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MISSION

To communicate value-based research innovation and disseminate knowledge in advanced technology to teaching fraternity, research scholars, thence contributing to publish quality research aiming the societal needs.

VISION

To explore sustainable solutions for latest technological problems through the diffusion of research outcome which aid in understanding advanced technology, research in the fields of engineering & sciences.

I am highly delighted to know that the Raj Kumar Goel Institute of Technology is releasing an e-International journal "NAVACHAR". The "NAVACHAR" is a great platform of Innovation, Research, Ideation of latest technology and valuable resource for knowledge sharing and collaboration for mutual benefits among the academic community.

This also provides help among multiple discipline researchers and for better connectivity and visibility. This online publication platform is open to all readers.

Also I would like to send warm regards to all readers with a wish for their health, happiness and great success.

Prof. (Dr.) D.S. Chauhan
Former VC – Dr. APJ-AKTU, Lucknow
 Uttarakhand Technical University, Dehradun
 GLA University, Mathura

It is our immense pleasure to publish the NAVACHAR Journal. The journal covers all areas of science, engineering, pharmacy and management and other related fields.

Navachar goals is to explore sustainable solutions for latest technological problems through the diffusion of research outcome which aid in understanding advanced technology, research in the fields of engineering & sciences.

It is working in the direction to communicate value-based research innovation and disseminate knowledge in advanced technology to teaching fraternity, research scholars, thence contributing to publish quality research aiming the societal needs.

I would like to sincerely thank the entire Editorial Board for their excellent contributions to this first issue. Your cooperation has made NAVACHAR possible.

Shri Dinesh Kumar Goel
Chairman RKG Group of Institutions

I take the platform to congratulate the team of NAVACHAR – International E Journal of RKGIT. Hope this E Journal will provide new Horizons in the growing field of Research and provide the platform for global research and teaching collaboration for better development of all. Navachar will help in bridging the gap between communication, innovation and the beauty of research creativity.

I extend my heartiest wishes for this endeavour to the Editorial Board of NAVACHAR.

Akshat Goel
Vice-Chairman RKG Group of Institutions

Congratulations Team NAVACHAR for the efforts! AtmaNirbhar Bharat- The concept well thought of by our Honorable Prime Minister will prosper when we have more researches done in the multidisciplines. The E Journal is going to forge linkages between industry, teaching fraternity and research community to come forward with innovations and creations that will contribute in the development of the nation. I wish NAVACHAR will come out with quality researches that will also develop the existing knowledge base of the teaching fraternity and enhance the learning of the students.

My best wishes for better days to come. Deep appreciation to the Editorial team for their accomplishment.

Dr Laxman Prasad
Advisor RKG Group of Institutions

It is a matter of pride and honor to know that the research team of our institution Raj Kumar Goel Institute of Technology is releasing the E-International Journal "NAVACHAR".

In the era of digitization and skilling India, the "NAVACHAR' is a platform for the Scientist, Researchers, Innovators, Students to exhibit their research and innovative technical papers.

I congratulate the complete team of "NAVACHAR" for releasing this. I wish a long long life for the E-journal "NAVACHAR"

Regards
Dr. D. R. SOMASHEKAR
Director
RKGIT

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Infant Brain MRI Segmentation: Challenges and Applications

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Abstract

Magnetic resonance imaging has been a significant instrument for both the systematic review of pediatric cognitive function as well as neurological conditions. Although numerous efforts in recent years have been taken to focus on the adult brain disease analysis using MR Image segmentation, but very less work is done on newborn brain MRI While several attempts were made in subsequent decades that concentrate upon this study of adulthood brain disorder utilizing MR Image, still very little research has been reported on infant brain MR images. The first two years in a child's life are a period of accelerated brain growth, and is believed to play a significant function in brain development. Throughout that time, the neuron expands rapidly in shape approaching 80–90% to adolescent volumes around two years of age. The amount of information available about this time span is presently very small. As a consequence, infant magnetic Resonance segmentation is a vast field of study. Its latest possible concerns as well as challenges of automated stratification for infant brain MR images are being reviewed in this article.

Keywords—Infant, Premature, MRI, Brain, Segmentation, Neuroimaging.

1. Introduction

Mostly during past few years, MR brain exams of newborns transferred to emergency department were improved significantly. Throughout the research assessment of pediatric cognitive development including impaired cognitive conditions, magnetic resonance (MRI) seems to be an effective instrument [1–3]. Accurate segmentation of infant MR Image is noticeably quite complex than adolescent MRI Brain stratification.

The key cause for this is the genetics and quick subsequent growth. Neo-natal neuro mRIs effectively restrict the medical and biological features of white matter myelination including wide liquid volumes, that is far less than adolescent brain mRIs, than those of the Contrast-Noise Ratio (CNR) [5-6].

The pediatric brain seems to be of a narrower scale form, including brain regions folding shape relative to adult brains. In comparison, time limitations as well as subject movement may impose major inhomogeneities, imagery including interference. The growth of the pediatric brains triggers a variety of unique segmentation problems. There are quite complicated distinctions among white as well as cortical gray matter including even cortical grey as well as CSF. The real concern deeply rooted in or stratified in portion concentration pixel values just at boundary among certain structures as well as regions influenced with these consequences in. The CSF / cGM limit was its key trouble region. Figure 1 represents intensity overlapping if brain tissues [7-8].
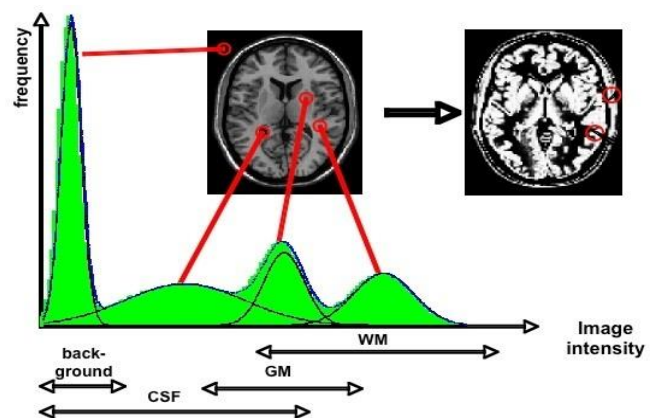

Fig.1. Overlapping intensities of brain tissues

CSF might have the poorest brightness either on T1-w image, whereas GM seems to have the maximum

concentration Thus, the limited pixel intensities were frequently incorrectly labelled with WM. Such issues have been compounded in pediatric diagnostic practice, that are otherwise normally designed for lower inter - slice precision clinical observations, including major consequences of partial volume.
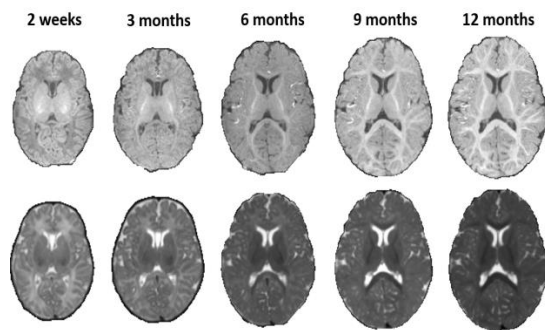

Fig. 2. Head Size increase along with time

The above is motivated by increased MRI usage to research neighbors with in invention of novel segmentation techniques with that stage of life. A routine, long-term as well as reproductive segmentation of infant brain is labor intensive. In contrast to automated stratification of adolescent MRI, these process is infinitely quite difficult linked to premature growth.

Autonomous structural magnetic resonance segmentation (MR) pictures are classified into three major tissue types: white (WM), gray (GM), cerebra-spinal fluid (CSF)[5]. This article therefore reflects mostly on present situation including different challenges problems and difficulties problems in the characterization of pediatric brain tissues. Below figure 2 depicts the brain growth from head size point of view [9-10].

2. Formatting Present Scenario

A sick baby is at a greater risk of brain damage and impaired cognitive development. A big concern for parents who deal with these infants is giving certain parents a very comprehensive diagnosis and treatment for their wellbeing. Investigators of preterm infant neuroscience face a significant challenging problem in designing experimental therapies to treat or prevent brain injury in infants. Innovative neuroimaging developments are increasingly being made, helping us to have a deeper awareness about how preterm infants brain damage evolve as well as how individuals affect future brain growth.

Magnetic resonance imaging (MRI) is proving to be more and more effective of the current neuroimaging methods for such people, despite becoming quite costly and difficult to access than head ultrasounds. Since it has reasonable temporal accuracy and hence precise anatomical information that cannot be provided from any other imaging technique, brain MRI is increasingly becoming the current standard of treatment for determining the exact type and magnitude of brain injury in ill newborns. Further research have demonstrate the significance of MRI as an accurate indicator of potential pathogenesis and the capacity to offer additional perspectives through growth and development, disruption and repairing mechanisms that develop in an infant brains at around the same time.[11-13]

In the affluent and emerging economies, birth defects are a significant health issue and children afflicted are overwhelmingly taken from impoverished people. Child injury in emerging nations persists a significant source of mortality including premature births amongst these young as well as the marginalized, pregnant adolescents and under-educated mothers being more prevalent. A recent international study showed that uneven income inequality and lack of government participation were higher than any other health result with reduced infant weight and child mortality. Such issues hit a global crisis extent as well as certain type of comprehensive prenatal care is needed in nations whose contemporary services are provided for around 7 percent of all babies. The challenges of perinatal illness must be tackled immediately on both political and social as well as health grounds [14-16].

3. Neuroimaging of Infants

Neuroimaging plays an emerging role in congenital diseases. Studies could be contradictory and imperfect, and certain diseases can be practiced in various ways. This research offers an analysis of the present importance of MRI in selected congenital diseases with in brain. Existing practise can shift more research and innovation therapeutic targets including modern MRI procedures [17-20]. MRI is a proven tool to assess the presence and nature of injury in children and young adults.
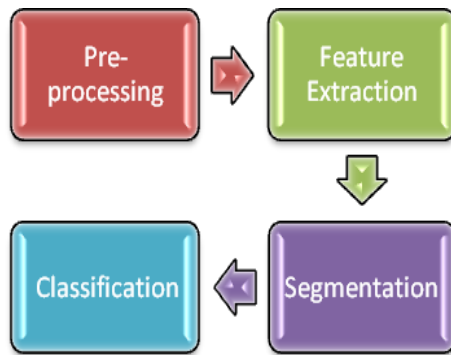
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JULY-DEC 2021

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Volume 1 / Issue 1

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Fig. 3. Steps of Neonatal Tissues Classification

4. Challenges and Objectives

Challenges to be corrected in different stages of image processing are discussed below along with that what kind of actions researchers have to take are also discussed [21-23].

A. Pre-processing-

1. Intensity Inhomogeneity Correction

2. Motion Artifects reduction

3. Noise Reduction

4. Contrast Enhancement

5. Partial Volume Correction

We have to overcome above challenges in pre-processing stage. For this we have to develop strategies with detail mathematical modeling, de-noising algorithm.

B. Segmentation & Classification-

1. We have to develop fully automatic & robust segmentation algorithm, which can be able to detect all tissues present in Brain MRI of newborn & premature infants.

2. Special focus must be given for myelinated white matter detection as it is very important from neurodevelopment point of view. So we have to design special strategy for accurate segmentation of myelinated white matter.

5. Performance Parameters

Following validation parameters are to be considered for performance investigations of different

segmentation and classification algorithm developed for infant brain MRI [24-27].

1. Dice coefficient
2. 95th percentile of Hausdorff Distance
3. Mean Surface Distance
4. Absolute Volume Difference
5. Computational Speed
6. Sensitivity
7. Specificity
8. Accuracy
9. Cohen's Kappa Coefficient
10. Jaccard Index

6. Conclusion

The method of marking perhaps every pixel value throughout a biomedical data set to show which tissues class as well as structure of the brain is known to medical image analysis. The labeling created as part for such method can be used for a multitude of functionalities in clinical imaging as well as computer vision. The imaging method and anatomy that is being visualized are two important features of diagnostic imaging making segmentation challenging.

