

Research Outlook, Innovations and Research Trends in Science and Technology



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Preface

This book is focused predominantly on academicians, research scholars belong to science and engineering, managers, scientists, technicians, and other professionals in the field of qualitative research. This book is comprehended from different sources of research in Science and Technology. On the first occasion, the task of providing researchers with a broad view of the relationship between science and technology. The second reason for writing the book was the need to fill a gap in academics and research. While many excellent books, documents, and article exist for innovative practices, we have not found a work in which we can properly understand the content that the researcher needs to understand. So, after much deliberation, we decided to collect all quality efforts in one string.

At the most basic level, this book is trying to show research scholars; what science, technology, and innovations are all about. It cannot study or gain knowledge of that part and is at a level that most researchers should find clear and understandable.

Our goal was to develop content that will help researchers who are beginning to use innovative practices. We hope to meet the needs of academicians, research scholars who are being encouraged to incorporate more reading and writing in the field of science and technology.

In summary, this book is targeted to the needs of individuals engaged in quality research activities in science and technology. Our goal is to present the topics of creativity and innovation to this audience in a way that enables them to incorporate new skills into their daily work.

We would like to thank all the contributors who have made the production of this book so fascinating and enjoyable. Their scholarship and dedicated commitment and motivation to ‘getting it right’ are the keys to the book’s quality, and we greatly appreciate their good nature over many months in the face of our editorial demands and time limits. We are also grateful for using their texts, ideas, and critical remarks

We would also like to thank Prof Dr Nilam N Ghuge, Prof Dr D Ayub Khan Dawood, Prof Dr Vilas A Pharande, all reviewers and all authors for their help in consolidating the interdisciplinary of the book.

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Chapter-1

Automatic Text Classification of News Blog Using Machine Learning

Dr Bhosale V K ¹, Ms Pratiksha Arun Kadam & Ms Jyoti Shankar Mane

Abstract

In recent years, due to the tremendous growth of information, text classification becomes a need for humans. In this paper, the data is classified into the various groups as per the existing content. As the machine learning algorithm is used for the text classification, this needs training and testing datasets. This paper illustrates the classification process by using automatic text classification. The training data is vectorized using a count vectorizer. The TF-IDF (Term Frequency-Inverse Document Frequency) is used for the normalizing data. Finally, the Stochastic Gradient Descent Machine algorithm is used to classify the data.

Keywords: Classification, Word2Vec conversion, TF-IDF information retrieval, text classifier.

Introduction

The machine learning technology is now playing an important role in the research and development sector. Now a day's many people have their busy schedule in their day to day life. This paper illustrates a system which is proposed to save the user time and their troubles. In this paper, the classification of news data is done. As the news spread in a wide range and it has a great influence on our society [9]. This system consists of the following processes: pre-processing, vectorization, normalization, and classification [1]. Previously the Chinese text has been classified, but the classification of the Chinese text is different than the English text classification [4]. This paper suggests the proper algorithm of text classification. It also states the accuracy score of text classification in different algorithms. This accuracy score will be calculated by using mean functions in the python and different libraries of python.

Literature Survey

The M.Ikonomakis and Kotisiantis suggested the text classification process using machine learning algorithms. They give an overview of all algorithms which can be preferred to implement text classification. Text classification plays an important role in information extraction, summarization, text retrieval, and question-answering [1]. Mita K. Dalal etc. suggested that automatically classification of sports blog data is done to the appropriate category of the sport by steps like pre-processing, feature extraction, and Naïve Bayes classification [2]. Cai-Zhi Liu etc. suggested the vector representation of feature words based on the deep learning tool Word2vec. In this, the weight of the feature words is calculated by the improved TF-IDF algorithm. By multiplying the weight of the word and the word vector, the vector representation of the word is realized [3]. Fang Miao etc. , give a comparison of three different machine learning algorithms like K-nearest Neighbour, Naïve Bayes, and Support Vector Machine (SVM) used for text classification. Among these algorithms, SVM is more compatible with the bigger dataset and smaller datasets as compared to K-nearest and Naïve Bayes [4].

Related Work

The automatic text classification system provides the facilities to users such as to save their time by using automatic text classification. This paper suggests a supervised machine learning algorithm. This system will train the machine which contains 20 Lac news data which is in the tabular form. This training data holds the news and its categories itself. Firstly the machine will extract the features from the training data, tokenize it. After this, the extracted data will be arranged in vector format by using a count vectorizer, which converts text documents into tokens [2]. This count matrix is given to the TF or TF-IDF vectorizer. (Term Frequency & Term Frequency- Inverse Document Frequency). This vectorizer transforms a count matrix to a normalized TF or TF-IDF representation. This is a complete process of training the machine.

After completing the training, the accuracy will be calculated. The accuracy ratio is dependent on the number of training data. After completing the training of the machine, testing data is passed to the machine. This testing data will consist of news as well as the type or category of the news. This testing data will also be presented in

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the tabular format i.e. it can be in CSV file. This system will pass the testing data in the CSV file which can be known as a comma-separated file.

This consists of the data which will be passed to the machine for categorizing purpose only. This file is passed to the pipeline in which the count vectorizer, TF-IDF vectorizer, and SGD classifier will work parallel to each other. In count vectorizer and TF-IDF, the same operation will be performed [3]. This pipeline will cover the operations like tokenizing, creating vector by using the count vectorizer, normalize this vector using the TF-IDF transformer. After this normalized data is taken by the SGD Classifier. SGD Classifier is like linear classifiers (SVM, logistic regression,) with SGD training [10].

Methodology

The Automatic text classification uses different types of methods. This can include various phases of classification [5]. These phases mainly consist of pre-processing, vectorization, normalization, and classification. Fig. (1) shows how the text classification is done by using the training and testing data. The training and testing data should be pipelined to form the classification result. This training set contains 20 Lac news which is stored in a CSV (Comma Separated Values) file. The training set consists of labels. This data is in a structured form because supervised machine learning doesn't allow unstructured data.

In supervised machine learning, the data is to be extracted from the training dataset in the labeled form. A supervised learning algorithm analyses the training data set and produces a function that can be used for mapping a new example. Supervised text classification means that you have a set of examples where we know the correct answer. For example, if we have a set of flower and color data like ['Rose', 'Tulip', 'Sunflower'] belongs to the flower category and ['Red', 'Black', 'Blue'] belongs to a color category.

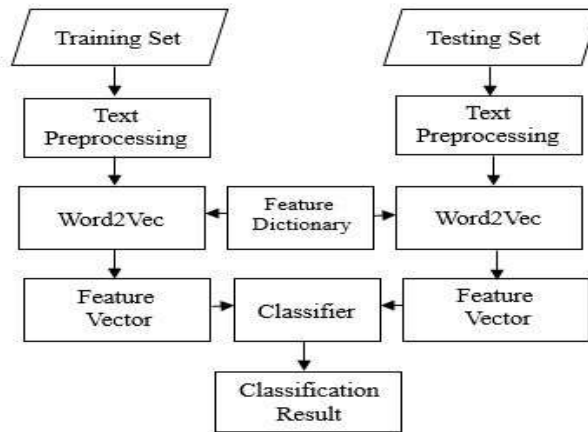


Fig.1. Classification Diagram

A. Preprocessing

The text pre-processing is said to be a phase in which the data is pre-processed in such that it is predictable to the machine. The first step of pre-processing is lowercasing and stop-word removal [8]. This pre-processing is very important in natural language processing.

The next step is the removal of punctuations and stemming. Stemming means to remove the stem from the word. The pre-processing also called the cleaning of the text document. The cleaning of all documents takes place here. The pre-processing of a text document is shown in the following Table 1.

E.g. this is a text classification!!!

Table 1: Pre-processing

Lowercasing	this is a text classification!!!
Stopword removal	text classification!!!
Punctuation removal	text classification
Stemming	text classify

B. Vectorization

The vectorization is the process of mapping the words from the vocabulary. After this, these words can be converted into the vector form. These vectors can be used for finding semantics and to predict the word. For this

vectorization, a count vectorizer is used. This count vectorizer is mainly used in the building of the vocabulary of the known datasets. By using count vectorizer raw data can be converted into the vector representation i.e. into the n-grams. Finally, n number samples and n number of features will be displayed. The following Fig.2 shows the process of vectorization.

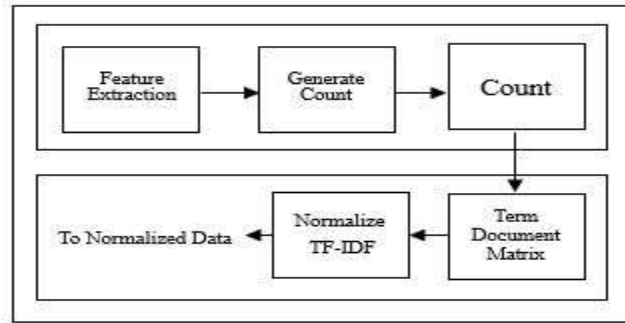


Fig2. Vectorizer

C.Normalization

The normalization is the process of reducing the weight of the text so that it becomes easy to classify the text. The TF-IDF (Term Frequency-Inverse Document Frequency) is used for the normalization process. The TF-IDF is another way of representing text [3]. This TF-IDF can be calculated by using the following formulas:

TF (Term Frequency)-

$$tf(t, d) = 0.5 + 0.5 \cdot \frac{f_{t,d}}{\max\{f_{t',d} : t' \in d\}}$$

Where,

TF (t, d): Term frequency in a document.

$f_{t,d}$: Raw count

IDF (Inverse Document Frequency)-

$$idf(t, D) = \log \frac{N}{|\{d \in D : t \in d\}|}$$

Where,

- N : total number of documents in the corpus $N = |D|$
- $|\{d \in D : t \in d\}|$: number of documents where the term t appears (i.e., $tf(t, d) \neq 0$). If the term is not in the corpus, this will lead to a division-by-zero. It is therefore common to adjust the denominator to $1 + |\{d \in D : t \in d\}|$.

TF-IDF (Term Frequency-Inverse Document Frequency)-

$$tfidf(t, d, D) = tf(t, d) \cdot idf(t, D)$$

The TF-IDF of the following document as:

Table 2: TF-IDF Example

Document 1	The sky is blue
Document 2	The sky is not blue

Document	TF		IDF	TF-IDF	
	A	B		A	B
The	1	1	$\log(2/2)$	0	0
Sky	1	1	$\log(2/2)$	0	0
is	1	1	$\log(2/2)$	0	0
blue	1	1	$\log(2/2)$	0	0
not	0	1	$\log(2/1)$	0	1

The above Table 2 shows how TF-IDF is calculated. TF-IDF is used to transform the count vectorizer into the normalized data [3]. The TF-IDF can vectorize the document until it fits into the normalized form. The TF is the term frequency which can reflect the internal feature of the text document and shows into 0 or 1 form. IDF is the inverse document frequency. It is the inverse of the TF. The IDF is used for the distribution of features in the text document. So that it shows the result in the n number of samples and n number of features. TF-IDF is an algorithm that is very easy and simple to learn. Therefore TF-IDF is suitable for normalization.

D. Classification

There are various classification algorithms but the SGD (Stochastic Gradient Descent) is the most preferable algorithm in the machine algorithm. The SGD is based on the gradient descent algorithm which will be used to improve the speed. This can work on the iterations so that it is also called an iterative method [10]. The SGD can select the data points from a large number of datasets and calculates the gradient. Hence the speed is improved. The evaluation matrices of the different models are as follows:

Table 3: Comparison Matrix

Model	Train Set Accuracy	Test Set Accuracy
Logistic Regression	98%	94%
SGD	95%	94%
Naïve Bayes	95%	93%
KNN	95%	92%

From the above evaluation in Table 3, it is cleared that the logistic regression has high training set accuracy but has low testing set accuracy [7]. SGD has the highest test set accuracy and is near to training set accuracy. Others can't fit in the accuracy matrix. Hence, SGD is the best for the text classification.

Result and Discussion

From the table of evaluation matrices i.e. TABLE 3, it is cleared that stochastic gradient descent is the best algorithm for the text classification. The experimental data which is used for the text classification is the raw data. This raw data is then pre-processed and vectorized by using vectorization algorithms.

First, the Naïve Bayes algorithm is used for the classification. But later it is identified that this algorithm can take too much time and it gives less accuracy than the stochastic gradient descent. The Naïve Bayes classifier is not efficient for a large number of datasets. Then the SGD algorithm is used for the classification. With the help of a gradient descent algorithm, the linear regression problem is solved. Gradient descent is the iterative method that can be used to increase the speed. This gradient descent algorithm is based on the slope and the gradient.

This algorithm can work in the following steps:

1. Compute the gradient function by finding the slope of the objective concerning the feature set.
2. Take any random initial value for the parameter (e.g. differentiate 'y' concerning 'x'. If there are more features then take a partial derivative of 'y' concerning all features).
3. By plugging the parameter update the gradient function.
4. Then calculate the step size for every feature. The step size is the product of gradient and learning rate.
5. Then calculate the new parameter and it is the difference between the old parameter and step size.
6. Finally, repeat the steps 3-5 until the gradient becomes almost 0.

The SGD can randomly pick the one data point from the set of whole data so that computations are enormously reduced [10]. After using the classifier the testing data and training data are pipelined for the simultaneous execution. And the result of the classification is as follows:

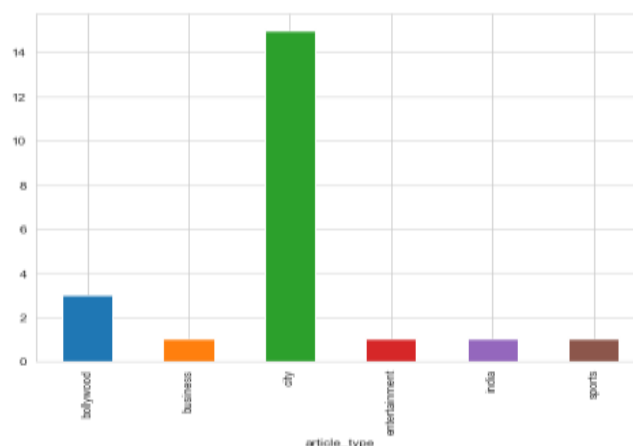


Fig. 3: Classification graph

The above graph classifies the categories of news. This can be classified by using the SGD classifier and the graph is plotted by using the matplotlib library. The matplotlibs are the python library which is used in the python for plotting graph. In testing data, there is much news that is passed in which machine learns this data and with the help of a training set, it can identify which news is from which category. The machine understands it and shows the counts of categories. So that it can be identified that news can be classified with a different category.

Conclusion

This paper suggests that various algorithms are used for the text classification but some take more time to classify, some can work on small datasets, etc. The SGD is the algorithm that overcomes all these points. The Stochastic Gradient Descent is said to be a speedy algorithm because it can work with slope and gradient [10]. With the help of the SGD algorithm, the text classification system is designed. This system constructs a module that predicts the accurate ratio of the testing data which consists of different news data. The predicted ratio is between 0 to 1. This ratio will be a means of all that testing data i.e. news. And finally, the news data is classified which is shown by the graph. The graph denotes the specific category of that news. It can be cleared that SGD is the most preferable algorithm in the text classification from different algorithms like naïve Bayes, KNN, logistic regression, etc. So the system can classify the text with high accuracy and more speed.

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Chapter-2

Performance Analysis and Comparison between Various Unidirectional Composite Lamina's to be used in Light Weight Automobile Leaf Spring

Mr. R B Gunale² & Dr. S. Chakardhar³

Abstract

Composite is a mixture of multiple materials to gain the combined advantage of all those which was otherwise not possible to achieve if added constituents considered alone and independent. Percentage varying of added material if do vary it leads to change lamina property which further effects laminate properties which can be derived from lamina on an average basis. Every application is unique and needed to support the best material to perform a said task in a satisfied manner for the expected period. A designer would have enough number of material choices readily available with him which he chooses or reject based on few parameters such as cost, processing easiness, availability, mechanical properties, thermal properties, electrical properties, etc. sometimes available standard materials are not enough to perform given task satisfactorily and thus designer would think for its replacement and thus the role of alternative material comes in to picture. This material performs well on the cost, availability, and performance front and thus recognized into role first time and starts gaining popularity later if consistently gives the satisfactory output as required.

The Paper describes performance comparison between various composite laminas, laminas behavior have studied for different fiber orientations, so the strength, stiffness, and effect of such change on mechanical properties have studied on each lamina. The current paper describes the behaviour of three composite unidirectional laminae in response to the change of fiber orientation, it reveals some laminas are less sensitive to such change and its properties remain unchanged till failure but few are very sensitive to such changes happened concerning orientation or alike parameters such as thickness, fiber, matrix volume fraction and shows the rapid change into properties and behavior. The industrial designer or researcher would have a choice of choosing the best material for a specific application, or he would fetch an idea about imparting structure with enough strength by varying a few basics parameter and that made him either to choose the right material for said application through comparative study or upgrading level of performance of material by varying some basic parameters, in both the circumstances, one is capable to pull out a choice of the best material for said application. The material performance comparison discussed in the paper tried to achieve similar objectives.

Keywords: Carbon-epoxy, glass/epoxy, Kevlar/epoxy, composite lamina, orientation, engineering properties, etc.

Introduction

Selection of material happened based on few parameters such as, its availability, processing easiness, cost, mechanical, thermal and electrical properties etc.

Composite material has widely and satisfactorily recognized by the world of engineering and its uses has initiated in different fields, still researchers are believe to fetch utmost use of it in different fields to the best possible extant which is not happened yet. Specification of idle material to be used for various applications are, its strength, cost, availability, easiness, moulding capacity, performing capacity affectivity by various parameters etc. the set of required properties are determined based on type of environment and nature of loading

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component will probably be subjected to during its operational tenure and thus job of industrial designer is to impart required perfection to address the objectives as framed inline to such operational requirements [1,7,12]. In the paper here, side by side study of performance and properties variation is studied for different laminas. The laminas further process in to laminate which further mould in to components. Ability of lamina and its constituents defines ability of processed components which are recommended to perform various mechanical and semi-mechanical tasks.

Comparison between various materials as an impact of orientation change is discussed throughout paper to determine and select the right lamina configuration with respective material to perform said application in utmost satisfied way.

The conventional automobile suspension systems are made of steel, chromium and cast iron, they are heavy in weight and wide in structure, they encompasses 30% of total weight of the automobile being a suspension system. Manufacturer now days are looking forward to manufacture something of compact in design and light in weight still offering highest performance when it is compared with conventional technology or structure. The composite leaf spring is a best alternative option emerged out now days which is used widely to replace conventional steel leaf spring structure by light weight mono leaf spring structure which carries several advantages of its implementation such as less weight, high stress and load sustaining capacity, high reliability, high frequency of vibration and compact structure etc. [1-10]

The composite material namely carbon/epoxy, glass/epoxy and kevlar epoxy moulded into lamina/laminate structure with manufacturing specifications fibre and matrix volume fraction 0.7 and 0.3 respectively, the layer thickness of all stacked laminas into laminate structure maintained to 0.5mm, the fibres are square packed and originated to 0 degrees. The laminated structure is tested for the performance of various parameters such as stress, strain, ultimate load sustaining capacity, stiffness etc. the experimentation and analysis of these composite laminated structure made of different materials is means to check its applicability towards manufacturing of best performance composite leaf spring which can be used as a replacement to conventional steel leaf spring structure used widely nowadays in every automobile as a part of suspension system. [1-5]

The composite structure is anisotropic in nature; its properties are direction dependant unlike isotropic material which carries similar properties along all principal direction/orientation. The change in one parameters leads to change the performance/behaviour of material under the said set of loading and thus investigating the performance of composite through experimentation let to map it further with benchmarked performance needed to operate it as composite leaf spring as a replacement to conventional leaf spring is investigated and described through this paper/research work. The major parameters studied through the work are stiffness, off axis and on axis stress, off and on axis strain, engineering elastic properties etc. the effect on these parameters virtue of changed orientation off fibre into matrix of lamina or lamina thickness is studied throughout the paper in terms of experimentation, graphical representation and analysis for different composite material which are there on choice list and can be recommended as a replacement to steel leaf spring structure in coming time successfully as an effective suspension system [6,8,9,10,15].

Review of literature

The strength of composite material though higher than isotropic material or conventional steel, the micro level manufacturing and molding defects reduces strength of composite material to drastic level, the failure occurred into composite during operational tenure can be well studied virtue of micro and macro mechanical theories of designing and analysis of composite thus every time they provide a better opportunity to design and develop the composite with superior performance [4,5]. The way of designing and assessing the performance of composite leaf spring is different from the conventional steel leaf spring, the fatigue behaviour, response of spring towards dynamic loading and thus percentage of spring life consumed virtue of intensity of load acting for definite tenure of operation is found low compared to conventional leaf spring, thus overall life of composite spring is more than conventional steel leaf spring [7]. The carbon, glass and kevlar can be considered as a best alternative composite material if aim is of replacement of conventional steel leaf spring structure [6]. The increased tenure of load acting or increased intensity of loading reduces life of spring drastically, its impact come to see more severe in the case when load intensity and tenure of load acting both increases proportionally, it consumes three spring life in a step of increase in load and tenure of load and the overall result of it come to see reduced life of spring which is not able to perform till the extent of benchmark it was aimed and designed for [9]. The failure of composite not only taken place due to load exceeding of maximum load sustaining limit of material or excessive bending stress but it is due to ply delamination also, this type of failure is result of inter laminar shear stress exceeds and reach to the extreme edge of lamina, the ultimate results come to see in terms of ply delamination and structure failure [12]. The fibre orientation, ply thickness, fibre and matrix volume fraction are few of the parameters which effects on the strength of composite lamina and hence on laminated structure [14]. The deformation, stiffness, deflection and mass of spring are few of the parameters based on which its performance can be compared with any other alternative material available or claimed into the manufacturing of spring [15]. Sisal, Jute are another sources of natural composite material available apart from the artificial fibres which are

manufactured in laboratory and can be used in the designing and development of bio inspired composite material which are used in artificial implants [19]. The different shapes of springs are there into option list which can be recommended into vehicle suspension system for unique reason when specific mode of operation is recommend/required, and few of them can be listed as, parabolic, non-parabolic square, polygonal etc. each of them has unique way of working towards load receiving, sustaining and transferring etc. [21]. Unidirectional fibres/lamina are good along longitudinal directional strength where woven fabric having mutually perpendicular organised fibres are capable to perform well longitudinally and perpendicularly [32].

Conclusion of the literature review: Composite material with set of an optimized specification parameters such as fibre, matrix volume fraction, ply thickness, lamina fibre orientation can be recommended for molding and manufacturing applications to transform it into any applicable geometry such as mechanical spring (In the current case), the performance of composite spring is found superior than conventional steel leaf spring and thus they can be recommended into replacement of conventional leaf spring structure to gain certain advantages from the process of this replacement. The performance and behaviour of composite leaf spring material virtue of change of its manufacturing and design parameters can be studied in versatile way either for multiple parameters one by one or in group of certain parameters so as to cluster the set of best performing parameters and thus continued with recommendation of similar parameters, manufactured composite structure is expected to perform superior/ at better front than conventional steel leaf spring or any other mechanical structure made of different material.

Background of the work/research: Spring is a mechanical device which is used to absorb the shocks and vibrations which are frequently raised during operation tenure of vehicle while running across regular or irregular road surfaces; the impact of these forces seems more when vehicle is running across irregular road conditions. The spring becomes the part of suspension system which absorbs the shocks and vibration, but it provide safety and comfort to the elements of vehicle from getting damage and peoples seated inside of vehicles as well. The suspension system carries 30% of the total weight of the vehicle and thus it reduces fuel operational efficiency of vehicle and thus it required to be reduced and only way of doing so is replacement of spring material by some alternative material which would light in weight/density. The world of today is keen to investigate and find new alternative and best performance material to the existence material through research. Composite is the material which is mixture of two or more than two materials which are physical distinct and mechanically separable still the material as a whole offers combined advantages of all the mixed sub-materials into it. The replacement of conventional leaf spring with composite leaf spring with choice of few composite materials to achieve the advantage of weight reduction, strength enhancement and increase into operational efficiency of vehicles are few of the aspects are tried to investigate, analyse and addressed through research work under consideration [21, 22, 29, 30].

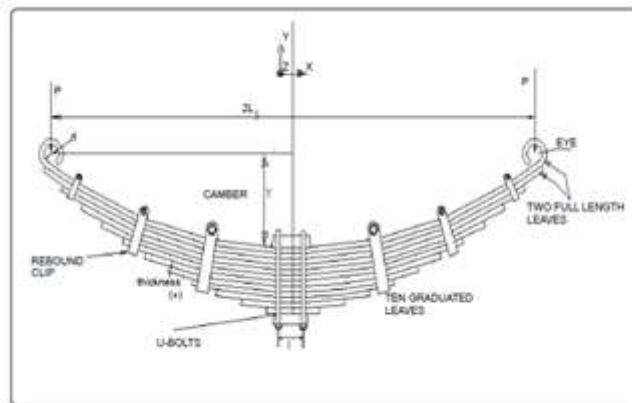


Fig (2.1): Conventional leaf spring made of steel.

The research work is focused on the aspect of investigate and hence analyse the performance of carbon/epoxy, glass/epoxy and kevlar/epoxy leaf spring. The material properties at lamina and laminate level have studied and analysed through various graphs plotted as results of experimentation. Considering the set of optimistic parameters depicting an idle/required/needed performance of lamina/laminate/leaf spring the final model of composite leaf spring has been moulded and tested, simulated for stress, deformation, mass/weight and reaction force. The best performance giving material among three chosen composite material was glass/epoxy, the value of stress, deformation and reaction force is noted low into corresponding leaf spring made of glass/epoxy and that led to conclude glass/epoxy is best performance giving composite material compared to carbon and kevlar. Moving ahead the performance of glass/epoxy is compared with conventional steel leaf spring model which is used currently into automobile vehicles, this comparison reveals the fact that, deformation, stress and mass of glass/epoxy is come occurred less when it compared with steel and that led researcher to reach to

final conclusion that, “The replacement of conventional steel leaf spring by means of composite mono leaf spring structure is possible with gaining benefits of an advantages of lowered value of stress, lowered value of deformation and reaction force, lowered value of weight/mass, compact structure etc.”

Laminate testing/experimentation made of different composite material to study the effect and behaviour of various performance affecting parameters: The leaf spring/laminate with material under investigation, chosen to manufacture the leaf spring and thus expected to recommend as a replacement to conventional leaf spring are named as, carbon/epoxy, glass/epoxy and kevlar/epoxy etc.

The dimensions of the spring made of above material are maintained same and constant in all cases of spring material as discussed above, the dimensions of the spring specimen considered and finalize after the completion of process of design are as, length 800mm, width 60mm, number of plies/layer of lamina 16, thickness of each ply 0.5mm, Total thickness of spring/laminate 8cm, fibre orientation 90 degrees, fibre volume fraction 0.7, matrix volume fraction 0.3, fibre packaging method; square etc. The specimens of leaf spring are manufactured in laboratory by “Hand Layup Techniques/Methods”.

During manufacturing of spring resin and catalyst deposited on previous ply impregnated with reinforcement, catalyst is added to increase the rate of reaction i.e. rate of hardening followed by drying. Plies are consolidated into metal mold of C shape provided with curvature of 52cm and rest of the dimensions are as similar as dimensions of the leaf spring itself by means of brush or roller. The rollers are recommended into operation after formation/placing of each successive ply to remove the trapped air which otherwise reduces strength of structure if remains present even after completion of hardening and drying of the specimen. The wax or polish is applied on the mold surface to avoid the sticking of material to the mold surface and thus will ensure easy removal of it after the completion of hardening and drying. For 1kg resin 100 gm hardener is added. Cobalt is also added as a catalyst to increase the rate of hardening and thus completion of drying at earliest. The specimen which hardened and dried well as per the requirement sent for the laboratory testing/experimentation.



Fig (3.1): Composite laminate specimen prepared in laboratory by hand lay up method.

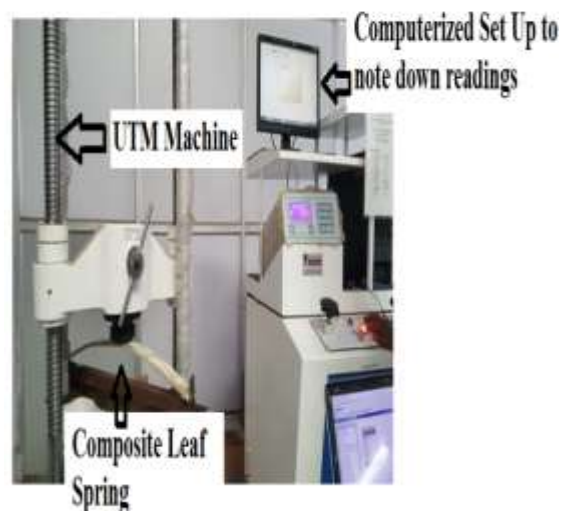


Fig (3.2): Laminate testing on UTM (Universal Testing Machine).

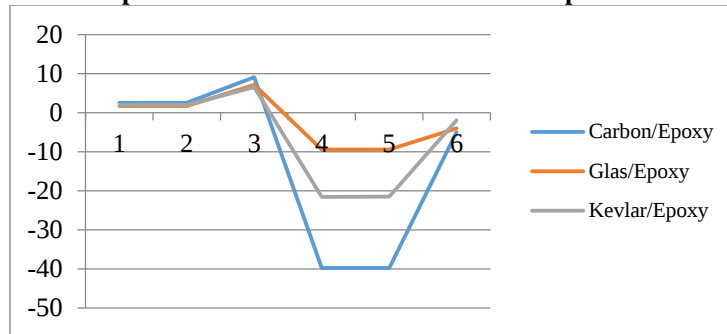
Following are lamina's engineering elastic properties obtained via Lamina Testing on UTM (Universal Testing Machine), the load applied on sample was uniaxial, gradual, loading magnitude has raisin till failure by fracture. Respective stress-strain graphs plotted were used to determine basic engineering elastic properties of different lamina as tabulated in the table given below [20,27].

Table (3.1): Material Engineering Elastic properties.

Engineering Elastic Constants Values	Glass/Epoxy			
	E1, GPa	E2, GPa	G12, GPa	U12
	38	7	4	0.24
Engineering Elastic Constants Values	Carbon/Epoxy			
	E ₁	E ₂	G ₁₂	μ ₁₂
	135	9	5	0.28
Engineering	Kevlar/Epoxy			
	E1	E2	G12	U12

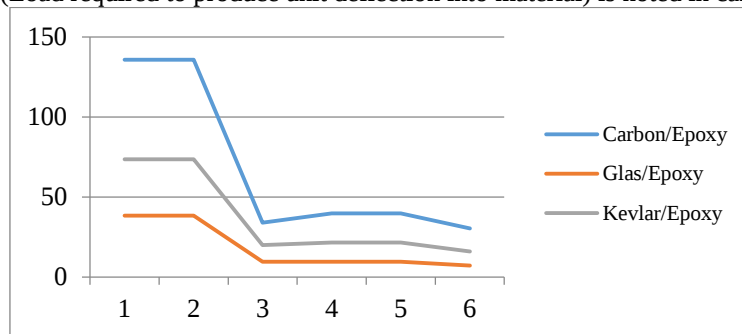
Elastic Constants Values	73	6	2	0.32
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Performance analysis and comparison between different laminar composites:



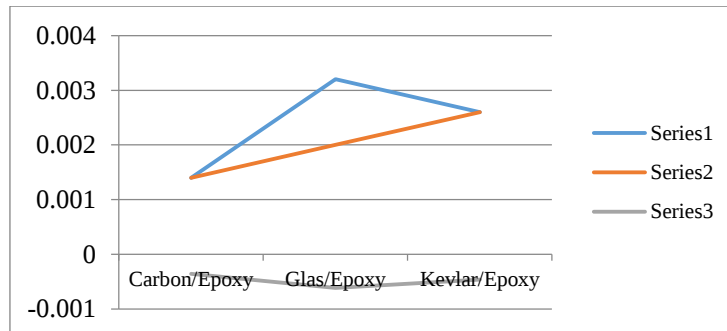
Graph (4.1): Minimum value comparison of laminar stiffness components as a function of changing orientation.

Graph above depicts effect of changed fibre orientation on the stiffness of composite materials which are recommend in the manufacturing of composite leaf spring further to use as a replacement to conventional spring structure in light weight automobile. The graph depicts changed orientation leads to change stiffness of lamina; the highest stiffness (Load required to produce unit deflection into material) is noted in carbon/epoxy.



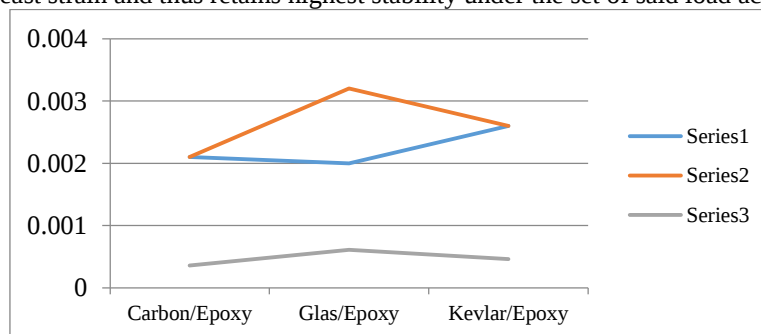
Graph (4.2): Maximum value comparison of laminar stiffness components as a function of changing orientation.

Carbon retains highest stiffness among all composite material recommend in the manufacturing of spring structure, thus fact can be concluded that, carbon has maximum load sustaining capacity among all other mentioned materials.



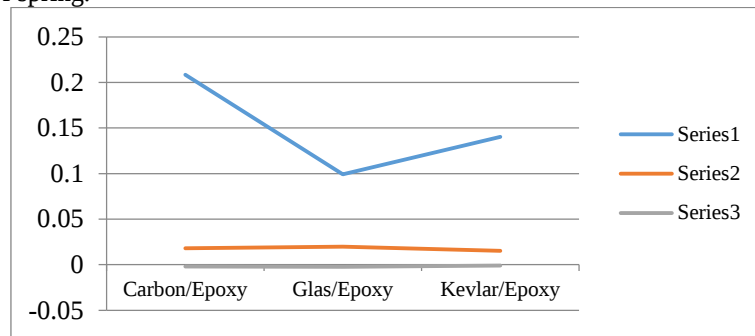
Graph (4.3): Minimum strain value among three different composite.

Kevlar is showing least strain and thus retains highest stability under the set of said load acting.



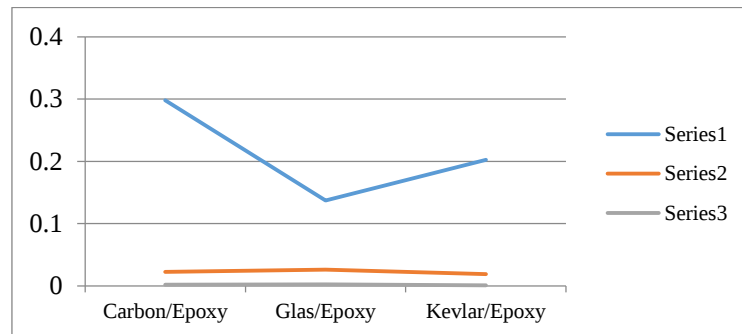
Graph (4.4): Maximum strain value among three different composite.

Glass is showing maximum strain and thus less stable under the considered sets of load acting during operational tenure of spring.

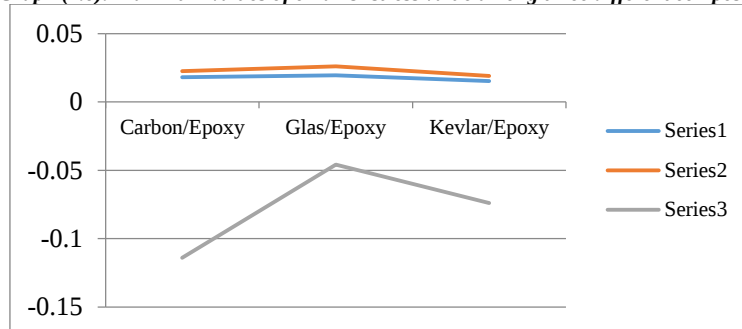


Graph (4.5): Minimum values of on axis- stress value among three different composite.

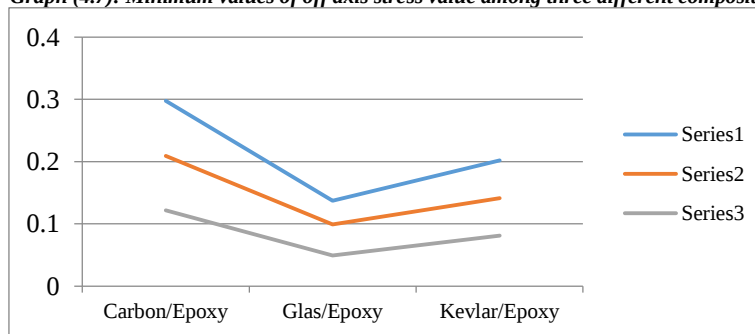
Kevlar is showing least stress arrived due to material restriction to deformation and thus it can sustain maximum loading magnitude.



Graph (4.6): Maximum values of on axis- stress value among three different composite.

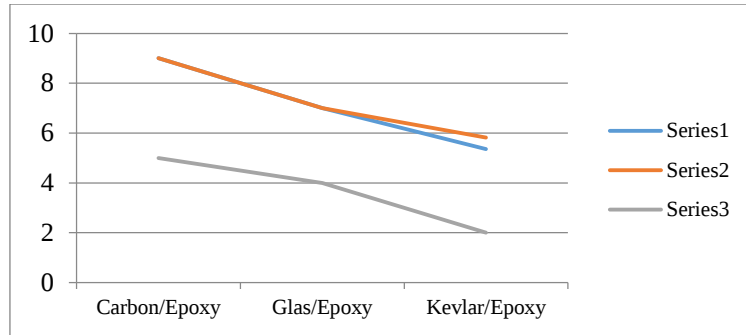


Graph (4.7): Minimum values of off axis stress value among three different composite.

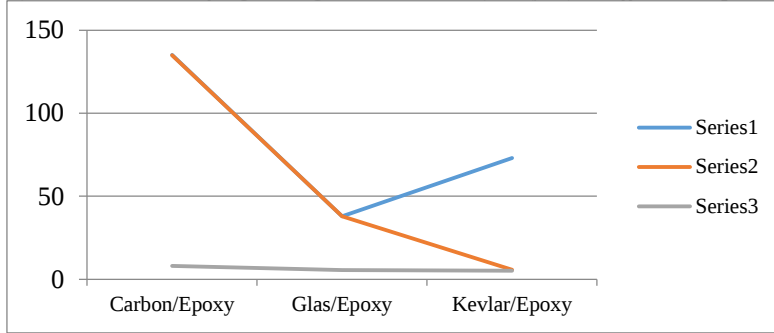


Graph (4.8): Maximum off axis stress value among three different composite.

Graph number (4.6 to 4.8) under the maximum and minimum expectancy of load and respective stress, the value stress is noted low in Kevlar in all the cases and that made it high magnitude of load sustaining material without undergoing for failure at earliest.

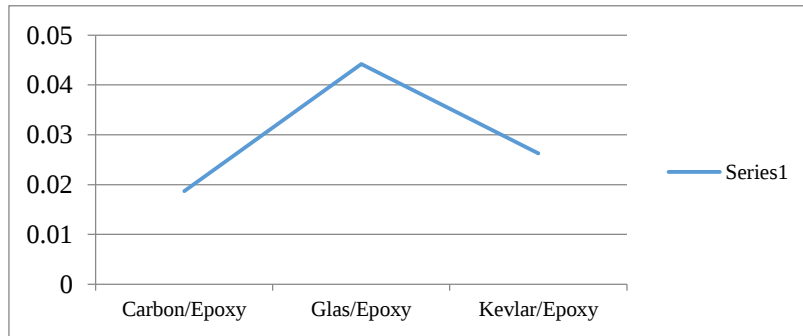


Graph (4.9): Minimum values of engineering elastic constants (E_x , E_y , E_z) in different composite materials.

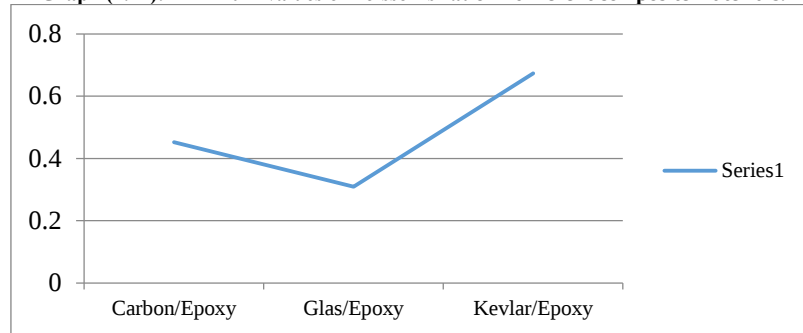


Graph (4.10): Maximum values of engineering elastic constants (E_x , E_y , E_z) in different composite materials.

Glass/epoxy is the material which carries highest values of engineering elastic constants compared to kevlar and carbon.

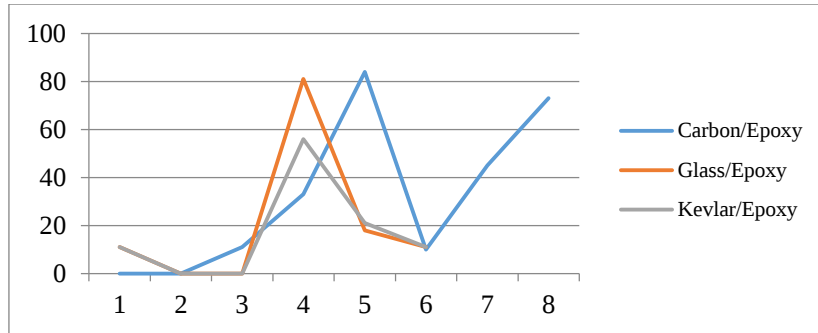


Graph (4.11): Minimum values of Poisson's ratio in different composite materials.

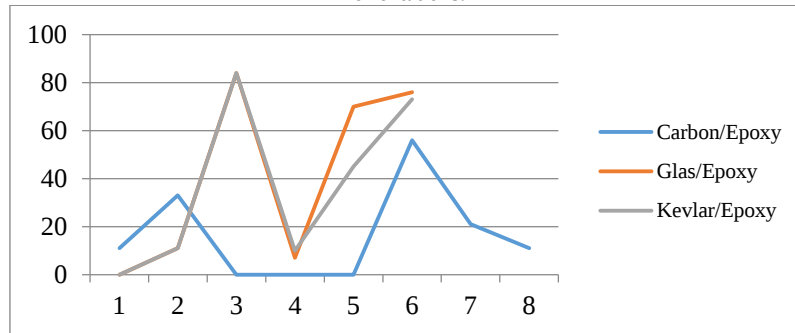


Graph (4.12): Maximum values of Poisson's ratio in different composite materials.

Glass/epoxy shows minimum value of Poisson's ratio compared to other material and thus it enables less flow of material from one plane to another under the set of load acting, thus it assures integration and stability of material which is not deformed uncontrollably.

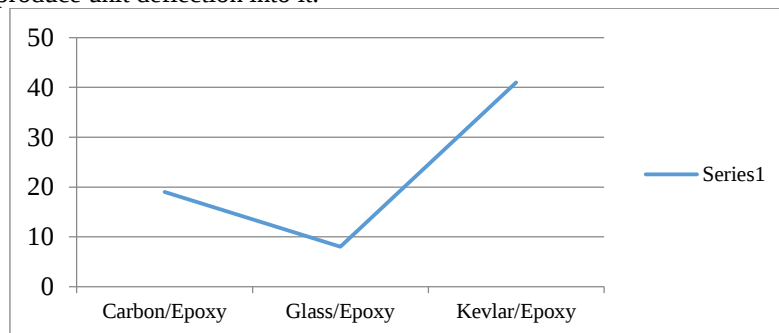


Graph (4.13): Maximum values of lamina stiffness components for different material among different laminas holds different fibre orientations.

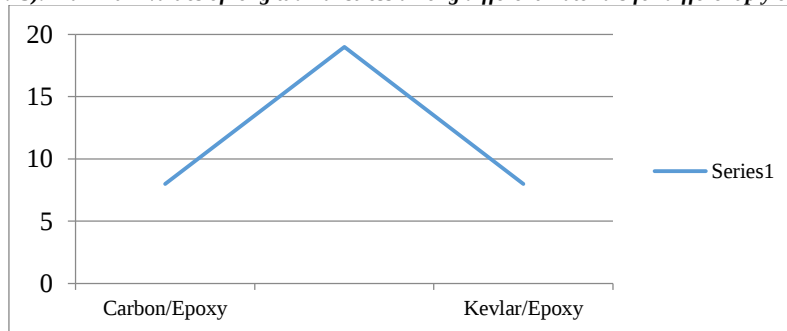


Graph (4.14): Minimum values of lamina stiffness components for different material among different laminas holds different fibre orientations.

Maximum value of lamina stiffness is noted for glass/epoxy for fibre orientation set for 80 degrees where the minimum value for stiffness is noted for Kevlar for same degree of orientation of fibre, thus fibre with orientation 80 degrees into glass/epoxy leads to produce structure with high stiffness which requires high amount of load to produce unit deflection into it.

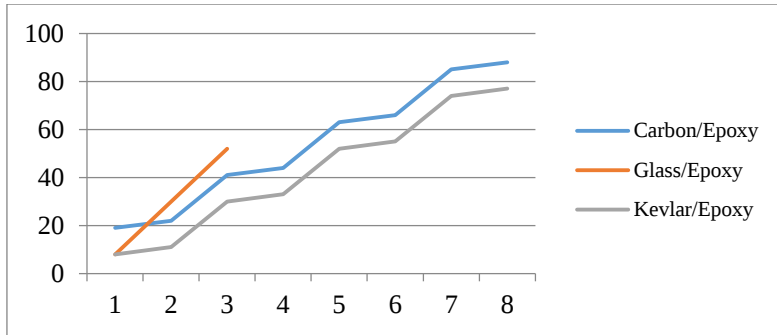


Graph (4.15): Maximum values of longitudinal stress among different materials for different ply orientations.

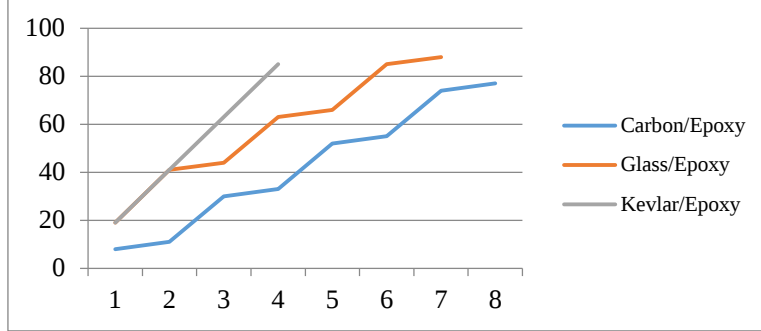


Graph (4.16): Minimum values of longitudinal stress among different materials for different ply orientations.

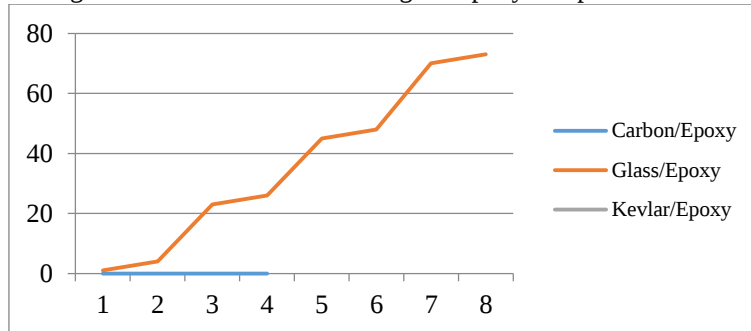
Minimum stress value is noted into glass/epoxy structure which assures safety of structure under acted set of loading by high margin.



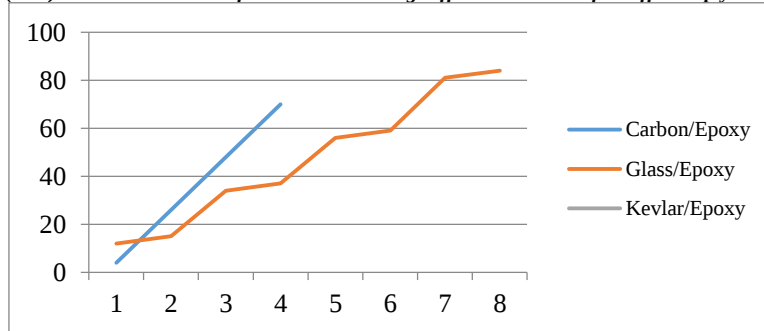
Graph (4.17): Maximum values of transverse stress among different materials for different ply orientations.



Graph (4.18): Minimum values of transverse stress among different materials for different ply orientations.
Again minimum and average value of stress is noted into glass/epoxy compared to carbon and kevlar.

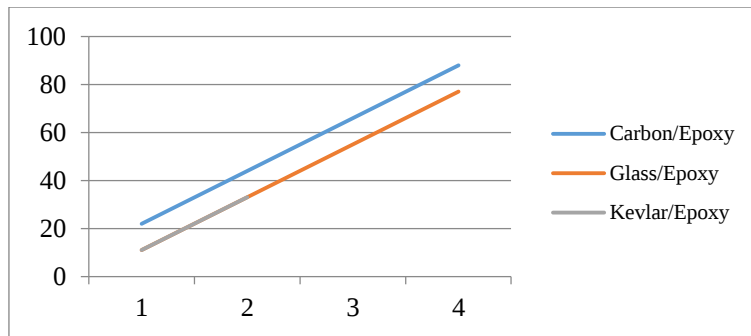


Graph (4.19): Maximum values of shear stress among different materials for different ply orientations.

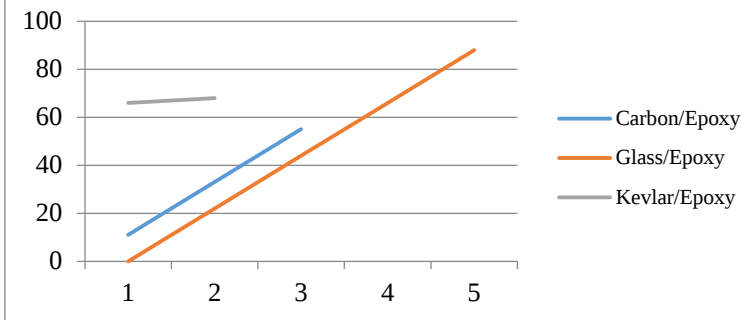


Graph (4.20): Minimum values of shear stress among different materials for different ply orientations.

Value of inter laminar shear stress which results into ply delamination or structure partial failure is noted low in the case of glass/epoxy again.

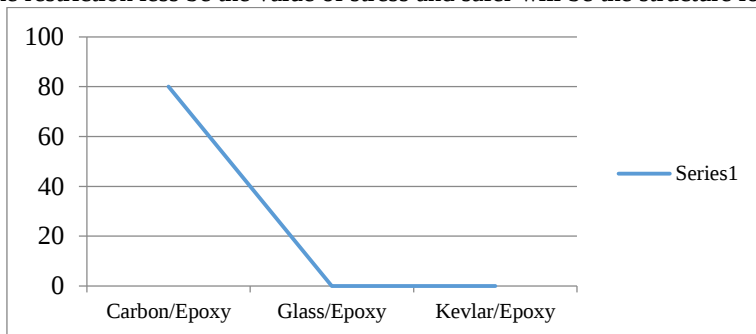


Graph (4.21): Maximum values of longitudinal off axis stress for different material among different ply orientations.

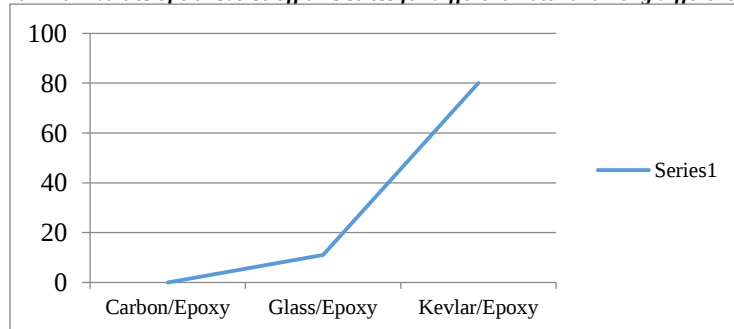


Graph (4.22): Minimum values of longitudinal off axis stress for different material among different ply orientations.

Value of off axis longitudinal stress is noted low in the case of kevlar and glass epoxy compared to carbon, the high restriction to deformation produces this stress and lead structure to fail as a surprising and immediate effect, less will be the restriction less be the value of stress and safer will be the structure longer.

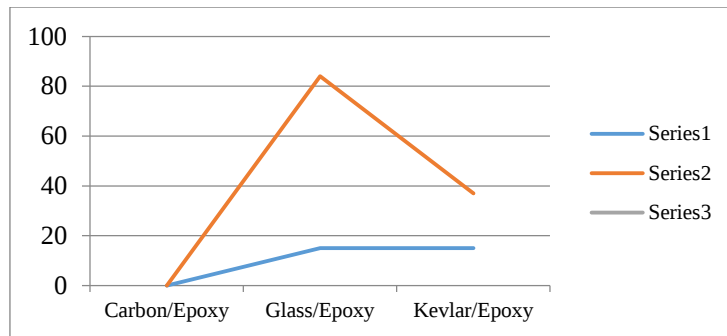


Graph (4.23): Maximum values of transverse off axis stress for different material among different ply orientations.

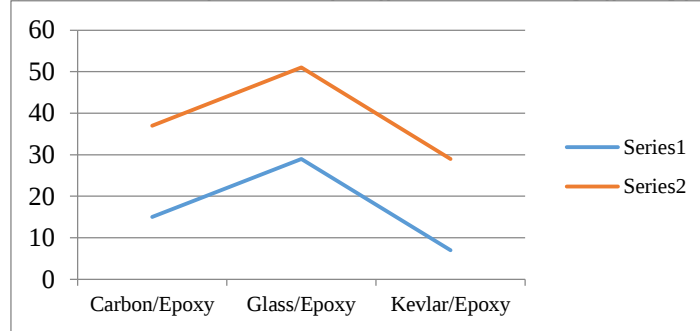


Graph (4.24): Minimum values of transverse off axis stress for different material among different ply orientations.

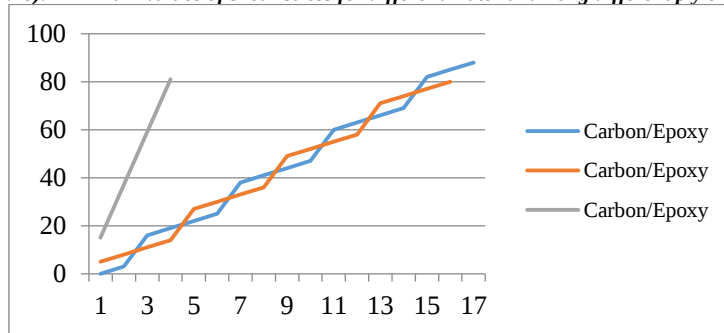
Like on axis transverse stress value of off axis transverse stress is also noted low in the case of glass and kevlar once again.



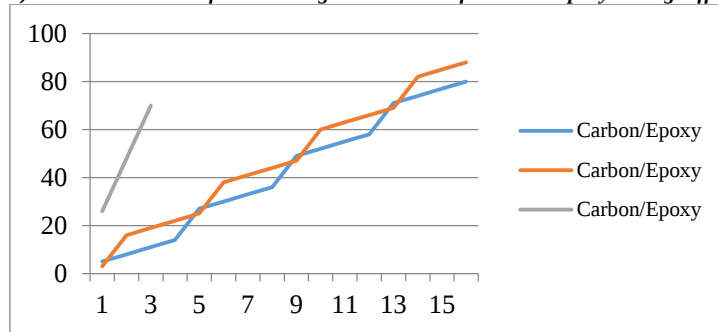
Graph (4.25): Maximum values of Shear stress for different material among different ply orientations.



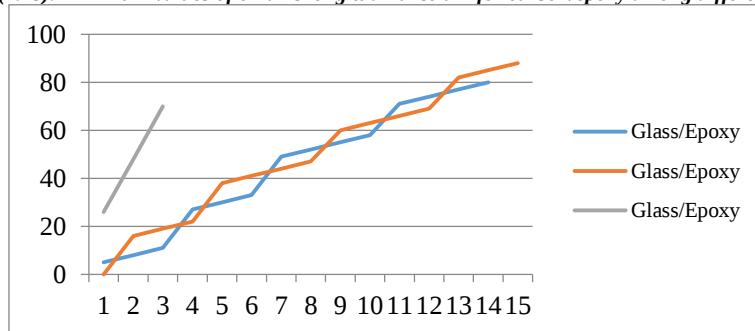
Graph (4.26): Minimum values of shear stress for different material among different ply orientations.



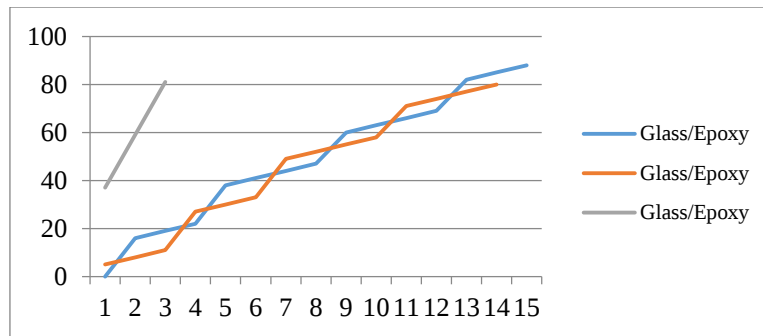
Graph (4.27): Maximum values of on axis longitudinal strain for carbon/epoxy among different planes.



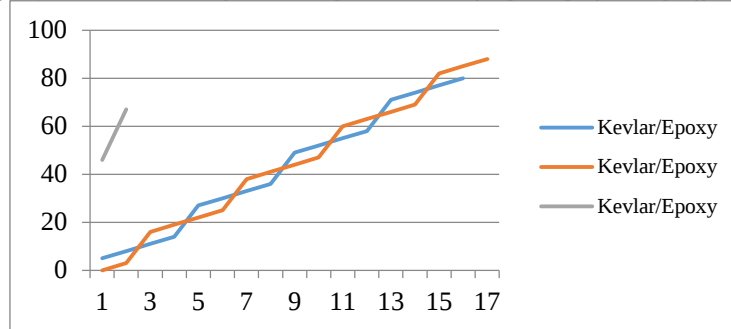
Graph (4.28): Minimum values of on axis longitudinal strain for carbon/epoxy among different planes.



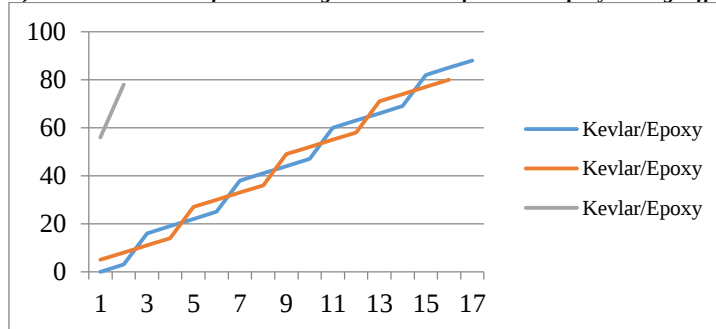
Graph (4.29): Maximum values of on axis longitudinal strain for glass/epoxy among different planes.



Graph (4.30): Minimum values of on axis longitudinal strain for glass/epoxy among different planes.

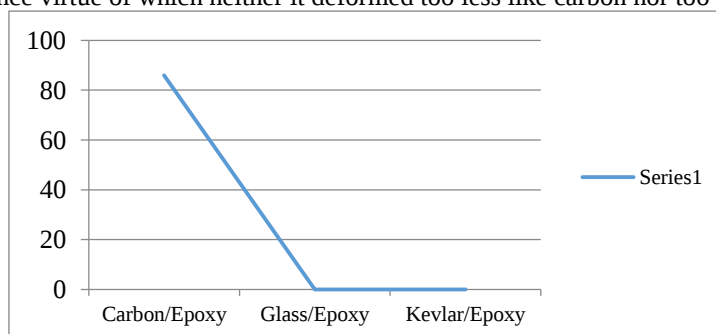


Graph (4.31): Maximum values of on axis longitudinal strain for Kevlar/epoxy among different planes.

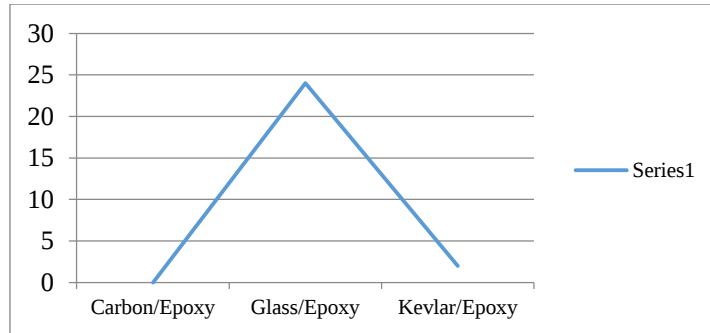


Graph (4.32): Minimum values of on axis longitudinal strain for Kevlar/epoxy among different planes.

Graph numbers (4.25 to 4.32) depicts strain value is noted low in kevlar and highest in carbon, only in the case of glass it falls to intermediate/middle/average location and that enables the material to deliver average and satisfactory performance virtue of which neither it deformed too less like carbon nor too more like kevlar.

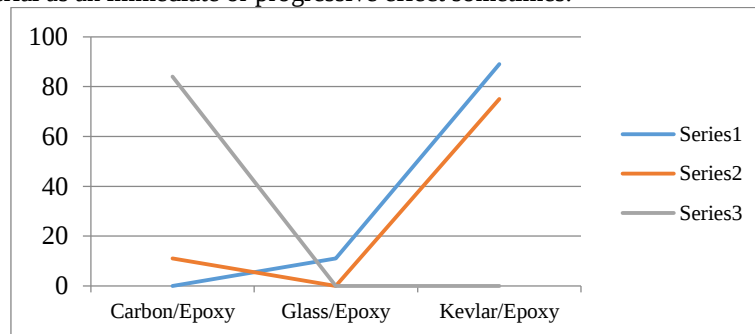


Graph (4.33): Maximum values of poisson's ratio for different materials among different planes.

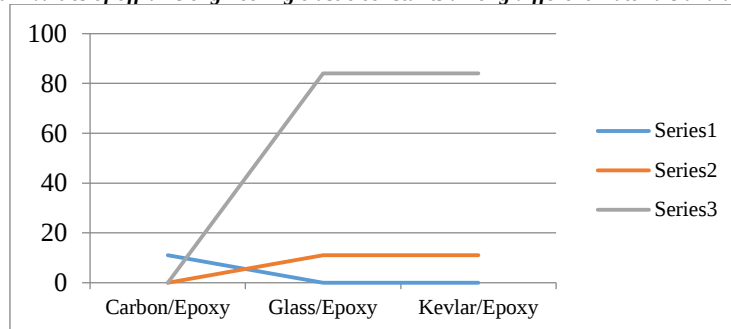


Graph (4.34): Minimum values of poison's ratio for different materials among different planes.

Glass is the only material which retains average value of poisons ratio and thus neither enabling material to deform more virtue of small magnitude of applied load or not at all virtue of application of heavy load under the circumstances where deformation is essential else situation of restriction against deformation would bring failure into the material as an immediate or progressive effect sometimes.



Graph (4.35): Maximum values of off-axis engineering elastic constants among different materials and different ply orientations.



Graph (4.36): Minimum values of off-axis engineering elastic constants among different materials and different ply orientations.

Engineering elastic constants which depicts the performance and behavior of material under the influence of mechanical or thermal or combinations of both the loading are found within satisfactory range in the case of glass/epoxy only, in the case of carbon it triggers too high where in the case of Kevlar it even could not reach to the required minimum benchmark of performance.

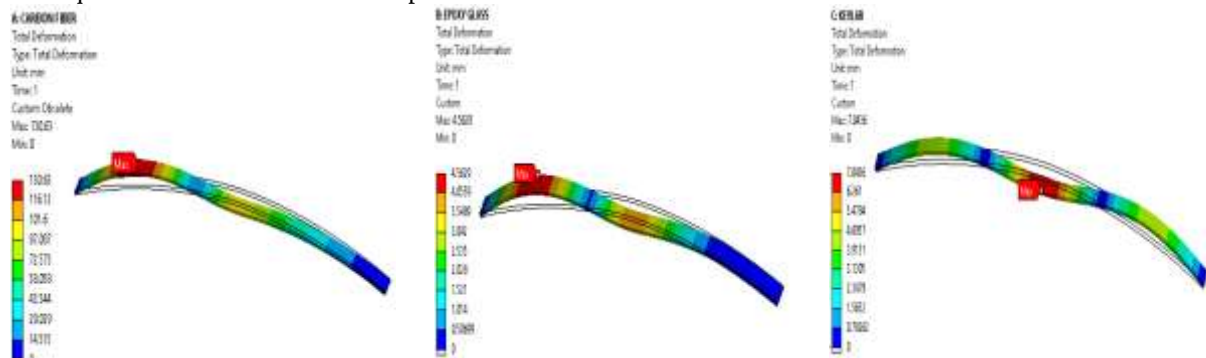


Image (4.37): Deformation results obtained for different composites through simulation carried into Ansys.

Deformation noted in carbon/epoxy leaf spring is 130mm; glass/epoxy spring is 7mm; and in Kevlar/epoxy 5mm respectively.

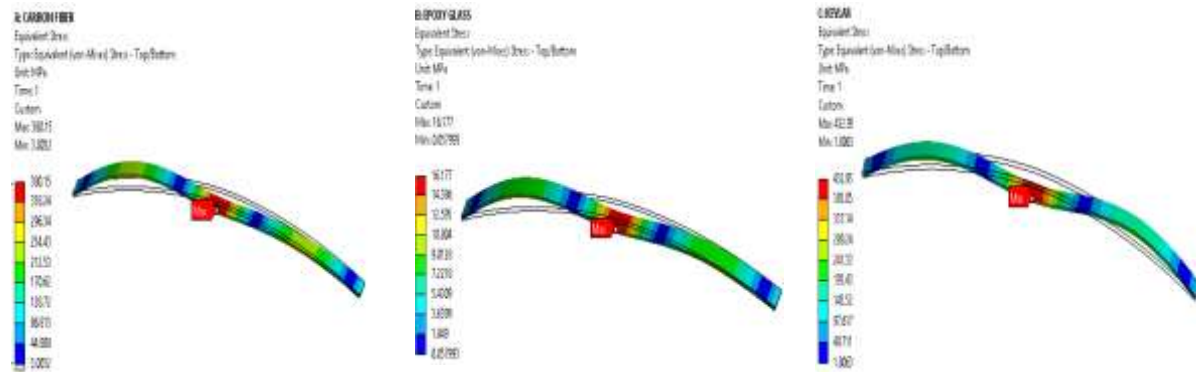


Image (4.38): Stress results obtained for different composites through simulation carried into Ansys

Stress value noted in carbon/epoxy leaf spring is 330 MPa; glass/epoxy spring is 16 MPa; and in kevlar/epoxy 400 MPa respectively.



Image (4.39): Value of reaction force obtained for different composites through simulation carried into Ansys

Value of reaction force revealed after simulation in x, y and z directions are depicted below for different material as follows,

- **For carbon/epoxy: x-axis:** 3.51×10^{-6} N, **y-axis:** 3.20×10^{-7} N, **z-axis:** -5400 N, **Total:** 5400 N.
- **For glass/epoxy: x-axis:** -2.277×10^{-8} N, **y-axis:** 1.08×10^{-8} N, **z-axis:** -220 N, **Total:** 220 N.
- **For Kevlar/epoxy: x-axis:** 1.89×10^{-7} N, **y-axis:** 4.47×10^{-8} N, **z-axis:** -5280 N, **Total:** 5280 N.

After governing the performance of composite leaf spring made of different fibers, the performance of glass/epoxy as a material for leaf spring is noted superior when it compared with carbon and Kevlar composite. The value of stress and reaction force is also noted low in glass compared of carbon and Kevlar, added deformation is noted average into glass composite, where in carbon it is noted too high and in Kevlar it is noted too low. This all led to reveal the overall conclusion from research and experimentation that, glass/epoxy is a best performance material which can be suggested in the manufacturing of leaf spring and thus replacement to the conventional steel leaf spring to overcome the certain disadvantage's which arrived from conventional leaf spring such as frequency of vibration, weight, shape and size, operational efficiency of a vehicle etc.

Result

Table (5.1): Lamina engineering elastic properties for different composite material depicted as a function of changed fiber orientation

Sr. No.	Parameter	Minimum value	Material/epoxy	Maximum value	Material/epoxy
1	Q_{xx} , GPa	1.69	Glass	135.7	Carbon
2	Q_{yy} , GPa	1.69	Glass	135	Carbon
3	Q_{xy} , GPa	7.07	Glass	33.94	Carbon
4	Q_{xx} , GPa	-39.79	Carbon	39.72	Carbon
5	Q_{yy} , GPa	-39.79	Carbon	39.79	Carbon
6	Q_{ss} , GPa	-4.99	Carbon	30.24	Carbon
7	G_{12} , GPa	0.0092	Glass	0.298	Carbon
8	G_{13} , GPa	0.018	Carbon	0.026	Glass
9	G_{23} , GPa	-0.0024	Glass	0.0024	Glass

10	$\bar{G}_{xx}$, GPa	0.015	Kevlar	0.29	Carbon
11	$\bar{G}_{yy}$, GPa	-0.019	Kevlar	0.20	Carbon
12	$\bar{G}_{xy}/\tau_{xy}$, GPa	-0.074	Kevlar	0.1222	Carbon
13	E_{xx} , GPa	5.356	Kevlar	135	Carbon
14	E_{yy} , GPa	5.82	Kevlar	134.95	Carbon
15	E_y/G_{12} , GPa	2	Kevlar	8.12	Carbon
16	u_{xy}	0.0187	Carbon	0.67	Kevlar

Note: The meaning of abbreviations used in table above can be explained as, (Q: Stiffness of lamina, KN/mm, $\bar{G}$: Mechanical Stress, MPa, E: Modulus of elasticity, GPa, G: Shear Modulus, GPa, u: Material Poison's ratio)

1. Stiffness of material is noted function of fiber orientation of lamina, it noted changes with respect to change into fiber orientation, the highest stiffness is noted in xx and yy plane where it is noted low in xy plane. The lamina with highest stiffness capable to sustain highest magnitude of load and thus structure is capable to perform under any surprising magnitude of loads acting even which were not considered by the time of design or manufacturing at all.
2. Value of off-axis and on axis stress is noted low in the case of glass/epoxy which increases margin of safety of moulded material or structure by great extent. Even it enables the structure to sustain the load of high magnitude unlike carbon which otherwise bring failure of structure in account of acting of such heavy or unpredictable loads which were not taken into consideration at all.
3. Engineering elastic properties are noted superior in the case of glass and Kevlar compared to carbon, the elastic properties leads to improve stiffness components/elements of lamina and thus altogether they are going to improve performance and load sustaining capacity of structure.
4. Poison ratio is noted optimistic in the case of Kevlar and glass unlike carbon which enables the material to deform within controlled limit and thus avoid the structure failure which occurred due to excess deformation beyond ultimate capacity of material.
5. Inter laminar stress which on exceeding reached to extreme edge of lamina and leads to delaminate the ply is noted low in the case of glass and very low in the case of Kevlar. Same is noted on highest side in the case of carbon. On exceeding the load, thus inter laminar stress whose effect once reached to extreme edge of laminate it further noted in terms of ply delamination effect which is called as failure of laminate and thus it is capable to perform no more at all.
6. The weight of composite leaf spring noted 18 kg whereas mass of the conventional leaf spring was measured 188 kg.
7. The stress value and deformation is noted least and precise into composite leaf spring compared to conventional steel leaf spring. The lowest value of stress i.e. 16 MPa noted into glass/epoxy where stress in conventional steel was noted 400 MPa approximately. The lowest deformation during operational tenure is noted into glass/epoxy i.e. 7 mm, where deformation noted into conventional steel was 79 mm.

Conclusion & Discussion

1. From strength and performance point of view, carbon/epoxy is best material comparative to glass and Kevlar epoxy.
2. Performance of carbon/epoxy lies at top, followed by performance of glass/epoxy and finally of Kevlar/epoxy.
3. Only strain and stress values shows variations for their maximum and minimum values among multiple planes, where rest of the parameters such as, stiffness, elastic constants, poison's ratio hardly shows any such variation, even though any variation associated with such parameters exists, it is hardly limited to two to three planes and not more than that.
4. Stiffness and elastic constants component's holds maximum values in multiple planes in case of carbon epoxy material.
5. Deformation occurs in carbon epoxy is noted less where it is noted highest in the case of Kevlar epoxy material.
6. Maximum stress value and thus restriction to deformation is noted highest in the case of carbon/epoxy, where it is noted on lowest side in the case of Kevlar epoxy, the performance in such regards is noted average in the case of glass/epoxy material.
7. For less deformation, maximum strength and load sustaining carbon/epoxy is proposed material for the designing of laminate leaf spring to be used in light weight automobile suspension systems.

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Chapter-3

Synthesis and Electrical Properties of Polypyrrole/CrO₃ Nanocomposites

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Abstract

Nanocomposites of polyaniline (PANI) and CrO₃ have been synthesized using the in situ polymerization method for different concentrations of nano CrO₃ powder. The formation of polymer nanocomposite and changes in the structural and microstructural properties of the materials were investigated. The surface morphology of PANI– CrO₃ nanocomposite was elucidated using Scanning Electron Microscopy.

Keywords: Polypyrrole, Nanocomposites, conductivity, Polymerization

Introduction

In the recent past, the conducting polymer-based nanocomposite has drawn attention in their application as gas sensing. Therefore, Pani- CrO₃ composites have been most intensively studied among various composites, because it could combine the merits of Pani and crystalline CrO₃ within a single material and are expected to find applications in electrochromic devices, photoelectrochemical devices, nonlinear optical system, and sensors. [3]. Also, it has attracted much attention due to its possible applications in electrochromic display devices, Schottky diodes [4], sensors [5], optoelectronic devices, and electromagnetic shielding [6].

Experimental Methods

2.1. Synthesis of Polypyrrole

Polypyrrole (PPy) was synthesized by chemical oxidative polymerization technique using monomer pyrrole. Analytical grade ammonium per-sulfate APS, (Sd fine) was used as an oxidizing agent. The chemical polymerization was carried out in a beaker by mixing 0.1 M aqueous solution of pyrrole and 0.1 M of APS in a 1:1 ratio by volume. The polymerization was carried out for three hours. After the termination of the polymerization process, the precipitate obtained was filtered.

2.2 Synthesis of PPy- CrO₃ Nanocomposites.

A known quantity of Pyrrole solution dissolved in Hcl is taken in a 1000 ml beaker and stirred for 5 minutes and 0.5 g (10wt %) of CrO₃ nanoparticles were added and stirred with a magnetic stirrer for about 15 minutes then ammonium persulphate was added drop by drop. Even after the complete addition of ammonium persulphate stirring was continued for another 10 minutes and allowed the precipitate for about 30-40 minutes to settle down. Now precipitate was filtered and washed with distilled water several times to remove the impurities. Now the resultant sample is the PPy- CrO₃ nanocomposite

Result and Discussion

3.1 Scanning Electronic Micrograph SEM image of pure PPy which has highly agglomerated granular in shape and has amorphous nature which shows in fig 3.1 (a). Fig 3.2 (b) shows the SEM image of composites the grains are well interconnected with each other which indicates that they have enough binding energy to combine with neighbor grains or molecules.

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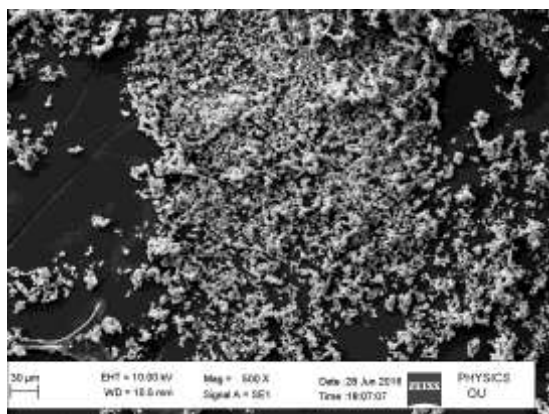


Fig a) PPY

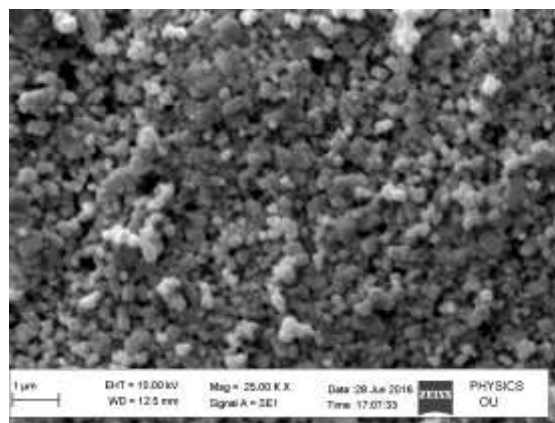


Fig b) PPY/CrO₃ Composite

Fig 3 shows the SEM image of PPY and its composites

AC Conductivity

Figure 4 shows the AC conductivity of PPY/CrO₃ nanocomposite. The conductivity of composites is higher than that of polypyrrole due to less number of charge carriers lead to a decrease in PPY conductivity compare to composites. increasing the dopant concentration leads to increase the conductivity and nanoparticles are easily increase the conductivity of PPY composites. Among all nanocomposites, 50wt% shows highest conductivity and this may due to dipole polarization.

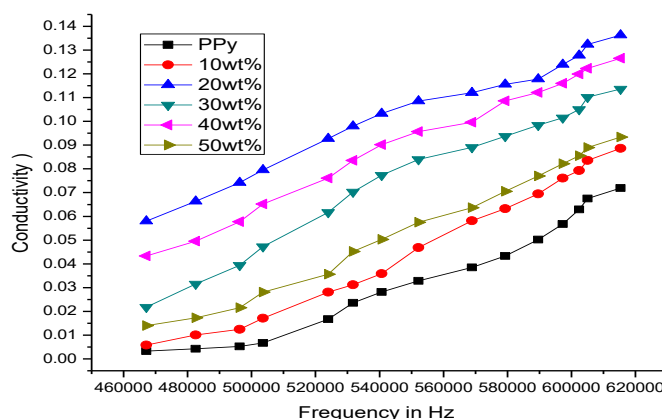


Fig 4 shows the AC Conductivity of PPY/CrO₃ composite

Conclusions

In this study, PPY/CrO₃ nanocomposites were successfully synthesized by in-situ polymerization method in the presence of CrO₃ particles. The results of SEM show the formation of the composite and indicates an interaction between PPY and CrO₃ particles. The electrical properties of the PPY/CrO₃ composite increase with increasing frequency because of the interaction between a metal oxide and PPY.

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Chapter-4

An Enhanced Messenger with Language Translator and Sentiment Analysis

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Mrs A. Vanathi M.E(PhD) Associate Professor⁵

Abstract

A Messenger application is a feature or a program on the Internet to communicate directly among Internet users who are online or who were equally using the internet. In the last few years, several Messenger applications came into existence and they are very useful for communication purpose.

It's The Time for the next evolution in Internet Communication. Bringing together different needs of users and Organization is the unique vision for The Messenger. Although they have been a lot of Messenger apps, the futuristic vision to come up with some new ideas on what we think a Messenger should be, and with whom they should be interacting with.

Keywords: Sentiment Analysis, Language Translation, Abusive Message Restriction, Spam URL

Classification.

Introduction

Chatting is a method of using technology to bring people together despite geographical barriers. The technology has been available for decades but the acceptance it was quite recent. Our project is an android chat app which works beneath the micro services which are built-in node.js and flask. Micro service is an architectural style that structures an application as a group of small autonomous services. Let Consider following problems such that our chat app can make a difference with its presence.

A person who has interaction with a lot of people with different language faces a lot of issues while communicating. There are a lot of translation applications available in the market to help solve this issue. In existing applications, there is a lot of work to be done to get the translated text. It also includes copying text from chat app and search in translator which is another app or site(maybe). So In proposed Chat app include a translator within and it can translate a message into more than 60 languages. Language Translator Service is using a 3rd party service namely Microsoft Translator Text API.

When Considering a chat system in a big or small-sized Organization a filtering system needed to filter vulgar or bad words in chat, Since their presence may affect Both the Organization reputation and Employees Discipline. So In the proposed Chat app Restricts vulgar words in chat and warns the sender.

Malicious URLs can be delivered to users via text messages in either group or private chat. The outcome may be downloaded Malware, Spyware , Compromised accounts. Another priority is to check whether it is a phishing URL or not. In proposed Chat app do not allow the user to directly open any URL in a message and user need to perform spam analysis on text message containing URLs and it displays URL and whether it is spam or not.

The idea is to automate the existing Chat applications and make the users utilize the services like Language translation, Spam URL Checking etc.so that their valuable time can be saved. To solve these concerns, the proposed mechanism is implemented. The proposed android chat application will not let the user send abusive messages and it can also show the importance of a message and classify URLs. It translates messages from text language to the desired languages at a time.

Literature Review

The literature review for this project was conducted on multiple research papers which are listed below.

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Chat Application With Abusive Classification Models And Their Comparative Study

The paper was intended to create an application that would perform a toxicity classification of social media messages using naive Bayes Logistic regression model and the LSTM model. Similar to this one we are performing sentiment analysis on chat message and considering polarity -5 as a border between toxic and non-toxic messages.

Chatting Application with Real-Time Translation

This paper presents a conception to develop accommodation for Intranet users to utilize Social networking in the preferred language. Project intention is to allow the receiver to translate the sender message any language from Options and then all the messages he received will be translated in that language. likely we are allowing the user to translate a single message to any of 70 languages at a time. here he can translate his and senders messages also.

