman spectra of NiFe₂O₄ nanoparticles.

are observed. The peaks at 299 cm⁻¹ and 460 cm⁻¹ are corresponding to the E_g and T_{2g} modes respectively. Additionally the band at 590 cm⁻¹ and 650 cm⁻¹ represents the A_{1g} (Co-O) and A_{1g} (Fe-O) modes respectively [8]. The above Raman modes are further confirming the formation of NiFe₂O₄ Nanoparticles via one pot hydrothermal synthesis method.

4. Conclusion

The simple phase NiFe₂O₄ nanoparticles have been prepared by one pot hydrothermal synthesis method. The Cubic structure along with space group was obtained from XRD Analysis which exhibits purity of the sample. HR-TEM results exhibit the sample has spherical shape morphology with smaller agglomeration. NiFe₂O₄ nanoparticles exhibit intense Raman modes which reveal the formation of simple phase cubic structure system.

CRediT authorship contribution statement

V. AntoFeradrick Samson: Conceptualization, Methodology, Writing - original draft. **S. Bharathi Bernadsha:** Writing - review & editing. **Roshini Xavier:** Data curation. **Chellaiya S. Thomas Rueshwin:** Investigation, Resources. **S. prathap:** Conceptualization. **J. Madhavan:** Project administration. **M. Victor Antony Raj:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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P. Robert Ramesh Babu*

Abstract

Self-esteem refers to the subjective judgment that every person makes of his ability to face life's challenges, to understand and solve problems, and his right to achieve happiness, and be given respect. Self-esteem is an important influential predictor of various outcomes, such as academic achievement and behaviour. According to Branden (1987), self-esteem is the sum of self-confidence and self-respect. The term self-esteem is one of the oldest concepts in the field of psychology. The term was coined by American Psychologist and Philosopher W. James in 1890. Self-esteem is usually defined as a personal judgment of worth living along a dimension with positive and negative ends. It is also widely assumed that self-esteem functions as a trait that is not stable across time within individuals. In psychology self-esteem or self-worth includes a person's subjective appraisal of himself or herself as intrinsically positive or negative to some degree that may become more positive or negative as a person encounters successes or failures in daily life. Synonyms of self-esteem include self-worth, self-regard, self-respect, and self-integrity. The researcher used Rosenberg Self Esteem Scale to measure the self-esteem of the students. Esteem is defined as "the evaluation which an individual makes and customarily maintains with regards to himself, expressed as an attitude of approval or disapproval" (Rosenberg, 1965, p5). The RSES consists of ten items that are measured on a 4 point Likert scale, with 1 representing "strongly agree" and 4 representing "strongly disagree". Silber and Tippet (1965) found that the scale correlated from 0.65 to 0.83 with several other self-esteem measures and clinical assessments. The same authors also found a test-retest correlation over two weeks of 0.85. The researcher aims to study the Self-esteem of the higher secondary school students of Dharmapuri. The sample size is 120. The researcher used Descriptive Research design. He has used Survey Method to collect the data. Among the respondents 55 percent were male and 45 percent were female. 55 percent of the respondents were doing XII Std and the rest of the respondents were doing XI Std. While analysing the data 64 percent of the respondents were having high Self Esteem while the remaining 36 percent had low Self-esteem.

Key Words: Self esteem; School students; Academic achievement; Self respect

1. Introduction

Self-esteem has been generally defined as the evaluation of the self; it is an affective response to one's self-description. The evaluation refers to a judgment of one's worth and what is being judged is one's perception of who one is, or one's self-concept. Self-esteem refers to a person's overall sense of his or her **value** or worth. It can be considered a sort of measure of how much a person "values, approves of, appreciates, prizes, or likes him or herself" (Adler & Stewart, 2004). Self-esteem is also defined as a global barometer of self-evaluation involving cognitive appraisals about general self-worth and affective experiences of the self that are linked to these global appraisals (Murphy, Stosny and Morrel, 2005). Self-esteem is confidence in one's capacity to achieve values (Branden, 1970). It is subjective and enduring sense of realistic self-approval. It reflects how the individual views and values the self at the most fundamental levels of psychological experiencing. (Bednar & Peterson, 1995). Erikson (1968) identified self-esteem as a function of identity development that results from successfully addressing the tasks associated with each of the developmental stages of life. Thus one's sense of developing, growing, and confronting life's tasks leads to feelings of worth.