A medical procedure in community hospital resource perspective is linked to recognizing structural features in MRI Brain images for better development in clinical use in addition to foster automated or semi - supervised learning MRI Brain methodological approaches in healthcare. In newborns brain MR images, as there are several are several possible complications as well as challenges. The appropriate way to increase efficiency must initiate; boost precision as well as analysis time whereas eliminating human encounters. The existence of spatiotemporal seamlessly changing intensity in as well as superimposing MR levels of intensity in various tissue groups complicate automatic and accurate segmentation.

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NAVACHAR

JULY-DEC 2021

RKG Publishing Ltd.

NAVACHAR....*route leading to innovation*

Volume 1 / Issue 1

http://www.navachar.rkgit.edu.in

Hand Written Digit Recognition Using Deep Learning

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Abstract-

Machine Learning and deep learning plays very crucial role in AI and computer technology. IT arises due to enhancement in technology in Machine Learning, Deep Learning and Computer Vision calculations. With collaborative use of deep learning techniques with human efforts recognition became much easier. This paper presents handwritten digit recognition from famous MNIST dataset to test whether data is perused accurately or not. Classifiers like KNN,SVM,RFC are compared in this paper on basis of accuracy, time etc. The confusion matrix drawn is used to summarize different algorithm in terms of accuracy**.**

Keywords-KNN, RFC, SVM, CONFUSION MATRIX

I.INTRODUCTION

Manually written digit recognition is the value of a PC framework that perceives the transcribed data sources like numerical, documentation and from various sources like messages, papers, image, texts, reports etc. This has been a subject of research from quite a while. Various research area include territories postal compose translation from envelopes, divider encumbers preparing, signature verification and so on.A great deal of characterization strategies using deep Learning and machine learning is created and utilized for this approach like K-NN, SVM, RFC and so forth.

However these techniques in spite of thefact that having the precision of 96.9% are sufficient for this present reality applications.As an illustrationif a letter is written and send to address as name "Aram" and the structure diagnose it wrongly with the name "Tanya" so letter is not gone to "Aram" but it is delivered to "Tanya".Later on there is quite possibility that it may reach to correct address but if the mail could be very urgent, a person has to pay loss due to delay so that means, the accuracy in these types of applications is very important. Also the shortcoming of this approach is that these techniques cannotbe completely relied on as they do not give the exact precision due to lack of complete information regarding task.

II. LITERATURE REVIEW

Machine and deep learningare the latest instrument for processing of an image, object identification, manually written numeric and character acknowledgement. Many AI instruments are created like scikit learn, scipy-picture and so on from this. These apparatuses make it strong and, in

this way progressively precise the neutral networks can practically emulate the human cerebrum and is a key fixing in picture preparing are like CNN along back propagation for image processing etc. Quite a research is done on the method of hand recognition using deep learning method, artificial intelligence. Researchers have analysed and also some have established various techniques to find more accurate method of supervised learning to recognise the different articles be it in form of number, text or an image.

III.MINIST DATASET

The subset of MINST has 70,000 database of handwritten digit recognition. Further it is divided into around or more than50,000 training samples and some testing sample around 10,000.The dataset size is 28*28 values representing images with label.

```
[offset] [type]        [value]          [description]
0000     32 bit integer 0x00000801(2049) magic number (MSB first)
0004     32 bit integer 60000            number of items
0008     unsigned byte  ??               label
0009     unsigned byte  ??               label
........
xxxx     unsigned byte  ??               label

The labels values are 0 to 9.
```

Fig -1: Training set label

```
[offset] [type]        [value]          [description]
0000     32 bit integer 0x00000803(2051) magic number
0004     32 bit integer 60000            number of images
0008     32 bit integer 28               number of rows
0012     32 bit integer 28               number of columns
0016     unsigned byte  ??               pixel
0017     unsigned byte  ??               pixel
........
xxxx     unsigned byte  ??               pixel
```

Fig-2: Training set image

```
[offset] [type]        [value]          [description]
0000     32 bit integer 0x00000801(2049) magic number (MSB first)
0004     32 bit integer 10000            number of items
0008     unsigned byte  ??               label
0009     unsigned byte  ??               label
........
xxxx     unsigned byte  ??               label
```

Fig-3: Test set label

```
[offset] [type]        [value]          [description]
0000     32 bit integer 0x00000803(2051) magic number
0004     32 bit integer 10000            number of images
0008     32 bit integer 28               number of rows
0012     32 bit integer 28               number of columns
0016     unsigned byte  ??               pixel
0017     unsigned byte  ??               pixel
........
xxxx     unsigned byte  ??               pixel
```

Fig-4: Test set image

Byte Value	Data Type
0x8	Unsigned Byte
0x9	Signed Byte

0x0B	Short(2Bytes)
0x0C	Int(4Bytes)
0x0D	Float(4Bytes)
0x0D	Double(8Bytes)

Table-1: MNIST Dataset

IV. READINGTHE MNIST DATASET

The capacity that peruses the picture information restores the picture data in the way of representation

the marks. This information is utilized in each program for building forecasts. To test the data is perused accurately, we print for a couple of the names. The yield is as per the following:-

Fig 6: Picture information

3 main algorithms are used for analysis and comparison:-

1.KNN

2.SVM

3.RFC

V.CLASSIFICATION USING RANDOM FOREST CLASSIFIER(RFC)

RFC creates a group of decision tress from randomly selected subset of coaching set the subsequent formula used is below:-

$$\hat{f} = 1/b \ ^b\sum_{b=1} \hat{f}_b \ (x')$$

THE MINST DATA AND THE RFC WORKS IS CLASSIFIED IN BELOW STEPS:

1.Fill MNIST information.

2.Separate the information and mark it as testing and training of images and names.

3. To prepare the classifier utilize cross approved for partitioning the training information into training and testing data.

4. RFC algorithms is been utilized by train classifiers. Information is given and then marked it as

contribution to train classifier. RFC stand in need of quantity of trees in timberland, numeral of highlights to search for finest split, most extreme profundity of trees and so forth even as the information.

5. The number perceived utilizing RFC is coordinated with the given training labels to acquire the exactness of testing classifiers.

6. For testing data the trained classifier needs to be utilized again.

7. The tested picture information are utilized to see names of numbers, they are contrasted with the provided test marks and to anaylse the precision of calculation.

8. The Confusion Matrix is mark that furnishes level of precision which every numbers has been perceived.

```
Classification report for classifier RandomForestClassifier(max_depth=2
random_state=0):
             precision    recall  f1-score   support

          0       0.87      0.99      0.93        88
          1       0.90      0.42      0.57        91
          2       0.66      0.80      0.72        86
          3       0.55      0.82      0.66        91
          4       0.91      0.82      0.86        92
          5       0.74      0.62      0.67        91
          6       0.87      0.99      0.93        91
          7       0.70      1.00      0.82        89
          8       0.92      0.26      0.41        88
          9       0.74      0.82      0.77        92

   accuracy                           0.75       899
  macro avg       0.79      0.75      0.73       899
weighted avg      0.79      0.75      0.73       899
```

Fig-7: Classification report for RFC

VI. Classification based on K-Nearest Neighbors (KNN) algorithm [2]

KNN is one of the most popular algorithm of machine learning. It is used most used classification algorithm. It is a supervised learning algorithm. It compares training data with a test data and gives a value K which is nearest to the training data point.

For every test data point it calculates Euclidean and Hamming distance between test data and training data. Based on the distance it sorts them in ascending order. Form sorted array it chooses K rows and assigns a class to the test point based on most frequent class of these rows.

KNN stores all available cases and classifies new cases based on some similarities. A new object is classified by a large number of neighbor classes. The new object is assigned to the most common class of its nearest neighbors.

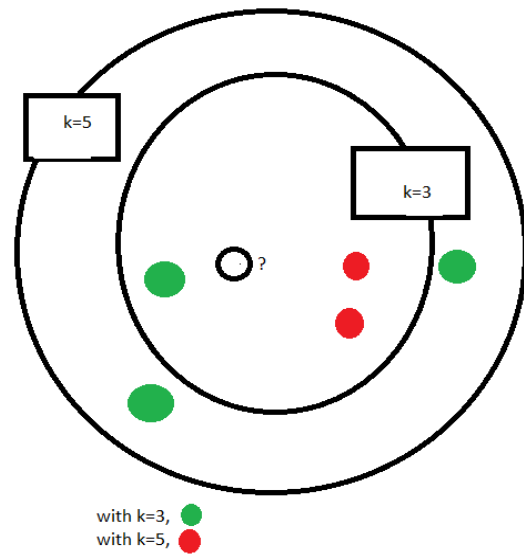Figure 6 gives clear understanding of KNN approach

Fig 8: Working of KNN

In the above figure, the empty circle is the test data and identificationof case to be assigned is required to be done.

When k = 3, red circle will be assigned as number of red circles 2 is greater than number of green circles 1.

Whereas when k = 5, green circle will be assigned as number of green circles 3 is greater than number of red circles 2.

For the calculation of Euclidian distance following formula is used:

$$d(p, q) = d(q, p) = \sqrt{(q_1 - p_1)^2 - (q_3 - p_3)^2 .... (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}$$

Classification of MNIST data with KNN:

```
             precision    recall  f1-score   support

          0       1.00      0.99      0.99        88
          1       0.99      0.97      0.98        91
          2       0.99      0.99      0.99        86
          3       0.98      0.87      0.92        91
          4       0.99      0.96      0.97        92
          5       0.95      0.97      0.96        91
          6       0.99      0.99      0.99        91
          7       0.96      0.99      0.97        89
          8       0.94      1.00      0.97        88
          9       0.93      0.98      0.95        92

  micro avg       0.97      0.97      0.97       899
  macro avg       0.97      0.97      0.97       899
weighted avg      0.97      0.97      0.97       899
```

Fig 9: Classification report for KNN

From the previous image, it is evident that the accuracy of trained classifier is 97.88% and for handwritten digit prediction, the accuracy comes down to 96.67%. This means that this algorithm lacks the accuracy by 3.33%. The error of 3.33% is large when written documents are considered.