Sentiment Analysis of Chat Application

This paper suggests a chat application which includes sentiment analysis so that from every message we can understand the emotion of each word in a text message and app recognize whether the message is negative, positive or neutral. In our project, we go through a similar approach to integrate sentiment analysis to the chat app. Every received message is in different colour illustrating sentiment. If the message is positive Green bubble will be displayed. If the message is negative Orange bubble will be displayed. if It is neutral Blue bubble is displayed.

1.Language Translation

The Translator API is easily implemented in the chat application using 3rd party service namely "Microsoft Azure Cognitive Translator Service", since the user-made ML model for translation may not give the best accuracy when compared to 3rd party Service. It allows the user to translate a message to more than 60 languages.

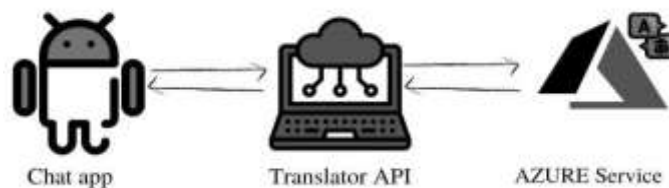


Fig 1 Asynchronous calls between Chat app and Translator API

Above image illustrates how API calls made from chat app to translation API and Language Translation API to Azure Cognitive Translator Service. Asynchronous Call is made Since Azure Service take time to Translate the text. The result is transferred from Azure Service to Chat App via Translator API. Asynchronous calls are made using async/await.

async functions return a promise and use this implicit Promise to return results. Even in the absence of promise, the async function makes sure that code is passed through a promise. await blocks the code execution within the async function, of which it (await statement) is a part. This can be achieved by following snippet of code

```
async function asynchronousFunction() {  
    return await fetch('/api/endpoint');  
}
```

Here Chat app send Payload containing message and languages list to which the message to be translated.

```
{  
  "text": "good boy",  
  "languages": ["te","hi"],  
  "endpoint":"https://api.cognitive.microsofttranslator.com",  
  "region":"centralindia",  
  "key":"XXXXXXXXXXXXXXXXXXXXXXX"  
}
```

Result Payload from Azure Service

```
{  
  "statusCode": 200,  
  "body": [  
    {  
      "detectedLanguage": {
```

```

    "language": "en",
    "score": 1
  },
  "translations": [
    {
      "text": "మంచి బాలుడు",
      "to": "te"
    },
    {
      "text": "अच्छा बच्चा",
      "to": "hi"
    }
  ]
}
]
}
}

```

1.1 Output Screens



Fig 2 Text message in Tamil Language



Fig 3 multiple language options to translate



Fig 4 final Translation Screen

2.Sentiment Analysis

The sentiment analysis is performed by applying the AFINN-165 word list and Emoji's Sentiment Ranking to perform sentiment analysis on individual blocks of the message.

AFINN is a list of words ranked for valence with a number between -5 to +5. Sentiment analysis is achieved by cross checking the words and emojis in text message excluding the negators with the AFINN list and getting their respective scores. here negators are cant, can't, dont, don't, doesnt, doesn't, not, non, wont, won't, isnt, isn't. The comparative score is simply calculated by the formula the sum of each token/number of tokens.

2.1 Screenshots of Data set used in the Sentiment Package

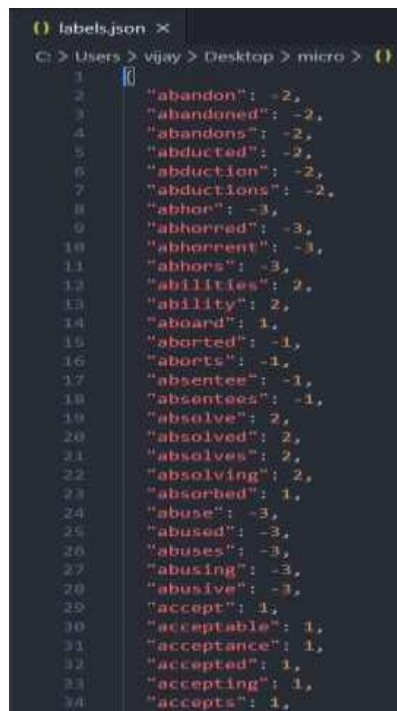


Fig 5 AFINN-165 wordlist



Fig 6 Emojis with Sentiment Ranking

Let Consider working of Sentiment Package of Node.js.

“good boys too have bad thoughts”

Above string results the following Object as a result

```
{
  score: 0,
  comparative: 0,
  calculation: [ { bad: -3 }, { good: 3 } ],
  tokens: [ 'good', 'boys', 'too', 'have', 'bad', 'thoughts' ],
  words: [ 'bad', 'good' ],
  positive: [ 'good' ],
  negative: [ 'bad' ]
}
```

Assuming -5 as the border for Abusive Words which means any Message having sentiment less than equal to -5 is considered as

abusive word and will not be sent to the receiver and warns sender not to use abusive words.

Illustration of Abusive Message Restriction Using Sentiment Score

Message	Score	Status
Hello	0	Sent
Good	3	Sent
Damn	-2	Sent
Damn Shit	-6	Not Sent
Bastard	-5	Not Sent
Connard	0	Sent
(Bastard in French)		

Note*: Other Language messages are not filtered Since Module is having Only English Words dataset

2.2 Output Screens



Fig 7 text message with abusive word



Fig 8 warning message about abusive word

3. Naive Bayes classifier

While Chatting we may encounter with a message containing URLs which may lead us to attacks like Compromised accounts.

Detecting spam URLs is mostly not available in any chat application. So we have done some research to get malicious websites links that are available in kaggle.com. Phishing URLs are also threats to the user as the attacker may steal their credentials using this phishing attack. So we get phishing URLs from phishtank.com that usually updates the latest phishing URLs. We split the resulting dataset which is a combination of both malicious and phishing URLs into train and test using the sklearn library in 80:20 ratio and trained it with multiple combinations of Classifiers and Vectors. Since we got the highest Accuracy for Naive Bayes and Counter Vector Combination, we trained Model Using Naive Bayes. The project includes flask API made with

Naive Bayes Algorithm. The Model trained with the dataset containing 4,20,465 records which include both phishing and malicious URLs

3.1 Screenshot of Data set Used in the Model Training

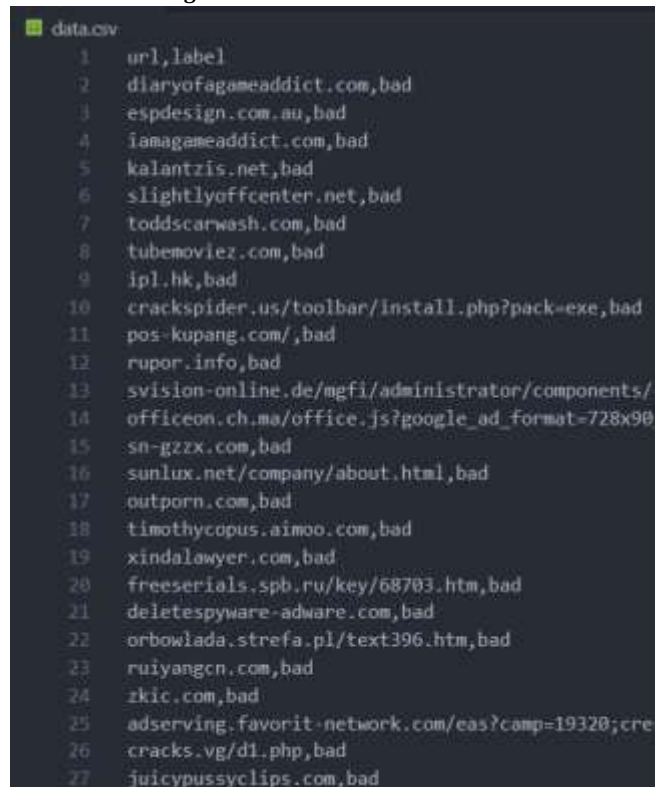


Fig 9 URL dataset

3.2 Implementation

```
import pandas as pd #Pandas for data pre-processing
import pickle #Pickle for pickling (saving) the model
from sklearn.feature_extraction.text import CountVectorizer #To Vectorize the text data
from sklearn.naive_bayes import MultinomialNB #The algorithm for prediction
from sklearn.externals import joblib
#Alternative Usage of Saved model from sklearn.model_selection import train_test_split
#Validation split Next, we need to load the data and split into text data(X) and labels (y).
df = pd.read_csv("spam.csv", encoding="latin-1")
X = df[url]
y = df[label]
#Now we need to vectorize the textual data by using Count Vectorizer. Then just split the training and testing data.
No further text preprocessing is taken into consideration as we aim is to build a model quickly and deploy it.
We can experiment with the text cleaning part to make the performance better.
cv = CountVectorizer() #Extract Feature With CountVectorizer
X = cv.fit_transform(X) # Fit the Data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=25)
Once this is done, we just need to fit the model and save it as a pickle file which will later be loaded in the flask app.
clf = MultinomialNB() #Naive Bayes Classifier
clf.fit(X_train, y_train)
print(clf.score(X_test, y_test)) #Alternative Usage of Saved Model
joblib.dump(clf, 'NB_spam_model.pkl')
joblib.dump(cv, 'cv.pkl')
```

3.3 Output Screens

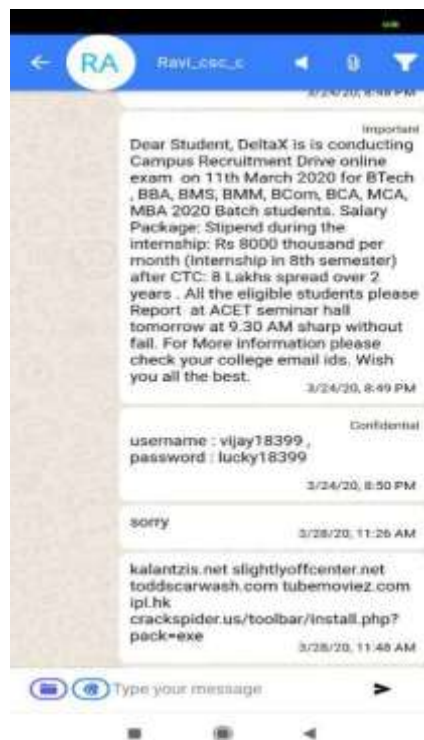


Fig 10 Text message with different URLs

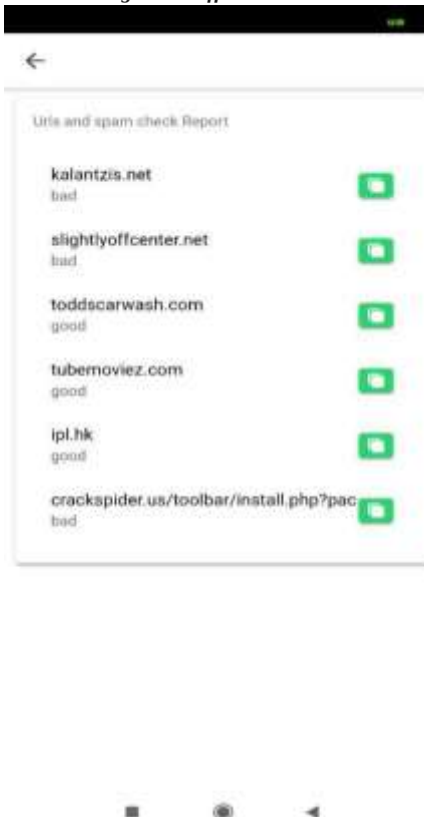


Fig 11 Complete Spam report on URLs

Results and Discussion

Chat app works very efficiently with external features like spam URL checking, language Translation and abusive message restriction. Since all external services utilized by the Chat app are implemented as micro services, So even one micro service failed remaining can work fine without failed one. When coming to spam URL classification, the Trained model has given the accuracy of 97.5%. So, It effectively classifies malicious and benign URLs. We performed multiple tests to leverage the toxicity of words with sentiment analysis and came up -5 as Border between extreme toxicity, So Every message which is having polarity less than -5 treated as a toxic message and restricted from sending to the receiver. It is restricting abusive message of English Language Only, Since Sentiment module is made with dataset having English words Only. In Order to Restrict all Sort of abusive messages model need to be trained with all language words which is added to the scope of this project

Conclusion

This study was intended to develop an Enhanced Chat Application. We had taken a wide range of literature review to achieve all the tasks, where we came to know about some of the applications that are existing. We made a detailed research in that path to cover the loopholes that existing systems are encounter and to eradicate them in our application. In the process of research, we came to know about the latest technologies like ionic, flask, node.js and their libraries. We have compared various classifiers (MultinomialNB, RandomForestClassifier, KNeighborsClassifier,...), Vectors (CountVectorizer, TfidfVectorizer, HashingVectorizer) Using Sklearn Library and performing Sentiment analysis one Chat messages Using NPM Package and we had implemented awesome functionalities in The Chat app. The portability of the application has been achieved by using some of the latest Cross-Platform Mobile App Development technology named Ionic. Ionic allows us to run as an Android, iOS, Electron, and Progressive Web App (PWA), all from a single codebase. We implemented all external functionalities using APIs which are built over using different technologies like flask, node.js.

The features like sentiment analysis, language translator, spam detection plays a major role. The Chat App protects user and device from various things like Abusive messages, Phishing Attacks and Malicious URLs. Each message received can be translated to more than 60 languages using 3rd party Service namely Microsoft Azure Cognitive service. The project is aimed that the people could have a better experience of chatting. It has the potential to attract different lingual people to chat.

Scope

- 1.Sentiment Analysis With Multiple Language Support
- 2.Instant URL Classification

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Chapter-5

Parametric Study of Compost Preparation from Organic Matter

Chetan Goyal⁶, Palak Bansal, Harshita Agrawal & Manjeet Singh

Abstract

Composting is a spontaneous process in nature, which includes a breakdown of leaves and aging of the cow manure over a period. The compost formed is then added to enhance the soil and plant growth. This work focuses on improving the composting method and to analyze optimum parameters for plant growth. 27 different pits were formed by varying the amount of Vegetable waste, cow dung and dry leaves in each one of them. The pits were provided with moisture and stirring at different interval of time. The pits were analyzed for various parameters after 45 days. It was observed that 8.2 acid content, 0.325 gm/lit salinity, .5 % carbon content, 5.8 kg/acre phosphorus content and 5.9 kg/acre potassium content are the optimum conditions for soil and plant growth.

Keywords: Vegetable Waste, Compost, Dry leaves, Cow Dung

Introduction

Municipal solid waste management has become one of the primary challenges for developing countries like India. The new Solid Waste Management Rules 2016 of India has defined solid waste as “solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture, and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radioactive waste generated in the area under the local authorities and other entities”[1] Intensive and quick urbanization is not only observed in developing countries but also those of the former communistic block, such as Poland. Unfortunately, the intensive development of cities is accompanied by several negative phenomena, among them primarily rapidly growing amounts of municipal solid waste (MSW) and sewage sludge (SS) [2,3].

Compost is produced by recycling various organic materials, which otherwise is regarded as waste products - and produces a soil conditioner (the compost). Compost is rich in nutrients. It is used in gardens, landscaping, organic farming, and urban agriculture. The compost is beneficial for the land in many ways as it provides the essential nutrients to the land, acts as a fertilizer, addition of vital humid acids, and as a natural pesticide in the soil. At the simplest level, the composting process requires making a heap of wet matter (as green waste such as leaves, food scraps, grass, etc.) and waiting for the materials to break down into humus after a while. The decomposition process is aided by adding moisture, shredding the plant matter, and ensure proper aeration by regularly stirring the mixture. Different methods are also used for the breakdown of matter such as earthworms and fungi. Bacteria requiring oxygen to function and fungi manage the chemical process by converting the inputs into heat, carbon dioxide, and ammonium.

Although landfill and incineration have been widely used means of solid waste disposal throughout the world, in recent years, interest has grown in disposal methods that take recycling into consideration.[7]

Composting is a spontaneous process in nature, which includes a breakdown of the leaves, aging of the cow manure, but with the length of the time and modalities of natural composting are long and heterogeneous. The principal factors that contribute to making an optimum atmosphere for the microorganisms to act for composting include- Oxygenation, Temperature, Moisture, Carbon/Nitrogen ratio, and pH level [7].

Since microorganisms consume carbon during the composting process, Carbon concentrations decrease, and Carbon mass losses (mainly as CO₂) may be substantial. Total Nitrogen (TN) concentration generally remains fairly constant as fresh manure is composted, which means that Nitrogen loss $\approx$ DM (Dry Manure) loss (expressed as a percent of initial mass). Increases in TN concentration during the composting show that N loss < DM loss, which is favorable. On the other hand, declines in Nitrogen concentration result in N loss > DM loss, which is undesirable. The form of inorganic Nitrogen also changes during composting. In the early

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stages, most of the inorganic Nitrogen is present as $\text{NH}_4\text{-N}$ with very little as $\text{NO}_3\text{-N}$. In the latter stages of composting, nitrification leads to a decline in $\text{NH}_4\text{-N}$ levels and an increase in $\text{NO}_3\text{-N}$. Hence $\text{NH}_4\text{-N}:\text{NO}_3\text{-N}$ ratio is often used as an index of compost maturity, with lower values (< 10) indicating stable product. Unlike Nitrogen; Phosphorous losses during composting are usually low unless the windrows are subjected to runoff (rainfall or snowmelt). Total Phosphorous concentrations generally increase, e.g., from an average of 4 g kg^{-1} in fresh manure to 5.3 g kg^{-1} in finished compost. Salt concentrations also increase during composting as organic matter is lost by decomposition, and salt mass remains constant [10].

There are different types of composting, such as – Onsite composting, vermicomposting, aerated windrows composting, in-vessel composting, etc. In this work, onsite composting of soil is done at different conditions, and the compost then formed is analyzed.

Material and Methods

Material

Vegetable waste was collected from a nearby restaurant, and dry leaves were collected from the college campus. Cow dung was used as a feed, which was brought from a nearby village called Malwal, as shown in figure1. Polybags were used for covering the pits, tools like shovel were used to dig the pit, a wooden stick was used for stirring the feed, and water was used for moisture.



Fig 1: Feed (dry leaves and vegetable waste, cow dung)

Method

The feed contains 500gm of vegetable waste and 500gm of dry leaves. Cow dung was filled in different proportions. The pits having dimensions of $1\text{ft} \times 1/2\text{ft} \times 1/2\text{ft}$ was dug. After this, the feed was filled in the pit by different proportions according to the ratios, which are mentioned in Table 1. Moisture and stirring conditions were varied in different pits. The pits were then covered with the plastic sheets. Analysis of fertility of the compost was observed. Carbon content, phosphorus content, Potassium content, salinity, and acid content of the soil and all 27 pits was analyzed. The samples were analyzed at Krishi Vigyan Kendra, Ferozepur.

Table1: Variation of Parameters

Pit No.	Feed	Cow dung (g)	Moisture (ml/2days)	Stirring Time (days)
1	Veg Waste (500g) + dry Leaves (500g)	0	0	0
2	Veg Waste (500g) + dry Leaves (500g)	0	0	After 5 days
3	Veg Waste (500g) + dry Leaves (500g)	0	0	After 10 days
4	Veg Waste (500g) + dry Leaves (500g)	0	500	0
5	Veg Waste (500g) + dry Leaves (500g)	0	500	After 5 days
6	Veg Waste (500g) + dry Leaves (500g)	0	500	After 10 days
7	Veg Waste (500g) + dry Leaves (500g)	0	1000	0
8	Veg Waste (500g) + dry Leaves (500g)	0	1000	After 5 days
9	Veg Waste (500g) + dry Leaves (500g)	0	1000	After 10 days
10	Veg Waste (500g) + dry Leaves (500g)	500	0	0
11	Veg Waste (500g) + dry Leaves (500g)	500	0	After 5 days
12	Veg Waste (500g) + dry Leaves (500g)	500	0	After 10 days
13	Veg Waste (500g) + dry Leaves (500g)	500	500	0

14	Veg Waste (500g) + dry Leaves (500g)	500	500	After 5 days
15	Veg Waste (500g) + dry Leaves (500g)	500	500	After 10 days
16	Veg Waste (500g) + dry Leaves (500g)	500	1000	0
17	Veg Waste (500g) + dry Leaves (500g)	500	1000	After 5 days
18	Veg Waste (500g) + dry Leaves (500g)	500	1000	After 10 days
19	Veg Waste (500g) + dry Leaves (500g)	1000	0	0
20	Veg Waste (500g) + dry Leaves (500g)	1000	0	After 5 days
21	Veg Waste (500g) + dry Leaves (500g)	1000	0	After 10 days
22	Veg Waste (500g) + dry Leaves (500g)	1000	500	0
23	Veg Waste (500g) + dry Leaves (500g)	1000	500	After 5 days
24	Veg Waste (500g) + dry Leaves (500g)	1000	500	After 10 days
25	Veg Waste (500g) + dry Leaves (500g)	1000	1000	0
26	Veg Waste (500g) + dry Leaves (500g)	1000	1000	After 5 days
27	Veg Waste (500g) + dry Leaves (500g)	1000	1000	After 10 days

Result and Discussion

The initial sampling of the soil was done, as shown in Table 2. The pits were analyzed after 45 days for Carbon content, phosphorus content, Potassium content, salinity, and acid content analyzed. The standards of analysis are shown in Table 3.

Table2: Initial Sampling of soil

S. No.	Parameters	Value
1	Acidic Content (pH)	9.1
2	Salinity Content (g/lit)	0.745
3	Carbon Content %	0.40%
4	Phosphorous Content (kg/acre)	4.8
5	Potassium Content (kg/acre)	5.2

Table3: Standards of Analysis

S. No.	CONTENTS	VALUES	
1	Salinity	Good	<0.8
		White Colour	>0.8
2	Carbon Content	Low	<0.4
		Medium	0.4-0.75
		High	>0.75
3	Phosphorous Content	Low	<5
		Medium	5 to 9
		High	9 to 20
		Too High	>20
4	Potassium Content	Low	<5.5
		High	>5.5
5	Acidic Content	Good	6.5 to 8.7
		Medium	9.0 to 9.3
		Black Colour	>9.3

The result of the analysis of the pits containing the feed is shown in Table 4. Pit no.11 contained 8.2 acid content, 0.325 gm/lit salinity, .5 % carbon content, 5.8 kg/acre phosphorus content and 5.9 kg/acre potassium content content and hence, was found to be best suited for plant growth.

Table 4: Analysis of Different Pits

Pit. No.	Acidic Content (pH)	Salinity Content (g/lt)	Carbon Content %	Phosphorous Content (kg/acre)	Potassium Content (kg/acre)
1	8.2	0.751	0.45	4.8	5.2
2	8.4	0.665	0.5	5.2	5
3	8.2	0.73	0.5	3.8	5.6
4	8.2	0.63	0.56	4	5.8
5	8.3	0.676	0.5	3.6	5.4
6	8.4	0.63	0.4	4.2	5
7	8.2	0.715	0.5	4.8	5.2
8	8.4	0.635	0.56	5.6	5
9	8.2	0.545	0.5	5.4	5.6
10	8.4	0.53	0.48	5.6	5.8
11	8.2	0.325	0.5	5.8	5.9
12	8.4	0.62	0.45	5.4	5
13	8.2	0.515	0.5	5.6	5.6
14	8.4	0.584	0.56	5.4	5.4
15	8.2	0.54	0.7	5.4	5.2
16	8.1	0.635	0.5	4.8	5.6
17	8.4	0.545	0.65	5.6	5.4
18	8.4	0.575	0.48	5.2	5.2
19	8.4	0.61	0.52	5.6	5.6
20	8.4	0.715	0.5	5.4	5.4
21	8.2	0.775	0.56	5.2	5.2
22	8.2	0.73	0.5	5.4	5.2
23	8.1	0.645	0.48	4.8	5
24	8.2	0.649	0.56	5	5.6
25	8.4	0.645	0.5	3.6	5.4
26	8.2	0.64	0.48	5	5.6
27	8.4	0.78	0.5	5.2	5.4

Figure 2 shows the graph of the acid content of all the 27-compost formed. The acid content (pH) of the compost from all the pits lied in the range of 8.1 to 8.4, which shows that the soil is most necessary in nature. Pit no.11 was found to have a pH of 8.2

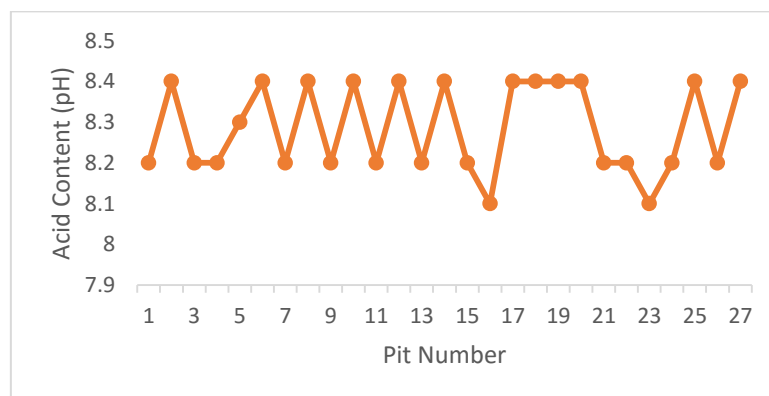


Fig 2: Acid Content of all sample pits

The graph between the carbon content of the pits lies in the medium range, which is 0.4-0.75. This range is required to maintain the quality compost and the growth of the plant. Whereas Salinity tells us about the saline

nutrients present in the soil, and it also tells us about the white color present in the soil. Due to the presence of white color in soil, logging takes place. It has been observed that pit no. 11 has a low value of salinity content, and Salinity should be low for the soil. It has also been observed that the Salinity of the soil has been decreased in comparison to that of the initial sample of soil (Figure 3).

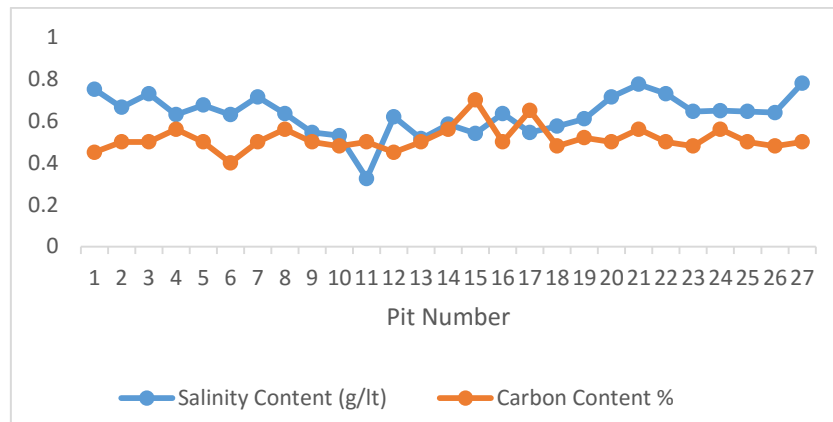


Fig 3: Salinity Content and Carbon Content of all sample pits

Phosphorous controls flowering in plants involving flowering or fruiting plants and phosphorous is often added to the soil before or during the flowering and fruiting life cycle stage to increase agricultural yield. It has been observed that pit no. 11 has high phosphorous content than other pits, which is the better result for quality compost. It has also been observed that there is an increase in the phosphorous content in the soil than in the initial sample of the soil. Potassium is involved in catalyzing many chemical reactions required to plant life, including drought, tolerance, and moisture regulation. Low potassium soil will likely need to be irrigated if soil amendment is not possible. It has been observed that pit no. 11 contains a high amount of potassium content than the other pits, which is the better result for quality compost. It has also been observed that potash value has been increased than that of the initial sample of soil (Figure 4).

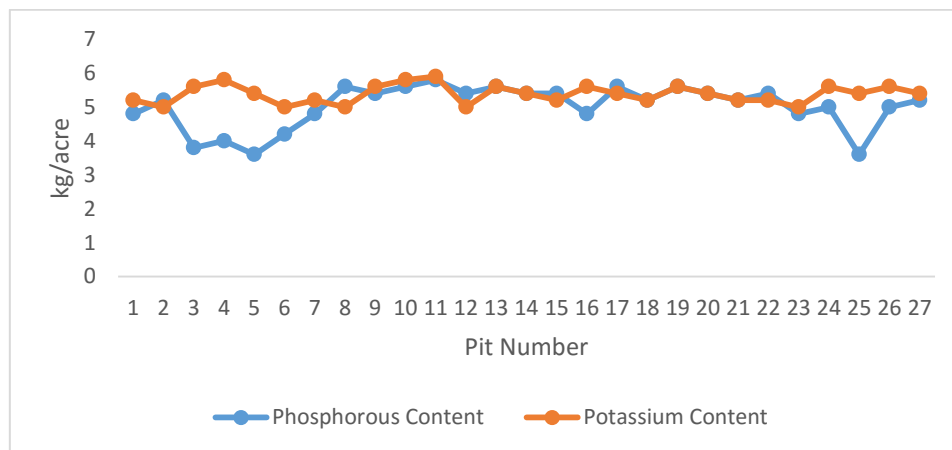


Fig 4: Phosphorous Content and Potassium Content of all sample pits

Conclusion

India produces about 3000 million tons of waste annually, out of which 40 –50 % is compostable. Compost quality plays a very important role in making MSW compost a marketable product as they are tested for fertilizing parameters, heavy metal parameters, and harmful pathogens. Parameters like carbon content, phosphorus content, Potassium content, salinity, and acid content of the soil and all 27 pits were analyzed. In this work, the preparation of compost with variation in cow dung quantity, moisture level, and the stirring effect was done, and the study was conducted for 45 days. It has been observed that compost of pit no. 11, which was having a feed containing 500 gm of each vegetable waste, dry leaves, and cow dung with no moisture added while periodical stirring provided after every five days showed the optimum results. Pit no.11 contained 8.2 acid content, 0.325 gm/l salinity, .5 % carbon content, 5.8 kg/acre phosphorus content and 5.9 kg/acre potassium content. These conditions were found to be most suitable for the soil and growth of plants.

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Chapter-6

Analyzing Critical Factors Causing Project Delays in Indian Metro Rail Projects

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Abstract

Worldwide, mass rapid transit system (metro projects) faces delay due to various reasons and India is no exception for this. Currently, in India approximately 13 metro projects are active across various metropolitan cities and 16 plus under construction projects and upcoming proposals. Among these upcoming projects different projects are at various levels of planning, construction and operations. In this study we focus on the innumerable factors that are causes for delay in construction and execution on metro rail projects across India. The purpose of the study is to highlight the critical delay-based factors affecting the execution of such projects. Factors that cause hindrance in the metro infrastructure projects are related to delay of payments, lack of government funding, poor financial arrangements, land acquisition proposals, lack of knowledge of the upcoming advance technologies, delay in review and approval of design documents, change in scope, revamping of stake holders, etc. This research paper is an attempt to look over the metro projects in India for examining the delay causing factors.

Keywords: Metro projects, Project delays, critical factors

Introduction

For the development of a country, construction industry plays a vital role in the economic growth of the nation and construction of mass rapid transit systems are one of them. The number of parties involved in the construction project makes them distinct and developing countries like India, delay in the metro rail projects on large scale brings disparity in the economy of the country.

The population of India stands at 31.16 % as per 2011 census of India which is expected to rise to 60 percent by the year 2050. As a response to this rising trend it is very necessary to expand the public transportation sector using the mass rapid transit systems. The government of India has proposed 16+ metro rail projects which are at different phases of planning, constructions, and execution. Even though there is a huge demand for the metro projects, delays in the completion of these projects is common with respect to the construction and execution phases. Factors of delay has been investigated time to time in different regions of India regarding metro projects with respect to the time, cost and quality factors. Performance value of metro rail projects in India equally fails project performance standards and has not received the desired attention.

Literature review

In Construction, delay could be defined as overrun of time far beyond the stipulated completion time of a project with respect to the contract or some kind of mutual agreement made between different parties for handing over of the project. Delay is the business matter that exceeds the expected time completion for a project according to the contract and may be caused by various parties such as the contractor, the engineer, the employer, force majeure occurrence or even third-party interference. Delay is generally regarded as the most common, complicated, uncertain and expensive issue faced in construction of metro rail projects. Completion of project in time is significant for both the contractor and the owner/employer/government. For the owner it is necessary to complete the project on time with respect to the performance of the project and for the contractor it is necessary to complete the project on time with respect to the accounts/profits. Sources claims that delays often end in litigation. Although delay is a common characteristic for most of the construction projects, the magnitude varies from contract to contract, days to months and year to year. It is very important to investigate thoroughly the delays and pen down the causes for the same to reduce their impact on the construction project and allow the project to complete on time (Y. Mittal., 2008).

Construction project is distinct and unique as it is a project-based activity. In some of the cases delays are unfavorable for the contractor as well. The types of delays studied for major construction of metro rail project

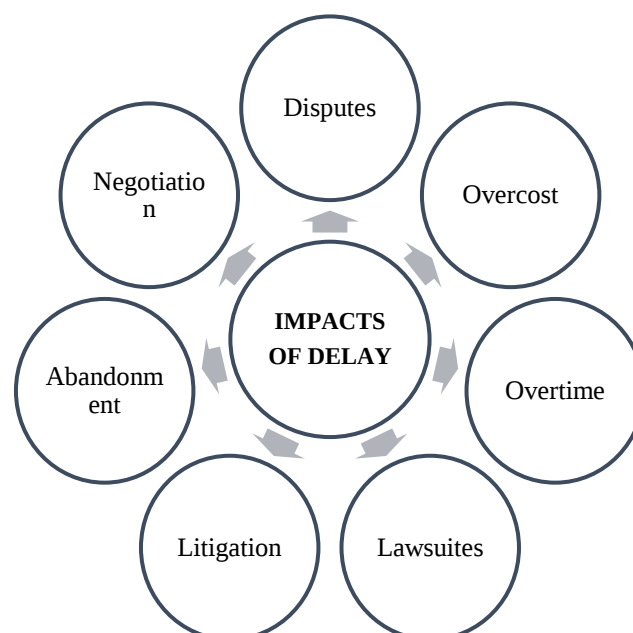
^{7 1,2&3} National Institute of Construction Management and Research, India

are: Delay of payments, Lack of government funding, Poor financial arrangements, Land acquisition proposals, Lack of knowledge of the upcoming advance technologies, Delay in review and approval of design documents, Change in scope, Revamping of stake holders, Extra overheads because of the period of work, Higher cost of material due to inflation, etc. (A. Al-Momani., 2000). Timely completion of project is highly desirable and factors of delays in construction of metro rail project can vary from a metropolitan city of a developing country to a developed country depending upon the availability of raw material, resources, new technology, construction equipment, favorable environmental conditions, and performance of parties' involved, political factors (S. Pai., 2013).

S. Shanmugapriya & Dr. K. Subramanian [10] (2013), this research were carried out on studying significant factors causing time & cost overruns in Indian construction projects. Questionnaire for the survey was developed based on 76 factors of time overruns and 54 factors of cost overruns and grouped into 12 & 8 major groups. It is resulted from various factors which had been identified in this study. A total of 70 samples were found as valid and analysed statistically using RII method on 76 & 54 factors on time & cost overruns. Aftab et al., [1] (2012), this study assessed the cost and time performance of construction projects in Malaysia using structured questionnaire survey. Questionnaire survey were conducted as a methodology and analysis were done by RII method. Findings of the study revealed that 92% of construction projects was overrun and only 8% of project could achieve completion within contract duration. In terms of cost performance only 11% of respondents mentioned that normally their projects were finished within the budgeted cost while 89% of respondents agreed that their projects were facing the problem of cost overrun with average overrun at 5-10% of contract price. The major contributors of this poor performance were includes a) Design & document issues b) Financial resource management c) Project management & Contract management issues.

Assaf et al. [5] (1995), determine the main causes of delays on large building projects in Saudi Arabia. The result of this study showed that contractors believed that: 1) Preparation of shop drawings 2) Delays in contractor's progress and 3) Payment by owners were the most important factors contributing to time delays. Al-khalil & Al-Ghafly [2] (1999), identify the main causes of delays in construction projects in Saudi Arabia. This research found that contractors considered as 1) Delay in claim settlement 2) Slow decision-making and 3) Delays in progress payments as the most important delay factors. Owners believed that 1) Poor early planning 2) Scope changes and 3) Financial difficulties by the contractors' were the major causes of delay. Apolot et al., [4] (2013), the main objective of study was to investigate the causes of construction project delays and cost overruns in Uganda's public sector & the five most important causes of delays in construction projects were found to be the following: 1) Changes to the scope of work 2) Delayed payments 3) Poor monitoring and control 4) The high cost of capital and 5) Political insecurity and instability.

Impact of delay in construction of metro rail project will have a negative effect on contractor, stakeholders, clients, time and cost of project, planning-scheduling-execution, mistrust, litigation and growth of adversarial relations between various parties involved. Also, this impact lead in difficulty of financing projects by manufacturers or contractors. It may impact on the delivery of material used in construction of metro rail project and also the supplier, shipper and contractor. The literature review states that the causes of delay in construction of metro rail projects will vary depending upon different geographical regions and also the scale and phase of the metro rail project in various cities. There is a clear need to investigate the factors that cause such delays in



all the phases of construction of a metro project, starting from planning, scheduling, construction, and execution (S. Assaf., 1995).

Fig.1: Impacts of Delay
Source: theconstructor.org

Methodology

The causes of delay in metro rail projects expressed among existing researches are studied and filtered to the most prior ones. Total listed causes were filtered on the basis of the answered questionnaire by the industry experts through interaction (Fig.1).

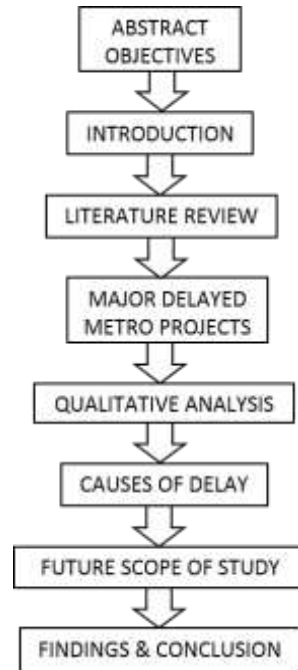


Fig.2: Methodology Flowchart

Major delayed metro rail projects in India

I. Mumbai Metro project- D N Nagar – Mandale Metro 2B corridor (Fig 3):

Contractors were allowed work on an elevated viaduct, MBZ-RCC was appointed for construction of elevated corridor and depot. The contractor was supposed to complete 65% of work in 30 months whereas they could complete only 5% of their stipulated work because of that Simplex Infrastructure Ltd. were fired from the project by MMRDA. Delays due to execution of work were seen between DN Nagar and Mandale metro station.



Fig.3: Mumbai metro 2B corridor

II. Mumbai Metro project, Colaba–Bandra–Seepz -(Fig.4)

This 33.5 km fully underground metro project was majorly affected due to Pandemic (Covid-19) lockdown. MMRC was looking to complete the tunnelling work by December 2020 but due to lack of labour, machinery, and disruption in supply chain because of lockdown delay the work beyond February 2021. Due to legal battles, earlier dead line of phase-I of underground metro project was delayed from June 2021 to revise as December 2021.



Fig.4: Mumbai metro Colaba-Bandra-Seepz

Source: urbantransportnews.com

III. Delhi metro- Phase IV project (Fig 5):

Delays occurred due to clarification of approval between Delhi govt. and Union govt. the project was primarily approved in 2016 delaying the project by four year because of which the initial installation increased by Rs.200 Cr by 2018-19. Delhi govt claimed that the centre had solitarily made the changes in project cost as well as other few components in the metro project. Whereas the Union govt. blames the Delhi govt. for the increase in the cost due to their delayed approval process. Finally, DMRC has revised the cost in 2018.



Fig.5: Delhi metro phase IV

Source: urbantransportnews.com

IV. Hyderabad metro corridor II (Fig 6): Jubilee station to Mahatma Gandhi bus station:

This project was delayed due to cost overrun. Forming the largest Public Private Partnership metro project, Hyderabad metro bears a huge debt burden due to the scale of the project. Initially the estimated cost of this project was Rs 14,132 Cr but the revised estimate says an expenditure of Rs 16,511 Cr till now resulting in an escalation of Rs. 3000 Cr right away. Experts claim that due to such huge losses the companies would require a time span of 5-6 years of operation to overcome this huge debt burden.



Fig.6: Hyderabad metro corridor II

Source: thehindu.com

V. Kolkata- Joka Esplanade Metro project (Fig 7)

This metro project got delayed due to infrastructure failure and lack of planning and scheduling. The collapse of the Majerhat Bridge (Fig 6) directly affected the metro project with serious delays in its construction phase. Earlier the project already suffered from heavy cost and time overrun due to encroachment and land issues. Later after the bridge collapsed, procurement of material on site was a huge problem faced and access to major part of the site was disrupted due to dismantling of old structure and building a new one. Since the implementing agency worked on the part just adjacent to the portion of the bridge that collapsed, they had to suspend the work for some days.

VI. Chennai metro- phase I extension (Fig 8):

This metro project was delayed due to the pandemic situation (occurring once in a century). The operational phase of the project was expected to start from 2020 but due to lockdown in the city nearly 80% of the workers are not available on site. Other than some critical tunneling work, rest of the complete stretch is at halt which would result in delay of the work. Contract workers were tested positive for Covid-19 because of which the working had to be stopped since it could have pushed lives of other workers at risk.



Fig.7: Kolkata- Joka Esplanade Metro project and collapsed bridge

Source: timesofindia.indiatimes.com



Fig.8: Chennai metro phase I extension project

Source: thehindubusinessline.com

VII. Lucknow metro rail project (Fig 9):

Delay in Lucknow metro rail project is due to government's reconsideration over turn-key based contract. LMRC has delayed in inviting bidders to develop the project within the terms and conditions applied to the tender due to short fall of high-power committee. According to a few sources and committee members from LMRC, the state government are willing to invite tenders from Delhi Metro Rail Corporation (DMRC) and Rail Vikas Nigam Limited (RVNL) because these two public sectors in India are highly qualified and experienced in the development of metro rail projects.



Fig.9: Lucknow metro project
Source: financialexpress.com

VIII. Bengaluru metro project (Fig 10):

Bengaluru metro project afflicted by delays caused due to land acquisition and huge cost variance. This metro project has changed MDs in the chief reason persistently during the work ship of last 14 years. Within 14 years of BMRC, 7 MDs were appointed periodically. While on the other hand, in the Delhi Metro Rail Corporation (DMRC) only 2 MDs were changed within 21 years. Due to such variation in intellectuals the cost of the metro project has escalated. This escalated cost in Bengaluru metro rail project has to be brought down by making use of timely technical selections and financial engineering.



Fig.10: Bengaluru metro project
Source: thehindubusinessline.com

Qualitative analysis

A questionnaire of total 5 questions was designed and circulated in the field experts of the construction industry to mitigate the factors causing delays in the construction of metro rail projects in India. Around 10-12 experts including Project Managers and Contractors from Delhi Metro, Nagpur MahaMetro, Bangalore Metro were interviewed and their views were pinned down. The expert's name, batch and site of project will remain closed

as a part of the non-disclosure. The interview was scheduled with prior appointments of the experts for around 10 mins to address the questions (M.Desai., 2003).

- I. According to you is there a need of a metro rail project in every metropolitan city?
- II. Are there any major problems faced by the employer/ government while acquiring the land for construction?
- III. Are the contractor contributed factors in the delay of construction of metro rail projects in India significant?
- IV. Does the advancement in the construction technology hamper the construction process of a metro project?
- V. Is there any external factor which impact the execution of a metro rail project?

Above questions were asked to few of the metro construction experts and other infrastructure experts along with few contractors. All the experts agreed to the fact that there is a need to develop the metro rail projects as a part of mass rapid transit system in most of the metropolitan cities as it reduces the traffic congestion, promoted public transportation facilities, reduces pollution caused by multiple private transports, and various other reasons (Doloi,et.al.,2012). Majority of the experts were of the opinion that acquiring land is one of the major hurdle to cross as farmers do not agree to give their piece of land and shopkeepers deny on shifting their setups even after paying a hefty amount and good rehabilitation plans. In the view of the employing experts, contractors contribute to the delays through factors like lack of planning and scheduling of their work, conflicts rising with other stakeholders, etc. Contracting experts were of the view that there is a lack of efficiency in the skilled labour force and unanticipated equipment breakdown cause a major problem on site. All the experts including the contractors agreed to the severe time lapse in the project due to external factors such as weather, climatic change, change in ground conditions, rain effects, political changes, delay in transportation of raw materials, lack of communication and coordination between the stakeholders (A.Faridi., 2006).

Causes of delay

Mentioned below are the major causes, categories along with their briefs drawn out of attention from the interviewed expert's opinions and their believes. Along with opinion of experts and self-research on the major causes we concluded the table mentioned below (Table 1)

Table 1: Causes of delays

Cause	Category	Brief
Lack of proper site management and supervision	Contractor and shipper	Lack of site management would cause delay in projects along with inappropriate shipment of raw materials leading to safety related issues and accidents.
Improper financing of the project by the manufacturer/contractor	Financial	Cost overrun, delay in intermediate payments and material billing.
Inter-party poor communication and coordination	Consultants	Poor communication lead to delays in project and abandonment of few planned works
Insufficient skilled labour	Labour associated	Unskilled labour will consume more time to complete a task and have less efficiency in completion of project
Faults and revisions in design documents	Drawing and Scheduling	Revisions and corrections in the design proposal lead to elongated approval process resulting in major breakdown of the project.
Environment issue	External conditions	Bad weather, rainy season, fog

Conclusion

This study summarizes of some major causes of delays that are faced in the construction projects. Metro rail projects are a major part of the mass rapid transit systems. Delays in metro rail projects is a result of imbalance in the cost, time and scope factors. Construction of metro rail projects are influenced by multiple restraint. These restraints can be related to owner, employer, stakeholder, consultant, political litigations, pandemic like Covid-19, labour issues, and many other environmental issues. A systematic scrutinizing of these factors must be carried out to reduce their impact in delaying the projects. The construction of metro rail project is to be planned and addressed carefully so that this mega project should not only be environmentally and socially acceptable but also technically and economically feasible. The paper presents the identification of critical delay factors in construction of metro rail projects and their importance.

Future scope of study

Further analysis on the identified factors causing delays in construction of metro rail project should be carried out in the future research papers using relative index analysis to find out the most commonly faced delay factors and their impacts. The experts should be asked for their opinion on how strongly do they agree or disagree on the particular causes of delay on the basis of a scale (0-5).

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Chapter-7

The Protective Role of Alpha Lipoic Acid in Tricyclic Antidepressant Induced Mitochondrial Oxidative Stress

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Abstract

Tricyclic antidepressants are a common over-the-counter drug well known for their versatile function from antipsychotic effects to alleviating unrelenting pain in fibromyalgia. Considering their ease of availability, they are one of the most commonly abused drugs either intentionally or unintentionally. Intoxication with these antidepressants causes a wide range of metabolic derangements especially to the enzymes of the mitochondrial free-radical scavenging system. This leads to a mounting up of free-radicals in metabolically active tissue like the liver, brain, etc. This buildup of free-radicals is unmanageable by the in-vivo antioxidant system leading to organ system failure.

Supplementation with a potent ex-vivo antioxidant like alpha lipoic acid which is highly fat soluble and partially water soluble provides a reduction in free-radical induced oxidative stress. Mitochondrial enzymes like glutathione peroxidase, superoxide dismutase, and catalase bear the major brunt of injury due to free-radical induced oxidative stress and are depleted faster than normal. Alpha lipoic acid is a potent free-radical scavenger that reduces this free-radical induced mitochondrial damage, thereby protecting the respiratory chain from oxidative damage. While alpha lipoic acid acts as a major intracellular free-radical scavenger, considerable extracellular activity is also noted. Moreover, it also replenishes the in-vivo free-radical scavenging system indicated by a reduction in their activity upon supplementation with the former.

In our study, we aim to stress the role of oral supplementation with antioxidants like alpha lipoic acid in patients admitted to the intensive medical care unit for acute intoxication with tricyclic antidepressants along with the routine standard emergency care provided to them. A double-blinded study was conducted to measure the effect of supplementation with oral alpha lipoic acid along with routine standard treatment, to that of people receiving only routine standard treatment. An estimation of the level of these mitochondrial enzymes and total antioxidants was done on admission and at regular intervals till discharge to establish the beneficial role of alpha lipoic acid supplementation.

Keywords: alpha lipoic acid (ALA), free-radicals, oxidative stress

Introduction

Tricyclic antidepressants are a class of antipsychotic drugs that are prescribed for the management of mild to moderate depression. Apart from this, antidepressants like amitriptyline are also used in the treatment of other conditions such as unrelenting chronic pain, insomnia, fibromyalgia, etc [1]. Sometimes due to the chronic nature of the pain and major depressive episodes, there is an increased likelihood of overdose in children or abuse for euphoria and suicide in adolescents and adults. According to a survey conducted by the American based toxic exposure surveillance system (TESS), there were 7430 cases of amitriptyline, 1152 cases of nortriptyline, and 1288 cases of doxepin misuse. About 76% of these individuals were treated in a healthcare facility, with 85 of them being dead due to the intoxication [2]. In a research carried out in India on the potential usefulness of antidepressants it has reported that the trend of usage of these drugs follows a pattern similar to that in the west. All the studies in the research were carried out in the acute phase of treatment with these drugs and none were extended into the continuum phase of usage. An elaborate review of the prescription, dose, side effect and abuse potential of these drugs is still lacking [3].

Acute intoxication with tricyclic antidepressants causes a variety of metabolic derangements from arrhythmia and respiratory insufficiency in adults to convulsions, lethargy, tachycardia, and hyperglycemia in children. The long term sequel of this intoxication was dry mouth, blurred vision, constipation, and micturition disorder. Though these symptoms resolved in time with supportive measures, a significant number of patients did suffer

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from permanent damage due to multi-system organ failure. Studies have shown that pretreatment with antioxidants like buthionine-[S, R]-sulfoximine (BSO) in patients to be started on antidepressants reduced the cytotoxicity of these drugs. It is believed that the antidepressants caused a reduction in glutathione at higher concentrations, leading to an alteration in the signal transduction pathways [4].

1.1 Chemical and Biophysical Properties of Tricyclic Antidepressants

Among the tricyclic antidepressants amitriptyline, and to a lesser extent dothiepin were the most commonly abused drugs [5]. Amitriptyline tablets are available as over-the-counter prescriptions of 10 to 150 mg. Tricyclic antidepressants chemically contain three rings of atoms with the central ring most commonly being an alicyclic ring. They upon absorption from the gastrointestinal tract, rapidly enter the tissues leaving only trace amounts in the systemic circulation. They are then rapidly metabolized in the liver and the conjugated metabolites are excreted from the kidneys. Amitriptyline is converted to its metabolically active byproduct of nortriptyline by demethylation. Nortriptyline by itself is a potent antidepressant and more toxic than amitriptyline. Dothiepin on the other hand is a thio- analog of amitriptyline and undergoes demethylation in the same manner. Tricyclic antidepressants exert their antidepressant and analgesic effect by blocking the neuronal reuptake of noradrenaline and serotonin at the α_2 adrenergic receptor in the dorsal horn of the spinal cord [6].

1.2 Oxidative Stress in Tricyclic Antidepressant Intoxication

Co-enzyme Q10 is a marker of mitochondrial dysfunction. It is a component of the mitochondrial respiratory chain and a potent antioxidant [7]. The mitochondrial levels of co-enzyme Q10 are disrupted due to oxidative stress induced by increased levels of tricyclic antidepressant metabolism, especially in tissues with high mitochondrial content such as the liver, heart, and brain. This leads to a buildup of free-radicals in these tissues far more than that could be scavenged actively by the in-vivo free-radical scavenging mechanism, leading to cellular apoptosis, tissue damage, and finally organ failure. The spill-over of free-radicals scavenging enzymes like superoxide dismutase, catalase from the damaged cells can be determined using the ferric reducing ability of plasma (FRAP) assay [8].

1.3 Antioxidants and their Role in Free Radical Scavenging

Free-radicals unlike the caged-radicals are those that have moved out of their immediate location of generation and are no longer controlled by their micro-environment. They are formed even in normal cellular metabolism due to certain disease processes or xenobiotics. Yet the cellular machinery of the body is sufficiently capable to tackle these to avoid major cellular derangements. When the free-radical scavenging mechanism of the body is overwhelmed as in the case of tricyclic antidepressant intoxication, these cellular mechanisms are incapable of self-repair leading to widespread damage of organ systems [9]. Catalase, superoxide dismutase, glutathione peroxidase, etc., are a group of potent in-vivo free-radical scavengers. Unlike these, certain dietary antioxidants that are not synthesized in the body like vitamin A (beta-carotene), vitamin E (alpha-tocopherol), and vitamin B12 (cholecalciferol) potentiate the free-radical scavenging ability of in-vivo antioxidants.

1.4 Estimation Method Of Enzymes And Antioxidants

1.4.1 Superoxide Dismutase

The superoxide dismutase is the first line of defense against specific free-radicals such as superoxide anions. In the hepatocytes, they are located in the nucleus and cytoplasm coupled with Cu^{2+} or Zn^{2+} while in the mitochondria they are coupled with Mn^{2+} . This redox reactive metal in each enzyme is reduced by the superoxide anion free-radical which yields oxygen as a byproduct. Furthermore, subsequent superoxide molecules are reduced to hydrogen peroxide by the metal ions. The rate-limiting step of this reaction is the rate at which superoxide anions diffuse the enzyme. The determination of the level of this oxidized enzyme on admission and subsequently at regular intervals provides an estimation of the amount of free-radical damage sustained by them. The half-life of this enzyme is 5sec at physiological pH [10].

1.4.2 Catalase and Glutathione Peroxidase

Detoxification of hydrogen peroxide is carried out by catalase and glutathione peroxidase. The major activity of catalase in the liver cells is confined to the peroxisomes, though some activity is also detected in the cytosol and intracellular granules. The human catalase is a heme based protein, which reduces hydrogen peroxide to water by obtaining electrons from it or other small molecules. Catalase is an inducible enzyme especially in the lung by hyperoxia and in the liver by caloric restriction or Phenobarbital exposure [11].

Yet another enzyme which actively scavenges hydrogen peroxide is glutathione peroxidase. It contains selenium as its active metal attached to the cysteine site of the enzyme. Glutathione peroxidase reduces hydrogen peroxide to water by using reducing equivalents from glutathione sulfhydryl (G-SH) groups. Since hepatocytes have a limited supply of these glutathione sulfhydryl groups, they are readily replenished by using reducing

equivalents from NADPH. This reaction is the rate-limiting step of the glutathione peroxidase cycle. Reduced glutathione is never transported out of the mitochondria. Oxidative stress inside the mitochondria induces higher levels of reduced glutathione in the serum, which could be measured to determine the extent of free-radical damage [12].

1.4.3 Alpha Lipoic Acid

This novel antioxidant was discovered three decades ago. It was originally thought to be a vitamin but was later reclassified as a fatty acid. It possessed more potent antioxidant property than old guard antioxidants like vitamin C and E. Alpha lipoic acid is a naturally occurring compound, produced in minor quantities by our body, while dietary intake being the major source. It is highly fat soluble, rapidly absorbed in the gastrointestinal tract, and is actively involved in mitochondrial energy metabolism. Both in-vitro and in-vivo models have shown that pretreatment with alpha lipoic acid increased cellular levels of reduced glutathione sulfhydryl (G-SH) groups by preventing its depletion and protecting mitochondrial integrity [13].

Materials and Methods

A total of 183 subjects admitted to the intensive medical care and toxicology unit of government general hospital, Chennai, India during the study period of three years were included. They were randomly allotted to two groups of one receiving only routine standard serving as the control group and another receiving oral supplementation with alpha lipoic acid after routine standard treatment serving as the study group.

1.5 Inclusion Criteria

- All patients with a history of tricyclic antidepressant overdose
- Drowsy but respond to verbal commands on admission, i.e. class 1 of Edinburg coma scale
- No history of prior alpha lipoic acid intake
- Medically stable to receive oral supplementation
- Spectrophotometrically negative hemolysate (i.e. UV absorbance spectrum inducible only with a chemical reaction)

1.6 Exclusion Criteria

- Unconscious and not responding to verbal commands
- Age groups, less than 12 years and more than 70 years were excluded due to the confounding effect of hormonal and metabolic alterations
- Multi-drug abuse along with tricyclic antidepressants
- History of hypersensitivity to alpha lipoic acid

1.7 Enzyme Level Estimation

1.7.1 Catalase Activity Determination

About 0.2ml of the hemolysate sample was mixed with 1.2ml of 0.05M phosphate buffer adjusted to a pH of 7.0. To this mixture 1.0ml of 0.03M hydrogen peroxide in phosphate buffer was added. The absorbance spectrum of the resulting chemical reaction was determined at 240nm at a regular interval of 30sec for 3min (Takahara et al., 1960). The level of activity of the enzyme was expressed as μ moles of hydrogen peroxide decomposed per minute per mg of hemoglobin [14].

1.7.2 Superoxide Dismutase Activity Determination

To 0.1ml of the hemolysate sample about 0.75ml of ethanol and 0.15ml of chloroform chilled in ice were added and centrifuged at 1500g, where g is the acceleration due to gravity. To the resulting supernatant obtained, 1ml of 0.1M carbonate-bicarbonate buffer adjusted to a pH of 10.2 and 0.5ml of 0.6mM EDTA were added. 0.5ml of 1.8mM epinephrine was added to start the chemical reaction (Misra et al., 1972). The activity of superoxide dismutase was expressed as 50% inhibition of epinephrine auto-oxidation per min per mg hemoglobin [15].

2.3.3 Glutathione Peroxidase Activity Determination

To 0.1ml of the hemolysate sample, 0.4ml of a neutral buffer, 0.1ml of sodium azide, 0.2ml of reduced glutathione, and 0.1ml of hydrogen peroxide were added. The volume of the mixture was raised to 2.0ml by the addition of distilled water. The entire mixture was incubated at 37°C for about 10min. About 0.5ml of 10% tricarboxylic acid was added to stop the chemical reaction. The contents were centrifuged at 1500g, where g is the acceleration due to gravity. The supernatant was separated and 1ml of DTNB (Ellman's Reagent) (5, 5-dithio-bis-2-nitrobenzoic acid) with 3.0ml of disodium-hydrogen phosphate was added (Rotruck et al., 1973). The absorbance spectrum of the mixture was read at 412nm. The level of activity of glutathione peroxidase was expressed as μ g of reduced glutathione utilized per min per mg of hemoglobin [16].

1.8 Antioxidants Level Estimation

1.8.1 Alpha Lipoic Acid Level Estimation

All patients in the study group were supplemented with 400mg of alpha lipoic acid. The determination of serum levels of alpha lipoic acid is performed using the method suggested by Borowczyk et al., 2015, in which alpha lipoic acid was extracted with 0.5% acetic acid in methanol by sonication. A quantitative analysis of alpha lipoic acid was done after extraction by isocratic RP-HPLC (reversed-phase high-performance liquid chromatography) using acetonitrile with methanol and 50mM of potassium dihydrogen phosphate buffer raised to a pH of 3.0 by phosphoric acid at a flow rate of 0.45 ml/min [17].

1.8.2 Total Antioxidant Status

Randox laboratories® commercial kit was used to determine the total antioxidant levels. It is based on the principle that when ABTS (2,2'-azino-di-ethyl benz-thiazoline sulphonate) is incubated with peroxidase metmyoglobin and hydrogen peroxide it produces a radical cation $ABTS^+$, which has a stable blue-green color at 600nm spectrophotometrically. This emitted color is suppressed proportionally to the concentration of antioxidants present in the sample. This phenomenon is used in the determination of total antioxidant levels. The level of other antioxidants can be calculated after deducting the level of alpha lipoic acid from the total [18].

Statistical Analysis

The level of enzymes in both the groups upon admission and discharge were plotted and a significant difference among them was noted. Multiple comparisons were carried out using the Bonferroni corrected t-test. A 'p' value of <0.001 was considered statistically significant. Statistical evaluation of this double-blinded study was carried out using the SPSS (version 14.0) software. A correlation between the variables was made using the Pearson test. A one-way ANOVA F-test was also used to validate the p-value and determine the significance of the test result.

Result and Discussion

All cases of confirmed tricyclic antidepressant overdose underwent routine standard treatment of gastric lavage with activated charcoal and supplementation with gastro-protective agents and intravenous fluid support. After stabilization, they were randomly supplemented with either alpha lipoic acid or placebo. Blood samples were drawn on admission and every two hourly for the first six hours and every four hourly for the next twelve hours. After this, the blood sampling was done twice daily for the first four days and once daily till their discharge. The serum level of enzymes such as catalase, superoxide dismutase, glutathione was determined from the hemolysate samples, while the level of alpha lipoic acid and total antioxidants were determined directly from the serum.

The mean levels of superoxide dismutase in the group receiving only routine standard treatment showed a minor change of 0.12µmoles per mg of hemoglobin (2.7%), while that of the group supplemented with alpha lipoic acid showed a dramatic decline in the activity of the enzyme suggestive of a protective and replenishing role of the latter towards the enzyme. The mean levels in the supplemented group showed a change of 1.67µmoles per mg of hemoglobin (11.5%) [Table1][Chart1]. Similarly, the activity of catalase also showed a significant decline in the antioxidant supplemented group of 2.31µmoles per mg of hemoglobin (37%) compared to that of the controls with 0.05µmoles per mg of hemoglobin (0.9%) [Table2] [Chart2]. Furthermore, glutathione peroxidase levels also showed a similar trend with the supplemented group showing a mean difference of 0.68µmoles per mg of hemoglobin (9.7%), while that of the non supplemented group showing a change of 0.25µmoles per mg of hemoglobin (4.2%) [Table3] [Chart3]. An estimate of the total anti-oxidant levels was also significantly higher in the supplemented group viz., 0.52mmol/l (31.1%) compared to the other group, 0.02mmol/l (1.1%) [Table4] [Chart4]. It can be seen that the addition of alpha lipoic acid to the routine treatment has even increased the total antioxidant level in the serum.

Tricyclic antidepressant overdose has led to oxidative stress as seen by the elevation of the protective enzyme levels compared to age-matched normal people. The deleterious effect of these free-radicals produced during oxidative damage to the cell organelles especially mitochondria by interfering in the respiratory chain has led to cell apoptosis and eventually tissue damage. Though the routine treatment in an intensive medical care unit provides symptomatic relief and recovery, the long term sequel of this intoxication in the form of oxidative stress needs to be addressed. Although in-vivo antioxidants and free-radical scavenging mechanisms do provide considerable protection against free-radical induced tissue damage, their effects fall short of the amount of protection needed. The supplementation of ex-vivo antioxidants not only provides for the free-radical scavenging, but it also potentiates the worn out in-vivo protection mechanisms. A versatile antioxidant like alpha lipoic acid does adequately provide for this cause. Based on the above study which showed a decline in the level of free-radical scavenging enzyme activity, it could be inferred that supplementation with alpha lipoic acid has a clear protective role in tissue damage induced by oxidative stress in tricyclic antidepressant

intoxicated victims. Of the 183 subjects included in the study, 101 were male (55.3%) while 82 were female (44.7%) correlating with an increased suicidal and abuse potential among males. The mean age was 33.5 years in both the groups with subjects as young as 16 years and as old as 65 years were present in both of them.

Tables

Table 1: Comparison of levels of superoxide dismutase in $\mu\text{moles/mgHb}$

Groups	On admission		On discharge		Difference of means & % change from baseline	multiple comparison by bonferroni t-test	Significance by one-way ANOVA f-test: f = 7.11
	Mean (%) change from baseline)	SD	Mean (%) change from baseline)	SD			
Routine treatment	6.33 (40.7)	0.87	6.21 (38)	0.5	0.12 (2.7)	t=0.15 p=0.90	Not significant
ALA supplemented	6.52 (44.9)	0.94	4.85 (33.4)	0.57	1.67 (11.5)	t=5.11 p=0.001	Significant

Table 2: Comparison of levels of catalase in $\mu\text{moles/mgHb}$

Groups	On admission		On discharge		Difference of means & % change from baseline	multiple comparison by bonferroni t-test	Significance by one-way ANOVA f-test: f = 9.45
	Mean (%) change from baseline)	SD	Mean (%) change from baseline)	SD			
Routine treatment	5.09 (71)	0.71	4.97 (67)	0.73	0.12 (4)	t=0.14 p=0.89	Not significant
ALA supplemented	5.58 (89)	0.69	3.27 (52)	0.49	2.31 (37)	t=15.11 p=0.001	Significant

Table 3: Comparison of levels of glutathione peroxidase in $\mu\text{g/mgHb}$

Groups	On admission		On discharge		Difference of means & % change from baseline	multiple comparison by bonferroni t-test	Significance by one-way ANOVA f-test: f = 7.11
	Mean (%) change from baseline)	SD	Mean (%) change from baseline)	SD			
Routine treatment	5.88 (6.3)	0.65	5.83 (5.4)	0.61	0.05 (0.9)	t=0.25 p=0.80	Not significant

ALA supplemented	6.62 (19.7)	0.74	5.65 (2.1)	0.51	0.97 (17.6)	t=5.69 p=0.001	Significant
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Table 4: Comparison of levels of total antioxidants in mmol/l

Groups	On admission		On discharge		Difference of means & % change from baseline	multiple comparison by bonferroni t-test	Significance by one-way ANOVA f-test: f = 7.11
	Mean (% change from baseline)	SD	Mean (% change from baseline)	SD			
Routine treatment	0.97 (58.9)	0.15	0.99 (59.3)	0.16	0.02 (1.1)	t=1.90 p=0.07	Not significant
ALA supplemented	0.92 (55.1)	0.12	1.44 (86.2)	0.47	0.52 (31.1)	t=4.89 p=0.001	Significant
Amount of serum alpha lipoic acid (ALA) = Difference of total antioxidant levels in the ALA supplemented group – Difference of total antioxidants in the routine treatment group i.e. 0.52-0.02 = 0.50(30%)							

Charts

Chart 1: Comparison of levels of superoxide dismutase in $\mu\text{moles/mgHb}$

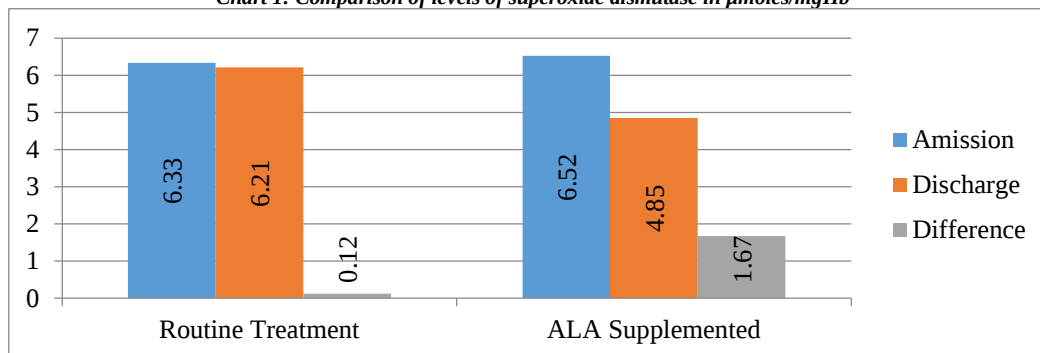


Chart 2: Comparison of levels of catalase in $\mu\text{moles/mgHb}$

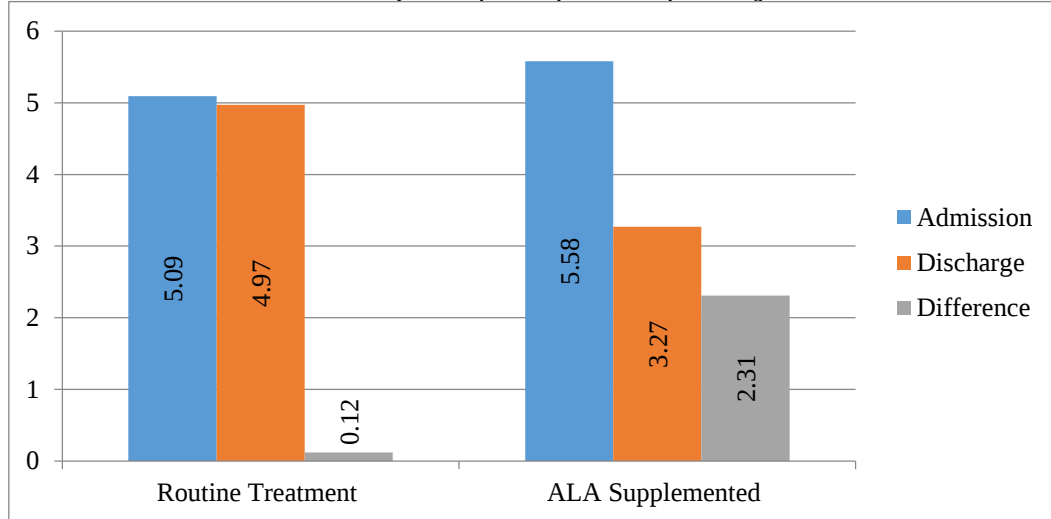


Chart 3: Comparison of levels of glutathione peroxidase in $\mu\text{g/mgHb}$

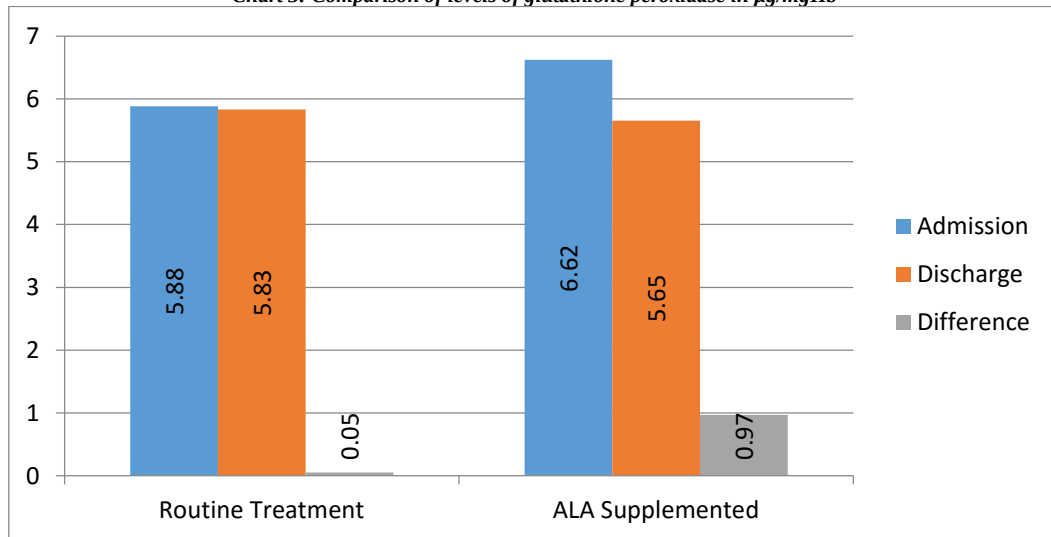
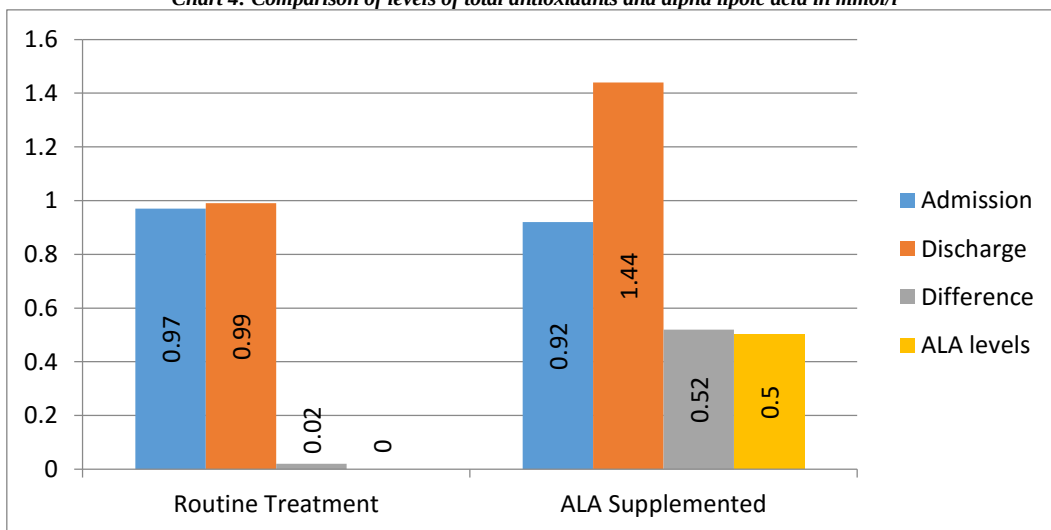


Chart 4: Comparison of levels of total antioxidants and alpha lipoic acid in mmol/l



Conclusion

Alpha lipoic acid has a definitive role in mitigating mitochondrial oxidative stress due to tricyclic antidepressant overdose. It has been suggested to supplement all acutely intoxicated subjects with alpha lipoic acid for their profound effect in protection against free-radical induced tissue damage. The recovery of in-vivo free-radical scavengers was faster and maximum with adequate oral supplementation at the time of admission.

Despite these beneficial effects, the major setback of the study was the inability to provide a direct cause-effect relationship between the enzyme activity and serum alpha lipoic acid levels. An evaluation of the role of supplementation of alpha lipoic acid with other antioxidants and their synergistic protective effect is also needed to be studied. Furthermore, the study was limited to a few major enzymes, while the effects of alpha lipoic acid supplementation on other mitochondrial enzymes like glutathione reductase, lactate dehydrogenase, and cytochrome P450 are yet to be determined. The efficacy of intravenous supplementation compared to oral supplementation is also needed to be evaluated.

To conclude, antioxidant supplementation is an inevitable need in drug intoxication induced mitochondrial oxidative stress especially, alpha lipoic acid in tricyclic antidepressant overdose. A delay in supplementation could cause a lack of harnessing the maximum potential of alpha lipoic acid in providing superior protection to these intoxicated subjects, leading to a lack of efficacy in the treatment rendered and permanent tissue damage and organ failure.

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Chapter-8

Analyzing the Results of Regression Models in Machine Learning for Predicting House Price

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Abstract

In Machine Learning Regression models allows us to predict a continuous dependent variable (y) based on the value of one or more independent variables (x). This paper is centered on analyzing the data set of House Price for estimating the price of a house based on several independent variables. This analysis of House Price Prediction will help people to calculate the correct price to buy a house or to sell a house. The implementation of Regression algorithms includes Polynomial Regression, Multi Linear Regression, Random Forest Regressor and Decision Tree Regressor on the data set. The Standard Scalar technique is used to normalize the dataset and the metric used is r^2 score.

Keywords – Machine Learning, Polynomial Regression, Multi Linear Regression, Random Forest Regressor and Decision Tree Regressor, Standard Scalar, r^2 score

Introduction

Machine Learning is a concept of making machines to learn from experience, learn from patterns to make decisions. Machine learning aims at automating the method of problem solving. It is quite interdisciplinary and has roots in many disciplines ranging from statistics, biology, and philosophy to computational theory, artificial intelligence, data mining, cognitive science etc. It is used to describe the extensive range of problems such as recognition, classification, grouping of patterns and recognizing patterns. These problems are important in variety of applications such as Signal processing, Physics experiments, Computer vision, Bioinformatics, Genomics, Remote sensing, financial forecasting etc.

Development of civilization is the base of increase of demand of houses day by day. Perfect house prices prediction is always an attraction for the buyers, sellers and bankers. Researchers have worked to undone the secrecies of the prediction of the house prices. The increase or decrease of house price is influenced by various factors viz., geographical location, culture of a particular area and socio-economic conditions. The house price is a number from some defined collection of features and so the prediction of prices of houses is considered as a regression problem. To calculate the price of a house every person gathers information of similar properties at his or her area and based on data which is collected t he or she will try to calculate the house price. These issues show that house price prediction is an important research area of regression which involves the understanding of machine learning. This has motivated us to work in this domain

Lodging costs are a significant impression of the economy, and lodging value ranges are of extraordinary enthusiasm for the two purchasers and dealers. In this, house costs will be anticipated given logical factors that spread numerous parts of private houses. Predicting the price for a house is based on different parameters like no. of bathrooms, bedrooms, square feet of basement, grade, etc. This prediction is done with ML algorithms like Polynomial Regression, Multi Linear Regression, Random Forest Regressor and Decision Tree Regressor.

The paper is scheduled in four sections. Section 2 introduces different Regression algorithms. Section 3 is for preprocessing of data, in which we identify the continuous and categorical variables. This section identifies the features that are not relevant or not contributing more to the analysis. Section 4 presents the results of Linear Regression and Random Forest algorithms on the processed data. Section 5 is a conclusion on the results presented in previous section and future scope.

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Regression Algorithms

Regression analysis is a procedure of analytical modeling technique which inspects the relationship between a target and predictor variable (s). This method is used for estimating, time series modeling and finding the relationship between the features. ML provides many regression models. Choosing a good regression model depends on the metrics like Mean Squared Error (MSE), Root Mean Squared Error (RMSE) and r^2 score. The more the r^2 score gives the good relation between dependent variable and independent variables. Different regression methods includes

- Simple Linear Regression
- Multiple Linear Regression
- Logistic Regression
- Decision Tree Regressor
- Random Forest Regressor

Methodology

Methodology gives a basic explanation about the context that is assumed. It consists of various steps that are to be performed in order to satisfy the objective. We have assumed different data mining and machine learning concepts. The methodology includes the following steps

1. Understand data
2. Visualize data
3. Removing Noise
4. Remove Correlated variables
5. Normalizing the input variables
6. Apply regression models
7. Compare results

3.1 Data and its contents

The dataset signifies the normal model of organized data with the features consistently calculated over numerous cases. Frequently the design paths in the dataset are characterized in a tabular form, or in single relation (term used in relational databases), where columns represent features of the table and rows represent the values of the features in the dataset for definite objects. The dataset used for analysis of house price is taken from Kaggle community which is named “House data.csv”. The data set contains many independent features like – *bedrooms, bathrooms, sqft_living, sqft_lot, floor, view, grade*, etc. Based on these independent features we predict the dependent feature i.e. *Price*.

3.2 Data Preprocessing

Data preprocessing in ML states the method of cleaning and organizing the raw data to make it suitable for structuring and training ML models. This includes several steps like acquire the dataset, import the libraries, import the dataset, finding missing values and handle them, encoding the categorical data, splitting the dataset, feature scaling etc. Fig1 shows libraries required for implementing our model viz., statistical and mathematical packages like Pandas, Numpy; Visualization packages like seaborn, matplotlib and Machine Learning algorithms packages from sklearn. The Fig 2 shows the sample dataset with first five records.

```
1 #importing packages
2 import pandas as pd
3 import numpy as np
4 import seaborn as sns
5 import matplotlib.pyplot as plt
6 from sklearn.preprocessing import StandardScaler
7 from sklearn.tree import DecisionTreeRegressor
8 from sklearn.ensemble import RandomForestRegressor
9 from sklearn.model_selection import train_test_split
10 from sklearn.linear_model import *
11 from sklearn.preprocessing import PolynomialFeatures
12 from sklearn.metrics import mean_squared_error, r2_score, accuracy_score
```

Fig1. Importing libraries

	Unnamed: 0	id	date	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	...	grade	sqft_above	sqft_basement
0	0	7129300520	20141013T000000	221900.0	3.0	1.00	1180	5650	1.0	0	...	7	1180	0
1	1	6414100192	20141209T000000	538000.0	3.0	2.25	2570	7242	2.0	0	...	7	2170	400
2	2	5631500400	20150225T000000	180000.0	2.0	1.00	770	10000	1.0	0	...	6	770	0
3	3	2487200875	20141209T000000	604000.0	4.0	3.00	1960	5000	1.0	0	...	7	1050	910
4	4	1954400510	20150218T000000	510000.0	3.0	2.00	1680	8080	1.0	0	...	8	1680	0

5 rows × 22 columns

Fig 2. Sample Housing dataset

The following Fig 3. shows the statistical information about the features of the dataset viz., mean, standard deviation, Minimum, Maximum etc of numerical features.

1	house_data.describe()										
	price	bedrooms	bathrooms	sqft_living	sqft_lot	floors	waterfront	view	condition	grade	
count	2.161300e+04	21613.000000	21613.000000	21613.000000	2.161300e+04	21613.000000	21613.000000	21613.000000	21613.000000	21613.000000	
mean	5.400881e+05	3.372870	2.115736	2079.899736	1.510697e+04	1.494309	0.007542	0.234303	3.409430	7.656873	
std	3.671272e+05	0.926378	0.768818	918.440897	4.142051e+04	0.539989	0.086517	0.766318	0.650743	1.175459	
min	7.500000e+04	1.000000	0.500000	290.000000	5.200000e+02	1.000000	0.000000	0.000000	1.000000	1.000000	
25%	3.219500e+05	3.000000	1.750000	1427.000000	5.040000e+03	1.000000	0.000000	0.000000	3.000000	7.000000	
50%	4.500000e+05	3.000000	2.250000	1910.000000	7.618000e+03	1.500000	0.000000	0.000000	3.000000	7.000000	
75%	6.450000e+05	4.000000	2.500000	2550.000000	1.068800e+04	2.000000	0.000000	0.000000	4.000000	8.000000	
max	7.700000e+06	33.000000	8.000000	13540.000000	1.651359e+06	3.500000	1.000000	4.000000	5.000000	13.000000	

Fig 3. Statistical information of numerical features

In the data some of features like Unnamed 0, id, date doesn't have any impact on the dependent variable and they can be dropped from the data frame. Next thing to do is to find the data types of all the features so that we can find if there are any categorical features which are to be encoded. Since there are no categorical values we can proceed further. Next we find null values and replacing the null values if present. The following figure Fig 4. Shows the features before and after replacing null values with mean of the corresponding attribute.