The formation of self-esteem implies a long process. It is correlated with the formation of self-image and self-conscience. Its evolution in time involves also downfall periods especially during transition periods from one stage to another, from one status to another, e.g., in adolescence (due to the psycho somatic changes), or grand age, as a consequence of the change in status, retirement and the change in tasks and responsibilities (Orth, Trzesniewski and Robins, 2010). While self-esteem appears to decline during adolescence, it increases during young

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adulthood (Tsai, Ying and Lee, 2001). In 2004, Heine and Lehman stated that over 18,000 studies investigating self-esteem have been published over the past 35 years. Still many researches being done on self esteem

Review of literature

Rosenberg (1965), one of the pioneers in this domain, stated that self-esteem refers to an individual overall positive evaluation to the self. He added, that high self-esteem consists of an individual respecting himself and considering himself worthy. Brown, Dutton, and Cook (2001) distinguished three ways in which the term "self-esteem" is used: (a) global or trait self-esteem to refer to the way people characteristically feel about themselves, i.e., feelings of affection for oneself; (b) self-evaluation to refer to the way people evaluate their various abilities and attributes, and (c) feelings of self-esteem to refer to momentary emotional states, e.g., a person might say her self-esteem was sky-high after getting a big promotion, or a person might say his self-esteem plummeted after a divorce.

Branden (1969) maintained that self-esteem consists of two components: (a) to consider oneself effective, to trust in one's ability to think, learn, choose and make correct decisions, and to overcome challenges and produce changes, and (b) to respect oneself, the confidence in one's right to be happy, and the confidence that people are worthy of the respect, love and self- fulfillment appearing in their lives. According to James (1890) three major elements of the self from which pretensions are chosen: the material self, the social self and the spiritual self. The material self refers to objects and pretensions that are considered as one's personal property or one's identification: body, clothes, family, home, car etc. If the material realm prospers, the individual feels enlarged on the contrary, if one's possessions are damaged or lost, the person feels smaller.

Epstein defines three interacting levels of self-esteem. The first level is global; the second one is the degree of self-esteem at any time in one of eight areas (competence, likeability, lovability, self-control, personal power, moral approval, bodily appearance, and bodily functioning); and the last one is visible self-esteem that is considered situation-specific (O'Brien & Epstein, 1983). The period of adolescence is important for the process of self-esteem formation. The formation of self-esteem can be stimulated, encouraged both by parents and teachers. The level of self-esteem is mirrored in the adolescent's attitude and behavior, both at home and at school (Mogonea and Mogonea, 2014)

The adolescents with a high level of self-esteem have the following characteristics: they are capable of influencing positively the opinion and behavior of others; they tackle new situations positively and confidently; they have a high level of tolerance towards frustration; they accept early responsibilities, they assess correctly situations; they communicate positive feelings about themselves; they succeed in having a good self-control and the belief that the things they are undergoing are the result of their own behavior and actions (Lavoie, 2012). Therefore, adolescence is the critical period for the development of self-esteem and self-identity, and low self-esteem may endanger adolescent's emotional regulation (Lin, Tang, Yen, Ko, Huang, Liu et al., 2008). On the other hand, high self-esteem serving as a role of resilience or positive adaptation (Moksnes and Espnes, 2012).

2. Research Methodology

Aim of the study

A study on self-esteem among the school students of Dharmapuri

Significance of the study

The simplest definition of self-esteem is found in Webster's dictionary, which says that "self-esteem is satisfaction with oneself". In another edition of the same dictionary, self-esteem means "one's good opinion of one's dignity or worth". It is very important that the students build up a good opinion about themselves. Due to the stage of adolescence as well as the performance in the academics have a lot of impact with their self-esteem. This study is trying to analyse the self-esteem of school students. Based on the result interventions would be suggested.

Objectives

- To find out the socio demographic details of the school students
- To study about the levels of self-esteem of the school students.
- To find out the difference between the socio demographic characteristics with the self-esteem of the school students of Dharmapuri.
- To provide suitable suggestion to improve the self-esteem level of the school students of Dharmapuri.

Null hypothesis

5. The majority of the respondents would have low level of self-esteem.
6. There is no significant difference between gender and self-esteem.

- 7. There is no significant difference between family type and self-esteem.
- 8. There is no significant difference between Std of Education of the respondents and self-esteem

Research design

The present study is to find the level of self-esteem among the school students. The researcher used Descriptive research design.