VII. SVM(SUPPORT-VECTOR-MACHINE)

SVM means support vector machine are the supervised learning model associated with the algorithm learning and analyse data. SVM is the very popular machine which offers the solutions to any problem. There are 2 types of SVM Linear and Non-Linear. A SVM model is a representation where in points in space are mapped so that the image gets separated in categories which finally gets divided as wide as possible.
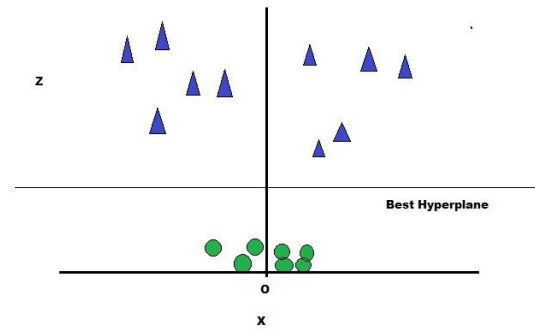
VIII. WORKING OF SVM

Consider a dataset which has two tags and two features x1 and x2, so a classifier is required that can classify the pair(x1,x2) of coordinates. In 2d space it is easy to separate the two classes by a straight line, but there can be multiple lines that can separates the classes. SVM also helps to find out the proper decision that bounded these boundaries and are said to be as hyper plane. These algorithms helps us to find the nearest points are called support vectors. The distance between the vectors and hyper plane is called margin. The distance between the maximum margin is called optimal hyper plane.
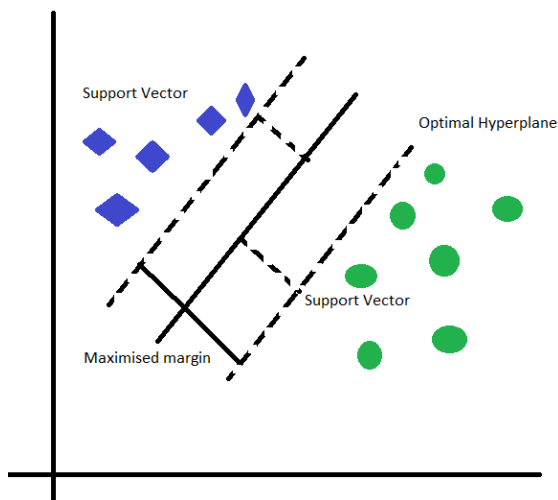

Fig10(a): Working of SVM

Fig 10(b): Working of SVM

IX. CONFUSION MATRIX

Every output shows a confusion matrix. It explains a particular table that permits a visual image of the performer of an associate degree by giving the accuracy such as every input and output categories. In this, the starting category is shown because the columns represent an information and the rows represent the instances in actual categories. Here the matrix C is specified as C[X, Y] which represented the quantity which familiar to be in cluster X however same expected to be in cluster Y, therefore in binary classification, the counting of all negative is C_[0,0], false negatives is C_[1,0],true positives is C_[1,1] and false positives is C_[0,1] With this process, the confusion matrix within the pictures is higher than it shows the actual accuracy of this digit which is found as a victim that algorithm rules as severally

Fig 11: Confusion matrix representing the accuracy of each digit

Digit	0	1	2	3	4	5	6	7	8	9
0	973	1	1	0	0	1	2	1	0	0
1	0	1133	2	0	0	0	0	0	0	0
2	10	9	996	2	0	0	0	13	2	0
3	0	2	4	976	1	13	1	7	3	3
4	1	6	0	0	950	0	4	2	0	19
5	6	1	0	11	2	859	5	1	3	4
6	5	3	0	0	3	3	944	0	0	0
7	0	21	5	0	1	0	0	991	0	10
8	8	2	4	16	8	11	3	4	914	4
9	4	5	2	8	9	2	1	8	2	968

The CNN for handwritten Digit Recognition has three different phases.

PHASE 1:
This section is toinput all the information. Then MNIST information is declared as 784-D array of pixels, thus first it has a tendency to convert it into

grayscale pictures exploitation which are of 28 X 28 pixels.

PHASE 2:
This section, led an outline models to simply make a convolution neutral network. In this, the tendency to use the consecutive category from Keras source to make a network from this network, 3 different layers are selected "CONV=>RELU=>POOL".

a) FIRST CONVOLUTION LAYER:

The primary layer tend to take twenty convolution channels that comes as a window of size 5x5 over all the
Photos of 28x28 network size and analysis is done at with a most sensible cost of the pixel.

b) RELU FUNCTION:

The convolution could be the techniques utilized in reverse proliferation. Hence, the RELU works the enactment whenever a convolution layer decline the odds of evaporating the inclination and furthermore stays away from poverty because of this it loses the important information and even got the information on a ton and furthermore ton inside the pixels.

c) POOLING FUNCTION:

This layer gets all the information from the RELU function to perform and also provides the major steps to the 3D TENSOR.In brief it pools all the layers whichis obtained from previous layer and that forms a replacement image matrix which is of smaller size. These pictures square measure once more input into the second set of layer i.e. "CON=>RELU=>POOL" and method will carry on until we have a tendency to identify the digit which is of small set.

PHASE 3:

This layer has to attach every previous layer to succeeding layers. It consists of five hundred neurons and finally, a SoftMax category can be used which gives us a list of possibilities for every ten class labels. The category label is biggest likelihood and is selected because the last output is shown from network.
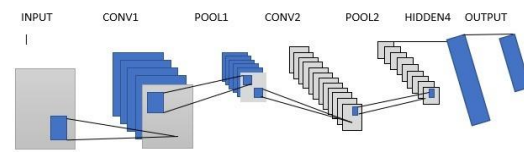

Fig 12: CNN Layers for Handwritten Digit Recognition

Fig 13: CNN Prediction Results on MNIST

The output produced is applied to form a confusion matrix for the model. Throughout the output there is a tendency for unit area and is able to add a larger variety of layers. However adding a lot of layers would possibly have an effect on the system. Since different layers are used, so it's referred as Deep Learning system.

X. RESULT AND ANALYSIS

The correct form for industrial application are digits, character and various others. Due to this it lead to a great interest of speed recognition. The accuracy and comparison of different techniques which are used is shown by the image given below. Accordingly it is analysed that the CNN have three hidden layers it provides the quantity of an accuracy of 98.72% although this accuracy is not exactly similar to others which are achieved. But mistreatment of Google's Tensor Flows the accuracy of 99.70% is achieved.

	RFC	KNN	SVM	CNN
Trainer classifier accuracy	99.71%	97.88%	99.91%	99.98%
Accuracy on test images	96.89%	96.67%	97.91%	98.72%

Table 2: Percent Accuracy of Each Classification Technique

Model	Test Error Rate
RFC	3.11%
KNN	3.33%
SVM	2.09%
CNN	1.28%

Table 3: Classifier Error Rate Comparison

By now the image should be acknowledgement by the speed and the recognition system. Given below

are the times of coaching and testing. The timings from CPU of coaching and testing are noted below. Using of GPU will increase the coaching and testing time.
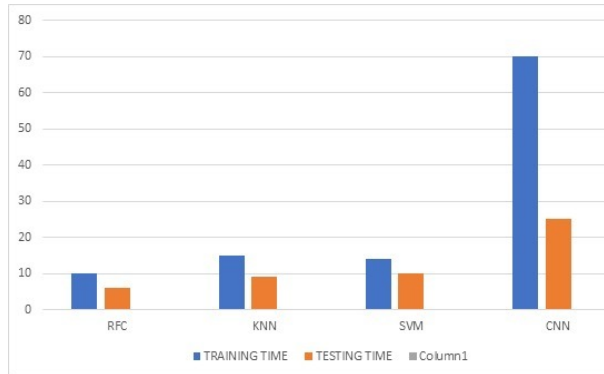

Fig 14: Classifier Training & Testing Comparison

Model	Training Time	Testing Time
RFC	10 min	6 min
KNN	15 min	9 min
SVM	14 min	10 min
CNN	70 min	20 min

Table 4: Training & Testing Time Comparison

XI. CONCLUSION

An overview of Deep learning has been done through this paper, a number of the most used Machine Learning algorithms i.e. RFC, KNN and SVM are trained and tested on the identical data to draw a comparison and this is why there is a need of deep learning method which is used in many critical applications like Handwritten Digit Recognition.
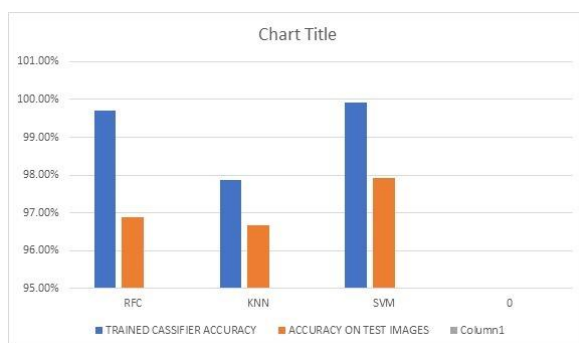

Fig15: Accuracy Comparison

Throughout the paper, it's shown that by use of Deep Learning technique a very high amount of accuracy can be achieved. Using the Convolution Neutral Networkit's given that accuracy is of 98.72%. Sopresenting the implementation of CNN using Tensor Flow it gives us a good result of accuracy which is about 99.70%. Every tool has its own complexity and accuracy. So now the process and the code complexity is normal.

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NAVACHAR

JULY-DEC 2021

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Volume 1 / Issue 1

http://www.navachar.rkgit.edu.in

Simulation Study of Fuel Cell in MATLAB/Simulink Environment

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NAVACHAR

JULY-DEC 2021

RKG Publishing Ltd.

NAVACHAR…. *route leading to innovation*

Volume 1 / Issue 1

http://www.navachar.rkgit.edu.in

Abstract

The entire earth is now in a poor state as a result of several issues relating to non-renewable energy sources. To meet the problems posed by the energy contingency Fuel Cells have the potential to meet more of the world's fuel requirements while still meeting sustainability standards. A fuel cell is an energy source that converts chemical energy into electrical energy by using hydrogen and oxygen as fuel. Fuel cell technology has a wide range of uses, including FCEVs, military applications, main or secondary sources of energy in many remote locations, and powering a variety of electronic devices. This paper uses matlab to model and simulate a Proton Exchange Membrane Fuel Cell (PEMFC)-based power generation device.

Keywords: Fuel cell, Proton Exchange Membrane Fuel Cell, Simulation
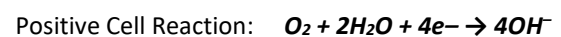
1. Introduction

A fuel cell is an electrochemical cell that uses an electrochemical reaction to produce electrical energy from fuel. To keep the reactions that produce energy going, these cells need a constant supply of fuel and an oxidising agent (usually oxygen). As a result, before the supply of fuel and oxygen is cut off, these cells will continue to produce electricity. Fuel cells are safe, silent, and effective electrochemical devices [1]. In 1839, an English chemist named William Grove patented the fuel cell. Grove also invented the wet-cell battery. They have no moving parts and can run indefinitely as long as fuel is available. In any case, fuel cell systems have cut emissions significantly as compared to traditional technologies [2]. There had been no significant investigation or review since then, when NASA started intensive fuel cell testing in the 1960s. NASA conducted a thorough investigation and research in order to improve the Alkaline Fuel Cell (AFC) for a space programme (Gemini, Apollo, and space lap) [3]. According to B. Laoun [4], there are two ways to estimating fuel cell (FC) efficiency using the polarisation curve. The first is focused on physical modelling of heat and mass transfer, while the second is based on a semi-empirical equation that is used as a black box in FC. There are various types of fuel cells depending on

the electrolyte used. Phosphoric Acid Fuel Fuel Cell (PAFC), Solid Oxide Fuel Cell (SOFC), Molten Carbonate Fuel Cell (MCFC), and Proton Exchange Membrane Fuel

Criteria	PEMFC	PAFC	MCFC	SOFC
Operating Temperature	$< 220\ ^0F$	$\sim 400\ ^0F$	$\sim 1250\ ^0F$	$\sim 1800\ ^0F$
Operating Pressure	1-5 atm	1-8 atm	1-3 atm	1-13 atm
Fuel	H_2	H_2	H_2, CO_2, CH_4	H_2, CO_2, CH_4, NH_3
Construction Material	Graphite Carbon	Graphite Carbon	Ni and Stainless	Ceramics and Metals
Cooling Medium	Water	Boiling water	Excess air	Excess air

Cell (PEMFC) are only a few of them   Table 1 compares the different types of fuel cells, their characteristics and functions.

Table I. Comparisons of Fuel Cell

2. Working of Fuel Cell

A cathode, anode, and electrolyte make up a fuel cell, which is identical to an electrochemical cell. The electrolyte in these cells allows protons to travel around. A fuel cell can use the reaction between hydrogen and oxygen to produce electricity. This kind of cell was used in the Apollo space programme and served two purposes: as a source of fuel and as a source of drinking water.