1	#Finding NAN values	1	#Replacing NAN values
2	house_data.isnull().sum()	2	mean=house_data['bedrooms'].mean()
		3	house_data['bedrooms'].replace(np.nan,mean, inplace=True)
		4	mean=house_data['bathrooms'].mean()
		5	house_data['bathrooms'].replace(np.nan,mean, inplace=True)
		6	house_data.isnull().sum()
price	0	price	0
bedrooms	13	bedrooms	0
bathrooms	10	bathrooms	0
sqft_living	0	sqft_living	0
sqft_lot	0	sqft_lot	0
floors	0	floors	0
waterfront	0	waterfront	0
view	0	view	0
condition	0	condition	0
grade	0	grade	0
sqft_above	0	sqft_above	0
sqft_basement	0	sqft_basement	0
yr_built	0	yr_built	0
yr_renovated	0	yr_renovated	0
zipcode	0	zipcode	0
lat	0	lat	0
long	0	long	0
sqft_living15	0	sqft_living15	0
sqft_lot15	0	sqft_lot15	0
dtype: int64		dtype: int64	

Fig 4. Before and after replacing the null values with their mean

3.3 Data Visualization

Data visualization is a significant ability in functional statistics and ML. Finding the correlation between the independent variables and the dependent variables helps us to find the best features to be considered for analysis the house price. The relation between the independent features and the dependent features can be shown in a statistical way using Heat map as shown in the following Fig 5. From this figure, we can observe that features like *grade*, *sqft_living*, *sqft_above*, *sqft_living15*, *bathrooms*, *view*, *sqft_basement*, *bedrooms*, *lat* have good correlation relationship with the dependent variable *price*. So we consider these features for predicting the house price.

Data Analysis using ML algorithms

Data analysis includes *cleaning*, *transformation*, *exploration* and *modeling* your data for decision making and supporting your conclusions. The key role of data analysis is hypothesis testing and machine learning. Before going to data analysis we should split the data into *training set* and *test set*. Training set is used for training the model and testing set is used for testing the accuracy of the model which is developed.

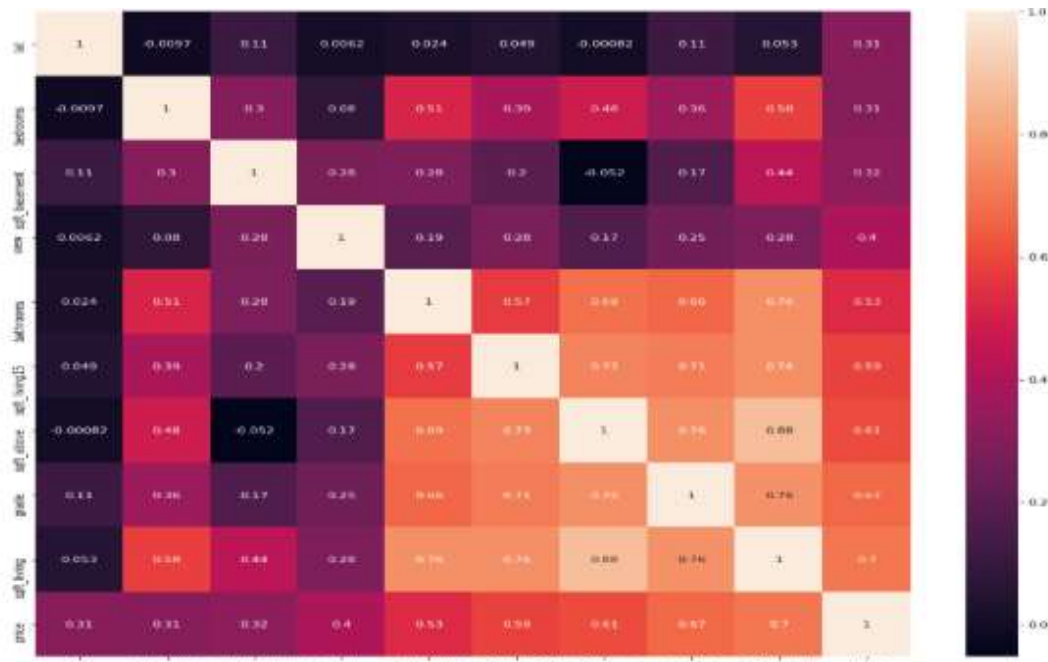


Fig 5. Heat map indicating the correlation between dependent and independent features

We can observe the range of the features in a statistical way using histogram plot as shown in the following Fig 6.

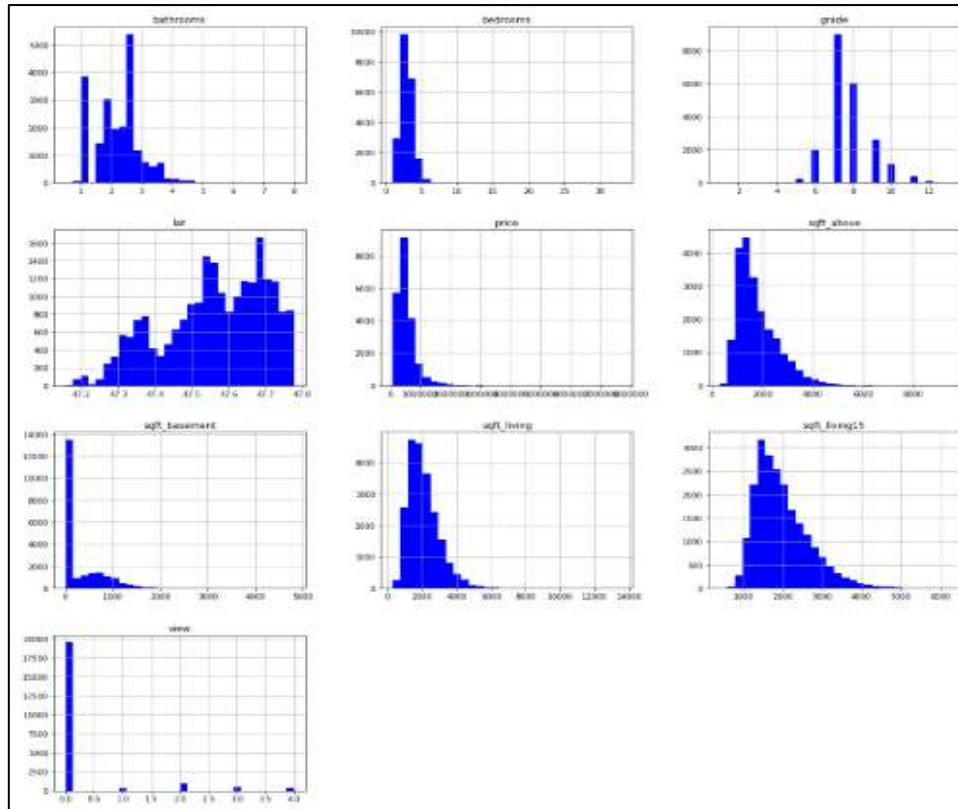


Fig 6. Histograms of numerical attributes

The accuracy of the model can be calculated with metrics like *Mean Squared Error (MSE)*, r^2 score, *Root Mean Squared Error (RMSE)*. The splitting of data can be done as follows,

```
1 X=house_data.drop(columns=["price"])
2 y=house_data["price"]
```

```
1 #Spllliting of data into train and test data
2 X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.20)
```

The train dataset is present in X_train and y_train. The testing dataset is present in X_test and y_test. X_train, X_test contains data of the independent features and y_train, y_test contains data of dependent features.

4.1 ML algorithms before normalizing

4.1.1 Multiple Regressions

Multiple Regressions is one of the important regression algorithms which model the linear relationship between a single dependent continuous variable and more than one independent variable. The formula for multiple linear regression is,

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + \epsilon$$

Where y_i and x_i are dependent and explanatory variables, β_0 and β_p are y-intercept and slope coefficients for each explanatory variable and ϵ is model's error term. We can perform multiple regression on training data as follows,

```
1 lr_model=LinearRegression()
2 lr_model.fit(X_train,y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
                  normalize=False)
```

When we apply cross validation on training data with 10 folds on Linear Regression the accuracy scores of each fold are obtained as:

[0.71099643, 0.66491709, 0.70011859, 0.68886699, 0.69131081, 0.70537751, 0.69153879, 0.72372471, 0.66848043, 0.67725525].

The mean accuracy for Linear Regression is 0.6922586578151644.

The accuracy of the model can be calculated by applying the model on testing data set

```
1 p=lr_model.predict(X_test)
2 lr_bn=r2_score(y_test,p)
3 lr_bn
```

0.710714160511356

The accuracy of the model is 71%. So from the cross validation we can say that the model is correct fit for the data without any over fitting and under fitting.

4.1.2 Decision Tree Regressor

Decision tree models the data in the form of a tree structure. It divides the dataset into minor and minor subsets which results in an associated decision tree which is incrementally developed. The model can be applied on the training data as follows,

```
: 1 dt_model=DecisionTreeRegressor(criterion='mse',max_depth=10,max_features="auto",min_samples_leaf=5)
  2 dt_model.fit(X_train,y_train)

: DecisionTreeRegressor(criterion='mse', max_depth=10, max_features='auto',
    max_leaf_nodes=None, min_impurity_decrease=0.0,
    min_impurity_split=None, min_samples_leaf=5,
    min_samples_split=2, min_weight_fraction_leaf=0.0,
    presort=False, random_state=None, splitter='best')
```

When we apply cross validation on training data with 10 folds on Decision Tree Regressor the accuracy scores of each fold are:

[0.76907263, 0.7784443, 0.76447457, 0.80182561, 0.78523624, 0.75068337, 0.7592864, 0.8341097, 0.79751424, 0.80889976].

The mean accuracy of Decision Tree Regressor is 0.7849546820613796.

To get the accuracy we should apply the model on the testing dataset,

```
: 1 dt_bn=dt_model.score(X_test,y_test)
  2 dt_bn
```

: 0.8115688522699928

The accuracy of the model is 81% and accuracy of the testing data is close to the mean accuracy of the model. This indicates that the model is not over fitted or under fitted.

4.1.3 Random Forest Regressor

A Random Forest is an ensemble technique capable of performing both regression and classification tasks with the use of multiple decision trees and a technique called Bootstrap and Aggregation, commonly known as bagging. This model can be applied on the data set as follows,

```
1 rf_model=RandomForestRegressor(n_estimators=100,max_depth=10)
2 rf_model.fit(X_train,y_train)

RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=10,
    max_features='auto', max_leaf_nodes=None,
    min_impurity_decrease=0.0, min_impurity_split=None,
    min_samples_leaf=1, min_samples_split=2,
    min_weight_fraction_leaf=0.0, n_estimators=100, n_jobs=None,
    oob_score=False, random_state=None, verbose=0, warm_start=False)
```

When we apply cross validation on training data with 10 folds on Random Forest Regressor the accuracy scores of each fold are:

[0.8369541, 0.85205705, 0.87194425, 0.85357568, 0.88014568, 0.84505028, 0.85891941, 0.88595848, 0.84664419, 0.84463657].

The mean accuracy of the model on training data is 0.8575885693849097

Now the accuracy can be calculated by applying the model on test data,

```
1 rf_bn=rf_model.score(X_test,y_test)
2 rf_bn
```

0.8642222914654465

The accuracy of the model is 86%. The accuracy of the testing data is close to the mean accuracy of the model so the model is good fit to the data without any over fit or under fit.

4.1.4 Polynomial Regression

Polynomial regression is used when the data points are not properly fit when we apply linear regression model for the data. Polynomial regression, like linear regression, uses the relationship between the variables x and y to find the best way to draw a line through the data points. The model can be applied on the dataset as follows,

```
1 pr=PolynomialFeatures(degree=4)
2 X_train_pr=pr.fit_transform(X_train)
3 X_test_pr=pr.fit_transform(X_test)
4 lr=LinearRegression()
5 lr.fit(X_train,y_train)
```

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
normalize=False)
```

When we apply cross validation on training data with 10 folds on Random Forest Regressor the accuracy scores of each fold are:

[0.70571732, 0.70941769, 0.70881677, 0.71290077, 0.71226, 0.66951719, 0.70615548, 0.66468177, 0.69006069, 0.68928915].

The mean accuracy of Polynomial Regression on training data is 0.6968817312851314. The accuracy of the model is calculated as follows,

```
: 1 p=lr.predict(X_test)
   2 pr_bn=r2_score(y_test,p)
   3 pr_bn
```

: 0.7126663013562755

The accuracy of the model is 71%. The accuracy of testing data is close to the mean accuracy of Polynomial Regression model on the data. So we can say that the model is good fit to the data.

4.2 Normalizing the data

Normalization is a kind of method which is often used as fragment of data preparation for ML. The basic idea of normalization is to alter the values of numeric features in the dataset to a common scale, without altering the ranges of values or trailing data. Normalization on the data can be done as follows,

```
1 scaler_X=StandardScaler()
2 X=scaler_X.fit_transform(X)
```

```
C:\Anaconda3\lib\site-packages\sklearn\preprocessing\data.py:645: DataConversionWarning: Data with input dtype int64, float64 w
ere all converted to float64 by StandardScaler.
return self.partial_fit(X, y)
C:\Anaconda3\lib\site-packages\sklearn\base.py:464: DataConversionWarning: Data with input dtype int64, float64 were all conver
ted to float64 by StandardScaler.
return self.fit(X, **fit_params).transform(X)
```