Sampling

The researcher collected data from one of the private school students of Dharmapuri. The researcher used simple random sampling by using lottery method. The size of the sampling is 120.

Data collection process

The researcher collected both primary and secondary data from various articles, books, and websites. Primary data collected through questionnaire and the secondary data was collected from the Books, articles, journals and websites. The researcher collected the data through standardized questionnaire from the respondents. Rosenberg self-esteem scale was used for data collection.

Statistical analysis

The data collected were analyzed carefully by using statistical package of social science (SPSS) and processed accordingly. Statistical techniques such as mean, chi square test and 't' test were applied systematically to obtain meaningful inference.

3. Analysis and interpretation of data

For analysis and interpretation of data, the relevant input and analytical findings and inference derived have been presented in different tables and diagrams.

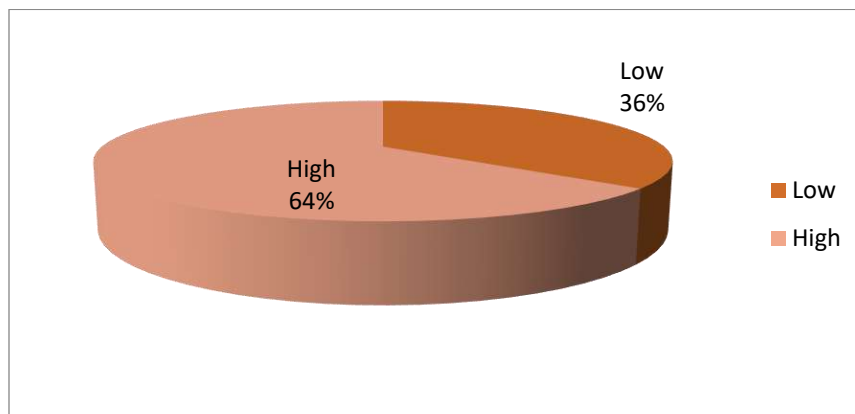


Figure 1. Distribution of the respondent's level of self-esteem

The above diagram presents the level of self-esteem among the school students. 36 percent of the respondents have low self-esteem and 64 percent of respondents have high self-esteem. Hence the hypothesis 1 is disproved. Majority of the students have high level of self-esteem.

Table 1. 'Z' test between the gender and level of self-esteem

Particulars	Gender	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Self-Esteem	Male	66	28.92	4.107	.505	Z= 0.313 Df= 118
	Female	54	28.24	3.071	0.419	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the gender with the level of self-esteem of the respondents. Hence hypothesis 2 is proved that gender has no significant difference in the level of self-esteem of the respondents. While analyzing the mean score it is observed that both male and female respondents have same level of self-esteem.

Table 2. 'Z' test between the family type and the level of self-esteem

Particulars	Family Type	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Self Esteem	Nuclear family	94	28.54	3.64	0.375	Z= 0.677 Df= 118
	Joint family	26	28.88	3.87	0.759	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the family types with the level of self-esteem of the respondents. Hence hypothesis 3 is proved that family type has no significant difference in the level of self-esteem of the respondents. While analyzing the mean score it is observed that respondents from nuclear family and joint family have same level of self-esteem.

Table 3. 'Z' test between the standard of education and the level of self esteem

Particulars	Family Type	N	Mean	Standard Deviation	Standard error Mean	Statistical Inference
Self-Esteem	XI	54	28.20	3.92	0.534	Z= 0.268 Df= 118
	XII	66	28.95	3.45	0.425	P>0.05 Not Significant

From the above table using 'Z' test it is found that there is no significant difference between the Std of Education with the level of self-esteem of the respondents. Hence hypothesis 4 is proved that standard of education has no significant difference in the level of self-esteem of the respondents. While analyzing the mean score it is observed that respondents from XI and XII have same level of self-esteem.

Findings of the study

- The mean age of the respondents is 16
- 66 percent of the respondents are male while the remaining is female.
- 93.3 percent of the respondents are from rural areas
- 94 percent of the respondents are from nuclear families.
- 64.2 percent of the respondents have high Self Esteem and 35.8 percent of respondents have low Self Esteem.
- There is no significant difference between the gender with the level of Self Esteem
- There is no significant difference between the family types with the level of Self Esteem of the respondents
- There is no significant difference between the Std of education with the level of Self Esteem of the respondents.