This fuel cell worked by transferring hydrogen and oxygen via carbon electrodes into a condensed sodium hydroxide solution. The following is a formula for the cell reaction:

Positive Cell Reaction: $O_2 + 2H_2O + 4e- \rightarrow 4OH^-$

Negative Cell Reaction: $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$

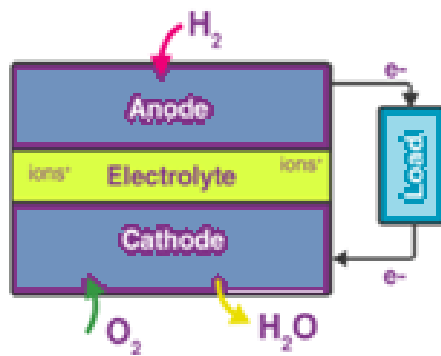Final Net Reaction: $2H_2 + O_2 \rightarrow 2H_2O$

Figure 1. Block Diagram of fuel cell

This electrochemical reaction, however, has a slow reaction rate. A catalyst, such as platinum or palladium, is used to solve this issue. Before being inserted into the electrodes, the catalyst is finely separated to maximise the usable surface area. Figure 1 dipicts the fuel cell's block diagram.

The above-mentioned fuel cell has 70 percent efficiency in the production of electricity, while thermal power plants have a 40 percent efficiency. Since the generation of electric current in a thermal power plant requires the conversion of water into steam and the use of that steam to spin a turbine, there is a significant difference in performance. Fuel cells, on the other hand, have a medium for converting chemical energy into electrical energy directly.

3. Classification of Fuel Cells

Fuel cells come in a variety of shapes and sizes, despite the fact that they all function in the same way. In this part, we'll look at a few of these fuel cell forms.

3.1 Polymer Electrolyte Membrane (PEM) Fuel Cell

a. Proton exchange membrane fuel cells (or PEMFCs) are another name for these cells.
b. These cells work in a temperature range of 50 to 100 degrees Celsius.
c. Polymer membrane, bipolar panels and a catalyst, electrodes, and make up a standard PEM fuel cell.
d. Despite their environmentally sustainable uses in shipping, PEMFCs can also be used for portable and stationary power generation.
e. A polymer with the ability to conduct protons is used as the electrolyte in PEMFCs.

3.2 Phosphoric Acid Fuel Cell

a. As a means to channel the H+, these fuel cells utilse phosphoric acid as an electrolyte.

b. The temperatures work for these cells are between 150 and 200 degrees Celsius.
c. The non-conductive aspect of phosphoric acid forces electrons to pass to the cathode from an external circuit.
d. The electrolyte's acidic composition causes the elements in these cells to corrode or oxidise with time.

3.3 Solid Acid Fuel Cell

a. The electrolyte in these fuel cells is a solid acid substance, and the solid acids' molecular configurations are ordered at low temperatures.
b. A phase transition will happen at higher temperatures, resulting in a significant rise in conductivity.
c. $CsHSO_4$ (cesium hydrogen sulphate) and CsH_2PO_4 (cesium dihydrogen phosphate respectively) are two examples of strong acids.

3.4 Alkaline Fuel Cell

a. In the Apollo space programme, this was the fuel cell that was used as the main source of energy.
b. An aqueous alkaline solution is used to saturate a porous matrix in such cells, and then separates the electrodes.
c. These cells' working temperatures are very mild approximately 90 degreeC.
d. These cells are extremely efficient. They still provide heat and water in addition to electricity.

3.5 Solid Oxide Fuel Cell

a. a. Solid oxide or ceramic electrolytes are used in such cells like yttria-stabilized zirconia.
b. b. These fuel cells are both highly effective (approrx 85 percent) and inexpensive.
c. c. These cells' working temperatures are very high. standard operating temperatures range of 800 and 1000 degreeC.
d. Because of their high working temperatures, such cells are limited to stationary uses.

3.6 Molten Carbonate Fuel Cell

a. Lithium potassium carbonate salt is used as an electrolyte in these cells.
b. At high temperatures, this salt becomes molten, allowing carbonate ions to float about.
c. These fuel cells, like SOFCs, have a reasonably high working temperature of 650o.
d. Because of the high working temperature and the presence of the carbonate electrolyte, the anode and cathode of this cell are prone to corrosion.

4. Features of PEMFC

1. A proton exchange membrane fuel cell is a basic structure that consists of a cathode, an anode, and a conducting medium in between. This works in the same way as traditional fuel cells, except the electrolyte and electrodes are all porous membranes.
2. In fuel cells, a polymer may be used as an ion exchange membrane electrolyte. Those membranes are excellent protons conductors. Pure water is generated as a byproduct in this form of fuel cell.
3. The electrolyte, which is a proton-conducting medium polymer, is the main distinction between PEM fuel cells and other fuel cells. The conducting polymer's mobile ion is H+. The electrolyte is an anion-conducting polymer with catalysed porous electrodes on both ends.

5. Identified Problem Statement

Rising fuel costs, as well as the pace at which fossil fuels are being depleted, as well as the emissions issues that come with them, have provided a worldwide push toward renewable energy sources. Nonrenewable energy supplies have been commonly considered for general use due to the success and reliability of combustion engines. However, rising fuel costs, as well as a strong emphasis on reducing global and local emissions, have prompted a greater focus on the production of alternative energy sources for use in other area.

6. Applications of PEMFC

Membrane is the central component of the PEM fuel cell, as previously said. The polymeric membrane serves three functions in PEM fuel cells: charge carrier for protons, separator of reactant gases, and electrical insulator to prevent electrons from flowing through the membrane (because of electron repelling and negative charge from SO_3). DuPont produced a perfluorosulfonic acid dubbed "Nafion" in the 1970s that increased the membrane's basic conductivity by two orders of magnitude while also extending its lifespan by four orders of magnitude. This quickly became the industry standard for PEMFC and remains so to this day. Advanced perfluorosulfonic acid membranes alongwith shorter side chains and a higher ratio value of SO_3H to CF_2 groups were developed by Dow Chemical Company and Asahi Chemical Company [5]. This Nafion membrane is made up of a copolymer of fluoro 3,6-dioxo 4,6-octane sulfonic acid and polytetrafluoroethylene (PTFE). The Teflon backbone gives the membrane its hydrophobic appearance, and hydrophilic sulfonic acid groups (HSO3) have been chemically grafted into the backbone. These ionic groups also allowed the polymer to absorb a considerable volume of water, resulting in hydration of the polymer. Thus, the degree of hydration and thickness of a suitable proton exchange membrane influence its consistency, which plays an important role in determining its suitability for use in a fuel cell [12].

7. Modelling of Fuel Cell

7.1 Static Model: The static model represents the fuel cell's static nature, i.e. the amount of the voltage of static fuel cell as a function of the FC's static current.

$$V_{st} = E_{cell} - b.log(a.I_{st}) - r.I_{st} - m.exp(n.I_{st})$$

Here E_{cell} = voltage fuel cell at a current of zero amp i.e. perfect output cell potent

V_{st} = static voltage in fuel cell

I_{st} = static current in fuel cell

a, b, r, m, and n are empirical parameters of fuel cell.

7.2 Dynamic Model: The control algorithm for fuel cell systems is designed and tested using a dynamic model. This is focused on the fact that minor current variations cause small changes in cell voltage. The model is only true for minor variations in current around a given steady point, since it is built on the premise that the fuel cell is a linear device for small current signal variations.

Dynamic model is used to design and test fuel cell systems control algorithm. This is based on the fact that slight current variations cause small changes in the cell voltage. The model is only valid for minor variations in current around a set stable point; this is based on the assumption that the fuel cell is a linear system for small current signal variations. Based on ideal voltage at normal temperature and pressure, activation polarisation as a function of current density, temperature and oxygen concentration, and ohmic polarisation as a function of temperature and current density, an expression for the actual voltage is created.

Mathematical formula for the voltage electrochemical model of a fuel cell is given by [13]

$$V_{fc} = E_{cell} - V_{act} - V_{con} - V_{ohmic}$$

V_{fc} =True value of output cell potential

E_{cell} =Cell's thermodynamic perfect output potential

V_{act} = activation overvoltage,

V_{ohmic} is ohmic overvoltage and V_{con} = concentration overvoltage.

8. Matlab Simulation and Result

Figure 3 represnts the Matlab/simulink model of fullcell while figure 4 shows simulation block diagram of power generation based on a Fuel cell. Figure 5 shows the output voltage of single cell and figure 6 shows the results of output load voltage vs load current of fuel cell.
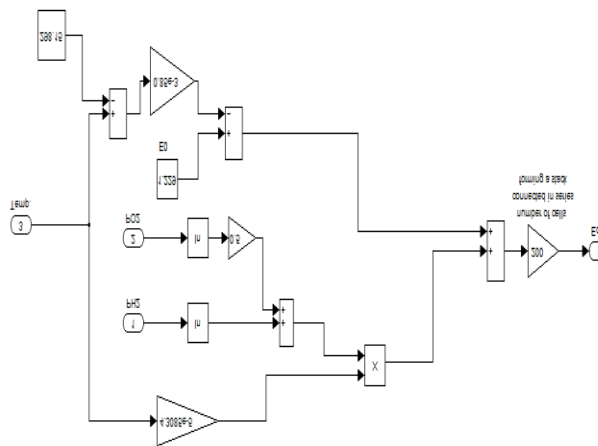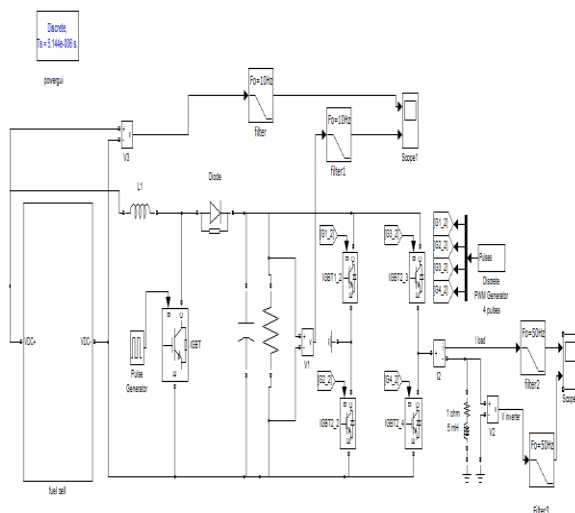

Figure 3. Matlab/simulink model

Figure 4. Simulation block diagram of power generation based on a Fuel cell
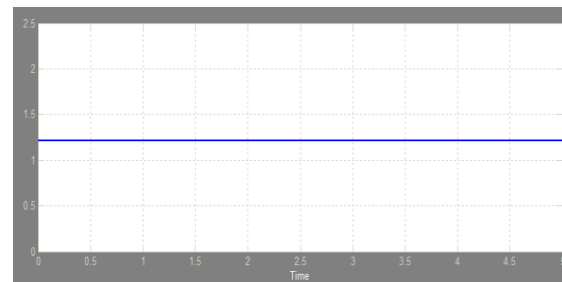
Figure 5. Output voltage of single cell
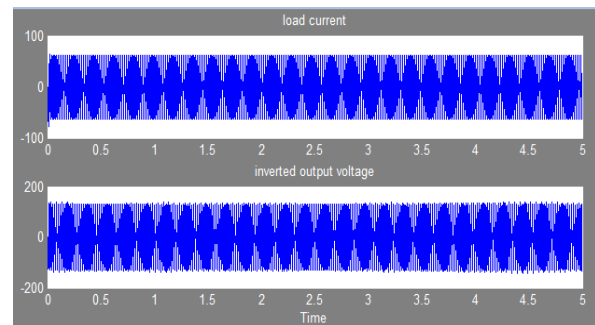
Figure 6. Output load voltage vs load current of fuel cell

9. Conclusion

The results of modelling and simulation are presented in this paper. The proton exchange membrane fuel cell is one of the most promising fuel cells for mobility and small stationary applications. Less pollution, higher efficiency, and low maintenance are all advantages of fuel cells. MATLAB simulink was used to analyse the static and dynamic features of the PEMFC.