```
1 scaler_y=StandardScaler()
2 y=scaler_y.fit_transform(np.array(y).reshape(-1,1))
```

We should again split the data into training set and testing set and apply ML algorithms in the same way as done before to predict the house price. The following Table 1 shows the accuracy of different regression models after normalizing the data.

Table 1. Accuracy of the regression models

Regression model	Accuracy %
Multiple regression	69.67
Decision Tree regression	80.76

Random Forest regression	88.18
Polynomial Regression	69.78

Conclusion

The aim of this paper is to find which ML algorithm is the best to predict the price of the house based on some independent features. These are the accuracies of the model we built before and after normalization.

	Models	Accuracy		Models	Accuracy
a	Decision Tree Regressor	0.811569	a	Decision Tree Regressor	0.807594
b	Random Forest Regressor	0.864222	b	Random Forest Regressor	0.881848
c	Linear Regression	0.710714	c	Linear Regression	0.696749
d	Polynomial Regression	0.712666	d	Polynomial Regression	0.697832

Fig 7 Accuracy of the models before and after normalization

From the Fig 7. we can observe that Random forest regressor outperforms in both the cases of before and after normalization with 86% and 88% respectively and we can also observe an increase of 2% after normalization. Except Random forest Regressor, the other regression algorithms are accuracy is decreased due to normalization.

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Chapter-9

A Study of Cyber Security Threats in the Era of Covid-19 Pandemic

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Abstract

Because of the COVID-19 crisis, the entire world relies more than ever on computer systems, mobile devices and the Internet to operate, connect, shop, exchange and receives information and otherwise reduces the effect of social distance. In this crisis, malicious actors leverage vulnerabilities to their own benefit. Cybercrime is one of the first to continue and spread misinformation and to achieve financial benefit. This paper provides how COVID-19 has so far changed the nature of cyber security threats. Society has seen a huge increase in cyber security attacks during this pandemic, and the purpose of this paper is to examine this. This paper addresses the specific threat in cyber security during this pandemic as well as their actions and their criminal aims. The impact of COVID-19 on society from the perspective of cyber security threats and a discussion on why information security awareness is still of the utmost importance is also given. Cyber security awareness appears to be the number one method of avoiding information security attacks.

Keywords: COVID-19, Cybercrime, Cyber security, Phishing, Ransomware, Malware, Phishing

Introduction

The beginning of 2020 put together conversations about the coronavirus and how they affect our everyday lives. By the beginning of 2020, COVID-19 had a huge impact on society as a whole. The virus was first observed in Wuhan, Hubei, China in December 2019. Eventually, on 11 March 2020, the World Health Organization [15] listed the virus as a pandemic. But this crisis is becoming an opportunity for cybercriminals and taking advantages for their own benefits by exploiting the situation. The worldwide effect of coronavirus, just as its ramifications, for example, isolate measures, a remote workforce, and the length of the pandemic, have prompted assaults that are more aggressive than any time in recent memory.

COVID-19 pushed everyone to become more internet-dependent for various services like education, entertainment, shopping, work from home and other services needed for everyday life. Internet service provider reported rise in data traffic around 9 Tbps which is equivalent to 1800 downloaded HD movie volume [1]. The COVID-19 virus is widespread all over the world, but cybercriminals manipulate the fear of people to steal data, obtain personal information, disseminate fake information, spread ransomware, etc. It is not shocking to do for them. Those employees who working first time from remotely were not aware about various threats. Cybercriminals registered and developed various fake website and mobile application regarding coronavirus as well as sent malicious mail poses as reputed health organization. Cyber criminals have use legitimate documents in phishing campaign to cover malware [2]. As per the Lt. Gen. Rajesh Pant, India's National Cyber Coordination Centre' chief (NCCC) in the Economic Times [3] thousands of "Fraud Websites" about coronavirus had lunched by cyber criminals to lure citizens to contribute against coronavirus by making donations. Even cybercriminals played with emotion of the citizens by launching fake websites related to "PM CARES Fund" and solicited money from the individuals. By phishing emails, cyber criminals pretend as intergovernmental or governmental health agencies, and inject malware into online services. Cybercriminals will consistently look to profit by the most recent patterns to attempt to help the achievement paces of assaults, and the coronavirus pandemic has made an ideal tempest for them.

Literature Review

During the lockdown there is huge spike in various types of cyber-threat like phishing, malware, ransomware etc. Few analyses of this cyber-threat are listed below.

- According to F. Monton and A de coning [4], Phishing is the number one threat that has been massive rise in during COVID-19. In this paper they discussed various phishing example like "Tax refund" and "US government relief" related scam. In which user enter their personal data and became a victim.

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- As per the paloalto networks, over 1 million newly observed hostnames (NOH) containing COVID-19 related keywords like “covid”, “coronav” etc and categorized it in “High Risk” category [5].
- According to data gathered and analyzed by Atlas VPN [6], the number of phishing websites spiked by 350% amid COVID-19 quarantine. According to the report, in January, Google registered 149k active phishing websites. In February, that number nearly doubled to 293k. In March, though, that number had increased to 522k - a 350% increase since January. As per the Joe Tidy reports on BBC News [7], every day 18 million scam messages were sent to Gmail user. As per the BBC News report [7], Google restricted more than 100 million scamming messages from reaching their recipients.
- Interpol [8] has assisted some 30 COVID-19 related misrepresentation trick cases with connections to Asia and Europe, prompting the hindering of 18 financial balances and freezing of more than USD 730,000 in presumed fake exchanges.
- As per the DARK Reading newsletters [9], 46% global businesses have faced at least one cyber threat.
- In March 2020, 30,000% rise in COVID-19 related malware attacks [10].
- 400% rise in installed malicious software in android smartphones [11].
- During COVID-19 there was huge rise in remote work, according to TechRepublic [12], 95% of IT professionals report additional challenges around security as a result of COVID-19. As well as 51% of organizations seen rise in email phishing attack during remote work [13].
- According to VMware report, around 148 % rise in ransomware related attacks and From February 2020 to March 2020, there is 38% rise in cyberattacks against Financial institutions [14].
- As per the Hacker News [15], cybercrime gang deceived three British Private Equity firms into sending them \$1.3 M.
- 38% rise in cyber-attacks against financial institution from February to March 2020 [16].

Objective

Cyberthreat is not possible without individual mistakes to use online services. Without user authentication and permission, it is beyond the realm of imagination to turned into a victim of cybercrime. Sometime user limited knowledge about Internet services, generally in provincial territory of India, and lack of awareness about the security and privacy policies of online services like email service, social media etc put individuals into web of malicious actor. Cybercriminal use various social engineering, skill to collect information from individual using their infirmity, techniques to tempt a client to do particular activity for identity theft. Cybercriminals are exploiting human qualities, for example, interest and worry around the coronavirus pandemic so as to convince possible casualties to download malware, ransomware, banking trojan, visit counterfeit website or lure them by sending phishing email and SMS.

In next few month, there is an opportunity to ascend in pernicious action utilizing COVID-19 related phishing, malware or trojan trick by cybercriminal. In this paper, we examine about different most recent distinguished digital threat, its strategy to exploit people and data it takes from the casualty gadget or devices. At long last, we outline the best practice must be execute by people during this pandemic to spare themselves from malevolent on-screen character.

Cyber Threat

I. Malware

Malware, malicious software, is software developed to gain access or installed into the computer without the consent of the user and perform unwanted task in the victim device for the benefits of third party. Malicious actors are utilized COVID-19 pandemic to perform different malicious activity utilizing malware and trojan that have been join in email or phony sites. There was ascend in sending counterfeit email to draw clients to download malware by tapping on malignant connect to their gadgets. Most altogether malware was appended as ZIP, IMAGE, RAR and VBA record. There are various types of malware distribution like Remote Access Trojan (RAT), banking trojan, ransomware as per the Mimecast Threat Intelligence team members research [17], It is detected that 35% rise in malware detection during Dec 2019 to mid of April 2020.

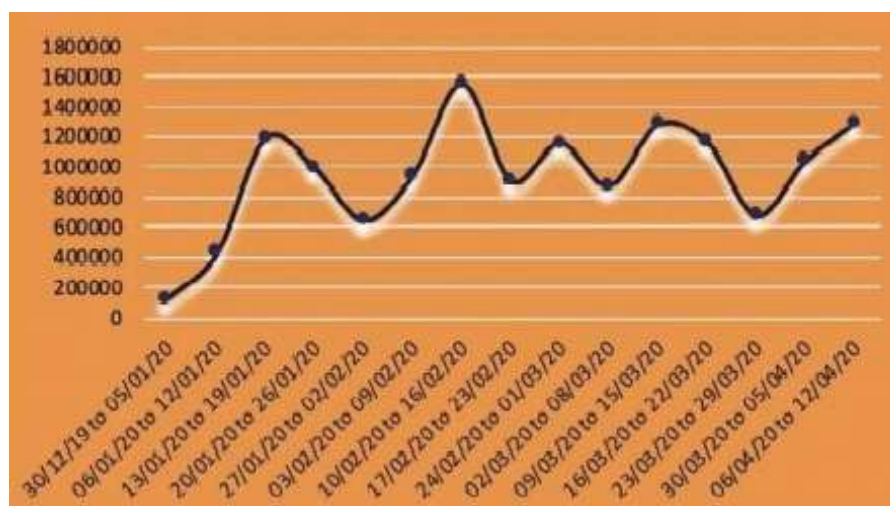


Figure 1 : Malware Detection Trend during December 2019 to April 2020 [17].

Here we are going to discuss one of the popular malwares and its working methodology.

“Coronavirus Maps” Malware: The malware called "Coronavirus Map" explicitly targets the Windows platform. It takes advantage of the public's desire for reliable knowledge about new diseases, deaths and transmissions associated with Corona. The program called "Coronavirus Map" is used to plant malware on



Figure 2 : False map of spread COVID-19 used to plant malware [18].

victim's computers. As per the digital shadows_ [18], this malware masks as Johns Hopkins University map, is the first map which provide statistic regarding COVID-19 to the world, and imitates the true map of the university made their own “fake” version of website [4].

As per the Mouton, Francois & de Coning, Arno. research, attackers build coronavirus-related websites to encourage you to download an app to keep you updated on the situation. This program involves no download, and gives you a diagram of how COVID-19 spreads. However, creating and installing a malicious binary file on your computer is a trap for attackers.

To be sure, these websites are genuine maps for coronavirus monitoring, but have a different URL or different information from the original source. In figure 2 depicts fake website, corona-virus-map.com, URL in red border. It shows false map of covid-19 to inject malware into user computers.

Working Methodology

As per the white paper published by Nokia on cyber threat linked to COVID-19 [19], the malware immediately contacts its Command and Control (CnC) server with collected details of the host after the device is compromised. The malware is designed to extract user credentials but it will also collect other information from the browser cache such as credit card numbers, account history, cookies, usernames and passwords. Linked to the AZORult malware family, this malware is known to open a backdoor on an infected computer using the Remote Desktop Protocol (RDP) and a (new) secret administrator password. AZORult is popular among cybercriminals, influential in underground fora, and used in a series of malicious campaigns. Removing malware manually is a challenging task.

Stealing: This is used to take user internet history of browsing, login credentials, credit card numbers, cryptocurrency and other interesting information of users. Additional malware can also be downloaded to compromised computers. In order to gather confidential data from an infected device, AZORult is widely sold in Russian underground discussion forums. A new version of AZORult installs a hidden admin account to do remote attacks on your computer [19].

Apart of this, there are other malware families included in the cyber-attack during COVID19 pandemic like Babyshark, trickbot, agent tesla, emotet, trickymouse, lokibot, vicious panda campaign [20].

Removing malware manually is a difficult process-to do this automatically, it is easier to use reputable antivirus or antimalware programs. Gaining information about coronavirus is significant, you can use checked dashboards only to keep a tab on it to avoid hacking [19].

II. Banking Trojan

Banking Trojans take online financial data by misusing security imperfections in PC data frameworks. Banking Trojans are malware, as they are intended to take cash straightforwardly from victims account. It masked as a legitimate application and lure people to installing it. Once installed, it uses various techniques like keylogging to log the user login credentials and sending this detail to its developers.

As per the Kaspersky [21], 42,115 establishment bundles of adaptable financial trojans. This is the most important motivator in the earlier 18 months, and more than 2.5 events higher than in Q4 2019.

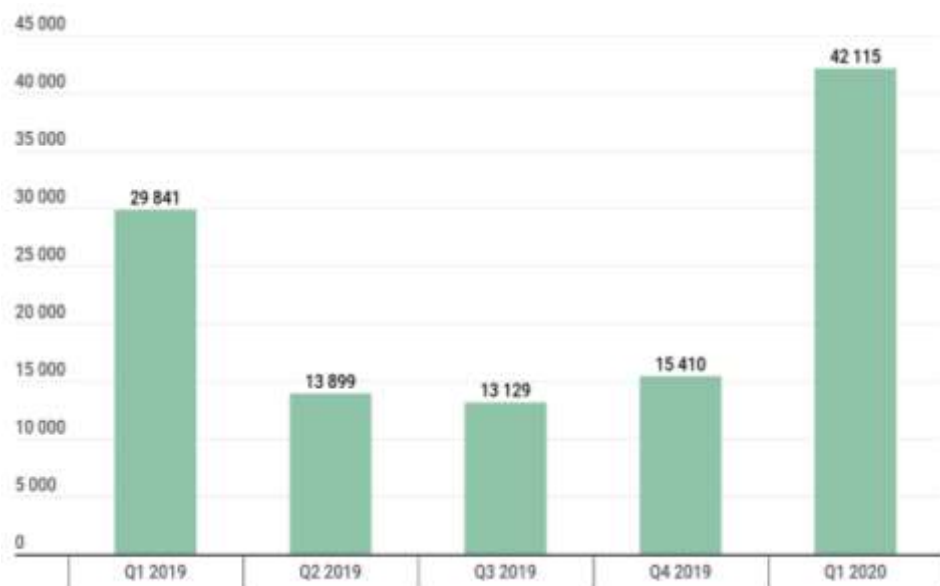


Figure 3: Mobile banking trojan installation packages from Q1 2019 to Q1 2020 [21].

In last one year, there are number of various banking trojans were unrolled by cybercriminals like Dridex, Emotet, Ursnif, Trickbot, Formbook, Lokiboot, Ramnit [22]. During corona virus pandemic, cybercriminals use coronavirus-themed spam mail. In May 2020, there was 16% rise seen in the overall cyber-attack compare to March 2020 and April 2020 [23]. Banking trojan is spread via fake application, via malicious program attached in phishing email or using social media promotion. Currently as per the cert-in [24], new android banking trojan “EventBot” is spreading worldwide.

Eventbot

It is mobile banking trojan used to steal the information from the Android's smartphone. It is fabricated Android's accessibility feature to users financial related data from financial applications, by taking permission to read SMS and captures SMS messages permitting malware to sidestep two-factor verification. It targets diverse banking related application worldwide. It is very difficult for normal user to identify this malicious program because it have nearly similar icon to authentic application like MS word, Adobe. Once installed on victim's device, as per cert-in (Indian Computer Emergency Responce Team), it ask consent for controlling devices by reading SMS messages, accessing internet, installing extra packages, getting to web, whitelisting it to overlook battery advancements, keep processor from resting or diminishing the screen, auto-start upon reboot. It will likewise examine Lock screen and in-application PIN which will offer attacker progressively special access over casualty gadget.

III. Ransomware

Ransomware or Cyber extortion is a malignant program that block users from accessing their system or personal files and demand large amount of money in exchange to access their system [25]. Ransomware is frequently spread through phishing messages that contain malicious link or attachment. when a user unconsciously visits a tainted site and afterward malware is downloaded and introduced without the client's

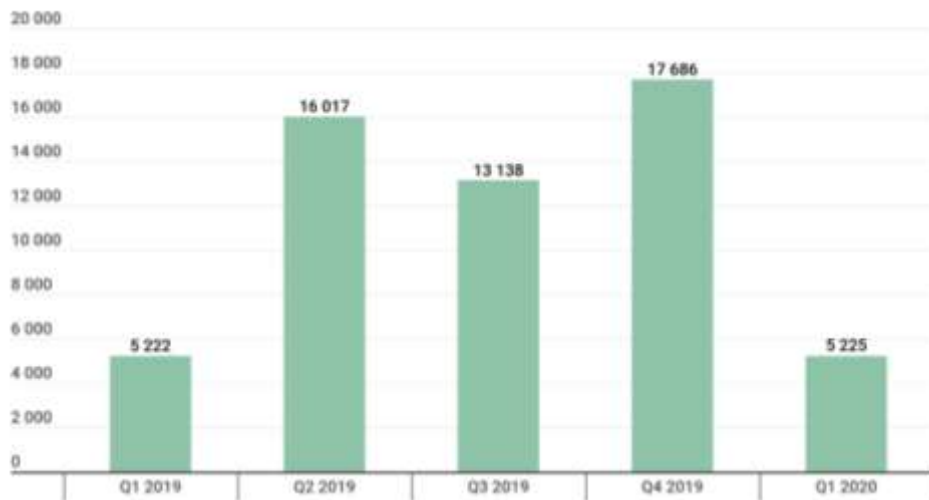


Figure 4 : – From Q1 2019 to Q1 2020 detection number of installation packages of mobile ransomware trojan [21].

information, there is a chance to install ransomware on user device. Also lack of awareness about cyber security, not follow password policies to generate strong password is also the reason to become a victim of ransomware.

As per the Interpol report [25], Because of the expanding prevalence of digital forms of money, there were a ton of ransomware variations after 2013. It by and large focusing on government offices, human services, training, transport and assembling area. As per Kaspersky Q1 2020 report [21], there are 4339 installation packages for mobile ransomware trojans and . In Q1 2020, five new ransomware families, around 5000 modifications were detected and detected 42,115 installation of mobile banking trojan. In following we discuss about latest ransomware and its working methodology.

CovidLock Android Ransomware: “Covidlock” is malicious COVID-19 tracking application. By prompting a change in the password used to open the handset, CovidLock uses techniques to refuse user access to their devices. This is also known as a screen-lock attack and has already been seen on ransomware for Android [26]. This locks the victim out of the application and asks the user to pay for the unlock.

Delivery: The user is drawn to a malicious website via a phishing e-mail or Google search which looks like a legitimate COVID-19 information site. Users are encouraged to install an application that will provide alerts in real time, but it's just a malware program that locks the machine [19].

Working Methodology: The CovidLock program demands access to the authorization as per the “AndroidManifest” XML file: BIND DEVICE ADMIN; If the access is granted, this permission gives CovidLock almost full control of the system.



Figure 5: This Android app plants ransomware appears to deliver real-time alerts on COVID-19 Invalid source specified..

After starting, CovidLock will test if it is operating with permissions from the administrator and if not, it will request these for privileges to increase. A message about allowing notification alerts when a patient with coronavirus is near is used to trick the user into granting this permission. The handset locks itself up with a warning on the locked screen as soon as the user clicks on "Search Area for Coronavirus". It is calling for \$250 in the form of bitcoins as ransom. The intruder is trying to leak the victim's private data including images, videos and more. The user should follow the steps suggested at <https://howtoremove.guide/covidlock/> for instructions to unlock the phone and disable CovidLock [19].

The best choice is to restore the encrypted files from the previous backup. When no such backups exist, a data recovery method may be used or the manual recovery process may be attempted [27]. Other option to unlock the feature, as per written in the Shivang Desai blog [28], use "4865083501" to unlock the device. But unlocking the system just doesn't fulfill the victim's mission, it is important to uninstall the application from the device.

IV. Phishing

Using social engineering, Malicious actors try to obtain personal information from vulnerable victims and utilize such information to introduce another attack. Social engineering is a skill to use human infirmity to urge activity and obtain secret information. Phishing or spam mail is example of social engineering where an attacker sends a tricky email to unsuspecting user or a group with the expectation of obtaining login details. The Covid-19 pandemic continues to spawn dozens of campaigns, scaring recipients into clicking on harmful links or attachment in emails, text messages or social media post [29].

As per infosecurity magazine [30], Phishing emails have spiked by over 600% since the end of February according to Barracuda Networks.

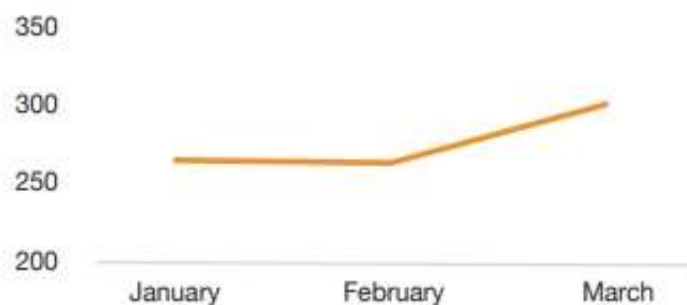


Figure 6 : Global volume of Phishing emails (in billion) [30].

Cybercriminals send emails with information about the coronavirus pretending to be from reputable organizations. The email contain attachment about the latest fact regarding coronavirus and it can lure user to downloading it by clicking on the attachment. Once user downloaded this attachment, it will likely invitation to malicious program to your computer. This malicious software could encourage cyber-criminal to take control of your computer, it monitors your keystrokes or log other activity related to financial information. Coronavirus-themed phishing emails will take various forms. The emails sent usually:

- Message from reputed medical or governmental institution,
- Attempt to spread fear
- Pretending to contain important details or news.
- Ask for a download and/or click on the links and attachments.

In the following, we saw how coronavirus related spam mails would address a victim in a way that suggests familiarity while offering the advice or safety measure. Phisher often use familiar company names or pretend to be someone you know. Here's a real-world example of a scam where phishers pretend to be the World Health Organization (WHO) by logo of the World Health Organization on it [31].



Figure 7: Fake WHO safety measure email [31].

Such "Phishing" emails seem to be from WHO, and you will be asked to give personal information liker username or passwords, send integrated downloading link in email or attachment and tempts user to downloading the attachment. Using this method, cyber-criminals can install malware to steal sensitive information from device.

As per the Mimefest researcher [17], 90% of compromise happens by spam email and over 90% of those breaks are basically owing to lack of user awareness. Researcher at Mimecast revealed a few distinct promotions – including messages focusing on medicinal services experts in regards to a staff course on the infection (where they are urged to enter their login information in an Outlook application) or messages containing a connection that guides beneficiaries to a phony site bearing a HMRC logo offering a tax refund, CDC alert message or work place policy email.

V. Misinformation Through Social Media

Social media provides the platform to transform misinformation regarding COVID-19 related misinformation.

COVID-19 related misinformation has been mainly transmitted via social networking sites and private messaging platforms. Misinformation does not certainly have the same financial impact as other forms of cybercrime, but it could be used to create fear, promote hazardous remedies at home and make contributions to drug shortages and essential medical equipment. Misinformation includes home remedies, fake stories, bogus regulation advisories, and misleading Chinese propaganda. The WHO has mentioned this massive amount of data – real and not – as a "infodemic," and has and has put together a committed team to watch the unfold of probably harmful information [18].

As per the J. Scott Brennen, Felix M. Simon, Philip N. Howard, and Rasmus Kleis Nielsen [32], there is high rise in the volume and diversity of misinformation circulation during January 2020 to March 2020 which is depicted in figure 8.

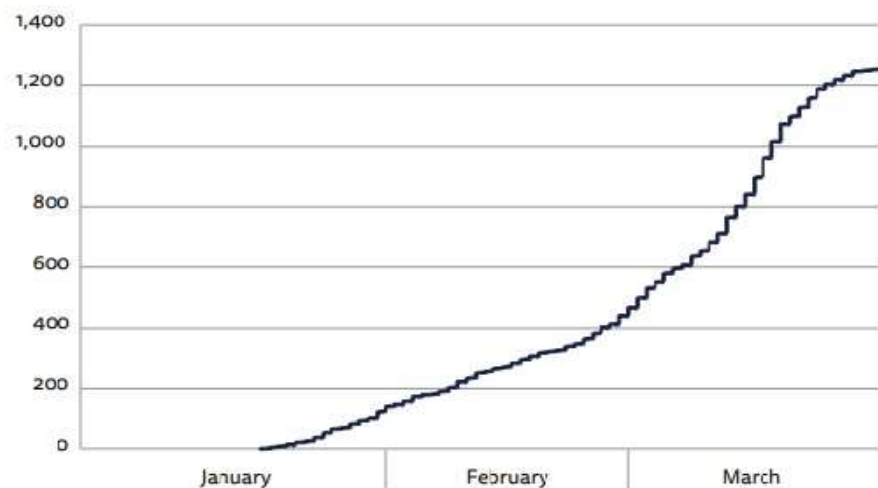


Figure 8 : Spreading Misinformation during January 2020 to March 2020 [32].

Figure 9 is example of misinformation spread in social media .

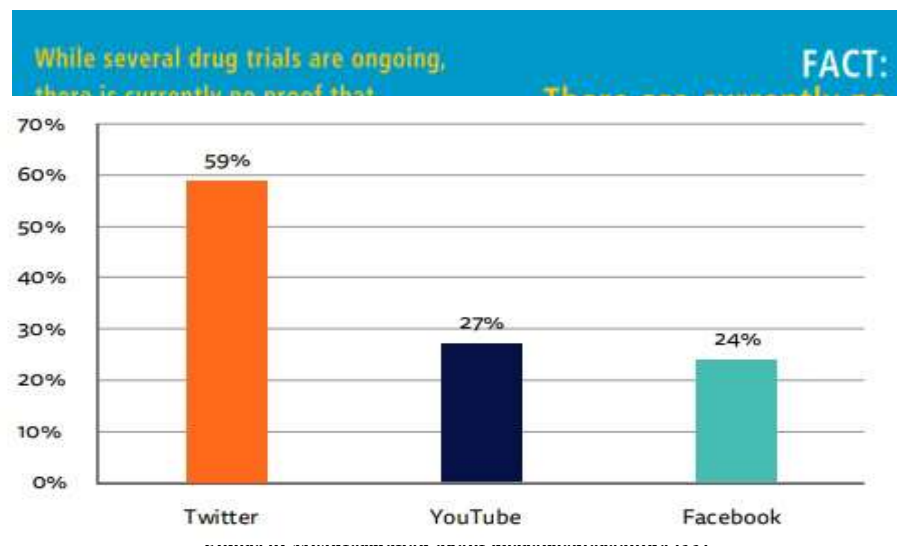


Figure 10: Percentage of false active post till March 2020 on Social Media Invalid source

As per the World Health Organization [33], There are currently no medicinal products approved to treat or prevent COVID-19 and there is currently no evidence that hydroxychloroquine or any other drug can cure or prevent COVID-19, although several drug trials are ongoing. Hydroxychloroquine abuse can cause serious side effects and disease, and can even lead to death. WHO coordinates efforts to develop and evaluate COVID-19-treatment medicines. As per Gadgets 360 reports [34], the Indian government has written to top social media companies like Facebook, YouTube, TikTok, ShareChat and Twitter to monitor the dissemination of information on Covid-19, generally referred to as Coronavirus.

As per the J. Scott Brennen, Felix M. Simon, Philip N. Howard, and Rasmus Kleis Nielsen [33], social media have reacted to a larger part of the internet-based life posts evaluated fake. From the figure 10, there is no any large difference between various social media. While 59% of bogus posts stay dynamic on Twitter with no

immediate notice name, the number is 27% for YouTube and 24% for Facebook. In a March 20 advisory [44], the government asked social media platforms to launch awareness campaigns, delete misinformation from the site, and promote credible virus knowledge. Social media sites themselves have also adopted a responsible approach to alleviate the dissemination of misleading COVID-19 information by flagging posts that could be illegal and employing third-party organizations to test messages for evidence.

Ways That Help Users Safe

Following guidelines are valuable to help individual and corporate web clients to shield their online tasks and shield advanced resources from unapproved access in the midst of coronavirus tricks and a few other online dangers.

- Use effective antivirus or antimalware software.
- Use Firewall to prevent unwanted traffic in our device.
- Use strong password / PIN.
- Use Password manager and Password generator tool.
- Use two-way authentication on online accounts.
- Avoid to send Personal Identifiable Information over social media.
- Avoid to use public Wi-Fi.
- Keep aware about Security and Privacy Policy of social media.
- Visit only trustworthy websites considered to be reliable sources of knowledge.
- Only install apps from authorized app stores (Google Play, Apple, Microsoft).
- Do not open email attachments unless the sender is identified and the email is unexpected.
- Do not give extra execution rights unless there is good justification to do so.
- Don't act immediately on any message coming from the unknown sources.
- Check the website link properly. Don't try to access website which give certification error.
- Backup data regularly.

Conclusion

This paper concentrated on addressing the effect of COVID-19 on the global information security threat landscape. This pandemic is changing every day, and the effect on the information security threat environment is shifting at a rapid rate. There has been a major rise in cyber security attacks. Society did not know what was going on at this moment, and did not know how to respond, so cyber criminals took the opportunity to strike. We discussed the emerging cyber security risks that the world is facing in the midst of this pandemic. Malicious actors are use various social engineering techniques to distribute malware to steal login information from the victims. Cyber security awareness is still severely lacking in culture, and, sadly, culture has now been forced to be more cautious. The time has come to concentrate on information security education as it is right now where it is most needed. In times like these, cyber security experts have to join together and try to protect society.

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Chapter-10

Antimicrobial Activity and Phytochemical Evaluation of *Grewia Abutilifolia*'s Leaves Extracts

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Abstract

Grewia abutilifolia is a threatened medicinal plant having immense unexplored therapeutic potential. The aspiration of this study was to establish the antimicrobial and phytochemical constitution of this natural product in order to perpetuate its unexplored potential. Extraction was carried out such as water, methanol, n-Hexane, and Ethyl Acetate. The antimicrobial activities of different extracts were assessed by the Disk diffusion method against four bacterial and two fungal strains. All the extracts have demonstrated an equivalent effect against four bacterial strains at different concentrations. The aqueous extract was found to be more effective against *E. coli* while extract of ethyl Acetate exhibited almost equal activity against all four bacterial strains. N-hexane's extract displayed more activity against by cold maceration and Hot percolation (Soxhlet apparatus) process using various solvents *B. Subtilis*, *P. aeruginosa*, and *E. coli*. Almost similar antimicrobial activities pattern was shown by cold macerated extracts. The Minimum Inhibitory Concentration (MIC) of the plant extracts ranged from 50 to 250 µg/ml. Some extracts exhibited antimicrobial potency comparable commercially antimicrobial agents. All these observations thus contribute to a strengthening of the utilization of plants in the cosmeceutical and pharmaceutical industries.

Keywords: Minimum Inhibitory Concentration (MIC), Therapeutic potential, Percolation, Maceration, Disk diffusion.

Introduction

Microbial infection is considered as one of the major causes of bereavement in emerging nations (Mostafa, A. A. *et al.*, 2018). Emerging resistance against antibiotics is a global concern in the public health protection and a major confrontation all over the world. As per National data submitted to WHO regarding Antibiotic consumption surveillance (2016-2018), oral administrated antibiotic consumption has risen from 50 to nearly 100% in countries. Medicine such as penicillin and β -lactamase is the most favored oral antibiotics. Economically emerging and underdeveloped nations are at the forefront of this increase (Reta, A. *et al.*, 2019). *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus aureus*, and *Bacillus cereus* are among the common pathogenic bacterial strains causing significant mortality and morbidity (Mostafa, A. A. *et al.*, 2018; Fair, R. J., & Tor, Y., 2014). As per the study carried out by Reta *et al.*, 2019 antibiotic resistance varied from 0 to 100% in gram-negative and gram-positive strains (Reta, A. *et al.*, 2019). The increasing incidences of MDR (Multi Drug Resistant) microbial strains against the synthetic drugs are limiting their clinical effectiveness as well as also reducing the treatment options. Since ancient times, India is entrenching for its copious biodiversity medicinal plants, due to diverse climatic conditions. *Grewia abutilifolia* is a shrub belonging to the family Tiliaceae and known for its diverse medicinal values (Khasim, S. M. *et al.*, 2020). *Grewia abutilifolia* experiences seasonal flowering and fruiting and it is distributed in moist deciduous forests in the central and southern parts of India. Ethnobotany studies divulges its various uses like a cooling agent, refreshing drink, Anti-inflammatory, Anti-rheumatism, demulcent and anti-diabetic (Quattrocchi Umberto 2012). As per time plant genus is widened in its medicinal properties instead of its traditional use as a fruit and cooling drink (Mall T. P. & Tripathi S. C. 2018). *Grewia abutilifolia* is one of the threatened species recorded in the Indian Biodiversity Organization. The present review highlights the possible Phytopharmacological properties of plants with existing ethnopharmacological importance. This study gives scientific evidence for the antimicrobial action of the drug.

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Material and Method

Plant material

The *Grewia abutilifolia* leaves were collected during July-August of 2018 in and around Pune, Maharashtra, India. Plant material was washed properly with the help of Tap water and shade dried. Dried plant material was pulverized and screened through mesh size 100mm and authenticated in NISCAIR (voucher no Ref No: NISCAIR/RHMD 3290/91).100.

Extraction Procedure

Dried powder was subjected to cold and hot extraction. The extraction was carried out with different solvents with increasing order of polarity, like n-Hexane, methanol, Ethyl Acetate, and Aqueous. Extract was filtered through Whatman filter paper (41) to accomplish filtrate. All extracts were concentrated with the help of rotary evaporator. The yield was weighted and stored in a small bottle inside the fridge at (8°C). The percentage yield was deliberated with the help of acknowledged method:

Percentage Yield (%) = $E/R \times 100$ (E= wt. of Extracted residue, R= wt. of Raw material)

The dried extracts were dissolved in Dimethyl Sulphoxide (DMSO) and taken for antimicrobial evaluation

Anti-microbial activity

Strains of Bacteria and Fungus

The antimicrobial study of various extracts of *Grewia abutilifolia* was assessed against four bacterial and two fungal species, the bacterial species used for the test were *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), *Bacillus cereus* (ATCC 11778), and *Staphylococcus aureus* (ATCC 25923). The two fungal strains used were *Penicillium sp.* (MTCC 1995) and *Aspergillus niger* (ATCC 16404). All microbial strains were obtained from Rivpra Formulation Pvt. Ltd.

Preparation of Inoculums

For culturing bacterial strains Himedia's Nutrient agar were used and for effective culturing of fungal strains Potato Dextrose Agar by Himedia, India were used. All bacterial species were cultured and inoculated in nutrient broth for the time of 72 hours at 35°C temperature. Fungal inoculums were made by using PDA (Potato dextrose agar) plate for the period of 96 hours at optimum temperature (37°C) and then fungal spores were collected with the help of sterile cotton swab and conveyed to a sterile plate with fresh Potato dextrose solution (20ml).

Antibacterial activity of Plant extract (Determination of Zone of Inhibition)

The antimicrobial activity of each plant extract was evaluated by the Disk Diffusion method. The Plant extract was liquefied by Dimethyl sulphoxide (DMSO) and sterilized by Millipore filter having size 0.22µm and then disinfected paper discs (6mm size) were used to load the desired concentrations 250µg/ml of plant extracts. To achieve the required growth of all bacteria, the streaking method was followed after pouring 25ml of Muller-Hilton agar medium into disinfected dishes. Disinfected paper discs loaded along with plant extracts with various concentrations were positioned on the Agar Plate's top. To permit Plant extract's diffusion, it was incubated at 35°C for 24hrs. Vernier caliper measurements were used as record and were considered as a marker for the activity. All these experiments were done in triplicate (Mostafa, A. A. *et al.*, 2018).

Anti-fungal activity of plant extracts (Determination of Zone of Inhibition)

The antifungal activity of each plant extract was evaluated by the Disk Diffusion method. The Plant extract were liquified by Dimethyl sulphoxide (DMSO) and sterilized by Millipore filter having size 0.22µm and then used sterile filter paper discs (6mm diameter) to get concentrations 250µg/ml of plant extracts. In Petri dishes, it was replated with (PDA) Potato dextrose agar and streaked by fungal spores. Filter paper disks of 6 mm size were implanted. The disc, drench concentrations (125µg/ml) of test compounds were investigated by liquifying in dimethyl sulphoxide (DMSO). Zones of inhibition were measured after the time period 96 hrs at temperature 37°C [37°C Temperature need to verify]. Vernier caliper measurement were used as record and considered as marker for the activity. All these experiments were done in triplicate (Bajpai, V. K. *et al.* 2007)

Determination of Minimum inhibitory concentrations (MIC's) of effective plant extract

The minimum inhibitory concentration of crude extracts of the *Grewia abutilifolia* was executed by mean of Disk diffusion method. MIC demonstrates least possible concentration of antimicrobial agents that prevents microbial growth within 24hrs and optimum condition of 37 degree Celsius. The plant's extract residues were dissolved in Dimethyl sulphoxide (DMSO) and sterilized by Millipore filter having size 0.22µm and then sterile filter paper discs of 6mm size were used, to achieve the desired concentrations 1000 µg/ml to 31.5 µg/ml serial dilutions of plant extracts. To achieve the required growth of all bacteria, the streaking method was followed after pouring 25ml of Muller-Hilton agar medium into sterile Petri dishes. Disinfected filter paper discs mounted along with plant extracts with various concentrations were positioned on Agar Plate's Top. Disc mounted with 5µg of Ampicillin was treated as control. To permit Plant extract diffusion, incubate at 35°C for 24hrs. Vernier caliper measurement were used as record and considered as marker for the activity. All these experiments were done in triplicate (Mostafa, A. A. *et al.*, 2018).

Preliminary Phytochemicals screening

As per various reports, i.e. Ali and Hossain, 2015; Weli A.M. *et al.*, 2018 (Ali, S.H.J., Hossain, M.A., 2015; Weli, A. M. *et al.*, 2018) disparate polarity of *Grewia abutilifolia* extracts were appraised their Phytoconstituent for estimation of assorted constituents (Elumalai, E. *et al.*, 2011) Below acknowledge tests were executed on different polarity plant extracts to analyze their presence:

Alkaloids Observation

Primary characterization was accomplished by Mayer's, Wagner's and Dragendorff's tests. For Mayer's and Wagner's test, 15mg of chloridic extract and 1% HCl (5ml) were prepared, heated for the time period of 5min on a water bath. It was Filtered with the help of filter paper. To the both test tube containing settled filtrate, few drops of Mayer's reagent and Wagner's reagent consecutively were added. Yellowish-white precipitate and Brown precipitate appeared in the Mayer's and Wagner's test, respectively, denotes the presence of alkaloids (Kachkoul, R. *et al.*, 2018). The existence of Dragendorff's test was countered by 2ml acidic solution in another test tube of 10 per cent ammonium mixture. Turbidity or precipitate observation indicates the positive Dragendorff's test and presence of Alkaloids (Auwal, M., S. *et al.*, 2014)

Detection of Saponins

According to research carried out by Weli A.M. *et al.*, 2018 saponin detection was accomplished by taking 5mg of residue diluted with 20ml distilled water and solution was quivered for 20 sec and left for a few minutes at the steady situation. Formation of foam depicts the appearance of saponins, which are known for their foam formation property (Weli, A. M. *et al.*, 2018).

Detection of Glycosides

As per the published report by Ezeonu, C. S., & Ejikeme, C. M., 2016 Glycoside test was accomplished with 2.00 g from every sample, added 15 ml of 1.0 M Sulphuric acid, after constant heating for period of 5 minutes with the help of water bath. Filtered with Whatman paper, acknowledge test were accomplished with resultant filtrate:

(a) Fehling's solutions(0.2cm³), x and y were assorted with filtrate (5 cm³) till it became alkalinescent (litmus evaluation). Brick-red colouration on warming depict successful outcome (Ezeonu, C. S., & Ejikeme, C. M. 2016).

(b) In place of aqua, 1.0 M Sulphuric acid (15cm³) was acclimate replicate the evaluation and amount of precipitate acquired with x. Excessive precipitate overcome with a positive outcome of glycoside although low outcome reflects the negative outcome (Ezeonu, C. S., & Ejikeme, C. M. (2016)

Detection of Cardiac Glycosides:

Keller-Killiani test (Cardiac glycoside):

5ml distilled water was quivered with 0.5 gm of extract, then few drops of ferric chloride and glacial acetic Acid (2ml) were added. Further, H₂SO₄(1ml) was added along the wall of the test tube, the brown band depicted presence of cardiac glycosides (Iqbal, E. *et al.*, 2015).

Detection of terpenoids:

Salkowski test: 100mg crude concentrate was individually quivered with 2ml chloroform, followed by addition of 2ml concentrated H₂SO₄ along the test tube sides. Reddish Brown coloration depicts successful outcome of terpenoids (Iqbal, E. *et al.*, 2015).

Test for reducing sugars:

Fehling test: 1ml of ethanol adjoined with 10mg of extract, afterwards 2ml distilled water was add, further 4 drops of (10%w/v) aqueous ferric chloride were added. Blue green colour depicts positive outcome for reducing sugar (Ismail, A. M. *et al.*, 2016).

Test for carbohydrates:

Molisch test: 2-3 ml of extract was taken, then two drops of Alpha naphthol mixture in Ethanol, were added and followed by the addition of few drops of Conc H₂SO₄ at the edges of the test tube. Violet ring showed successful outcome (Ismail, A. M. *et al.*, 2016).

Tannin's Identification:

10 mg of every concentrate was combined in 1mL of ethanol, then 2 mL of distilled water was added, then 4 drops of ferric chloride aqueous solution (10% w/v) were added. The appearance of a blue color depicted the presence of polyphenols.

5ml of 45% methanol was boiled with 2gms of extracts. The blend was refrigerated and filtered. The filtrate was subjected to the acknowledged tests:

(1) Lead sub-acetate test: three drops of the lead sub-acetate solution were mixed to 1 ml of the filtrate solvent. The appearance of tannins was observed when a cream gelatinous precipitate formed.

Detection for Phenols:

Ellagic Acid Test: Two drops of 5% w/v Gallic Acid and 5% w/v NaNO₂ mixture was combined with test. Validation of phenols accomplished by the absence of muddy or Niger Gray, otherwise vice versa.

Results

Plant extraction yield

The percentage yield of various extracts was demonstrated in **Table 1**. The concentrate of 50g of shrivel plant material with various solvent capitulated concentrate stretch from 1.56 to 9.43% of range. The highest capitulate of plant extract, appeared in water (6.99%) followed by methanol (7.58%) and Ethyl acetate (1.93%). Although n-Hexane (0.71%) establishes the lowest extract yield, to cold extraction percentage yield for water (5.83%) followed by methanol (5.67%), n-hexane (0.69%) and ethyl acetate (1.83%), respectively.

Table 1: Percentage yield of various extracts of leaves of *Grewia abutilifolia*

Plant Extract	Percentage Yield(w/w)
HEX	0.71%
MET	7.58%
ETA	1.93%
AQA	6.99%
cHEX	0.69%
cMET	5.67%
cETA	1.88%
cAQA	5.83%

**** HEX-** Hexane Extract(Hot Extraction), **MET-**Methanol Extract(Hot Extraction), **ETA-** Ethyl Acetate Extract (Hot Extraction), **AQA-** Aqueous Extract(Hot Extraction), **cHEX-** Hexane Extract(Cold Extraction), **cMET-**Methanol Extract(Cold Extraction), **cETA-** Ethyl Acetate Extract (Cold Extraction), **cAQA-** Aqueous Extract(Cold Extraction).

Antibacterial activity of plant extracts

The 6 plant extracts were investigated to assess their antimicrobial activity against four bacterial and two fungal species. Out of four bacterial species two were gram-positive (*B.subtilis* and *S.aureus*) and two were gram-negative bacteria (*E.coli* and *P.aeruginosa*). The result showing antibacterial activity depicted in **Table 2**, asserted that each extract with varying concentrations displayed equivalent antibacterial activity to standards. Methanol, Ethyl acetate, and n-Hexane have evident finer activity than the standard counter four microorganisms. The aqueous extract was additional effectual counter to *E. coli*. Ethyl acetate extract was found to be almost equally effective against the all four bacterial microorganisms. N-Hexane was effectual against *B.subtilis*, *P.aeruginosa* and *E.coli*. Almost similar antibacterial activities were shown against cold macerated extracts. The presence of Phytochemicals was shown in **Table 3**. Different extracts did not manifest significant antifungal activity.

The results of the antibacterial activity of extracts revealed that all strains were found to be susceptible to the methanol Extract, ethyl acetate and n-Hexane extracts. However, water extract was found to be active against the *E. coli*. All results collectively suggest that methanol, n-hexane and Ethyl acetate have the most effective results and manifest as an antibacterial agent.

Experiments were performed to determine their Minimum inhibitory concentration of extracts against all 4 susceptible bacterial stains.

Table 2: Zone of Inhibition of various extracts of leaves of *Grewia abutilifolia* against Microorganism

Microorganism	Concentration (µg/ml)	HEX	MET	ETA	AQA	cHEX	cMET	cETA	cAQA
<i>E.coli</i>									
	1000	17±0.1	13±0.2	15±0.1	11±0.1	13±0.2	15±0.1	13±0.1	11±0.4
	500	12±0.25	11±0.1	12±0.1	10±0.2	12±0.1	12±0.3	12±0.2	9±1.0
	250	7±0.2	9±0.25	9±0.2	8±0.2	10±0.2	10±0.1	10±0.3	7±0.2
	125	0	7±0.2	7±0.1	7±0.3	8±0.3	9±0.21	8±0.1	6±0.7
	62.5	0	6±0.2	6±0.3	6±0.4	7±0.1	7±0.2	7±0.3	0

	31.25	0	0	0	0	0	0	0	0
<i>P. aeruginosa</i>									
	1000	14±0.13	12±0.2	16±0.6	0	11±0.1	13±0.2	15±0.2	0
	500	13±0.1	11±0.13	15±0.3	0	10±0.01	11±0.4	13±0.1	0
	250	12±0.4	9±0.2	13±0.1	0	9±0.02	9±0.1	11±0.2	0
	125	9±0.2	8±0.32	11±0.3	0	8±0.1	7±0.1	9±0.1	0
	62.5	8±0.8	7±0.14	9±0.3	0	7±0.2	0	7±0.4	0
	31.25	7±0.1	0	7±0.2	0	0	0	0	0
<i>B. cereus</i>									
	1000	15±0.3	14±0.16	12±0.1	0	14±0.25	12±0.4	14±0.3	0
	500	13±0.1	13±0.1	11±0.2	0	12±0.1	11±0.12	12±0.1	0
	250	11±0.3	10±0.2	9±0.2	0	10±0.2	10±0.1	11±0.2	0
	125	10±0.2	8±0.15	8±0.1	0	8±0.2	8±0.2	9±0.2	0
	62.5	9±0.25	7±0.1	7±0.2	0	7±0.1	7±0.1	7±0.2	0
	31.25	7±05	0	0	0	0	0	0	0
<i>S. aureus</i>									
	1000	12±0.2	13±0.1	15±0.1	0	0	13±0.8	14±0.2	0
	500	10±0.1	11±0.0	13±0.2	0	0	12±0.1	13±0.4	0
	250	9±0.3	10±0.1	12±0.3	0	0	10±0.2	10±0.3	0
	125	8±0.2	8±0.2	10±0.2	0	0	8±0.3	8±0.1	0
	62.5	7±0.25	7±0.0	8±0.1	0	0	7±0.5	7±0.1	0
	31.25	0	0	7±0.4	0	0	0	0	0
<i>Panicillium frequentans</i>									
	1000	0	0	0	0	0	10±0.1	0	0

500	0	0	0	0	0	9±0.3	0	0
250	0	0	0	0	0	8±0.5	0	0
125	0	0	0	0	0	7±0.1	0	0
62.5	0	0	0	0	0	6±0.2	0	0
31.25	0	0	0	0	0	0	0	0

Aspergillus niger

1000	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0
62.5	0	0	0	0	0	0	0	0
31.25	0	0	0	0	0	0	0	0

** HEX- Hexane Extract(Hot Extraction), MET-Methanol Extract(Hot Extraction), ETA- Ethyl Acetate Extract (Hot Extraction), AQA- Aqueous Extract(Hot Extraction), cHEX- Hexane Extract(Cold Extraction), cMET-Methanol Extract(Cold Extraction), cETA- Ethyl Acetate Extract (Cold Extraction), cAQA- Aqueous Extract(Cold Extraction).

Table 3: Phytochemicals present in different extracts of leaves of *Grewia abutilifolia*

Phytoconstituents	HEX	MET	ETA	AQA	cHEX	cMET	cETA	cAQA
Alkaloids	+	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+	+
Flavonoids	+	+	+	+	+	+	+	+
Terpenoids	-	-	-	-	-	-	-	-
Cardiac glycosides	-	-	-	-	-	-	-	-
Carbohydrates	+	-	+	+	+	-	+	+
Saponins	-	-	-	-	-	-	-	-
Glycosides	+	+	+	+	+	+	+	+
Sterols	+	+	+	-	+	+	+	-
Phenols	-	+	+	+	-	+	+	+

** HEX- Hexane Extract(Hot Extraction), MET-Methanol Extract(Hot Extraction), ETA- Ethyl Acetate Extract (Hot Extraction), AQA- Aqueous Extract(Hot Extraction), cHEX- Hexane Extract(Cold Extraction), cMET-Methanol Extract(Cold Extraction), cETA- Ethyl Acetate Extract (Cold Extraction), cAQA- Aqueous Extract(Cold Extraction).

Minimum inhibitory concentration (MIC's) of the effective plant extracts

The minimum inhibitory concentration of the most effective extracts was employed by the Disk Diffusion method to assess their bactericidal and bacteriostatic properties. The upshot depending on concentration of Plant extract were acknowledged in **Table 4** and embellished with **Fig. 1**. The reticence effect of methanolic extract (Cold extraction) was found to be 62.5µg/ml counter *E. coli*, 62.5µg/ml counter *S.aureus*, 62.5µg/ml for *P.aeruginosa* and 125µg/ml for bacillus species, While the inhibitory effect of Ethyl acetate extract(cold extraction) was found to be 62.5µg/ml counter *E.coli* , 62.5µg/ml counter *S.aureus*, 62.5µg/ml for *P.aeruginosa* and 62.5µg/ml for *B.cerus* species. Ethyl acetate extract's (Hot extraction)

inhibitory effect was found to be 62.5µg/ml for *E. coli*, 31.25µg/ml for *S.aureus* and 62.5µg/ml for *P.aeruginosa* and 125µg/ml for *Bacillus* species. N-Hexane extract (Hot extraction) show inhibitory effect at 250µg/ml counter *E. coli*, 62.5µg/ml counter *S.aureus*, 31.25µg/ml for *P.aeruginosa* and *B.cerus* species. While methanol (Hot Extract) shows an inhibitory effect on 125 µg/ml counter *E.coli*, 62.5 µg/ml counter *P. aeruginosa*, *B. cerus* and *S. aureus*. N-Hexane Extract (Cold Extraction) showed an inhibitory effect at 62.5 µg/ml against *E. coli*, *P. aeruginosa* and *B. cerus*, while 125 µg/ml for *S. aureus*. For Aqueous Extracts (Cold and hot Extraction) MIC was found to be 250 µg/ml and 125 µg/ml respectively. Penicillin was used as standard and has 4 µg / ml MIC. Variation in the results of various extracts was possibly due to variation in the chemical constituent present within it. Terpenoids, Phenols and Alkaloids are various chemical constituents responsible for effective antimicrobials. The Phytoconstituents generally interact with proteins of the microbial cell wall and cause its turmoil to disseminate a flux of protons towards cell exterior which induces cell death or inhibit enzymes obligatory for amino acid Biosynthesis and also inhibit Efflux pump (Khameneh, B. *et al.*, 2019). As per Lebecque, S. *et.al.*,2019 the hydrophobic nature of some plant extracts enables them to act with proteins of the microbial cell membrane and mitochondrial turmoil their permeability and structure (Lebecque, S. *et al.*, 2019) This study leads to a conclusion that all extracts of plants having antibacterial activity could be used for some preservative use and Phytomedicine uses or pharmaceutical preparation formation.

Table 4: Minimum Inhibitory Concentration of various extracts of leaves of *Grewia abutilifolia* against Microorganism

Microorganism	HEX**	MET	ETA	cHEX	cMET	cETA	Ampicillin
<i>E.coli</i>	250*	125	125	62.5	62.5	62.5	4
<i>P. aeruginosa</i>	31.25	62.5	31.25	62.5	125	62.5	4
<i>B. cereus</i>	31.25	62.5	62.5	62.5	62.5	62.5	4
<i>S. aureus</i>	62.5	62.5	31.25	-	62.5	62.5	4

*All values in µg/ml unit.

**HEX- Hexane Extract(Hot Extraction), MET-Methanol Extract(Hot Extraction), ETA- Ethyl Acetate Extract (Hot Extraction), cHEX- Hexane Extract(Cold Extraction), cMET-Methanol Extract(Cold Extraction), cETA- Ethyl Acetate Extract (Cold Extraction).

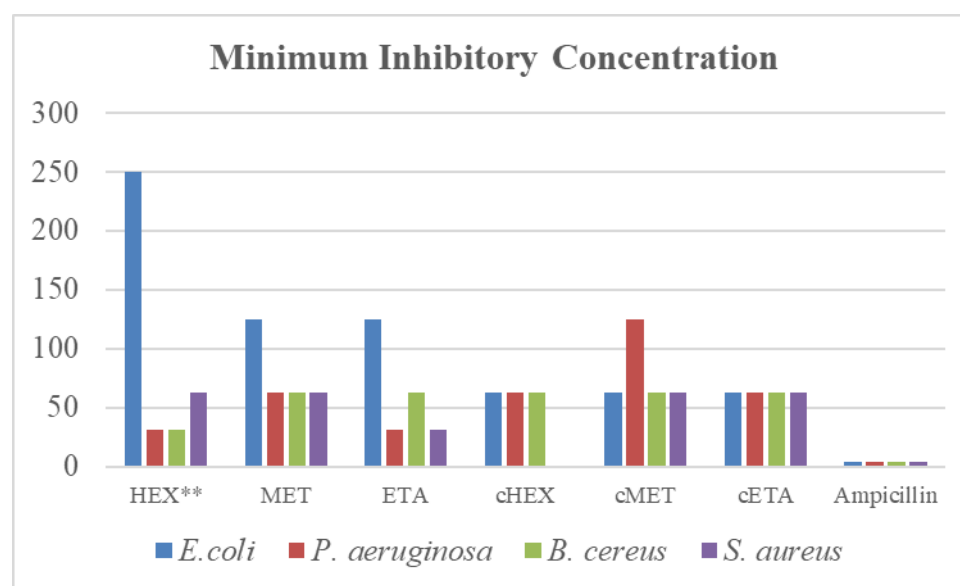


Fig 1: Minimum Inhibitory Concentration of various extracts of leaves of *Grewia abutilifolia* against Microorganism

**HEX- Hexane Extract (Hot Extraction), MET-Methanol Extract (Hot Extraction), ETA- Ethyl Acetate Extract (Hot Extraction), cHEX- Hexane Extract (Cold Extraction), cMET-Methanol Extract (Cold Extraction), cETA- Ethyl Acetate Extract (Cold Extraction).

Discussion

The medicinal value of plants lies with various chemical constituent's presence. Phytoconstituents present in the plant extract attribute for their medicinal value. In the current study, some of the plant extracts has potential anti-Bacterial activity against some pathogenic bacteria. The study helps to conclude more options for treatment of pathogenic bacterial species. As bacterial resistance is the most common problem in front of researchers, so extracts can be tried against the drug resistance strains of bacteria. Plants based safer antimicrobial agents could be proved as an alternative of synthetic compounds with less incidence of adverse reaction and associated side effects.

Conflict of Interest

NA

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Chapter-11

Applications of Novel Didactic tools in Green Chemistry Teaching

Tidke Vishwamber Angadrao¹⁴

Abstract

During the COVID-19 outbreak in the entire nation, the country is facing major difficulty in the entire sector and worst hit sector is education. To ensure that there is no interruption in the education and students, the online teaching recognised the role of green class; it is substantive and imperative to raise awareness and call attention, how to innovate and energize online teaching. Green chemistry is known for integrative, holistic, and interdisciplinary philosophy that endorses improvement of the organic development of the world. The application of ICT based didactic resources may also help achieve a more integrated and holistic understanding of green chemistry which is reflected by systems thinking. Include the availability of the resources, the transformation and processes and the waste management, at end-of-life of a good process. Green teaching means minimizing the amount of resources in a didactic process and depend on software and hardware infrastructure during designing educational tasks. A well- knowledgeable society would treat green teaching as a natural and necessary step for achieving goals.

Keywords - COVID-19, Green chemistry, didactic resources, sustainable development.

Introduction

During the COVID-19 outbreak in the entire nation, the country is facing major crisis in every sector and worst hit sector is education. To ensure that there is no interruption in the education and students, the online teaching recognised the role of green class; it is substantive and imperative to raise awareness and call attention, how to innovate and energize online teaching. Green chemistry is known for integrative, holistic, and interdisciplinary philosophy that endorses improvement of the organic development of the world.² Novel design about the development, and employment of chemical processes; researchers are required “to design chemicals, chemical procedures and commercial manufactured goods. Similar to teaching other subjects, teaching of green chemistry needs a high-level plan of the educational process to reach wide audiences as well as constant thought about incorporating didactic tools, which are becoming popular. Today’s digitally competitive generations³ grow up with information and communication technology (ICT) that they use to experience different activities. Thus, sharing knowledge, teaching, or incorporating skills can employ various digital didactic tools, such as e-learning platforms, games, intelligent accessories and videos. The use of these tools in teaching can help students gain a better understanding of the presented issues and improve their interest in the green chemistry content.⁴ It must be noted that since ICT tools are still being developing stage, the digital learning environment can be categorised nascent in the course of formation. This creates dual situation: teaching is known, yet technology is hesitant; technology is known, but its applications of technology cautious.⁵ Therefore, it is paramount important to recognize the possible innovative didactic tools to accomplish the anticipated learning outcomes and intern increase the cognizance of sustainable development. The three-domain model: ecology, economy, and the social order.⁶ The use of modern didactic tools economically reasonable and serves society (open access to all). Most commonly used innovative didactic tools in green chemistry teaching, which comprise e-learning platforms, web-based social media tools, virtual worlds on screens recorded in virtual worlds.

Green Chemistry Teaching System Thinking

Knowledge of chemistry is vital for understanding green chemistry such as basics of organic and inorganic chemistry with the fundamental principles of stoichiometry, chemical equilibrium, and kinetics of chemical reactions. Deep understanding of the basics is crucial to design processes and products that reduce or eliminate the use and generation of hazardous substances, fading negative impacts on the environment requires the combination of knowledge and understanding about sustainable green chemistry. Indicates that the curriculum should include natural and man-made environments with respect to their social, cultural, political, ecological and economical dimensions. Students need to increase awareness and skill in problem-solving, through the

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matter of chemistry⁷ and should also know how to involve in societal decision-making to contribute to the creation of a sustainable world. This type of approach in the teaching process is reliable with systems thinking, which promotes the idea to build latest scientific knowledge, convert knowledge into worthwhile applications, and facilitate science for the benefit of society.⁸ Teaching chemistry across a systems approach contains three subclasses: learner systems, chemistry teaching and learning, and environment and community systems.⁹ A teacher, as the driving force, as to decide on the appropriate tools and develop environments to make the learning process more attractive and striking that have a greater encouragement to other learning communities. This role requires using creative action to didactics in terms of pedagogy, techniques, and tools as well as building environments favourable to individual learning paths.

Green chemistry teaching

The application of ICT based didactic resources may also help to accomplish an integrated and broad understanding of green chemistry which is shown by structural thinking. Include the accessibility of the feedstocks and resources, the transformation and processes and the waste management, at the end, a decent process. The vital scientific training is at the source of a skilled chemist able to look holistically at a chemical process, product and understand its effect on humans and on the environment. Early, from the impact of availability of resources, which is then suitable to plan the interconnections between chemistry, the environment, and society overall. Green chemistry deals with developing new processes and products with less impact, that need less energy and fewer natural resources, that minimize or eliminate toxicity, and that reduce waste, along with being socially and economically acceptable.¹⁰

New innovative didactic tools are functional in education may boost the promotion of sustainability. These new technologies that are used to foster the concept of sustainability in the perspective of the UNESCO directions.¹¹ The teachers can easily utilize the potential of innovative didactic channels to spread the sustainability approach in green chemistry teaching. The “Green tools” are moreover, reusable and recyclable. It is vital to emphasise that new technologies not only help educational purposes, but also generally offer research material relating to human behaviours and social groups.¹² This involves the sharing of knowledge, which is the highest standard designed for using adequate and relevant information.

Innovative didactic tools

The innovative didactic tools such as virtual classrooms, virtual laboratories, and virtual field trips provide great access to educational activities.¹³ Digital tools employed in green chemistry teaching can be included: e-learning which can be consist of social media, or websites, virtual worlds (3D platforms) with entirely innovative devices and intelligent accessories. E-learning podiums consider to be two-dimensional and the tools used very often in education processes in either synchronous or asynchronous modes. Although they undergo constant changes¹⁴ they can be divided into the following categories: learning management systems [LMSs] for content management, outlining learning progress, reporting and managing the course.¹⁵ Learning content management systems (LCMSs) used specifically for creating, editing, delivering, and administering didactic content¹⁶ and virtual communication systems (VCSs) for online lectures, live streaming, video conferences, recording the sessions, sharing documents or a whiteboard. Especially the LMC and LMS, can be enhance with more advanced features, which create them extra flexible to different types of activities. These useful functionalities incorporate the learning content, send personalized portions of materials to students, and automatically check their score. Platforms help teachers to systematise a learning space, learners can act together and team up virtually, that significantly boost the students sense of belonging to a team spirit and their motivation.¹⁷ To participate students into learning activities, particular tasks of platforms can be used for creating gamification assignments or storytelling which improves students enjoyment, motivate, and engage in the learning process.¹⁸ Gamified activities for green chemistry teaching were evaluated and reported to have great value for high school and undergraduate students.¹⁹

Some examples of e-learning centres are Swayam, NPTEL, Sodhganga are used to document research, experiments, and procedures has grown popular among teachers and students. Virtual reality (VR) platforms provide experiences that are related or differ from fabricated experiences and compose multiuser virtual environments, thus enriching learning experiences.²⁰ Teachers and students sense as more appealing, descriptive, and more attractive than actual experiences. Gallego et al.²¹ who recommended a motivational model, the model clarifies and expects the acceptance of Second Life in education and which includes the seven constructs of convenience, status seeking, entertainment, socializing, shared experience, information seeking, and persistence intention. Virtual reality platforms are very realistic in support of green chemistry teaching. Virtual worlds are frequently used to delivering lectures or seminars, especially when the learners are in geographically scattered locations.²² A digital facility thus can provide communicating objects, multimedia displays, learning activities and prompt feedback methods. An ever-increasing blend of VR platforms with other tools gives teachers ample opportunities to conduct experiment with the didactic means. To create a full engagement of students, teachers can even design massive open online courses (MOOCs)²³ blended learning

tools combined with an experimental laboratory enlarge learning results. Students' involvement in courses conducted in a 3D platform lead to in positive learning outcomes of learning languages, radiology, medicine, biology and chemistry to visualize the end result of chemical virtual reality of various forms²⁴ and apply a blended experience of green chemistry.²⁵ They can serve as a field for virtual reality for crisis response situations, or other scenarios which can occurs in an adverse environment. A simulated world an outstanding atmosphere in which to conduct research on social behaviour in the field of green chemistry.

Conclusions and future implications

New didactic tools, fit into the heart of “green chemistry” by justifying their level of development, warrants the minimization of costs and manufactured waste. The innovative didactic tools can help teachers collaborate interdisciplinary learning routes where students understand to solve actual world problems inside green chemistry. These tools created by teachers or students, the digital resources can be recycled and used yet again with other factions. They can be available for a large number of students anytime, anywhere. Collected digital coursework can be also used for research purposes. Digital tools enable teachers to accomplish the didactic objectives through individualization of teaching and control of the teaching outcomes. Students learn from their own errors without of being hurt or injured. All these aspects significantly contribute to the improvement of a sustainable world. Future Prospect might stimulate green chemistry teaching and the smooth realization of sustainability goals should involve deliberate thinking about three issues: attention to new move to instructional design, technical and human problems, causing unevenness in technology use, and imparting green teaching into the principles of green chemistry.

For green chemistry teachers, knowledge about didactic tools and pedagogy approaches must be a key interest, technology-enhanced programs, it is necessary to predict technical and human challenges. Technical challenges are commonly related to underinvestment in education, which frequently accompanies bad resource management. Human challenges apply to teachers and learners. This results in irregularity in the use of these tools. Other researchers have found that teachers do not use technology in the delivery of their lessons although they have high competency levels in the use of technology resources²⁶ hesitant to apply green teaching into the principles of green chemistry.²⁷ In the Indian context Green teaching lack behind due to lack of good connectivity , Knowledge of usage of technology on teachers point of view as well as learners. This unenthusiastic attitude must be dealt by providing suitable environment to nurture green chemistry teaching in the area of learning and designing products, processes, improving, materials, and systems. Chemistry students, scientific community, and engineers should involve in various technology-enhanced didactic forms such as lectures, laboratories, and seminars. Moreover, the resources and training facilities could also be digital, which would reduce the cost.²⁸ All three issues should be taken into consideration in the context of green chemistry education delivery at a national level.

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Chapter-12

Ultrasonic Study of Uni-univalent Mixed Electrolytes (containing CH_3COO^- ion) in Water

Nidhi Sharma¹⁵

Abstract

Ultrasonic velocity and density studies of aqueous solutions of mixed electrolyte systems have been used to calculate various acoustic parameters - viz; adiabatic compressibility, apparent molar compressibility, inter molecular free length, specific acoustic impedance, hydration number and relative association constant. The results of the study have been discussed in terms of ion- solvent and ion - ion interaction.

Keywords: ultrasonic velocities, mixed electrolyte, ion-ion interaction, ion – solvent interaction and hydration number.

Introduction

Mixed electrolytes are very important as they are found in numerous processes in chemical industry. They occur in enormous quantities in the water of ocean and play an important role in the physiological process of body fluids and cell equilibria.

Ultrasonic velocity and absorption measurements in aqueous solutions of electrolyte provide useful information on the structural, physical and chemical aspects of the solution^{1,2, 22}. Application of acoustic methods have showed extensive possibility in the fields of solution chemistry, physical chemistry, biochemistry, chemical engineering and process control for a fundamental understanding of many phenomena in solutions and liquid systems^{3,4}.

It is also possible to estimate the hydration numbers of the electrolyte solutions from the molar compressibility value at infinite dilution. Metal ions play an important role in chemical and biological systems so the hydration of ions in these systems is a key issue to understand the chemical and dynamical processes^{5,6,23}. Propagation of the sound wave perturbs the equilibrium between solute and solvent molecules and relaxation process are setup leading to excess absorption of the sound wave. Ravichandran et al.⁷ determined ultrasonic velocity of aqueous solutions of NH_4Cl , $\text{NH}_4\text{H}_2\text{PO}_4$, $(\text{NH}_4)_2\text{C}_2\text{O}_4$ at temperature of 303 K and concluded that ultrasonic velocity increases in a non- linear manner. Ultrasonic velocity parameters were used to study interactions in Binary⁷⁻⁸ and ternary⁹ systems, as well as the ion-solvent and inter ionic interaction in aqueous¹⁰, mixed aqueous¹¹ and non aqueous¹² systems. Bhat and Shiva Kumar¹³ studied on acoustic behaviour of potassium thiocyanate in aqueous and various non-aqueous solvents and determined the values of apparent molar compressibility (Φ_k), apparent molar volume (Φ_v) and limiting apparent molar compressibility (Φ_k^0), limiting apparent molar volume (Φ_v^0). The ion – ion and ion- solvent interactions have been discussed in terms of these parameters^{22,23}. Recently Palani and Jayachitra¹⁴ have reported ultrasonic study of ternary electrolyte mixture ($\text{KCl}+\text{MgSO}_4+\text{HgCl}_2$) at different molalities and temperature with a view to ascertaining the nature of ion-ion and ion-solvent interactions²³.

“The review of literature on acoustical studies of solutions reveal that the ultrasonic velocity data as such do not provide significant information about the native and relative strength of various types of inter molecular and inter- ionic interactions between components²³. Hence in present study, their derived parameters of aqueous solutions of mixed electrolytes such as adiabatic compressibility (β_{ad}), apparent molar compressibility(Φ_k), inter molecular free length (Lf), specific acoustic impedance (Z), hydration number (Hn) and relative association constant (RA) have been calculated to shade more light on such interactions”-Nidhi²⁴.

With this aim in view, ultrasonic studies of aqueous solutions of mixed electrolytes have been undertaken in the light of the following aspects:

- I. Determination of ultrasonic velocities at a constant frequency of 10 M Hz and a constant temperature

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298.15 K, of the following uni-uni valent mixed electrolytes in aqueous mixture $\text{CH}_3\text{COONa} + \text{NaNO}_3$, $\text{CH}_3\text{COONa} + \text{NaBr}$, $\text{CH}_3\text{COONa} + \text{NaCl}$.

- II. Determination of the values of various acoustic parameters, viz; Adiabatic Compressibility (β_{ad}), Apparent Molar Compressibility (Φ_k), Inter Molecular Free Length (L_f), Specific Acoustic Impedance (Z), hydration Number (H_n) and Relative Association Constant (R_A)²⁴.
- III. Ascertaining the nature of ion-solvent and ion-ion interactions in terms of acoustic parameters.

Experimental

All the chemicals used were of AR grade and were used as such without further purification. The digital electronic balance (Mettler) with accuracy ± 0.1 mg, was used for the mass determination. The ultrasonic velocity measurements were recorded on a multi-frequency ultrasonic interferometer (M-83; Mittal Enterprises, New Delhi) at 298.15 K by using a cell of 10 MHz frequency. The solutions of electrolytes were prepared in double distilled water (conductance is $1 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$). The densities of solvent (water) and solutions were measured with a 5 ml pycnometer.

The various acoustic parameters were determined as below:

$$\beta_{\text{ad}} = 1 / u^2 \rho \quad \text{-----} \quad (1)$$

$$\Phi_k = 1000 / C \cdot \rho_0 (\beta_{\text{ad}} \rho_0 - \beta_{0 \text{ ad}} \rho) + M \cdot \beta_{0 \text{ ad}} / \rho_0 \quad \text{-----} \quad (2)$$

$$L_f = K (\beta_{\text{ad}})^{1/2} \quad \text{-----} \quad (3)$$

$$Z = u \cdot \rho \quad \text{-----} \quad (4)$$

$$R_A = \rho / \rho_0 \cdot (u_0 / u)^{1/3} \quad \text{-----} \quad (5)$$

$$H_n = n_1 / n_2 [1 - \beta_{\text{ad}} / \beta_{0 \text{ ad}}] \quad \text{-----} \quad (6)$$

“In the above relationships, u and ρ are the ultrasonic velocity and density of the solution respectively. ρ , ρ_0 and β_{ad} , $\beta_{0 \text{ ad}}$ are the density and adiabatic compressibility of the solution and solvent respectively. M is the molecular weight of the solute and C is the molar concentration of the solution. K is the Jacobson constant (temperature dependent constant), Z is the acoustic impedance, H_n is hydration number, n_1 and n_2 are the no. of moles of solvent and solute respectively”²⁴.

Results and Discussion

The densities (ρ), ultrasonic velocities (u) and other acoustic parameters of aqueous solutions of the mixed uni-univalent electrolyte systems (keeping CH_3COO^- one anion common in all the three mixed electrolyte systems): $\text{CH}_3\text{COONa} + \text{NaNO}_3$, $\text{CH}_3\text{COONa} + \text{NaBr}$, $\text{CH}_3\text{COONa} + \text{NaCl}$, have been determined as a function of fraction of ionic strength (y) due to the first electrolyte in the mixture of two electrolytes of constant ionic strength, $\mu = 1.0$ and $\mu = 2.0$. The data's have been presented in Table 1 and 2.

Table 1& 2 shows that the ultrasonic velocity (u) increases with y in the following mixed electrolyte systems: $\text{CH}_3\text{COONa} + \text{NaNO}_3$, $\text{CH}_3\text{COONa} + \text{NaCl}$, $\text{CH}_3\text{COONa} + \text{NaBr}$. The increase in ultrasonic velocity (u) with y may be due⁸ the structure making properties of the first electrolyte in these mixed systems.

The adiabatic compressibility (β_{ad}) (Table 1 and 2) of all the uni-univalent mixed electrolyte systems is found to be less than that of pure solvent which is in agreement with the previous workers¹³. Adiabatic compressibility, β_{ad} is a measure of intermolecular association or dissociation. It also determines the orientation of the solvent molecules around the solute molecules. Further, it is seen that the β_{ad} of the mixed systems: $\text{CH}_3\text{COONa} + \text{NaNO}_3$, $\text{CH}_3\text{COONa} + \text{NaCl}$, CH_3COONa , β_{ad} decreases with y . The decrease in β_{ad} with y may be attributed¹³⁻¹⁴ to the structure making or breaking properties of the first electrolyte in these mixed systems. Ultrasonic waves are high frequency mechanical waves. Their velocities in medium depend inversely on compressibility of the medium reported by Hykes et al¹⁵. The rapid decrease of adiabatic compressibility, with increase of first electrolyte concentration, clearly indicates the formation of a large number of tightly bound systems. Since the velocity increases with concentration and the density does so, the compressibility must decrease with increase in concentration. Such reduction in compressibility has been found in the solution due to solute molecules. The decreased compressibility brings the molecules to a closer packing resulting in a decrease of intermolecular free length.

The inter molecular free length (L_f) (Table 1 and 2) decreases with increase in ultrasonic velocity (u) of all the mixed electrolyte systems. This conclusion is supported by the earlier studies^{14,24}. At lower concentration of CH_3COONa in the mixture of $\text{CH}_3\text{COONa} + \text{NaNO}_3$, $\text{CH}_3\text{COONa} + \text{NaCl}$, $\text{CH}_3\text{COONa} + \text{NaBr}$, the molecules are not closer and thus inter molecular free length, L_f is high.

But as the concentration of CH₃COONa in mixed aqueous solution increases, the molecules come closer and segment- segment interaction will exist, thereby decreasing the L_f and hence internal pressure decreases.

A continuous decrease in β_{ad} or L_f is a clear evidence for the existence of strong interactions. Such strong interaction may be due to dipole- dipole, ion - dipole, H-bonding, etc

The acoustic impedance (Z) (Table 1 and 2) increases with ionic strength of first electrolyte (y) in the following mixed electrolyte systems: CH₃COONa + NaNO₃, CH₃COONa + NaCl, CH₃COONa + NaBr, mixed electrolyte systems the acoustic impedance decreases with y. The increase in the value of acoustic impedance (Z) with y supports²¹ the structure making property of the first electrolyte in these mixed systems. The values of acoustic impedance, Z increase with increasing CH₃COONa concentration are in agreement with the results of Mehrotra^{16,17}, which indicates that there is a significant interaction between ion- ion and ion- solvent molecules which considerably affect the structural arrangement. “The increase in the values of specific acoustic impedance, Z with increasing CH₃COONa concentration, can be explained on the basis of hydrophilic interaction between the solute – solute and solute- solvent molecules, which increases the intermolecular distance, making relatively wider gaps between the molecules and becoming the main cause of impedance in the propagation of ultrasonic waves”²⁴.

Table 1and 2 shows that in the mixed electrolyte systems: CH₃COONa + NaNO₃, CH₃COONa + NaCl, CH₃COONa + NaBr, the relative association constant (R_A) decreases with y (at ionic strength μ = 1.0 and 2.0), signifies¹⁴ a decrease in the solvation of the first electrolyte in these mixed systems.

The apparent molar compressibility (Φ_k⁰) has been calculated from ultrasonic velocity (u) and density (ρ) data (at ionic strength μ=1.0 and 2.0). For a single electrolyte system the concentration-dependence of the apparent molar compressibility (Φ_k⁰) is given by the following relation¹⁸

$$\Phi_k = \Phi_k^0 + S_k \sqrt{c}$$

From the above relation it follows that the variation of Φ_k⁰ with √c must be linear. However in the present study of uni-univalent mixed electrolyte systems, the plots of Φ_k versus y are found to be linear. From this it follows that the variation of Φ_k⁰ with y is linear and governed by the following relation

$$\Phi_k = \Phi_k^0 + S_k . y$$

From the intercept and slope of these linear plots the values of Φ_k⁰ and S_k have been obtained.

A perusal of Table shows that the values of Φ_k are negative in the following mixed electrolyte systems: CH₃COONa + NaNO₃, CH₃COONa + NaCl, CH₃COONa + NaBr, which signify^{19,20} the loss of compressibility of the surrounding water molecules due to strong electrostrictive forces in the vicinity of ions of mixed electrolyte systems causing electrostrictive solvation of the electrolytes.

A perusal of Table 1and 2 shows that for all the mixed electrolyte systems containing Na⁺ the values of H_n, lies between 5-8. These results are supported by the values of S_n reported in literature²². Further the values of H_n increases with increase in the concentration of CH₃COONa²⁶.

Conclusion

A survey of authors` scientific investigations in the field ultrasound velocity measurements in electrolyte solutions and various liquid systems is presented.

Various acoustic parameters; viz. specific acoustic impedance, Z, apparent molal compressibility, Φ_k and hydration number, H_n increase, while adiabatic compressibility, β_{ad} inter-molecular free-length, L_f and relative association number , R_A decreases with increase in concentration of CH₃COONa, irrespective of the total concentration of the solution and the second electrolyte taken in the mixed electrolyte system. At any given concentration, the different acoustic parameters increases or decreases, this indicates the structure promoting nature of Na⁺ is balanced and subdued by the presence of different anions consistent with the behavior of anion disrupting the hydrogen bonded structure of water.

From the above study, it may be concluded that the existence of intermolecular interaction of ionic, hydrophilic nature exist in the system studied. It indicate the presence of strong ion-dipole interactions. The strength of the solute-solvent interaction depends on concentration, size, charge, symmetry of charge distribution of the ion and polarity of the medium. These investigations can be used to analyse the primary and secondary sheath of solvation.

Similar ion - solvent interaction has been discussed earlier¹⁴ which support our present study.

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Grateful thanks are extended to Dr. Mithlesh Shukla and Dr. Mukhtar Singh for their precious and valuable guidance.

Table 1: Densities(ρ), ultrasonic velocities(u) and other acoustic parameters of mixed electrolyte systems in aqueous solution as a function of the fraction of ionic strength(y) due to the first electrolyte in the mixture of two electrolytes at constant ionic strength, μ= 1.0 at temperature 298.15 K

CH ₃ COONa + NaNO ₃ Mixed electrolyte system
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Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ² sec ⁻¹	$\text{\AA}$ L_f	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 1.0	0	1.048	1.5521	39.61	16.27	0.3934	-389.95	1.04	6.41
0.05 + 0.95	0.05	1.0466	1.5551	39.51	16.28	0.3929	-382.1	1.04	6.5
0.1 + 0.9	0.1	1.0456	1.5569	39.46	16.28	0.3926	-371.02	1.04	6.53
0.2 + 0.8	0.2	1.044	1.564	39.16	16.33	0.3911	-370.7	1.03	6.84
0.25 + 0.75	0.25	1.0431	1.568	38.99	16.36	0.3903	-372.11	1.03	7.01
0.3 + 0.7	0.3	1.0392	1.571	38.99	16.37	0.3903	-342.93	1.03	6.97
0.5 + 0.5	0.5	1.0331	1.5819	38.68	16.5	0.3887	-300.19	1.02	7.2
0.75 + 0.25	0.75	1.0334	1.5967	37.92	16.52	0.3849	-324.37	1.02	7.96
0.8 + 0.2	0.8	1.033	1.6003	37.8	16.53	0.3843	-318.52	1.01	8.06
0.9 + 0.1	0.9	1.0317	1.606	37.58	16.57	0.3831	-311.56	1.01	8.25
0.95 + 0.05	0.95	1.031	1.609	37.47	16.59	0.3826	-307.83	1.01	8.34
1.0 + 0.0	1	1.03	1.6116	37.38	16.6	0.3821	-300.8	1.01	8.41
Pure solvent	-----	0.996	1.4936	45.01	-----	-----	-----	-----	-----

CH₃COONa + NaBr Mixed electrolyte system

Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ² sec ⁻¹	$\text{\AA}$ L_f	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 1.0	0	1.0602	1.5232	40.65	16.15	0.3985	-260.2	1.06	5.14
0.05 + 0.95	0.05	1.0596	1.5267	40.49	16.18	0.3977	-265.98	1.06	5.32
0.1 + 0.9	0.1	1.0577	1.5321	40.28	16.21	0.3967	-270.9	1.05	5.54
0.2 + 0.8	0.2	1.0551	1.5409	39.92	16.26	0.3949	-280.15	1.05	5.93
0.25 + 0.75	0.25	1.054	1.544	39.8	16.27	0.3943	-279.68	1.05	6.05
0.3 + 0.7	0.3	1.051	1.551	39.55	16.3	0.3931	-283.63	1.04	6.31
0.5 + 0.5	0.5	1.0458	1.5675	38.92	16.39	0.3899	-293.14	1.03	6.95
0.75 + 0.25	0.75	1.0383	1.5895	38.12	16.5	0.3859	-301.8	1.02	7.73
0.8 + 0.2	0.8	1.0371	1.5939	37.95	16.53	0.385	-305.87	1.02	7.9
0.9 + 0.1	0.9	1.0334	1.6045	37.59	16.58	0.3832	-310.16	1.01	8.24
0.95 + 0.05	0.95	1.032	1.6092	37.42	16.61	0.3823	-313.33	1.01	8.4
1.0 + 0.0	1	1.0314	1.612	37.31	16.63	0.3818	-314.12	1.01	8.5
Pure solvent	-----	0.996	1.4936	45.01	-----	-----	-----	-----	-----

CH ₃ COONa + NaCl Mixed electrolyte system									
Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ⁻² sec ⁻¹	L_f Å	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 1.0	0	1.0347	1.5584	39.79	16.12	0.3943	-431.54	1.02	6.28
0.05 + 0.95	0.05	1.0346	1.5612	39.66	16.15	0.3936	-426.56	1.02	6.41
0.1 + 0.9	0.1	1.0344	1.564	39.52	16.18	0.3929	-422.13	1.02	6.55
0.2 + 0.8	0.2	1.034	1.57	39.24	16.23	0.3915	-412.72	1.02	6.83
0.25 + 0.75	0.25	1.0337	1.572	39.15	16.25	0.391	-403.37	1.02	6.9
0.3 + 0.7	0.3	1.0327	1.5744	39.07	16.26	0.3906	-354.31	1.02	6.91
0.5 + 0.5	0.5	1.0324	1.5853	38.54	16.37	0.388	-370.89	1.02	7.46
0.75 + 0.25	0.75	1.0319	1.5976	37.97	16.49	0.3851	-390.58	1.01	8.04
0.8 + 0.2	0.8	1.0316	1.6008	37.83	16.51	0.3844	-350.63	1.01	8.1
0.9 + 0.1	0.9	1.0312	1.606	37.6	16.56	0.3832	-319.8	1.01	8.25
0.95 + 0.05	0.95	1.031	1.6088	37.47	16.59	0.3826	-313.84	1.01	8.35
1.0 + 0.0	1	1.0308	1.6116	37.35	16.61	0.382	-307.41	1.01	8.45
Pure solvent	-----	0.996	1.4936	45.01	-----	-----	-----	-----	-----

Table 2: Densities(ρ), ultrasonic velocities(u) and other acoustic parameters of mixed electrolyte systems in aqueous solution as a function of the fraction of ionic strength(y) due to the first electrolyte in the mixture of two electrolytes at constant ionic strength, $\mu=2.0$ at temperature 298.15 K

CH ₃ COONa + NaNO ₃ Mixed electrolyte system									
Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ⁻² sec ⁻¹	L_f Å	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 2.0	0	1.0967	1.5984	35.69	17.49	0.3734	-308.99	1.08	5.33
0.1 + 1.9	0.1	1.0945	1.601	35.65	17.5	0.3731	-294.5	1.07	5.31
0.2 + 1.8	0.2	1.0933	1.6036	35.57	17.5	0.3727	-284.23	1.07	5.32
0.3 + 1.7	0.3	1.0915	1.606	35.52	17.51	0.3725	-271.14	1.07	5.3
0.5 + 1.5	0.5	1.088	1.6124	35.35	17.52	0.3716	-248.64	1.06	5.32
0.8 + 1.2	0.8	1.0825	1.6192	35.23	17.52	0.371	-207.57	1.06	5.26
1.0 + 1.0	1	1.0794	1.6244	35.11	17.53	0.3703	-183.48	1.05	5.24
1.2 + 0.8	1.2	1.0762	1.6296	34.99	17.53	0.3697	-159.2	1.05	5.22
1.5 + 0.5	1.5	1.072	1.6374	34.79	17.54	0.3687	-125.06	1.04	5.2
1.8 + 0.2	1.8	1.0662	1.6452	34.65	17.54	0.3679	-84.35	1.04	5.14
1.9 + 0.1	1.9	1.0651	1.6478	34.58	17.55	0.3675	-73.8	1.03	5.13
2.0 + 0.0	2	1.061	1.6504	34.6	17.56	0.3676	-52.02	1.03	5.06
Pure Solvent	----	0.996	1.4936	45.01	-----	-----	-----	-----	-----

CH ₃ COONa + NaBr Mixed electrolyte system									
Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ⁻² sec ⁻¹	L_f Å	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 2.0	0	1.125	1.584	35.43	17.82	0.372	-305.05	1.11	5.43
0.1 + 1.9	0.1	1.122	1.5867	35.4	17.8	0.3719	-292.27	1.1	5.41
0.2 + 1.8	0.2	1.119	1.5895	35.37	17.79	0.3717	-279.50	1.1	5.39
0.3 + 1.7	0.3	1.115	1.5935	35.32	17.77	0.3714	-265.46	1.1	5.37
0.5 + 1.5	0.5	1.1096	1.5993	35.23	17.75	0.371	-242.76	1.09	5.35
0.8 + 1.2	0.8	1.1001	1.6091	35.11	17.7	0.3703	-204.8	1.08	5.3
1.0 + 1.0	1	1.0933	1.6159	35.03	17.67	0.3699	-178.44	1.07	5.26
1.2 + 0.8	1.2	1.0872	1.6225	34.94	17.64	0.3694	-154.2	1.06	5.23
1.5 + 0.5	1.5	1.0787	1.6338	34.73	17.62	0.3683	-123	1.05	5.22
1.8 + 0.2	1.8	1.0674	1.6434	34.69	17.54	0.3681	-76.98	1.04	5.1
1.9 + 0.1	1.9	1.0651	1.6463	34.64	17.53	0.3679	-66.78	1.04	5.09
1.0 + 0.0	2	1.061	1.6504	34.6	17.51	0.3676	-52.02	1.03	5.06
Pure solvent	----	0.996	1.4936	45.01	-----	-----	-----	-----	-----

CH ₃ COONa + NaCl Mixed electrolyte system									
Conc. Of first electrolyte + second electrolyte	Fraction of ionic strength of first electrolyte (y)	ρ gm c.c ⁻¹	$u \cdot 10^{-5}$ cm sec ⁻¹	$\beta_{ad} \cdot 10^{12}$ cm ² dyne ⁻¹	$Z \cdot 10^{-4}$ gm.cm ⁻² sec ⁻¹	L_f Å	$\Phi_k \cdot 10^{11}$ cm ² mol ⁻¹	R_A	H_n
0.0 + 2.0	0	1.07	1.6113	36	17.24	0.375	-352.86	1.05	5.29
0.1 + 1.9	0.1	1.0699	1.6128	35.93	17.26	0.3747	-338.61	1.05	5.29
0.2 + 1.8	0.2	1.0697	1.616	35.8	17.29	0.3739	-327.12	1.05	5.32
0.3 + 1.7	0.3	1.069	1.6172	35.77	17.29	0.3738	-309.51	1.05	5.29
0.5 + 1.5	0.5	1.0685	1.621	35.62	17.32	0.373	-280.82	1.04	5.29
0.8 + 1.2	0.8	1.0673	1.6269	35.4	17.36	0.3719	-236.57	1.04	5.26
1.0 + 1.0	1	1.0663	1.6308	35.26	17.39	0.3711	-206.25	1.04	5.24
1.2 + 0.8	1.2	1.0657	1.636	35.06	17.43	0.3701	-179.83	1.04	5.25
1.5 + 0.5	1.5	1.0647	1.6406	34.9	17.47	0.3692	-132.98	1.04	5.18
1.8 + 0.2	1.8	1.0633	1.6465	34.69	17.51	0.3681	-87.77	1.03	5.13
1.9 + 0.1	1.9	1.063	1.6484	34.62	17.52	0.3677	-73.07	1.03	5.12
1.0 + 0.0	2	1.061	1.6504	34.6	17.53	0.3676	-52.02	1.03	5.06

Pure solvent	-----	0.996	1.4936	45.01	-----	-----	-----	-----	---
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Chapter-13

Corrosion Inhibition of Mild Steel Using Rhoeo Discolor Leaves Extract in Different Concentration of Acid (HCl) with Different Temperature

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Abstract

A study of naturally occurring Rhoeo discolors plant extract of corrosion inhibition on mild steel in HCl solution. Evaluated by potentio-dynamic polarization and electrochemical impedance methods. Different concentrations of inhibitor were added to the electrolyte. Inhibition efficiency and rate of corrosion has been determined with different temperature like 313K & 323K. When we add higher concentration of plant extract (0.5g/L) there was significantly decrease in the rate of corrosion at each temperature. As we observed when there is increase in temperature increasing in the corrosion rate which implies the kinetic activation in between metal and electrolyte.

Key Words: Inhibitor: Rhoeo Discolor: HCL

Introduction

Corrosion is destructive of metal either chemical or electrochemical method [1]. Destructive of metal takes place when painting, plating or storage of metal before that pre treatment of a metal under pickling and cleaning occurs for the finishing of metal surface with an acid [2-4]. We are attention to the industries and plants which were more concern to the steels or Iron based alloys. Most of the industries are getting shut down only due to the corrosion. There are so many methods of corrosion controlling corrosion Galvanization, Metal coating, etc[5].The best method to use control the corrosion is using Inhibitors in a small concentration. Inhibitors are organic molecules which mainly consisting of Nitrogen, Sulphur, Oxygen, aromatic and aliphatic compounds [6-8]. When we add small concentration to a electrolytic media it hinders the either anodic or cathodic and both. Inhibitors which adsorbed on a metal surface through pi electron cloud of the donar atoms and acts as a barrier between metal and the electrolyte solution [9]. Inhibitors are mainly occurs in two forms natural and synthetic. Synthetic inhibitors are overpriced, lethal and act to be a risk for environment and to the human [10-12] .Eg: some chromates and dichromates based molecules such as Zinc chromates are reported as toxic to both human and environment. Because of toxicity these inhibitors are banned or restricted to use. Natural inhibitors are easily available, Very cheap, biodegradable, no harmful to the society and human [13-15]. The method of extraction is also simple not required more chemicals and not a time consumable. Hence the researchers have been giving more focused towards the natural inhibitors.

It was reported by researchers some plant extract are more inhibition efficiency [16-24]. For eg, Khillab extract on mild steel in 1M HCl showed 99.21% and opuntia extract in aluminium in an acid reported 96% inhibition efficiency. Rhoeo discolor is a plant which belongs to the commanaliaece family, Species tradescentia spathecia, common name is boat lilly [25].

Our present study on Rhoeo discolors plant leaves extract by potentiodynamic and polarization study in higher temperature.

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Experimental Procedure

2.1 Preparation of Natural Products Extracts:

Roughly around 4-5 kg of plant extract leaves were collected and washed with distilled water thereafter set aside for drying for a day. The leaves were crushed in a grinder it has a thin liquid. It was then placed in a separating funnel by adding 70% of ethanol for a night. The green color extract was filtered by using filter paper, washed with double distilled water, kept for 6-7 days at room temperature. The dried extract was the powdered and used as inhibitor.



Plant Plant Extract Inhibitor

2.2 Preparation of Test Medium.

Hydrochloric acid 0.5M (43.1 ml) was taken out from the flask and transferred to the volumetric flask by proper addition to make it diluted using double distilled water up to 1000 ml. The 0.5M HCl was standardized by 0.5M NaOH solution (standardized by oxalic acid) using phenolphthalein indicator.

2.3 Preparation of Specimens

The Mild steel was cut into Cylinder shape in the dimension of 4 X 2.04cm² (exposed part dimension was 2.04cm²) Different grade of sand paper where used to polish the metal bars in the range of 160 to 1500. (i.e. from coarser to finer). The metal bars were scrupulously wipe with de ionized water and rinsed with acetone, and kept it for dry.

2.1.1 Electrochemical measurements

Version 5.14 software of Gill AC (ACM Instrument) was used for all electrochemical measurements which consist of conventional three electrodes glass cell. Mild steel rod was used as working electrode, while platinum and standard calomel electrode (SCE) were used as counter and reference electrode respectively. The potential was measured and reported with respect to the reference electrode. Before each trial, the working electrode was polished and immersed in the medium till steady state open circuit potential was attained. Polarization and electrochemical impedance performed immediately after electrochemical impedance spectroscopy (EIS) studies on the same electrode in the same medium without any further surface treatment.

2.1.1.a. Potentiodynamic polarization studies

The working electrode area of 2.04 cm² mild steel specimen was exposed to 0.1M HCl solution. Calomel electrode is used as a reference electrode and all electrochemical measurement were carried at room temperature (30±1⁰ C) using 100ml of 0.1M HCl. Before each method of EIS for attaining stable state the electrode kept in solution for the period of 30 minutes at open circuit potential in potentiodynamic studies. Potentiodynamic polarization curves were recorded from -2.5 mV to +2.5 mV around the OCP with scan rate 1mv/sec. All potential investigated were with reference to SCE. The value of related electrochemical corrosion kinetic parameters i.e corrosion current density (i_{corr}) cathodic and anodic tafel slopes (b_c –barrier potential of cathode & b_a -barrier potential of anode) were got by extrapolation of polarization curves.

2.1.1.b. Electrochemical Impedance Studies (EIS)

The Electrochemical measurement along with EIS were implement out with potentiostat interfaced with a Computer OCP Vs Time. Potentiodynamic polarization curves were reported in acceptance with the Gill AC. The OCP was measured for 30min before begging the EIS which was carried out at frequency range 0.01-

1,00,000 Hz in open circuit potential and potential range - 2.5 to + 2.5 mV and Scan rate 1mV/sec. Finally the impedance plots were made by scanning the potential from negative to the positive OCP.



Instrumentation Setup for Potentiodynamic Polarization & Impedance.

Results and Discussion

3.1 Potentiodynamic polarization studies

Corrosion rate were calculated using

$$CR = \frac{k \times E \times i_{corr}}{\rho}$$

ρ

CR indicates rate of corrosion in mm y^{-1} (millimeter per year), k is a constant that refers the unit of corrosion rate and has a constant value of 3272, where E is the equivalent weight of the corroding alloy, i_{corr} which implies the corrosion current density in mA cm^2 and finally ρ is the density of the alloy in kg m^{-3} .

The following equation is used for IE with different concentration of inhibitor.

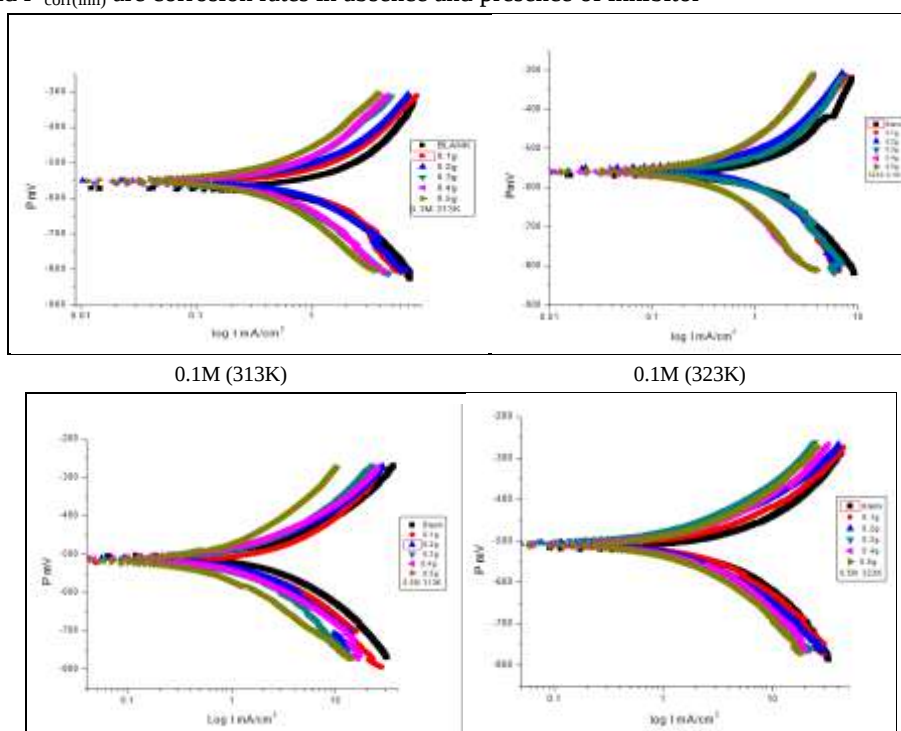
$$IE (\%) = \frac{i_{corr} - i_{corr}^*}{i_{corr}} \times 100$$

Where i_{corr} and i_{corr}^* are corrosion current in the absence and presence of plant extract.

$$\text{Surface Coverage } \theta = \frac{i_{(corr)} - i_{(corr)}^*}{i_{(corr)}}$$

$$\% IE = \theta \times 100$$

Where, i_{corr} and i_{corr}^* are corrosion rates in absence and presence of inhibitor



0.5M (313K)

0.5M (323K)

Figure 1. Potentiodynamic polarization curves of mild steel in 0.1M & 0.5M HCl at 313K & 323K in presence and absence of various dosage of plant extract.

On observing Table 1 & 2. We found not much difference between values of β_a and β_c . This showed that inhibitor controlled both anodic and cathodic reactions. The I_{corr} values decreased indicating inhibitor adsorption on metal surface that hindered the metal contact with an acid [26].

As seen in Figure 1. the inhibition efficiency has direct proportion to the dosage of the inhibitor. This is chiefly due to a thin coat of barrier film preventing the formation of acidic environment on the metal surface [27]. In presence of Rhoem discolor plant extract, the corrosion potential was shifted to positive potential but did not change significantly with respect to the concentration of inhibitor. It was therefore evident that extract of Rhoem plant is a effective inhibitor of corrosion of mild steel in HCl media by influencing both anodic and cathodic reaction [28].

Table-1 Mild steel in 0.1-0.5M (313K) with Rheo Discolor extract of polarization method

Con. Of Acid	Concn Inhibitor g/L	Of In	I_{Corr} (Ma/Cm ²)	Tafel Slope (Mv/Decade)		Corrosion Rate	θ Surface Coverage	Inhibition Efficiency (%)
				β_a	β_c			
0.1M	Blank		1.8341	262.96	304.96	1.88		
	0.1		1.3555	236.14	259.3	1.39	0.2609	26.09
	0.2		1.133	212.96	240.69	1.16	0.3822	38.22
	0.3		0.7179	206.38	233.77	0.73	0.6085	60.85
	0.4		0.6863	226.29	247.17	0.7	0.6257	62.57
	0.5		0.5531	209.42	257.12	0.56	0.698	69.8
0.2M	Blank		2.9418	248.14	305.57	3.021		
	0.1		1.9964	215.11	207.69	2.05	0.3213	32.13
	0.2		1.8481	205.04	229.42	1.89	0.3717	37.17
	0.3		1.5112	172.97	219.84	1.55	0.4863	48.63
	0.4		1.0325	227.27	229.28	1.06	0.649	64.9
	0.5		0.8884	176.37	213.75	0.91	0.698	69.8
0.3M	Blank		4.039	248.56	244.36	4.14		
	0.1		3.9857	171	195.9	4.09	0.0131	1.31
	0.2		3.0324	119.15	173.48	3.11	0.2492	24.92
	0.3		2.3802	170.97	249.86	2.44	0.4106	41.06
	0.4		1.9007	186.14	219.83	1.95	0.5294	52.94
	0.5		1.1015	193.94	226.12	1.13	0.679	67.9
0.4M	Blank		4.3534	205.53	233.22	4.47		
	0.1		3.1187	164.69	209.25	3.2	0.2835	28.35
	0.2		2.1635	206.33	206.6	2.21	0.503	50.3
	0.3		1.8791	179.53	189.23	1.92	0.5683	56.83
	0.4		1.615	168.71	200.09	1.65	0.629	62.9
	0.5		1.2527	176.7	233.04	1.28	0.6776	67.76
0.5	Blank		4.0491	195.66	219.76	4.75		
	0.1		3.6709	163.22	201.4	3.77	0.093	9.3
	0.2		2.8671	192.75	201.33	2.94	0.2919	29.19
	0.3		2.4176	165.3	210.23	2.48	0.4029	40.29
	0.4		2.3384	179.88	238.99	2.4	0.4224	42.24
	0.5		1.3711	150.49	183.2	1.1	0.6613	66.13

Table-2. Mild steel in 0.1-0.5M HCl (323K) with Rheo Discolor extract of polarization method

Con. Of Acid	Concn Inhibitor g/L	Of In	I_{Corr} (Ma/Cm ²)	Tafel Slope (Mv/Decade)		Corrosion Rate	θ Surface Coverage	Inhibition Efficiency (%)
				β_a	β_c			
0.1M	Blank		1.804	250.02	225.02	1.852		
	0.1		1.3674	213.93	240.17	1.404	0.242	24.2
	0.2		1.2696	221.22	223.51	1.3	0.2962	29.62
	0.3		1.1779	224.66	269.66	1.2	0.347	34.7
	0.4		0.6312	232.25	271.87	0.64	0.6501	65.01

	0.5	0.5908	247.34	257.46	0.6	0.6725	67.25
0.2M	Blank	3.8831	230.8	241.57	3.98		
	0.1	3.278	221.7	234.74	3.36	0.1558	15.58
	0.2	2.7872	239.6	245.45	2.86	0.2822	28.22
	0.3	2.6508	223.44	225.41	2.72	0.3173	31.73
	0.4	2.0259	224.36	356.3	2.08	0.4782	47.82
	0.5	1.6995	172.74	236.49	1.74	0.5623	56.23
0.3M	Blank	3.4931	198.18	244.91	3.58		
	0.1	3.4221	205.26	217.09	3.51	0.0203	2.03
	0.2	3.2001	203.61	197.5	3.28	0.0838	8.38
	0.3	3.0059	195	218.56	3.08	0.1394	13.94
	0.4	2.6076	181.62	222.16	2.67	0.2534	25.34
	0.5	2.1036	163.36	209.47	2.48	0.5573	55.73
0.4M	Blank	4.3368	154.26	197.42	4.45		
	0.1	3.8036	199.17	193.35	3.9	0.01229	12.29
	0.2	3.5721	152.7	201.07	3.66	0.1763	17.63
	0.3	3.3539	141.53	163.98	3.44	0.2266	22.66
	0.4	3.3245	138.28	172.45	3.41	0.2324	23.24
	0.5	2.3351	158.53	200.27	3.37	0.4615	46.15
0.5	Blank	5.3209	164.06	224.53	5.46		
	0.1	4.4456	149.71	202.93	4.56	0.1645	16.45
	0.2	4.2169	136.57	165.87	3.26	0.2074	20.74
	0.3	3.8847	165.87	210.13	3.24	0.2699	26.99
	0.4	3.4489	161.58	200.42	2.76	0.3518	35.18
	0.5	2.8718	158.13	193.93	2.56	0.4602	46.02

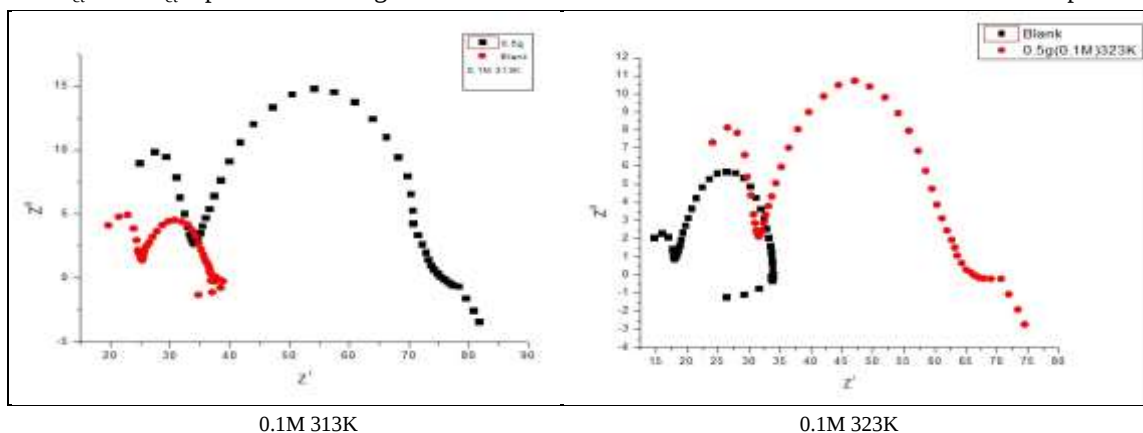
3.2 Electrochemical impedance spectroscopy (EIS) studies

The mechanism of corrosion and inhibition can be carried out a powerful technique is an EIS. The impedance spectra of mild steel in HCl medium in the absence and presence of various concentrations of plant extract.

For impedance study the following equation is used to calculate the IE

$$IE(\%) = \frac{R_{ct} - R_{ct}^0}{R_{ct}} \times 100$$

Where R_{ct} and R_{ct}^0 represent the charge transfer resistances in the with and without of the inhibitor respectively.



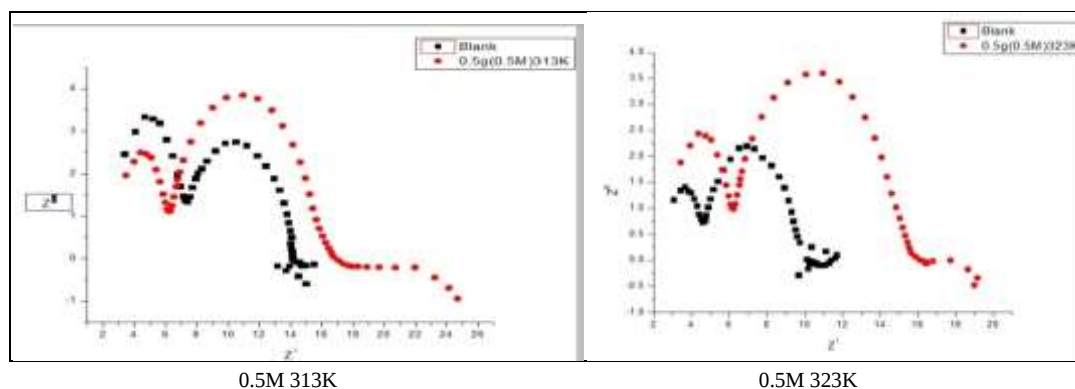


Figure 2. Nyquist plots of mild steel in 0.1 & 0.5 M HCl at 313K & 323K with different dosage of plant extract.

Table 3: Mild steel in 0.1 to 0.5M HCl at room temperature (313K) with Rheo Discolor extract by Electrochemical Impedance.

Concentration Of Acid	Concentration Of Rheo.Plant In g/L	R_t ($\Omega \text{ cm}^2$)	C_{dl} ($\mu\text{F}/\text{cm}^2$)	Inhibition Efficiency (%)
0.1M	Blank	11.92	2.725×10^{-4}	
	0.1	19.63	2.54	39.27
	0.2	22.85	2.173	47.83
	0.3	36.15	2.075	67.02
	0.4	38.47	1.707	69
	0.5	41.85	1.504	71.51
0.2M	Blank	10.23	4.14	
	0.1	12.7	2.9	19.44
	0.2	17.8	2.27	42.52
	0.3	19.5	1.987	47.53
	0.4	20.8	1.704	50.81
	0.5	32	1.56	68
0.3M	Blank	5.61	4.59	
	0.1	6.92	3.26	18.9
	0.2	8.86	3.13	36.6
	0.3	14.8	2.85	62.08
	0.4	15.2	2.55	63.09
	0.5	17.7	1.97	68.3
0.4M	Blank	7.24	4.91	
	0.1	8.51	4.34	14.92
	0.2	9.78	3.231	25.97
	0.3	10.1	3.17	28.31
	0.4	11.8	3	38.64
	0.5	18.2	2.28	60.21
0.5M	Blank	4.8	6.59	
	0.1	7.38	4.97	34.9
	0.2	7.95	4.43	39.6
	0.3	9.96	4.3	51.8
	0.4	10.5	3.92	54.2
	0.5	11.5	3.68	58.26

Table 4: Mild steel in 0.1 to 0.5M HCl at room temperature (323K) with Rheo Discolor extract by Electrochemical Impedance.

Concentration Of Acid	Concentration Of Rheo.Plant In g/L	R_t ($\Omega \text{ Cm}^2$)	C_{dl} ($\mu\text{F}/\text{Cm}^2$)	Inhibition Efficiency (%)
0.1M	Blank	16.79	3.875	
	0.1	17.31	3.37	3
	0.2	17.48	3.318	3.9
	0.3	24.6	3.194	31.7
	0.4	29.87	2.908	43.7
	0.5	47.34	2.665	64.5
0.2M	Blank	7.71	4.69	
	0.1	9.38	4.15	17.8
	0.2	12	3.87	35.75
	0.3	15.6	3.13	50.64
	0.4	17.6	2.732	56.19
	0.5	21.1	1.56	63.4
0.3M	Blank	6.9	3.68	
	0.1	9.24	3.61	25.32
	0.2	9.9	3.44	30.3
	0.3	9.93	3.25	30.51
	0.4	11.1	3.19	37.83
	0.5	13.3	2.85	48
0.4M	Blank	6.61	6.02	
	0.1	7.23	5.25	8.5
	0.2	7.27	5.18	9.07
	0.3	7.37	4.04	10.31
	0.4	7.85	4.02	15.58
	0.5	12.48	3.64	47.03
0.5M	Blank	5.51	5.51	
	0.1	5.76	4.18	4.3
	0.2	6.501	3.97	15.2
	0.3	7.58	3.716	27.3
	0.4	7.59	3.13	27.4
	0.5	9.62	2.65	42.7

As we observed in Table 3 & 4 value of R_{ct} increased and C_{dl} value decreased with concentration of inhibitor is due to the dielectric constant and increase of thickness of the electric double layer. It could be also be assumed that decrease in C_{dl} value is affected by replacement of water molecule on the surface with inhibitor [29-30]. In Figure 2 all plots show a two stage profile. a) A large semicircular capacitive loop at high frequency (HF) and then b) A small inductive loop at low frequency (LF). The transfer of charged ions between the mild steel and electrolyte causes the HF capacitive loop while relaxation process due to adsorption species Cl_{ads} and H_{ads} on the surface of electrode is the cause of LF inductive loop [31]. Similar graphs for other customized dosage show that the insertion of inhibitor does not have any bearing on corrosion mechanism. The double layer behavior and charge transfer process control corrosion reaction [32]. Other cause could be the adsorption of inhibitor or intermediate corrosion reaction on the surface of electrode. As dosage of extract increased the raised of nyquist diagram besides the increases of low frequency value as well as phase angle at high frequency. It showed mitigation of corrosion reaction through blocking of active sites which stems from approaching and adsorption of inhibitor molecule on the surface of mild steel.

3.3 Effect of temperature

The experiment is carried out with different temperature ranging from 313K & 323K using potentiodynamic alongside polarization studies. We observed that value obtained from both experiments show that increasing temperature increases the corrosion rate and decrease the inhibition efficiency. Because at higher temperature reaction of both anodic and cathodic accelerates particular in media of H_2 gas evolution in acidic environment.

Arrhenius equation tells about mutual relation between temperature and corrosion rate i.e

$$\text{Slope} = \frac{E_a}{R}$$

R

E_a-Activation energy, R- Gas constant,

$$\therefore E_a = \text{Slope} \times R$$

Here we have taken different concentration of inhibitor from lower to higher and also absence of inhibitor. The activation energy value depends on the corrosion rate of mild steel when it is contact with acid. The activation energy of corrosion rate without inhibitor is -11.91K J/mol but in presence of inhibitor i.e lower concentration to higher concentration the values -0.16 KJ/mol to 1.24 KJ/mol which conclude that adsorption of inhibitor molecule on the surface of mild steel is physisorption. (For physical adsorption it is expected value of E_a should be less than 80.00KJ/mol [33-34].

Table 5 :Activation parameters of mild steel in 0.1 M HCl in the absence and presence of 313K

0.1M (313K)	E _a (KJ/mol)	ΔH (KJ/mol)	ΔS (J mol ⁻¹ K ⁻¹)
0.1g/L	-11.917	1.09395	-639.037
0.2g/L	-0.1662	2.187	-445.66
0.3g/L	0.106	3.281	-0.798
0.4g/L	0.763	4.375	-0.6044
0.5g/L	1.2456	4.405	0.561

Activation Parameters

The activation parameter for the studies system (E_a,ΔH,and ΔS) were estimated from the Arrhenius equation and transition state equation

$$\text{TST} = \frac{-\Delta H}{R} = \text{slope}$$

R

$$\therefore -\Delta H = \text{Slope} \times R$$

$$\text{Intercept} = \ln \left(\frac{R}{Ln} + \frac{\Delta S}{R} \right)$$

$$\therefore \Delta S = R \left(\text{Intercept} - \ln \frac{R}{Nh} \right)$$

N-Avogadroes number,h is plank's constant, ΔH & ΔS are enthalpy and entropy changes of activation state complex, R is Universal Gas constant.

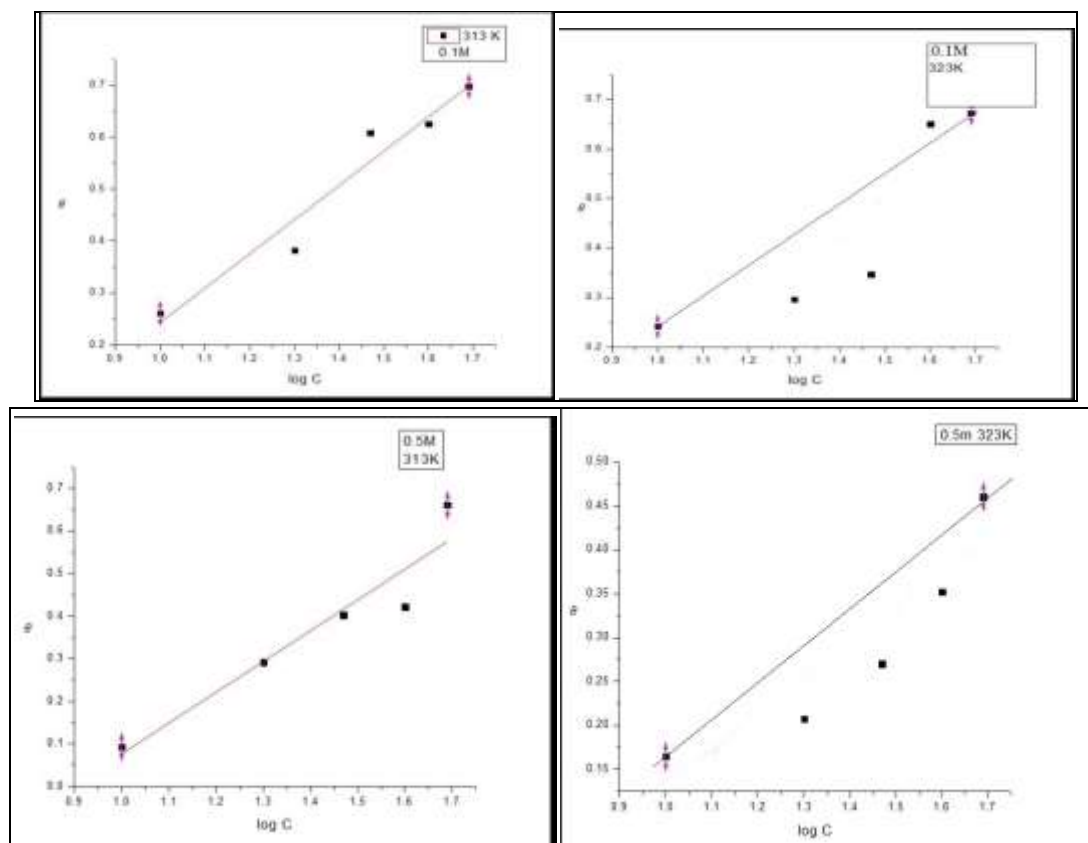
Temperature play a very important role in corrosion mechanism as temperature rises there is decrease in the inhibition efficiency of rhoeo discolor plant extract .As a concentration of inhibitor increases activation energy of metal /solution interface is also increases which suggested that physical adsorption on the mild steel surface [35] . Increasing in the activation energy dissolution of inhibitor would be more and accumulation of molecules on the surface which made barrier between metal and solution. The value of ΔH increases in the concentration of inhibitor which needs more energy for dissolution and it reflects endothermic reaction attain to achieve equilibrium [36].

Compare to blank solution (without inhibitor) the entropy activation value is increased in presence of inhibitor. The transition state of the rate determine recombination step represents a more orderly arranged relative to initial state, so increase in value of entropy of the activation is observed.

The presences of inhibitor however the rate determining step prevent discharge of H₂ ions and to form adsorbed hydrogen atoms. Since the surface is covered with inhibitor molecule, this will retard the discharge of hydrogen ions on the metal surface causing the system to have more random arrangement and hence free entropy of activation is higher. The presence of inhibitor increases the dis-ordering from being reactant to an activated complex [37].

Adsorption isotherm

When inhibitor thin coated on surface of metal it acts like barrier to metal to prevent the further rate of corrosion. This mechanism prevention to corrosion can be explained on the basis of behavior of adsorption molecule on the surface coverage. The techniques we used to determined the surface coverage by potentiodynamic and polarization studies.



0.5M 313K 0.5M 323K
0.1M 313K 0.1M 323K

Figure 3. Frumkin adsorption isotherm for mild steel in 0.1 & 0.5M HCl containing different concentrations of Rheoeo at 313K,323K

The experimental data were applied to various adsorption isotherm including Freundlich, Frumkin, Langmuir, Temkin and Flory-Huggins isotherm. A correlation between the surface coverage (Θ) and the inhibitor concentration (C) in an electrolyte can be represented by Frumkin adsorption in Figure 3.

$$\theta = \frac{1}{K_{ads}} + \log C$$

C defines concentration of inhibitor, K_{ads} is adsorption-desorption equilibrium constant and Θ is the surface coverage which is given by

$$\Theta = \frac{\% IE}{100}$$

Straight lines were obtained when Θ was plotted against $\log C$ (g/lit)

The linear relationship suggested that adsorption of inhibitor obeyed Frumkin adsorption isotherm.

Conclusion

The Rheoeo discolor plant extract acts as an efficient inhibitor on mild steel at various concentrations of HCl solution with different temperatures. It was observed that a dosage of 0.5 g/L showed higher inhibition efficiency in both potentiodynamic polarization and in Impedance method. Polarization graphs showed mixed type of inhibitor. And impedance graphs indicate the development of a barrier for mass and charge-transfer and can be interpreted as the formation of a protective layer on the electrode surface. It shows physisorption and it obeys Frumkin adsorption.

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Chapter-14

Software Bug Classification using Machine Learning and Deep Learning Approach

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Abstract

The manual approach of bug reports for technical detection is a time-consuming and much expensive method. Automated Machine Learning (ML) methods are reliable when it comes to finding solution with less knowledge. In most cases, the issues with the software domain define as a learning experience that depends on the different situations and adjusts accordingly. Using a machine learning algorithm, a statistical model is built, and divided into particularly non-defective modules. Machine learning models allow developers to collect valuable information after classification and to analyze data from various types of information. Machine learning methods are found useful in detecting software bugs. This research is used for software bug classification using various machine learning algorithms on publicly available data sets and offered a comparative output analysis of various machine learning techniques for software bug prediction. Our results demonstrate each machine learning outcome with classification accuracy and F-measure of each algorithm with real time twitter dataset.

Keywords: Deep Learning, Machine learning, bug classification, NLP

Introduction

In recent years, the error fixing phase in the corrective software maintenance is becoming an arduous task. Since software bugs recorded in broad applications systems (for example, open-source projects) are increasing enormously[1], the number of recorded bugs, for example, filed daily with the open-source Mozilla program averages 135[2]. A considerable number of new bugs submitted by various people every day is very large. It also raises the amount of research performed from the so-called bug triage, which identifies and analyzes these bugs within the context. The time and money is needed to assign a sufficient amount of gravity level and correct developer(s) that will repair those fixed bugs. With the wealth of open source software accessible for analysis, there's an experience to study the patterns of bugs that can lead directly from data to security vulnerabilities. In essence, software vulnerabilities are defined as operating system's defects being exploited illegally by unauthorized personnel. In the information engineering domain device vulnerability identification is an important area of study. This is partly because security vulnerabilities are continually disclosed. While previous studies shows that the utility of using multiple detection methods, models, and frameworks to identify software vulnerabilities, enhancing the efficacy of these detection models and tools remains a major challenge for researchers and practitioners alike. In this work, we present a data-driven security vulnerabilities detection approach using deep learning. It is motivated by the effectiveness of the model in these fields of study. We use a theoretical framework to investigate its feasibility within vulnerability detection domain. Dynamic analytics tools rely on detailed monitoring of runtime properties, including log files and memory, and require a wide range of representative test cases for the application to be used. Therefore, standard practices still rely heavily on domain knowledge to identify the most vulnerable part for intensive security inspection of a software system. With the wealth of open source code available for analysis, there is an opportunity to learn the patterns of bugs that can lead to security vulnerabilities directly from data. In this paper, we describes a data-driven approach to vulnerability detection using various machine learning approaches

Literature Review

According to [1], a innovative deep-learning branded version DeepLSTMPred, is used to convert a vector of actual numbers by understanding its semantic context, identifies lengthy-term correlations in concepts of deep short-term memory (LSTM) and classifies variables of short fixing periods or lengthy fixing times. DeepLSTMPred is checked against Mozilla Group error reports. Results shows that the proposed algorithm

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gives better than a state-of-the-art solution. After analyzing the six releases of Ubuntu campaign, they found a strong linear correlation between the amount of time spent on bug fixing and the number of people involved in bug fixing. The aim of these researchers is to uncover what kind of reported bug a developer can repair. This model receives the bug and the result is submitted as a list of a minimum team of engineers who can address the issue.

According to [2], use of an AUV, as that of the noise source to invert the target-independent SSP along with the location and amplitude of the AUV and the water column length. Based on the Doppler wavelength and time-domain theory, the forward methodology is established to calculate the replica field to integrate the effects of source motion. Considering the source frequency and water depth of this experiment, the adjacent Doppler-shifted wavelengths are hard to resolve. An empirical resolution of the forward method is obtained with arbitrary intervals of signal integration for a monochromatic source, moving radially relative to the receiver. The feasibility of using an Autonomous vehicle source for water column SSP alternation has been illustrated via model and innovative data management; the waveguide sensor model has proven to be highly more powerful compared to the model that would not recognize the Doppler waveform effect..

In [3], a correction method is suggested for a towed gradiometer of an airborne magnetic tensor consisting of four fluxgates arranged in a cross-shaped structure. The theoretical basis of the proposed method is based on the static error model and the dynamic characteristics of a single fluxgate, the characteristic that the gradient tensor of the geomagnetic field is approximately zero at high altitude, and the phenomenon that the unchanged tensor rotation due to no uniform magnetic field on the ground may imply the inconsistency of the scale factor. The actual results of the flight using a helicopter proved and confirmed the accuracy and efficacy of the proposed process. Both features guarantee the credibility and accuracy of the remedy of proposed method and are also good in consonance with conventional aeromagnetic survey geological conditions. They tried to solve the problem by establishing a review sharing platform where the informative feedback from s-projects can be equally spread to f-projects. To ensure the accuracy of shared feedback, they introduced a new computer clone detection model based on Convolutional Neural Network (CNN) and create appropriate "s-projects, f-projects" pairs via clone detection. Correctly, a semi-supervised learning technique based on an auto-encoder is used to reduce the difficulty of the dataset during training and testing. Furthermore, heuristic filtering strategies are applied to reduce the cost of time to improve the sharing experience. At the same time, the LDA (Latent Dirichlet Allocation) classification algorithm is used to tackle specific themes of study. They have implemented the sharing platform as a prototype RSharer+ framework, which consists of three representative modules: data preprocessing, application clone recognition and feedback presentation. The collected data sets are first converted into context-sensitive number vectors in the preprocessing of data. In the clone detection method, data vectors are trained and evaluated on the BigCloneBench and real code-review pairs.

Technology developments nowadays have contributed to the development of trial versions of software to compile client bug reports. Software engineers then managed the collected error reports to make consequent applications that are both more accurate and stable. However, the high recurrence of approaching bug reports forges the bug fixing process into a troubling & tedious process. Bug triage is an integral component of the issue management process and it deals with the selection of an appropriate software developer to handle reported bug so that the assigned developer can address the reported problem. Such methods use several classifiers to make a prediction, and have been shown to outperform traditional classification in machine learning. In this study author's had presented, an empirical analysis of ensemble-based approaches for classifying new incoming bug reports. They had studied five strategies for classifying the ensemble, namely Bagging, Boosting, Majority Voting, Average Voting and Stacking, using 25 different classifiers for machine learning as base classifiers. The experimental results showed that ensemble classifiers outperformed classic machine learning algorithms for selecting the correct developer to handle the bug report[5].