4. Discussion and Conclusion

64.2 percent of the respondents have high self-esteem which is a positive thing to be appreciated. People with high self-esteem experience more happiness, optimism, and motivation than those with low self-esteem, as well as less depression, anxiety, and negative mood. Self-esteem rises when a person succeeds, is praised, or experiences another's love, making self-esteem dependent on not only one's perceptions of himself but also other's perceptions of him (Schmidt and Padilla, 2003). Self-esteem is a major key to success in life. The development of healthy self-esteem is extremely important for good personal and social adjustment.

The big concern is on those 35.8 percent of the students who have low self-esteem. People with low self-esteem suffer from feelings of worthlessness, inferiority, and emotional instability, so leading to dissatisfaction with life (Ha, 2006). Moreover, there is a tendency of respondents with low self-esteem scores to have a general negative attitude toward many things, including other people and personal circumstances (Mackinnon, 2015, p. 15).

Low self-esteem has been linked to depression, aggression, less competency to overcome difficulties and decreased level of well-being in adolescence (Stavropoulos et al., 2015). Weber (2001) hypothesized that college students who report emotional abuse are expected to have a lower self-esteem than those who do not report emotional abuse. While analysing the mean scores of gender, Std of Education and family type with the level of self-esteem it was observed that there is no significant difference in those variables.

Conclusion

While appreciating those who are having high self esteem it is good to know the dark sides of high esteem. Baumeister, Smart, and Boden (1996) suggested that people with high self-esteem are more likely to be conceited, arrogant, or occasionally narcissistic. They expect to receive positive evaluations from others; if they are provided with negative feedback, a threatened ego motivates them to spend personal resources on coping with the negative evaluations. Neff (2011) pointed out that pursuit of high self-esteem can be problematic, can sometimes be counterproductive, and may involve puffing the self up while putting others down.

Most theories of self-esteem view it as a relatively stable personality trait. Based on this perspective, self-esteem is stable because it slowly builds over time through personal experiences, such as repeatedly succeeding at various tasks or continually being valued by significant others. A number of studies, however, assumed that self-esteem can momentarily manipulated or affected. Therefore, self-esteem can be viewed as a "trait" as well as a "state" (Heatheron and Wyland, 2003).

Greenier et al., (1995) stated that self-esteem instability is a dimension distinct from level of self-esteem. Self-esteem instability refers to the magnitude of short term fluctuations that people experience in their contextually based feelings of self-worth. Among high self-esteem individuals, self-esteem instability reflects fragility in one's positive self-feelings, and is associated with heightened tendencies to defend and promote these positive self-feelings. On the other hand, among low self-esteem individuals, self-esteem instability is related to various indices of psychological difficulties and maladjustment.

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CURRENT CHALLENGES IN FIELD WORK TRAINING AND SOCIAL WORK EDUCATION

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ABSTRACT

Social work in its professional learning has numerous challenges. As the syllabus itself comprises theories and field based exposures, the learners find difficult to move along with the rhythm. Prior to that choice of joining in the degree of social work itself has an open door for the +2 students of any group and the under graduates of any discipline including engineering. Thus, the budding social workers have so many challenges in their daily learning. In theory they find difficult to understand the concepts, terms, methods, research methodologies, statistical analysis and psychological theories, etc. In practical learning they face so many challenges, starting with choice of specialization, finding an institution to do their field work, getting permission, economical difficulties, distance of field work places, time consumption, travel, family support, exposures, disrespect, accommodations and misguidance, etc. The study has been conducted in Government Arts College and Don Bosco College, Dharmapuri which includes 50 students of BSW and MSW. Thus, the result of this study highlights the current challenges of field work training and social work education. Moreover, it also suggests certain pathways to overcome such challenges.

Key words: Research Methodologies, Statistical Analysis, psychological theories, exposures, etc.

Introduction

Around the Globe or in India, the importance of social work education increases every year as the human society faces unimaginable problems every day. Since there is a demand to serve the human society the employment opportunity is also more for the social work professionals. As India in its own nature enriches of various culture, language, religion etc, the social work education has been expected to have all these concerns in its curriculum or syllabus. The status of social work education in India is still debated and commented upon its quality in various factors such as: quality of syllabus, facilities in the institution, quality of fieldwork practices, standard of the students, ability of faculties or the quality of teaching, the person as a trainer in field work learning, their roles and responsibilities, skill and knowledge teaching and learning process, method of teaching, standard of the students, etc.