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Matthew Arnold: An Iconoclast, the Great Gainsayer of English Criticism

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Abstract

Criticism has power to make the best ideas prevail. Criticism can be of enormous service to future creative writers merely by performing its true business. "It is the business of criticism to know the best that is known and thought in the world, and in its turn by making this known, to create a current of true and fresh ideas." Criticism in this way tends to produce ultimately an intellectual and spiritual atmosphere by which creative genius can be happily inspired. It creates stir and growth which makes creation possible. That is why great creative epochs are preceded by great epochs of criticism. In order to be successful, criticism must be essentially the exercise of curiosity, in the best sense of that word. Curiosity is a fine quality, it is the desire to know the best. should not be taken as a term of disparagement.This paper focuses on the point that excellence of poetry lies both in matter and substance and its manner or style.

1. Introduction

Matthew Arnold (1822-1888), the greatest name among the Victorian critics, is a poet turned critic. He started his literary Career by writing poetry. It was only at the age of thirty-one, in 1833, that he published his first piece of criticism as a Preface to the Poems, 1853, and then for the rest of his life, for full thirty-five years, he hardly wrote anything but criticism.

His criticism easily falls into three phases or periods. To the first phase from 1853 to 1866, belong

1. The Preface to the Poems, 1853. The work is regarded as his critical manifesto. In it appear for the first time many of the views and principles which were elaborated in later works.

2. On Translating Homer, 1816. The work contains his views on the grand style.

3. Essay in Criticism, First Series, 1866. 4. On the Study of Celtic Literature, 1866.

The second phase of his carrer was a phase in which he was involved for more than a decade in the political, educational, social and religious controversies to the day. The chief works of this phase are :

1. Culture and Anarchy, 1869. 2. St. Paul and Protestantism, 1870. 3. Literature and Dogma, 1873. 4. God and the Bible, 1875.

Culture and Anarchy is the most valuable and significant work of this period. In this work he asserts the value of poetry as an anti-dote to the cultural anarchy of his age.

2. Discussion

In the third phase, Arnold retired from contemporary controversies to devote himsell once again to his literary studies. During this phase, he published a series of articles on a number of English poets which he later on collected and published as, Essays in Criticism, Second Series, 1888.

3. Socio-Ethical Criticism

Arnold's criticism may conveniently be divided into literary criticism, and Socio ethical criticism. The criticism of the second phase is socio ethical, and Culture and Anarchy is the most represen. tative work or this period. It would seem that a socio-ethical work is out of place in a work on literary criticism. But it has been included here for a brief consideration, for it throws valuable light on Arnold's view of poetry, as a means of culture. Literary Criticism

Further, his literary criticism may in itself be divided into two categories—-(a) theoretical criticism, or literary aesthetics, and (b) practical criticism. His theoretical criticism is contained largely in his Preface to the Poems, 1853, The Function of Criticism at the Present Time, standing at the head of the first series of his Essays in Criticism, and The Study of Poetry with which opens the second series of his Essays in Criticism. His practical criticism largely consists of his estimates of English and continental poets contained in both the series of Essays in Criticism.

4. Formative Influence

A number of influences operated upon Arnold from the earliest days and determined his views and attitudes. First, there was the influence of his father, Thomas Arnold, the famous headmaster of Rughby whose death the poet mourns in his elegy Rughby Chapel. Dr. Arnold was a man of powerful, dominating personality. A strict disciplinarian, he was a propagandist for the classical methods in education. Himself a great scholar, he inculcated in his son also a love of the great classics of antiquity. Arnold owes much of his knowledge of the Greek and Latin masters to his great father. His classicism was inspired by him, and it is to this fact that George Watson attributes the quality in his writing, the incongruity between the head and the heart. He was an incurable romantic whose romanticism was pushed out by the classicism imposed upon him by a more powerful and dominating personality. This accounts for the wide gap that exists between his practice of poetry, and his theory of it.

The second powerful influence on him was that of the age in which he lived and created. Disgusted with the degenerate and decandent romanticism of the day, its mammon worship and false money values, its cultural anarchy, its historicism, its Provincialism, its Philistinism, he is critical of it and seeks to bring about a cultural revolution. In his literary criticism he represents the classical resistance to romanticism. "In his criticism we are face to face once again with authority." He is an inconoclast, "the great gainsayer of English criticism, the most inconsistent and professional of non-conformnists." Defiance of his age' is a powerful under current running through his works ; his criticism cannot be understood without an understanding of the age.

Thirdly, Matthew Arnold was a widely read man, both in the ancients and the moderns, and quite naturally, his reading influenced him profoundly. Love for the classics of ancient Greece and Rome was inculcated in him by his father, and he drank deep at the fountain of Homer, Sophocles, Virgil, Aristotle and many others. During the College days, he was regarded as the best scholar of the classics. It is Greek thought which governs his theory of poetry and theory of criticism. His classicism is seen in his respect for authority, in his passion for order and 'sanity', and his condemnation of romantic individuality and subjectivity. His stress on 'action' is akin to Aristotle's stress on 'Fable' or plot. His mission was to Hellenise English thought, English literature, and literary

criticism. His admiration for the Greek Masters, his passion for Greek literature and criticism, and Greek way of life is reflected in all his works.

Fourthly, to the influence of the Ancient was added that of the moderns. The German poet Geothe, and French critics Tuine and Sainte-Beuve were the most powerful influences. He shared Geothe's admiration for the Greeks, as well as his Catholicism and largeness of spirit. Arnold rates Geothe very high and pays him glowing tributes in his Memorial Verses. It is the critical method of Sainte-Beuve which appealed to him, and which, in the main, he made his own. Arnold regarded him as the first of living critics'; it was from him that he learnt the value of "disinterestedness" for a critic, as well as the theory that in order to understand a work, one must first understand its author. He "idolised Sainte-Beuve" and his influence was profound and far-reaching. His biographical-critical method is Arnold's own. Similarly, from Taine he learnt that a work of art is the product of certain social forces which must be understood for a right understanding and appreciation of the work itself. Taine's emphasis on the race, the milieu, and the moment, is echoed by Arnold when he writes : "For a literary masterpiece, two powers must concur, the power of the man, and the power of the moment, and the man is not enough without the moment." Another continental influence on him was that of the German Jewish poet Heinrich Heine ; from him Arnold borrows the word Philistine to indicate the vulgarisation of the English middle class. Indeed, Arnold's criticism is largely continental in orientation. There are few Arnoldean terms that do not have a continental origin ; there are few ideas of his which may not be traced to some French-or German--source.

As Wimsatt and Brooks point out his continental orientation is nowhere seen to better advantage than in his plea for an English Academy on the model of the French Academy.

Fifthly, despite all these manifold sources of influence and inspiration, Arnold might not have turned a critic, if a favourable opportunity in the form of his appointment in 1857 to the Professorship of Poetry at the Oxford University had not presented itself. As George Saintsbury points out, this provided him with the vantage ground of authority from which he could speak with the certainty of being heard. The appointment gave him prestige and authority, it gave him financial stability, and the leisure to devote himself exclusively to literary activity. Though he also contributed to the various journals and periodicals, the bulk of his literary criticism consists of lectures which he delivered at Oxford in the course of years.

As the both the Series of Essays in Criticism are his most important works of literary criticism, we would now examine them in some detail

We give below brief synopsis of The Study of Poetry which develops his theory of poetry, and of The Function of Criticism in the Present Age as being the most coherent expositions of his literary theories.

5. The Study of Poetry : Brief Synopsis

The future of poetry is immense All our creeds and religions have been shaken. They have grown too much tied down to facts. But for poetry the idea is everything. The strongest part of our religion today is its unconscious poetry.

We should study poetry more and more, for poetry is capable of higher uses. We have to turn to poetry to interpret life for us, to console us, and to sustain us. Without poetry science will remain incomplete and much that passes with us for religion and philosophy will be replaced by poetry.

Poetry can fulfil its high function, only if we keep a high standard for it. No Charlatanism should be allowed to enter poetry. Arnold then defines poetry as, "a criticism of life under the conditions fixed for

that criticism by the laws of poetic truth and poetic beauty." Arnold does not explain what these laws are.

Only the best poetry is capable of performing its task. Only that poetry which is the criticism of life can be our support and stay, when other helps fail us. So it is important that readers should learn to choose the best. In choosing the best, the readers are warned against two kinds of fallacious judgments ; the historic estimate and the personal estimate. The readers should learn to value it as it really is in itself. The historic estimate is likely to affect our judgment when we are dealing with ancient poets, the personal estimate when we are dealing with our contemporary poets.

Readers should insist on the real estimate, which means a recognition and discovery of the highest qualities which produce the best poetry. It should be a real classic and not a false classic. A true classic is one which belongs to the class of the very best, and such poetry we must "feel and enjoy as deeply as we can."

It is not necessary to lay down what in the abstract constitute the features of a high quality of poetry. It is much better to study concrete examples, to take specimens of poetry of the high, the very highest quality, and to say: the features of the highest poetry are what we find here. Short passages and single lines from Homer, Dante, Shakespeare, Milton, and others may be memorised and applied as a touchstone to test the worth of the poems we want to read. This other poetry must not be required to resemble them; but if the touchstone quotations are used with tact, they will enable the reader to detect the presence or absence of the highest poetic quality

However, in order to satisfy those who insist that some criteria of excellence should be laid down, Arnold points out that excellence of poetry lies both in its matter or substance and in its manner or style. But matter and style must have the accent of, "high beauty, worth and power". But Arnold does not define what this mark or accent is. He says we would ourselves feel it, for it is the mark or accent of all high poetry.

If the matter of a poet has truth and high seriousness, the manner and diction would also acquire the accent of superiority. The two are vitally connected together.

Arnold then undertakes a brief review of English poetry from Chaucer to Burns in order to apply practically the general principles laid down above and so to demonstrate their truth. The substance of Chavc-r's poetry-his view of things and his criticism of life-has largeness, freedom, shrewdness, benignity. He surveys the world from a truly human point of view. But his poetry is wanting in high seriousness. His language, no doubt, causes difficulty, but this difficulty can be easily overcome. Chaucer will be read more and more with the passing of time. But he is not a classic, his poetry lacks the accent of a real classic. This can be easily verified through a comparison of a passage from Chaucer with one from Dante, the first poetic classic of Christendom. This is so because he has truth of substance but not 'high seriousness'.

Shakespeare and Milton are our great poetical classics, but Dryden and 'Pope are not poetical classics. "Dryden was the puissant and glorious founder, and Pope was the splendid high priest of the age of prose and reason, of our excellent and indispensable 18 th century." but their is not the verse of men whose criticism of life has a high seriousness, or even without that high seriousness, has poetic largeness, freedom, insight, benignity. Their application of ideas to life is not poetic application. They are not classics of English poetry; they are classics of English prose.

The most singular and unique poet of the age of Pope and Dryden is Gray. Gray is a poetic Classic, but he is the scantiest of classics. He lived in the company of the great classics of Greece, and he caught their manner, and their view of life. His work is slighter and

less perfect than it would have been, had he lived in a congenial age.

Elsewhere, Arnold tells us that the difference between genuine poetry and the poetry of Dryden, Pope, and other poets of their school, is briefly this : "their poetry is conceived and composed in their writs, genuine poetry is conceived and composed in the soul." Gray's poetry was so composed.

Next, coming to Burns, Arnold points out that his real merit is to be found in his Scotch poems. In his poetry, we do find the application of ideas to life, and also that his application is a powerful one, made by a man of vigorous understanding and master of language. He also has truth of substance. Burns is by far the greater force than Chaucer, though he has less charm. But we do not find in Burns that accent of high seriousness which is born of absolute sincerity, and which characterises the poetry of the great classics. The poetry of Burns has truth of matter and truth of manner, but not the accent of the poetic virtue of the highest masters.