According to [6], three supervised machine learning algorithms are considered to construct the model and forecast the occurrence of software bugs based on historical data by deploying the Logistic Regression, Naïve Bayes and Decision Tree classifiers. Historical data has been used to predict the future software faults by deploying the classifier algorithms and make the models a better choice for predictions using random forest ensemble classifiers and validating the models with K-Fold cross validation technique which results in the model effectively working for all the scenarios. The significant factor taken into account in their research is the dispersal of developer-led changes. With respect to predictors commonly used in literature, the results obtained are more promising and high complement. It also shows that the results of a "hybrid" prediction model which combines predictors with existing ones.

In [7], Fuzzy Similarity Method is used to include a strategy for categorizing program problems. Similarity measures Factor is calculated for the Github bug data sets, and any non-bug classification bug is consumers depend on a user specified threshold rating. Several studies were conducted out and the precision, recall, performance, and F-measure specifications of the SLC classification model are correlated with other classifiers. SLC classification algorithm is much better in any way than other classification methods. The potential purpose of the proposed research is to apply the similarity measure principle for the classification system of software

defects by multi-label. This is proposed to identify the bugs as bugs or semi-bugs using a binary computer creative thinking using fuzzy semantic similarity. The fuzzy similarity of a software bug is measured and can be then assigned to bug or non-bug classification based on a user-defined predefined threshold of the bug.

In the system of [8], a novel hybrid approach is proposed which is centered on a diversified range of features and an intense learning machine (ELM) ensemble. Next, the useful information is extracted from the records of defects; then the data is pre-processed to create a vector space model (VSM); and the diversified range of features is pre-processed to pick a smallest set of reflective and no redundant features with maximum statistical data. Finally, an ELM teaching classifier based on GA ensembles is used. Experimental findings shows that the proposed ELM-based bug triage method with symbolic feature selection strategies greatly increases the efficiency of bug triages as opposed to SVM, C4.5, NaiveBayes and KNN classification models. Bug repositories play a very important role as they provide the software engineers around the world with a contact channel. Most error reports can be patched in time with such repositories. The introduction of an growing number of repositories of bugs effectively increases the application development efficiency. Repository bugs take many forms, such as

Deep learning applied to the identification of multi-class artifacts and exploration of convolutional neural networks (CNN) according to [9]. The convolutional neural map is formed using standard setup and trained with training set of sample images from nine distinct categories of objects plus sample test images utilizing widely varied dataset. All tests are implemented in the tensorflow python framework. Based on linear L2-SVM classifier, we analyze and compare CNN findings with final selected features derived from BOW variant approaches. The fruitful intellectual life shall be evaluated by capacity to learn. For a more sophisticated way of classifying any unexplained phenomenon from given datasets, ML is now able to learn and predict. Neuro-biologically motivated Neural Artificial Networks (ANNs). The living thing brain is composed in the form of neurons, of complex multi-layer nerve cells. To boost the efficiency of the CNN model for the identification of multiclass objects, the initial weight initialization scale for each layer was adopted as standard initialization with a heuristic approach. The suggested framework was further modified, and the level of acknowledgement improved.

One of the methods to overcome software vulnerability, which is the use of consistency software metrics. In evaluating whether it is a combination of metrics that really can predict the image of security related bugs, we used a multilayer deep feed forward network. We have applied standard machine learning techniques such as decision tree, random forest, naïve bayes, and vector support machines and compare results with the Deep Learning techniques. The results have shown confidently that an efficient predictive model for forecasting software vulnerability based on software measurements and using Deep Learning could be established. All the generated models have shown more than sixty percent accuracy with computer vision leading the list. This result has shown that using Deep Learning approaches and a combination of software metrics can be used to create a better predictive model to help software developers predict security bugs [10].

Proposed System Design

In this document, a comparative performance evaluation of machine learning methods is researched on publicly available sets for software bug prediction. Machine learning methods are found useful in detecting program glitches. The information repository data provides a lot of knowledge in determining the quality of software, but machine learning methods can be applied to them to gather data on software bugs. To compare their productivity, the machine learning techniques are broadly classified into two categories; such as supervised learning versus transfer classification. Comparison is made between Multilayer perceptron, Naive Bayes classifier, Support vector machine, Random Forest and Decision Trees in supervised learning algorithms such as ensemble classifier as bagging and boosting. Clustering approaches, such as the K-means algorithm, K nearest neighbour, are contrasted to each other in the case of unsupervised learning such as radial basis function distributed network.

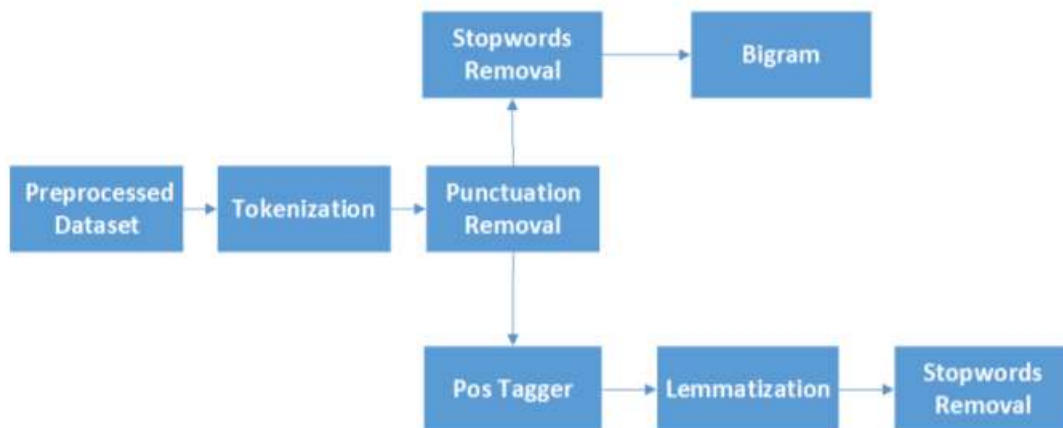


Figure 1 : Feature extraction using NLP

Training Data Extraction: Mark it as a mistake or clean by mining the revision history of a design and the monitoring system for problems for each update. Change buggy means the transformation contains viruses (one or more), while clean change would mean no bug.

Extraction feature: Collect values of different characteristics from each update. In previous research on classification of changes, many specific characteristics were used.

Model Learning: Construct a model based on the labeled changes and their appropriate for the specific, using a classifier model.

Model Application: extricate values of different features for a new modification. Enter these values into the model learned to determine whether adjustment is unstable or clean.

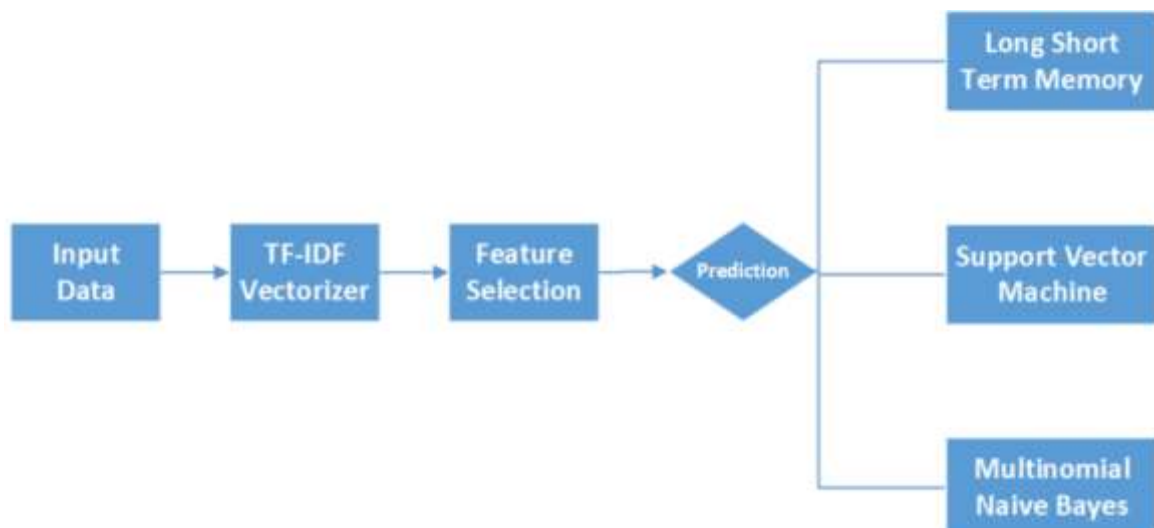


Figure 2 : Prediction module using machine learning and deep learning

Results and Discussions

The proposed implementation was performed in the open-source environment of Windows, while java platform was used due to open source availability. The freely accessible twitter API was used to retrieve the data from the web application on Twitter. We have constructed various data chunks with three separate machine learning algorithms to perform the device classification accuracy. Three different types of cross-validation methodologies have been used separately for the splitting of data cross validation. In below Table 1 and Figure 3 we demonstrate the results of proposed research.

Table 1 : Performance evaluation of different classification using machine learning approach

Classifier	Accuracy	AUC	F-measure
JRIP	81.50	0.72	0.89
NBM	82.80	0.86	0.89
NB	83.60	0.84	0.87
DT	84.90	0.86	0.90
SVM	77.50	0.59	0.88
KNN	75.60	0.75	0.86
J48	80.30	0.76	0.87
DNN	89.50	0.88	0.91

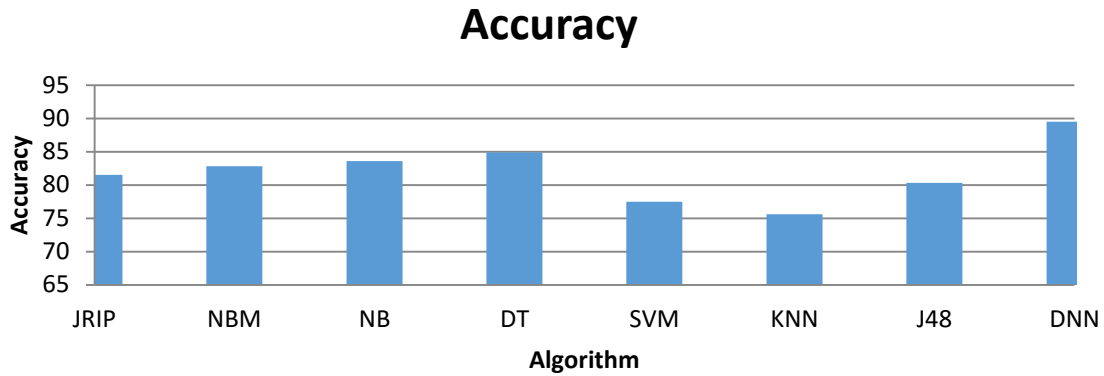


Figure 3: Classification module using various ML algorithms

KNN, NB, has suggested a preference prediction method based on the help vector machine NB. Our methodology estimates the importance of error reports that have just entered. The study shows the accuracy of various machine-learning techniques can effectively predict the importance of less than 70% of Eclipse projects bugs. Eventually, researchers suggested a set of useful solutions to machine learning and statistical methods to predict the frequency of bug reports. Our proposed methodology differs from current approaches, as we first predict the frequency of bug reports by using profound supervised learning.

Conclusion

Classification of software problems at an earlier phase of the software development life cycle assists in guiding software quality assurance measures and also improves software management process. The prognostication of an effective bug is completely reliant upon a good model of forecasting. This research dealt with the numerous computer vision approaches which could be used to predict a bug. This analyzed the effectiveness of various algorithms on various computer datasets. The SVM, RF, NB and DT based bagging techniques mostly undertakes well on the bug datasets. To choose the correct method for the estimation of bug the professional developers will weigh different factors, such as with the type of databases, scope, data-set confusion, or project existence.

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Chapter-15

Deep Learning Techniques used in Mobile Devices and its Frameworks

Patil Dipak Raghunath¹⁹ & Dr Manish Sharma

Abstract

Various mobile apps have been activated by scientific advances in deep learning and artificial intelligence and machine learning. Even while traditional computer frameworks focused on digital sensing and cloud computing, there are some benefits of integrating on smartphones. Such advantages include low latency of communications, low cost of cloud computing services, fast response and increased data protection. Fundamental research of deep learning on mobile and data product has attracted considerable attention recently. Various applications much of the time grasp deep learning counts, for instance, CNN and RNN to isolate information from cell phones. In this work, we investigate various deep learning frameworks for managing mobile computing or multiple file systems. In the experimental analysis, we demonstrate the effectiveness of each deep learning module and how it accelerates the default performance of the system with memory and speed.

Keywords: Deep Learning, Mobile Computing, File systems

Introduction

Deep learning today is typically reliable and true model for outlining an impulse or choosing whether something is valid. From the knowledge begun from customary consumer activities and algorithm-dependent setting [1] – an innovative area of AI that is rapidly transforming how large complex data from this present illustrates the truth [2]. The scale of deep learning-influenced inference projects consolidates the recognition of faces [2], emotions [3], objects [4], and words [5]. At any rate, such reasoning is necessary for numerous versatile applications, although few of which have grasped the methodology of profound learning. One of the great human lead and setting sensors are mouthpieces. Advances in sound-based point and environment computational models continue to extend the spectrum of derivations accessible to flexible clients [6]. This is possible to instigate, for example, through the speaker: regularly work out (e.g. eating [7], hacking [8], driving[9]), inside consumer environments (e.g. stress[10], feeling[11]) and enveloping situations (e.g. number of people near to customers[12]). Throughout the tale, sound recognition of versatile applications has developed into a vital structure hindrance that enables clients to screen and improve their productivity and thrive[13], effectiveness[14], and condition[15].

For example, on adaptable processor execution of in-depth learning estimation, a convolutional neural framework[4] is significant in light of genuine computational essential elements. DeepSense – a profoundly convolutional neural network (CNN) focused on adaptable GPU. He studied the differences between working class and comfortable class GPUs for its structure, and found the sufficiency of various smoothing-out procedures. DeepSense[16] system for conducting deep learning figures without cloud uploading on mobile phones. By using a flexible graphical planning unit (GPU) which starts late and is organized into cell phones, the fact is to support the originators

1. To understand a wide degree of current DNN[7],
2. Achieving persistent or responsive inactivity for unremitting identifying and mediating;
3. Restricting the use of imperatives on the enrolling mobile phones.

DeepSense structure is built on OpenCL[17] which is currently maintained unequivocally by various adaptable GPUs, such as Adreno and Mali.

A glimpse is an infinite, growing system of affirmation of stuff for camera-arranged mobile phones. Impression gets complete video creation, finds objects of interest, sees and names them, and monitors them from packaging to client story. As the figures for the affirmation of the article require critical calculation, Impression tests them on machine-workers. Exactly when the dormancy between the worker and cell phones exceeds a packaging

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time, this system reduces the exactness of the affirmation of the thing. Impression uses a work store of video plots on the versatile device[18] to recover accuracy.

MCDNN [9] considers the application of model enhancement to multi-programmed, spill environment. Different applications, such as sound, meaning, video and warm video, would hope to run diverse DNNs on moving towards high-data rate sensor transfers. Given the use of smoothed out models, the enormous number of simultaneous DNNs in practice and the high repeat of their use would strain open resources. Routine updating to fix this issue model makes an simple tradeoff between accuracy and resource use. Through using fewer exact varieties of modified versions, [10][11][12] a device may acclimatize to high residual weights in this manner. ii) Spilling and multi-programming itself provide an additional framework allowing notable new model optimization[19].

Deep[20] then engaged in the execution of deep cell phone learning through component counts over various processors.

DeepShark shares a peculiar state of mind with DeepMon[21] (about reuse of the figuring resource), DeepShark's holding methodology encourages deficient center outcomes in the wake of convolutional layers preparation, allowing a more fine-grained sharing of computing resources throughout the entire cell phone

Literature Survey

Lane et al. ventured towards the consistent execution of cell phone deep learning[20].

The bunch of sensor data is executed with a DNN using a feed-forward figure that freely takes a shot on each piece of data. The count begins at the information layer and always pushes layer by layer ahead. Feed-forward updates the condition of each unit separately at each layer. This system closes once all units are reanimated in the yield layer. The reasoned class identifies with the most significant state by the yield layer unit[22]. CNN's an elective arrangement of deep learning CNNs used for tasks related to vision and picture[23], yet their use is developing. A CNN is much of the time made up of one convolutional layer, pooling or sub-reviewing layers, and related layers, at any rate. The basic idea in CNN models is to remove direct features from the significant standard data image and change over them a while later into logically complex features at the higher layers at many low targets. This is cultivated by a) applying distinctive convolutional channels to bring data properties closer to one another. B) Search for max / min pooling layers which make isolated features invariant to understanding; this also happens as a kind of decrease in dimensionality. The ordinary segment between convenient identifying applications in mobile sensing apps is that they all incorporate the collection and appreciation of sensor data. They embed AI computations in their application structures to succeed in this. DeepX is proposed to be used by originators as a black-box for these suitable applications and to give a condition for execution of replacement acceptance for any deep learning model they grasp. Sensor applications that present the most testing circumstance with persevering unravel of data. Since they can deduct a second on different events; and along these lines, the use of resource per-gathering must be virtually nothing if the application is to have extraordinary battery life. Applications which, on the other hand, can reliably hold up senselessly, at the expense of higher costs per reasoning. Regardless, deep models need resource smoothing out before they can even run on a portable stage[24]; specific deep models have memory requirements that are irrationally large to help with an adaptable SoC[4]. Execution times will reach the limits recognized to an application (e.g., 30 seconds) without a very remarkable stretch — suggesting a issue whether or not the customer inconsistently initiates the derivation for the day. One possible course of action is the runtime weight of fully linked in-depth plan layers to the the critical memory and collection times. As the SoCs advance in cell phones, they pound in an unquestionably vast array of different computational units (GPUs, low-control CPU focus, multi-focus CPUs). In reality, even the Android-based LG G Watch R[25] joins a Snapdragon 400 [26] which contains a DSP mix and a dual focus CPU. Each processor shows their one of a kind resource profile when conducting various types of computation. Based on the layer form or another brand name, the execution of portions of a deep model system allows obvious trade-offs for them. Such diverse assortment is generally new for mobile phones and used a layer-wise allocation method pursued by disengaging a condition of upgrade.

DeepEar [27] has shown the quality of running entire DNNs. For each undertaking DeepEar can play out a different system of ace sound. In Emotion Sense As optimistic in [28], 32 PLP descriptors (16 static and 16 deltas) and 128-fragment far-reaching GMMs (i.e., one configuration for all conditions) are navigated by the rundown of skills. Remember, [29] portrays a speaker separating classifier of proof anyway they get the pipeline of confirmation of inclination. The Stress Sense[29] agrees to close 19 MFCCs by another seven hand-picked apps. We conduct each of the 26 integrates to replicate the overall model proposed in [29] and give it to 16-section GMM's. In any case they are not testing the structure's adaptable variation. Moreover Speaker Sense[30] uses 19 MFCCs. 32-section GMMs supply the request and set up a change limiting framework[31] that reduces the impact of noisy data. A Five. Smoothing window correlates with the output of the classifier. The safe [32] pipeline uses a 13-estimated MFCC vector coupled with four additional ridiculous features. Collection occurs with 32-portion GMMs and a sliding window of 384 ms to smooth results[32].

DeepSense [16] provided early evidence that using a GPU could help to boost the persistence of profound learning. DeepSense two main approaches are OpenCL, and CNN. OpenCL is a system that helps to transversely program continuously over various levels, such as CPUs , GPUs or even DSPs. Starting late, both popular cell phone processors (e.g., Snapdragon and Exynos) and notable compact GPUs (e.g., Adreno and Mali) supported OpenCL extensively[17]. Convolutional neural network (CNN) is a kind of feed-forward neural system extensively obtained for confirmation of picture and video[33,34]. DeepShark expands the research by providing many more updates, a full execution and a detailed evaluation.

Glimpse [18] uses the cloud to engage in progressive identification and high-quality cameras are available directly on nearly every handheld and wearable cell phone. Combined with unavoidable far-off accessibility, the significant requirements of these cameras make it conceivable to produce accurate, steady applications for article affirmations. The Articles or Faces affirmation pipeline, which continues to run on a video plot, comprises three stages: field, integrate extraction, and affirmation. The stage filters the edge for artifacts of interest in Detection and discovers them with skipping frames, but without names. The article identifier uses unique features of items such as a car shut-off, an apparent concealing distinction from the establishment for road signs, and area differences for appearance (eyes are more hazy than cheeks). The extraction stage of the app frames the material inside the locator enrolled ricocheting box to concentrate on the post, using techniques such as SIFT[35] and SURF[36]. In Acknowledgment / Marking stage you see the material and assign it a name using a separately arranged AI classifier using a named stuff pictures database. The focused arrangement stage integrates vectors as described above, after which, for example, it assembles a model, a Help Vector Machine[37].

DeepX [20], a programming animating expert for practical learning execution, structure and utilization. DeepX fully cuts down the contraction resources needed (viz. memory, estimation, imperatives) by profoundly discovering that it is actually going around as a real bottleneck for adaptable determination. DeepX 's foundation is a few advantage control statistics, designed for significant understanding of the derivation era, that:

(1) separate strong deep model systems into unit squares of different types which are then more competitive for heterogeneous neighborhood contractors (e.g. GPUs, CPUs); and

(2) carry out principled resource scaling that changes the deep model plan to form the overhead of each unit-square current. Examinations are showing up, DeepX will allow even huge scope of deep learning models to be able to execute on today's adaptable processors and beat established course of action, such as cloud-based offloading.

DeepMon [21] The brisk development of head-mounted contraptions, for example , allows for a robust mix of tireless vision applications with a Microsoft Holo-point convergence. These applications routinely receive substantial learning computations, such as CNN and RNN to extract rich, meaningful knowledge from the necessary video transfers for individual viewing. Notwithstanding the high precision, the use of deep learning forecasts in mobile phones poses crucial difficulties, i.e., heavy exposure to idleness and use of force. DeepMon, a modular deep learning enlistment system for running a variety of deep learning, surmising mostly in a fast and viable way on a portable computer. For this, techniques for development to properly discharge convolutional layers to compact and activate GPUs. The treatment of; note that the convolutional layers are the usual execution bottleneck of different deep learning models. The test results offer the idea that DeepMon can define an image on Samsung World S7 in 644ms over the VGG-VeryDeep-16deep learning model , taking a noteworthy development toward perpetual vision without compelling any security concerns nor organizational frameworks costs[21].

MCDNN adventure [19] conducted profound learning through cell phones and fogs. MCDNN provides shared, capable structure for compact cloud applications that need to use Deep Neural Systems (DNNs) to process spouting data (especially video). The AI Society has concentrated on reducing DNN execution overheads. For giant models , for example, speaking and affirmation of things, asking about gatherings has been an excellent attempt to actually express smooth representations of individual DNNs that are competitive at runtime [38,39]. A few attempts typically have common automated methodologies with advance DNNs in the AI social order. In essence, network factorization and sparsification varieties to decrease space[40,41] and computational requests[42]. A large number of such undertakings share the keenness of the individuals that DNN precision can be widely traded off for resource use. MCDNN supports these undertakings in that they are freethinkers to the unique modifications that are used to create model varieties that trade-off execution accuracy for money. For example, the reputation of head-mounted expanded reality (AR) devices such as the Microsoft Hololens[44] and

the Google Glass[43] has offered a climb to another class of consistent, flexible vision apps. They range from constantly understanding road signs to providing headings[45], to perceiving people on Earth to offering a course to people suffering dementia[46]. The mutual characteristic in all these use cases is the need to continuously perform PC vision estimations on a tireless video transfer provided by the AR contraptions.

DeepShark [47] Deep learning offers agile systems new ways to achieve greater execution than before. Or maybe again, today's actual learning execution on mobile phones is primarily referring to costly overhead tool, creating a colossal burden on battery life and persuasive memory space. Existing procedures either use cloud or edge establishment requiring consumer data to be transferred, in any case executing a danger of security spillage and enormous data movements; or stuffed deep models, coincidentally reducing count accuracy. In DeepShark, a step to allow cell phones to use business-ready (Bunks)deep learning systems with the limit on flexible resource mission. Appeared differently about established philosophies, DeepShark searches by customer needs for a fair point between time and memory capacity, isolates current deep model into code square stream and consistently executes these squares on on-chip structure (SoC). DeepShark then naturally takes less memory space on the mobile phone, and achieves the same accuracy. Similarly, all implied product preparation customer data is handled locally, thereby retaining good critical ways from needless movement of data and idleness of the system. DeepShark is produced on two deep learning systems, Caffe and TensorFlow. Exploratory assessments demonstrate their magnitude in memory space bits, and the cost of important objects.

Results and Discussions

The proposed implementation has done on open source environment with python 3.7 with deep learning approach. The file system has used for experimental analysis with various time stamp committed file data. The basic objectives behind this research to eliminate redundant data and boosting the processor performance with various techniques. Below we demonstrates the various techniques used for large file system for mobile devices.

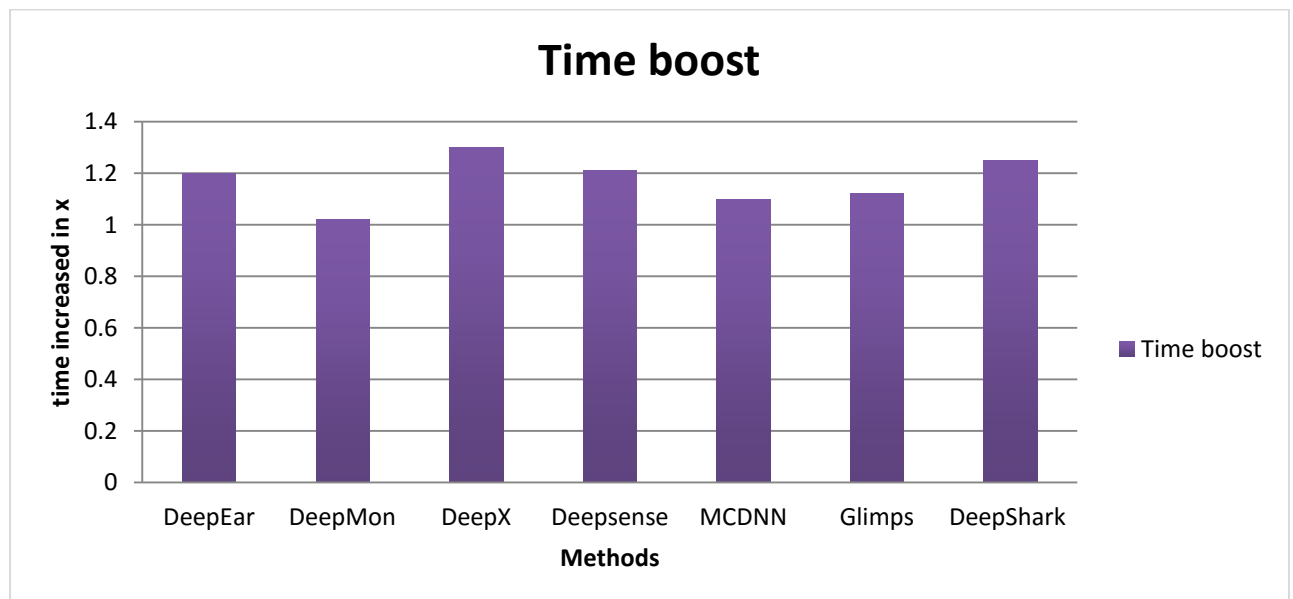


Figure 1 : Time increased with different techniques apply on basic Nvidia processing systems

The above figure shows we apply various models on default Nvidia storage system, and demonstrates the effect of time boosting with various models. In below table we showed no. of iteration with time boosting with various techniques.

Table 1 : system performance with various deep learning platforms

	DeepEar	DeepMon	DeepX	Deepsense	MCDNN	Glimps	DeepShark
Memory	452	650	850	510	459	530	589
Iterations	4	5	6	3	4	4	4
Reduced Memory	432	603	820	477	439	502	523
Time Required	725	903	1140	730	720	760	820
Boosting	1.2x	1.10x	1.18x	1.21x	1.25x	1.30x	1.35x

performance (upto)

Conclusion

We look in this paper at the DeepEar, DeepMon, DeepX, Deepsense, MCDNN, Glimpse, DeepShark used on mobile phones. DeepEar has shown the feasibility of running whole DNNs for sound recognizing applications on low-control versatile DSPs. DeepX then engaged the execution of DNN and CNN over separate co-processors on mobile phones by portion figuring's. DeepMon will base itself on reducing convolutional layer dormancy. This also improves OpenCL, Vulkan and GPUs on the market's tax-displayed mobile phones. DeepSense has shown that using a GPU could help increase the idleness of DNN estimates – DeepMon expands that research by providing even more headways, maximum usage, and comprehensive evaluation. Impression used the cloud to engage ongoing article recognition and follow-up while MCDNN conducted deep learning computations through mobile phones and fog. However, though DeepMon shares a peculiar state of mind with MCDNN (about re-using the DNN computation), DeepMon's replacement system re-uses the center's partial results when preparing convolutional layers, requiring more fine-granular sharing of estimates significantly through consecutive photos. DeepShark, a novel stage that offers a flexible assignment of resources in Beds, adaptable deep learning systems.

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Chapter-16

Trends and Changes in Environmental Education in India

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Abstract

Being considered as a problem that should be taken care of, environment is not always has to be justified as it has to be in today's modern times. There were times when the environment was not protected by people but reversely environment protects people. This is a review of papers, journals and research articles considering the trends in Environmental education that is given historically and its evolution in different forms now. We shall try to look at the effects of the efforts done in different times by various educational institutions as well as the Legislation. Looking at the past scenarios of education in environment the current situation will be compared.

Keywords: Environment, Vedas, Environmental law, protection

Introduction

The education on environment which is considered so necessary in current times had already been a integral part in India from the time of Aryans. The environment is integrated in that era with the people and their life's through culture and religion. Vedas- The ancient scriptures have provided the raw beginning of the environment education 5000 years ago. *Rig-Veda* has already provided the *Prurshashukta* that considered humans as the integral part of the environment (Almeida and Mackenzie, 2011).

The word *Paryavana* in Sanskrit defines environment as something which surrounds or encircles us; words with similar meaning has been seen in *Arthavaveda* –*Vritavrita*, *Avritah*, *Abhivarah*, *Parivrita* etc. (Tiwari, 2016, p.158). The five elements of the environment – water, air, earth, fire and space all these are the main components of environment similar to as of the human body and correlates with the five senses of humans. *Prakriti* or we can say the environment if formed by the integration of all these five elements and works in coordination with other non living (abiotic) things. The evidences of existence of environment education can also be seen in the times of *Ramayana*. Ravana who always considered and resembled with evil, had also a *Ashok vatika* full of trees, fruits, medicinal plants, flowers etc. *Rama* himself has spent his 14 years living in forests and gained the enormous benefits from the environment. There were *pushp vaticas* and *sarovars*. The ideals of *Hindu dharmas* can be always seen with animals in the pictures considering them as similar lives as of humans. For example- *Rat* is considered as the vahan of lord *Ganesha*.

The coconut is considered as sacred. Similar to coconut the lotus flower and tulsi (Basil tree) is also considered as sacred and used for offered to during worship. All plants and products of plants are highly used in the ancient times and there is no need of protection of these natural resources.

Considering a forward era Kautilya himself took so many ahead of time steps for the environment. Kautilya considered environment as same as any other community, that has been taken care of. *Arthshashtra* provides that Kautilya suggested about the formation of *Abhayarana* (forest sanctuaries) and *abhayavana* (animal sanctuaries) for the protection of forests and animals from any kind of distress. He also suggested for the formation of post of forest superintendent. He initiated penalties in case of poaching and damage of forests especially the productive ones. (Tanwar, 2016, p-3)

Ashoka's ruling period was the most important period ecologically. He has imported and grown herbs which are important for humans and animals. He is known for his consideration towards environment very well as he has done so many environment activities like planting of banyan tree for shade, dug up ponds and banned hunting and poaching of animals that shows his consideration about the wildlife. (Giri 2018, 61-64)

Trends from Ancient to Medieval

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Medieval period is marked with the establishment of national parks ,gulistan, fruit orchards etc.The most important feature of *Mughal* period was that there is increase in interest of people towards the natural history. There were some key features in this period that marked the concerned approach towards environment. *Muhtasibs* were introduced for the prevention of pollution in these times. Babar gave a description about the fauna of India describing about various types of flowers. Next to him the Jahangir is considered concerned about the animals, birds and fauna. Credit of some of the finest gardens in India goes to Jahangir. Along with these some long heighted trees are possible to be grown in plains of India only by the contribution of Jahangir. Akbar can be seen as the innovator for various new techniques in the medieval era. He introduced several new fruits to the gardens and introduced the techniques of grafting.

Trends from medieval to modern

Environment science, ecology, natural resource management, biodiversity conservation are the various disciplines of modern science which provides us a brief about the environment describing its elements and provides professional education in these. A bit consciousness about environment has already been seen in the medieval era by various *Mughal* emperors. As the society has grown through ages similar to that education has also crossed barriers from the ancient to modern era. The time where environment is an integral part of life's of people to the time when it has to be mandatory made by laws and legislation it has crossed critical boundaries. The education on environment in modern era can be understood in two different parts-One is the before 1990s time when the economy of the country was not so appreciable and fulfilling. On the other it could be after 1990s or we could say the era of liberlisation of Indian economy and it becomes second fastest growing economy of the world.(Luce;2006).Poverty is considered to be the most disruptive factor in way of education. The growth of economy consecutively leads to the growth of education in India. The growth of education step by step in modern era is described in the table below:-

TABLE 1: Chronology of Key Developments in Environmental Education in India (Adapted from Sarabhai, Raghunathan & Kandula, 2000, p. 130)

1964-1966	Report of the Education Commission – the Kothari Commission	Considered the root of Environmental Education (EE) in India
1975	Curriculum for the Ten-Year School: An Approach Paper and Curriculum for the Ten-Year School: A Framework	First framework to explicitly indicate teaching of EE
1984	Establishment of the Centre of Environment Education (CEE) as a National Centre for Excellence in EE under Ministry of Environment and Forests	CEE worked with different sectors – particularly education- to spread environmental awareness.
1986	Adoption of the National Policy on Education The National Environmental Awareness Campaign of the Ministry of Environment and Forests	First National policy indicated including EE in schools.
1988-89	Environmental Orientation to School Education Scheme of the Ministry of Human Resources Development	Called for orientating curriculum to include EE
1989	C.P.R. Chennai established as a second Centre of Excellence.	Works towards promoting EE in south India
1991	First Supreme Court of India mandate requiring the University Grants Commission to prescribe courses on the environment at all levels of higher education	The judiciary steps in to help control environmental problems – a first of its kind step.
2003	Second Supreme Court judgment mandating EE to be taught across all formal education institutions.	Requires every school in every state of India to teach EE.
2005	National Council for Teacher Education provides the EE curriculum framework for teachers and teacher educators National Curriculum Framework is drafted – clearly specifies the role of EE	A major step providing national level impetus for the inclusion of EE in teacher education. School curriculum now includes EE and has to be mandatorily taught.

Source-Almeida and Mackenzie, 2011

As there were growth in economy there was increase in the industrialization and development. This increase led to the destruction of the environment slowly and the education provided remains to the books only and focuses more on the growth by forgetting about the price of the growth we are paying. Soon before the time was gone we can say the people and the legislation of India realized that the amount we paying for the growth by being unconscious about the environment is too high. For the compensation of the loss already happened there were

inaction of laws and provision for making them mandatory as people are not yet fully aware about the lack of resources ,future generations are going to face.

There is formation of environment law as a separate subject as all other laws. This subject primarily focuses on providing information on the protection of environment with the help of laws. The basic laws that were made can be described in the table below-

<i>Table- Basic law and the years they have enacted</i>	
Name of the law	YEAR
The Wildlife protection Act	1972
The water prevention and control of pollution Act	1974
The forest conservation act	1980
The air prevention and control of pollution Act	1981
The Environment protection Act	1986
The motor vehicle Act	1988
The manufacture, use, import, export and storage of hazardous microorganism and genetically engineered cell rules	1989
Coastal regulation zone Notification	1991
Public Liability Act	1991
Noise pollution regulation and control	2000
The Biological diversity Act	2002
The Forest Rights Act	2006
The Hazardous and other waste(Management and transboundry movement)Rules	2016
Bio medical waste management rules	2016
E-waste (management) Rules	2016

Result

As this a theoretical review, no numerical results were found to be mentioned but looking at the trends environment have followed from the initial time to the current time it seems to be huge distance. To get back to the same situation that was initially present in the medieval times or time where there is no degradation and enough susceptibility of the natural resources to every person it seems so far. Despite of it if we look at the efforts done by Centre and state government in making the protection of environment mandatory under various protection acts , there is a hope to get the sustainable development goals of – Clean water and sanitation to each and every human being fulfilled.

Discussion

From the review of the papers studied and looking at the results obtained by them it could be said that people are getting a bit concerned about the living space- The environment. By thoroughly looking it could be interpreted that there is a huge loss that has happened in fast few years due to carelessness and lesser concern towards the environment and the ancient studies which are proving the knowledge since years and more concern towards modernization and development of the country through technological innovations. More can be improved through using the ancient knowledge and making amendments in the laws made for the protection together. This is further a topic of concern and much more can be introduced in it for complete fulfillment. The Environment is still going through several trends currently and what we can do is to give it a positive direction.

Conclusion

The education on environment has changed its aims and methods completely in these times. On one hand environment as a subject of study and research is reaching its heights by coming up to new innovations on the other hand its too sad to know that we have to aware people about the environment ,motivate them to conserve it. Its sad to look back and see that the environment which have been a integral part of people and their lives need to be protected now. Although the efforts done now are helpful in mitigation of distress to the environment as well as education and will help the future of the environment education grow in India. The integration of people with legislation will help the environment to sustain in future and will help in providing a environment, which is integrated with the people.

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Chapter-17

Artificial Intelligence and the Need to Reengineer Banks

N Venkatesh²¹

Abstract

Future of banking is based on usage of Artificial Intelligence to bring the power of advanced data analytics to manage the fraudulent transactions and help in minimizing the financial risks associated with the adoption of technology. Artificial Intelligence includes Machine Learning and Natural Language which can be effectively used in the banking sector. It helps in protecting personal data and Artificial Intelligence-based mobile applications can make the transaction quick and safe. Time is not far away when we would find Artificial intelligence taking away all the jobs of humans which would include automated programs to speed up response time, keep the humans apprised of regulatory changes thereby creating a secured environment. However, replacing the adaptive behaviour of human with Artificial intelligence would cause some threats like resistance from employees causing irrational behaviour, huge investments and problems of unemployment. Banking sector has to be prepared to take up the technology based applications into their work routine as it is likely to create attitudinal problems in the minds of the employees and would delay the benefits of such huge outlay of funds. This study attempts to identify the effectiveness of its implementation, the positive image generated and also the associated problems with its usage.

Keywords: Artificial Intelligence, Technology, Big Data, Digital Transformation.

Introduction

Liberalisation, privatisation and globalisation has brought about a radical transformation in the financial sector and greater impact has been witnessed in the banking sector. Technological changes in the banking sector with stiff competition from the entry of foreign banks and also with increasing number of private banks after the banking sector reforms of 1991, has totally changed the way banks need to function and exist in the future. Traditional methods of banking under the brick and mortar have paved way for technological banking using the latest gadgets to replace the interaction between the employees and the customers. Banks are looking into the use of artificial intelligence to carry out their routine functions and are emphasising its greater usage for fraud detection, diversification of their products and services, assessment of risk, cyber security issues etc. Now, they are not a choice for banks but are taken as strategies necessarily to be adopted for adding and creating value to its sustenance in this competitive financial era.

Adoption of this technology of Artificial Intelligence into the financial application of the banking sector requires many technologies and one of the emerging technology gaining confidence and attention of the users is reinforced learning. Knowledge based institutions are now considered as the learning human systems requiring the free flow of knowledge, where in employees are free to share insights, experiences and knowhow. Artificial Intelligence supports the reinforced learning process by giving clear impressions of sharing of learned knowledge, enabling free exchange of information and encouraging new ventures with innovation and ideas. Employees need to be involved in the process of eliciting and representing expert knowledge and is bound by certain human limitations like the physical constraints of human sensory and motor systems which is linked to the capacity of each individual's memory. Today's banks are developing strategies and process to best utilise the intellectual resources at both operational and strategic levels with the use of Artificial Intelligence. Artificial intelligence role in banks operations to improve lending, providing better customer service, fraud detection and to have more adaptive applications has become a compulsion rather than being a choice. Banks have started revamping their total system to accommodate itself to the new modes of functioning with technology driven artificial intelligence in every facet of their functionality.

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The three main channels for the use of Artificial Intelligence includes

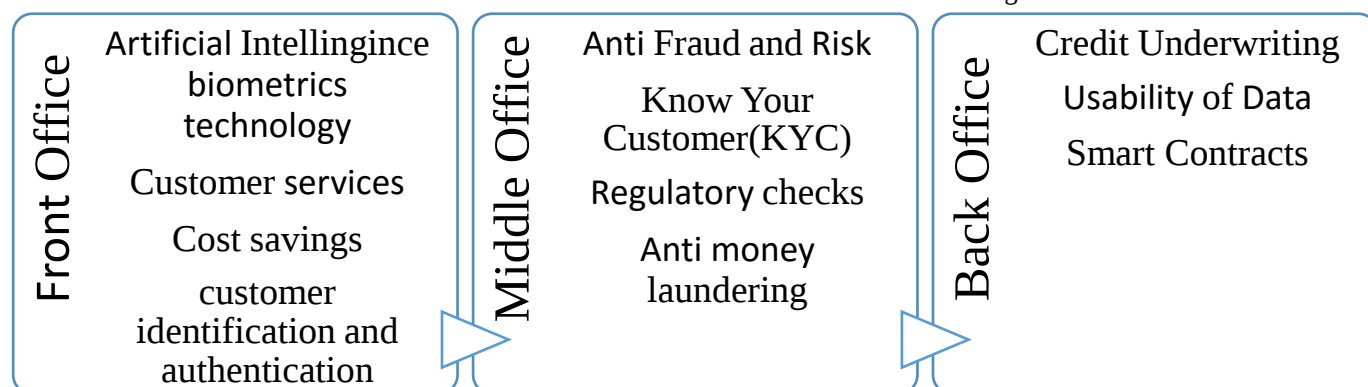


Figure 1 Channels of Artificial Intelligence

Customers have witnessed a landscape change in how the services of banks are rendered to them with Artificial Intelligence enabled chatbots, voice assistants, impact of biometric authorisation, ATM's and also those who would like to visit bank, Artificial Intelligence enabled robotic assistance is available.

Benefits	Reduced workload for employees
	Easy to handle risk
	Better Control and prediction
	Fraud detection and prevention
	Transparent operations
	Big data - Accumulation and analysis possible
	Card management system -Technology assisted and improved
	Minimisation of rate of errors
	Claim management
	Providing personalised planning
	Smart content
	Back end operations more efficiency
	Enabling customised products and services
	Easy detection of fraud related anomalies

Figure 2 Benefits of Artificial Intelligence

Statement of the problem

Artificial Intelligence is now one of the most popular concepts in banks functioning with regard to decision making and also creating value to its products and services. Though its entry is quite early from 1950s, it has a snail's pace in integrating itself in this century. The current trend has given sufficient space for the embedment of digital transformation with AI. The artificial intelligence has now an important role to play but requires the banks to be ready with the infrastructure and other developments. IT has already made its place in banks, but they need to be more prepared to accept this change with some preparedness. Employees of the bank play a crucial role to its ready acceptance and implementation.

Review of Literature

Artificial Intelligence has brought about a drastic change in the finance sector by enabling detection of fraud and regulation, use of chatbots and with the use of robot instructor services, algorithmic trade-off, configuration of trading portfolio and leveraging, recheck testing, robotic instructing , pressure trial assessment. Assessing insider trading with algorithms is also an important role played with the help of Artificial Intelligence.(Fethi and Pasiouras,2009). Scam recognition and fraud prevention has become imperative with the use of artificial intelligence. Artificial Intelligence to observe master card fraudsters, help prevent theft of information and data, by sending warning notification to the genuine holder's through emails or smartphones or other personalised wallets has gained popularity.(Buchanan,2019) This would enable increase efficiency and productivity, through automation to minimise mistakes.

The application of Artificial Intelligence to study the overall performance of the banks and also to analyse its application in the banks of Middle East countries was studied and noted that it created a positive impact on the efficiency of services. (Amar, Awad Alzaidi(2018)Artificial Intelligence has given numerous benefits, starting from creation of efficient business process to offering personalised services and most important creating goals

for financial inclusion. Banks are exposed to risk associated with cyber security. The challenges of using Artificial Intelligence include block chain and analytics to create a defence .(Vijai.C 2019) Effectiveness of Artificial Intelligence on the banking sector services is always a speculation and need to be made positive for usage with the help of tools like metrics, outcomes, data capture, quality metrics. Technology and automated systems can go a long way to remove the obstacles to ensure quality driven artificial intelligence systems. (Smith,Aaron&Nobanee2020).

Application of Artificial Intelligence in banking sector can create a base for changing customer preferences in dynamic industry 4.0 era and importance of repository to collect the artificial intelligence innovation for future use and implementation has been studied. (Bhavana, Himanshu,2018).Artificial Intelligence is now considered as an apt tool to make banking services digital. It can reduce cost and improve customer experience but it also exposes risk form sophisticated models. The transformation should be ingrained in the culture of the organisation to be widely accepted by the people. (Lucasdu Croo de Jongh,Gokhan Ozfurk and Malte,2018)

Indian Banking sector is taking a step further to digitalise by investing in robotics and artificial intelligence to serve better its customers in a more advanced and efficient manner. Analysis of bank performances with the help of artificial intelligence has gained prominence and importance. (Fethi & Pasiouras, 2010). Transparent operation, low cost of production, open source system and accessibility would make the artificial intelligence the main component and mechanism to interact with customers. (Sinha, 2017)

There are have been many studies on the use, benefits, and methods of artificial intelligence in the various banking services. The researcher has attempted to study the employee's effectiveness of artificial intelligence and also understand the positive impact with the problems faced in the implementation.

Objectives of the study

- To study the opinion of the employees on the effectiveness of Artificial Intelligence enabled services
- To understand the positive impact of Artificial Intelligence on their performance
- To identify the problems faced in implementation and the revamping of the banking system to incorporate the AI

Research Methodology

This empirical study completely encounters with primary data derived from employees of public, private and few foreign banks in Chennai. The responses are obtained through a well-structured questionnaire, which consisted of three parts, namely

1. Demographic variables
1. Statements regarding satisfaction and
2. Problems faced by employees due to the use of Artificial Intelligence

The question is composed of optional type questions as well as statements as Likert's 5 points scale, which ranges from strongly agree to strongly disagree. This research instrument is considered as a powerful tool to test a proposed model of the researcher. The model consists of two important entities namely, benefits from the usage of artificial intelligence and the challenges banks face due to its application. Statements regarding the satisfaction of the employees towards the various services having beneficial impact to employees included 10 statements and the statements towards the problems in implementation had 10 variables.

Reliability Analysis and Pilot Study

After constructing the research instrument, the researcher intended to check its reliability through the statistical tool. In order to conduct this pilot study, the researcher obtained 100 responses from banks through convenience sampling method. The researcher meticulously selected Cronbach alpha method, actually this method verifies how far the statements are well understood by the respondents. The required benchmark Cronbach alpha value is 0.75 which actually indicates the percentage of variance. More the variance is an indicator for the better understanding of employees in expressing their responses. The direct application of Cronbach alpha method derived 0.770 for artificial intelligence, whereas the 10 statements of the problems in implementing artificial intelligence scored 0.886. Both these values are above 0.75, therefore the researcher came to the conclusion that the constructs pertaining to satisfaction of the employees and problems associated with the implementation is well understood by the employees and would enable to meet the practical implications and also understand its impact.

Main Study Data Collection

Convenience sampling method was used to collect maximum information from the employees of public, private and foreign banks in greater Chennai. The researcher circulated 300 questionnaires among the employee and able to obtain 227 filled in responses. Hence the sample size of the research is 227. These responses are systematically tabulated and coded in SPSS package version 23, to automatically analyze the responses from the employees. Data mining process is done at this stage to clean the data and also to verify the existence of

variance for reliability as well as the normality of the data. It is found through the application of exploratory factor analysis, Cronbach alpha method and confirmatory factor analysis that two blocks of analysis, namely, Big Data analytics capabilities and organizational performance are respectively 0.820 and 0.891. This shows that all the 227 responses are the employees of manufacturing companies who have considerable amount of variance and displayed a wide normality for the rational representation of perceptual difference among the employees.

Analysis and Discussion

I Association between Demographic variables and Behavioural variables and the Positive impact of Usage of Artificial Intelligence in banking services

H₀: There is no association between demographic variables and the positive impact of usage of Artificial Intelligence in banking services.

Table1 Association between Demographic and positive impact of Usage of Artificial Intelligence in banking services

Demographic variables	Calculated chi square value	Table value	D.F	Ho	Remarks
Gender	2.590	5.991	2	Accepted	Not Significant
Marital status	2.962	5.991	2	Accepted	Not significant
Age	25.850	16.810	6	Rejected	Significant at 1% level
Monthly Income	21.368	20.089	6	Rejected	Significant at 5% level
Level	13.689	12.593	8	Rejected	Significant at 1% level
Educational Qualification	14.425	12.592	6	Rejected	Significant at 5% level

Source: Primary Data

Table1 shows that employees Gender and marital status are not associated with the positive impact of Artificial Intelligence, whereas the employee's age, monthly income, level and educational qualification are associated with the opinion of employees on the positive impact of Artificial Intelligence. This is evident from the fact that the calculated value of chi square is lesser than the table value in the case of gender and marital status and vice versa for age, monthly income, occupation and educational qualification.

Hence, the null hypothesis is accepted for gender and marital status indicating that male and female employees irrespective of their marital status have similar opinion about the positivity's of using the services of banks with the assistance of artificial intelligence.

But employees in varied age, drawing different salaries, in different cadres, with varied educational qualification have different opinion regarding the benefits of using artificial intelligence.

II Association between Behavioural variables and the positive impact of Use of Artificial Intelligence in banking services

H₀: There is no association between Behavioural variables and the positive impact of usage of Artificial Intelligence in banking services.

Table 2 Association between behavioural and positive impact usage of Artificial intelligence in banking services

Behavioural variables	Calculated value of chi square	Table value	D.F	HO	Remarks
Length of service	17.252	15.506	8	Rejected	Significant at 5% level
Type of Bank	5.041	9.489	4	Accepted	Not Significant

Table 2 shows that employee's years of experience had created different opinion regarding the positive impact of use of artificial intelligence in banking services. Employees had varied opinion about the usage and the convenience of handling artificial intelligence based on the number of years they had worked. Employees who were new and young found the system adaptable and easy to apprehend and use, whereas employees who were more aged and had more service were quite apprehensive about the use of technology .Resistance to change was a major concern for those employees .Since the calculated value of chi square is more than the table value, the

Ho is rejected, showing that there is association between the length of service and the positive impact of use of artificial intelligence.

Employees from the public, private and foreign banks however had the same opinion about the positive impact of artificial intelligence role in banking services. Since the chi square value is less than the table value, the Ho is accepted indicating that there is no association between the type of bank and the positive impact of usage of artificial intelligence in banking services.

III Degree of relationship between positive impact of artificial intelligence on banking services and the level of satisfaction towards artificial intelligence (Correlation Analysis)

The relationship between the positive impact of use of artificial intelligence in banking services and the level of satisfaction towards artificial intelligence has been found by using correlation analysis. The analysis showed the extent to which the dependent variable (positive impact of artificial intelligence) would predict the dependent variable (level of satisfaction towards artificial intelligence)

HO There is no relationship between positive impact of artificial intelligence and the level of satisfaction of customers towards the use of artificial intelligence in banking services.

Table 3 Degree of relationship between positive impact of artificial intelligence and level of satisfaction towards the use of artificial intelligence in banking services (Correlation Analysis)

No	Independent variables	'r' value	'p value'	HO
1.	Level of satisfaction towards artificial intelligence	of -0.042	0.186NS	Accepted

The correlation table shows that there is no relationship between the impact of artificial intelligence and the level of satisfaction towards the use of artificial intelligence. Since the p value is greater than the 0.05(0.186), the null hypothesis is accepted. The level of satisfaction towards the use of artificial intelligence is not affected by the positive impact of artificial intelligence

IV Problems faced by the Bank Employees (Public Sector, Private Sector and Foreign Banks) while using artificial intelligence in banking services (Henry Garrett Ranking Technique)

Artificial intelligence is in the process of offering banks an edge over customers, but the full potential of the technology can be accessed only when banks are physically having the infrastructural support to rely on this. Banks are having problem not only with the regulations forcing them to go for this change but also with the resistance from the employees to take up these new methods involving huge initial outlay by the banks. For the purpose of this study the ten problem faced by banks are identified and Henry Garrett Ranking technique was employed to find the most common problem.

Table 4 Problems faced by the employees with the use of Artificial Intelligence in banking sector

S.No	Problems	Total score	Mean Score	Rank
1	Unavailability of people with right data science skills	15394	39.6	X
2	Threat to redundant employees	27933	56.9	III
3	Capital Adequacy	17809	45.8	VII
4	Diverse language sets	24317	49.5	VI
5	Absence of structured mechanism	16060	41.3	IX
6	Access to data	28863	58.8	II
7	Availability of right data	21931	56.4	IV
8	Actual Implementation	23080	59.3	I
9	Data Privacy	21410	55.0	V
10	Hurdles in proper adoption of technology	17267	44.4	VIII

Table 4 shows that the most common problem banks faced was the actual implementation (59.3). Banks are quite slow in bringing these changes as it involves augmenting and replacing human resources outright. The fear of leading the change and also the huge capital outlay has put fears in the mind of the banker. Employees also fear the access to data (58.8) with the use of technology. The most predominant fear directly affecting employees is the threat of their jobs (56.9). The new methods of functioning are considered by employees as a replacement for them, which in turn affects their mental state of being. Of course now banks are coming up with counselling and training sessions to employees to make them understand that these mechanisms are going to be part of their work. Other problems include Availability of right data, Data privacy, diverse language sets for which banks are coming out with proper software to enable the proper management of big data. Employees also have said few

bank have problems with the capital adequacy, but over a period they have managed to overcome this. Hurdles in proper adoption of technology, Absence of structured mechanism and unavailability of people with right data science is considered as problem by some of the employees. They feel banks have barged into the implementation of the technology without being prepared for it, which has led to the initial crash down and also strained relationship with the employees. So they need to have a procedural start-up, which would also provide the employees with the strength to accept the change in a systematic manner.

Conclusion

Advancement in technology has increased the expectations of the customers and with diverse competition, banks are looking at ground breaking changes in how they provide service to customers. Digital transformation being the key to change has enabled banks to make use of artificial intelligence to attract and retain customers. Banks have joined with the information technology sector to provide these services in a more efficient manner. But the banks have come with variety of new issues with the modern methods of banking, starting from their initial cost to vulnerability of cyber-attacks, frauds, training of employees, employee's resistance to new challenges etc. Profitability of banks are at stake due to these problems especially the customer's trust and relationship also being tarnished. So banks have to first revamp and reengineer their total mechanism to readily accept and implement the new methods of functioning with Artificial Intelligence. A Deloitte report says, around 94% of the enterprise implementing Artificial Intelligence face problems like limited technical knowledge, price factor including cost of implementation, input data and storage, man power requirements, ethical challenges, speed and the most important being the associated myths and expectations with the use of Artificial Intelligence. Artificial Intelligence is not new to India. As per the Accenture's recent Accenture banking technology vision 2018 report, 83% of the Indian bankers are confident of the use and believe that AI would be future tool to be associated with the human power to execute the banking functions, as against the global average of 79%. 93% of the Indian banks have already started the functions with Artificial Intelligence and seem to be slowly bouncing back to normalcy from the teething problems. Banking sector is also coming out with means to reduce fraud by using machine learning, algorithm models, reinforcement learning etc. Employees also need to understand that Artificial intelligence is going to be an augmenting force and is not a replacement for the human talent. It would free the employees of the mundane task so that they can concentrate on task which is adding value to their consumer. There is going to be a total transformation in the way we bank with leveraging of the software like cloud, machine learning and artificial intelligence. Future of banking sector can be looked through the use of Artificial Intelligence.

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Chapter-18

Chemical Studies on Liquid-liquid Extraction and Recovery of Chromium (VI) from Industrial Waste Solution

Dr Nidhi Sharma²² & Dr Pooja Mehrotra²³

Abstract

Calixe (6) arene is dissolved in toluene at pH 6.5. It is found to be a good extraction of Chromium (VI) from aqueous medium. The equilibrium time is determined to be in the time 20 to 25 min. The extent of extraction is found to increase the Chromium (VI) concentration in the aqueous phase though, the extraction ratio gets decreased and it increases the Chromium (VI) concentration. This extraction increases the pH of Calixe arene concentration. The various parameters influencing extraction such as pH, effect of diluents, effect of temperature, effect of stripping agent, and period of equilibrium time were studied to determine the optimum conditions for the separation of Chromium (VI). The regenerated solvent could be reused in succeeding extraction of chromium (VI). Finally, the method was applied for extraction Cr (VI) from electroplating and leather tanning waste solutions.

Keywords: Solvent extraction, wastewater solution of electroplating, Recovery of chromium.

Introduction

Chromium is the 17th most abundant element in the Earth's mantle. It was discovered by Vanquelin in 1997. Chromium occur in nature in combined state, generally in plants, animals, rocks, soil, and volcanic dust and gases. Chromium forms a various color spices corresponding to the +2, +3 and +6 Oxidation State. Chromium (II) is a strong reducing anent whereas Chromium (VI) has oxidizing agent. Chromium (VI) is highly toxic, and carcinogenic metal, and can cause adverse effect to the environment and human health. We observed that last few year Chromium (VI) are widely used in stainless steel production, electroplating, leather tanning, textile manufacturing and wood preservation. These applications will increase concentration of Chromium (VI) in wastewater. Therefore it is necessary to develop rapid and precise analytical method for its separation and determine.

Experimental Procedure

The solution containing 30 µg/ml of chromium (VI) was taken and it is pH was adjusted to 6.5 with dilute hydrochloric acid. The total volume of solution was made up to 10 ml with distilled water and it was transferred into a separatory funnel. Then 10 ml of hexaacetato calixe (6) arene in toluene (0.00001 M) was added to it and shaken vigorously for 5 minutes. The two phases were allowed to settle and separate. Chromium (VI) was stripped with 10 ml of 4.0 M hydrochloric acid from the organic phase and determined spectrophotometrically at 540nm as it is complex with xylenol orange. The concentration was computed from the calibration curve.

Result and Discussion

Effect of pH

When chromium (VI) was extracted in the pH range of 1 to 8.5 with 0.00001 M hexaacetato calixe (6) arene in toluene the extraction was less than 50% at pH 2.0 and 75% at pH 4.0. From pH 6.0 to 7.5 extraction was quantitive and beyond pH 8.0 it decreases. Therefore all experiments were carried out at pH 6.5 (Table 1).

Effect of various Diluents

Various solvent having different dielectric constant like benzene, toluene, Xylene and carbon tetrachloride were tested as diluents at pH 6.5 with 0.00001 M hexaacetato calixe (6) arene (Table 2).

Effect of temperature

The temperature has a positive effect on chromium (VI) extraction, by 0.00001M hexaacetato calixe (6) arene in toluene, and accelerates the separation between the aqueous and the organic phases during the settlement.

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Effect of Stripping Agents

The extraction of chromium (VI) was stripping with varying concentrations of various mineral acids like Hydrochloric, Sulfuric and Nitric Acid at pH 6.5. We observed that 2M sulfuric acid and 4M Hydrochloric acid and 3M Nitric acid the stripping was quantitative while in other diluents there was incomplete extraction of chromium (VI). No correlation between dielectric constant and percentage extraction was observed (Table 3).

Period of Equilibrium

The extraction of chromium (VI) was carried out with varying shaking time from 1-15 mins. The optimum period of equilibrium was 3 minutes. Hence 3 minutes period of equilibrium was employed throughout the investigation (Table 4).

Table 1: Effect of pH on Extraction of Chromium (VI)

Sr. No	pH	%E Extraction	D Distribution ratio
1	1.0	17.9	0.22
2	2.0	51.0	1.04
3	3.0	62.1	1.63
4	4.0	75.3	3.04
5	5.0	81.1	11.8
6	5.5	89.3	36
7	5.7	91.0	99
8	6.0	95.5	190
9	6.5	99.5	199
10	7.0	99.5	199
11	7.5	99.5	199
12	7.7	98.5	65.2
13	8.0	90.5	9.8
14	8.5	71.6	2.4

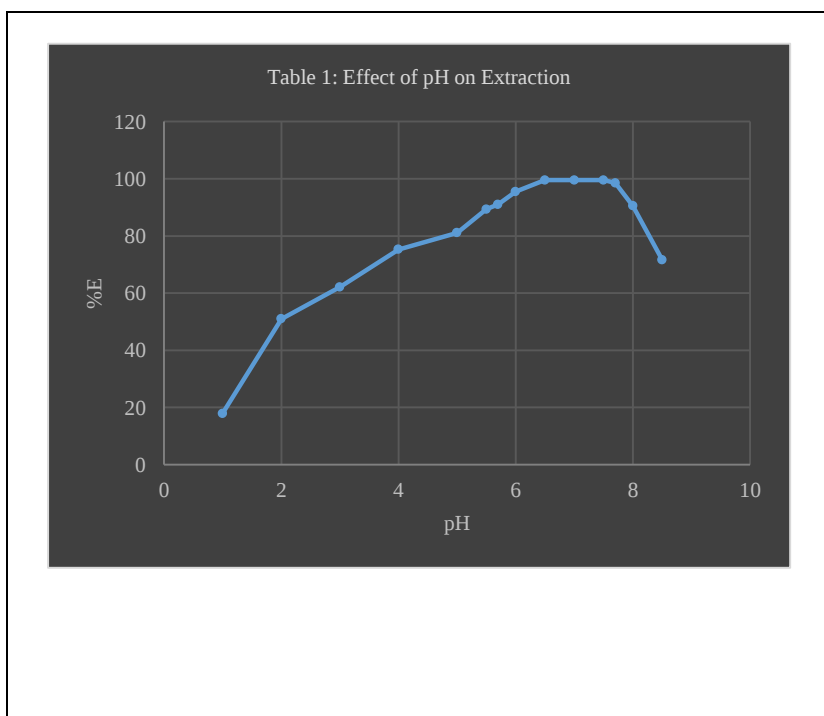


Table 2: Effect of various Diluents

Sr.No	Diluent	Dielectric constant	%E Extraction	Distribution ratio(D)
1	Benzene	2.28	83.5	5.1
2	Xylene	2.38	98.2	89.5
3	Carbon tetrachloride	2.24	99.5	192
4	Toluene	2.3	99.8	199

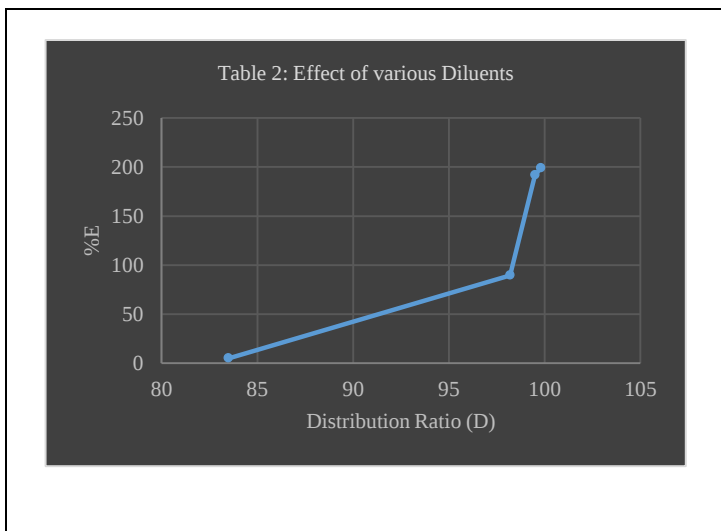


Table 3: Effects of stripping Agents

Acid concentration (M)	% E				
	0.5	1	2	3	4
HCl	34.2	43.7	58.9	86.8	99.5
HNO ₃ H ₂ SO ₄	53.2	79.5	99.5	-	-
HNO ₃	45.1	58.7	77.5	89.4	-

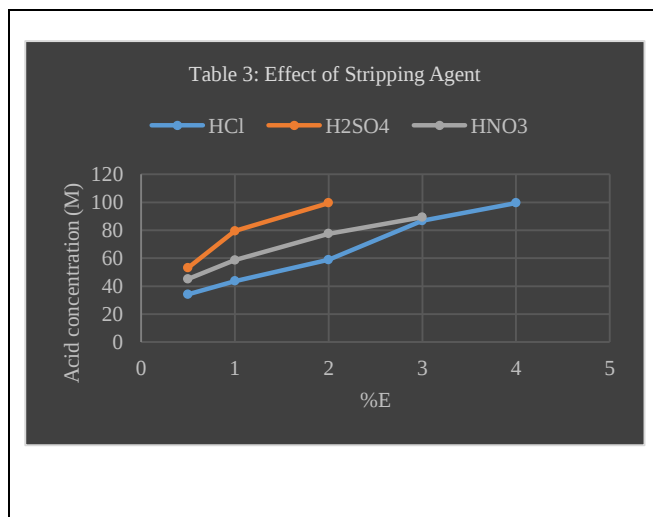
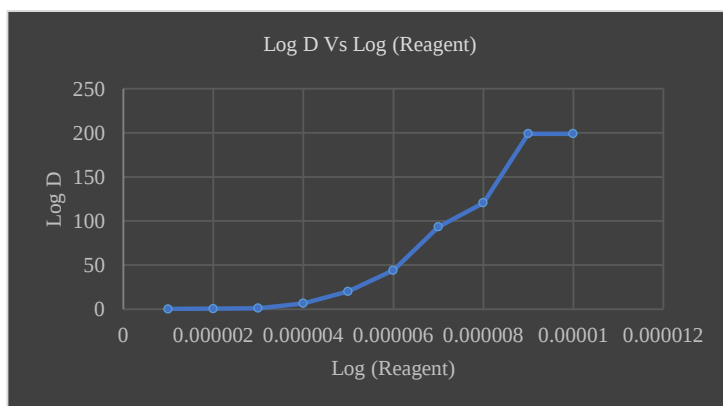
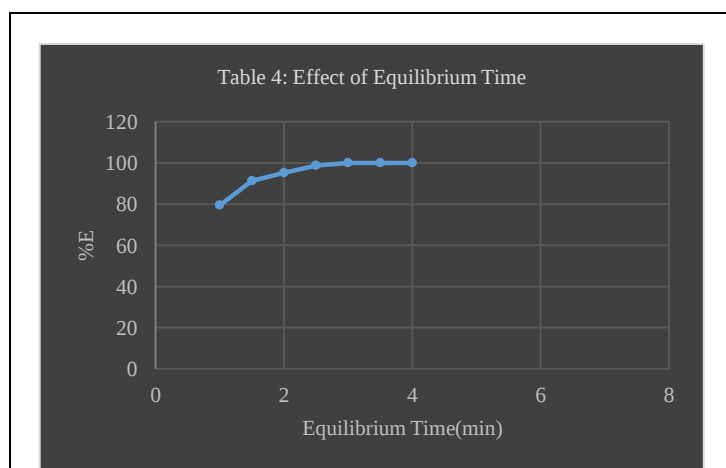


Table 4 : Effect of Equilibrium Time

Sr. No	Equilibrium Time(min)	%E Extraction
1	1	79.5
2	1.5	91.3
3	2	95.2
4	2.5	98.8
5	3	100
6	3.5	100
7	4	100



Calibration curve: Log D verses Log (Reagent)

Conclusion

Some important points to be concluded from the method are:

1. This method is simple, rapid and selective.
2. Less reagent concentration (0.00001M) is required for the quantitative recovery of chromium (VI) with less period of equilibrium.
3. It is free from the interference of large number of interfering ions which are commonly associated with chromium (VI) in its natural occurrence.
4. The separation was done successfully from treated aqueous wastewater solution and can be dispose directly without affect the environment and human health.

Acknowledgement

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Chapter-19

Identification of Real and Fake Activities from Streaming and Synthetic Data using Deep Learning Approach

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Abstract

Manipulation of identities on social media sites is becoming an increasing issue with a massive rise in the popularity of social media platforms. The fake characters used for numerous malicious reasons by offenders. This work aims to analyze different strategies for classifying false vs actual accounts on social networking sites online. Social networks are becoming popular because people around the globe can communicate and exchange videos, images and correspondence. One of the security problems that have become a significant concern for consumers of those same networks is the development of fake stories. The proposed system we describes deep learning using Recurrent Neural Network (RNN) for the real-time and synthetic dataset. Some Natural Language Processing (NLP) based techniques have used for data normalization, and some deep learning algorithms have evaluated on both dataset. Finally, experimental analysis demonstrates the classification accuracy of the system for both dataset and algorithms respectively.

Keywords: Fake Accounts, Fake Identities, Social Media, Data Science, Friends, Followers, Fake Profiles

Introduction

Everybody in society in the current generation has affiliated with both the Online Social Network (OSN). Such OSNs have brought about a dramatic shift in the way system conduct systems social lives. It has now become easier to meet close acquaintances, keep in contact with them rather than learn their updates. Yet with the exponential growth of social media, other issues such as false profiles, online imitation have also developed. There is no viable solution to monitor these issues. Fake profiles may either be user-generated, computer-generated, or cyborgs. A cyborg is a semi-personal, quarter-bot account [1]. Such an account will be opened manually by a person, but a bot automates the activities from then on. To become an OSN participant, the user must build users profile by entering information such as location, photograph, date of birth, email ID, education information, place of work, home county, interests, etc.[2][3].

Many fields become mandatory, and others are available and differ from OSN to OSN. Such websites are popular because people are interested in finding friends, exchanging images, tagging others in group photos, exchanging their ideas and opinions on familiar subjects, maintaining good business relationships and general interest with everyone. In this paper, the system has established a system where rapid identification of fake accounts is feasible and is thriving. This approach uses classification techniques such as Support Vector Machine, Random Forest and convolutional neural networks to identify the profiles into false or legitimate groups. Because it is an automated detection tool, it can be easily implemented by OSN, which has thousands of profiling where patterns cannot be a research question. There have been several challenges in today's social networks, such as fake profiles, online imitation, etc., so far, no one has come up with a viable solution to these problems. In this experiment, the system plan to provide a system in which fake profiles can continue automatically detected. To protect people's social life, and to use automated detection methods, the system can make it simpler for the platforms to handle the vast amount of accounts that can manually be managed by algorithms.

Literature Survey

The three-phase methodology, according to [1] has defined for to detect click-farming in vulnerable environment. The Framework begins by clustering communities that have focused on newly established cooperation networks.

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The System then uses the Louvain principle of group identification to identify populations. The computer finally conducts a binary classification on the communities found. Results of more than a year of research indicate that

1. Click-farming is different in prevalence across OSNs;
2. The majority of click-farmers are low ratings;
3. Communities that farm clicks have fairly close user-to-user relations;
4. More high-rated stores have a more significant proportion of fake reviews.

The System applies machine learning classifiers to distinguish from real-user communities those click-farming communities in the final stage of program methodology.

Besides, research work has done to detect, recognize and remove fake bot accounts created, and cyborgs can't be used to distinguish fake account created by humans. Machine learning has grown as has been the case in recent days. The program can quickly identify false statements by applying a data set of fake accounts and labeling them as valid fake and real accounts. Therefore, after the model learns the report misleading and which account is accurate, the model should be able to accurately distinguish a human-generated fake account from a true one when the original data set has given. The ML models used different features for bots to compare the number of followers on social networking sites (SOCIAL MEDIA Sites) with the number of friends an account has. The no. of friends to the no. of followers of any statement is readily available in account profiles, and no rights have infringed on any account. A fabricated human account[2] has created to fulfill the mission of detecting, recognizing, and removing the network of fake accounts.

A convolutional neural network (CNN) that uses a single Social Media message to identify bot accounts. The System has contrasted system performance with an artificial neural network (ANN) trained on the characteristics derived from account profiles. Results showed that bot accounts with 98.71% accuracy could be detected using CNN compared to 97.6% of ANN. The social networking sites offer a forum for political debates around the world. Facebook and Twitter serve as a forum for discussion about civil movements, public health interventions and elections around the world. Scientists have been studying offensive content in the form of spam and phishing on social media for more than a decade. The bots are best known for their spamming behaviour[3].

A genetic architecture, SVM-NN, has been developed to save for effective identification of fake tweets and bots, versatility of system formulation and application of feature reduction strategies. Three learning techniques for machine learning have been used to assess the real or incorrect ethnicity of the target account. Different algorithms supported vector machine (SVM), neural network (NN), as well as recently designed system algorithm, SVM-NN, which effective software less it whilst still being able to properly categorize around 98% of the structure training data. In past months, online social networks (OSNs) were becoming especially important, including such Facebook, Twitter, RenRen, LinkedIn, Google+ and Tuenti. People use OSNs to keep in contact, exchange news, host events and sometimes even run their e-business. Motivated by the relevance of identifying fraudulent transactions, scientists have previously begun to look for ways to information access fraudulent identities. Most recognition mechanisms seek to predict and identify user accounts by analyzing user-level behaviour or graphically constructing them as true or false (malicious, Sybil)[4].

Malicious accounts have been identified, according to [5], by using the messages sent by social media users to prevent the circulation of dirty and false information on the internet. To this end, an automated or regular account classification scheme has developed using smart techniques. The nearest neighbor, logistic regression, and random forest algorithms have used in the identification of falsified accounts. The classification performance of these methods compared, and similar algorithms were applied to improve efficiency, smote and majority voting techniques.

System obtained another monopolistic sample of users, consisting of subscribers from all forms of black-market networks, as per [6]. The Framework provides these users with network-centric, profile-centered, chronology-centric, and rewet-centric functionality. It highlights how consumers involved in specialized illicit trade services show different characteristics than those engaged in large-scale services. Besides, System employs living stuff corpora to label monopolistic users in various forms: bots, ad buyers and former customers. Following this, the System curates 63 interesting properties for running state-of-the-art classifiers in two configuration-binary (collusive vs legitimate) and two-label classification (bot, advertising customers, ordinary customers, and authorized users). Some studies identify fraudulent users, spammer groups, fake followers and so on to address a wide range of issues such as exchange of information, user behaviour, suspicious group sensors, etc.

The research was done to detect fake identities made by humans, especially on SMPs has done in [7]. In addition, there are several examples of occasions and the use of machine learning has effectively detected fake accounts created by bots or machines. In the case of malware, these monitored machine learning techniques focused about the use of handcrafted features, like the "friend-to-followers ratio," evolved from characteristics like "buddy-count" and "viewer-count," that were directly available on SMPs throughout the conventional wisdom account. The work presented elsewhere applies all these technology companies to a collection of fake human identities,

intended to facilitate successful identification of stolen names on human-made SMPs. Serious identity theft of data networks (such as social media) is a widespread problem due to the continued growth and rapid development of these networks. Given that very little has been done so far to distinguish real and false host of activities. The program has been looking at previous studies that deal with similar problems. Spam behaviour processes discovered in e - Mail , for instance, showcase the same evil intentions with fake stories conveying false rumors. According to [8] the proposal sets out a tweet stage, Semi-Supervised Spam Detection (S3D) method. The proposed architecture consists of two main modules: the collaborative filtering module which operates in real-time, or the batch processing approach on streaming data.

- (1) The spam detection module consists of lightweight application detectors:
- (2) Temporarily banned domain detectors from identifying tweets containing blacklisted URLs,
- (3) Near-duplicate tweets similar to duplicates of confidently pre-labelled tweets,
- (4) Accurate label ham detection systems published by trustworthy users with no spam names, and
- (5) Multi-classifier label tweets Spam is a serious problem. Spammers may use different techniques on different platforms, and the method of spam detection developed for one System may not be applied directly to several other channels.

This approach not only analyses the probability of a shift in click stream user activity but also considers the time feature of the behaviour. Findings from device studies on real online social network sites show that detection accuracy for different types of malicious social bots by the method of detecting malicious social bots based on the transfer likelihood of user activity. Click streams improves by an average of 12.8% compared to the quantitative user behaviour analysis method of detection. Social bots are virtual accounts run in online social networks by computer programs, which can perform corresponding operations based on a set of procedures. Within social networks, malicious users are likely to exhibit patterns of behaviour that vary from normal users as they try to enhance their own needs and intentions. User activity analysis is not only useful in getting a detailed understanding of user intent. Still, it's also critical to detecting online social networks accounts of malicious social bots [9].

A pattern-based classification mechanism for detecting social bot, specifically for Twitter, is to be used under [10]. The program will also implement a new feature model for social bot identification which will expand an existing model with Twitter account usage features and tweet content sentiment analysis. The state-of-the-art classifiers are not patterning dependent, and that model of system feature offers better classification outcomes than other literature published. Nowadays, the public has a vast number of online social networks, such as Twitter1 and Facebook. People are very interested in social networking, and typically follow others, they find paramount musicians, athletes and politicians alike. Twitter uses bots with various purposes in mind. One group of bots, known as spammers or content polluters, are used to spread spam, attract customers to products, generate revenue and spread malicious websites.

Proposed System Design

The classifier is adequately trained as a new set of training data is fed into the classifier. The algorithm determines out whether the description is false or true. In categorizing the sample, the classifier may not even be 100% accurate, and the input collected from the test is returned to the classification model. For instance, if the profile is marked as fake, social media sites that send notification about submitting information to the page. Classification is the process through learning a linear target function, which maps each record consulting of a collection of attributes from an input data set to one of the known class models. Classification technique is an approach to building model classification from a set of input data. This technique uses a learning procedure to recognize a model which best suits the learning set relationship between both the attribute set and class mark. The model created by the learning algorithm should both match the input data correctly and predict correctly that the software algorithm's classification algorithms are to construct the model with excellent generality capability. Different steps are taken to identify an account as fake or genuine profiles. They are fake and genuine profile data set with different attributes such as several friends, followers, status count. Dataset is divided into data for training and research. A classification model was trained using training examples, and the test data set is used to calculate detection accuracy. From the data set was used, around 85% of both (real as well as fake) are used to formulate a training data set, and 15% of in original profiles has used to organize a test dataset. For the run time data classification using proposed algorithms, has used various features selection strategies to get better accuracy. Additionally, the classification algorithm is discussed. Attributes are selected as features if they are not dependent on other attributes and increase detection accuracy after selecting attributes, the profiles dataset which is already labeled as fake or genuine is provided for the classification algorithm's network training. Researchers used a publicly accessible dataset of 1337 fake users and 1481 genuine users composed of different attributes including mentioned amount, status count, number of friends, count of followers, likes, recognized languages, sex code.

Identification is the mechanism whereby a data object is classified called classes based on features related to the data object. The framework uses a classifier, an algorithm which performs each data object's attributes and outputs a class based on that information. We use Support Vector Machine as a classification in this project. Help Vector Machine is an elegant and reliable classification method on an extensive data set not unlike Social Network's multimillion-profile datasets. Help Vector Machine, Random Forest, and Deep Neural Networks are algorithms used for classification.

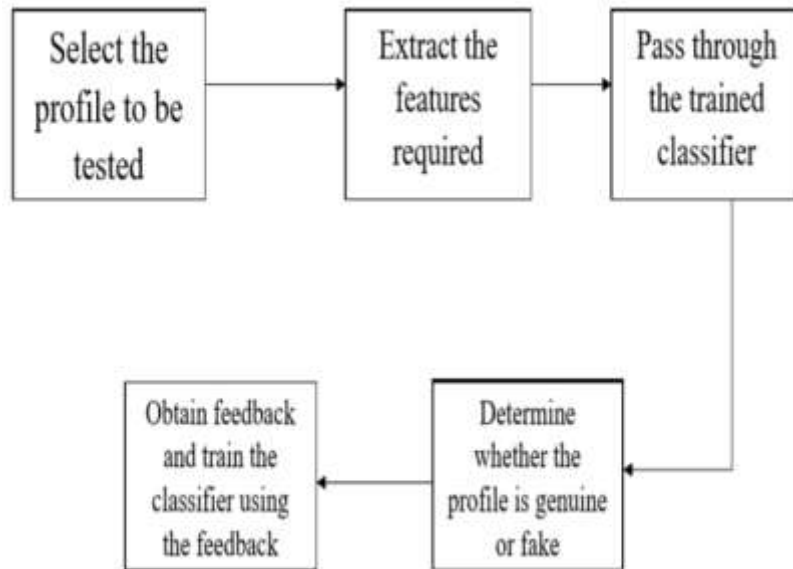


Figure 1 : Proposed system design architecture

Results and Discussions

The following figure 2 illustrates the result classification model is being trained to utilize supervised machine learning model since we have class-labeled data (injected fictionalized accounts) accessible for the classification model. Here we test for four various cross-validation strategies, i.e. three folds, five-folds and ten folds, wherein 70% data is used for training and the rest 30% data is used for evaluation.

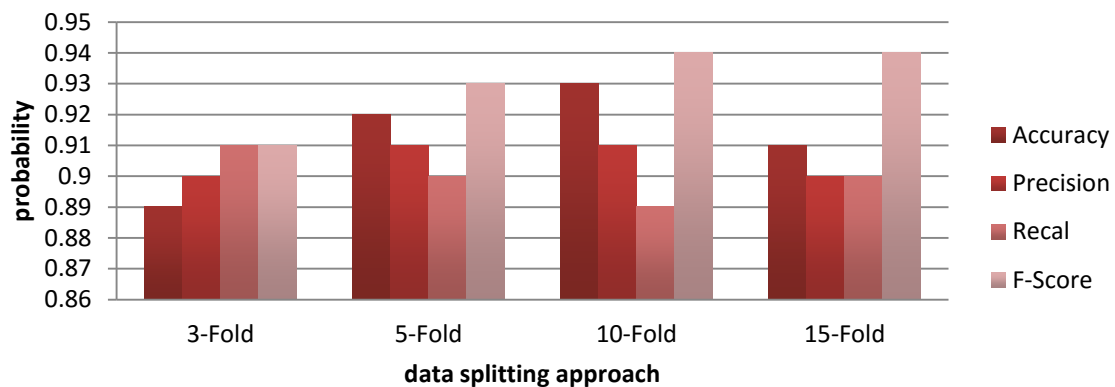


Figure 2: Confusion Matrix Calculation for Proposed System with Different Cross Validation

The above figure 2 shows the experimental analysis of proposed system confusion matrix of proposed system with various fold validation. The system achieves optimum accuracy for 15 and 10 fold validation is better than others.

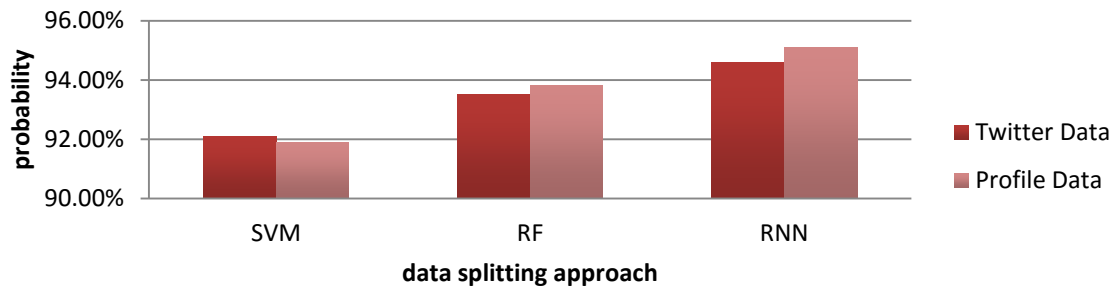


Figure 3: Performance Evaluation of Proposed Algorithms

In the second's experiment, we calculate the classification accuracy proposed deep learning-based RNN algorithms, for real-time streaming as well as the synthetic dataset. Above figure 3 demonstrates the archived results with both algorithms on different datasets.

Conclusion

We introduced a machine learning pipeline throughout this Project to identify fake profiles in social network sites. Instead of guessing each existing transaction, our program classifies clusters of fake accounts to decide whether the same actor created them. Our assessment of both experimental and out-of-sample data showed high results, and we used the program to identify and limit more than 250,000 users in development. Recurrent Neural Network (RNN) has been used to solve the problem of determining fake vs real identities with accurate results of 95.10% on social networks. The efficiency of the given program varies with that of the dataset utilized. We also discovered that validating 15 fold cross gives better results than confirming five fold and threefold cross. Besides, accuracy should be improved in the future by enriching features set and checking for other classification strategies such as deep learning (e.g. integrating multiple hybrid Deep Convolutional Neural Networks) and analyzing them for different kernel function.

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Chapter-20

A Review on Pulse Battery Charging for Vehicles

Mr SunildattaSomnath Kadlag²⁵ & Dr Mukeshkumar Gupta

Abstract

A complete line of superior battery chargers are made with simple gadgets of non-battery-powered batteries, for example, lead corrosive, and lithium-particle and nickel-based. Pulse chargers offer numerous advantages of exchanging chargers effectively as that of straight chargers. They don't require any blocking diode/micro-controller or MOSFET. In the charge chargers, a progression of voltages or current Pulse are communicated as the battery embeds. The boundaries, for example, the ascent time, the pulse (recurrence), the pulse width and plentifulness are carefully constrained by DC pulse. This is an adaptable innovation i.e.it can work with any limit, size, voltage, or science of batteries, including valve-managed and engine. There is a chance of utilizing powerful fast batteries without warming it with a cardiovascular charger. In lead-corrosive batteries, this separates lead-sulfate precious stones, subsequently altogether broadening battery life. This paper surveys the idea of battery charging innovation particularly in vehicles.

Keywords: Charging techniques, Li-ion battery, Pulse charging.

Introduction

For recent years, lithium-particle batteries (Li-particle) batteries have a developing interest for their piece of the overall industry in the market of battery-powered batteries. By 2024, they are anticipated to outperform the lead-corrosive battery advertise. This is mostly because of their high characteristics of absence of memory impact, low self-release, high vitality thickness. [1] They are accessible in numerous gadgets and applications, from electric vehicles to Internet of Things (IoT) gadgets. Lithium-particle polymer (LiPo) batteries are like Li-particle partners. Special case is the utilization of a gel-like polymer electrolyte, which attempts to improve particle stream. They are generally fitted with a pack group that permits the LiPo battery to be shaped into numerous open items. Lightweight with high mechanical quality and execution are the upsides of LiPo batteries. With the expansion in presentation of electric vehicles by different vehicle makes, go uneasiness and the length of charging time required by the batteries are as yet a subject of concern. The need of high flows accelerate the charging procedure, diminish vitality proficiency and cause quickened limit and loss of intensity. As of late, endeavors to diminish the impacts of environmental change and nearby air contamination have quickened progress toward the improvement of lithium-particle electric vehicles. [2] While makers are hurrying to present recorded choices on their cost, client acknowledgment of EVs, and battery-fueled (BEV) vehicles that are not hybridly controlled by an inside ignition motor (ICEs), are as yet constrained. [3] Range issues and longer charging occasions contrasted with the time required to re-fuel vehicles are regularly referred to among the key issues blocking the far reaching reception of EVs. Quick charging has consequently been one of the key issues focused in the battery and EV ventures. Quick charging is a multiscale issue, so considering littlest subtleties from nuclear to framework level are expected to comprehend and improve the exhibition of quick charging. [4] Fast charging, additional battery life, and expanded battery charging and power productivity are significant highlights for customers today in attractive electronic applications. In spite of the fact that battery life can be improved by utilizing different PC and programming procedures, these alluring highlights are impacted by the sort of charging calculation utilized, and accordingly, many charging systems have been proposed to accomplish the required and powerful yield measurements. In these charging calculations, pulse charging is generally excellent. Pulse charging is the utilization of current gadgets that are painstakingly controlled from the battery.

Literature Survey

The test in planning and creating pulse charging calculations is to distinguish and characterize conditions that produce higher battery execution. Pulse charge flows have the various characteristics that can be balanced at various levels. The battery yield execution measurements, for example, the battery charge and vitality

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efficiencies, life cycle, and charge time, vary contingent upon the determination of these traits and their levels. Pulse charging has answered to have predominant execution. The effect of these elements and their levels on the cycle life of the battery and its impedance boundaries are likewise researched. Paper [5] gives a diagram of the battery chargers of module type electric vehicles. Standard battery chargers dependent on front-end diode rectifiers, unidirectional battery chargers and front-end diode rectifiers made with semiconductor embedded in them, battery chargers and coordinated chargers are a portion of the points examined in this paper. Paper [6] presents a delicate exchanged pulse charging component utilized in elite Pb-corrosive and Li-particle. This procedure limits exchanging misfortunes that makes the approach basic and most appropriate for executing the National Electric Code (NEC) level-1, level-2 chargers or exceptionally the level-3 charger all the more advantageously for EVs. A variable recurrence pulse charge (VFPCS) framework, which can recognize and every now and again arrive at the fitting charging recurrence and furthermore improve battery charging reaction is proposed [7]. To assess the presentation of the framework, a VFPCS model of 600 lithium-particle battery was created and actualized. Contrasted and the current norm and standard force framework, the charging rate of the proposed VFPCS is improved by over 24%. Paper [8] presents a disconnected battery charger planned utilizing buck-help Power factor rectification (PFC) kind of converter for electric engines. Utilizing customary three-stage Voltage Source Inverter (VSI), the incorporated battery charger is gotten. This goes about as a buck-help converter having power change capacity. The PFC regulator controls the battery voltage and controls the gracefully of this changing chance to accomplish ideal force which is exceptionally advantageous and gives great execution. In paper [9], an obligation shifted voltage beat charge technique (DVVPCS) methodology is planned. This framework distinguishes and overwhelmingly screens the correct activity of a charging drive, and thus, improves battery execution. The presentation of the proposed DVVPC charging has improved by 3.4% contrasted with the overall CC-CV. Contrasted and the standard DFVPCS with $D = \text{half}$, the proposed DVVPCS productivity improved by 1.5%. In paper [10], an extra sort of system connector is proposed to diminish the charging season of a lithium particle battery. To test the exhibition of the proposed beat driving technique, an extra kind of heartbeat type was created and performed. The proposed pounding charger is constrained by beat capacity, recurrence and extent. Paper [11] gives a survey of EV's quick charging innovation and its effects on battery frameworks, including heat the executives and different other related confinements.

Pulse Battery Charging

The pulse charging calculation is viewed as a promising method to charge the battery to meet the different necessities of shoppers of electronic gear to have quicker charging just as expanded battery charging limit. Be that as it may, to amplify the advantages of heartbeat charging, the charge furthest reaches of current heartbeats ought to be painstakingly chosen to guarantee great battery execution and furthermore broaden battery life. Pulse accusing consolidated of shrewd controls carries numerous advantages over regular approaches to keep up battery limit and its life. [12] Some chargers use pulse to check the present status of the battery just because when the charger is associated. Next consistent current charging procedure is utilized while quick charging and afterward use beat charging technique to keep up that charge. A few chargers use "negative pulse charging", likewise named as "Reflex charging" or "burp charging" where both positive and negative pulse charges are utilized. Nonetheless, till date there is no such confirmation that expresses that negative pulse charging is more productive than common heartbeat charging. Pulse charging includes cautious choice and control of charge current heartbeats so as to charge a battery. Figure 1a shows a macro-model of a pulse charger where by controlling the switch, S_w , charge current, I_c , is pulsed into the battery. Every pulse charge current that is applied to the battery has the following factors or attributes: peak current amplitude, I_{pk} , a duty cycle, $D = t_{on}/T_p$, and frequency, f , as shown in Figure 1b.

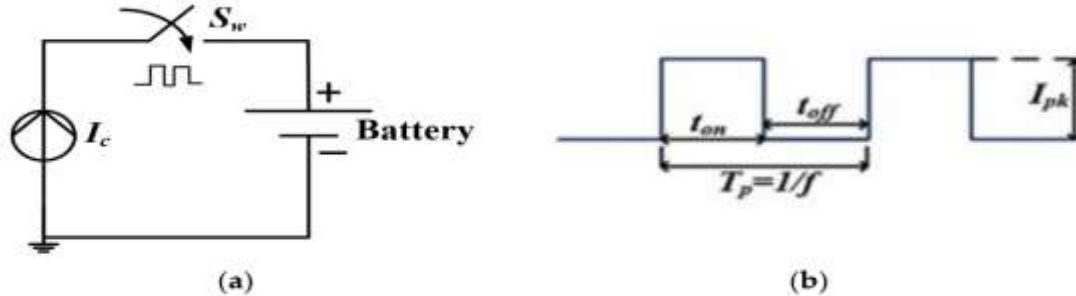


Fig 1: (a) Pulse charging micro-mode and (b) pulse waveform [13]

Battery life cycle, its impedance boundaries and charge time are affected by the choice of pulse qualities and its various levels. Figure 2a speaks to the comparable circuit of LiPo battery. It is obviously demonstrated as an arrangement opposition, R_s , in arrangement with an equal mix of the charge move obstruction, R_{ct} and C_{dl} . Here, R_s speaks to the obstruction of the electrolyte and other contact protections. R_{ct} speaks to the obstruction of the energy of the Faradaic forms in the battery and C_{dl} speaks to the charged regions between the terminal

and electrolyte. Figure 2b speak to the battery impedance boundaries that are separated from the Nyquist plot. This extraction procedure is finished with the assistance of electrochemical impedance spectroscopy (EIS). During beat charging, decrease in polarization voltage is acquired by appropriately intercalating the Li⁺ into anode. This likewise lessens the vitality misfortunes in the battery, expanding the pace of influence move and improving charge and vitality efficiencies. Considering a fixed heartbeat charge current adequacy, lower obligation cycles suggest longer charge times, though higher obligation cycles infer shorter charge times. And yet battery turns out to be more powerless to cheating and overvoltage. These two conditions can demonstrate negative to the battery life cycle. Considering a fixed obligation cycle, higher normal charge flows are a consequence of high current amplitudes. This further outcomes in quicker charge times, anyway the chance of cheating the battery is high. The scientific connection among I_{pk} , D , and the normal charge current I_{avg} can be communicated as:

$$I_{avg} = I_{pk} \cdot D \quad (1)$$

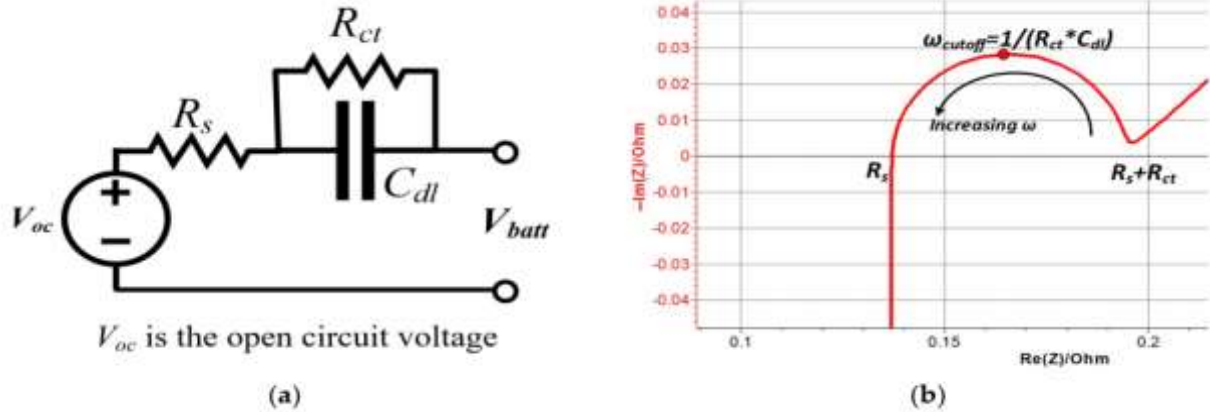


Fig 2: (a) LiPo battery equivalent circuit (b) Nyquist plot [13]

In wording recurrence, it is seen that quicker charge time can be gotten by beating at the recurrence at which the battery impedance is least f_{min} . [13] .

The obligation shifted pulse charge procedure comprises of changing the obligation cycle. This system depends on the straightforward certainty that a littler obligation cycle, D , will in general have better current thickness trade i_0 . This gives better proficiency and having bigger rest period the charging time will be long. Subsequently, we either need to bargain between high charging effectiveness or quicker battery charge. Therefore, the pulse charge factor is characterized as:

$$\eta = D \cdot i_0$$

Given that, the exchange current density i_0 is given by:

$$i_0 = F k_0 (1 - \theta)^{(1-\alpha)} \theta^\alpha c^{(1-\alpha)}$$

Where,

1. k_0 : Standard rate constant for heterogeneous reaction
2. F : Faraday (96487C/equiv).
3. θ : mole fraction
4. α : transfer coefficient.
5. c : concentration at the surface of the electrode.

Hence the pulse charge factor will be as,

$$\eta = D \cdot F \cdot k_0 (1 - \theta)^{(1-\alpha)} \theta^\alpha c^{(1-\alpha)}$$

Here, α and c are not corresponding to $(1-D)$. Subsequently, to achieve better productivity and quick charge time the obligation cycle D is never fixed to half. [14] These past capacities have decided the suitable measure of pulse rate that will bring about decreased charging time and expanded battery charging limit and vitality efficiencies. Momentary enhancements in effectiveness and charging times are restricted to charging, yet it is essential to decide how the effect impacts current attributes or qualities that influence the battery over the long haul. This will influence the general expense of the framework, as though the proposed beat charging calculations decrease battery life or increment the estimation of the impedance boundary, visit substitutions will be required, that will affect the drawn out expense of that specific battery controlled application.

Conclusion

The pulse charging innovation utilized in lithium-particle batteries in electric vehicles. Number of charge and release cycles increment, contingent upon the expansion in battery impedance boundary esteems. The pulse charging calculation is viewed as a promising method to charge the battery to address the issues of customers of electronic gear to have quicker charging and expanded battery charging limit. Be that as it may, to expand the advantages of pulse charging strategy, the determination of pulse charge current boundaries ought to be done cautiously so as to guarantee battery execution and furthermore broaden battery life. Pulse accusing joined of other keen controls carries numerous advantages over basic approaches to keep up battery limit and broaden battery life. It is seen that contrasted with batteries exposed to CC-CV at a similar temperature, batteries exposed to pulse charging at half obligation cycle at room temperature show low impedance esteems. The outcomes acquired from the quickened maturing of the battery, demonstrate that contrasting with the benchmark technique CC-CV, pulse charging done at the ideal qualities shows an expansion of an extra 100 cycles.

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Chapter-21

A Survey Paper on MQTT Protocol Using IoT

Ms Nilima T Dhokane²⁶ & Dr Binod Kumar²⁷

Abstract

The norm and constant correspondence innovation is an unalloyed certainty for the improvement of Internet of Things (IoT) applications. Notwithstanding, the determination of a norm and successful informing convention is a difficult and overwhelming undertaking for any association since it relies upon the idea of the IoT framework and its informing prerequisites. Bountiful informing conventions have been created and utilized by different associations dependent on their prerequisites over the most recent two decades. However, none of them can bolster all informing prerequisites of a wide range of IoT frameworks. Informing convention is a continuous quandary for the IoT business; thusly, it is imperative to comprehend the advantages and disadvantages of the broadly acknowledged and developing informing conventions for IoT frameworks to decide their best-fit situations. There are various correspondence or middleware conventions that are ordinarily utilized in the arrangement of IoT applications including Hyper Text Transfer Protocol (HTTP), Message Queuing Telemetry Transport (MQTT), Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), Extensible Messaging and Presence Protocol (XMPP), and Data Distribution Service (DDS), among others. Such conventions backing somewhat comparative highlights as far as network, in any case, they fluctuate in how much these highlights are advertised. This paper presents a study of MQTT convention utilized as a one of the informing convention in IOT which is chosen by Organization for the Advancement of Structured Information Standards (OASIS).

Keywords: Advanced Message Queuing Protocol (AMQP), Constrained Application Protocol (CoAP), Data Distribution Service (DDS), HyperText Transfer Protocol (HTTP), IoT, MQTT

Introduction

Advances in networking technology have profoundly contributed to how IoT devices produce exchange and perceive data. This is becoming more evident as the magnitude and rate at which data is generated by IoT devices is rapidly increasing. This has also contributed to the deployment of a wide array of messaging protocols that enabled IoT devices to exchange messages more efficiently. Application layer protocols are considered as the underlying layers used by applications in defining the structure of message exchanges and how they can be transmitted. Given that IoT systems primarily depend on IoT devices for data collection and message exchanges for the overall functioning of the system, the choice of which communication or messaging protocol to use for device interconnectivity becomes a very time consuming and challenging task. Furthermore, when choosing a suitable messaging protocol, it is imperative to consider the hardware characteristics of IoT devices and type of data link layer protocols employed. In addition, IoT devices can vary significantly in terms of the bandwidth they support. That is, IoT devices do not use a universal radio technology and therefore the physical data rate they support varies considerably depending on the size and hardware components used to build these devices. For example, LRPANs leverage the IEEE 802.15.4 physical layer that supports data rates up to 250 Kbps with packet length of approximately 127 bytes. Other variations also exist at other layers of the OSI model such as HTTP. In the IoT, everyday things and machines are in the lead role and communicate with each other.

These IoT networks employ various radio technologies such as RFID, WLAN, WPAN and WMAN for communications at the lower level [1]. Irrespective of the specific radio technology used to deploy the M2M network, all end-devices should make their data available to the industrial Internet [2]. Industrial Internet can be considered as the connection of industrial machine sensors and actuators to the Internet that can independently generate value [3]. One of the major factors that determine the performance of this M2M communication is the messaging protocol specially designed for M2M communications within the IoT applications. The selection of a standard and effective messaging protocol is a challenging and daunting task for any organization. While selecting an appropriate messaging protocol for IoT systems, the pre-requisite is the better understanding of a target IoT system and its message/data sharing requirements. IoT devices producing data at a high velocity often require lightweight communication protocols. For example, a small battery-supported IoT temperature device

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programmed to send localized temperature readings at a fixed frequency to an IoT hub may not have sufficient power by the time it transmits a day-long temperature readings using HTTP. It would be desirable in this case to alternatively use a lightweight messaging protocol such as MQTT in which the smallest packet size is 2 bytes (compared to 200 bytes in HTTP in the uncompressed header size scenario). MQTT is M2M / IoT connectivity protocols designed as an asynchronous lightweight publish/subscribe messaging transport protocol.

MQTT protocol was designed by IBM and in 2013 was standardized by OASIS (Open Architecture System). It has been approved as ISO standard, called ISO/IEC 20922 from June 2016. The protocol continues the evolution including new functions and formalizing common capability options [1]. Internet of Things (IoT) is a prominent paradigm applied to several areas ranging from medicine to industrial networks. It aims at connecting to the Internet of millions of daily used objects. Important challenges in this area consist in to propose mechanisms and protocols that meet security, device interoperability, quality of service and energy-efficiency requirements. Particularly, the MQTT protocol has been prospected in order to provide efficient communication at the application layer for the IoT. This survey aims to present the fundamentals, tools and future directions related to MQTT protocol and its variation tailored for sensor networks, called MQTT-SN [2]. Messaging protocol is an ongoing dilemma for the IoT industry; consequently, it is important to understand the pros and cons of the widely accepted and emerging messaging protocols for IoT systems to determine their best-fit scenarios. There are four established messaging protocols MQTT, CoAP, AMQP and HTTP for IoT systems [3].

Literature Survey

IoT is a conspicuous worldview applied to a few territories extending from medication to modern systems. It targets interfacing with the Internet of million of day by day utilized articles. Industry 4.0 is another idea speaking to the advancement of the current creation frameworks through the union of new advances of mechanical computerization and data frameworks. The IIoT stands apart for the correspondence among hardware and frameworks, offering to clients an assortment of valuable data for the administration of progress of creation frameworks. Significant difficulties around there comprise in to propose instruments and conventions that meet security, gadget interoperability, nature of administration and vitality effectiveness prerequisites. Especially, the MQTT convention has been prospected so as to give proficient correspondence at the application layer for the IoT.

The intermingling of AI and IoT makes ready for an imminent headway in proficiency, precision, efficiency, and generally speaking cost-reserve funds for asset compelled IoT gadgets. At the point when AI calculations and IoT cooperate, we can accomplish improved execution for correspondence and calculation, better controllability, and improved dynamic. Because of cutting edge checking from thousands to billions of omnipresent detecting gadgets and improved correspondence capacities, IoT can possibly improve the nature of human life and expected applications for modern development (toward Industry 4.0). IoT's latent capacity has fundamentally improved with the combination of AI and man-made consciousness. [1]

The product characterized border is considered for the MQTT convention system in the IoT applications. Truth be told, the SDP furnishes an extra layer of security with or without SSL/TLS by supplanting the conventional login technique (username/secret word) with a SPA process. This will darken the end gadgets, by shrouding and making them be out of reach by assailants. Therefore, this keeps the sign in data from being undermined without encryption. [2]

In Today s World, Security and Storage are key purposes of any association. Clients need greater security towards their information and furthermore need to pack information in less space. Savvy City model will utilize advanced cells for its useful executions as we as of now have a readymade framework. To achieve that, we need some availability over the city at each point. Utilizing Router, Switch, Firewall, Server, Access point, Cell Tower, Optical links we can accomplish this objective. From that point onward, we need great sensors and Actuators that can give us data. By preparing this data we can control things. This all named as IoT where web indicated as availability and things signified as physical gadgets. Typically, openness to PC arranges requires application conventions over vehicle layer of Internet convention stack. HTTP is one of them. At the point when HTTP is applied to IoT , a lot of little information squares are sent and gotten. The issue of control overhead and subsequently execution debasement is taken note. To conquer these issues MQTT is utilized. It presented "Named based steering" and gives an other for IP address based directing for IoT. [3]

Numerous gatherings attempt to structure and actualize suitable conventions to IoT. We can specify the case of IPv6 "over Low force Wireless Personal Area Networks" which centers around the IEEE802.15.4 standard of IPv6. We likewise incorporate the CoRE which characterized a light form of the HTTP convention entitled CoAP [13]. We have additionally notice the presence of the new MQTT convention which is an open source transport convention dependent on the distribute/buy in design. The principal adaptation of this convention was distributed in 1999 by Andy Stanford - Clark and Arlen Nipper. MQTT is perfect for interchanges M2M and IoT situations because of its low data transmission. This convention offers three levels nature of administration and a notice component if there should arise an occurrence of the customer is separated. In November 2014 the

variant v3.1.1 of MQTT turned into a norm. Another variety of this convention is called MQTT - SN (MQTT for Sensor Networks) intended for situations that not founded on TCP/IP conventions like Zigbee. [4]