All over the world the social work education should promote basic knowledge about the society and skills to handle the issues of society with humanist approach and should improve the knowledge, skills, attitude of each and every social work student. To achieve such status, it is very important and necessary to identify the current challenges of social work education and field work training. Thus, this research would help the social work forum to have better understanding about current challenges in social work learning.

Literature Review

Rambabu Botcha (2012) - Problems and Challenges for Social Work Education in India: Through his study states that seventy five years of professional social work in India has been marked by few triumphs and too many travails that warrant a serious discussion on what the future holds for a 'profession' beleaguered by several internal and external constrains and considerations. During the period of seven and half decades after its inception in India achievements are very few the problems and challenges are very many. Teachers, practitioners and learners should come together with collective vision and mission to overcome all those problems and challenges to strengthen the social work education and training in India at least by end of the eight decade.

F. Adaikalam (2014) has points out that social work education in India has experienced multiple realities given the cultural, geographical, physical, social, ethnic and linguistic differences. The social work education has been situated into a peculiar yet challenging milieu in its journey to ensure welfare of the people. In this study the author states an overview on the issues challenges and concerns of social work education in India. **H. P. Jyoti (2015) – Issues and Challenges of Social Work Education in India:** highlights the issues and challenges of social work education. In the study the author has focused on admission procedure and method of teaching followed by the social work institutions in Karnataka State. He has examined the infrastructural facilities such as library; hostel etc. to explore the course content is also one of the major objectives of the study. From the study the author has found that majority of the social work education institutes lack in human and physical infrastructure. He has pointed out that lack of infrastructure facility and lack of human resources will have a bearing on the declining quality of social work education.

Alessandro Sicora & Susan Lawrence (2017) - Current challenges and emerging signposts the future of social work education in Europe: in the study the author indicated that Social work and social work education have faced many fundamental challenges in recent years. Such as: the global convergence of the neoliberal discourse and the excesses of global capitalism leading to financial and economic crises; the political responses and choices made by governments and international organisations to these economic ideas and financial and banking catastrophes; conflict, war, major environmental events and disasters causing suffering, displacement and mass migration.

Mohammad Amirii (2018) - Problems of Social Work Students in India: The analysis of the study ensures that Social work education has experienced multiple realities due to differences in addition, culture and geographical, physical, social and ethnic variations. Due to these differences in India, social work education is still facing various challenges. The author also states that these challenges come from the fact as social work has not contributed enough to develop theory and practice

pertaining to India. Through the study the author has made an attempt to take an overview of the social work education functions with reference to curriculum, fieldwork, negative factors influencing the student's inability of translating theory and knowledge into practical work etc. on the basis of collected information. He has concluded that social work education students are facing various challenges and problems during their academic course work and fieldwork practice.

Objectives of Study

The general and specific objectives of the study are:

- To get the opinions of the students about their syllabus or curriculum of social work education.
- To identify the challenges faced by social work trainees during the field/block placement trainings.
- To find out the difficulties of converting class room theories into practical learning.
- To understand the current challenges of social work education on students perspective.
- To know the overall challenges of students in social work education and field work training.