Even in the case of Burns, one is likely to be misguided by the personal estimate. This danger is even greater in the case of Byron, Shelley and Wordsworth. Estimates of their poetry are likely, not only to be personal, but also, "personal with passion". So Arnold does not take them up for consideration.

Having illustrated, practically, his touchstone method, Arnold expresses the view that good literature will never loose its currency. There might be some vulgarisation and cheapening of literary values, as a result of the increase in numbers of the common sort of readers, but the currency of good literature is ensured by, "the instinct of self-preservation in humanity". So strong is Arnold's faith in the value of poetry of the highest kind.

6. **The Function of Criticism at the Present Time**

Criticism is certainly lower in rank to creation. But the creation of great works of art is not always equally possible. The elements with which the creative power works are ideas, but the best and noble ideas may not always be current. That is why creative epochs in literature are so rare. For great creation, "the power of the man and the power of the moment must concur", but the power of the moment' may not be always available.

Even the tremendous natural power of the romantics was partially crippled by the lack in the English society of the nineteenth century, of a vigorous intellectual life such as had 'nourished certain other poets. "This makes Byron so empty of matter, Shelley so incoherent, Wordsworth even, profound as he is, yet so wanting in com. pleteness and variety." This deficiency is one which literary criticism alone can help to remedy.

Criticism must also be disinterested. It must keep aloof from, "the practical view of things". It must refuse to lend itself to ulterior, political, and practical considerations. While the practical man tends to see an object only in so far as it seems likely to aid or impede his designs, the critic must try to view it more detachedly, to see it, "as in itself it really is". In England, criticism is being stiffled by such practical considerations.

It is the function of criticism to keep men from self. satisfac. tion which is retarding and vulgarising. It must lead men to perfection. But in England, criticism is not fulfilling this spiritual function because it has grown too controversial and too practical.

Criticism, thus conceived, is to be directed not only upon works of art but also upon life in general. The habit of dispassionate appraisal fostered by strictly literary criticism can be of the widest social utility.

But a critic who is disinterested and who tries to see the thing as it really is in itself, is very likely to be misunderstood. In England, where "practice is

everything, a free play of the mind is nothing," such misunderstanding is almost inevitable. But the critic must pursue his course with the greatest sincerity, and thus convince even the practical man of his sincerity.

A critic must resist the temptation to indulge in false estimates. Even if a work has some practical utility the critic must not recommend it unless it has genuine worth. He must be perpetually dissatisfied with those works which fall short of a high and perfect ideal. He must beware of Philistinism.

Strictly, literary criticism should be the exercise of disinterested curiosity, the desire to learn and propagate the best. "Judging is often spoken of as the critic's one business, and so in some sense it is : but ihe judgment that, almost insensibly, forms itself in a fair and clear mind, alongwith fresh knowledge, is the valuable one," and thus knowledge, and more knowledge must be the critic's concern. When deliberate judgment is called for, "the great safeguard is never to let oneself become abstract, always to retain an intimate and lively consciousness of the truth of what one is seeing." The moment this consciousness fails, the critic may be sure that there is something wrong.

In his search for, "the best that is known and thought in the world," the English critic will quite naturally need to dwell much on foreign literature. He must know literatures other than his own. What is needed is a criticism which regards Europe, was being, for intellectual and spiritual purposes, one great confederation, bound to a joint action and working for a common result, and whose members have, for their proper outfit, a knowledge of Greek, Roman and Eastern antiquity, and of one another." Such a European ideal was Goethe's ; in our own age it has been that of T.S. Eliot.

As for the standards, by which the best that has been known and thought is recognised, they are embodied in the works of Homer, Dante, Shakespeare, Goethe and others. In England, however, their existence is commonly ignored and from this results the contemporary vulgarisation and cheapening of literary values, Philistinism, as Arnold calls it.

Criticism may not be creative, but criticism of such a high order approaches very near to creation. Criticism which is sincere, simple and ardent gives a joyful sense of creative activity.

7. Conclusion

To conclude with the words of Saintsbury : "His services, therefore, to English criticism, whether as a "preceptist" or as an actual craftsman, cannot possibly be over-estimated. In the first respect he was, if not the absolute reformer, the leader in reform, the solvenly and disorganised condition into which Romantic criticism had fallen. In the second, the things which he had not, as well as those which he had, combined to give him a place among the very first." He had not the sublime and ever new-inspired inconsistency of Dryden. He had not the robustness of Johnson, the supreme critical "reason" of Coleridge ; scarcely the exquisite, if fitful, appreciation of Lamb, or the full-blooded and passionate appreciation of Hazlitt. But he had an exacter knowledge than Dryden's ; the fineness of his judgment shows finer beside Johnson's bluntness ; he could not wool-gather like Coleridge ; his range was far wider than Lamb's; his scholarship and his delicacy alike were superior to those of Hazlitt,

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Classification and Segmentation Model for Steel Defect Detection

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Abstract

Machine learning achieved impressive recognition rate in image classification task. In order to exploit those capabilities of machine learning algorithms, this paper represents classification and segmentation of surface defects. Nowadays, Automatic defect recognition is one of the research key areas in steel production. The authors of this article have understood the inadequacies of the previously available detection procedure in noticing slight and complex defect marks and would like to share a new enhanced target finding algorithm in steel shallow defect detection. For classification author has used pre-trained InceptionResNetV2() model by keras. In training the model, the author builds four segmentation models to train four defect classes separately. The results show excellent defect detection with accuracy of 94 percent in comparison of Support Vector Machine model which gave us accuracy of 84 percent only.

1. Introduction

Metals consisting of surface defects are eliminated and rejected at the time of manufacturing to avoid any further error. Pre-detection techniques reduce cost of manufacturing and further damage to the products. One of the most important and required operation on image is to recognize and categorize the various kinds of defects. The final product can be rejected or accepted by the customer based on the correctness of required features. The products are automatically sorted and packed but the final checking is done by hand to assure the correct dimensions and features. Examination by humans is very time consuming, costly and are not error free. These human judgements depend on previous knowledge and experience. It is very important to check the quality of the product before it gets delivered to the customer. Continuous inspection is required for quality enhancement [1]. Plates of steel are crucial resources for the vehicle manufacturing, national security industry, equipment manufacturing, biochemical manufacturing, light industry, etc. Though, because of the difficulties of

raw resources and technology, numerous kinds of imperfections will be formed in the making procedure of steel plates—especially blows, coatings, curling boundaries, holes, scratches, and other imperfections on the surface. Automatic recognition of steel exterior imperfections is very significant for product superiority control in the steel manufacturing. Though, the old-style methods cannot be well useful in the manufacture line, as of its low accurateness and slow execution speed.

In this work, we propose a classification model for defect detection, which can meaningly improve the accurateness and decrease the average execution time of the procedure. The organizational assembly of this research paper is as follows: Section 2 presents the work done on this problem in past. Section 3 comprises the proposed work in detail. Sections 4 shows the experiment setup to prove the accuracy and competence of the algorithm, and compare our outcomes with other approaches. Finally, Section 5 précises the work and draws a conclusion.

2. Literature Review

In the previous periods, investigators have established a variety of procedures [2] to detect defects on steel exteriors. One of the old-style methods is built on statistical evidences and image features. This technique needs investigators to manually plan some image features and conduct statistical study on these features to obtain the detection outcomes. The usually used approaches are Sobel [3], canny [4], hog [5], local binary patterns (LBP) [6], Fourier transform [7], wavelet transform [8], etc.

T. Arthi, M, Karthi and M. Abinesh's [9] worked on Discovery and study of surface defects on alloys using Wavelet transformation. Their practice was calculation of variance, standard deviation, mean, skewness and kurtosis from the developed image. Mayuri Dharma Shinde's [10] work on detection and identification of

defects on Industrial pipe. The methodology they used was Morphological logics, Dilation and Erosion Operations. Y. Ramadevi, T. Sridevi, B. Poornima, B. Kalyani's [11] work on Segmentation and Entity Recognition using Edge Detection Methods. Their methodology was based on EM Algorithm and Genetic Algorithm. Gagen Kishore Nand [12] used a methodology of entropy segmentation for defect detection of steel surfaces.

Image segmentation can be done by numerous edge detection methods like Prewitt, Roberts, LoG, Genetic Algorithm and EM algorithm. Various methodologies like Morphological image processing and statistical classification method, Entropy segmentation, Contrast adjusted Otsu's technique (for imperfection detection in titanium coated aluminum surfaces) have also been used. Each method has its own merits and demerits. It is clearly understood that some methods are speedy but give less accuracy. Whereas, some methods have high accuracy but have complex calculation speed. From time to time, these methods have evolved into a better form to give better accuracy. In general, there is no perfectly proposed methodology to detect defects but the ones with highly accurate results are used.

3. Methodology

This section provides us with our problem statements along with data set and solution approach.

3.1. Problem Statement

Given an image, authors task is to classify the defect and locate the segmentation of the defect. For each image author must segment the defects if it belongs to each of the class.

3.2. Solution Approach

As this problem deals with binary classification, multi-label classification and segmentation, there can be many approaches to solve this problem, the pipeline strategy used is shown in figure1., where firstly author has filtered the defected images and then passed it through multi-label classification where single image can belong to more than one class. We directly take the results and pass it to the four segmentation models separately belonging to (ClassId= [1,2,3,4]).
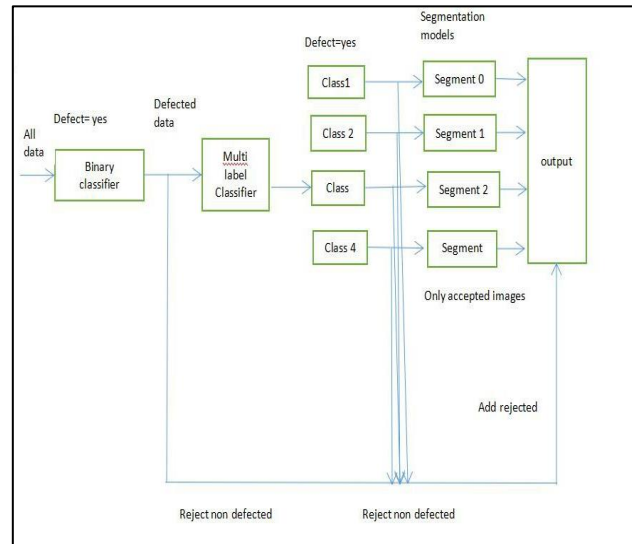

Figure 1. Pipeline Strategy

4. Experiments and Results

4.1. Exploratory Data Analysis

Author used EDA to get to know more about data. Author firstly saw the distribution of defected and non-defected classes. Figure 2. shows that the problem is a well-balanced binary classification problem, after this author finds out the class count distribution as shown in Figure 3., which shows a challenging problem as our multi-label classification is imbalance in data, as class-2 defected images are very less in data while class-3 defects are very high in number, class -3 and class-4 are somewhat balanced.

4.2. Binary Classification

Author Splits the data into train-CV randomly. Author by reading finds that the train and test data are not same so it is advisable to augment the data to solve the problem to a little extent. Then firstly for the binary classification model author has used InceptionResNetV2 model with output layer as -

out=dense (1, activation='sigmoid') (x).

Similarly, for the multi-label classification author has used the same InceptionResNetV2 model with output layer as -

Out=dense (4, activation='sigmoid') (x).