Machine to machine correspondence in IoT is cultivated with application conventions, for example, the Constrained Application Protocol and MQTT. The transparency of these conventions prompts different sorts of assaults including DoS Attack. MQTT is generally utilized in secure IoT applications like wellbeing checking. One of the noticeable assaults in IoT is the DoS assault. This authorizes the requirement for an effective interruption location framework strategy in MQTT-based application. The aggressor bargains the agent and sends bogus control or information parcels during the DoS assault. Consequently, programmed recoverability from the DoS assault, the time taken for the recoverability, and the effect of specialist disappointment in the IoT application are the critical security worries in MQTT convention.

Paper [5] proposes a lightweight fluffy rationale based interruption recognition conspire called Secure-MQTT, for recognizing pernicious movement during the correspondence between IoT gadgets. A safe rendition of MQTT and MQTT-SN conventions in which security include is increased to the current MQTT convention dependent on Key/Ciphertext Policy-Attribute Based Encryption utilizing lightweight Elliptic Curve Cryptography is proposed in [6].

Lightweight IoT gadgets send an ever increasing number of reasonable information in zones of Smart Building, Smart City, Smart House, Smart Car, Connected Car, Health Care, Smart Retail, IIoT, and so forth. This makes the security challenges in the conventions utilized in the IoT especially significant. The norm of MQTT convention emphatically suggests execute it over TLS rather than plain TCP. Regardless, this choice is unimaginable in most lightweight gadgets that make up the IoT biological system. Frequently, the compelled assets of IoT gadgets forestall the utilization of secure deviated cryptography calculations executed without anyone else. A security composition in MQTT convention utilizing Cryptographic Smart Cards, for the two difficulties, the verification pattern and the confided in information classification and information uprightness is proposed in [7].

IOT can devour and offer RESTful types of assistance. In any case, the run of the mill arrange frameworks don't bolster the design and middleware arrangements utilized in the cloud-based Internet. The creators in paper [8] show how frameworks planned with RESTful engineering can be executed by utilizing an IoT-explicit innovation called MQTT. Their model case is an application improvement and arrangement framework that can be utilized for far off administration of IoT gadgets. The outcomes recommend that MQTT utilizes less focal handling unit time and memory. System clandestine channels are a piece of the data concealing exploration territory that manages the mystery move of data over correspondence systems. Secretive channels can be used, for example, for information spillage and covert malware correspondences. While information stowing away in correspondence systems has been concentrated inside the most recent years for a few significant correspondence conventions, as of now no work is accessible that examines clandestine channels for the distribute endorser model.

To fill this hole, creators in paper [9] present the main far reaching investigation of incognito stations in a convention using the distribute endorser model, i.e., the MQTT convention which is generally conveyed in IoT situations. Specifically, seven immediate and six circuitous clandestine channels are portrayed and assessed and classified them utilizing the system data concealing examples approach.

The cutting edge video reconnaissance framework has incredible difficulties in different applications, for example, keen urban observation frameworks and savvy urban areas. In these applications, we have to manage the quickly developing number of reconnaissance hubs which present a few imperatives, e.g., high idleness, high data transfer capacity, high vitality utilization, and CPU and memory use. To address these issues, the IoVT, which is viewed as a piece of the IoT, can be an answer. The IoVT is made out of visual sensors associated with the web. In contrast to ordinary frameworks, the VSS under an IoVT system gives various layers (i.e., edge, haze, haze) of correspondence and dynamic by catching and examining rich logical and social data. Since a suitable ALP can help in lightening the difficulties of future VSSs, the choice of ALPs is significant for IoVT-based frameworks. Paper [10] presents a nonexclusive engineering of an IoVT-based VSS and a similar examination of a few ALPs, for example, MQTT, AMQP, HTTP, XMPP, CoAP, and DDS, with continuous experimentation that will assist clients with choosing the suitable ALPs.

Background MQTT Protocol

MQTT is one of the most established M2M correspondence conventions, which was presented in 1999. It was created by Andy Stanford-Clark of IBM and Arlen Nipper of Arcom Control Systems Ltd. It is a distribute/buy in informing convention intended for lightweight M2M interchanges in compelled systems. MQTT customer distributes messages to a MQTT representative, which are bought in by different customers or might be held for the future membership. Each message is distributed to a location, known as a subject. Customers can buy in to numerous themes and gets each message distributed to the every point. MQTT is a double convention and ordinarily requires fixed header of 2-bytes with little message payloads up to most extreme size of 256 MB. It

utilizes TCP as a vehicle convention and TLS/SSL for security. In this way, correspondence among customer and representative is an association situated. Another incredible component of MQTT is its three degrees of QoS for dependable conveyance of messages. MQTT is generally reasonable for enormous systems of little gadgets that should be observed or controlled from a back-end worker on the Internet. It is neither intended for gadget to-gadget move nor for multicast information to numerous recipients. It is a fundamental informing convention offering just a couple of control alternatives. The distribute buy in model is made out of a dealer (for example a worker) and customers set up an association with the representative whenever. In this model, customers send messages through the dealer which is known as the distributor. At that point, the intermediary channels these approaching messages and circulates them to customers who are keen on getting these messages. To this degree, a customer that registers with the dealer to get these messages should initially buy in to explicit points. Customers get the payload (or message information) when another gadget distributes a message. An endorser can get a distributed message later. That is, the endorsers can get distributed messages at various occasions. Figure 1 presents an elevated level outline of the MQTT handling model that shows the entirety of the substances engaged with this engineering including: (a) brought together specialist, (b) distributors and (c) supporters. In this distribute buy in model, a distributor can send messages to various endorsers with one single distribute activity to the representative. The dealer handles the "telecom" or sending messages to all supporters bought in to subject of the message as appeared in Figure 1.



Fig 1: MQTT Centralized Broker Model

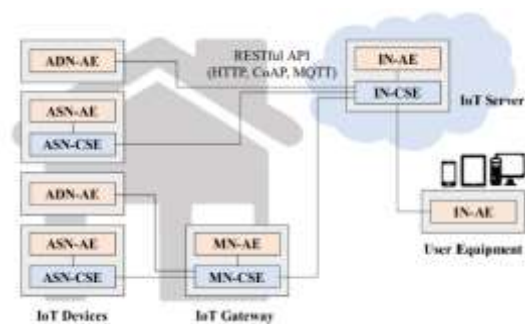


Fig 2: OneM2M reference architecture model [11]

The oneM2M reference engineering model is appeared in Fig. 2. The oneM2M design separates the M2M/IoT conditions into two areas (framework and field space) and characterizes four kinds of hubs that dwell in every area considering the setup situation where oneM2M frameworks are conveyed: Infrastructure Node (IN), Middle Node (MN), ADN, and ASN. The IN is situated in the system foundation and gives M2M administration. The MN goes about as an entryway between the gadgets and the system framework. The ADN is a compelled gadget with constrained usefulness that incorporates just M2M administration rationale. The ASN is a nonexclusive hub that in CSFs just as M2M application. The oneM2M engineering depends on a various leveled substance model, which contains the Application Entity (AE), the Common Service Entity (CSE), and the fundamental Network Service Entity (NSE). The AE gives the application rationale to a start to finish IoT arrangement and speaks to the application administrations situated in a gadget, door, or worker. The CSE is a stage that gives CSFs, a M2M administration work that can be utilized by different application substances in like manner. The CSFs incorporate enlistment, security, application, administration, information and gadget the executives, and so forth. The NSE gives organize administrations to the CSE.

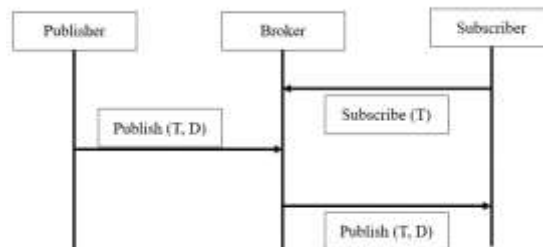


Fig 3: Message delivery method of MQTT

MQTT is a correspondence convention intended to empower the connection of different friends inside a distribute/buy in engineering. The fundamental idea of message conveyance through the MQTT convention is outlined in Fig. 3 where T speaks to point and D speaks to information. A customer is a companion that speaks to a program or gadget that trades application messages over a given subject with another customer through a worker, which is additionally called a message agent. Customer cooperations are constantly directed by the worker, thus customers don't have to know one another. Customers convey by mentioning the worker to buy in

or distribute messages about a given point. Customers who need to distribute messages will mutually indicate the payload and subject of the message, while customers who need to get the message buy in to the predetermined arrangement of points through the theme channel articulation. Points are sorted out progressively in a tree structure, and the subject channel articulations permit one to allude to all components at a given hierarchal level in the tree. This permits the conveyance of messages that reference numerous subjects dependent on the equivalent directing models. A subject is a string of alphanumeric tokens, which are called point levels, that are isolated by a theme level separator. A theme channel is a string organized as an arrangement of point levels, each indicating an alphanumeric token or the trump card character '+' or '#'. A trump card '+' can be supplanted by a solitary token, though a special case '#' is supplanted with a symbolic succession of a self-assertive length. For instance, the subject channel articulation 'house/firstfloor/room/mugginess' is the point grouping of the messages that shows the moistness of the room on the main floor of the house, while the articulation 'house/firstfloor/+/stickiness' demonstrates the dampness of the considerable number of rooms on the principal floor and the articulation 'house/#' shows every single physical amount that have been estimated in the house.

Conclusion

The IoT is an immense assortment different of conventions, administrations, and arrangements. By virtue of new up and coming advances for low-power remote interchanges and minimal effort processors, the IoT has made the following stride in systems administration gadgets, bringing about structure mechanization, keen matrices, insightful administrative frameworks, and savvy homes. This paper presents a review of broadly utilized MQTT convention in the field of IOT. MQTT is an informing convention for the IoT chose by the Organization for the Advancement of Structured Information Standards. It empowers productive information transmission in low force, problematic system. MQTT is reasonable for trading messages between backend applications and edge arrange hardware in light of the fact that the representative sends messages to endorsers who buy in to a particular point, and it utilizes a little size message header to limit the overhead. Moreover, it gives three degrees of Quality of Service (QoS) to guarantee unwavering quality in the transmission of distribute/buy in based messages, in this manner guaranteeing the dependable transmission of significant messages that must be communicated.

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Chapter-22

Textile Antennas for Wireless Body Area Network Applications

Vilas S Ubale²⁸ & O S Lamba

Abstract

Over the last decade, a significant demand for wearable antenna has increased in biomedical applications for healthcare monitoring. Recently, many researchers present several textile antennas for healthcare applications in their research papers and books. Earlier, patch antenna was used extensively in monitoring systems in healthcare units to monitor patient's vitals such as ECG, heart rate, etc... In many instances, the measuring antenna was normally placed in close vicinity of the patient's body and data of these vitals was transmitted to the remote monitoring unit. A microstrip patch antenna is not flexible in nature and hence is not favorable in such cases; demanding need of textile antennas. A textile antenna is an antenna that is fabricated on textile materials such as cotton, silk, and synthetic and finds wide applications in the healthcare monitoring system, low range wireless communication application, and so on. Major challenges of the textile antenna are the complexity of fabrication of antenna on textile material while maintaining required bandwidth, compact size, and robust structure to provide the same advantages as that of the regular microstrip patch antenna.

Keywords: Textile antenna, WBAN, medical applications,

Introduction

A low dielectric constant material helps in reducing the surface wave losses and increasing impedance bandwidth is a perfect choice for the design of the textile antenna. Textile material based wearable antenna tends to have larger dimensions as compared to the traditional microstrip antennas. The fabric used for the textile antenna can be either man-made fabric or natural fabric [1]. A principal concept of wireless body area network (WBAN) has evolved over the last decade and is a primary focus of researchers in the textile wearable antenna design. The wireless body area network allows embedding electronic devices on the human body. Embedding electronic devices on the human body was initially limited to healthcare monitoring systems and now has been expanded in military services and wearable computing. As stated earlier, in healthcare monitoring systems the wearable antennas are used to collect patient's vital parameters such as blood pressure, heart rate, calories being burned, no of steps walked, ECG signal, and even glucose levels. These vital's are to be recorded and collected in real-time and transmitted to a remote monitoring unit via a textile wearable antenna. The communication over wireless body area network (WBAN) can happen between implant device and wearable device, two wearable devices and or a wearable device and a remote unit such as mobile phone, tablet, smartwatch, or personal computer termed as in-body, on-body communication and off-body communication respectively as shown in Figure 1 [2]. The 402 – 405 MHz Medical Implant Communication System (MICS), 2.4 – 2.5 GHz and 5.7 – 5.8 GHz Industry Scientific and Medical (ISM) band and 3.1 – 10.6 GHz Ultrawideband (UWB) frequencies are allotted for the wireless body area network applications. The WBAN now finds a wide range of applications including healthcare monitoring systems, military applications, and is now extended to sports and fitness, entertainment applications. [1][3]. 5th generation communication systems have considered wireless body area networks as an integral part of **communication** systems. The operation of body-centric wireless communication occurs between the scope of personal area networks (PAN) and body area networks (BAN). The 802.15.6 standard of IEEE is the latest international standard recognized for wireless body area networks.

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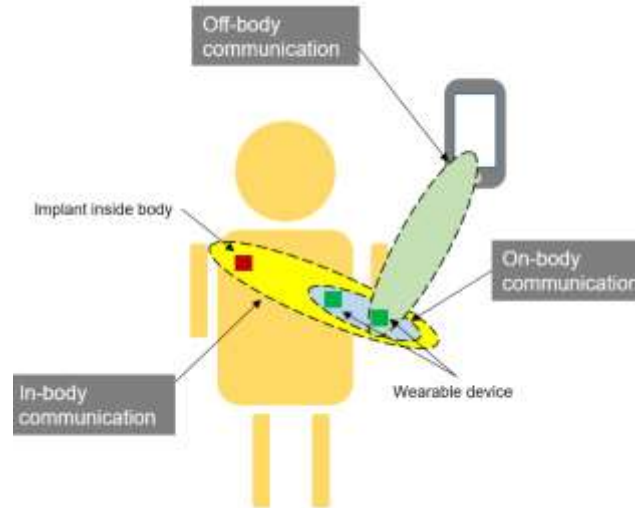


Fig 1: On-body, off-body, in-body communication

Short-range, extremely low power wireless communication within or in a vicinity of the human body is called wireless body area network communication. It may be on-body or off-body or in-body applications. There are several disadvantages of microwave frequency on the human body, to avoid such disadvantages like signal penetration in human tissues, lower frequencies are desirable for medical treatments. However, a large size antenna has resulted in a large wavelength at lower operating frequency. In the same operating frequency band, a compact antenna is required for this purpose. Furthermore, a broad bandwidth is needed for high range resolution which indicates that a high relative bandwidth should be obtained. With the demand for wearable antennas increasing rapidly, wearable antennas are facing major challenges such as maintaining a compact size and lightweight, operation at multiband, desired radiation characteristics along the E and H-plane, conformability on the human body and cost.

Textile Antenna

Textile antennas consisting of a radiating patch structure, usually metallic or conducting nature, embodied on textile materials such as cotton, silk, or synthetic fabrics. The fabric used for embodying the antenna must be durable and highly flexible; making it suitable for healthcare monitoring and military applications. This type of antenna can also be termed as a wearable antenna. The fabric used for wearable or textile antenna must have a low dielectric constant as it helps in reducing the surface wave losses and increasing impedance bandwidth. The ISM 2.4 GHz band is considered suitable for WBAN applications. In the next section, we will discuss the different wearable antennas designed by various researchers.

Literature Survey

Table 1: Antennas for WBNA and Its Analysis

Reference No.	Year of Publication	Focus	Outcomes
[4]	2020	In this paper, a flexible microstrip antenna operating at 2.45 GHz was proposed for wearable applications. The antenna was fed using the conventional microstrip feedline. The fabrics used for wearable antenna design was cotton jeans of 3mm thickness and dielectric constant of 1.67.	The performance of the antenna slightly varies on the human body when compared to its performance in free space. The results show a better performance with $S_{11} = -14.2$ dB, VSWR 1.49, and 7.39 dB gain is obtained at 2.45 GHz in free space while on human phantom $S_{11} = -14.9$ dB, VSWR 1.46, and 7.54 dB gain at 2.48 GHz is obtained.
[5]	2019	The primary focus of this paper was to investigate the design of a flexible textile antenna operating both the WBAN and the UWB bands as specified by the IEEE 802.15.6 standard. The antenna consists of an innovative and compact UWB radiator on top with a full ground plane on its back.	A low SAR level of 0.491W/kg was achieved by the proposed antenna which meets the absorption requirements as specified by FCC.

[6]	2019	In this communication, an attempt to design and investigate a miniaturized textile antenna operating at the ISM frequency band is done. The proposed antenna consists of Shieldit conducting material embodied on a 0.7 mm thick denim substrate having a low dielectric constant of 1.7. The researcher here used a simple microstrip feedline network for exciting the antenna.	The proposed antenna offered single band operation over the 2.2 – 2.5 GHz frequency band offering wider impedance bandwidth.
[7]	2019	In this communication, yet another attempt to design and investigate a miniaturized textile antenna operating at the ISM frequency band is done. The antenna consists of a radiating patch on the top and a ground plane at the bottom separated by bedsheet cotton having a relative permittivity of 3.27 and the loss tangent is 0.00786.	The size of the proposed antenna is 40mm × 34mm × 1.26mm. This antenna provides a wider bandwidth within the frequency range of 2.1GHz to 2.7GHz and 3.6 GHz to 4.3GHz. The antenna has an efficiency of 94%. The SAR value of the designed antenna is 1.25 which is less than the SAR limitation so this antenna will not cause radiation problems when placed on a human body.
[8]	2018	A healthcare monitoring system used to measure patient's vitals such as blood pressure, pulse rate, and body temperature over the WBAN is used that uses a low profile wearable microstrip patch antenna is proposed. The operating frequency of the antenna is taken as 2.45 GHz which lies in industrial, scientific, and medical (ISM) frequency band. Polyester textile fabric with a relative permittivity of 1.44 and a thickness of 2.85 mm is used as a substrate material.	The proposed antenna shows SAR values as low as 0.0640W/kg when tested on the 3-layer human phantom model at 2.45 GHz. The proposed antenna offers excellent impedance bandwidth and gain.
[9]	2018	In this paper, a novel metaheuristic known as Coral Reefs Optimization with Substrate Layer (CRO-SL) is used to design a low-profile textile-modified meander line Inverted-F Antenna (IFA) operating at 2.4-GHz using WBAN technology is proposed.	A novel Coral Reefs Optimization with Substrate Layer (CRO-SL) algorithm has been proposed to adjust the resonant frequency and the bandwidth of the wearable antenna for off-body communications Wireless Body Area Network (WBAN) services at 2.42 GHz.
[10]	2017	A compact planar dipole antenna designed on extremely flexible nitrile butadiene rubber polymer composite material for body area network applications is investigated. The proposed antenna operates at 2.4 GHz ISM band.	The proposed antenna is compact in size and easy to fabricate. It is fully flexible for wearable applications in the 2.36–2.50 GHz band, with a small dimension of only 58 mm × 40 mm × 3.5 mm is achieved. The fabricated prototype has good impedance matching ($VSWR < 1.8$) over the targeted frequency band and an efficiency of around 18%.
[11]	2017	In this paper, the effects of a wideband wearable antenna operating at 5.8 GHz is presented. The proposed antenna consists of two U-shaped, two F-shaped, and two L-shaped slots to achieve wide-band operation.	When the antenna applied to the wireless body area network (WBAN) application, the characteristic of the proposed antenna had been degraded to near to the -10 dB return loss.

Discussion, Challenges, and Opportunities

There are many challenges and opportunities in textile antennas used for WBAN. The antennas are designed for one or two specific applications that are limited use only. The antennas designed for health care applications have many limitations, like harmful radiations generated by microstrip antennas will affect the human body, flexibility, and placement of the antenna on the human body. Other challenges are the size and shape of the antenna, return losses, and gain of antenna and radiation pattern. A wearable antenna designer must maintain desired electrical characteristics while maintaining the size of the antenna. A trade-off between the size of the antenna and the required gain states that antenna size can be reduced at the cost of low gain. Similarly, higher efficiency, larger impedance bandwidths, and good radiation characteristics can be achieved at the cost of increased antenna size. So antenna design for various applications has a large number of opportunities like, selection of proper substrate material with low dielectric constant, less thickness and it should be highly flexible. The antenna should be designed in such a way that it should be used for multiple applications with little changes. It should be highly flexible and easy for placement on different applications, like on-body and off-body applications.

Conclusions

In this paper, we have presented the study of textile antenna design technique, substrate material used for antenna, and different applications of the antenna in WBAN. The good research is carried on the textile antenna with different methods of designing, different substrates are used for implementations of textile antennas, different types of shapes are prepared for getting best results. To get the desired frequency band the size of antennas is continuously updated by the researcher. The concept of dual-band and multiple-band antennas is now very popular amongst the researchers. The proposed textile antennas were designed on flexible substrates for different frequency bands and for different applications. If we design antenna by using the cloth material as a substrate, with proper shape and structure the flexibility of wearable antenna increases, the antenna will work on multiple frequency bands and it can be used for different applications.

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Chapter-23

DDoS Attacks in Cloud Computing Environment

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Abstract

Cloud computing is the rising generation and many of the IT rendered services are expecting through cloud computing. In contemporary time the Internet base depends on the cloud especially for their business. Concealment, coherence, possibility and approachability are the prime facet of the cloud. Possibility plays major apprehension in cloud environment in providing utilities to the cloud end users in the absence of disarrangements. Secretiveness and Certainty influence the cloud profits. Distributed denial of service (DDoS) attack is one of the prominent pledge require greatest compensation. As due to some of cloud assets are devalued and an entrance to censorious services are repudiated that chief to monetary fall, data breach and undesirability. The paper furnishes an outline of the DDoS in cloud, new mania and the existing modes on the part of cloud reliability. Various guarantee concerns, the DDoS detection and mitigation approaches and the warning daunts are deliberated. In addition of these, the obligation for virtual DDoS aids are asserted and the modern times demand well-built security explanations and specifications for real time formation in the course of cloud computing.

Keywords: Cloud Computing; DDoS; detection; mitigation; certainty

Introduction

Cloud computing offers the resources, platform and web applications on demand with high availability. The computing framework have changed the whole view of the organizations and industries far from the perspective of deploying the daily work basis of their applications/services by giving on request and pay as your utilization. Cloud computing has gained its popularity in different sectors of the IT domain because of the availability and quality of services for the client [1]. The National Institute of Standard and Technology (NIST) symbolize the important features of the computing model as on request, resources spooling and quality of service.

The Cloud Computing Service Model is based on three primary tenants – Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) [9-10]. All IT functions such as applications, networking, security, storage and software work in tandem to provide users with a service based on the client-server model.

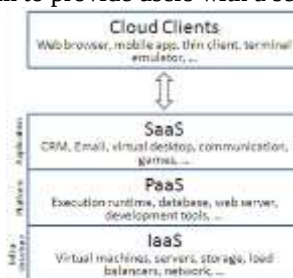


Fig.1: Cloud Service models

Software as a Service (SaaS): SaaS stands for Software as a Service. The referred classification is basically organized as endusers. SaaS [6] is significantly appropriate for students as it contributes a connection to various utilizations at all. Learners can access any type of accessories such as laptops, smart phones, tablets or another web-enabled devices easily. With the help of SaaS, we can add many users or broaden the program to more campuses or classrooms.

Platform as a Service (PaaS): PaaS is entirely a deployment and development tool. One can code and develop the implementations efficiently with the help of PaaS. In cloud, staff, students and other pedants can enlarge new resources and plea, escorted by PaaS [6]. It also beneficial for deployment, testing, cooperating, providing and supporting functions.

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Infrastructure as a Service (IaaS): IaaS is a combination of hardware and software that focuses on all servers, storage, network and operating systems. The high up referred also known as on demand data centers that furnishes memory, power, storage and especially priced per hour is maintained by the system consumption [4]. It fulfills the infrastructure related demands of staff, students or other pedants.

Deployment Models: The Cloud is categorized in the four deployment Models, which are mentioned as:

Private Cloud: Private cloud is one of the types of cloud computing. It endorses same benefits to public cloud. It offers advantages such as scalability and self- services [5]. As public cloud offers services to multiple organizations, a private cloud works for single organization.

Public Cloud: A Public Cloud is another type of cloud computing model. In this model, Service Provider delivers applications publicly via internet among multiple organizations. Different Providers offers different applications but storage capabilities or virtual machines are common in all. Some of the public cloud furnishes their resources free of cost [7]. Organizations with huge amount of data demand this type of cloud model.

Community Cloud: In Cloud computing, a Community cloud shares cooperative efforts. In community the framework is concerted among various organizations.

Hybrid Cloud: Hybrid cloud is a mixture of two or more clouds including private, community or public. Data and applications to be shared between them [8]. Hybrid cloud computing model gives all the uses of cloud computing.

Ddos Attacks in Cloud

Attack:

The Cloud Computing Environment perhaps composed in three ways. The attack may be derive from the following ways:

External to Internal

Internal to External

Internal to Internal

External to Internal: In this type of attack the botnet come from outside the destination system. The attack marks the subjective gateway of the cloud Infrastructure or the server.

Internal to External: In this type of attack, the attack starts by getting [18] the partnership of a virtual machine. This is possible because of Trojan horse.

Internal to Internal: in such case, an inside botnet is made and can attack other destination within the system. Many of the cloud applications may gap under these types of attacks.

2.2. DDoS Attack:

A DDoS stands for distributed denial- of Service attack. It is a little affectionate of attack where the attacker's pursuit to forbid certain users from penetrates the use. The attackers deliver enormous information in a DDoS attack querying the network or server to attest demands that have baseless arrival addresses [16]. The server or network are helpless to catch the arrival address of the attackers while posting the validate confirmation, making the server to remain since terminating the acquaintance. The attacker also drops verify information by null arrival addresses. The mechanism of attest and server wait will start repeatedly, henceforth, it making the connection or server active.

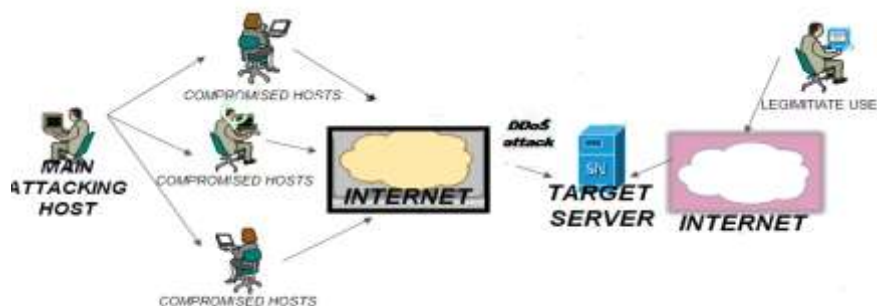


Fig.2: Architecture of DDoS Attacks

Types of DDoS Attacks

Following are the DDoS Attacks which are categorized into two types:

Network based Attacks

Application based Attacks

1. Network based Attacks

The NBA Attacks are further categorized in the following types:

TCP SYN Flood

ICMP Smurf Flood

UDP Flood

1) TCP SYN Flood

TCP SYN Floods are the earliest attacks. It occurs only to those systems whose are connected to the internet and also offering web server, email server and file transfer services i.e. TCP services. It initiated when various SYN Packets are being sends to the victim. Typically, when a client sends a SYN Packet to the server and requesting for a TCP connection. The server sends SYN-ACK packet back to the client as an Acknowledgement [2]. Further, the client sends an ACK packet to the server requesting for a connection. This mechanism is referred to as a “three way handshake.”

In this type of attack, Attackers usually join authorized information (source Port 0 or sequence number) and that could be a serious issue for us.

2) ICMP Smurf Flood

In ICMP Smurf Flood, here the Intruder can get the IP address of the victim’s address and will respond numerous of ICMP echo [17] requests among the systems those are at the Network. Various systems will get the request packet and send to the victim with ICMP echo replies. I this way, traffic will occur on the Network.

3) IUUDP Flood

UDP stands for User Datagram Packets. These are one of the DDoS Attacks where the plenty of UDP Packets are being sent to a particular server those packets are sent for repressive the device’s capability to send. In this situation, only the firewall will protect the server’s device. When a server gets a UDP packet, it comes across the following steps that are:

The server will confirm any of programs being running at a first instance. That can currently listen for requests at a particular point [3].

If none of the programs are getting packets at a particular port, the server will sends with ICMP packets that will acts like information sharing regarding the “destination of server is unreachable.”

2. Application based Attacks

Slow read Attacks

It is also one of the DDoS Attacks; here attackers can send an appropriate HTTP request to the server [12-11]. A response is very slow while reading. Due to the slow speed sometime you can only get a one byte at a time. In this way, an attacker can escape from the server by getting an idle connection timeout.

2) HTTP Flood

It is the also the type of distributed DOS Attack where an attackers is able to modify HTTP and then can POST unnecessary requests with an aim of attack an application.

Following are the categories of HTTP Flood attacks:

(i) HTTP GET Attack

These attacks are designed in this way that numerous systems can work together to send numerous requests such as images, files etc. [15].

(ii) HTTP POST Attack

This attack is initiated, when we submit a form on a website. While submitting a form on a website, a server handles the requests and then pushes the data or information into a database [13-14]. This whole mechanism of handling requests and pushing data into a database is known as POST.

Conclusion

As attack techniques continue to lead, the companies today have to face various threats. The paper provides an overview of cloud computing threats in the cloud, impact of DDoS attacks in recent trend. The significance and the effects of DDoS attack in the cloud computing environment are highlighted. DDoS attacks are increasing day by day. So this paper gives a survey about various kinds of DDoS attacks and how to handle them.

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Chapter-24

Depression, Anxiety and Emotional Intelligence in Nursing Staff

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Abstract

*Nurses play crucial role in treatment of patients as they are with patients 24*7 and they are the link between doctors and patients. The purpose of the current study was to examine association among Depression, Anxiety and emotional intelligence in nursing staff. For this purpose 51 nurses with the mean age of 35.02 working in different departments of BMC hospitals in Mumbai were selected using purposive sampling method. Variables under the study were measured using Beck Depression Scale (Beck, 1996), Beck Anxiety Scale (Beck, 1988) and Schutte Emotional Intelligence Scale (Schutte, 1998). Descriptive statistics and Pearson correlation was computed on SPSS 16.0 for analysing the data. The results stated significant positive correlation between depression and anxiety in nursing staff ($r=0.37$, $p<0.01$). However, correlation between depression and emotional intelligence ($r=-0.02$, $p>0.05$) and anxiety and emotional intelligence ($r=-0.23$, $p>0.05$) was found to be insignificant.*

Keywords: Depression, Anxiety, Emotional Intelligence, Nursing Staff

Introduction

Nurses spend most of their time in hospital taking care of patients. They are involved in making decisions for patient's care. At the same time the ratio of nurses and patients is not proportionate which may overburden them with work that in turn may affect their mental health (Stetz et al., 2007). Various other work conditions such as changing shift timing, long working hours (Masoooleh, Kaviani, Khaghanizade & Araghi, 2007), lack of professional support (Gong et al., 2014), making decisions, responsibility of patient (Menzies, 1960), death of patients, taking care of terminally ill patients, insecurity due to aversive conditions of patients, etc. are the reason for development of depression, anxiety and stress in nurses. Khodadadi, Hosseinzadeh, Azimzadeh and Fooladi in 2016 found that Iranian nurses suffered from a moderate level of anxiety, stress and depression and hospital ward type had a relation with stress level. Nurses do not only take care of patients but also educate families of them to rehabilitate the patients (DeLucia, Ott & Palmieri, 2009). However, poor mental health of the nurse may affect the quality of the work or support that they provide to the patients or their caregivers. Currently, increased use of technology and increasing cost of health care has increased stress in nurses (Menzies, 1960).

The department in which nurse work may have different workloads and impacts nurse's health at different rate. Research investigating anxiety levels of the nursing students who were caring for the patients in the terminal period found their scores to be higher than the average level in people in general (Sancar, Yalcin & Acikgoz, 2018). In a study by Tsaras, et al. (2018) 52.7% of nurses were found to be depression, 48.2% were experiencing anxiety. Demographic variables such as age, marital status and educational level were found to related to depression and anxiety; whereas working experience was solely responsible for depression in nurses. Research has also found high level of burn out in nurses with poor mental health. There is a positive correlation between poor mental health and long working hours in nurses (Masoooleh, Kaviani, Khaghanizade & Araghi, 2007). Mousavi, Ramezani, Salehi, Khanzadeh and Sheikholeslami (2017) established significant positive correlation between psychological symptoms (depression, anxiety and stress) and burnout dimensions (emotional exhaustion, depersonalization and reduced personal accomplishment) in nurses.

Depression symptoms may differ in their severity and manifestation from person to person. It is considered as consisting of symptoms such as persistent sad or anxious feelings, loss of interest in activities or hobbies once pleasurable; feeling of emptiness; feelings of guilt or pessimism; hopelessness, worthlessness, or helplessness; irritability and restlessness (National Alliance on Mental Illness, 2015; National Institute of Mental Health, 2014).

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Depressive symptoms found in nurses include depressed mood (2 weeks or more), continual fatigue, aches in different parts of the body or joints, disturbed sleeping, thoughts of death and difficulty while concentrating on work (Welsh, 2009). Depression in most of the instances may have comorbidity with anxiety or anxious feelings (Ardekani, Kakooei, Ayattollahi, Choobineh & Seraji, 2008; Bjorvatn et al., 2012; Oyane, Pallesen, Moen, Akerstedt, & Bjorvatn, 2013). Depression is often found to be escorted by report of at least one chronic disease (Gao et al., 2012; Ohler, Kerr, & Forbes, 2010). Anxiety refers to an emotion regarded as feelings of tension, worry, recurring and intrusive thoughts with some of the physical symptoms such as increased blood pressure, sweating, rapid heartbeat or dizziness. It may also involve avoidance of things, people or situation that leads to the feeling of anxiety or fear (American Psychological Association).

A research indicated that emotional intelligence program helps in preventing and managing depression (Abdellatif, Hamad, Saleh & Zoromba, 2015; Shabany & Ghajarzadeh, 2018). Emotional intelligence refers to the ability to perceive, control, and evaluate emotions (Johnson et al., 2009). However, the awareness of emotional awareness, managing one's emotion, understanding and managing patient's or their caregivers' emotions is lacking in many nurses. Nurses are not aware of the concept of emotional intelligence. Many studies have emphasized that higher emotional intelligence is related to lower level of depression and anxiety. However, lack of interventions or training for developing ability to understand emotions of self and others in nursing courses lead to deprivation of ability to deal with the situations effectively and thus improve their quality of care in nursing students and nursing staff. Szczygiel and Mikolajczak found that poor emotional intelligence lead to negative emotions in nursing staff which eventually increased burnout in them. Another research found that higher emotional intelligence is good predictors of lower stress, anxiety, and depression in resident physicians (Kousha, Bahgheri & Heydarzadeh, 2018). Emotional intelligence has been found to be related to wellbeing (Koubova & Buchko, 2013 as cited in Raghubir, 2018), stress, mental health, emotional well-being and help-seeking behaviours in nursing staff (Akerjordet & Severinsson, 2007, as cited in Raghubir, 2018). Emotional intelligence also improves one's ability to empathise, understand and judge the situation and make decisions (Akerjordet & Severinsson, 2007, as cited in Raghubir, 2018).

In hospitals nursing staff is available with patients 24*7 playing different roles such as teacher, caregiver, decision maker, critical thinker and a link between patients and doctors. However, since few years researches has reported increasing number of nurses experiencing depression, anxiety and stress (Pirani, 2019). There are many reasons reported by different nurses for feeling depression and anxious in the beginning of the chapter. Nurses are with the patients from beginning of the patient's treatment till they take discharge. Thus they are the most trusted healthcare professional. Poor mental health affects job satisfaction, performance on the job of nursing staff and hence the quality of care provided to the patient (Melnik et al., 2018; Pirani, 2019; Putnam & McKibbin, 2004; Wang et al., 2010). Many researchers have emphasized that emotional intelligence may play a role in reducing the depression and anxiety experienced by nurses (Akerjordet & Severinsson, 2007, as cited in Raghubir, 2018; Kousha, Bahgheri & Heydarzadeh, 2018) and thus current research also aimed at exploring the association between depression, anxiety and emotional intelligence in nursing staff working in different departments of BMC hospitals in Mumbai.

Method

Hypothesis

Hypothesis 1: There is a significant correlation between depression and anxiety in nurses.

Hypothesis 2: There is a significant correlation between depression and emotional intelligence in nurses.

Hypothesis 3: There is a significant correlation between anxiety and emotional intelligence in nurses.

Participants

Sample consisted of 51 nurses working in different departments of BMC hospitals in Mumbai between the age group of 25-40 years. The sample was selected using purposive sampling method. Education qualification of all nurses was of General Nursing course.

Research Design

Correlational study design was used.

Instruments

Beck Depression Inventory II (BDI-II): It was developed by Aaron Beck in 1996 and is a 21 item self-report questionnaire. The BDI-II are rated on 4 point Likert scale ranging from 0-3 based on severity of each item. It is widely used indicator of severity of depression. It is available in multiple languages and it monitors changes over time. BDI-II can be used to assess patients diagnosed as depressed and to detect depression among the normal population. Total score obtained on BDI-II between 0 and 13 indicate minimal depression, the score between 14 and 19 indicate mild depression, the score between 20 and 28 indicate moderate depression and the score above 28 indicate severe depression. BDI-II has good psychometric properties. The internal consistency is found to be 0.90 and the test-retest reliability ranged from 0.73-0.96. The criterion based validity of BDI-II shows good sensitivity and specificity for detecting depression (Wang & Gorenstein, 2013).

Beck Anxiety Inventory (BAI): This scale was developed by Aaron Beck in 1988 and its revised manual was published in 1993.

It is a self-report measure with 21 items. Scores range from 0 to 3 for each item depending on the responses of the participants. Scores between 0 to 21 suggest very low anxiety, 22 to 35 suggest moderate anxiety and above 35 is suggestive of severe anxiety. The scale has high internal consistency with the Cronbach alpha scoring 0.94. Test-retest reliability was also found to be 0.67 over the period of 11 days. High correlation was found between BAI and state-trait anxiety scale (Fydrich, Dowdall & Chambless, 1992).

Schutte Self-Report Emotional Intelligence Test (SSEIT): The Schutte Self-Report Emotional Intelligence Test (SSEIT) is developed by Dr. Nicola Schutte (1998). It measures four dimensions such as emotion perception, utilizing emotions, managing self-relevant emotions, and managing others' emotions. It was developed based on the Salovey and Mayer's Emotional Intelligence model (1990). It is a self-report scale with 33 items on which participants have to respond on the continuum of strongly agree to strongly disagree. Reliability of SSEIT is 0.9 (Schutte et al. 1998). Correlation between SSEIT and happiness was found to be 0.7 (Petrides and Furnham, 2000).

Procedure

Various nurses working in different departments of BMC hospitals were contacted. They were explained about the research and aim of the current study. They were explained the consent form in which confidentiality of their details, their privacy and voluntary participation were emphasised. Informed consent was taken from the participants before giving them questionnaires. They were read instructions about how to respond to each questionnaire. If they had any doubts, they were clarified. After collecting data participants were debriefed about their results and thanked. After data collection completed data analysis was done using SPSS 16.0.

Results and Discussion

As mentioned above, the current study looked at correlation of depression, anxiety and emotional intelligence in nursing staff of BMC hospitals in Mumbai. Result of the analysis is discussed below.

Table 1: Sociodemographic and other characteristics nursing staff

Sociodemographic variables	Mean (SD)	n (%)
Age (years): mean (SD)	35.02 (6.65)	
Marital Status		
Married		46 (90.2%)
Unmarried		5 (9.8%)
Family type		
Extended joint family		22 (43.14%)
Joint family		27 (52.94%)
Nuclear family		2 (3.92%)
Work experience: mean (SD)	14.82 (7.38)	
Department of hospital		
Medical		7 (13.73%)
Surgical		6 (11.77%)
Paediatric (Neonate)		14 (27.45%)
Maternity (obstetrics and gynaecology)		11 (21.57%)
Psychiatric		4 (7.84%)
Intensive Care Unit		6 (11.76%)
Emergency department		1 (1.96%)
Operation theatre		2 (3.92%)
Monthly income (in Thousand)		
Below 30,000		2 (3.92%)
31000 – 50000		32 (62.75%)
51000 – 70000		16 (31.37%)
71000 and above		1 (1.96%)

Table 1 represents sociodemographic and other characteristics of nursing staff. The mean age of nursing staff was 35.02. Whereas, standard deviation of female nursing staff was 6.65 which indicated that the nursing staff was nearly from the similar age range. Majority of the participants were married (n= 41, 90.2%). 22 nurses were living in extended joint family, 27 were living in joint family and 2 nurses were living in nuclear family. Work experience mean (SD) was found to be 14.82 (7.38).

As it can be observed in table 1 most number of nurses were from Paediatric (Neonate) (n=14, 27.45%), followed by Maternity (obstetrics and gynaecology) department (n=11, 21.57%), followed by Medical (n=7,

13.73%), Surgical (n=6, 11.76%), and Intensive Care Unit (n=6, 11.76%)), followed by Psychiatric (n=4, 7.84%), Operation theatre (n=2, 3.92%) and least from Emergency department (n=1, 1.96%). Most of the participants (n=32, 62.75%) of the study had the salary of 31000 – 50000 rupees per month. 16 (31.37%) nurses had the salary of 51000 – 70000 rupees per month. Two (3.92%) nurses had the salary of Below 30,000 rupees and One (1.96%) nurse had the salary of 71000 rupees and above per month.

Table 2: Descriptive statistics and prevalence and average scores of Depression, Anxiety and Emotional Intelligence in nursing staff

	Normal Threshold	Mean	Interpretation	Prevalence	SD	N
Depression	≤14	9.04	Normal	25.49%	8.85	
Anxiety	<21	13.22	Mild	13.72%	9.73	51
Emotional Intelligence	-	133.04	-	-	17.85	

As it can be observed in table 2 the mean and SD of depression was 9.04 and 8.85 respectively; of anxiety was 13.22 and 9.73 respectively; and 133.04 and 17.85 respectively. It was also found that out of 51 nursing staff three nurses reported for mild depressive symptoms, ten nursing staff conveyed to have moderate depression according to BDI and seven nursing staff informed to have moderate anxiety and two nurses reported severe anxiety based on BAI. Thus 25% of nursing staff reported of presence of depression and 13% reported of having symptoms of anxiety.

Table 3: Pearson Correlation Coefficient of Depression, Anxiety and Emotional Intelligence in nursing staff

	Anxiety	Emotional Intelligence
Depression	0.37**	-0.02
Anxiety		-0.23

**p<0.01

Table 3 depicted that the correlation between Depression and anxiety was positive and moderate indicating increase in the level of depression may lead to increase in the level of anxiety in nursing staff. It was found to be significant ($p<0.01$). Conversely, the obtained correlations between depression and emotional intelligence and anxiety and emotional intelligence were negative and low. However, they were non-significant ($p>0.05$).

A study by Rathnayake and Ekanayaka (2016) reported positive correlation between depression, anxiety and stress among undergraduate nursing students in Sri Lanka. Depression and Anxiety are comorbid conditions complained by many nurses (Ardekani, Kakooei, Ayattollahi, Choobineh & Seraji, 2008; Bjorvatn et al., 2012; Oyane, Pallesen, Moen, Akerstedt, & Bjorvatn, 2013).

Different triggering factors are associated with depression such as personality characteristics and situational events, internal factors and work process such as professional activity, shift interpersonal relations, work overload, work scheduled problem, client care exhaustion, social support and insecurity. Years of experience and the unit in which nurses work may also have an impact on the depression (Schmit, Dantas and Marziale, 2011). Age, gender, hospital level, and job tenure may predict depression and anxiety in nurses (Huang, Wu,, Ho,& Wang, 2018). Hospital ward type and type of work at different shifts may have a relation with stress level (Khodadadi, Hosseinzadeh, Azimzadeh & Fooladi, 2016).

Salgueroa, Extremera and Fernández-Berrocal (2012) found that there was no significant negative correlation between emotional intelligence and depression in women. Ishii (2018) advocated that education program for newly graduated nurses, planning and methods of postgraduate education programs, and evaluation of education programs are required for improving emotional intelligence in nurses. However, in many nursing courses nurses are not trained for improving emotional intelligence. There are many hospitals where the mental health facilities are not available for nurses which affect their ability to manage stress related to family or work conditions involving colleagues, patients and their relatives. A qualitative research conducted by Janet in 2014 revealed lack of awareness of the concept of emotional intelligence which could be used to handle stressful situations. The awareness level of emotions is also found to be lower in mental health nurses and medicine nurses (Ishii & Horikawa, 2019). Current study has incorporated participants from different age group which may have led to non-significant correlation between Emotional intelligence and depression and anxiety. Emotional intelligence and age are found to be correlated with each other (Ishii, 2018). Many a times emotional competence may be present in nurses however, they may find it difficult to express as emphasized by Humpel, Caputi and Martin (2001) there is no correlation between emotional competence and emotional expression in female nurses. They also found insignificant correlation between trait affectivity and stress in nurses.

Conclusion

The current study highlighted the percentage of nursing staff with moderate levels of depression and anxiety. It can be concluded that in nursing staff as depression increases, the level of anxiety also increases. However, no such relationship was obtained between depression and emotional intelligence and anxiety and emotional intelligence.

There is an obvious limitation in the study as it doesn't give us direction of the relationship between variables. Data were collected from the nursing staffs of different departments of BMC hospitals. Work experience of nursing staff may also have affected the results. Examining the effects of sociodemographic variable with a larger group may give us better understanding about the variables. Qualitative analysis in terms of exploring the causes and effects of depression and anxiety in nursing staff may give more insights about the topic. Further research for identifying support strategies, interventions, provision of mental health services for nurses in their workplace for free of cost may help in improving the mental health and wellbeing of nursing professionals and in turn the quality of care provided to the patients.

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Chapter-25

Analysis of Machining Parameters in Milling Operation of C64 Steel by Response Surface Methodology

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Abstract

This paper investigates the way to implement and testing of a lively controlled palletized work holding system for milling operations in horizontal milling machine and the way to target a piece holding system for the control of unwanted vibration during machining operation therefore decreasing the surface quality. As a result, degraded quality on the machined parts, shortens the tool life, and unsightly noise, hence is to be necessarily damped out. As a result, unwanted vibrations & noise must be arrested so as to make sure higher accuracy and surface finish alongside productivity. The arose vibrations on a slotted table and horizontal miller are damped out using composite structure as a substitute for the bottom of the work piece. Experiment wise investigation of the Poly vinyl chloride (PVC) plates is fixed on the slotted table below the work piece specimen milling operation is administered work piece specimen as C64 plate. All setting of experiment is administered response surface methodology (RSM) design of experiment and also finds out which factor influence the surface roughness.

Keywords: Composite material, C64 plate, Milling machine, Poly vinyl chloride (PVC) plate, Response surface methodology, Surface roughness

Introduction

Metal cutting is one among the foremost significant manufacturing process within the area of material removal. Metal cutting are often defined because the removal of metal from a piece within the sort of contribute order to get a finished product with desired attributes of size, shape and surface roughness. Machining condition plays a really important role in estimating the performance of machining operation. The machining conditions like cutting speed, feed rate, depth of cut, affect the operation in great extent. These parameters must be taken to optimize the machining operation. The target of present work is to analyze the effectiveness of milling parameter on surface roughness (Ra) and the test performed in horizontal miller. The work piece material is C64 steel. The effect of feed rate, cutting speed and depth of cut on surface roughness were studied using MINITAB 18 analysis software. RSM was used to design the experiment and optimization. The Analysis of Variances (ANOVA) was to determine the cutting parameters significantly affecting the surface roughness.

Literature Review

Bhagat et al. (2014) performed AN experiment on AISI 52100 steel (D3 type) in miller . They studied the effectiveness of edge parameter on surface roughness (Ra) and metal removal rate (MRR). Davim (2003) used Taguchi methodology in analysis development. The cutting conditions like feed rate, depth of cut and speed influence the surface end. Suresh et al. (2002) performed an experiment, Die steel (D3 type) used for work piece material and machining performed throughout this work piece. Tin coated W inorganic compound (CNMG) was used for cutter. Trivedi et al. (2014) throughout this analysis work, the slotted table horizontal miller are used for machining purpose and so the work piece material is mild steel plate. Wankhede et al. (2 0 1 6) through out this analysis, the experiment performed on slotted table horizontal miller. Rao et al. (2013) throughout this analysis, a trial has been created to review the result of cutting parameters like depth of cut, speed, feed rate that influence the quality of surface roughness. Akhyar et al. (2008) throughout this analysis Taguchi methodology is utilized to optimize the cutting parameters in turning operation. Kopac et al. (2007) throughout this analysis numerous flank edge parameter designed to optimize the edge surface roughness, cutting force, material removal rate at intervals the machining of AN alloy casting plate. Ghani et al. (2004) the target of this analysis is to optimized the cutting

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parameters like cutting speed, feed rate and depth of cut in finish edge method miller accustomed machining the hardened steel AISI H13 with Tin coated P10 inorganic compound insert tool. Kumar et al. (2014) throughout this analysis confirm the best optimum cutting parameter leading to most metal removal rate (MRR) and minimum roughness by Multi Objective Genetic algorithmic program (MOGA) with desegregation response surface methodology (RSM) in face edge of Al 6061 alloy. Singh et al. (2014) this study evaluates the machining performance of EN24 steel. The machining operation perform by CNC machine with inorganic compound finish mill cutter Taguchi style of experiment use for experimental purpose and study the response variables like MRR and surface roughness.

Problem Identifications

From the available literature, it is often seen that though some work has been reported on influence of milling parameters on surface roughness and cutting forces measurement of the machined surface, no attempt has thus been made to material using between work piece and bed of milling machine for increasing the roughness responses. Therefore, there should be research Endeavour to use to material in miller to achieve reasonably low value of SR

Objective of Research Work

The objective of this experimental work is to measure the surface roughness of a work piece specimen C64 mounted on varying multi-layered stacked sheets of PVC during machining operations and also evaluate the consequences of various cutting parameters on work piece of C64

Material & Method

- Machine: Horizontal Miller Machine
- Work piece material : C64 Steel

Table 1: Physical properties of C64 steel

Name of the Material	YS MPa	UTS MPa	EI %	Core Hardness (HRC)
<i>Ferrium C64</i>	1372	1579	18	45-50

Table 2: Composition of C64 steel

Name of the Material	Fe	C	Co	Cr	Ni	Mo	W	V
<i>Ferrium C64</i>	Bal.	0.11	16.3	3.5	7.5	1.75	0.2	0.02

Composite material: Poly vinyl chloride (PVC)

Table 3: Properties of composite material

Name of the Material	Material Type	Cross section (mm)
Poly vinyl chloride (PVC)	Thermoplastic	210x210x5

Table 4: Machining parameter and their level

Control Parameter					
Parameter	Symbol	Level			Unit
		1	2	3	

Feed rate	F	16.0	20.5	25.0	mm/min
Cutting speed	S	180	230	280	RPM
Depth of cut	d	0.01	0.02	0.03	Mm
No. of plate	n	1	3	5	

- Design of Experiments : L27 basic types of standard orthogonal arrays (OA) used for the design of experiment. Since three factors are taken in the experiment, three level of each factor are considered. Therefore, an array L27 is selected for the experiment.

Experimental Result

Table 5: Experimental results

Run no.	F (mm/min)	S (RPM)	d (mm)	No. of plates	(Ra)
1	16.0	180	0.02	3	0.82
2	25.0	180	0.02	3	1.21
3	16.0	280	0.02	3	2.05
4	25.0	280	0.02	3	1.64
5	20.5	230	0.01	1	1.42
6	20.5	230	0.03	1	1.73
7	20.5	230	0.01	5	1.67
8	20.5	230	0.03	5	1.94
9	16.0	230	0.02	1	1.72
10	25.0	230	0.02	1	1.50
11	16.0	230	0.02	5	1.54
12	25.0	230	0.02	5	1.80
13	20.5	180	0.01	3	1.82
14	20.5	280	0.01	3	2.20
15	20.5	180	0.03	3	1.25
16	20.5	280	0.03	3	2.00
17	16.0	230	0.01	3	1.65
18	25.0	230	0.01	3	1.27
19	16.0	230	0.03	3	1.85
20	25.0	230	0.03	3	1.97
21	20.5	180	0.02	1	1.83
22	20.5	280	0.02	1	1.85
23	20.5	180	0.02	5	1.05
24	20.5	280	0.02	5	1.45
25	20.5	230	0.02	3	1.69
26	20.5	230	0.02	3	1.23
27	20.5	230	0.02	3	0.79

Results and Discussions

The influences of the cutting parameters like Cutting speed (S), Feed rate (F), depth of cut (d) and number of plates (n) on the response variables selected are assessed for 3 different secondary bed materials by conducting experiments. The results are put into the Minitab 18 software for further analysis Influence on surface roughness (SR). Figure 1, 2 & 3 surface plots of roughness shows graphical representation of cutting speed, feed rate and depth of cut Vs surface roughness at cutting speeds of 180, 230 and 280 RPM, with feed rates of 16, 20 and 25 mm/min, depth of cut of 0.01, 0.02 and 0.03 mm and numbers of plates 1,3, and 5. During this figure is clearly indicates the when the feed is increase in 16 to 20 then the surface roughness is increasing and if the feed is increase in above the 20 mm/min the Ra value is decreasing. So, it is often seen that the upper value of feed given the great surface finish of this experiments. If the speed is increased within the roughness value is decreasing up to maximum level then they start to increasing. The optimum value of the speed in 230rpm permanently surface finish. Depth of cut is slightly increasing so there's not significantly effect on surface roughness that also are described within the ANOVA analysis of surface roughness. The number of plates is increasing the roughness value in decreasing. So, it is often shown that the amount of composite plate in increasing the surface finish in increasing. Table 6 is the ANOVA for before elimination of non-significant terms and after eliminations the insignificant terms the ANOVA shown in Table 7.

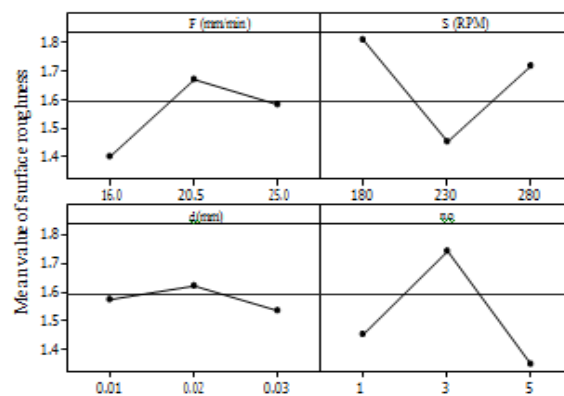


Figure 1: Main effect plots for surface roughness

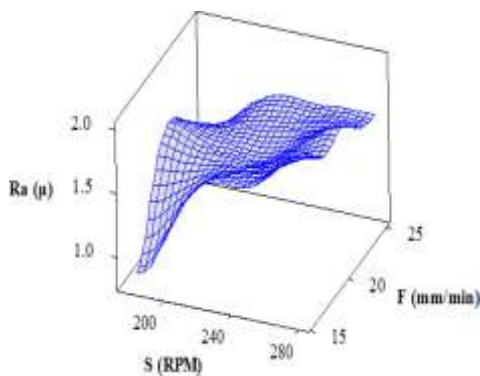


Figure 2: Surface Plot of Ra vs F, S

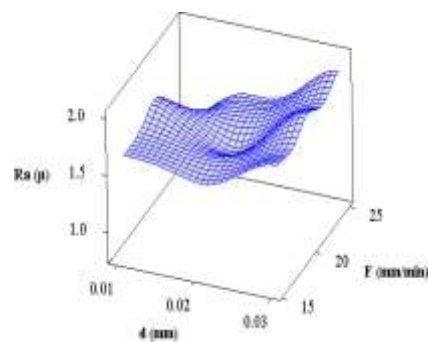


Figure 3: Surface Plot of Ra vs F, d

Table 6: Analysis of Variance for (Ra) Before eliminations of non-significant terms

Source	DF	Seq SS	Adj SS	F	P
Regression	14	3.04612	3.04612	16.85	0.000
Linear	4	0.16038	0.16028	3.10	0.057
F	1	0.09921	0.09901	7.67	0.017
S	1	0.02531	0.02521	1.95	0.188
D	1	0.00423	0.00403	0.31	0.587
No	1	0.03213	0.03203	2.48	0.141
Square	4	1.58333	1.58332	30.66	0.000
F*F	1	0.21004	0.36750	28.46	0.000
S*S	1	0.51756	0.10830	8.39	0.013
d*d	1	0.00770	0.15187	11.76	0.005
no*no	1	0.84801	0.84801	65.68	0.000
Interaction	6	1.30252	1.30252	16.81	0.000
F*S	1	0.12602	0.12602	9.76	0.009
F*d	1	0.16000	0.16000	12.39	0.004
F*no	1	0.00000	0.00000	0.00	1.000
S*d	1	0.03240	0.03240	2.51	0.139
S*no	1	0.06250	0.06250	4.84	0.048
d*no	1	0.92160	0.92160	71.38	0.000
Residual Error	12	0.15494	0.15494		
Lack-of-Fit	10	0.13488	0.13488		0.500
Pure Error	2	0.02007	0.02007	1.34	
Total	26	3.20107			

Table 7: Analysis of Variance for (Ra) after eliminations the insignificant terms

Source	DF	Seq SS	Adj MS	F	P
Regression	12	3.01373	0.251154	18.67	0.000
Linear	4	0.16128	0.045071	2.89	0.056
F	1	0.09801	0.099007	7.42	0.018
S	1	0.02531	0.025218	1.98	0.192
D	1	0.00413	0.004233	0.33	0.598
No	1	0.03303	0.032433	2.59	0.145
Square	4	1.58532	0.394829	28.58	0.000
F*F	1	0.21004	0.367500	27.46	0.000

S*S	1	0.51756	0.108300	8.09	0.013
d*d	1	0.00770	0.151875	11.35	0.005
no*no	1	0.84801	0.848008	63.37	0.000
Interaction	4	1.27012	0.317531	23.73	0.000
F*S	1	0.12602	0.126025	9.42	0.008
F*d	1	0.16000	0.160000	11.96	0.004
S*no	1	0.06250	0.062500	4.67	0.048
d*no	1	0.92160	0.921600	68.87	0.000
Residual Error	14	0.18734	0.013382		
Lack-of-Fit	12	0.16828	0.013840	1.39	0.493
Pure Error	2	0.02107	0.014033		
Total	26	3.20108			
S = 0.125679 R-Sq = 95.35% R-Sq(adj) = 88.15%					

Conclusions

Based on the experimental results, the subsequent conclusions are often drawn:

1. Response surface methodology is found to be a successful technique to perform analysis of surface roughness in milling operation with reference to various combinations of design variables (cutting speed, feed rate, depth of cut and numbers of plates).
2. The upper value of feed rate gives the great surface finish.
3. Speed is increased within the surface roughness value is decreasing up to maximum level then they start to increase. The optimum value of the speed is 230 rpm permanently surface finish.
4. The amount of plate is increasing the surface roughness value in decreasing. So, it is often shown that the amount of composite plate is increasing the surface finish. 2nd order response model for Ra is more precise significant results during machining operations

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Chapter-26

Agroforestry for Forest and Landscape Restoration

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Abstract

Agroforestry systems that provide permanent tree cover should be promoted in forest landscape restoration initiatives where neither natural forest restoration nor full sun crops are viable large-scale options. An intimate knowledge of local livelihoods, forest use, and farming systems are required for successful initiatives that aspire to revive forest landscapes and develop sustainable agriculture. Agroforestry can improve the resiliency of agricultural systems and mitigate the impacts of temperature change. Existing research suggests that integrating trees on farms can prevent environmental degradation, improve agricultural productivity, increase carbon sequestration (Aertsens et al. 2013), generate cleaner water, and support healthy soil and healthy ecosystems while providing stable incomes and other benefits to human welfare. Although these claims became more widely accepted because the body of agroforestry research increases, systematic understanding of the evidence supporting them remains lacking for high-income countries. Most up-to-date definitions of land degradation also embrace negative changes within the capacity of ecosystems to produce a spread of social and environmental goods and services. Over time, land degradation can increase the vulnerability of rural communities to biological and environmental hazards and to the results of global climate change. Poverty and natural resources/environmental degradation tend to negatively reinforce each other; that's, because the land is degraded, agricultural productivity is lowered, leading to decreasing incomes and food security and vice-versa. For agroforestry to satisfy its potential as an FLR strategy, variety of challenges remains. First, because it tends to fall between the forestry and agriculture sectors, agroforestry has not received much support or planning in many countries. Access to top quality propagation materials (including seeds/seedlings) is additionally key but often lacking. Adoption of agroforestry also requires that local landholders are ensured proper tenure rights (especially tree tenure) which they need ready access to relevant markets.

Keywords: Agroforestry System, Tree Cover, Home Garden, Forest Landscape, Forest Restoration

Introduction

In a perfect world, restoration wouldn't be necessary; but, nowadays several forest habitats are already thus broken that their semi permanent survival, and so the ecological services they provide, is unsure we tend to desperately should contemplate restoration if we are to realize conservation and sustain the livelihoods of people passionate about nature. Forest conservation methods that swear exclusively on protected areas and property management have established scarce either to secure variety or to stabilise the atmosphere. The UN Environment Programme currently an oversized proportion of the world's land surface as "degraded" and this degradation is making an oversized vary of ecological, social, and economic issues. Forest loss and degradation is also a notably vital part during this worldwide drawback with annual world estimates of forest loss being as high as sixteen million hectares, and other people for degradation even higher. Reversing this harm is one altogether the largest and most advanced challenges of the twenty first century (Acharya and Kafle, 2009).

According to remote sensing data, 43 % after all agricultural land had a minimum of 10 % tree cover in 2009, representing over one billion hectares of land. This provides an indication of the large extent of agroforestry that's practised by over 1.2 billion people. Agroforestry will diversify and increase agricultural production whereas conjointly providing land users with different economic, social and environmental advantages. Many agroforestry approaches are on the marketplace for restoring and increasing land productivity whereas conjointly meeting the needs of low-income farmers, and thus the presence of trees confers form

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of benefits. As an example, trees will fix N, stabilize the soil, and be used in terracing; contour cultivation and strip-cropping to combat geologic process and increase soil fertility. Planted in windbreaks and shelterbelts, trees will shield soils against wind erosion. Trees can also be planted in superior fallows and alley-cropping systems, with the branches cropped and applied as mulch to increase soil organic matter and nutrient standing. In silvopastoral systems, tree canopies give stock with shade and wind protection and so indirectly improve animal welfare, health and productivity. Forest soils are often fertile, especially where forest ecosystems are relatively undisturbed and are able to cycle and recycle essential plant nutrients and organic matter over long periods. Even where forest soils are poor, significant amounts of nutrients are often held within the above-ground biomass. In relatively young secondary forests or woody fallows, organic matter from tree litter (leaves, bark, branches, etc.) can quickly accumulate. Moreover, the deep root systems of trees are able to “pump” nutrients from the soil that are inaccessible to other plants.

Farmers round the world amalgamate trees into farming systems. In some places, these practices are conventional; in others, they're newly adopted. Some depend on standing forest while others involve cultivating trees. Agroforests are often accustomed recover agricultural productivity, restore degraded soils, augment food security, and diversify livelihoods. In terms of carbon sequestration and biodiversity they fall between native forest restoration and monoculture agriculture. For agroforestry to satisfy its potential as a forest and land restoration strategy, variety of challenges remain. First, because it tends to fall between the forestry and agriculture sectors, agroforestry has not received much support or planning in many countries. Access to prime quality propagation materials (including seeds/seedlings) is additionally key but often lacking. Adoption of agroforestry also requires that local landholders are ensured proper tenure rights (especially tree tenure) which they need ready access to relevant markets.

The Dilemma of Shifting Agriculture

Farmers have beleaguered forest ecosystems for hundreds of years. Usually this has taken the form of shifting agriculture, whereby a patch of forest is cleared, burnt, and then farmed for a pair of years until much of the soil fertility has been dwindling and/or colonisation of the plot by weeds becomes too difficult to manage. In these traditional systems, the realm is then deserted and left fallow for variety of years. If the duration of fallow periods is long enough, shifting cultivation could be a sustainable system. However, in many tropical developing countries, high increment rates have led to an amplified demand for arable land that has, in turn, resulted in shorter and shorter fallow periods for these systems. The shorter fallow periods end in unacceptable soil fertility and declining yields. Over time, this has led to severely degraded lands not appropriate for agriculture. Farmers are then forced to clear the primary forest again for the fertile soils needed for acceptable crop yields. The long-term result has been an accelerated rate of forest degradation and deforestation.

A Short Introduction to Agroforestry

Agroforestry isn't a replacement practice and has, in fact, existed for as long as humans have practised agriculture. However, it's only during the past 30 years that it's received ample scientific attention and systematic study. The accepted definition of agroforestry is “a collective name for land-use systems and technologies where woody perennials are intentionally used on equivalent land-management units as agricultural crops and/or animals, in some variety of placement or temporal sequence. The key word here is “deliberately,” because the people employing these systems couple intentionally. Some kinds of agroforestry are potential avenues for contributing to forest landscape restoration while also responding to agricultural needs and thus the shifting cultivation dilemma. Agroforestry can contribute to Forest and Landscape Restoration (FLR) in several ways: through enhancing sustainable agricultural intensification, alleviating poverty, and for its under-recognised prospective for climate mitigation and biodiversity conservation.” Farmers round the world incorporate trees into farming systems. In some places, these practices are conventional in others, they're newly adopted. Some depend upon standing forest while others occupy cultivating trees. Given the wide diversity of those systems it's challenging to characterize them, but nevertheless, the numerous distinct varieties of agroforests hold much promise to meeting FLR objectives in populated landscapes across the tropics.

It has been estimated that 40% of the world's agricultural land (>1 B ha) has over 10% tree cover, although this substantially underestimates agroforestry's input because it omits systems defined as forests but still extensively used within food production systems. Agroforestry has also been accepted because the natural (or appropriate) because of farm within the tropics. Yet, it's one thing knowing that trees on agricultural land afford many goods and services, and another persuading farmer to plant trees. Agroforestry often doesn't amuse the support from governments it warrants and there leftovers a robust tendency among farmers to confiscate trees from their farms. Indeed, for many, amplification is synonymous with the promotion of monoculture systems.

How can we confirm that agroforestry contributes to FLR?

In part, agroforestry is ignored because it's considered neither agriculture nor forestry and thus falls outside the remit of institutional structures. A critical aspect to FLR is that it should be cross-sectoral, but nonetheless it helps if agroforestry is given an accurate home, usually within the ministry or department of agriculture. A second related step is to create up a national strategy on agroforestry, like for example in India. Critical here is consideration of land and tree tenure. Without long-term tenure, there's little encouragement for farmers to grow trees. A final major limitation is that the availability of planting material, which may be a concern for FLR as an entire. It's important that farmers can access prime quality seeds and seedlings for the species they have to plant at reasonable prices. Nevertheless, even where farmers acknowledge the services trees provide, they'll be unwilling to take a position in planting, protecting and fostering those trees unless there's a ready marketplace for the products. Trees take several years to yield benefits and poor farmers often require more rapid profits on their investment, particularly if they believe it risky. There are in fact some ways around these problems, like long as structured markets or schemes for adding value, out growers' schemes, but these have to plan and built into the FLR process (Vierra et al. 2009). Agroforestry includes a crucial contribution to make to FLR, especially through its responsibility in sustainable agricultural intensification and poverty alleviation, but also through its often under-recognised potential for climate mitigation and biodiversity conservation. Realising these goals will need creating the appropriate enabling conditions in order that farmers are eager, and not just willing, to speculate in trees.

The Multipurpose Tree and Species' Choice

Domestication of Natural Forest Species and Biodiversity Considerations one in every of the foundations of agroforestry is that the multipurpose tree. This is often a woody species (tree or shrub) that may furnish over one product or service. Species that may put in these multiple benefits are preferable to people who provide only 1 product or service and may be actively promoted in restoration efforts intended at sustaining agriculture. for instance, many nitrogen-fixing shrub species may augment soil fertility while at the identical time providing nutritious fodder for livestock and holding soil in situ (combating erosion) (Zoomer et al. 2014). Similarly, fruit trees can provide food while also contributing to conservation. Which woody species to allow your support to in restoration efforts is additionally important from a biodiversity stand point? There could even be natural forest species that provide sustenance for key threatened fauna within the landscape. Ideally, it'd be preferable to steer species that fill this niche while at the identical time providing goods and services that are valuable for the local farming systems. Efforts to master propagation of those natural forest species so they will be planted in densely populated landscapes is also a key ingredient to successful restoration. this can be the primary step within the domestication process whereby valuable, local native species are planted and integrated into the farming system.

1. Competition between Woody Plants and Herbaceous Crops. One critical problem is to give some thought to when planning forest restoration to prolong agriculture is competition for light, water, and soil nutrients between trees/shrubs and crops. Spatial tradeoffs might have to be negotiated so as to realize an appropriate balance of agricultural yields and forest goods and services. as an example, it's going to be necessary to spice up the spacing between hedgerows so as to realize the specified agricultural yields in alley cropping (hedgerow intercropping) systems.

2. Trees Scattered Throughout the Landscape Versus Restoring a Closed Canopy Forest. In densely populated landscapes where arable land is in high demand, it should not be possible, from a socioeconomic standpoint, to revive significant areas wholly dedicated to tree cover or forests. Maybe alternatively, one ought to point of interest on planting trees and shrubs in "in-between" places on farms. These places could incorporates farm or field borders, hedgerows along contour lines in sloping areas, or small clusters of trees and shrubs adjacent to homes. The goal would still stick restoration of the products and services that woody plants provide.

3. Stakeholder/Client Needs and Forest/Tree Services Lastly, but most significantly, it's important to possess a firm understanding of who the key stakeholders or clients are furthermore as what their land and natural resources use viewpoints and priorities are in any forest landscape restoration programme. When it involves restoration aimed toward sustaining agriculture, the key stakeholder group are visiting be local farmers who practise agriculture within the landscape in question. It'll be of principal importance to understand the local agricultural systems and their relationship to forest cover. Similarly, it's significant to understand how the forest is traditionally used, that is, which species provide products that are helpful to the local population.

According to a worldwide assessment of restoration potential, there are quite two billion hectares of deforested and degraded land around the world where opportunities for some type of restoration intervention could also be realised. Restoring forests and forest landscapes may be a crucial step in recapture the health and functionality of these ecosystems.

Land degradation and poverty

Land degradation is one amongst the foremost prominent symptoms of planetary exploitation. Picture a desolate expanse of bare soil and sparse struggling vegetation, or a unadorned slope gouged with raw gullies, or a forest smothered under a shroud of vines. The ecological integrity of those lands has been dented through human mistreatment to such an extent that its capacity to support agriculture and provide ecosystem services has been completely damaged. The dimensions of land degradation are confounding. Globally there are over 2 billion hectares – a neighbourhood resembling Mexico, USA and Canada combined – impacting an estimated 1 billion people, predominantly within the Global South (Rebligio and Reyes, 2016). In geographical region, FAO has designed that the maximum amount as 65% of arable land and 30% of lea are degraded. Meanwhile, to satisfy the strain of growing populations and improved affluence, global food production has to increase by 70% or more by 2030 (FAO,2011).

Poverty and land degradation are intricately entangled, as farmers without alternatives try to eke out an existence in fragile environments, often having to challenge with poor soils, erratic rainfall, and inequitable and restricted access to resources. Land degradation reduces agricultural yields and incomes, increases the vulnerability of rural populations to climate and economic shocks, and fuels involuntary migration, social and political marginalisation, and conflict. Moreover, in an effort to supplement meagre incomes, poor farmers invade forests to clear more land or to chop trees for timber and charcoal. Thus, poverty and land degradation also are major causes of deforestation, and hence significant drivers of the world global climate change and biodiversity crises (Reij and Garrity, 2016). Political momentum for forest and landscape restoration (FLR) was borne out of a recognition that to sustain global temperature rise at or below 2°C, we want to reinstate 300-400 million hectares (Mha) of forest by 2050. And, to realize this, we simultaneously could do with to deal with the goals of reducing poverty and enhancing food security. Under the auspices of the Bonn Challenge, the world community has set a target of restoring 350 Mha by 2030 through FLR (Hooke et al. 2012). While this is often a awfully laudable political aspiration, there's a risk that in countries' rush to fulfil targets; authorities may advocate inappropriate and ultimately unsustainable interventions that fail to congregate the requirements of local populations. Agroforestry includes a critical role to play in addressing this concern.

Multiple roles for agroforestry in restoration

In some parts of the tropics, marginal agricultural land is being abandoned as economically unprofitable, thereby releasing land for forest restoration without impinging on local people's productive utilize of the landscape. Implementation of relatively simple legal and policy instruments, counting as an example carbon credits, could consolidate these gains and expand the world available for restoration. However, much of the world's degraded land occurs in landscapes that are engaged by poor farmers who are obsessed with the land and its natural resources for his or her livelihoods (Souza et al. 2016). In such situations, large-scale forest restoration is probably going to be in divergence with improvement goals. Restoration instead must concentrate on restoring ecological functionality to flexible landscapes, thereby improving the livelihoods of local people while simultaneously enhancing global goods and services, like carbon sequestration and biodiversity conservation.

Trees on farmland provide many goods and services.

Products include nutritious fruits and nuts for food, fodder for livestock, fuel for cooking, and timber for building. Trees also endow with shade and shelter for crops, livestock and folks, and habitat for pollinators and other beneficial organisms. Although often underappreciated, these ecosystem services can make a considerable contribution to farmers' livelihoods. for instance, combining trees with grazing lands, so-called silvopastoral systems, can amplify beef and dairy production by over 30% as a consequence of enhanced grass productivity and access to shade for livestock (Calle et al. 2013). Likewise, access to prime quality pollination services increases coffee yields by over 20%. In farmers' fields, the judicious choice and placement of trees can improve soil health, increase water infiltration and reduce erosion. And, of course, trees sequester carbon, both in wood and in soils, and might substantially increase the worth of agricultural landscapes for conservation. Although on a per area basis, the amount of carbon which will be sequestered through agroforestry is way below for mature forests, the scale of the acreage available implies that agroforestry's prospective for temperature change mitigation is substantial. for instance, it's been estimated that if all the possible agroforestry land within the EU were realised, it'd offset one-third of the EU's gas emissions. Globally, an amount of carbon corresponding to approximately 20 years' worth of deforestation is stored in agroforestry systems. Hence, most developing countries have recognized agroforestry as a key strategy for meeting national commitments under the Paris Agreement. Similarly, though agroforestry supports well lower variety than forests, trees on farmland will advocate an enormous conservation profit by making a far additional biodiversity-friendly matrix than one lined in cultivable or plantation monocultures, and thereby make probable the movement of life between forest patches. Enhancements to soil management, food and nutritionary security, and incomes conjointly enhance the

resilience of poor farmers. As farmers typically fall back on harmful activities like timber gather or charcoal production in times of would love, raising their resilience will raise reduced deforestation and forest degradation. additionally, agroforestry will offer viable forest restoration pathways in things wherever restoration would otherwise be wasteful. Natural regeneration provides the foremost lucrative and most property mode of forest restoration (Lundgreen and Raintree, 1982). However, once land is extremely degraded – as an example, terribly impotent or chop-chop geological process soils – institution of naturally seeded trees could even be poor and recovery of vegetation slow. Or, if the target for restoration is far from seed sources, then the quality of vegetation arising from natural regeneration could even be poor. However, prices of land preparation and planting are usually prohibitory unless there is a chance to recover costs. Agroforestry systems that mix natural regeneration or planting of native tree species with financial gain generation through, as an example, shade grownup crops (e.g. low or cardamon), timber (e.g. *Eucalyptus*), non-timber forest products (e.g. rubber, mushrooms, fruits or firewood) or placental grazing, is habituated transition degraded lands to natural forest. Discrimination agroforestry during this approach, as an interim step to ecological restoration of forests, might alter governments and landowners to well increase the dimensions of restoration they'll take into account.

Putting the Land into FLR

The “Land” in FLR speaks additional to the method through that restoration ought to be enforced than it will to the dimensions of restoration. In essence, the landscape approach is one that involves comprehensive, devolved decision-making to improve land-use coming up with and governance of common-pool resources. An important part is that they ought to implement systems thinking, so the implications of land management choices at completely different scales are understood and acted upon (Minnemeyer et al. 2011). Agroforestry naturally requires a systems perspective. At the sector scale, agroforestry interventions intend to capitalize on multiple advantages, like rising soil health and providing fuel wood, whereas minimising negative interactions between trees and crops. as an example, *Faidherbia albida*, a wide promoted fertilizer tree in Africa, fixes chemical element however its real return as an agroforestry tree comes from the actual fact that it drops its leaves within the early wet season, thereby totalling chemical element and organic relate the soil and plummeting light-weight interception, simply once the crops are increasing most chop-chop. At the farm scale, agroforestry contributes to economic diversification, moreover on food and nutritional security. Within the developing world, several rural communities undergo seasonal hunger within the final months before harvest. Even comparatively short periods of hunger will have a heavy impact on a child's physical and mental development. However, the standard observe of planting home gardens with fruit trees is tailored, through careful species choice, so there's a year-around production of nourishing fruit and round the bend. Diversification at the farm scale is additionally insurance against bully outbreaks, and climate and economic uncertainty, and thus will raise resilience. Finally, agroforestry involves the amalgamation of woods and forests into the farming system, as well as an example placental grazing and therefore the offer of non-timber forest merchandise, like honey, mushrooms and insects. Community level land use coming up with and management of those resources is crucial to confirm individuals will still obtain advantages. Thus, agroforestry brings with it a systems thinking that may be without delay integrated into landscape approaches.

The challenges for agroforestry in landscape restoration

Various examples worldwide illustrate that landscape restoration is possibly to happen at an oversized scale once countries place conservation, property land use and land restoration and make a facultative setting for the implementation of restoration initiatives. Planting monocultures of exotic tree species, that within the past was seen as a suitable suggests that for restoring degraded land, is short. In distinction, forest and landscape restoration (FLR) may be a long technique that each allows the restoration of ecological practicality and enhances human well-being employing a type of land uses and numerous plant species. FLR desires sensible coming up with and therefore the native adaptation of a mosaic of restoration choices. There are many ways to re-establish degraded landscapes, however few will restore variety and ecosystems whereas conjointly delivering food and financial gain within the approach that agroforestry will. Yet, there are barriers to the uptake of agroforestry at the national and native levels.

At the national level, the unclear standing of land and tree resources, adverse laws, a stress on business agriculture, an absence of coordination between sectors, and an absence of recognition by governmental establishments of the potential key task of agroforestry in contributively to property development are essential constraints on agroforestry. Rising policies and therefore the institutional context, therefore, is at the backbone of the agenda for agroforestry based mostly development. Particularly, it's vital to concentrate in tree and legal right, which, in several countries, is usually insecure, unclear, convoluted and disjointed. Challenges at the native level embody delayed returns on investment; underdeveloped markets and price chains for agroforestry products; restricted information of the benefits of agroforestry; and an absence of practical support and

extension services to persuade farmers to adopt agroforestry. The delay in returns on investment is particularly vital obstacle.

The high opportunity costs of purchasing, planting, protecting and tending tree seedlings, and the long time before the first harvest, make it tricky for poor farmers to invest in trees. Moreover, because land tenure is insecure in several developing countries and trees are not always the property of farmers, such investments are risky. Low or no access to credit is a supplementary constraint, especially for women. Agroforestry systems can be complex. Their implementation, therefore, requires support by specialized extension services that use participatory methods to educate farmers how to execute and manage agroforestry systems compatibly with the aim of restoring their lands and increasing agricultural production in the short and long terms.

Policy recommendations

Agroforestry systems have the potential to revive degraded lands, support livelihoods, restore food and nutrition security and reduce poverty, but constraints limit the adoption of those land-use systems in landscape restoration initiatives. the subsequent policy recommendations would stimulate the scaling of agroforestry in landscape restoration:

- Greater recognition of agroforestry systems as valuable options for restoring degraded landscapes is crucial in restoration plans and policies. Because they supply a large range of ecosystem services, counting biodiversity conservation and carbon sequestration, agroforestry systems are significant to the implementation of international conventions like the UNCCD, the UN Framework Convention on temperature change, and therefore the CBD.
- Enabling policy environments have to be put in situ for the event and scaling of traditional and improved agroforestry systems in landscape restoration projects. this implies revising and reformulating adverse regulations and legal restrictions on agroforestry; improving coordination among the assorted sectors involved in agroforestry development; expounding and securing land and tree tenure, taking into consideration the wants of girls for better access to land and associated resources; and supporting agroforestry product value chains.
- Incentive schemes supported the role of trees within the contribute of ecosystem services like erosion control, enhanced biodiversity, water quality and carbon sequestration should be put in situ to motivate farmers and landowners to favour agroforestry as a valuable option for increasing the productivity and profitability of their lands. Combined with upfront finance or other support to hide the often-significant start-up costs, such incentives would facilitate farmers overcome investment barriers – especially delays in returns on investment within the period after tree establishment, during which trees yield little income but require resources for his or her upkeep.
- it's important to smooth the progress of the event of local technical capacities for the gathering, production and distribution of crop and tree varieties and livestock breeds which will tolerate environmental extremes (e.g. drought, heat stress and salinity) so as to support local communities in adapting to temperature change.
- Access to information and training should be provided to rural advisors and farmers, especially women and youth, to motivate the adoption of agroforestry, taking advantage of both scientific and farmer knowledge.
- Risk-mitigation mechanisms are needed to draw in more investment in agroforestry and to facilitate private investors to play their key role in realizing the sector's potential.

Recommendations to facilitate agroforestry adoption

Knowledge dissemination

Due to the relative novelty of agroforestry, want knowledge about the practice and its profits is liable for its slow adoption. Although research and suggestions on agroforestry practices exist, it's not thought to be a private field of study. Building the research aptitude for agroforestry will show vital for disseminating knowledge about this land-use practice. More field experiments are required, using different scientific methods to gauge the suitability of agroforestry in several areas of the Central Asian Countries (Atangana et al. 2014). The research should target relevant tree and crop species which will be efficiently combined in forests, farmlands and kitchen gardens. Additionally, economic assessment is vital to value the economic potential of agroforestry alternatives. Socio-economic investigations into farmers' perceptions of agroforestry as a replacement technique on their farms could help to search out proper implementation pathways that are socially and culturally compatible. Knowledge sharing about best practices and species combinations for agroforestry would be essential. Lapeña et al (2014) mention the absence of fruit growing and tree grafting skills, ascribing it to lack of access to advisory services and lack of communication between academic and research organizations. This highlights the necessity for enhanced spreading of information. Farmers' associations can help with this. For instance, the Kyrgyz Association of Forest and Land Users is a bridge between its members and national government, state agencies, drawing concentration to urgent issues and promoting needed laws and regulations for approval at national level. Such organizations that are able to communicate directly with farmers would play a fundamental role within the adoption of agroforestry. Village centres, too, can play an

important role in organizing meetings and training programmes for farmers. Finally, international institutions can help introduce agroforestry management practices from experiences abroad.

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Chapter-27

Twitter Sentiment Analysis Text Detection with Python

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Abstract

Social networks are the big platform to collect information about people's thoughts, opinion and sentiments towards different topics as they spend hours daily on social Media platforms and share their opinions and thoughts. In this paper, we show the application of sentimental analysis and how to connect to Twitter and run sentimental analysis queries. We run experiments on distinct queries from politics to humanity and show the fascinating results. We analyzed that the neutral sentiments for tweets are significantly high which clearly demonstrate the limitations of the current works.

Keywords: *Sentiment Analysis, opinion Polarity, Social Networking.*

Introduction

These days, social media has a vital role to play in data exchange, sharing their thoughts. An important role is maintained by emotional effects of a person on his/her day to day life. Sentiment Analysis is what can be defined as a procedure of analyzing not only the opinions but also the polarity of thoughts of the person. In this matter, Twitter has a definite importance as a platform for sharing the thoughts, opinion and sentiments on different occasions. Thus, the method of analyzing the emotions from tweets (message posted by user in twitter) can firmly be taken up as Twitter Sentimental Analysis. Tweets become very helpful in having the Sentimental values from the users. For instance, the data imparts the Polarity indication like positive, negative or unbiased values. It basically focuses on the person's tweets as well as the hash tags in order to understand the situations in each aspect of the criteria. The paper is to observe analytically the famous persons' id's or hash tags for having or getting the mindset of people in each situation when the person has made some tweet or has given some reaction upon some incidents. The proposed system is supposed to observe the sentiment of the people who are users of python, twitter API, Text Blob (Library for processing text). It helps in analysing the post with a better accuracy.

With an increase in the development of micro blogging, websites have come to be one of the largest web destinations for people for expressing their thoughts, opinion and attitudes about different topics [1], [2]. Keeping this in consideration, Twitter does possess famous major micro-blogging & social networking website where users tend to post and interact with messages known as "Tweets". Here, over 100 million users are generating over 500 million tweets every day. As a result of such a huge audience, users have been continuously getting fascinated towards Twitter in order to convey their opinions about any issue, company, brand or any other topic of interest. In this regard, Twitter has been being widely used as an informative source by many companies, organizations and institutions. For Example: in case a person has to buy a product or make a decision, he/she initially searches its reviews online, converse about it on social media. The content that is displayed for that product is mainly taken into the point as well as the discussion in the social media is also noticed and these made the way to make our business a success. For this, Sentimental Analysis (SA) has been introduced to the world to tell us whether the information is correct or wrong in each scenario using the social media tags. In this way, it becomes easy for us to understand how world or people are reacting to every aspect currently happening in the world.

Twitter sentiment analysis has now become a popular and important topic of research because of its usefulness as it helps in gathering and classifying public opinion by analyzing big social data. However, Twitter data has certain features or characteristics that create problems in conducting sentiment analysis in contrast to analyzing other types of data. For example, on Twitter there is a word limit which leads in compacting of statements by people by using emoticons, short forms, slang, abbreviations etc. [3] Moreover, people tend to convey their

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opinions by using Polysemy (association of one word with two or more meanings) and sarcasm (opposite of what is said or written to hurt or criticise others in a humorous way).

Thus, it is absolutely true to define the twitter language as unstructured.

One of the fundamental elements of our project is sentiment analysis which can also be called as opinion mining and in its own way it is an important natural language processing task which defines the sentiment arrangement of a text as positive, negative, or neutral [4], [5]. We must have to train a classifier using the several machine learning techniques some of which include various supervised and unsupervised algorithms. The result from this can be used in many fields like analyzing and monitoring changes of sentiment with an event, analyzing public view of government policies, sentiments regarding a particular brand or release of a particular product. Text understanding is a significant problem to solve.

1.1 What Is Sentiment Analysis

The term Sentiment analysis is defined as a procedure of ‘computationally’ determining and observing whether a piece of writing is positive, negative or neutral or simply known as opinion mining. Moreover, Sentiment analysis can be taken up as a task of Natural language processing (NLP) techniques that takes a text written into consideration in natural language thereby having the opinions, judgment present within it. In other words, Sentiment Analysis is better to be called as an automated process used to identify subjective opinions from text, categorizing it as positive, negative or neutral.

For instance, one has a lot of text lying around, put forward by different people. If one hasn’t read that pieces of text, he or she will have no idea of what they’re talking about yet, they definitely possess some data that’s important to him/her and his/her business. It may be in the form of online reviews of your products, NPS (net promoter score) responses, or news pieces reporting on new technology one is interested in. There are numerous possibilities.

So, it is better to know the overall feeling and opinion expressed by the writer in each content of text, but it may end up being a mammoth task for one person, especially when there’s a massive amount of data to be read and made sense of. This is where sentiment analysis comes to play its role.

Practically speaking, the basic objective here is to have a text and label it that summarizes the sentiment of this text, e.g. positive, negative and neutral. Let us take an example, in case we are dealing with hotel reviews, we would want the sentence “The staff was splendid” to be labeled as Positive and the sentence “The shared rest room was absolutely disgusting” labeled as Negative. Bringing machines in order to do this job is a hard task and it contains skills from different fields of knowledge, such as computer science, statistics, and linguistics

1.2 Role of Sentiment Analysis in Twitter

It makes it easier for businesses to quickly process and have actionable insights from large volumes of text even without reading all of them. In a more specific manner, it’s appropriate for gauging how an audience feels about something. Sentiment analysis acts as a tool enhancing an organization’s understanding of customer opinions and actions whether it be tweets, product reviews, or NPS (net promoter score) comments. Bring automated, it lets one perform analysis of texts in real time and always against the same set of criteria. Thus, one isn’t dealing with many people with different biases at work, but rather with a single unified system having a consistent output.

Business: It is utilized in marketing field by companies in order to develop their strategies, to understand customer’s feelings towards product or brand, people’s response to their campaigns or product launches and the reasons why consumers don’t buy some products.

Politics: In politics, it has also an important role to play as it is used to keep track of political view, to detect consistency and inconsistency between action and statement at the government level. It can be used for predicting the elections result as well!

Public actions: Sentiment analysis can also be used to monitor and analyze social phenomena, for the spotting of potentially risky situations and determining the general mood of the blogosphere.

Literature Review

Various works have focused on analyzing social media data, especially those related to specific events. This intensive use of social media has attracted broad attention from academic research, and many investigations have been conducted to obtain important information on these events. In recent years, substantial studies have been carried out in the field of sentiment analysis on Twitter.

Jain and Dandannavar [6] inspected several steps for sentiment analysis on Twitter data using machine learning algorithms. They also provided details of the proposed approach for sentiment analysis. The approach collected data and then preprocessed tweets using NLP-based techniques. Thereafter, feature extraction was performed to export sentiment-relevant features. Lastly, a model was trained using machine learning classifiers, such as naive Bayes classifiers, support vector machine (SVM), and decision tree. The proposed framework performed sentiment analysis using multinomial naive Bayes and decision tree algorithms. Results showed that decision trees perform effectively, showing 100% accuracy, precision, recall, and F1-score.

Considerable work has also been performed by Go et al. [7] who proposed a solution for sentiment analysis based on tweets using distant supervision. In their method, they used training data containing tweets with emoticons, which served as noisy labels. They assembled models using naive Bayes classifiers, maximum entropy (MaxEnt), and support vector machine. Their features comprised unigrams, bigrams, and Part of speech (POS). They concluded that Support Vector Machine outperformed other models and that unigrams were more effective as features. Bouazizi and Ohtsuki [8] introduced SENTA, which helps users select from a wide range of features those best suited to the application used to run the classification. The researchers used SENTA to analyze texts collected from Twitter's multi-class sentiment. The study was limited to seven different classes of sentiments. The results exhibit that the proposed approach reached accuracy as high as 60.2% in the multi-classification. In both binary classification and ternary classification, this method has been shown to be sufficiently accurate.

Furthermore, several SemEval works discussed the task of classifying the sentiment of tweets with hundreds of participants [9] [10] [11]. The evaluations are designed to investigate the essence of meaning in language as significance is intuitive for humans and thus it has proved elusive to transfer these intuitions to computational analysis.

There has been an amplifying interest in Sentiment Analysis based on Twitter data research along with ordinal regression over the past decade. Ordinal regression problem is one of the main study areas in machine learning and data mining, with the aim of classifying patterns using a categorical scale showing a natural order between labels [12] [13][14]. However, less attention was paid to the problems of ordinal regression (also known as ordinal classification). Recently, the field of ordinal regression has developed, many algorithms have been proposed from a machine learning approach for ordinal regression such as support vector ordinal regression and the perceptron ranking (PRank) algorithm.

There is a lot of research interest in studying ordinal regression problems. Gutiérrez et al. [15] highlighted the ordinal regression methods and proposes taxonomy based on how models are designed to bring the order into consideration. Taxonomy of ordinal regression techniques divides them into three groups. In addition, a thorough experimental study is suggested to verify whether the use of order data improves the efficiency of the models, taking into account some of the taxonomy methods. The outcomes show that ordering information benefits ordinal models to enhance their accuracy and closeness of predictions to the ordinal scale objectives.

Li and Lin [16] proposed a reduction framework based on expanded examples from ordinal regression to binary classification. The framework can perform with any reasonable cost matrix and any binary classifier. The framework consists of three steps: removing expanded examples from the original examples, learning a binary classifier with any binary classification algorithm on the expanded examples, and building a binary classifier ranking rule. Their framework enables not only good ordinal regression algorithms based on well-tuned binary classification methods, but also new generalization boundaries for ordinal regression to be derived from recognized binary classification boundaries. Their framework also unifies many current ordinal regression algorithms.

Rennie and Srebro [17] recommend various loss functions in a systematic manner for discrete ordinal regression. Study carried out using the two threshold-based structures on the 1 Million Movie Lens data set and discovered that the all-threshold building outperformed multi-class classification and simple regression techniques, as well as the immediate threshold design. Two evident methods for managing discrete ordinal labels are: treating the distinct rating levels as unrelated classes and learning to forecast them as in a multiclass classification setting and treating them as real-valued answers and using a conventional regression setting with a loss function such as sum-squared error.

Niu et al. [18] present an End-to-End learning method to deal with ordinal regression problems using deep Convolutional Neural Network (CNN) that could together perform feature learning and modeling of regression. They apply it to the age estimation task and obtain better efficiency by avoiding designing hand-crafted characteristics directly. Estimating age can be cast as an ordinal regression problem.

In particular, an ordinal regression problem is transformed into a series of binary classification sub-problems. And the authors propose a multiple output CNN learning algorithm to collectively resolve these classification sub-problems so that the correlation between these tasks could be explored. They also release an Asian Face Age Dataset (AFAD) with more than 160 K facial images with accurate groundage truths, which is the biggest dataset of public age to date.

In recent years, various tasks has been done in the field of Twitter sentiment analysis based on ordinal regression, but fundamentally, all of those previous studies concentrated on transforming ordinal regression problems into a series of binary classification sub-problems. Whereas, to study the opinion of a user, it would be more interesting to go deeper into the classification and detecting a categorical scale of the sentiment hidden behind his post.

Differences between our approach and the other researches discussed above are not small. However, note that our approach tackles sentiment analysis on tweets full of noise. Another advantage of our model is that our technique for sentiment polarity is also different as we deal with five categories of sentiment (highly positive,

moderate positive, neutral, moderate negative, and highly negative) and therefore cannot apply their approach directly.

Research Methodology

3.1 Twitter API

Before we start coding Firstly login from your Twitter account and go to Twitter Apps (<https://apps.twitter.com/>). Construct a new app ([How to construct twitter app](<http://www.letscodepro.com/twitter-sentiment-analysis/>)) and goto `__Keys` and access tokens__ and copy Consumer Key, Consumer Secret, Access Token and Access Token Secret. We will need them later. Here we need to register an app to generate various keys associated with our Application Program Interface. The Twitter API can be used to perform many actions like create and search.

Now after creating the app we can start coding.

We need to install packages. These packages are shown as below.

3.2 Installation

Download or Clone the repo, Navigate to the directory containing the files and run