Research Methodology

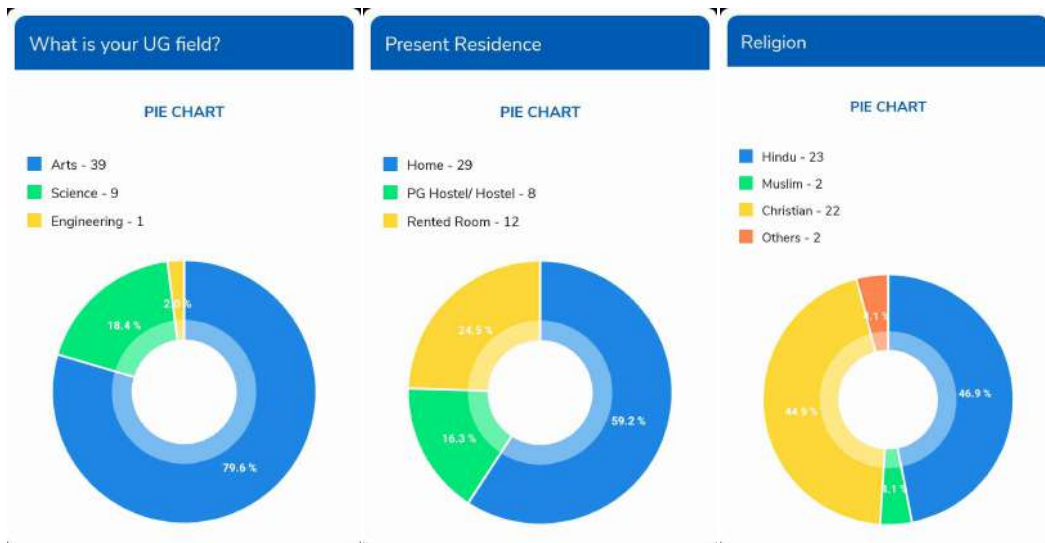
The researcher has adapted descriptive and exploratory design to indicate the current challenges of field work training and social work education. For the data collection through questionnaire, simple random sampling method was adapted. The universe of the study is 152 and the sampling size is 50 consists of BSW and MSW students from Government Arts College and Don Bosco College, Dharmapuri. The study has both primary and secondary data.

Findings of the Study

1. Demographic Details

The study indicates that 56% of the respondents belong to the age group of 22-24 and 65% were Male while 35% were female. Vast majority 93% were MSW

students and 84% belong to Tamil Nadu and 16% from other states. Among the respondents 82% hail from nuclear family and 18% from Joint family. 86% come from Rural background and 14% Urban.



2. Challenges of Field work Training

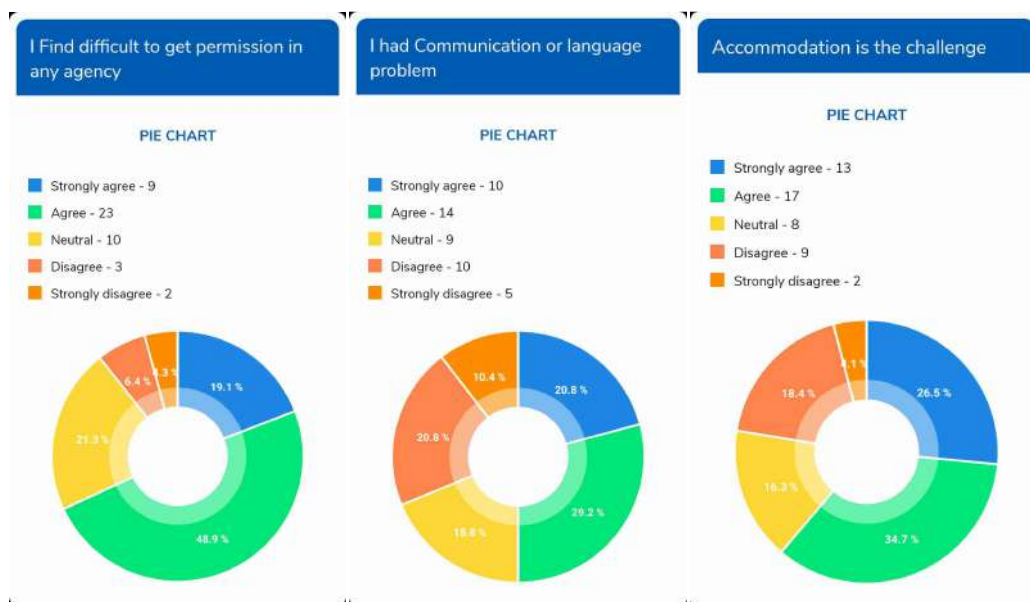


Table:1 Challenges in Field work Training

* 5 – Strongly Agree , 4 – Agree, 3 – Neutral, 2 – Disagree, 1 – Strongly Disagree

* F - Frequency

Items	5		4		3		2		1	
	F	%	F	%	F	%	F	%	F	%
They never respond to our request	2	4	9	18.7	13	27.0	22	45.8	4	8.2
I have to spend long hours during training	11	22.9	25	50	6	12.5	6	12.5	2	4
They demand to do their personal work	8	16.3	14	28.5	6	12.2	13	26.5	9	18.3
I felt hesitance to clarify my doubts	7	14.5	15	31.2	14	29.1	14	29.1	0	0
After the completion of field work, I was compelled to connect with them	8	16.6	11	22.9	10	20.8	16	33.3	5	10.2
I faced public fear	9	18.7	18	37.5	11	22.9	10	20.5	2	4.0
They follow unofficial schedule (invite us to work on extra days)	5	10.4	13	27	10	20.8	15	31.2	7	14.2