For better results author used test time augmentation for better results. After few epochs we observed that binary model gave accuracy 94 and recall 96 and multi-label model gave accuracy of 96.
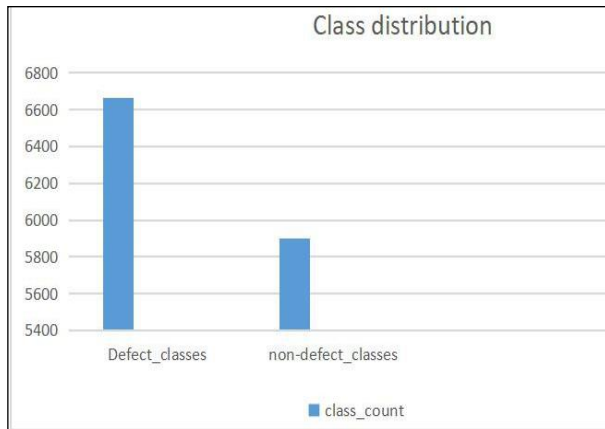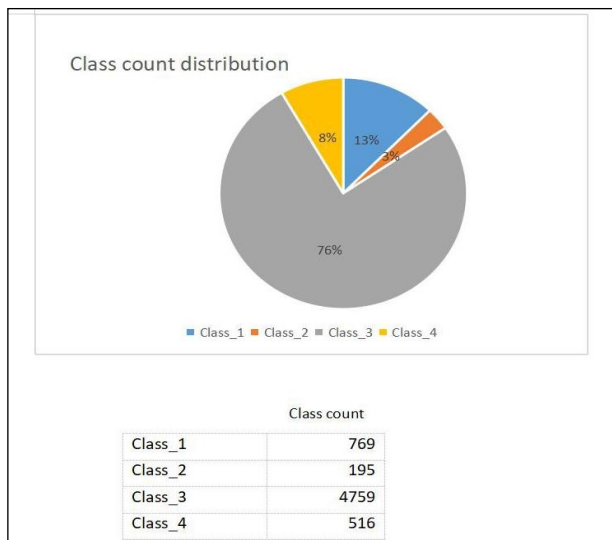
Figure 2. Binary Classification

Class count	
Class_1	769
Class_2	195
Class_3	4759
Class_4	516

Figure 3. Multi-Label Classification

4.3. Segmentation

The classified image became the input of segmentation model and the RLE's provided in train data were converted to masks to get fit in train data. Four different segmentation model was built because one image belongs to multiple classes so it became easy to predict exact location of defect. The model gave us good results with dice coefficient (F1 score) of 92 after 25 to 30 epochs. For predicting the pixel regions of defected images run length encoders were used which was given by Kaggle [13] to reduce file submission size.

5. Conclusion

There were 12568 train images and 1801 test images which we categorized as defective and non- defective after which the defective images were classified into four different classes. At last, our binary model gave us the accuracy of 94 and the multi-label classification model gave the accuracy of 96. The results can be improved either by using better data augmentation techniques or by using a better pipeline strategy. Moreover, our technique is light weighted, which means that it does not comprise too many parameters and does not require too many resources to train. As an effect, it will be easy to be taken into practice.

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Antifungals from Indian plants: A revisit in the covid –era

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Abstract

Although most fungi are harmless to people, some of them are capable of causing infections under specific conditions. Nonetheless, it can evade the immune system via various processes, including recombination, mitosis, and expression of genes involved in oxidative stress responses that prompt chronic fungal diseases. Despite the development of health care facilities, the incidence rate of fungal diseases is still impressively high.

Moreover, The occurrence of multidrug-resistant strains(MDR) of fungus has further necessitated the need to reconsider various classes of new antifungals from natural sources. The approach based on structural modifications of phytochemicals from traditional antifungals is high on expectation for improvement of the pharmacokinetic and pharmacodynamic property of this agent, further could reverse the antibiotic resistance. This review article aims to provide an insight into antifungal agents in natural prospects. In addition, modifications to the chemical structures of traditional antifungals are known to improve antifungal activity and pharmacokinetic parameters. We hereby present a review on plants of Indian origin,along with their diverse phytochemicals viz. Alkaloids, terpenoids, flavoinds, phenolics etc for the development of novel formulations.

Considering these facts, it could be stated that phytochemicals represent a valuable source of bioactive compounds with potent antimicrobial activities.

1. Introduction

It is a well-known fact that humans co-habitat with various microorganism but an inherent innate immune system protects them from disease.

Fungi are microorganisms characterized by a substance in their cell walls called chitin. A few fungi, like many types of mushrooms, are edible. Different kinds of fungi, like aspergillus, can be extremely dangerous and lead to dangerous illnesses[1].

Various types of fungi can cause fungal diseases (see table No-1, Table no-2). Sometimes, fungi that aren't commonly found on or inside your body can colonize it and cause an infection. In different cases, fungi that are normally present on or inside your body can multiply out of control and cause an infection

Table no 1 : Classes Of Fungi [2]

Subclass	Example
Chytridiomycota	Allomyces, Blastoladiella, Coelomomyces, Physoderma, Synchytrium
Zygomycota	Amoebophilus, Mucor, Phycomyces, Rhizopus, Thamnidium
Ascomycota	Ascobolus, Aspergillus, Candida, Crinula, Neurospora, Penicillium, Pneumocystis, Saccharomyces
Basidiomycota	Agaricus, Boletes, Dacrymyces, Lycoperdon, Polyporous, Uromyces, Ustilago
Giomeromycota	Acaulospora, Entrophospora, Glomus
Microsporidia	Amblyopia, Encephalitozoon, Enterocytozoon, Nosema
Cryptomycota	Rozella

Fungal infections can be infectious. They can spread from one individual to another. In some cases, you can also catch illness-causing fungi from infected animals or contaminated soil or surfaces.[2]

A fungal infection is also called mycosis. Although most fungi are harmless to people, some of them are capable of causing infections under specific conditions.

Fungi reproduce by releasing spores that can be gotten up by direct contact or even breathed in. That's why fungal diseases are most likely to influence your skin, nails, or lungs. Fungi can also penetrate your skin, influence your organs, and cause body-wide systemic diseases.

Fungal infections are divided into two types: primary and opportunistic. Opportunistic infections occur mainly in immunocompromised hosts, but primary infections may also occur in hosts with a healthy immune system.

A few kinds of fungi don't regularly cause infections in people but can cause illness in humans with weakened immune systems. These are called opportunistic diseases [1]. Worldwide, among some 2 million fungal species found only 600 species are known to cause diseases. The significant species that are mostly engaged with causing diseases are Cryptococcus, Candida, Trichophyton, and Aspergillus. The nature of fungal infection (see Table no -3) affecting the community can be categorised in the five following types:

1. Invasive fungal infections: cryptococcal meningitis, Candida bloodstream infection, invasive aspergillosis, Pneumocystis pneumonia

2. Chronic lung or deep tissue infection: chronic pulmonary aspergillosis

3. Allergic fungal disease: allergic bronchopulmonary aspergillosis also known as ABPA and severe asthma with fungal sensitization (SAFS).

4. Mucosal infection: oral and oesophagal candidiasis, Candida vaginitis

5. Skin, hair, and nail infection: athlete's Foot tinea capitis and onychomycosis [1] [3].

In this Covid -19 era, Indians as a community have become vulnerable to some rare life-threatening fungal infection. The reason behind this resurgence is the presence of a large no of diabetic and patients with other comorbidities.

Moreover, the widespread use of antifungals as prophylaxis used in case of life-threatening complications in patients with chemotherapy-induced neutropenia and patients on long-term immunosuppressive therapies following hematopoietic stem cell or solid-organ transplantation leads to a breakthrough of invasive mould infections aspergillosis; mucormycosis;[4].

Pandemic initiated use of steroids and antivirals, antimicrobials have further increased the risk for secondary infections with fungus. further risen in the no of immunocompromised patients.

In India, the prevalence of mucormycosis before Covid-era was as high as 0.14 cases per 1000 population, which is about 80 times the prevalence of mucormycosis in developed countries making India more vulnerable [5] [6].

2. Conventional antifungal treatment

The synthetic antifungal agents are categorized structurally mainly under the classes of azole, allylamine, morpholine, hydroxypyrimidine, and polyene. (see Table no-3) [8]

Therapeutic options for aspergillosis are limited, particularly so for oral formulations, with azole drugs forming the backbone of therapy [9]. Many patients that develop resistant infections fail treatment, so resistance is an important factor in the outcome of these cases [10]. Multidrug resistance and side effects of synthetic antifungals: an emerging crisis

Table no-2: Epidemiology of Fungal infections worldwide [7]

Fungal infection	Distribution	Estimated life-threatening infections/year at that location*	Mortality rates (% in infected populations)*
Opportunistic invasive mycoses		More than200,000	30-95
Aspergillosis (Aspergillus	Worldwide	More than400,000	46-75

furnigatus)			
Candidiasis (Candida albicans)	Worldwide	More than1000,000	20-70
Cryptococcus neoformans	Worldwide	More than10,000	30-90
Mucromycosis (Pneumocystis jirovecii)	Worldwide, prevalent in Asia (China , India)	More than400,000	20-80
Endemic dimorphic mycoses			
blastomyces (dermatitidis)	Midwestern and Atlantic United States	aprrox3,000	<2-68
Coccidioidomycosis (Coccidiodes immitis)	Southwestern United States	aprrox25,000	<1-70
Histoplasmosis (Histoplasmosis capsulatum)	Midwestern United States	aprrox25,000	28-50
Paracoccidioidomycosis (paracoccidioides braselliensis)	Brazil	aprrox4,000	5-27
Penicilliosis (Penicillium mameffei)	Southheast Asia	More than8,000	2-75

Table no-3: Treatment by antifungals [11] [12]

S.	Class	Drugs	Diseases

No			
1	Azole antifungals	Clotrimazole, Econazole, Isoconazole, Miconazole, Ketoconazole, Itraconazole	Topical fungal infections, Candidiasis, aspergillus and candida infections, vaginal yeast infections
2	Echinocandins	Caspofungin, Micafungin	Oesophagal Candidiasis, Salvage therapy
4	Polyenes	Amphotericin B, Nystatin	Systemic mycosis, superficial mycosis
5	Phenolic cyclohexane	Griseofulvin	Dermatophytic infections
6	Synthetic pyrimidines	Flucytosine	Cryptococcosis, severe invasive aspergillosis, cryptococcal meningitis treated along with other antifungals
7	Morpholines	Amorolfine	Topical fungal infections
8	Pyridines	Buthiobate, Pyrifenox	Dermatophytic infections, Tinea conditions
9	Phthalimides	Captan	Invasive dermatophytic conditions and candida infections

The rapid increase of severe systemic infections and the spread of resistant microorganisms are indisputable

facts. MDR is an unavoidable natural phenomenon, posing serious worldwide menace combat the MDR (see Table no-4). Pathogens tend to adopt various resistance mechanisms to survive unfavourable conditions. Inadequacy of available antimicrobial drugs compels the continuous development of newer drugs and novel therapies[13]. A combinational approach with new novel drug delivery systems and newer molecules from plants and their modified derivatives acting by various mechanism simultaneously can be an answer.