```
Python setup.py install
```

Or if you have different versions of python installed then

```
python3 setup.py install
```

to install the dependencies.

- **Tweepy**

Tweepy is the python library for the official twitter Application Programming Interface. This package will be used for handling the Twitter API. Install it using following pip command:

** pip install tweepy*

- **Text Blob**

Text blob is the python library for processing textual data. This package will be used for the natural language processing task such as sentiment analysis. Install it using following pip command:

** pip install text blob*

- **Matplotlib**

Matplotlib is a plotting library for the python programming language and its numerical mathematic extension Numpy. Install it using following pip command:

** pip installs matplotlib*

3.3 Usage

Once you have created an app on twitter and installed all the dependencies by running `__setup.py__`, open `main.py` and paste your Consumer Key, Consumer Secret, Access Token and Access Token Secret. After that save and run the script. You will be prompted to enter the keyword/hashtag you want to analyze and the number of tweets you want to analyze. Once the analysis is completed, a pie chart will be generated disclosing the results of analysis.

3.4 Implementation

Tweepy supports OAuth authentication. Authentication is handled by the tweepy. OAuthHandler class. An OAuthHandler instance must be created by passing a consumer token and secret. On this auth instance, we will call a function `set_access_token` by passing the `access_token` and `access_token_secret`. After that, we create our tweepy API instance by passing this auth instance into the API function of tweepy.