3. Challenges in Social Work Education

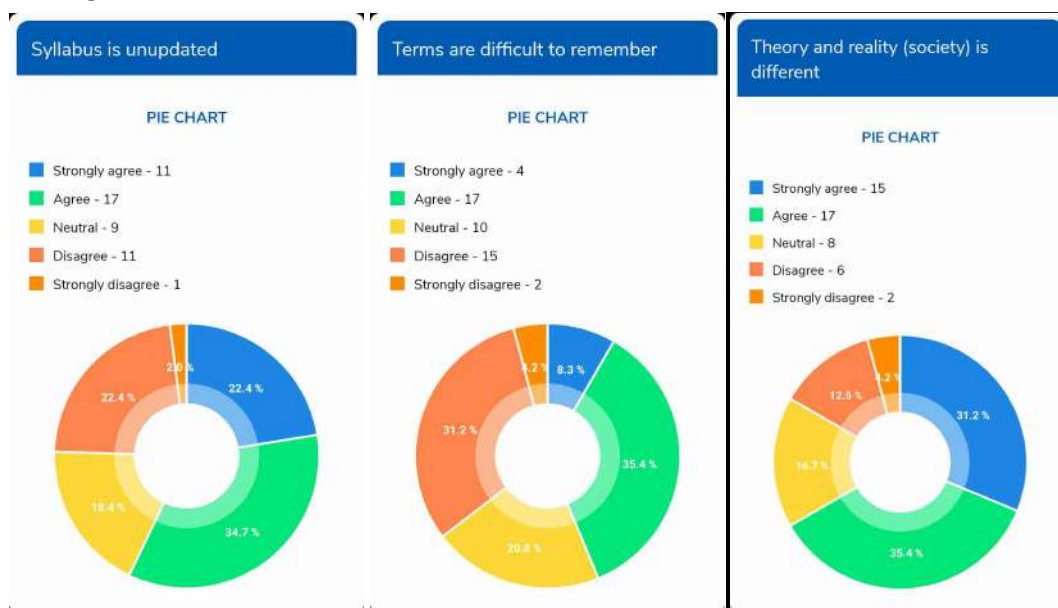


Table:2 Challenges in Social Work Education

* 5 – Strongly Agree , 4 – Agree, 3 – Neutral, 2 – Disagree, 1 – Strongly Disagree

* F - Frequency

Items	5		4		3		2		1	
	F	%	F	%	F	%	F	%	F	%
To get a job after the completion of Social Work	21	42.4	18	38.3	7	14.2	2	4.2	2	4.2
Method of teaching	10	20.8	26	52.6	5	10.4	7	14.5	2	4.1
Medium of examination	8	16.6	24	48.7	10	20.8	7	14.5	2	4.1
choosing the specialization is a challenge	9	18.7	22	44.6	6	12.5	10	20.8	3	6.2
Lack of faculty (staff)	10	20.8	20	40.5	7	14.5	11	22.9	2	4.1
To get admission to the course	9	18.7	26	52.6	12	25	2	4.1	1	2
Lack of facilities in the department	7	14.5	18	36.3	12	25	10	20.8	3	6.2

Suggestion

- The social work forum throughout the world should make effort to reduce the challenges of social work education.
- Social work course has to be recognized as professional course with a council in India in order to enhance the quality of social work education.
- The autonomous institutions or the universities should update the syllabus or uniformity of syllabus.
- The social work institutions should provide necessary measures, such as: sufficient faculties, teaching aids and field based exposures.
- The trainers of various NGOs', Institution, Hospitals, Industries should help the social work trainees to access class room theories into practical learning.

Conclusion

Social work education or the course of study has multiple challenges due to differences in culture and geographical, physical, social strategies. As India differs in culture, religion, language, etc, currently social work education faces various

challenges. The reason behind this is, so far the social work education system was not improved to manage class room theories into practical exploration in the society. Through this study the researcher has identified some of the current challenges in field work training and social work education in view of students' perspective. As a conclusion the researcher would state that the present generation of budding social workers as students or as trainees in the field work faces various challenges and problems.

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