```
import tweepy
```

```
auth = tweepy.OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
```

```
api = tweepy.API(auth)
```

```
public_tweets = api.home_timeline()
for tweet in public_tweets:
    print tweet.text
```

Result & Discussion

4.1 Result 1

In the command prompt type CD and paste python file (main) link (Cd C:\Users\Personal\Desktop\project\Twitter-Sentiment-Analysis\TwitterSentimentAnalysis) and then type *Python main.py* and pop up window will open and display the enter keyword/tag to search about: _____ Enter how many tweets to search: _____ And then enter any name and any number and it will show the result of positive, negative and neutral tweets. In this paper we search about narendra modi tweets. We analyze 100 tweets at a time. The result shown as below in the bar graph.

How people are reacting on narendra modi by analyzing 100 Tweets.

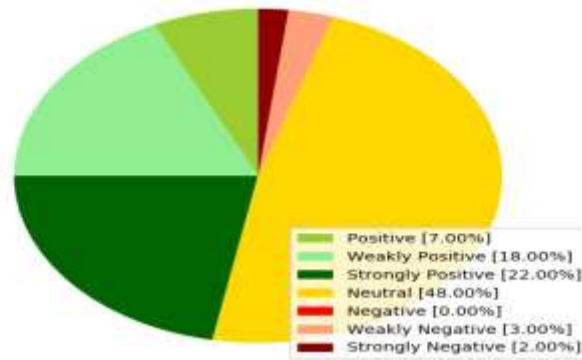


Figure 1. Polarity of Narendra Modi Tweets

This bar graph and table demonstrate the sentimental analysis results of how people are reacting on Narendra modi by analyzing one hundred tweets. As it can be clearly seen in the table and the bar graph the percentage of the neutral tweets are significantly high.

Table1: Detailed report 1

Positive	7.00%
Weakly positive	18.00%
Strongly positive	22.00%
Neutral	48.00%
Negative	0.00%
Weakly Negative	3.00%
Strongly Negative	2.00%

4.2 Result 2

In this we show that how many people are reacting on universities by analyzing 100 tweets.

How people are reacting on UNIVERSITIES by analyzing 100 Tweets.

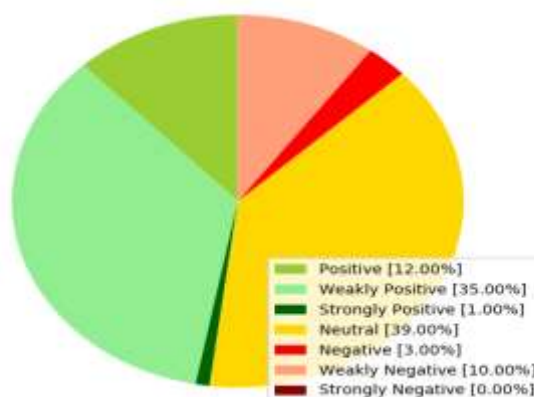


Figure 2. Polarity of University Tweets

In this result we analyzed that the neutral percentage was strongly high. In this bar graph showed that 35% people was thought weakly positive and 12% thought positive. This bar graph also shows that the negative percentage was very low. Only 10.00% people were weakly negative thinking and negative thinking 3%.

Table 2: Detailed report2

Positive	12.00%
Weakly positive	35.00%

<i>Strongly positive</i>	<i>1.00%</i>
<i>Neutral</i>	<i>39.00%</i>
<i>Negative</i>	<i>3.00%</i>
<i>Weakly Negative</i>	<i>10.00%</i>
<i>Strongly Negative</i>	<i>0.00%</i>

Conclusion

Twitter has famous major social networking website on which users post and interacts with messages known as “Tweets”. People directly share their opinions on twitter. Social media sites such as twitter, facebook, linked In are the major contributors to this data. Social media network are rapidly used by the users to connect and share opinions related to events and products, business and politics anytime from anywhere. In social media site like twitter users sent 25 billion tweets in 12 months. Due to the widespread acceptance of social networking sites, it is not possibly to ignore this fastest growing communication mechanism. People post messages almost in every field containing thoughts and opinions, which is rich source for sentiment analysis and opinion mining. In this technical paper, we discussed the importance of social network analysis and its applications in different areas. We focus on Twitter as and have implemented the python program to implement sentimental analysis. In our project we search about any issue, company, politics, brand or any other topic of interest and analyze the judgment of different people. In all results we observed that the neutral sentiments are uncontrollable high which shows there is a need to improve Twitter sentiment analysis.

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Chapter-28

Different Horticultural Crops under Arecanut Based Multistoreyed Cropping System in West Bengal

Dr G Chandrashekhar³⁶

Abstract

Arecanut palm is an important plantation crops in India. Arecanut based cropping systems have been developed at different places and net returns from the garden have been increasing manifold. Due to its long gestation period, fluctuation in price, for better utilization of space and sunlight and for getting more income per unit area, multi-storey cropping is gaining popularity. Intercropping in plantation crop garden helps to meet the food requirement besides increasing the net return per unit area. Keeping these things in mind, an experiment was undertaken at Horticultural Farm, UBKV. Yield and income of five representative samples of arecanut (main crop) and the intercrops from all the seven models were observed. Maximum mean yield of arecanut was observed to be in var. Mohitnagar (1.590 kg/plant), Maximum mean yield of turmeric and chilli were observed to be 486.20 g/plant and 191.60 g/plant, respectively. Maximum income and B:C ratio of Rs. 36,919.95 and 3.68:1 respectively were observed in Model-III. Minimum B:C ratio of 1.13:1 was observed to be in Model-VI. From this study, it can be concluded that, Model –III (Arecanut + Banana + Turmeric) was the best remunerative one and the farmers can adopt this model in this region as areca nut based multi-storey cropping system for more income per unit area. The methodology used in this study for qualifying the economic impact of arecanut based cropping systems could be used in other cropping systems as well.

Key words: Arecanut, Intercrops, Cropping systems, B:C ratio.

Introduction

Arecanut (*Areca catechu* L.) is a commercially important plantation crop predominantly grown in humid tropics of West Coast and North East regions of India. The arecanut palm has a gestation of 5 to 6 years during which period; farmers do not get any kind of yield and income. Arecanut as a sole crop does not fully utilize the natural resources such as soil, space and light. In order to utilize the natural resources to the maximum extent, growing different crops as inter/ mixed crops is a common practice. Contrasting to annuals, the potential for increasing the productivity per unit area of land, time and inputs through high density multi species cropping is considerably higher in perennial crops (Bavappa and Jacob, 1982).

In West Bengal, arecanut cultivation is mainly restricted to North Bengal, but due to fluctuation of price, people are losing interest in arecanut cultivation. Arecanut is a perennial crop and it can produce fruits up to 40 to 50 years. The root distribution pattern studied in arecanut revealed that at a spacing of 2.7m x 2.7m could effectively use only 30% of the total land area (Bhat and Leela, 1968).

Many crops, particularly short duration crops were reported ideal for growing under areca nut in the initial period of 5-6 years. In later years, as the arecanut canopy increases, mixed cropping with other shade tolerant perennial crop species could be grown. Studies have revealed that areca can utilize only 30% of the land area and 16% of airspace and permits 40% of PAR to penetrate down that can be utilized by mixed crops. The intercrops, apart from giving additional income, created job opportunities.

Materials and methods

This experiment was conducted at Horticultural Farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. The area is Terai agro-climatic zone of West Bengal. The experiment was laid out in randomized block design with three replications having seven treatment combinations as given Table.1. The soil of the experimental site was texturally classified as sandy loam in nature and coarse textured having medium water holding capacity. The composite soil samples from the entire experimental field were collected from

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different depths and analyzed before planting of the crop. The experimental site is of six years old. Spacing followed for arecanut and banana and was 2.7m x 2.7m and 5.4m x 5.4 m, respectively and remained same under all treatment combinations (Fig.1). Crops were supplied with recommended fertilizers and other operations were carried out as and when required. The yield, cost of production and B:C ratio of different intercrops were estimated following simple statistical programmes taking into consideration of the prevailing Pundibari region market price.

The prevailing market prices of plant protection chemicals, fertilizers, manure, FYM, planting materials, transportation, land lease value, labour wage, etc., were taken into account for the economic analysis. Prevailing market prices of arecanut, banana, and turmeric were considered. Economics of different mixed cropping is calculated taking into consideration of establishment cost of associated crops.

Results and Discussion

The yield of the processed arecanuts per palm did not show significant variation among different treatments. However, the maximum yield (2.86 kg nuts/palm) and minimum yield (1.76 kg of nuts/palm) were, respectively recorded in Model-V and Model-I. Observations on yield of chali (processed nuts) revealed that, the mixed cropping systems such as Model-V and Model-III were recorded higher yield than sole crop of arecanut and other systems of crop combinations also yielded similar magnitude of yield of mono cropping. The mean yield of processed nut (chali) per palm was slightly lesser (2.65 kg/palm) under mixed crop combination consisting of Model-IV as compared to Model-III and V (2.86 and 2.23 kg/palm) because fertilizer applied to arecanut might have been used by both crops chilli and spinach. Among all the cropping systems, Model-V consisting of okra and brinjal as associated mixed crop registered more than 2.5 kg mean yield of chali per palm.

The maximum profit of Rs. 36,919.95 could be earned from Model -III (Fig. 2), where banana along the rows of arecanut and turmeric in the beds in the interspaces were grown. Minimum profit Rs. 15,637.15 was observed in growing arecanut as monocrop. Similar results discovered to be in Hore *et al.*, (2007) grown intercrops were ginger, colocasia [*Colocasia esculenta*], okra, turmeric, elephant foot yam [*Amorphophallus paeoniifolius*] and French bean [*Phaseolus vulgaris*]. These crops can be chosen as intercrops with coconut in West Bengal condition. The maximum profit was obtained from coconut+ ginger combination. .

The additional income generated in model over arecanut monocrop was found to be in tune with the net returns generated from each model. Model-III was found to generate the highest additional returns with a BCR of 3.68 (Fig.3) where, banana and turmeric were grown as intercrops with arecanut and slightly followed by Model- II with turmeric as intercrops with arecanut and Model-I with arecanut as monocrop had the Benefit: cost ratios of 3.63:1 and 3.31:1. While minimum (1.13:1) in case of Model-VI where banana, okra and brinjal were grown along with arecanut as main crop. Similar results found with to be Girijadevi and Muralidharan Nair (2003) reported various B:C ratios- 1.59 with banana, 2.28 banana + ginger, 1.89 banana+ ginger + vegetable cowpea, 1.56 with banana+ turmeric and 1.64 with only banana in arecanut garden.



Fig 1. Arecanut based multistorey cropping system

Table1. Details of various crops interplanted in existing arecanut based multistorey cropping models

Model	Main crop and inter-crops			
Model-I	Arecanut	--	--	--
Model-II	Arecanut	Turmeric	--	--
Model-III	Arecanut	Banana	Turmeric	--
Model-IV	Arecanut	Cow pea	Tomato	--
Model-V	Arecanut	Chilli	Spinach	--
Model-VI	Arecanut	Banana	Okra	Brinjal
Model-VII	Arecanut	Chilli	Coriander	--

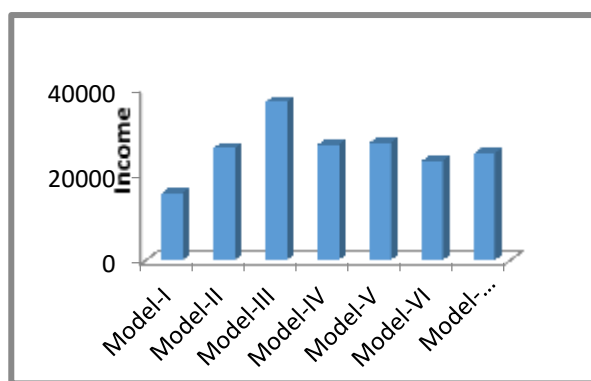


Fig. 2. Gross income of models

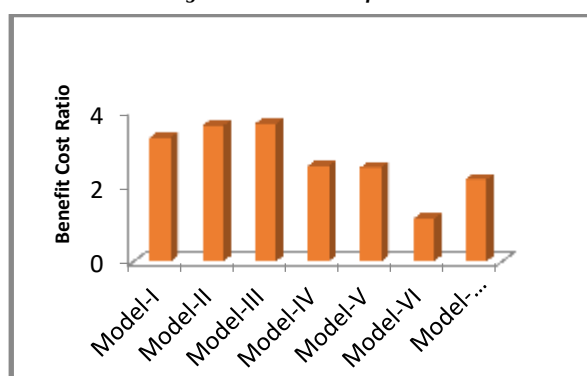


Fig. 3. Cost: Benefit ratio

Conclusion

The above said investigation it could be concluded that growing intercrops as multistoreyed cropping in arecanut generating more income from those crops, yield and return from arecanut also increased.

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Chapter-29

Effect of Thermal Annealing on Structural Properties of CdS Nanopowder obtained by Chemical Route

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Abstract

In this investigation, the cadmium sulphide (CdS) nanoparticles were synthesized by chemical co-precipitation route. After heat treatments at different annealing temperatures, the prepared powders were investigated by studying their structural properties. X-ray diffraction (XRD) results suggest that the samples were polycrystalline in nature with a pure phase of hexagonal crystal structure with preferential reflection of grains along (101) plane and the average crystalline size is in the range 19.61-32.01 nm.

Keywords: CdS, co-precipitation, X-ray diffraction (XRD)

Introduction

Nanostructures are the most investigated smart materials due to their fundamental research and a wide range of applications. Properties of nanometer-sized semiconductors strongly depend on their size because of an increase in optical energy gap relative to that of bulk solid, and their high specific area results in high chemical reactivity. Semiconductor quantum dots (QDs) exhibit physical and chemical properties when their size is comparable to Bohr exciton radius, and the quantum confinement effect leads to tunable optical properties. CdS is an important II–VI group compound semiconductor material, and its nanoparticles have great interest due to their unique size dependent chemical and physical properties [1]. CdS, a compound material of direct band gap of 2.43 eV in visible region [2, 3] at room temperature, has been extensively applied in the fields of photo cells, light-emitting diodes, laser diodes, solar cells, display devices, inverters, sensors, photo electro catalysts, surface acoustic wave devices, biological labels, electroluminescent layers and optoelectronic devices based on its nonlinear optical properties [4-10]. CdS has three types of crystal structures i.e. cubic (zinc blende), hexagonal (wurtzite) and high-pressure rock-salt phase. Hexagonal phase has been revealed in both the bulk and the nanocrystalline CdS, while cubic and rock-salt phases have been observed only in nanocrystalline CdS [11]. The nanoparticles of CdS can be grown by different physical and chemical methods such as physical vapor deposition, spray pyrolysis, thermal evaporation, chemical deposition, electro deposition, melting nucleation approach, sol-gel, co-precipitation, dip coating, spin coating and chemical bath deposition (CBD) [12-18]. In the present communication, we describe the synthesis of nanocrystalline CdS powder by co-precipitation method. The as-prepared and annealed powders were further investigated for their structural properties.

Experimental procedure

Cadmium acetate dehydrate 99% AR grade $\text{Cd}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ and sodium sulphide flakes nonhydrate ($\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$) were purchased from Loba chemical Pvt. Ltd. In the present work, solution of 1M $\text{Cd}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ and solution of 1M $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ were prepared separately using distilled water. Then dissolved solutions of sodium sulfide were added drop wise into cadmium acetate solution and the mixture continuously and vigorously stirred for 3 hours at constant stirring at 800 rpm, to react completely and homogeneity of the material then a dark yellow CdS precipitate formed which was filtered out and washed several times with double distilled water and methanol. Finally, the product was dried for 24 hours in dry air. After drying the precipitate was crushed to fine powder by grinding process using a mortar and pestle. In this way CdS hexagonal phase (wurtzite structure) were prepared using simple precursors by chemical co-precipitation technique. The powders of CdS were characterized for structural properties. The structural properties of obtained CdS nanopowders were done by XRD (AXS D8 Advance, Bruker).

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Results and Discussion

3.1 Structural analysis

Fig. 1 shows the X-ray diffraction diagrams of the as-synthesized CdS nanopowder sample (S4) prepared with [Cd]/[S] ratios 0.96. The well-defined peaks at $2\theta \approx 24.92^\circ$, 26.59° , 28.26° , 36.73° , 43.84° , 47.98° and 52.00° correspond to reflections from (100), (002), (101), (102), (110), (103) and (112) planes of pure hexagonal CdS phase, corresponding to orientation (101) at angular position $2\theta \approx 28.26^\circ$ for as-synthesized CdS powder which is well supported by the JCPDS data card 80-0006 respectively [19]. The inter planer spacing (d) values were evaluated by calculating θ values from the peaks of the X-ray spectrum by using Bragg's relation $2d \sin\theta = n\lambda$ ($n=1$ in present study and $\lambda = 1.5406$ for $\text{CuK}\alpha 1$). The experimental d-values of as-grown CdS nanopowders are exactly matched with the JCPDS d-values of CdS having hexagonal (wurtzite) structure with polycrystalline in nature.

The structural properties of as-synthesized and annealed CdS powder for sample (S4) i.e. $[\text{Cd}]/[\text{S}] = 0.96$ have been investigated with post thermal annealing treatment to identify their phases, structure and components using XRD patterns as shown in **Fig. 1**. The sharp intense peaks of CdS nanopowder confirm the good polycrystalline nature and besides no other impurity peaks are seen, suggesting the formation of single phase CdS structure. The effect of the annealing on the crystallinity was also observed. The intensity of dominant peak (101) and all the peaks were found to be increased continuously with post annealing that revealed to an improvement in the crystallinity which leads to enhancement in the efficiency of the solar cells [20].

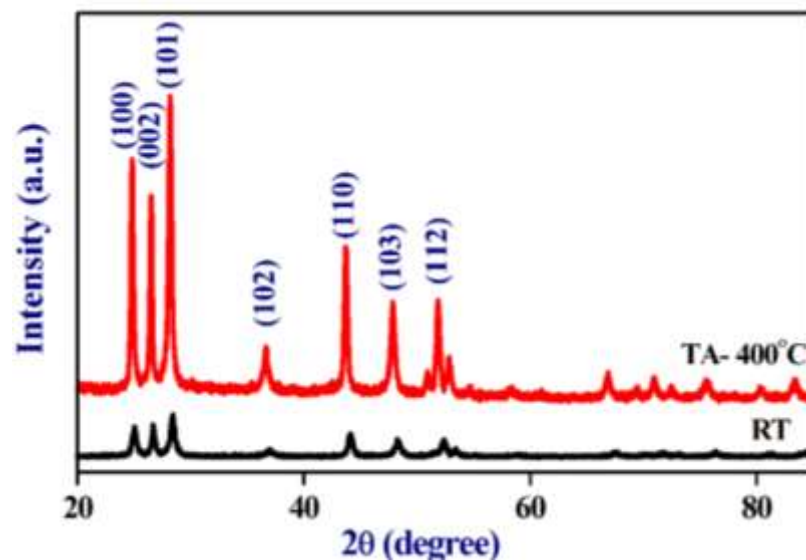


Fig. 4.3: The X-ray diffraction (XRD) patterns of the as-synthesized and annealed CdS powder at 400°C .

To discuss in depth about structural properties, the structural constants viz. crystalline size (D) was estimated by Scherer's formula for dominant diffraction peak (101) while other constants i.e. lattice constant (a) and inter-planar spacing (d) were calculated using concern relations are given below [21, 22] and presented in **Table 1**.

Table 1: The structural parameters of as-prepared and thermally annealed CdS powder at 400°C .

Samples	$2\theta^\circ$	FWHM	(hkl)	d (Å)		a = b (Å)		c (Å)		D (nm)	Volume (Å) ³
				Obs.	Std.	Obs.	Std.	Obs.	Std.		
As-grown	28.26	0.4176	(101)	3.1541	3.1480	3.642	4.121	3.642	4.121	19.61	83.711
TA- 400°C	28.18	0.2558	(101)	3.1633	3.1480	3.652	4.121	3.652	4.121	32.01	84.398

Conclusion

The powder of CdS nanoparticles synthesized using chemical co-precipitation method. The XRD patterns reveal that the powder has preferred orientation (101) have wurtzite structure of hexagonal phase with polycrystalline nature. The structural parameters like inter-planner spacing, lattice constant, crystalline size were calculated. The inter-planner spacing and lattice constant are in good agreement with the standard data. The intensity of preferred orientation peak (101) is found to be increased continuously with post annealing which revealed to an improvement in the crystallinity which leads to enhancement in the efficiency of the solar cells

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Chapter-30

State of Art Survey on Diagnosis of Brain Tumor using MRI

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Abstract

In today's era most hazardous diseases like brain tumor is increasing so its detection should be as early as possible with accuracy. Automated tumor detection techniques on medical images can be used to detect it. MRI images with the edges detection can be used to detect tumor so get an idea about the tumor growth and region. MRI images play important role in detection of unwanted growth of tissues and blocks of blood in nervous system and brain. The main goal of brain tumor imaging analysis is to extract clinical information and features which is required for diagnosis. This information is embedded within the multi-dimensional image data. The process required to do investigation is just like pyramid where at each level, data get processed, extracted, labeled and represent information which is required for diagnosis. It is necessary to represent information in high level of abstraction so relevant knowledge can be obtained for high speed processor, storage, network, image display unit; software programs are required for effective management, processing, visualization and analysis of obtained dataset.

General Terms: MRI images, Segmentation, algorithm

Keywords: Machine learning, Supervised, Semi-supervised and Unsupervised

Introduction

Unwanted growth of tissue in brain is nothing but the tumor. It is of two types one is cancerous and another one is non-cancerous. Non-cancerous is called as benign has a uniformity in structure and does not contain active cells whereas, cancerous is called Malignant which is non-uniformity in structure and contain active cell. MRI images gives information about various tissue parameters like PD, Spin lattice (T1) and Spin spin (T2) relaxation times, flow velocity and chemical shift. T2 images are used for underlying evolution and identifying tumor type and also for separating tumor from non-tumor tissue. T1 images are helps to enhance tumor boundaries from the neighboring normal tissues.

First step to detect brain tumor is shape of brain. The brain shape is symmetric and asymmetric in shape. Next step is segmentation which consists of f-transform and morphological operations. These steps are used to detect boundaries of brain tumor and calculate the area of tumor using MRI images because in MRI images accuracy and clarity are dependent on each other. From a data analysis point of view, anomaly detection is the problem of finding abnormal instances in the data, where data are considered normal if they fit some expected distribution. It is a multi-disciplinary research area that has been investigated extensively by researchers from statistics, data mining and machine learning. In practice, it can be defined as a classification task where the goal is to decide whether an incoming instance is normal or anomalous.

For a comprehensive survey of this area we refer to outlier detection techniques that can be classified on the basis of the availability of supplementary information on training data (e.g., class labels) and the type of data they manipulate.

Supervised, Semi supervised and Unsupervised Approach

Supervised techniques are often handled using classical machine learning techniques where the problem is treated as a binary classification problem with the abnormal class being poorly represented (imbalanced data). To detect anomalies without knowledge on the class variable; Unsupervised techniques is used. It is assumed that abnormalities are geometrically separated in the features space from the normal instances. These techniques usually employ clustering algorithms assuming that normal instances are closer to each other's than to outliers which are placed in low density regions. So, they require the availability at processing times of instances from all the classes.

A limitation of these approaches consists in the fact that they assume that the training data contain both normal and abnormal instances. In many applications, this is a strong requirement, since abnormal data are often difficult or expensive to obtain. A solution to this point comes from the semi supervised approaches that do not

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require anomalous instances in the training phase. Normal class model with training data was built and recognize the abnormalities in test data as to differ the instances from the normal model. When normality shifts, it may relearn the data model is consider as a positive side effect. Semi-supervised learning is a class of supervised learning. Here, tasks and techniques that also make use of unlabeled data for training typically a small amount of labeled data with a large amount of unlabeled data.

Literature Survey

Most of researchers are attracted by outlier detection of tumor using advance data mining and machine learning. This research gained new impetus and gave rise to novel approach and algorithm.

The World health organization WHO has classification system of tumor of brain and central nervous system which is used by many medical institutes and research centers to identify tumor.[1] WHO presented information about glioma, papillary, glioneural tumor etc. WHO presented some information about historical variants that are capable of different edge distribution, location, symptoms and behavior [2].In medical field, for detecting the tumor various modern techniques are used like fuzzy clustering method. In MRI images, for detecting abnormal tissue part, effective fuzzy clustering algorithms are used. Using this clustering technology, accurate region of abnormal tissues can be detected and for better identification MRI image can used. [3].

The neural network is “HOT” research area which is based on human brain and neuron principle. This technology is used in various research area like a cardiology, radiology, oncology etc.to solve highly complex problem. In this, three is combination of neurons into layers which permits for artificial neural network [4] Watershed method along with edge detection is used to detect brain tumor from color MRI image. In this RGB image is converted into HSV color image .the image is separated in 3 regions such as hue, saturation and intensity. The canny edge detector is used to rebuild process to obtain edges. In last step, all three images are combined and resultant segmented brain tumor image obtained. It gives excellent results [5].

In MRI images, boundaries of tumor tissue are highly irregular. Also there are some difficulties in MRI images like undefined location of tumor or data loss at boundaries, silent edges is not extended. In this proposed algorithm, silent edge is extended and boundaries of tumor location can be found. Once boundary area and location of tumor found, it can remove easily [6]. Dino Ienco et. al. presented an algorithm based on semi supervised approach to detect tumor which deals with categorical data. Training set is consist of normal class and can be analyzed the relationship among features for extraction of discriminative characterization. The principle idea is to build model which characterizes features of normal tissues and then use distance based techniques ti identify abnormal tissue from normal one[10].

S. Jian, G. Pang et al. showed that to represent the hierarchical coupling relationship (i.e. value to value cluster interaction) of categorical data is very critical and challenging to capture data characteristics in learning task. They also showed a novel and flexible coupled unsupervised categorical data representation framework which captures the hierarchical couplings as well as it is flexible to be instantiated for contrastive learning tasks. Two instances the coupled data embedding for clustering and coupled outlier scoring of high dimensional data for outlier detection are instantiated by finding the ways of value clustering and coupling learning between value clusters. It embeds categorical data into a new space in which features are independent and semantics are rich. It represents data with an outlying vector to capture complex outlying behaviors of objects in high-dimensional data. [11]

H. Jia, Y. Cheung et al. proposed effective and significant learning algorithm based on distant metric. It is difficult to measure a distance for numerical data but it may be non-trivial problem for categorical data set. Authors presented new distance metric method based on characteristics of categorical value for categorical data .the distance between two values from one attribute is calculated by frequency probabilities of two values and other attribute values which have high interdependence with calculated values [12]

L. Bai, X. Cheng et al. proposed an optimization model for clustering categorical data streams. In the model, when each new input data subset is flowing, cluster validity function is proposed as objective function. In clustering process, clustering model and continuity with last clustering model are simultaneously considered. To solve an optimal solution of the objective function with some constraints, an iterative optimization algorithm is proposed. To catch the evaluation trend of cluster structure on categorical data stream, detection method is proposed that integrates the detection index and optimization method. The new method can effectively avoid ignoring the effect of the clustering validity on the detection result. They showed the effectiveness of the proposed algorithm in clustering categorical data streams, compared with existing data-streams clustering algorithms. [13]

C. Zhu, L. Cao et al. explained that, to capture complex data characteristics is difficult using learning metric approach. Metric learning of categorical data along with hierarchical coupling relationships and Local heterogeneous distributions and are challenging and rarely explored. For categorical data, Heterogeneous metric learning with hierarchical coupling is proposed. Low-level attribute and high-level attribute to class hierarchical couplings captured by HELIC. it reveals the intrinsic heterogametic embedded. HELIC effectively represents complexities like theoretical analyses of effectiveness and generalization error bound. Extensive experiments on 30 data sets with diverse characteristics demonstrate that HELIC-enabled classification significantly enhances the accuracy, compared with five state-of-the-art baselines. [14]

J. Li, J. Zhang, N. Pang et al. proposed WATCH method that is weighted outlier mining method. It discriminates outliers from inliers in high dimensional categorical datasets. WATCH method is consist of two

modules as feature grouping and outlier mining. Feature grouping is by virtue of correlation measurement among features and outlier mining is by assigning scores to objects in each feature group. WATCH is a feature grouping module which groups an array of features into multiple groups to discover various aspects. It gives number of outliers specified by user. It bypasses the optimization of any user given parameter. Author implemented and evaluated WATCH method using synthetic and real world datasets. Its output achieves high performance in terms of precision, efficiency and interpretability. It detects outliers in high dimensional categorical datasets [15].

Mohamed Bouguessa stated challenging problem of outlier detection in mixed attribute space. Very few approaches have been proposed. The drawback of existing methods is no automatic mechanism of distinguish between outlier and inlier is existing. Common method to identify outlier is to estimate an outlier score for each object and provide the ranked list of points. He proposed method of identifying outlier based on bi variate beta mixture model to identify outliers in mixed attribute data. In this, outliers are automatically detected and can be applied without any feature transformation to mixed and single type attribute data [16].

Aggarwal C.C. has discussed primarily on numerical data. Categorical attributes are ubiquitous in real-world data hence the setting of numerical data represents a gross oversimplification. For example, quantitative attributes such as the age may be contained by demographic data, other attributes such as gender, race, and ZIP code are comes under categorical attribute. Data collected from surveys may often contain responses to multiple-choice questions that are categorical. Similarly, data types such as the names of people and entities, IP-addresses, and URLs are comes under categorical. Most of the times, same data set contain both categorical and numeric attributes. Mixed-attribute data are really challenging to machine-learning applications because there are difficulties in treating the various types of attributes in a homogeneous and consistent way [18].

The research work by [19] proposed automated approach to detect brain tumor using MRI gray scale images. In its initial stage enhancement to minimize gray scale color variations for better segmentation, maximum noise was removed by filter operation for gray scale images threshold based OTSV segmentation was used. Pre-proposing & post-processing techniques are used that includes enhancement, filter operation and segmentation. Post-processing includes feature extraction & identification accuracy obtained by this approach is almost near to 92%. Research study by [20] proposed method of brain tumor detection from MRI images includes pre-processing, edge detection and segmentation. In edge detection Sobel, Prewitt and Canny edge detection is used, K-means clustering is used to identify the tumor but in this more regions exists along with tumor region so confusion is increases accuracy obtained by this method is almost 90%. In research work of [21] superior accuracy of tumor detection was demonstrated using watershed segmentation and analysis was done by morphological operations. Three different data sets were used for testing accuracy obtained is 97% but still unwanted region is exist in output. Another research work [22] tells about morphological techniques for tumor detection and threshold segmentation was used for feature extraction non negative factorization was used.

Existing research work by [23] proposed a method in which images are segmented and clustered using K-means clustering & then morphological operations like filtering was used to miss clustered tumor. Another research work by [24] demonstrated brain detection, here images were converted into gray scale images then sharpening & enhancement method was applied for extraction of boundary. Shapes and sizes of tumor was detected by applying mathematical operations.

V. Anitha & S. Murugavalli proposed brain tumor classifier using two-tier classifier with adaptive pillar K-means algorithm for segmentation for classification methodology two-tier classification was used. Self-organizing map neural network trains the features extracted from DWT (Discrete wavelet transform). The resultant filter factor was trained by K-nearest neighbor. Testing process was completed in two stages. This system classifies the brain tumor in two trained process so it gives better performance than traditional method. Research work by [26] tells about brain tumor detection by segmentation and area calculation, method using SCILAB. In this K-mean clustering algorithm was proposed based on segmentation & morphological operations. Images were pre-processed and then subjected to K-means clustering after morphological operations applied to extract tumor and finally area is calculated.

Conclusion

Image processing plays important role in applications of biomedical field. According to survey, various techniques are used to detect abnormal tissues and exactly tumor gets detected. One of the major goals in tumor detection research is to accurately locate cancer and its accuracy. Computer aided medical diagnosis or use of latest technology like machine learning, deep learning, and neural network in medical image analysis gives more accurate results.

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Chapter-31

Review on Applications and Recent developments in Heat Pipe

Mr Harshit Bhavsar⁴⁰, Mr Pulkit Thakar & Mr Manish Patel

Abstract

Now a days Heat pipes are becoming prevalent as passive heat transfer technologies due to their high efficiency. A comprehensive review of the performance of current heat pipes shown in this paper. Heat pipes (HPs) have gained importance in recent years, mainly in the field of cooling electronic components, since they need heat removal from limited volumes to the environment. By using Nano fluids as working fluids thermal Performance of heat pipes can be improved. Heat pipes are used in many different applications with desired requirements. In this paper various application of heat pipe technology are given in solar thermal applications, in medical devices, in heat exchangers, in electronic components, in ovens and furnaces. Heat pipes attached with novel evolving technologies and methods have been highly valued. In this review paper a brief overview of the heat pipe history is given and the different applications are presented.

Key words: Heat pipe, heat transfer, Nano fluid, evaporator.

Introduction

Heat pipes are Heat transfer devices. It's a cylindrical hollow pipe in which fluid is filled. This fluid evaporates to transfer the heat. Available heat is supplied to particular machinery components. Examples are it is used in Refrigeration and Air conditioning system, heating & cooling devices. In 1942 heat pipe was first introduced by R. S. Gaugher. Heat pipe with good thermal conductivity and capability to transport large amount of heat. Riffat and Ma (2007) had done a review of progresses in heat pipe advance technology and its applications between years from 2000 to 2005. They have reviewed recent development of this years and suggested new wick type structure for heat pipe. Also given importance of using various nano fluids in heat pipe.

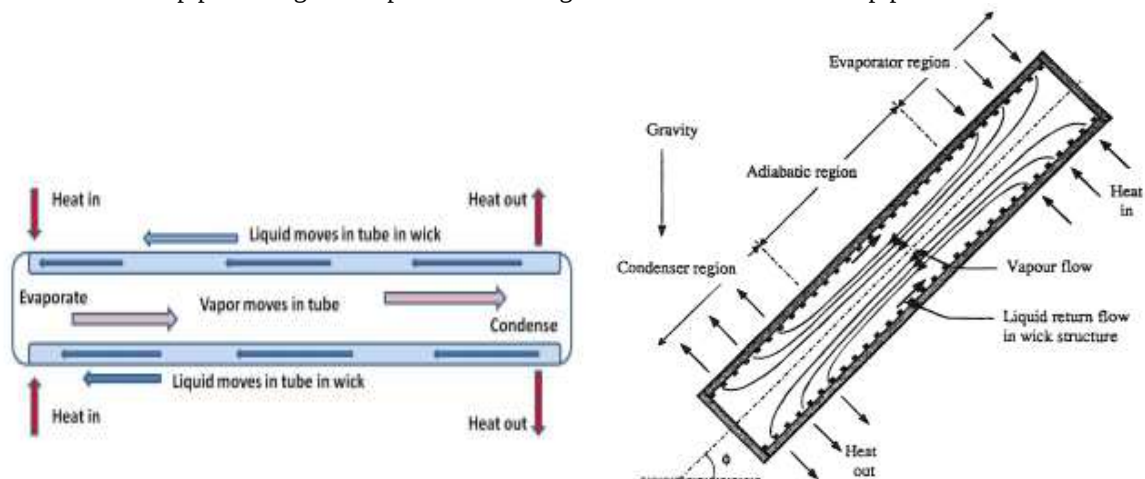


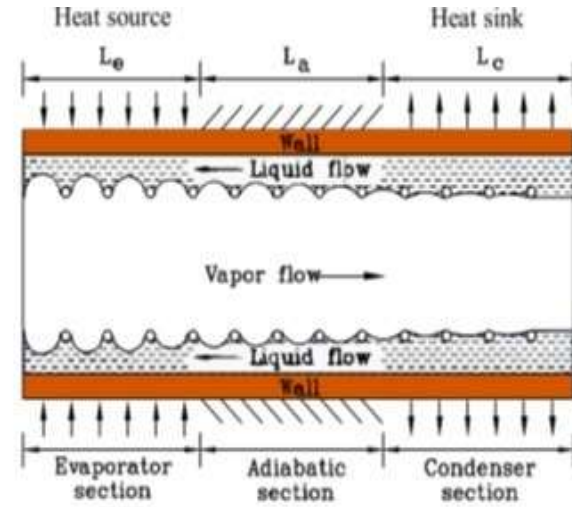
Fig. 1 Diagram of Heat pipe

Heat pipe is having a simple structure of cylindrical shape and required length. It is made of inlet –outlet section, evaporator and condenser places, and wick structure at middle. According to different operating temperature range different material like sodium, ammonia, methanol, water, acetylene used as working fluid. Total length of a heat pipe is distributed into three parts: the evaporator section, adiabatic (transport) section, and condenser section. Heat supplied from the evaporator section is absorbed by adiabatic region wick structure of Heat pipe.

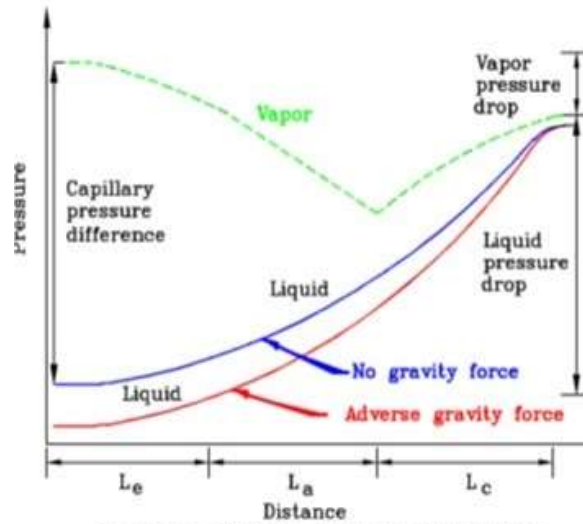
The ensuing vapor pressure pushes the vapor through the adiabatic section to the condenser, where the vapor shrinks, liberating its latent heat of vaporization to the heat sink. Therefore, the heat pipe can continuously

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transport the latent heat of vaporization from the evaporator to the condenser section. Process is remain continuous till the capillary pressure can make the condensate back to evaporator section.



a) Liquid-vapor interface



b) Vapor and liquid pressure distributions

Fig. 2 heat pipe interface

Essentially, anyone can evaluate the process of heat pipe as a one part of thermodynamic process, related to the first and second laws of thermodynamics. Zuo and Faghri predicted the transient heat pipe performance by thermal resistance model of heat pipe.

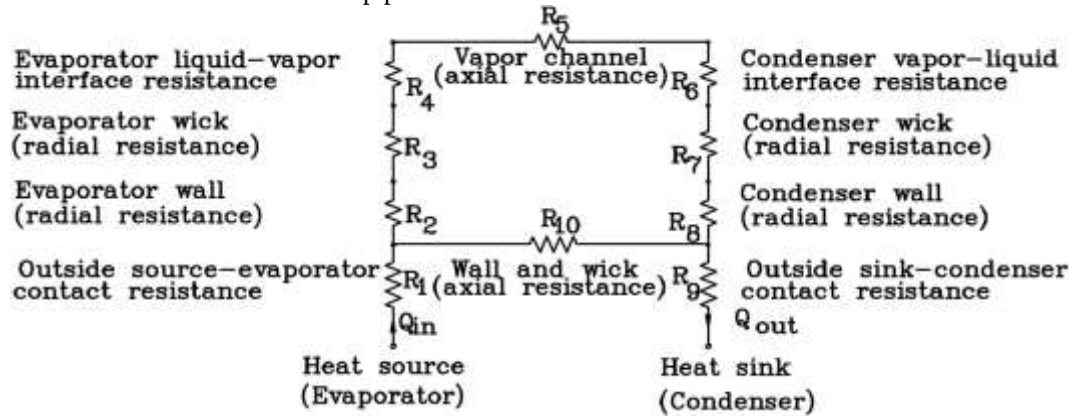


Fig.3 Thermal resistance model of heat pipe

Nandy Putra & Yanuar Yanuar et al.(2011) investigated the addition of various concentrated nano fluids to improve the performance of heat pipe. Mashaei et al. presented a numerical study on the hydro-thermal performance of cylindrical HP using $\text{Al}_2\text{O}_3/\text{water}$ Nano fluid. It is noticed that the best thermal-hydraulic performance is obtained at a middle particle concentration level of 5% with a highest heat load of 112 W. The smaller size of nanoparticles expands the thermal-hydraulic performance of HP more effectively. Ghanbarpour et al. employed a modified analytical method combined with experimental studies to predict the thermal performance of cylindrical HP with Al_2O_3 Nano fluid. It reveals that using Nano fluid is an efficient way to reduce the entropy generation in HP due to the lower thermal resistance.

Types of Heat Pipe

Flat Plate: - considerable like old-style cylindrical heat pipes used but now a days a rectangular designs are also available. This type of heat pipe used in different electronics devices like semiconductor or transistor assemble working to reduce the temperature. Azad (2008) has done the experimental investigation of heat pipe for application in solar thermal appliances. Installation of simple solar collector was done and tested in atmospheric condition of Tehran. Ruchi, (2014) undertaken trial study of a flat-plate solar collector to examine the performance of thermosyphon solar water heating (SWH) system using R744 (CO_2) as the working fluid.

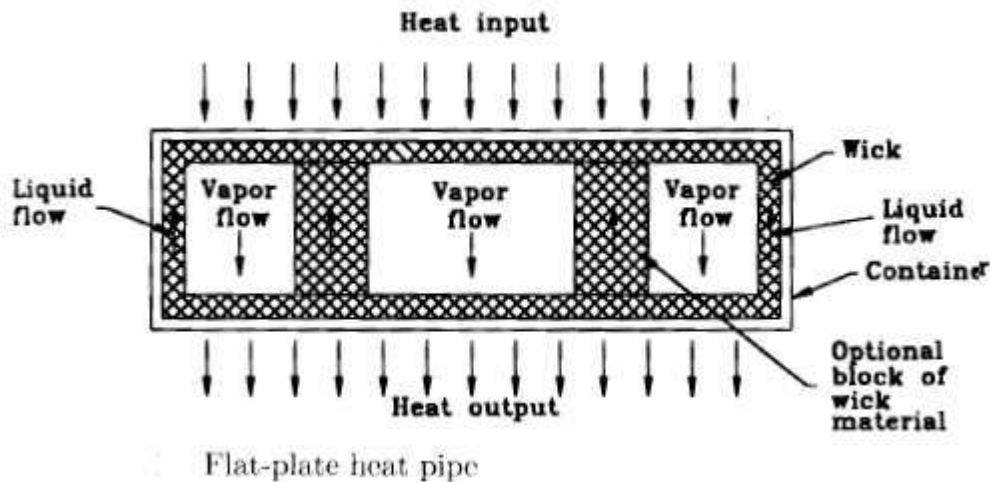


Fig. 4 flat heat pipe

Micro heat pipes: - small heat pipes that are noncircular and use square corners as liquid arteries. Employed in cooling semiconductors (improve thermal control), laser diodes, photovoltaic cells, medical devices. Liang et al, (2012) have done the experimental study on U shape Natural circulation heat pipe. This heat pipe designed for generating medium temperature range in parabolic collector. Ramsey et al, (1978) have done analysis by using three-four different type of absorber in parabolic through solar collector. In area Phoenix of Arizona states the testing were performed at a desert test site at a latitude of 34°N .

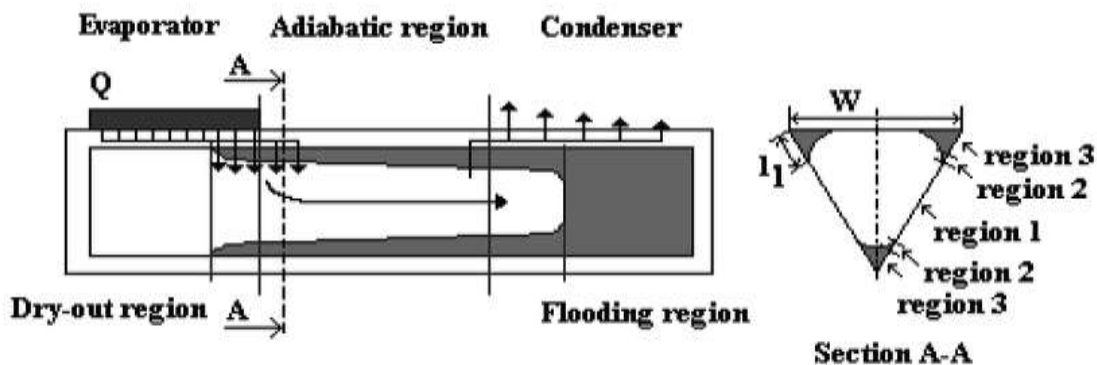


Fig. 5 Micro Heat pipe

Variable conductance: - In a Variable Conductance Heat Pipe (VCHP) a Non-Condensable Gas (NCG) is available or added along with the working fluid. When the heat pipe is not functioning, the non-condensable gas like argon, helium and working fluid vapor are diverse through the heat pipe vapor space. When the variable conductance heat pipe is functioning, the non-condensable gas is flounced toward the

condenser end of the heat pipe by the flow of the working fluid vapor. They are available in various forms like gas loaded form or excess-liquid. The gas-loaded form is shown here which Used in electronics cooling. (Faghiri, 1995)

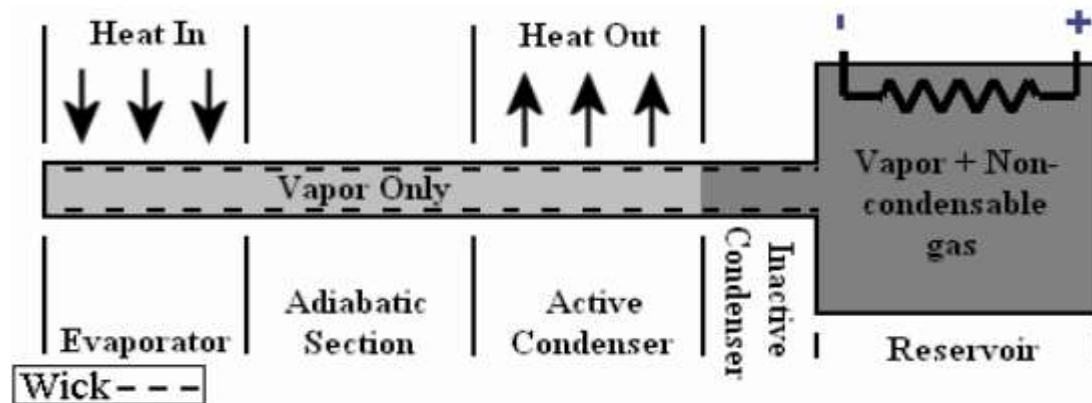


Fig. 6 Variable Conductance heat pipe

Capillary pumped loop heat pipe: - this type of heat pipes are used where the heat from the heat source needs to be moved far away or heat flux are too high. In the loop heat pipe during working the vapor travels around in a loop and it condenses at one place and returns to the evaporator. Better to use in electronics cooling. (Faghiri, 1995). The loop heat pipe (LHP) operates on a multi-phase fluid-flow cycle, having capillary medium in the evaporator. In this heat pipe with negligible temperature difference a heat transfer unit can transfer large amount of heat for long distance and time.

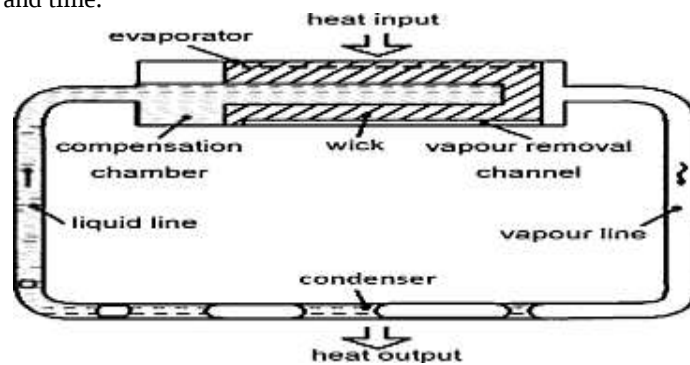


Fig. 7 Loop heat pipe

Type of Heat pipe	Advantages	Disadvantages
HP without Wick TS	The simplicity of design, low cost, high reliability	Don't work against mass forces
HP with Wick (powder –metal fibre)	High reliability, operating in TS mode, in the horizontal arrangement, and against mass forces	The average cost, thermal resistance is high than HP without wick
Flat plate HP	Small design, low cost, high reliability	Have low heat transfer characteristics
Loop Heat pipe	Work at any orientation, may provide a flexible design	Cost is high
Pulsating heat pipe	Work at any orientation, have simple construction, low cost	Unstable work, studied insufficiently

Applications of Heat Pipe

Aerospace

Used in spacecraft cooling and temperature stabilization. Thermal stress occurring from heat inequalities is a critical issue in many orbiting astronomical experiments. At this places heat pipe are used to transport heat from the side fronting the sun to the cold side away from it, thus equalizing the temperature of the arrangement. To achieve this, heat pipes are commonly used to affect heat transfer and heat redistribution functions in the microsatellites.

Heat Exchangers

The heat exchangers are used heat pipe for humidity control of Air-conditioning system. When the condenser of the HPHE is used as a reheater to heat the airstream coming from the cooling coil, the relative humidity can more easily be reduced to the comfort zone, below 70%. Various industries, such as metallurgy, power plants, and oil refining industries also used Heat pipes. Heat exchangers with heat pipe are also used to recuperate the thermal energy from various components of machinery.

Electronic Components

Heat pipe technology is used for cooling of electronic components such as central processing units (CPUs), circuit boards, and transistors. Usually an aluminum heat sink used to reduce the overheating of CPU . This is an efficient method in terms of unit price, weight, and performance.

Ovens and Furnaces

One of the initial applications of heat pipe technology was in conventional baking ovens. In Upgrade oven with heat pipe transfer of heat take place in side oven by the flow of working nano fluid, which provides heat circulation very effectively. Uniform constant temperature in oven and 20 to 25% reduction in fuel of power consumption.

Solar Thermal Applications

Evacuated heat pipe collectors are used in this system to generate the heat required for the distillation process. Use of various solar appliances are example of this. Heat pipes are utilized for solar cookers in transporting heat from the heat source to its destination

Agriculture

The heat pipe can be used to reduce the heat generated in the greenhouse, thus reducing the cooling load of evaporative cooling.

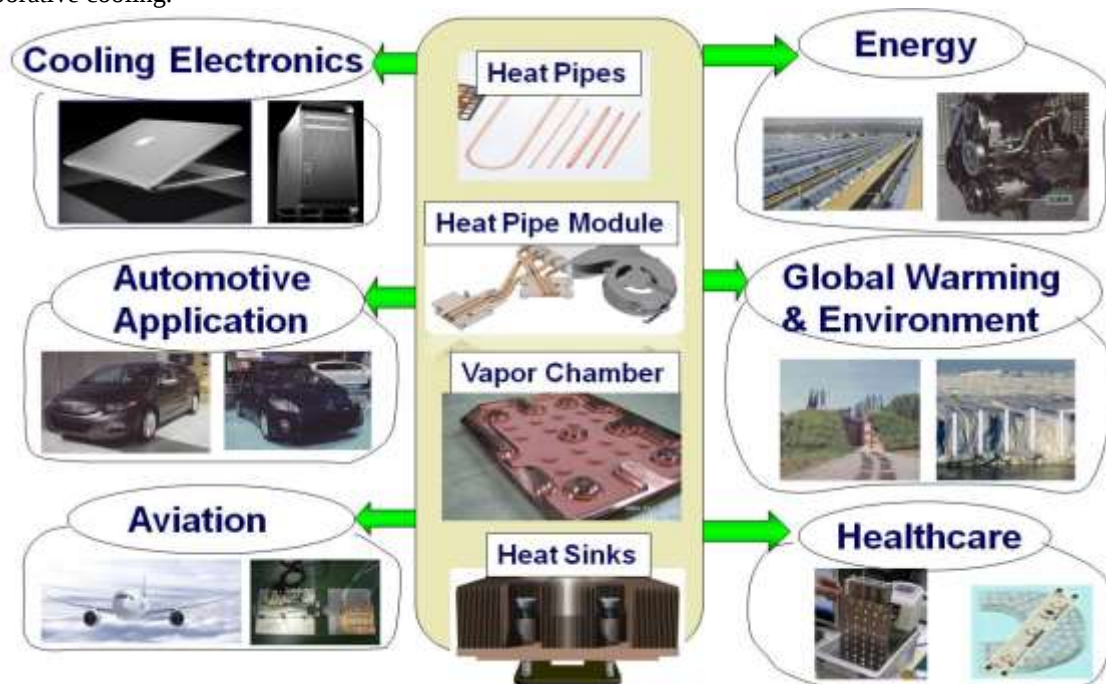


Fig.8 Applications of Heat Pipe

Medical Applications

Heat pipe applications in medicine are in the heat pipe cooler. Used for non-invasive treatment of rectum, or pelvis and for common gynecological and rectal conditions. Heat pipes having many advantages in medical/hospital devices in positions of space area, weight reduction, and reduction of maintenance costs, as they result in less environmental effects as equate to other cooling systems that depend various technologies such as pumped liquids etc.

Transportation Systems

Heat pipes are used to expand the safety of various transportation systems. And used for reliability of air, roador rain transportation system. During the long winter season in Serbia snow may fall at the rate of 1000-1500 mm per day with the ambient air at -5 to -7°C. Heat pipe technology is used to heat the rails to avoid ice formation.

Cutting Tools

Cutting processes are commonly used in all industries. The heat generated in the tool and work piece is passed away by the working fluid. To do all kind of cutting process without fluid new design or alternative method

should be developed to accumulate the heat. Heat pipes are an effective alternative solution to the problem of heat absorb without using cutting fluid.

Diverse Applications of Heat Pipe

- Heat pipe roll-bond panels for warming bathroom floors
- Heat pipe-cooled dipstick for cooling motorbike engine oil
- Passive cooling of remote weather station equipment (Canada)
- Thermal control of thermoelectric generators
- Cooling of gas turbine blades
- Thermal control of electric storage heaters
- Cooling of semiautomatic welding equipment (Russia)
- Deicing fish farms and ornamental ponds
- Cooling of soldering iron bit
- Cooling of bearings for emergency feed water pumps
- Thermal control in electric battery dehumidifiers
- Car passenger compartment heating
- Domestic warm air heaters

Conclusion

Is necessary to use the Heat pipe in various applications to get more advantage of heat transfer. Heat pipes should be attached or use with the various solar application. Each HP type has its advantages and disadvantages, which determines their usability in given design. However, it is necessary to take into account the fact that the HP brings additional thermal resistance into the overall system. This paper shows the review of heat pipe and the effectiveness of heat pipe in solar thermal system by designing new system

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Chapter-32

Bioremediation of AZO Black Dye by Novel Bacteria Isolated from Tannery Effluent

Faridha Begum I⁴¹, Manikandan K, Edet Love Mendie and Hemalatha S

Abstract

Leather and dyeing industries largely produce effluents contaminated with dyes. The leather dye industries consume a substantial amount of water and produce extensive amount of waste which is contaminated with dyes such as reactive dyes, azo dyes and much more non-degradable waste materials. Hence there is a pressing need to treat the tannery effluent since it contains hazardous chemicals and microorganisms and can pose a huge threat to the environment. This current work is focused to isolate the novel azo dye degrading bacterial species present in the tannery effluent that can degrade the azo black dye, which is used in tannery industries. The current results suggested that one bacterial isolate from tanneries can be utilized to degrade the dye from tannery industries which can be further utilized for agriculture.

Keywords: Tannery effluent, Azo Black dye, Dye degradation, Bacterial isolate

Introduction

Synthetic or fabricated dyes are known to be largely utilized in various industrial sectors which includes but not limited to leather tanning, textile industry, paper industry and food industrial sector. The larger parts of these synthetically manufactured dyes currently employed in industries are the derivatives of azo. These dyes are not only known to generate pollutants to the environments but they further pose severe health risks to living organisms as a result of their massive production alongside their increased use. With the increasing influence of environmental protection on diverse industrial development, the evolution of eco-friendly technologies is encourage (Desphande, 2001) with less intake of freshwater and lowers output.

Enormous amount of pollution is usually being carried by tannery effluents owing to the bulky amount of highly colored synthetic dyes. These synthetic dyes are known to be resistant to microbial degradation which makes their removal from the waste water treatment plants difficult (Shaul et al. 1991). Elimination of dye products from wastewater is not only a difficult task but also an expensive process. The physical as well as the chemical methods exhibits several drawbacks in application, some of which are: high – energy costs, increase sludge production and composition of by-products (Sarioglu et al. 2007). Interestingly, these shortcomings can be override via bioprocessing which is both cost effective and environmentally harmless process. Increased interest is seen on biological process which is a feasible alternative, involving the exploitation of microorganisms, owing to their cost effectiveness, decreased sludge production and eco-friendliness (Kalyani et al. 2008).

Bacteria are more advantageous as they are more easily cultured with the ability to grow rapidly than fungi. Also they have the capacity to produce carbon or any energy source through the metabolism of chlorine and other organic contaminants for example: oil and mineralize chemicals (Balamurugan et al. 2011). Vimala et al 2015 explained and checked for effluent bioremediation for different effluent samples collected from different places. They found that *Micrococcus* sp. worked well in adapted environment and *E.coli* showed same decolorization potential in adapted and non adapted environment. Shah et al 2013 also showed the extent of decolorization and facile conditions revealing the possible prospective of *Bacillus* ETL-1982 as a biological treatment of effluents.

However, a novel approach in the biodegradation process is an in situ degradation of effluents. This requires that, isolated bacteria from the tannery effluent treatment plant can be used for the removal of dyes present in the tannery effluent. Hence, this study is developed with the intention of isolating an efficient novel dye degrading bacterial strain from the tannery effluent. Considering that these strains are originally derived from dye contaminated tannery wastewater plant, it is possible for the strains to adapt readily to its predominant environment.

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Methodology

I] Collection of samples from Tannery effluent treatment company

Collection of tannery effluent samples from the Chennai tannery effluent treatment plant using sterile falcon tubes from various processing steps of the treatment including Raw water, Equalization tank, Primary clarifier, Biological treatment, Secondary clarifier, Dual media filter, Ultrafiltration, RO feed, RO permit and RO reject.

II] Isolation and Identification of bacteria based on unique morphology and Biochemical Test

Tannery samples were collected and serially diluted and plated on agar plates. These plates were incubated at 37°C for overnight. The unique morphologic bacterial strains were identified by biochemical tests.

III] Screening the efficacy of dye degradation against bacterial strains from tannery effluent

The synthetic azo black dye was prepared with a stock concentration of 100mg/ L. The pH of Luria Bertani broth was adjusted to pH 7, the bacterial inoculum was 10% and the temperature was 37°C. The tubes were incubated with triplicates and control. The absorbance was measured from initial hour to 60 hours.

Results and Discussion

I] Isolation, Identification and Characterization of bacterial strains from Tannery Effluent

From all samples of tannery effluent 8 unique bacterial strains could be obtained by serial dilution method and purified by repeated streaking. Each of the pure bacterial strains was maintained in slants as a pure or stock culture. The bacterial strains were identified by biochemical tests and coded as given in table 1.

Table 1: Biochemical Test for Identification of bacterial isolates

Isolate Number	Indole Test	MR Test	VP test	Citrate Test	Catalase Test
TE1	-	-	-	-	-
TE2	-	+	+	-	-
TE3	-	+	+	-	-
TE4	-	+	+	-	-
TE5	-	+	+	-	-
TE6	-	-	+	-	-
TE7	-	-	-	-	-
TE8	-	-	+	+	-

The '+' sign denotes positive and the '-' sign denotes negative

II] Screening the efficacy of dye degradation against bacterial strains from tannery effluent

The isolated bacterial strains were used to degrade synthetic azo dyes mainly used in tannery and textile industries. Among 8 bacterial strains, one bacterial strain (TE8) showed effective dye degradation when compared to other bacterial strains (Table 2).

Table 2: Efficacy of Dye degradation against bacterial strains

Strain Name	Black Dye	
	24 h	48 h
TE 1	-	+
TE 2	-	+
TE 3	-	-
TE 4	-	-
TE 5	-	+
TE 6	-	+
TE 7	+	+
TE 8	+	+

Conclusion

In this study, among 8 strains which are isolated from tannery effluent treatment plant, one strain showed effective degradation for azo black synthetic dye which are predominantly used in leather and textile industries. The application of the bacterial isolate could be considered as efficient treatment method of various industrial effluent as it provides zero sludge production during the treatment process and its effectively degrade the

complex organic complex material present in the industrial effluent. Thus, this novel dye degrading bacteria is useful for the emergence of an effective biological water waste treatment plant.

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Chapter-33

Zebrafish an Emerging Biomedical Tool in Translational Research

S M Fazeela Mahaboob Begum⁴² & S Hemalatha⁴³

Abstract

Zebrafish has evolved as a potential animal model to study human disease pattern, pathology and drug screening. The genetic similarity, organ resemblance and metabolic patterns has led to the effective utilization of Zebrafish as an alternate to murine models. Currently zebrafish models are used in studying diabetes, cancer, alzheimers disease, obesity, circadian rhythm, atherosclerosis and inborn errors of metabolism. The current review discusses the advantages of zebrafish as an alternate animal model in translational research and drug development.

Keywords: Zebrafish, biomedical models, high-throughput screening, translational research

Background

Cell based analysis provides limited information about the absorption, distribution, metabolism and toxicity of compounds that are screened [Goldstone *et al.*, 2010]. To overcome this limitation, murine models are employed in drug screening. But owing to the cost, availability and maintenance of animals, the ability of compounds to cross the blood brain barrier and immunological response induced, an alternate model was always searched for [Bootorabi *et al.*, 2017]. This has led to the emergence of Zebrafish as an alternate to murine models.

Zebrafish a valuable animal model

Zebrafish (*Danio rerio*) a fresh water telost belongs to *Cyprinidae* family is commonly found in the Ganges basin of India [Rubinstein 2003]. It possess various characteristics that has made it an attractive model for animal studies. These include the small size with the adult reaching 2.5 – 4 cm in length which minimizes the space constraint in growing the fish and is easy to maintain hence cost effective [Prang 2005]. Zebrafish has high fecundity and thus produce 250 -300 eggs/mating/week. Moreover, the fertilization and embryo development are ex-utero which has enabled the study of pathological and physiological mechanisms in developmental biology by live cell imaging [Lieschke and Currie 2007, Veldman and Lin 2008]. Hence, Zebrafish became a preferred model to study human diseases [Santoriello and Zon 2012].

Further, Zebrafish possess 70% genetic similarity to humans and 82% orthohomology to human disease related genes [Howe *et al.*, 2013]. This has led to the development of human disease models in Zebrafish which enables the analysis of molecular pathways and screening novel therapeutic compounds. Also the external fertilization of Zebrafish embryos has enabled their exploitation in *in vitro* fertilization studies [Phillips 2014]. The generation time is very short (3-5 months) when compared to murine models. All these features have made the use of Zebrafish as a potential alternate to murine models [Giannaccini 2014].

Zebrafish embryos are widely employed in High throughput drug screening (HTS). The embryos hatch externally at 28°C in 48 hours post fertilization (hpf) and survive as free living animals. Drugs / compounds to be screened are diluted in the fish water which is taken by the embryo through the chorion and enters its circulation [Rennekamp *et al.*, 2015].

The cellular and molecular mechanisms involved in drug detoxification are similar in Zebrafish and mammals, hence, the Zebrafish has evolved as a valuable tool in drug toxicity analysis [MacRae 2015]. As innate immunity is active and adaptive immunity is not developed, immune response is not triggered till 6 weeks of post fertilization in Zebrafish. These features favour the utilization of Zebrafish embryos in genetic manipulation, ribonucleoprotein microinjection, morpholino development, and cancer cell xenotransplantation [Zhao 2016, Li 2016]. The molecular pathways and events in carcinogenesis are similar in Zebrafish and mammals. This has caused the emergence of xenografted embryos where human cancer cells are implanted in Zebrafish embryos and observed for proliferation, angiogenesis and metastasis [Saltari *et al.*, 2016].

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As the embryos are transparent, it enables the study of organ development, angiogenesis and drug distribution. The European Food Safety Administration has declared that Zebrafish embryos (5dpf) experience less pain, stress and harm and comply with the 3Rs (replace, reduction and refinement) for human animal research [Bootrabi *et al.*, 2017, Lovera *et al.*, 2017].

Similarly, several cancer models are developed in adult Zebrafish. These include the exposure to carcinogens and injection of human cancer cells into adult fish for development of tumors [Yang *et al.*, 2017]. Hence, Zebrafish has emerged as a valuable comprehensive alternate animal model for analyzing lung [Stoletov 2017], colon [Wyatt *et al.*, 2017], ovarian [Drabsch 2017], skin [Idilliet *et al.*, 2017], breast [Brown *et al.*, 2017], prostate [Melong *et al.*, 2017] and pancreatic [Feng *et al.*, 2017] tumors.

Zebrafish are employed as biomedical models to study Duchenne muscular dystrophy, leukemia, polycystic kidney disease, kidney injury, Parkinson's disease, Huntington's disease, myocardial infarction, various metabolic disorders and neurological disease such as Alzheimer's disease, tauopathy [Nada *et al.* 2016] and inborn errors of metabolism [Gut *et al.* 2017]. As they possess fully developed major organs they are useful in the study of metabolic disorders including diabetes, atherosclerosis, fatty liver, liver cirrhosis and lipedemias [Chen *et al.* 2018, Zang *et al.* 2017]. Further, the high level of behavioral similarity between zebrafish and humans has led to the utilisation of zebrafish models in studying the patterns of learning, hearing, feeding, vision, courtship, social behaviour, emotions and anxiety [Valente *et al.* 2012]. Similarly, the neuroanatomy, neurotransmitter signalling and neurochemical pathways share a considerable level of similarity among Zebrafish and humans [Stil *et al.* 2016]. Hence Zebrafish are used as successful models in analyzing neurogenetic and neuropathology diseases [Saleem 2018].

Conclusion

The present review, aims to illustrate that zebrafish have emerged as a vital tool for the strategic study of various diseases. Zebrafish models enable to bridge the gap between cell culture based drug discovery and pre clinical studies. Zebrafish has evolved as a best candidate for high-throughput screening of new molecules before analyzing in murine models. Enormous research has already been performed to elaborate on the scope of zebrafish as a model to understand various disorders and disease mechanisms. To conclude zebrafish is an attractive model in the field of drug discovery, toxicity analysis and disease pathology. It is reasonable to say that Zebrafish models offer excellent opportunity and can be capitalized upon for novel drug screening and studying disease pattern in humans.

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Chapter-34

Cympobogan Citratus Nanocolloids- in the Treatment of Bovine Mastitis

S Ranjani⁴⁴, Shruthy priya.P, Maroudam Veerasami. M & S Hemalatha

Abstract

Nanotechnology is the interdisciplinary field which deals with manipulation of particles in nanosize. Green nanotechnology involves the utilization of biological material for the synthesis of nanosized particles. In this study Cympobogan citratus Nanocolloids was utilized to validate its antibacterial efficacy against antibiotic resistant pathogens such as A. junii, K. pneumoniae, P. stutzeri and A. baumannii strains isolated from Bovine Mastitis milk. Array of antimicrobial assay such as MIC, MBC and antibiofilm assay was performed and the result confirmed that nanocolloid was effective in inhibiting and killing the pathogens even at the lower concentration of 1.5µg/ml. Further nanocolloids can effectively control the formation of biofilm. These results show that nanocolloids can be formulated effectively for topical application to control bovine mastitis.

Key words: Green Nanotechnology, Cympobogan citratus, Nanocolloids, Bovine Mastitis

Introduction

Bovine Mastitis is an inflammation in mammary gland, which adversely affect the milk production and cause greater economic loss to the country. Mastitis results in decreased in quality and quantity of milk production, sometimes results in death and culling of animals [1]. Mastitis milk poses threat to humans because the contaminated milk is liable for zoonoses and other toxins present in the contaminated milk. The major causative agents of Mastitis are bacteria, which are controlled by the usage of antibiotics. But the continuous usage of antibiotics results in the development of antibiotic resistant strains. The spread of antibiotic resistant strains to humans' results in deadly infections. Thus, the effective alternative method is mandated to control the spread of antibiotic resistant strains [2].

With the advent of green nanotechnology, many eco-friendly products are developed from cosmetics to pharmaceutical products. The unique size, shape and its property of green silver nanoparticles are responsible for its unusual properties such as anticancer, antimicrobial, which has been harnessed in manufacturing of several silver-based ointments, lotions, creams, dental implants, textiles etc [3].

In this study the beneficial effect of silver and *Cympobogan citratus* (CcNc) were combined to formulate silver nanocolloids, which were tested against Mastitis causing antibiotic resistant pathogens such as *A. junii*, *K. pneumoniae*, *P. stutzeri* and *A. baumannii* strains.

Materials and Methods

Materials

Cympobogan citratus nanocolloid (CcNc) synthesis and characterization was done and the data was published in Ranjani et al (Ranjani et al., 2019a). This green nanocolloid was used in this study to validate its efficacy against *A. junii*, *K. pneumoniae*, *P. stutzeri* and *A. baumannii* strains isolated from Bovine Mastitis pathogen.

Antimicrobial Assay

A. junii (Mas1), *K. pneumoniae* (Mas2), *P. stutzeri* (Mas 3) and *A. baumannii* (Mas 4) strains were treated with CcNc to validate the bacteriostatic, bactericidal and antibiofilm activity. All the experiments were carried out in a 96 well microtitre plate and absorbance was measured using multimode reader. Micro dilution assay CcNc was carried out in a 96 well microtiter plate to detect the bacteriostatic concentration (MIC) and Bactericidal concentration (MBC). Antibiofilm assay was carried out to calculate the least concentration of CcNc, which prevents the biofilm formation of microbes. Antibiofilm assay is the continuation of bacteriostatic and bactericidal assay in the same microtiter plate followed according to the protocol without any modification [4-7]. All the experiments were carried out with control and Ampicillin treatment (25µg) as positive control.

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Results and Discussion

The array of antimicrobial assay was carried out and the minimum inhibitory concentration of CcNc was observed as 1.5 $\mu\text{g/ml}$ for all the test pathogens such as *A. junii*, *K. pneumoniae*, *P. stutzeri* and *A. baumannii* strains when compared with the control. From the growth curve the bacterial growth rate was observed after 24 hours of CcNc treatment and it was found that the growth rate was decreased by 74% for *A. junii*, 85% for *K. pneumoniae*, 66% for *P. stutzeri* and 69% for *A. baumannii* at the concentration of 1.5 $\mu\text{g/ml}$, when compared with the control and ampicillin treatment (Fig 1).

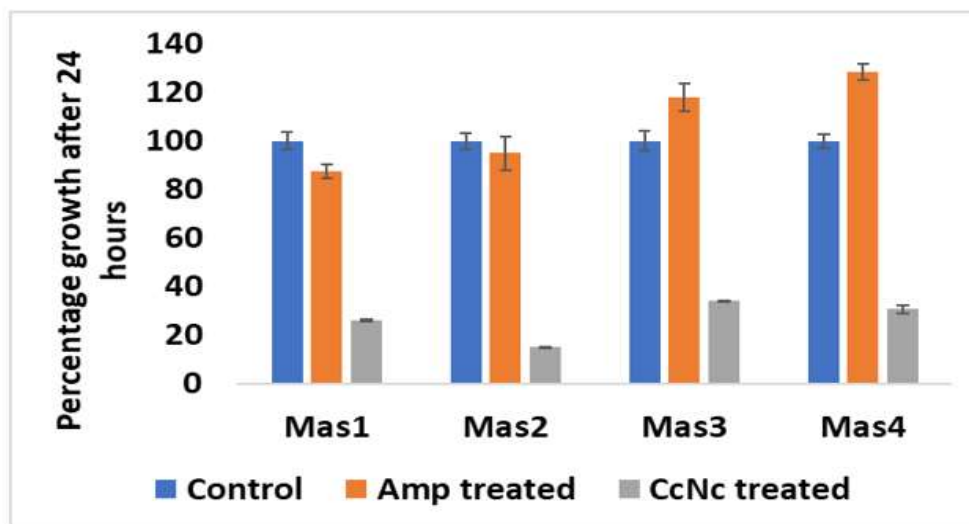


Figure 1: Percentage of bacterial growth rate after 24 hours of CcNc treatment.

The antibiofilm assay was carried out and result shows that 1.5 $\mu\text{g/ml}$ of CcNc can control the formation of biofilm by 52% for *A. junii*, 60% for *K. pneumoniae*, 55% for *P. stutzeri* and 66% for *A. baumannii*, when compared with the control and ampicillin treatment. From the antibacterial and antibiofilm assays it was observed that CcNc can effectively control the growth, biofilm formation and kills the antibiotic resistant organism even at the concentration of 1.5 $\mu\text{g/ml}$ (Fig 2).

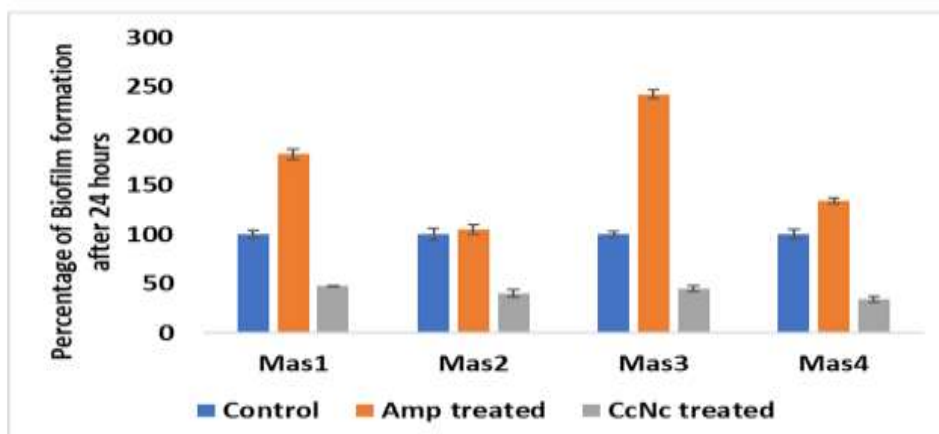


Figure 2. Percentage of biofilm formation in pathogenic strain upon treatment with different concentration of CcNc.

There were previous research works supporting our data that smaller sized nanoparticles present in nanocolloidal solution effectively enter the bacterial cell through disrupting the cell membrane. Immediately after entering the cell, nanoparticles target the cellular machinery such as replication, transcription and translation and disrupt the entire system in the cell followed by effective killing of the pathogen without causing adverse effect on host cell[9].

Conclusion

This study can be concluded that CcNc synthesized using *Cymbopogon citratus* effectively inhibit the growth and biofilm formation through killing the bacterial cell, which were resistant to antibiotics. Thus, this CcNc can be formulated for topical application which could be a better alternative to treat the mastitis.

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Conflict of interest

Authors have no conflict of interest

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Chapter-35

A Content Level Based Deduplication on Streaming Data Using Poisson Process Filter Technique (PPFT)

Mohd Akbar⁴⁵, Dr Prasadu Peddi & Dr K E Balachandrudu

Abstract

The proposed work on Poisson's process-based algorithm is subtracting data streaming material. Because Poisson processes are intended to count different events over time and space, it is helpful to recognize data replication as it is transmitted in time and space, allowing the deduction process to be carried out in tandem. Some of the deduplication work focuses on deduplicating file rates and blocks, while focusing can be shifted to content level as data streams become more complex. In this method, information level deduplication allows intelligent analysis of data while saving time for deduplication.

Streaming data also has its inherent randomness and can address random behavior in the dynamically linked system by providing deduplication dependent on the Poisson method. The suggested approach defines the data that can be contained in the database. Based on the experimental results, the Poisson Process-based algorithm produces the accuracy of 0.912 Area Under Curve (AUC), which means the algorithm's performance is fairly good if the AUCs exceed 0.8. Compared to existing approaches, this means that the intelligence-based deduplication model has generated reliable and robust data streaming deductions.

Keywords: Algorithms, Streaming Information, Poisson Processes and Semantic Levels

Introduction

Data deduplication is a process by which redundant data in a system is eliminated, typically designed to improve efficient storage. During the deduplication process, an additional copy of existing data is deleted in a data set / stock medium, and an additional copy remains to be stored, leaving only one copy. For the following reasons, data deduplication is required,

1. Reduce storage usage and increase database performance.
2. For accuracy and cost reduction.
3. Reducing disk I / O functionality.

Current methods for managing duplicates on the storage media are file level and Block level deduplication. File level deduplication is easy to use, enforce, which works at file level by deleting duplicated files, takes fewer energy to deploy and thus is not cost-effective to maintain over large quantities of the physical storage media. Block-level deduplication in contrast to file-level deduplication is much more effective and accurate. It operates in a fixed block or in a variable block by eliminating redundant blocks.

It may delete sections of data less than its file and these mechanisms concentrate on the size of data including file, sub-file, chunk, block, byte and the bit. This type of algorithm cannot therefore provide an optimal solution for a specific scenario such as the deduplication of streaming data to the content stage. In this research, it is proposed the Poisson algorithm, a stochastic procedure that accounts for the number of events during a given event. Here, in the content level data deduplication for streaming data, the Poisson method is implemented.

It is difficult to handle the main complication of the deduplications of data streamed because it needs a smarter way, as in Poisson Process (Stochastic) to perform the deduplication of data in terms of contents that saves crucial time for the process and produces a more efficient deduplicate. The main complications of streaming is their behavior.

Literature Review

A.K. Elmagarmid, P.G. Ipeirotis, and V.S. Verykios (2007) Most data stream systems do not have conventional duplicate removal techniques. For certain streaming scenario, it is not necessarily feasible to precisely delete duplicates in an infinite data stream. We therefore strive to approximately remove duplicates in

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a limited space in streaming environments. We implement a datastruktur, a stable Bloom Filter and a new and simple algorithm based on a well-known bitmap sketch. The basic concept is since the entire history of the stream cannot be preserved, SBF constantly expels the old elements so that the more recent ones will be available to SBF. After analytical determination of certain properties of SBF, we show a near upper band of false positive values. We equate SBF with alternative approaches in our empirical analysis. The results show that both precision and time efficiency are superior to our approach when a fixed space and an appropriate false positive rate are indicated.

N. Koudas, S. Sarawagi, and D. Srivastava (2006) Information similarity computation is an important issue in the processing of information and data mining. Approximation approaches are used for large-scale similarity estimation in order to resolve the related performance and scalability challenges. One common feature of all sketch-based privacy solution protocols is that the sketch is carried out locally on the basis of general randomness. The input into the sketching algorithm is different from the randomness in a semi-honest model. However, we consider a new threat model when a party is allowed to use the common randomness to disrupt their input (1) offline and (2) to guide the approximation result to a malicious selected output before executing any secure protocol. Under this adversarial model, we formally describe disturbance attacks and suggest two attacks on the techniques of min hash and cosine skills. By assessing their performance on synthetic and real data, we demonstrate the potential of disturbance attacks.

Peter Christen (2012) They suggest a serve raided architecture in order to minimize such disorder attacks, where another entity, the server, assists in the secure approximation of similitude by treating common randomness as private data. In the server-suited architecture, we revised and implemented the requisite protected protocols to apply minhash and cosine drawing techniques. Our implementation shows that this new architecture can reduce offline disruption without compromising restoration protocol performance and scalability.

Methodology

The content-level deduplication is an efficient way of testing duplicate data at semantime level and maximizing time and storage complications for storage media among existing practical approaches. This approach focuses on the deduplication of content level from streaming data through Poisson Process Filter Based Technique (PPFT). In the real-world situation, the Poisson cycle has its own knowledge to solve this kind of problem. Therefore, it solves the problem of data deduplication by using some property called content or semantime level test to prevent doubling of data.

Step 1: Data Sharing

Data from different sources is continuously created, and streaming mechanism helps to create streaming data as the device input.

Step 2: Physical Fish Step Filter (PPFT)

With the assistance of temporary database, PPF monitors the number of occurrence blocks of the same data. It works as a filter that restricts the duplicate file based on the deduplication of contextual data. It detects the duplicate file using a Temp DB and classification algorithm using the Poisson method. Streaming data will be checked whether it is null or not if it is null then the replication will be checked in Poisson or an instruction to the machine will be given to test the data. Events are mutually autonomous in the Poisson cycle. The occurrence of one occurrence therefore does not affect the probability of another event happening. The events are constant by time period. There are no two events simultaneously. With this function, the process of Poisson tests incoming streaming data using the *Temp* database as well as the classification algorithm model for already existing data.

Step 3: Temp DB

Temp database stores current data from main or cloud storage by using the algorithm classification model and sends data deduplication to PPF. It also receives new data from PPF and temporarily sends it to the model for classification algorithms.

Results

The deduplication of data is a very important storage mechanism technique. The cost of storage, access time and precision are ever. The deduplication level and block level are already in place but the new scheme made using poisson process filter technology provides a great deal of precision at the level of the contents. Because here streaming data are random things, and the machine does not know, which one comes first. It is important to find Poisson processes in order to find data whether the algorithm is already accessible or not. Classification algorithm used to divide the streaming data into a variety of categories, which helps to store it in the database.

Graphs:

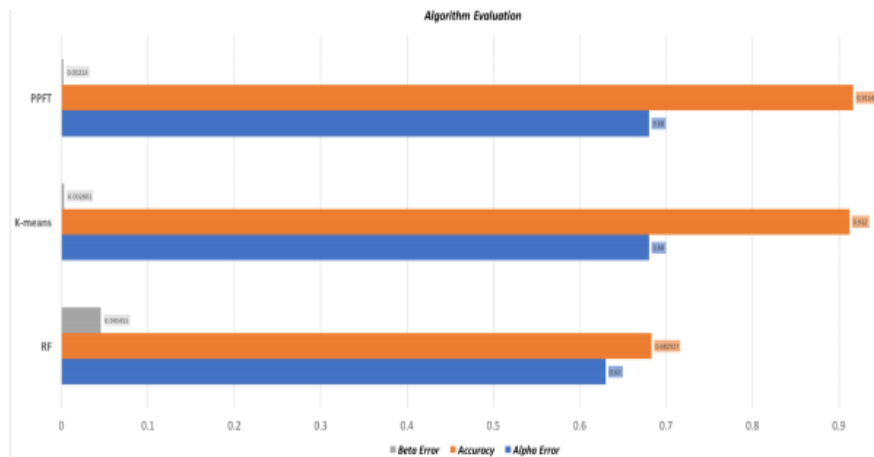


Fig. 1 A Graph demonstrating Algorithm Evaluation

This work shows that the deduction of streaming data is carried out on the somaticized level. Data can be streamed of any kind, but should be monitored on time, since all data are classified and stored in the database. Existing approaches such as files and block rates have not looked at content or semantime rates of data available and do not match random events such as streaming. PPFT has achieved this work by further improving the data deduction on streaming data by the use of artificial intelligence.

Conclusion

Typically deduplication techniques for large-scale data workloads reduce the use of the CPU cycle for fingerprint disk block comparison and prevent disk I / O bottlenecks in various process components. In order to design a highly useful and representative disk-block cache maintained in the main memory, we have created Sungem to use a novice sampling technique to prevent disk I / O searching on a large majority of requests. Unlike typical fingerprint deduplication techniques (time location) that take place at the same time in one place on the disc, Sungem uses the space to store disk fingerprints and, as a result, both the fingerprint comparisons and the disk I / O search that prefigures the fingerprints to the principal storage cache. Sungem also offers a large-scale waste collection solution which, to our best knowledge, is the first known garbage collection algorithm which can be genuinely escalated in the sense that overhead bookkeeping is only proportional to the size of the difference between consecutive back-up operations for every backup operation.

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Chapter-36

Pulmonary Function Screening for Assessment of Respiratory Health- A Cross Sectional Study from Delhi, India

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Abstract

Screening of Pulmonary functions is used as a routine practice to analyze the status of respiratory health with reference to the efficacy of lungs for ventilation and breathing. There is a continuous decline in the respiratory health of the urban population with increasing exposure to harmful emissions and the consequences worsen with time if remain undetected. Basic testing of pulmonary function has become an indispensable tool for early screening of individuals at risk. Spirometry breathing test (Pulmonary function test; PFT) is a commonly used cost effective, noninvasive and safe method for assessment of the status of respiratory health. It is an efficient tool which measures how much (different volumes) and how fast the air moves (flow rates) for early diagnosis of lung condition (Chronic Obstructive Pulmonary Diseases; COPD) enabling us to allow proper primary care.

The study group consisted of 508 subjects (Females 85.24% and Males 14.76%) of different age groups (17-65 years) and was analyzed at two levels using peak flow meter and spirometer. The second level test (Spirometry) was performed for 31.69% of the subjects (11.80% Males and 88.20% Females) detected with low values for the first level test. The results of spirometry were normal for 63.16% males and 65.49% females but in the rest of the subjects, either possible mild restriction/ possible severe restriction/ mild obstruction/ moderate restriction/ moderately severe restriction or obstruction & possible restriction was observed. Subjects with deviated body mass index (BMI) (underweight or overweight) either had lower lung capacity or narrowing of the lung airways. The spirometry data obtained in the present study can help the subjects to understand their respiratory health status in present and also prepare them for management and treatment of respiratory problems.

Keywords: Spirometry, Body Mass Index, Chronic Obstructive Pulmonary Diseases, Lung capacity

Introduction

Due to constantly increasing environmental pollution, it has been observed that the respiratory health in urban populations is continuously declining and susceptibility to common respiratory problems (asthma, bronchitis, emphysema and Chronic Obstructive Pulmonary Diseases) is increasing. According to a World Health Organization report it is estimated that 235 million people suffer from asthma. These pulmonary problems cause nearly 4 million deaths per year. More than 90% of the world's population lives in areas where level of air pollution does not meet the safety standards (UNESCO, 2019). Increase in environmental pollution due to extensive anthropogenic interference has caused various respiratory problems among mankind. The risk factors include: exposure to indoor and outdoor air pollutants, allergens, occupational exposure, tobacco use etc. while unhealthy diet, obesity, overweight intake, physical inactivity add to the risk.

Diagnosis and monitoring of these pathological conditions can be done with the help of pulmonary function tests (PFT) using peak flow meter and spirometer. Pulmonary function tests (PFTs) are an important tool in the investigation and monitoring of patients with respiratory problems. These tests do not provide exact diagnosis of the disease but various respiratory diseases have different abnormality patterns, which tend to establish a diagnosis (Ranu et al., 2011). Functioning of lungs depends upon many factors like neuropsychological factors and respiratory muscles strength and, in turn PFTs depend on the same (Akhani et al., 2019).

In the present study, pulmonary function screening of 508 subjects was carried out to detect any kind of respiratory problem. Along with the analysis of the tests, medical history of subjects related to respiratory health was also analyzed to find out correlation with other clinical conditions. Awareness was generated about

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the increasing risk of pulmonary illnesses and benefits of early detection with simple non- invasive procedures of PFT. The spirometry data obtained in the present study can help the subjects to understand their respiratory health status in present and also prepare them for management and treatment of respiratory problems.

Methods

2.1 Subjects

The study was conducted at Maitreyi College premise in the presence of medical personnel with 508 randomly selected subjects belonging to different age groups (17-65 years), residing in the Delhi NCR area. Participation of subjects was voluntary. They were informed about the objective of the study and informal consent was taken from all of them.

2.2 Questionnaire-based Survey

A uniform questionnaire was designed and provided to subjects. It was aimed for obtaining information about their personal characteristics, respiratory problems, allergy history, medical family history and lifestyle habits (smoking status).

2.3 Physical Parameters

The body mass index (BMI) of the subjects was also calculated [BMI = body weight (kg)/ body height (m²)].

2.4 Pulmonary Function Test (PFT)

All the pulmonary function tests were done on the subjects comfortably in an upright position. The steps for the tests were explained to the subjects and a demonstration was shown before proceeding for their PFT. Each subject tried thrice and the best reading was used for efficacy. Spirometry was performed using the portable computerized digital Spirometer SpiroSift SP-470 (Fukuda Denshi, Tokyo, Japan). The pulmonary impairments were classified as per Miller's prediction quadrant. The value of vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), peak expiratory flow (PEF) were recorded by the spirometer, with predicted values originally programmed in the spirometer.

The pulmonary function screening was performed in two stages:

- **Peak flow Meter:** To detect the highest rate at which air can be expelled from lungs via mouth. Respective values were compared to the expected values according to their height, age and sex. Subjects with deviated values in this test were asked to attempt a second test which was done by spirometry.
- **Flow Spirometry:** To measure air flow in and out of the lung and measure various lung volumes like Vital capacity (VC), Forced vital capacity (FVC), Forced expiratory volume (FEV), Forced expiratory flow (FEF) and Maximal voluntary ventilation (MVV). Spirometry is used for generating graphs (spirogram), which are helpful in assessing respiratory health conditions.

2.5 Data Analysis

Percent of predicted FEV₁ (%FEV₁), percent of predicted PEF (%PEF), and FEV₁/FVC (FEV₁%) were analyzed for each category of subjects.

Results and Discussion

With increase in environmental pollution due to various anthropogenic activities, respiratory health is deteriorating. The study was conducted on 508 subjects (Females 85.24% and Males 14.76%) belonging to the age group of 17 to 65 years. In this respiratory health assessment, first the individuals went through peak flow measurement using the peak expiratory flow rate test (PEFR Test). The values for the PEFR test were within the normal range according to the age groups in 347 (68.31%) subjects. The second test was performed using a spirometer for subjects (31.69%) with subliminal result values in the PEFR test. After the spirometry test, it was found that 11.023% of subjects had one or the other type of problem in their pulmonary function efficiency. Subjects with possible mild and mild restriction had their FEV₁/ FVC % value more than their predicted FEV₁/ FVC% and those with obstruction and possible restriction had lower value indicating that they are more prone toward obstructive lung diseases like asthma, COPD and cystic fibrosis.

Spirometry test was done for 161 subjects including females (88.20%) and males (11.80%). Analysis of spirograms of these

161 individuals exhibited that 65.22% had normal spirometry, 27.95% had possible mild restriction, 0.62% had mild obstruction, 1.24% had obstruction and possible restriction, 0.62% had possible severe restriction, 3.73% had moderate restriction and 0.62% had moderately severe restriction (Table 1, 2).

Table 1. Assessment of spirometry results

Spirometry Result	Female (142)	Male (19)	Total (161)
Normal	93 (65.49%)	12 (63.16%)	105 (65.22%)
Mild Obstruction	1 (0.7%)	0	1 (0.62%)

Possible Mild Restriction	40 (28.17%)	5 (26.32%)	45 (27.95%)
Possible Severe Restriction	1 (0.7%)	0	1 (0.62%)
Obstruction & Possible Restriction	1 (0.7%)	1 (5.26%)	2 (1.24%)
Moderate Restriction	5 (3.52%)	1 (5.26%)	6 (3.73%)
Moderate Severe Restriction	1 (0.7%)	0	1 (0.62%)

Table 2. Assessment of various parameters of the subjects with deviated values of spirometry results

S. N o.	Age (Years)	Height (cm)	Weight (kg)	BMI (kg/m ²)	Forced Vital Capacity		Forced Expired Volume		Peak Expiratory Flow		Spirometry Result
					Measured	Predicted	Measured	Predicted	Measured	Predicted	
1	17	155	50	20.81	3.14	2.87	2.17	2.57	4.06	6.35	Mild Obstruction
2	18	155	40	16.65	2.05	2.87	1.87	2.57	5.41	6.35	Possible Mild Restriction
3	18	164	51	18.96	2.42	3.36	2.28	2.93	5.54	7.16	Possible Mild Restriction
4	18	154	48	20.24	2.24	3.03	2.02	2.65	3.81	6.72	Possible Mild Restriction
5	18	152	40	17.31	2.06	2.92	1.9	2.54	5.73	6.56	Possible Mild Restriction
6	18	163	43	16.18	2.46	3.28	2.12	2.85	5.91	7.05	Possible Mild Restriction
7	18	157	45	18.26	2.19	3.08	2.1	2.68	5.23	6.78	Possible Mild Restriction
8	18	150	50	22.22	2.03	2.83	2.23	2.52	5.3	6.3	Possible Mild Restriction
9	19	162	60	22.86	2.45	3.2	2.31	2.79	5.7	6.94	Possible Mild Restriction
10	19	157	49	19.88	2.39	3	2.14	2.61	8.24	6.67	Possible Mild Restriction
11	19	162	45	17.15	2.54	3.2	2.46	2.79	6.78	6.94	Possible Mild Restriction
12	19	162	60	22.86	2.58	3.31	2.54	2.89	6.24	7.11	Possible Mild Restriction
13	19	144	41	19.77	1.94	2.56	1.75	2.21	5.09	6.06	Possible Mild Restriction
14	19	150	44	19.56	2.21	2.8	2.17	2.43	5.88	6.39	Possible Mild Restriction
15	20	160	50	19.53	2.52	3.31	2.11	2.89	4.74	7.11	Possible Mild Restriction
16	21	150	78	34.67	1.31	2.8	1.14	2.43	3.07	6.39	Possible Severe Restriction
17	21	160	55	21.48	2.35	3.2	2.27	2.79	6.74	6.94	Possible Mild Restriction
18	34	152	54	23.37	2.09	2.8	1.81	2.42	5.25	6.42	Possible Mild Restriction
19	37	157	61	24.75	2.13	2.71	1.99	2.33	4.32	6.3	Possible Mild Restriction
20	46	152	70	30.3	1.7	2.3	1.54	1.96	4.68	5.76	Possible Mild Restriction
21	48	162	68	25.91	2.41	3.13	2.23	2.65	5.5	6.93	Possible Mild Restriction
22	52	152	64	27.7	1.71	2.24	1.48	1.89	3.99	5.69	Possible Mild Restriction
23	59	160	65	25.39	1.99	2.56	1.81	2.16	4.59	6.14	Possible Mild Restriction
24	60	160	65	25.39	1.15	2.35	0.71	1.98	1.66	5.86	Obstruction & Possible Restriction
25	27	172	65	21.97	3.48	4.48	3.03	3.79	5.64	9.67	Possible Mild Restriction
26	47	173	80	26.73	2.76	3.78	2.22	3.1	7.28	8.55	Possible Mild Restriction
27	49	170	62	21.45	2.86	3.68	2.16	3.01	4.84	8.4	Possible Mild

											Restriction
28	50	164	80	29.74	2.75	3	1.64	2.7	3.15	7.99	Obstruction & Possible Restriction
29	51	162	75	28.58	2.58	3.28	2.2	2.67	6.34	7.86	Possible Mild Restriction
30	21	165	46	16.9	2.54	3.39	2.23	2.96	2.61	7.22	Possible Mild Restriction
31	20	155	45	18.73	1.98	3	1.81	2.61	2.39	6.67	Moderate Restriction
32	19	154	40	16.87	2.2	2.95	2.17	2.57	2.36	6.61	Possible Mild Restriction
33	18	166	70	25.4	2.46	3.43	1.86	3	1.7	7.27	Possible Mild Restriction
34	20	155	45	18.73	2.07	3	1.95	2.61	2.67	6.67	Possible Mild Restriction
35	18	156	50	20.55	2.15	3.03	1.99	2.65	3.25	6.72	Possible Mild Restriction
36	20	167	54	19.36	2.63	3.47	2.39	3.03	2.5	7.33	Possible Mild Restriction
37	19	167	48	17.21	2.21	3.47	2	3.03	2.91	7.33	Moderate Restriction

38	19	165	42	15.43	2.54	3.39	2.27	2.96	2.54	7.22	Possible Mild Restriction
39	19	156	50	20.55	2.44	3.6	2.22	3.14	1.76	8.65	Moderate Restriction
40	20	167	45	16.14	2.71	3.47	2.64	3.03	2.5	7.33	Possible Mild Restriction
41	20	166	48	17.42	2.64	3.43	2.56	3	2.24	7.27	Possible Mild Restriction
42	21	167	58	20.8	2.55	3.47	2.45	3.03	2.39	7.33	Possible Mild Restriction
43	18	160	50	19.53	1.99	3.2	1.81	2.79	2.59	6.94	Moderate Restriction
44	19	155	45	18.73	2.25	3	2.09	2.61	1.25	6.67	Possible Mild Restriction
45	19	164	40	14.87	2.54	3.36	2.4	2.93	1.49	7.16	Possible Mild Restriction
46	25	161	56	21.6	2.58	3.23	2.21	2.83	1.78	7	Possible Mild Restriction
47	20	163	65	24.46	2.15	3.31	1.91	2.89	3.12	7.11	Moderate Restriction
48	19	156	44	18.08	2.03	3.03	1.77	2.65	2.51	6.72	Possible Mild Restriction
49	22	160	56	21.88	2.42	3.2	2.18	2.79	1.67	6.94	Possible Mild Restriction
50	20	154	58	24.46	1.64	2.95	1.59	2.57	0.33	6.61	Moderately Severe restriction
51	21	155	40	16.65	2.3	3	2.21	2.61	2.78	6.67	Possible Mild Restriction
52	20	152	45	19.48	2.09	2.87	1.57	2.5	1.27	6.5	Possible Mild Restriction
53	19	153	52	22.21	2.05	2.92	1.88	2.54	1.62	6.56	Possible Mild Restriction
54	23	154	50	21.08	2.09	2.95	2.09	2.57	1.57	6.61	Possible Mild Restriction
55	51	167	62	22.23	2.7	3.5	1.95	2.89	1.9	8.21	Possible Mild Restriction
56	23	163	59	22.21	2.61	3.96	2.43	3.41	5.4	9.08	Moderate Restriction

The use of PFTs is primarily based on expert opinion and international guidelines predominantly dealing with asthma, chronic obstructive pulmonary disease (COPD), and lung fibrosis (Sveum et al., 2012, Vestbo et al., 2013). It helps in understanding the various lung capacities and chest wall mechanics which enable prediction of early damage to the pulmonary system (Raju et al., 2014). In clinical medicine, PFTs are often used to evaluate respiratory symptoms, to diagnose diseases, and to assess functionality and preoperative risk (Crapo, 1994). During the last two decades there has been a great increase of interest in the detection of COPD with spirometry as the first step of detection analysis.

Chronic obstructive pulmonary disease (COPD) and asthma are extensively prevalent in old age people (Dow et al., 1992, Dow et al. 2001, Lee et al., 1990, Renwick and Connolly 1996). In the present study, the percentage of subjects showing deviations in spirometry increased with increase in age indicating age related deterioration in respiratory health (Table 3, Figure 1). Lung functions tend to decline with age even in absence of any type of lung disease. According to Thomas et al., (2019), the definition of chronic airway disease may need to be reconsidered to allow for normal ageing and ensure that healthy people are not harmed by potential over-diagnosis and overtreatment. The first step required is to apply age, sex and ethnicity-adjusted FEV₁/FVC thresholds to the definition of COPD (Thomas et al 2019).

Table 3. Spirometry results in different age groups.

Age Group (years)	Total Number of Subjects in the Age Group	Number of Subjects with Deviation in Spirogram Values in the Given Age Group
17-30	133	44
31-50	18	7
51-65	10	5

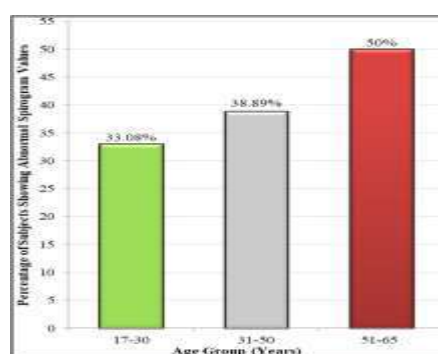


Figure 1. Percentage of subjects showing deviation in spirometry results in different age groups

Body Mass Index (BMI) and spirometry results of 161 subjects were co-analyzed (Table 4, Figure 2). Among these subjects 65.83% had healthy weight and 31.67% were either underweight or overweight. Out of 31.67% individuals who had deviated BMI, 47.05% had possible mild restriction/ possible severe restriction/ mild obstruction/ moderate restriction/ moderately severe restriction or obstruction & possible restriction. For BMI calculation, BMI standard chart was followed.

The correlation between nutritional abnormalities and occurrence of COPD is well established. There is unexplained weight loss as a result of malnutrition and contributes to weakness of respiratory muscles leading to complication of symptoms (Kant and Gupta, 2008). Also, general wellbeing and social life of subjects is being affected due to various taboo associated with symptoms after COVID-19 outbreak (shortness of breath, cough, wheezing, frequent chest infection).

Sedentary lifestyle along with unhealthy dietary habits contributes to complication of disorder and low relief with medications. If remained undiagnosed or untreated chronic respiratory diseases may result in pulmonary hypertension and eventually right-sided cardiac failure and death (Ranu et al., 2011).

Table 4. Spirometry results in different weight and BMI categories.

Weight Categories	BMI	Number of Subjects in the BMI Category	Number of Subjects with Deviation in Spirogram Values in the BMI Category
Underweight	<18.5	31	14
Healthy Weight	18.5-24.9	106	32
Overweight	25-29.9	17	8
Obese	30-34.9	3	2

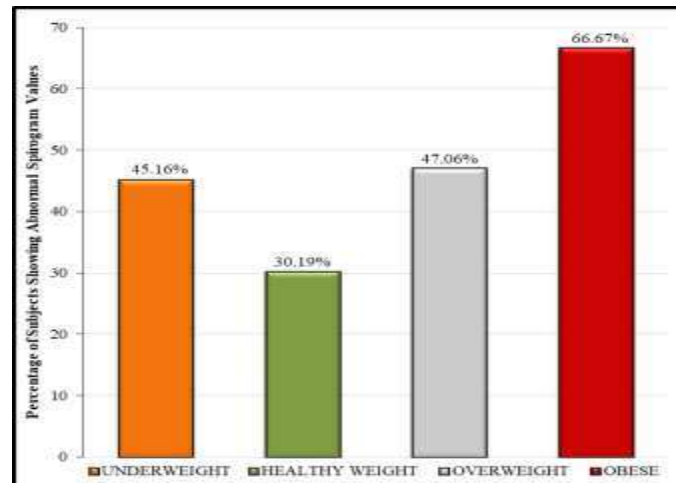


Figure 2. Percentage of subjects showing deviation in spirometry results in different BMI categories

Conclusion

Effortless breathing is a prerequisite for normal well-being of an individual and once affected due to any factor or disorder makes the survival difficult. It is essential to follow some precautions to maintain healthy lungs and airways to avoid the occurrence of respiratory illness. Following an active lifestyle, healthy dietary habits and low exposure to air pollutants are advisable. Age, smoking, and consumption of alcohol further increase the likelihood of encountering the disease. Thus, awareness should be generated among individuals about possible complications and management for the same. The benefits of early detection with simple non-invasive procedures of PFT are most important in management of the COPD. It is a simple non-invasive procedure and takes little time to be completed.

We should assess the risk of modern lifestyle on respiratory function and regular health checkups should be promoted for early diagnosis of any disease before it becomes chronic. Air pollution standards should be revised and implemented as well to reduce respiratory disease chances in future. Reducing air pollution is about protecting the environment, preserving biodiversity, and mitigating climate change, which make up some of the most pressing challenges of today (WHO, 2007).

Despite the difficulty of eradicating the problem of anthropogenic environmental pollution, a successful solution could be envisaged as a tight collaboration of authorities, bodies, and doctors to regularize the situation (Manisalidis et al., 2020).

Low levels of regular physical activity appear to be associated with an increased risk of respiratory tract infection (i.e., showing a so-called J-shape association) (Hull et al., 2020). Opting for a more active lifestyle and encouraging children to get involved in more outdoor activities can help a lot. Regular health education regarding the importance of the use of respiratory masks, and medical examination is very much essential.

The spirometry data obtained in the present study helped the subjects to understand their respiratory health status in present and also prepared them for management and treatment of respiratory problems. It is important to note that interpretation of the tests must be analysed in combination with clinical history.

Amidst the current COVID-19 outbreak and its overlapping symptoms with respiratory disorders has created a lot of difficulty in treatment of COPD and asthmatic subjects. Subjects with COPD are significantly at higher risk of Covid-19 infection (Sissons, 2020). Under-diagnosis leads to mismanagement and under-treatment for the subjects. Thus, it is imperative to generate awareness among the general population with respect to respiratory illness associated with airways obstruction and restriction.

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Chapter-37

Natural Gas Pipeline Leak Detection and Monitoring Using Wireless Sensor Networks

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Abstract

In view of the problems associated with poor detection efficiency, high false rate, and poor location accuracy with conventional leak detection techniques, this article is a kind of hierarchical leak detection for use in surveillance networks. Sensors for monitoring natural gas pipelines and provide a method of location. In the signal pre-processing phase, the original monitoring signals are processed using the wavelet transformation technique in order to extract the single-mode signals and the characterization parameters. During the initial validation phase, an SVM-based multi-scalifier model is created and the attribute parameters are sent as input parameters to the multiplier for initialization. At the final decision stage, a better evidence combination rule has been developed that allows the results of the initial recognition to be incorporated into the final decisions. In addition, a weighted average location algorithm based on the arrival time difference is introduced in order to detect the leak time. Experimental results show that this hierarchical method of detecting and detecting leaks in the pipeline can effectively improve the accuracy of the location of the leak and reduce the failure rate and false alarm rate.

Keywords: leak detection, leak point localization, pipeline monitoring, and sensor networks.

Introduction

Today, natural gas has become one of the most important energy resources in the world, relying primarily on pipeline transport. However, with the widespread demand for natural gas supply, the issue of leak detection in pipelines has become very important. Periodic inspections by maintenance personnel do not allow real-time monitoring of the pipeline. As a result, no leaks can be detected in a timely manner, which can lead to significant economic losses and environmental pollution. Because wired surveillance systems pose a risk of damaging any part of the network and the cost of deploying them in the underground scenario is very high. On the other hand, wireless sensor networks (WSNs) are a much more robust and efficient option for monitoring pipelines. This technology can be used as a routing protocol to monitor pipeline infrastructure and transmit information from sensor nodes to wells. Although some WSN-based surveillance systems have been developed in recent years, this type of network information processing has been studied. This is mainly due to the fact that surveillance information has uncertainties and multiple impressions, in large numbers, and complex relationships. Therefore, no mechanism has yet been devised for effective monitoring of information obtained from pipelines. First, sensors can be affected by background noise in urban situations, so detection information is very vague. In addition, the information provided by these types of sensors is therefore always incomplete or inaccurate due to its shortcomings and environmental interference, so that each node can First, the detection information is very ambiguous because the sensor can be affected by background noise in urban situations. In addition, the information provided by this type of sensors is such that each node has an amount of acoustics, flow, pressure, etc. You may want to integrate different types of sensors. In light of the above issues, this white paper discusses the advantages and disadvantages of existing methods and proposes a new hierarchical method for detecting and locating pipeline leaks. Employs different detection methods to handle leak information at different levels.

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Methodology

The Natural Gas Pipeline Monitoring Sensor Network includes a number of sensor nodes, sinks, and control and operation centers. As illustrated in Figure 1, the entire network adopts a similar clustering structure, with sensor nodes installed along the pipeline in charge of signal aggregation and data preprocessing. The process results are then sent to sync via a multi-hop route. The monitoring network takes in-tube communication mode for message exchange between sensor nodes. Sync, as a cluster leader, is responsible for the operation of the sensor nodes in its cluster, coordinating the preprocessing results for the final decision and localizing the location of the leak if leaked. Finally, the diagnostic result is sent to the Control and Management Center, which determines whether a leak warning should be issued.

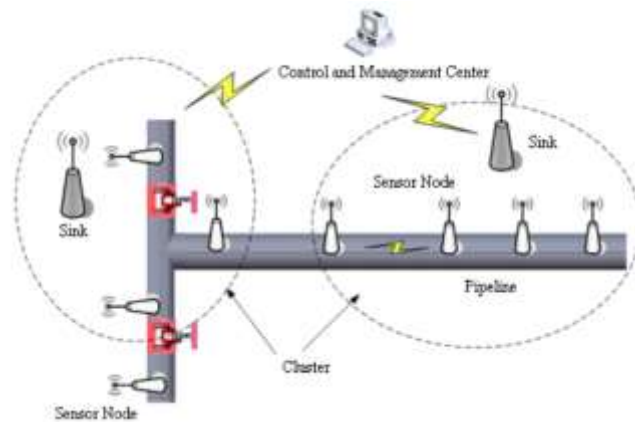


Figure 1. Architecture of pipeline monitoring sensor networks.

Result and Discussion

If there is a leak along the pipeline, the signal wave received at the five sensor nodes is shown in Figure 2. Since the original signal is a continuous, noise-emissive signal with large amounts of noise and other interference mixed in, it is difficult to distinguish the leakage characteristics from these signals.

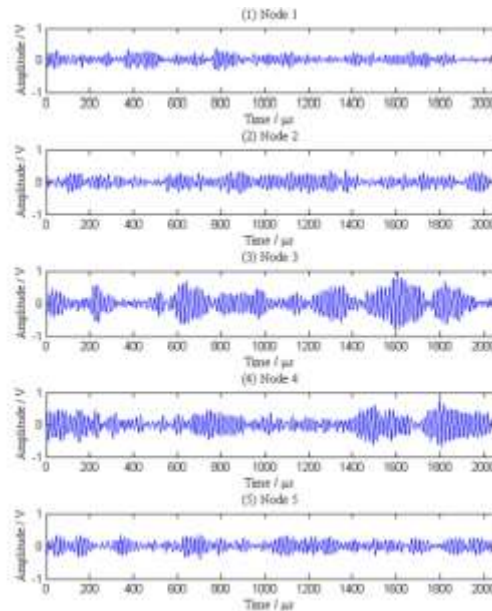


Figure 2. Original signals received by five sensor nodes.

Additionally, the average amplitudes of original signals obviously decline with the increasing distances between sensor nodes and the leak point.

Conclusion

To eliminate noise interference and scattered phenomena, sensor nodes first use wavelet transformation technology to mute leak signals and obtain single-mode signals and leakage parameters of the leak. Experimental results show that the classification approach can clearly improve the accuracy of pipeline leak detection and avoid critical difficulties. In this article, we will focus primarily on linear pipelines without considering other pipeline options. For this reason, we plan to conduct extensive research in the future on leak detection and localization approaches for pipelines with special structures such as zigzag or curved pipelines. In addition, we have undertaken underground pipelines such as water and oil, as well as underground pipelines, and possibly to expand our methodology, one of the experiments to test the feasibility and justification of our approach. Will run Lots of industrial applications.

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Chapter-38

Long Non Coding RNA in Various Cancers and Their Potential as Biomarkers

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Abstract

The lack of proper and specific biomarkers leads to failure in accuracy of diagnosis in cancer. Long non coding RNAs (LncRNAs) are RNA transcripts with length above 200 nucleotides. LncRNA, though non-coding, are reported to play a major role in multiple molecular mechanisms, however, the functions are not fully explored. LncRNAs are reported to be modulated in various diseases including cardio vascular disease, neurodegenerative diseases and cancer. The role and potential of LncRNAs as prognostic and diagnostic markers have been identified. Certain oncogenic LncRNAs could act as therapeutic targets for prostate cancer. The future of diagnosis and treatment of prostate cancer could depend on LncRNA research.

Keywords: prostate cancer, biomarker, LncRNAs

Introduction

Researchers have been trying to understand the molecular mechanisms of various cancers. In the past, protein-coding genes were researched to unravel the mechanisms, but now, with Advancement in high- throughput technology, the study of RNA derivatives and their roles in cancer was made possible [2]. Long non coding RNAs (LncRNAs) are RNA transcripts above 200 nucleotides long. LncRNAs belong to a large family of non coding RNAs. LncRNAs had been previously considered as junk DNA due to their non coding nature. The technological advancement and bioinformatics analysis revealed non coding RNAs to play major role in multiple biological mechanisms, including cancer progression, proliferation chemo resistance, tumor suppression and more.

LncRNAs have been divided into four subclasses, based on molecular mechanisms: guide, signaling, scaffold and decoy[3]. The Guide LncRNAs are known to be involved in physically guiding ribonucleoprotein complexes (RNP) towards specific regions of genome and regulate genes. Scaffold lncRNAs act as platform for Ribonucleioproprotein complex formation [4]. Signaling LncRNAs are involved in sequestering active transcription factor. LncRNAs have been linked to processing of post-transcriptional mRNA , and in regulation of splicing of pre-mRNA [5]. LncRNAs function as tumor suppressors (XIST, TINCR, PCAT29), Oncogene(MALAT1, FALEC,PVT1), induce Androgen Receptor changes(PCGEM1, CTBP1-AS, GAS5),interact with ceRNAs(PVT1, UCA1, MALAT1), Epigenetic regulation(ZEB1-AS1, HOTAIR,DANCR) , DNA damage(PCAT1, ANRIL, NEAT1), tumor metabolism(LincRNA P-21, PCGEM1) in cancer [2].

LncRNAs in various cancers

Gastric cancer

Gastric cancer has the third highest mortality among cancer related deaths worldwide. A lack of obvious symptoms at early stages cause the diagnosis to be delayed and make treatment difficult, leading to lower survivability. Abnormal expression of long noncoding RNAs are linked with tumor progression, radioresistance, chemoresistance and targeted therapy sensitivity[6]. PCAT1, located at chromosome 8q24.21, when upregulated in gastric cancer was reported to be involved in platinum drug resistance[6]. Further experimentations suggested that knockdown of PCAT1 by siRNA was linked to promotion of apoptosis and decreased proliferation[195]. Experiments show the long non coding RNA DANCR to be located at chromosome4q12 and it is associated with drug resistance in cancer. DANCR Upregulation of DANCR in cell lines(SGC7901, BGC823) was reported to be linked to platinum drug resistance in gastric cancer[6]. Upregulation of multiple Long noncoding RNAs such as SNHG5,GHET1, AK022798, ANRIL, UCA1, HULC, HOTAIR,XLOC_006753, ZFAS1, BCAR4, MALAT1, PVT1, BLACAT1 have been reported to be Involved in drug resistance.[6]. Various Long non coding RNAs like HOTAIR, CASC9,

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MRUL, D63785, HULC, NEAT1, ROR upregulation is linked to ARD resistance in gastric cancer cell[6]. It was shown that long non coding RNAs like ANRIL, UCA1, HULC, XLOC_006753, MALAT1, PVT1, LEIGC dysregulation are involved in causing 5- FU resistance in gastric cancer[61-83]. ZFAS1, MALAT1, PVT1, HOTAIR, CASC9 upregulation is involved in PTX resistance in gastric cancer cells[6]. One of the most widely studied Long noncoding RNA MALAT1 stands for metastasis associated lung adenocarcinoma transcript 1 and is located in chromosome 11q13.1. MALAT1 upregulation is involved in metastasis by EMT, Angiopoiesis, VM in gastric cancer[6]. HOTAIR (HOX transcript antisense RNA), with location at Chr-12q13.13 is involved in multiple cancers. Research suggested that HOTAIR upregulation is involved in gastric cancer metastasis by targeting PCR2, miRNA-34a, SNAIL1, c- MET, CDH1, miRNA-152, HLA-G by Epithelial Mesenchymal transition and immune escape mechanisms[7]. The long non-coding RNA FRLnc upregulation is involved in gastric cancer cell metastasis by EMT[7]. Various other LncRNAs (ARTB, XIST, SNHG-6, ZFAS1, LINC00152, LINC00978, YAP1) whose upregulation are responsible for metastasis in gastric cancer cells through EMT process have been reported in studies[7]. The dysregulations in LncRNAs LET, RuPAR, H19, IGF2, CCAT1, LSINCT5, FER1L4 appear to associate in gastric cancer cell metastasis[7]

Lung cancer

Among all the cancers related death across the globe, lung cancer is the leading cause [1]. Lung cancer can be divided on the basis of pathology into the subtypes:- small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). Among these, NSCLC accounted for 80-85% of all lung cancer cases. Lung carcinoma has a low five year survival rate, due to delayed diagnosis, chemoresistance, recurrence and metastasis[8]. LncRNAs have been reported to be of value for diagnosis and treatment in lung cancer because of their potential as biomarkers. Reports indicated MALAT1 (Metastasis associated lung Adenocarcinoma transcript 1) expression in NSCLC is higher than normal cell tissues. Higher expression rates of MALAT1 is associated with lower overall survival (OS). MALAT1 is known to be involved in pathogenesis of various other cancers which include breast cancer, colon cancer, uterus cancer, ovarian cancer, liver cancer[8]. Interestingly, MALAT1 is involved in differentiation of tumors, EMT, proliferation of cancer, migration of cancer cells, invasion and also chemoresistance[8]. H19 is a maternally expressed 2.3kb long LncRNA which is revealed to involve in lung cancer and other human cancers including gastric cancer, pancreatic cancer, bladder cancer[8]. H19 was shown to be upregulated in lung cancer and is a cause for cell growth, differentiation, migration, invasion and Epithelial mesenchymal transition[8]. Research suggested H19 was also linked to platinum drugs resistance in small cell lung carcinoma[8]. TUG1 is 7.1 kb long that is involved in lung cancer and other human cancers[8]. Links between Higher expression of TUG1 with smaller tumor size and higher survival rate [8]. Overexpressed TUG1 levels in small cell lung cancer is associated with increased tumor size, greater tumor lymph node metastasis (TMN), and low prognosis[8]. TUG1 is involved in drug resistance in SCLC[8]. MEG3 is a LncRNA which is 6.9kb long and is involved in various cellular processes[8]. MEG3 is downregulated in lung cancer[8]. Higher expression of MEG3 is linked to better prognosis and suppress cell proliferation, regulate cell cycle[8]. However, MEG3 is negatively associated with drug resistance[8]. AFAP-AS1 is 6.8kb long non coding RNA which is linked to progression of multiple cancers including lung cancer[8]. Overexpression of AFAP1-AS1 was reported to be linked to NSCLC[8] and was associated with migration, cell growth, migration, and inhibition of Apoptosis in NSCLC cell lines[8].

Breast Cancer

Among all cancers affecting women, breast cancer is most prevalent. Breast cancer has high fatality rate[9]. LncRNAs have been reported to perform major part in the breast cancer. They are known to be participating in cell growth, cell stemness of cancer, cell migration, apoptosis and invasiveness. LncRNAs have value in diagnosis, prognosis and as therapeutic targets[10]. H19 which is involved in various other cancers, was reported to be naturally expressed in embryos and was reported to be overexpressed in tumor[196]. H19 is a LncRNA involved in breast cancer. H19 overexpression is linked to tumor formation in breast epithelial cells[10].

The long non coding RNA LSINCT5 is 2.6kb LncRNA reported to be involved in breast cancer. Overexpression of LSINCT5 is observed in breast cancer cells[10].

Underexpression of ZFAS1 LncRNA was linked to breast cancer. ZFAS1 overexpression is reported to cause suppression of breast cancer cells[10].

Interestingly, LncRNA Smad7 which is normally expressed in all mammary gland cells[10], was reported show links of tumorigenic activity in breast cancer[10]. LOC554202 was found to have increased expression in breast cancer tissue[10]. It was reported to be linked to cancer cell proliferation, induced apoptosis, inhibition of migration but LOC554202 expression was reported to be lowered in triple negative breast cancer[10].

Table1 Role of LncRNAs in various types of cancers.

Name of lncRNA	Function	Gene type	Types of cancers associated with	References
MALAT1	Increased Cell growth and invasiveness, migration	Oncogene	Colon, ovarian, liver, uterus, breast, prostate	2,8
HOTTIP	Increased Cell proliferation and inhibition of apoptosis	Oncogene	Colorectal cancer, lung cancer, Pancreatic cancer, prostate	2
SChLAP1	Associated with invasiveness	Oncogene	Prostate cancer,	2,14
PCAT1	Promotes Proliferation	Oncogenic	Gastric cancer, prostate cancer	2
PART1	Increased proliferation and inhibition of apoptosis	Oncogenic	Lung Cancer, ovarian cancer, colorectal, prostate	2
H19	Cell migration suppression	Potential oncogene		2
XIST	Suppress cell proliferation and invasiveness	Suppressor	Prostate cancer, multiple cancers	2
LUCAT1	Increased Invasiveness and migration	Oncogene	Lung cancer, breast , ovarian and Gastric cancer	2
GAS5	Apoptosis and DNA damage	Suppressor	Prostate cancer	10
HOTAIR	Cell growth and androgen-independent AR activation , chemoresistance	Oncogene	Gastric cancer, thyroid cancer	2,6, 11
UCA1	Cancer cell proliferation	Oncogenic	Breast cancer	10
NAMA		Suppressor	Thyroid	11
CCAT1	Tumor proliferation	Oncogenic	Lung cancer, Gastric cancer , colon cancer	8
PVT1	Cancer proliferation and apoptosis inhibition	Onocgenic	Prostate	25

A p27(tumor suppressor) gene suppressing Long non coding RNA, UCA1 was found to promote breast cancer proliferation by same mechanism of suppression of p27. UCA1 has been reported to be oncogenic in breast cancer progress[10]. Multiple studies have shown the LncRNA HOTAIR is 2.2kb and is derived from HOXC gene cluster[10]. It is linked to invasiveness and is a valuable biomarker and therapeutic target[10]. Research showed that SOX2OT which is a long multi exon lncRNA[10], when overexpressed is positively related to breast cancer[10]. FAL1 is reported to perform major part in cell proliferation and regulation of p21[10]. GAS5 downregulation is linked to breast cancer[10]. GAS5 is indicated to be a potential tumor suppressor [10].

Thyroid Cancer

Among all the malignant tumors, thyroid cancer is most prevalent, with an increasing incidence for the last 40 years[11]. There are various Subtyped based on which cells are involved. Theses subtypes are papillarythyroid cancer(PTC), Follicularthyroid cancer(FTC), Anaplastic thyroid cancer(ATC) and poorly differentiated thyroid cancer(PDTC). PTC is the most common among these and ATC has the lowest overall survival[11].

LncRNAs have been reported to involve in vital mechanisms in thyroid tumor formation[11].Long noncoding RNA, NAMA is reported to be significantly downregulated in PTC and is reported to act as suppressors of tumors in

thyroid cancer[11]. Reports have shown, RP5-1024C24 is underregulated in thyroid cancer and is indicated to act as a suppressors of tumor in thyroid cancer[11]. Another such lnc RNA, PANDAR, is underexpressed in thyroid carcinoma cell line and tumor tissue. It is associated with inhibiting cell growth and cell cycle, and promotes apoptosis[11]. Various long non coding RNAs are under regulated thyroid cancer and are linked to progression of the cancer. GAS8-AS1, LINC00663 and MEG3 are known to be underexpressed. GAS8-AS1 expression in thyroid cancer cells is linked to suppression of cell proliferation in thyroid cancer[11]. Also, LINC00663 is underexpressed in thyroid cell-lines. It was observed that its presence in cancer indicated to have tumor suppressive action[11]. The underexpression of another lncRNA, MEG3 is in thyroid cancer cell lines and tissue is reported to be negatively associated with thyroid cancer. Normal levels in cells are linked to inhibit invasion and are associated with LNM[11]. Unsurprisingly, HOTAIR which is known to be present in various other cancers is also found to be overexpressed in thyroid cancer cell lines and tissues. Its involvement in triggering cell growth and invasion is known[11]. HOTAIR expression is linked with lowered survival of thyroid cancer patients[11,12]. Also, the long noncoding RNA, Nuclear paraspeckle assembly transcript 1(NEAT1), located at chromosome 11q13.1[11], has been overexpressed in thyroid cancer cell lines. It is reported to promote tumor progression and is linked to increased tumor size[11]. It was found that HOXD-AS1 is highly expressed in cell lines and thyroid cancer tissue[11]. It was plausible to assume the role of MALAT1 in thyroid cancer as it is involved in multiple cancers. It was found to be upregulated in thyroid cancer cell lines and tissues. Reports suggested its link in the regulation of proliferation, migration and EMT via TGF- β [11].

Another lncRNA involved in thyroid cancer was found to be ANRIL, which was found to have increased above normal in thyroid cancer cell lines and tumor tissue. It was shown to be involved in proliferation, invasion and metastasis through regulation of TGF- β /Smad[11]. Various reports have been made on H19 and it was dysregulated multiple cancers including thyroid cancer. H19 had elevated levels in thyroid cancer cell lines and tissue. It has been linked to increased cell growth, cell migration and high invasiveness in thyroid cancer cells. It acts as an oncogenic lncRNA[11]. Yet another long non coding RNA named BANC1 was indicated to be overexpressed and involved in thyroid cancer cell proliferation. BANC1 is linked to inhibition of apoptosis in thyroid cancer cells[11]. All these studies suggest a vital role of lncRNAs in regulating cancer.

Colon Cancer

Colorectal cancer has the highest incidence among all gastrointestinal cancers. It is more common among adults and diagnosis of cancer happens at later stages in nearly half of the cases, leading to lower survival rates, about 11%[8]. One of the major long noncoding RNAs involved in colon cancer is Colon cancer associated transcript 1(CCAT1). Unsurprisingly,CCAT1 is an oncogenic lncRNA, located at chromosome 8q24.2 [8]. CCAT1 is overexpressed in colon cancer[8]. Overexpression in multiple types of cancers like lung cancer and gastric cancer is reported [8]. Similarly, the lncRNA CCAT2 was found to be overexpressed in colorectal cancers[8]. According to the reports, upregulation of CCAT2 is known to promote tumor growth and increase invasiveness of the cancer. Another lncRNA involved in colon cancer was reported to be CRND1. CRND1 overexpression was linked to colorectal cancer and various other cancer types[8]. The lncRNA, CRND1 was linked to proliferation, chemoresistance and WNT/ β -catenin signalling pathway, which is crucial for colorectal cancer development[8]. Multiple lncRNAs have been identified to be of prognostic value in colon cancer and predicting recurrence[8]. LINC01843, LOC101928168, ILF3-AS1, MIR31HG, AC0006329.1, AC105243.1 lncRNA have potential for predicting recurrence in colon cancer[8].From the reports it is evident that lncRNAs play a major role in regulating the molecular machinery of cancer.

Prostate Cancer

lncRNA dysregulation is linked to prostate cancer. lncRNAs have been found to have both oncogenic and tumor suppressive activity. The potential molecular mechanisms through which lncRNAs influence prostate cancer are Androgen receptor interactions, ceRNA interactions, Epigenetic regulations, DNA damage, tumor metabolism. There is a vast list of lncRNAs which have been found to be involved in oncogenesis. There are reports of various long non coding RNAs, which are specifically dysregulated in prostate cancer cells. Among them, MALAT1 overexpression in prostate cancer was linked to increased occurrence of cancerous cell growth, and increase in invasiveness, migration of prostate cancer cells. Unsurprisingly, It is reported to have high value in diagnosis of prostate cancer[2,13]. Also, SChLAP1 is a known oncogene, which is upregulated in prostate cancer. Higher expression is linked with invasiveness and metastasis. It has value in prognosis and risk prediction of prostate cancer[2,14]. Another such lncRNA is PCAT1, which is oncogenic. Higher expression of PCAT1 is linked to invasion and metastasis in prostate cancer[2,15]. Also, a lncRNA named TUG1 overexpression was linked to proliferation and migration of prostate cancer cells[16]. Another study found that MYU, an antisense lncRNA had

higher expression in prostate cancer and is associated with proliferation in prostate cancer cells[2]. It was reported that NAP1L6 is upregulated in prostate carcinoma and is associated with proliferation and migration of cancer cells[2,17]. Yet another lncRNA, named ROR was reported to be overexpressed in prostate cancer and found to promote proliferation, invasiveness and migration in cancer cells[2,18]. Studies reported LUCAT1 overexpression to be linked to cell invasiveness and promotes migration of prostate cancer cells[19]. The lncRNA POU3F3 overexpression promotes cell proliferation in prostate cancer cells[20]. Also, reports showed AFAP1-AS1 was linked to cell metastasis and known to promote proliferation of cancer cells in prostate cancer[2,21]. Mostly, lncRNA overexpression could have negative effects but few lncRNAs have been known to be beneficial, similar to the lncRNA GHET1 overexpression was reported to be linked positively to cell proliferation and inhibit apoptosis[2,22]. It was reported that HOTTIP, an antisense lncRNA, is highly expressed in prostate cancer and is reported to cause advancement in cell proliferation, chemosensitivity and inhibition of apoptosis[23,24]. Also, PART1 overexpression is reported to lead to advancement of cell proliferation, chemosensitivity and inhibits apoptosis[2]. Unsurprisingly, PVT1 overexpression is linked to advancement of cell proliferation, migration and inhibition of apoptosis in prostate cancer cells[25]. Another lncRNA named PCGEM1 was reported to be overexpressed in prostate cancer and was reported to lead to higher proliferation and inhibition of apoptosis. It interacts with androgen receptor Signalling pathway[2]. Reports suggested that PCGEM1 overexpression is involved in tumor metabolism as well. We know that androgen receptor modifications are involved in prostate cancer and PRINCR1 overexpression in prostate cancer is linked to androgen receptor transactivation[2]. The lncRNA PCA3 overexpression was reported to be linked to prostate cancer and has potential as a prognostic marker[2]. PCGEM1 overexpression is linked to prostate cancer cell growth[2]. Epigenetic regulations are also a major pathway through which lncRNAs are involved in prostate cancer and HOTAIR overexpression is linked to prostate cancer by acting on epigenetic regulation[2]. HOTAIR is known to be overexpressed in multiple cancers and the reports suggest that the fact holds true even for prostate cancer.

Long noncoding RNAs are known to be important factors in oncogenesis, but many lncRNAs have been known to cause suppression of cancer by various mechanisms. It is reported that lncRNAs could affect cell migration and proliferation similar to what PCAT29 upregulation, which is linked to suppression of cell migration and proliferation [2]. Also, PCAT29 has clinical significance as a predictor of recurrence[2]. Another lncRNA is DRAIC whose upregulation is linked to suppression of prostate cancer. DRAIC upregulation lead to suppression of cell migration as well as invasion[2]. Also, the downregulation of H19 is linked to higher cell migration. Unsurprisingly, H19 upregulation suppressed cell migration in prostate cancer[2]. Another lncRNA, GAS5 is known to be linked to be under expressed in prostate cancer and is linked to suppression of proliferation and promotion of apoptosis[2]. XIST, which is known for X chromosome inactivation, is downregulated in prostate cancer and is known to suppress cell proliferation and metastasis[2]. The lncRNA BDNF-AS is downregulated in prostate cancer and is linked to suppression of cell proliferation[2]. Reports indicated TINCR downregulation in prostate cancer is a cause for cell proliferation and migration of cancer cells[2]. Reports suggested it to be valuable as a prognostic biomarker[2]. Also, IGF2AS downregulation is associated with cell proliferation and invasion in prostate cancer. It is known to be tumor suppressive in action and is valuable as a prognostic biomarker[26].

Conclusion

The discovery of Novel lncRNAs and their various functions in cancer have been reported. The value of lncRNAs as diagnostic, prognostic and therapeutic targets are reported. to improve the accuracy of diagnosis. Further research could unveil unknown pathways and give insight into novel lncRNA functions. Once regarded as 'junk DNA', the progression of RNA-sequencing technologies led to greater understanding of how lncRNAs are involved in various molecular pathways. A deeper understanding of how lncRNA dysregulation cause disease could reveal about new potential therapies and targets.

In this review, we have discussed the role of lncRNA in multiple cancers like lung, gastric, breast, colon and thyroid. The progression and suppression of prostate cancer based on dysregulation of lncRNAs has been reported in greater detail and the value of lncRNAs in diagnosis, prognosis and as therapeutic target was Majorly discussed. The potential of lncRNAs as therapeutic targets suggest a need in improvement of clinical molecular targeting techniques to treat prostate cancer. Advancement in RNA-sequencing techniques will further boost the lncRNA research and make the possibility of using this knowledge of lncRNAs in various therapeutic methods a reality.

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Chapter-39

Recycling of Natural Nutrients in the Symbiotic System of Urban Aquaponics on High Rise Terraces

Dr Rashmi Tyagi⁴⁹ & Dr Shilpa Jejurkar⁵⁰

Abstract

An urban aquaponic system has been set up in the Mumbai city in a high rise apartment. Since, there is no need of soil or fertilizers there is absolutely no need for pesticides for plants. The water in this system rotates from fish tank to the plants. There is no water wastage except for the water evaporation. It is observed that effectively only 10 % of water is consumed during the whole process as compared with traditional soil farming. The best part is that the plants get a constant feed of nitrates and nitrites hence the growth is phenomenal and hence high growth rates and much more yield takes place. Apart from all these benefits the most appealing part is that it can be installed in a much smaller area than that of soil farming, which makes it a home farming as well.

Keywords: Aquaponic system, Fish tank, Home farming, urban aquaponics.

Introduction

Aquaponic is a symbiotic system in which plants and fishes coexist together. The ancient roots of aquaponics can be traced back to southern India where the paddy fields co-existed with fishes. In aquaponics the plants are grown for support in stones unlike the traditional soil in a regular fish tank with filters etc. The principle behind aquaponics is that the fish's excreta which is ammonia based breaks down into nitrites and nitrates in due course of time. When this water is rotated to the plants side of the system then these plants not only consume them as nutrients but also bring about cleaning of the water thereby making it reusable for fishes. In today's world there are many challenges in the farming specially in the urban areas e.g. metropolitan cities like Mumbai, Delhi etc. Some of the biggest challenges of farming in metropolitan cities is that there is always lack of space. Also in the modern farming the use of pesticides has almost become a necessity giving rise to toxicity in the plants. Since the traditional farming is soil based and plants are in constant need of water a huge amount of power is consumed to irrigate the fields where over 90% of water is usually wasted. According to British Institute on Mechanical Engineering, as of 2013, half of food is wasted worldwide. In low-income countries, most loss occurs during production, while in developed countries - about 100 kg food per person per year is wasted at the consumption stage. The urban aquaponics may solve almost all of the problems faced in today's farming in urban areas and much more. Apart from all these benefits the most appealing part is that it can be installed in a much smaller area than that of soil farming, which makes it a home farming as well. If the green house is inside your home, there is no way to damage the food in the supply chain and much lesser chances to waste it in the fridge due to over stocking.

Experimental

A year back with enough perceived information, it was started off with two trays of 3 square feet size, housing about 6 plants and a 110 L fish tank with gold fishes. In the initial three months different plants like aloe vera, basil, mint, mogra, green chili, jasmine, Chinese bamboo, tomato and few others have been tried out. Soon a bigger system with approx 220 L water and 12 pots was designed. The effect of the duration of water which is supplied to the plants from the fish tank, on the growth of the plants has been studied. For this purpose, the study is conducted in two ways, i.e., continuous circulation of fish tank water to plants and circulation of fish tank water to plants at particular intervals. Apart from the aquarium's setup which includes fish tank to accommodate fishes, air pump for air supply

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and a filter, a small motor is installed to pump the water up to the plant's tank. The first part of the study is then progressed by manually controlling the supply of fish tank water to plants by pumping it once in 8 hrs for 30 min. In the second study water supply from fish tank to plant's tank is connected through fish tank filter which can pump water up to the plants non-stop as far as it is switched on.

Result and discussion

It has been noticed that the plants getting water supply at intervals are doing much better than the plants put on a non-stop water circulation. Since controlled water circulation provides an optimized time window for the plants to absorb the nutrients from the fish excreta in water than that of from continuous circulation, they grow 2 times faster and better. Figure 1 shows the difference between the plants growth done by employing both the methods in same assembly.



Figure 1: Plants (left) when water is circulated at interval, (right) circulated continuously.

Conclusions

It is concluded that urban aquaponics may solve almost all of the problems faced in today's farming in urban areas and much more. For home aquaponics systems fish tank water supply to the plants is more beneficial with intervals. Besides, all the cool benefits, it's a great way to engage kids who learn a lot of basic science fundamentals like working of a water pump, electric wiring, buoyancy force for water circulation, mechanics of water flows and its fitting, heating systems, filters, chemical balance and most important is the understanding of the nature's symbiotic system.

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Chapter-40

A Review of Biodiesel Oxidation Stability and Chemistry

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Abstract

The biodiesel proven as an alternative fuel for the diesel engine. It has number of advantages viz. reduction in harmful gases, improve output, environment friendly. In addition to this biodiesel shows some limitations viz oxidation instability, higher fuel consumption and lower heating value. The research for biodiesel has mainly limited due to the storage and use of biodiesel for prolong time. The current work is a review to discusses the oxidation chemistry and its stability for biodiesel by using antioxidant, and its role. The study revealed that, the antioxidants in biodiesel avoid the process of lipid oxidation which leads to off-flavour development. Plant extracts having phenolic compounds were found as a good source of antioxidant.

Keywords: Vegetable oil Biodiesel, Animal fat, Oxidation, Characterization, Antioxidant.

Introduction

Antioxidants are the substance added to biodiesel in fewer concentrations, which help to prevent or slow down the oxidation process of the biodiesel [1]. The long term use of vegetable oil and derived biodiesel are limited due to its stability, which is the ability of the biodiesel to resist degradation of its properties. In general biodiesel/oil stability is categorized into, the stability in storage for long time, the stability in high temperature/heated environment and for the most part the stability in exposure to surrounding air for oxidation stability. The vegetable oil/biodiesel are significantly degraded due to thermal-oxidative decomposition, foreign particles/impurities inclusion. Oxidation and hydrolysis of all such inclusion particles changes biodiesel/oil properties and adversely affect the engine performance. The oxidation process result in some byproduct formation leads to deposition formation in a storage container, fuel supply system, fuel filters. The initial accumulation of hydroperoxides which later on polymerize to form unsolvable residues that prone to plugging filters, fouling injectors, and degrading engine performance. In addition, it increases the viscosity of the biodiesel. Severe oxidation results in two phases separation that affect fuel pump and fuel injector operation. Oxidation of biodiesel is an inherent process however, using antioxidants one can reduce the rate of oxidation[5-7].

The exposure to surrounding air, forms free radicals due to the oxidation, which start chain reactions. Such chain reactions can be eliminated by removing these free radicals with adding an antioxidant into biodiesel/oil. The antioxidant content help to remove free radical and terminate degradation or damage of biodiesel/oil properties [1-2].

Deterioration of fat categorised into four types,

- **Hydrolysis** – is the transformation where triacylglycerols convert to free fatty acids and byproduct glycerol.
- **Rancidity** where during the process of polyunsaturated fatty acids oxidized and form objectionable volatile components.
- **Reversion** in this vegetable oils and fish oils when oxidized lead to degrade the odour and test.
- **Polymerization** where cross linking of two carbon atoms of unsaturated fats are described.

Stability of Triacylglycerides and Alkyl Esters

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The Olefinic unsaturation of free fatty acid (FFA) chain lead to degradation of methyl ester derived from fats/oils. The animal fats and vegetable oils are transesterified to alkyl esters, without any change in acid chain. Consequently, the degradation of alkyl esters will be the same as of the fatty oils. Oxidative and thermal instability are categorized based on the chemical reaction of fatty acid chain [2].

Structural arrangement of fat/vegetable oils and derived biodiesel

The naturally occurring animal fats or vegetable oils contain multiple Olefinic unsaturation. Fig. 1. shows the structural arrangement of unsaturation for linolenic acid.

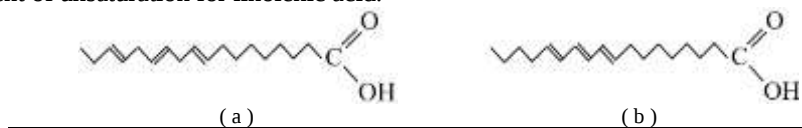


Fig 1: Structure of unsaturation; a) Methylene-interrupted, b) Conjugated

Olefinic unsaturation shows thermal stability caused by delocalization of the pi-electrons. However, this required high activation energy, which does not occur at normal temperatures.

Primary Oxidation

The peroxidation of fatty oil during oxidation occurs in three steps. Fig. 2 illustrate reaction steps, wherein, initiation step remove hydrogen from a carbon atom and form a carbon-based free radical. The step of propagation, peroxy radical abstract another hydrogen form another carbon radical and a hydroperoxide (ROOH). The step of termination, wherein propagation ends when mutually free radicals reacts.

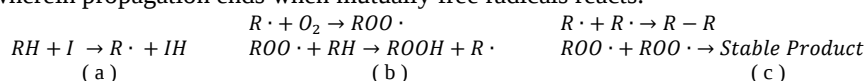


Fig 2: Reactions Steps; a) Initiation, b) Propagation, c) Termination

The concentration of ROOH towards the end of induction period increases rapidly. This indicates the commencement of the oxidation. The peroxidation chain abstracted hydrogen bond to allylic carbons as compared to that of non-allylic carbons in the olefinic unsaturation. The oils contains more polyunsaturatin shows more tendency to get oxidized [1-2].

Secondary Oxidation

The formation of fatty oil hydroperoxides lead to decompose and form aldehydes such as hexanal, haptens, and propanal. The viscosity of the oil / biodiesel increased on account of decomposition of hydroperoxides and formation of oxidative polymerization with higher molecular weights. In vegetable oil, which shows oxygen content within inherently reported the fatty acid by C-O-C linkage and C-C linkage. The decomposition of ROOH under an inert atmosphere results in C-C linkages in polymers.

Vinyl polymerization, inclusion of a carbon-based free radical to an olefinic carbon and form a C-C bond in addition with other free radicals [1-3].

Other Factors Oxidation

The ability of fatty oils to get oxidized also depends on the inclusion of metals contents like iron, copper, nickel, brass, etc. Inclusion of Copper has reported reduction in the Oxidation Stability Index more than iron and nickel. Iron proven as hydroperoxide decomposer, and it is more distinct at 40°C. Total Acid Number with inclusion of iron is observed more compared to that of copper. The presence of FFA significantly affect stability of oils against oxidation. The transesterification process, the use of alcohol plays a vital role in the oxidation stability of the resulting monoesters. Oxidation stability increased with methyl to butyl alcohol group size [3-4].

The storage of ethyl ester in open exposure to air and at about 50°C, shows rapid rise in Total Acid Number and ROOH. Vegetable oils inherently shows presence of anantioxidants tocopherols. On distillation or during converting to methyl esters the content of tocopherols reduced or eliminated completely. Which lead to the increasing level of oxidizing [14]. Photo-oxidation due to direct exposure of light lead to attack of oxygen on the olefinic carbons of fatty oils.

Thermal Polymerization

The temperature, about 250°C and above causes transformation of polyunsaturated olefin to isomerize conjugated structure which is the more stable in nature.. Such conjugated diene group can react with a single olefin group to form a cyclohexene ring [2, 12].

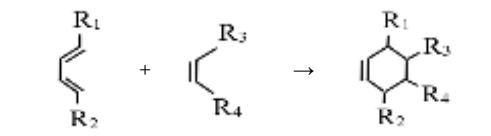


Fig 3: Diels Alder reaction

Thermal polymerization reaction between a dimer side chain with a conjugated diene leads to the formation of trimmers. However, the impact of thermal polymerization will not affect storage stability.

Antioxidants

The inclusion of an antioxidants help to break chain structure or decomposed hydroperoxide. Mostly the phenolic compounds act as chain breakers in oils and esters. Tocopherols are naturally occurred in vegetable fatty oils. These tocopherols observed in four isomers (Fig. 4, a-d) viz. α , β , γ , and δ . Among all these, the γ and δ isomers are the most effective antioxidants. Also it is reported that, γ -tocopherol is better than α -tocopherol in regards of oxidation stability [2-3, 12-13].

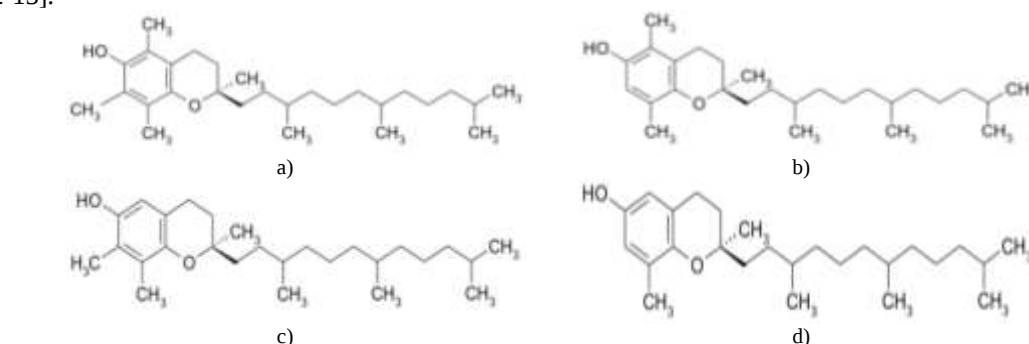


Fig 4: Structure, a) α -tocopherol, b) β -tocopherol, c) γ -tocopherol, d) δ -tocopherol

Mechanism of Antioxidant

The presence of a free radical plays an important role in oxidation. This involves reaction of active oxygen species in the presence of light, temperature, enzymes, metals, and micro-organisms.

The free radicals forms in unsaturated fatty acid by the abstraction of allylic hydrogen. This promote oxidation by extracting hydrogen from fatty acid and trigger propagation.

The singlet oxygen initiate the triplet oxygen lipid oxidation, as singlet oxygen react directly with double bonds and there is no formation of free radicals. The oxidation rate is higher in singlet oxygen oxidation reaction. It produces such compounds which are not observed in triplet oxygen oxidation. This is mostly influence by the communication with light, sensitizers, and oxygen. Phenolic substances which is an antioxidant terminate free radicals at the initiation stage [1-2].

Hindered phenolics like Butylated hydroxyanisole (BHA), Butylated hydroxytoluene (BHT), Tertiary butylhydroquinone (TBHQ), and tocopherols, as well as polyhydroxy phenolics like propyl-gallate, are primary antioxidants, which delay or inhibit the initiation step by reacting with a lipid-free radical or by inhibiting the propagation step by reacting with the peroxy or alkoxy radicals [1-2].

P. Mohamed Shameer et al. [2017], has investigated the effect of antioxidants, pyrogallol (PY), propyl gallate (PG), tert-butyl-hydroxy-quinone (TBHQ), butylated hydroxyl-toluene (BHT), butylated hydroxyl-anisole (BHA) for the biodiesel produced from Calophyllum inophyllum. The researcher found that for biodiesel blend B20, oxidation stability using antioxidants tert-butyl-hydroxy-quinone increase from 48.74 hrs to 65.53 hrs. [5, 7].

Table 1: Effectiveness rank of Antioxidants [5, 7-9]

Biodiesel	Antioxidant	
	Concentration	Effective Rank
Soybean Oil	8000 ppm	TBHQ > BHT > BHA
	3000 ppm	TBHQ > PY > PG > BHA > BHT

	1000 ppm	TBHQ > PG > BHA > BHT
Cottonseed Oil	1000 ppm	TBHQ > PY > PG
Palm Oil	---	TBHQ > BHA > BHT
Animal Fat	3000 ppm	TBHQ > PG > PY > BHA
Calophyllum Oil	1000 ppm	TBHQ > PG > PY > BHT > BHA

Biodiesel has inherent properties of oxidizes with time when exposed to air. This is depended on many factors which play role in the oxidation process like the structure of fatty acid, presence of certain metals which accelerate the degradation of biodiesel. In addition heat or elevated temperature, inclusion of irrelevant materials, peroxides, exposure to light or pressure play an important role in oxidation. Also type of antioxidants used and the surface area of biodiesel exposed to air [5, 8]. The oxidation biodiesel degrade the properties and form gums which tends to clog the filters and injection systems. In addition, the presence of hydro-peroxides along with carboxylic acids having corrosion effect on the fuel system. Also, oxidation reduces the lubricity of the biodiesel results in high wear rate of respective sliding parts [8, 11]. The changes in the composition of biodiesel which includes alteration of acid value, density, viscosity, peroxide value, flash point etc. The oxidation of biodiesel are responsible for changing the chemical properties which then influence in degrading engine performance and emissions. Oxidized biodiesel reported 1.2% higher BSFC as compared to un-oxidized biodiesel also shows higher NO_x emission and lower heating value of fuel [5-6, 8, 10].

Senthil Ramalingam et al. [2016], has conducted a study on oxidation stability and exhaust gas emissions using biodiesel B20 blend of Calophyllum oil with the various proportions of leaf extract additives. The experiment was conducted with the Neat B20 blend and B20 blends with 0.5%, 1% and 1.5% of additive extracted from Calophyllum leaf. Findings of the study reveals that, the NO_x and smoke emission level are reduced for the additive B20 blends as compared to neat B20 blend and with more additive % there is more reduction observed. CO and HC emissions found to be increased with an increase in additive % but observed lesser in compared to neat diesel fuel. The researcher suggested to leaf extract of Calophyllum as additive was may use as a renewable replacement for synthetic fuel additives [9-10].

Conclusion

- Presence and structural configuration of Olefinic unsaturation decided the chemical reactivity of oxidative and thermal instability of fatty oils.
- Polysaturated fatty acid chains is the key factor influence vegetable oil stability.
- It is concluded that primary oxidation products decomposed and chemically interact to form secondary oxidation products.
- The study shows, the most effective antioxidant is tertiary butylhydroquinone. And this hold good in the range of concentration 200 ppm to 1000 ppm.
- Many of the plant-based antioxidants and the plant essential oils can be considered as the natural alternative to chemical antioxidants.

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Chapter-41

Evolutionary Computing Assisted Control Environment for Six-Step Mode High-Speed and Accelerating Induction Motor Drives

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Abstract

Exponential rise in induction motor applications, especially for high-speed drives and accelerating environment has alarmed academia-industries to develop more robust and potential control solutions. Major at-hand induction motor controllers either focus on speed or torque enhancement using different methods including scalar or vector control methods and predictive control strategies. Unfortunately, most of them fail under high-acceleration and high-speed environment, especially under field-weakening conditions. In aforesaid conditions, the classical motor drives undergo torque-ripple, harmonics and unstable speed affecting overall dynamic performance of the induction motor. As a potential solution, in this paper a highly robust evolutionary computing assisted closed loop control environment. Our research contributes a novel six-step mode induction motor drive system which exploits maximum possible DC-link voltage to enable torque extension under field weakening condition. Additionally, as current control function, our proposed inner loop encompasses Flower Pollination Algorithm (FPA) assisted Proportional-Integral and Derivative (FPA-PID) controller that in conjunction with a band-stop filter and SVPWM enables six-step inverter for transient controllability with assured ripple and harmonic suppression. The key contribution of the proposed model can be summarized as a maximum DC voltage utilization concept for torque extension under field weakening region, and FPA-PID with filter assisted inner closed current loop control for torque-ripple and harmonics suppression. Thus, the overall proposed system enables a six-step mode drive control environment, which can assure transient controllability within 0.4 second of time to accommodate high- speed and accelerating induction motors. MATLAB based simulation outputs have affirmed robustness of the proposed system in terms of swift (transient) controllability, significant ripple and harmonics suppression and uniform torque.

Keywords- High-speed Induction Motor Control, Six-step mode drive, Ripple-Harmonics Suppression, DC-link voltage utilization, field- weakening control.

Introduction

Electrical engineering has irreplaceable significance towards human activities. Among major innovations and contributions, Induction Motors (IMs) have played vital role in high-speed applications serving gigantic purposes like motor control, power-trains, train-traction systems, elevators, precision mechanical equipments etc. Its robustness, cost, reliability and ability to retain speed extension even under field-weakening condition [1][2] enables IM to be used across human socio- economic and scientific activities [1]. However, non-linear operating environment and field-wakening conditions force classical drive solutions to undergo harmonics, torque ripple and speed error etc, which eventually limits its dynamic performance and precision controllability [2][3]. Though, in recent years numerous efforts were done towards IM design enhancement by means of design parameter optimization, predictive control strategies etc; very less efforts address the problem of speed- error, field weakening region, high-order harmonics and torque ripple over non-linear conditions. Undeniably, IM has gained widespread attention towards high-sped and accelerating applications with varying operational rotations or orientations. Such complex environments limit dynamic performance [2]. Undeniably, speed-flux error sensitive prediction based methods have performed satisfactory towards dynamic performance assurance [3]; however doesn't address micro-but practical problems like ripple, harmonics and reduced torque under field weakening. To retain high drive acceleration and load capacity, especially in the field weakening region (FWR), it is always expected to retain the maximum possible torque with confined stator current and DC link-voltage. It can be achieved by means of better and enhanced DC-link voltage utilization. In major IM drives, stator current used to be fixed, and therefore DC-link voltage enhancement

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