Moreover, these drugs possess serious side effects (see Table no-5) on the physiology viz. amphotericin B, which acts by binding to the sterol component of a cell membrane, leading to alterations in cell permeability and cell death, or fluconazole which is a highly selective inhibitor of fungal cytochrome P450 dependent enzyme lanosterol 14-a-demethylase for fungistatic effect, and thus having numerous side effects.[17]

Table no-4: List of drug-resistant fungi based on disease in the current scenario[13]

Disease	Genus/species of resistant Fungi	drug name	references
Candidiasis	Candida sp.	Fluconazole and echinocandins	[14]
Cryptococcosis	Cryptococcus sp.	Fluconazole	[15]
Aspergillosis	Aspergillus sp.	Azoles	[10]
Onychomycosis	Scopulariopsis sp.	Amphotericin B, flucytosine, and azoles	[16]
mucormycosis	Rhizopus sp. or Mucor sp, Apophysomyces sp	Posaconazole	[4]

Table No-5: Side Effects Of Antifungal Drugs [12]

S. No	Side effects	Drugs
1	Non-melanoma skin cancer prolonged therapy	Voriconazole
2	Fever, Chills	Isavuconazole, Ketoconazole, Voriconazole, Flucytosine, Anidulafungin, Caspofungin
3	Rash	Flucytosine, Fluconazole, Ketoconazole, Clotrimazole, Voriconazole
4	Nausea, vomiting	Isavuconazole, Itraconazole, Flucytosine, Fluconazole, Ketoconazole, Clotrimazole, Voriconazole
5	Abdominal pain	Flucytosine, Ketoconazole, Isavuconazole, Voriconazole
6	Anaemia	Amphotericin B, Caspofungin, Flucytosine
7	Leukopenia, Thrombocytopenia	Flucytosine, Fluconazole
8	Decreased renal function	Amphotericin B, Caspofungin, Voriconazole
9	Headache	Flucytosine, Fluconazole, Ketoconazole, Isavuconazole, Voriconazole, Caspofungin

10	Dark urine, clay-coloured stools, jaundice	Anidulafungin C, Micafungin

3. Indian Plants of interest with antifungal activity

Previous ethnopharmacological studies reveal the importance of medicinal plants in health and community care. They provide a vast resource for physiologically active bioactive compounds like polysaccharides, phenolic, tannins, flavonoids,

terpenoids like steroids, saponins, alkaloids etc. [12]. This high chemical diversity of natural products make them successful candidates by affecting the evolutionary pressure to create biologically active molecules. Starting with the discovery of penicillin, Some antifungals, including polyenes and echinocandins, derive directly from natural sources. Nowadays, 80% of all available clinically used antibiotics are directly (or indirectly) derived from NPs [17].

The indian system of medicines are having a backup of more than 2000 plant spices. This review aims to give insight on researches based on plant drugs. the Table no-6 enlist the plants with reported antifungal activities.

Table No 6: Medicinal Plants of India active against different human pathogenic fungi[45]

S. No.	Botanical name	Family	Parts used	Chemical classes	Activity	Ref
1	Xanthium strumarium L	Asteraceae	Leaves	Essential oil	Active Against Candida Aspergillus	[30] [31]
2	Moringa pterygosperma,	Moringaceae	Leaves	Extracts (Aqueous, metahnol)	Candidiasis	[30] [32]
3	Micromeria nervosa	Labiatae	Oil Arieal parts	Phenolic compounds Extracts (Aqueous and Ethanolic)	Antifungal	[30] [33]
4	Inula viscose	Compositae	Oil Arieal parts Flowers	Phenolic compounds Extracts (Aqueous and Ethanolic)	Active Against Colletotrichum Ascomycetes Basidiomycetes	[30] [33]
5	Piper aduncum	Piperaceae	Inflorescence Leave	Terpenes, Essential oil	Dermatomycosis	[30] [34]
6	Aniba panurensis	Lauraceae	Whole plant	Alkaloid (Indazolidium)- novel agent	Active Against Drug resistant strain of candida	[35]
7	Syzygium jambolanum	Myrtaceae	Seeds Leaf	Alkaloids Glycoside	Anticandidal	[30]

			fruit stem bark			[36]
8	*Cassia tora*	Leguminosae	Seeds	Anthraquinone	Anticandidal	[35]
9	*Mentha piperita*	Lamiaceae	Oil Arieal parts	Terpenes Essential Oil	Active Against Candida Aspergillus	[30] [37]
10	*Cymbopogon citratus*	Poaceae	Oil Arieal parts	Terpenes Essential Oil	Active Against Malassezia Trichophyton Dermatophytes	[30] [38]
11	*Tectona grandis*	Verbenaceae	Bark Leaves	Extract (Aqueous)	Candidiasis	[39] [32]
12	*Aquilegia vulgaris*	Ranunculaceae	Leaves Stems	Bis (benzyl)	Anticandidal	[35]
13	*Persea americana*	Lauraceae	Leaves	Chromene	Anticandidal	[35]
14	*Tithonia diversifolia*	Asteraceae	Whole plant	Saponins Polyphenols	Anticandidal	[40]
15	*Prunus yedoensis*	Rosaceae	Leaves	Diterpenes	Anticandidal	[35]
16	*Datura metel*	Solanaceae	Whole plant	Diterpenoid, Alkaloids	Anticandidal	[41]
17	*Schinus terebinthifolius*	Anacardiaceae	Stem bark	Extract	Anticandidal	[35]
18	*Alibertia macrophylla*	Rubiaceae	Leaves	Extract	Anticandidal	[35]
19	*P. regnellii*	Piperaceae	Leaves	Extract	Anticandidal	[35]
20	*Ecballium elaterium*	Cucurbitaceae	Fruit	Extract	Anticandidal	[35]

21	*Vernonanthura tweedieana*	Asteraceae	Root	Extract	Anticandidal	[39]
22	*Psidium guajava*	Myrtaceae	Leaves	Extract (methanol)	Anticandidal	[35]
23	*Achillea millefolium*	Asteraceae	Arieal parts Leaves Bark	Flavonoids Phenolic acids Coumarins, Terpenoids (monoterpene,sequiterpene, diterpene, triterpenes) Sterols	Anticandidal Antiaspergillus	[30] [33]
24	*Ajania fruticulosa*	Asteraceae	Fruits	Guaianolides	Anticandidal	[35]
25	*Lupinus albus*	Leguminosae	Leaf surface	Isiflavonoids	Active Against Trichophyton	[35]
26	*Chamaecyparis pisifera*	Cupressaceae	Leaves Twigs	Isoflavone	Anticandidal	[35]
27	*Justicia secunda*	Acanthaceae	Leaf Whole plant	Extract (Methanol)	Anticandidal	[30] [33]
28	*Cajanus cajan*	Fabaceae	Roots	Alkaloids Flavonoids Tannins Extracts (Methanolic)	Anticandidal	[30] [34]
29	*Curcuma longa*	Zingiberaceae	Rhizome	Oil ofTurmeric	Anticandidal	[35] [30] [33]
30	*Terminalia chebula*	Combretaceae	Fruit Bark Roots Leaves Seed	Phenolics Tannins Extract of seed (Methanol , aqueous)	Strong Antifungal Anticandidal Antimucor Antiaspergillus	[30] [42]
31	*Parapiptadenia rigida*	Fabaceae	Stem bark	Pyrrolidine amide	Anticandidal	[35]

32	*Piptadenia colubrina*	Mimosaceae	Stem bark	Saponins Tannins Lecuanthocyanidins ,Extract (alchohol and aqueos)	Dermatophytes Active against Trichophyton	[35]
33	*Mimosa tenuiflora*	Mimosaceae	Stem bark	Sesquiterpene lactone	Anticandidal	[35]
34	*Eugenia uniflora*	Myrtaceae	Leaves	Sesquiterpenes Monoterpene hydrocarbons	Anticandidal	[35]
35	*Zingiber officinale*	Zingiberaceae	Rhizomes	Steroidal saponin	Anticandidal	[39] [43] [32]
36	*Ocimum gratissimum,*	Lamiaceae	Whole plant Oil of Tulsi	Terpenes (monoterpene)	Active against Candida Mucor Aspergillus Mycospora Trichophyton Pathogenic plant fungi	[30] [34]
37	*Eucalyptus globolus*	Myrtaceae	Leaves Leave Oil	Terpenes Extract (methanol)	Anticandidal (highly significant)	[30] [12]
38	*Punica granatum*	Punicaceae	Seeds	Terpenes Extract (methanol)	Anticandidal	[30] [12]
39	*Artemisia mexcana*	Asteraceae	Arieal parts Leaves Bark	Terpenes Extract (methanol	Anticandidal Fusarium Aspergillus Trichophyton Mocor	[30] [12]
40	*Bocconia arborea*	Papaveraceae	Oil Arieal parts	Terpenes, Extract (methanol) Alkaloids	Anticandidal	[30] [12]
41	Hypericum scabum	Hypericaceae	Aerial Parts Bulb Seed	Extract (Trichloromethanol, n-hexane, aqueous)	Active Against Candida Cryptococcus neoformans	[30] [33]

					Rhodotorula	
42	*Rubia tinctorum*	Rubiaceae	Root	Anthraquinone Qninones Alizarin Triterpene	Anticandida	[44]

4. Role of Phytochemicals in antifungal activity: a mechanistic approach

Each class of synthetic antifungals has a unique mechanism of action each class though is unique: azoles inhibit the synthesis of ergosterol; polyenes attach to ergosterol; allylamine mount up squalene in the upstream of the ergosterol biosynthesis pathway; hydroxypyrimidine hampers the DNA replication, and morpholine diminishes ergosterol by inhibiting d14-sterol reductase [19].

The prime target of sensitive anti-fungal agents is the ergosterol pathway as it is optimized to protect the fungi against mechanical and oxidative stress [18] [8].

Though the mechanisms of action of natural antifungal products and their structure-activity relationships are largely unexplained, researchers suggest that these phytoconstituents act singly or with combined mechanisms providing a wider spectrum and sensitivity in overcoming the development of drug résistance against agents. This varied and voluminous range of phytochemicals classified Based on their chemical structures into major i.e. alkaloids, sulfur-containing compounds, terpenoids, and polyphenols etc... They are advantageous because of their properties like antioxidant, antifungal, antibacterial, immunity enhancer [20].

Alkaloids, the heterocyclic nitrogen molecule primarily act by Efflux pumps Inhibition (EPI) like piperine (piper longum, by inhibition of cell division like berberine (Berberis vulgaris), by the destruction of the cell wall by solasodine (Solanum khasianum) [21].

Organosulfur compounds, the Sulphur containing compounds such as allicin and ajoene from Allium sativum, dialkenyl and dialkyl sulphides, S-allyl cysteine and S-ally-mercapto cysteine, and isothiocyanates showed antimicrobial and antifungal activities by different thiol-dependent enzymatic systems. Phenethyl isothiocyanate, found within brassica vegetables might be related to factors viz. intracellular accumulation of reactive oxygen species and depolarization of mitochondrial membrane [3] [22][23].

Phenolic compounds, as bioactive molecules contain a large set viz flavone, isoflavones, flavonoids and flavonolignans, chalcones, polyphenols etc., play an important role in enhancing antibiotic or antifungal activity against resistant pathogens through various mechanisms viz. reverse inhibitors and competitive with ATP (apigenin), direct interaction with peptidoglycan inhibiting cell wall synthesis (Sophoraflavanone B), inhibitors of some enzymes like dihydrofolate, reductase, urease, sortase, and finally by inhibitory activity against DNA gyrase like in case of anthraquinones and tannins like chebulic acid [24].

Tannins also inactivate microbial adhesions and transport proteins through antibiofilm effects [25].

Quinones also exhibit antibiofilm activity by complex formation with nucleophilic amino acids leading to protein inactivation and loss of cell function. Purpurin, a natural red pigment found in madder root act by the downregulation of filamentation-associated genes and hyphal protein. [25]

Coumarins are reported to have several activities like a vasodilator, estrogenic, anticoagulant, analgesic, anti-inflammation, sedative and hypnotic, hypothermic, anti-helminthic, anticancer, antioxidant and dermal photosensitizing activity are potential subjects for multidrug therapy as well as against MDR pathogens [26]. Pterostilbene isolated from plants Pterocarpus marsupium act via ergosterol biosynthesis, oxidoreductase activity and heat shock proteins. [25]

Terpenes, the most diverse class of phytochemicals, widespread are high potential candidates as antifungal agents. Monoterpenes, like carvone, thymol, preferential impact on the structures of the membrane through increasing its fluidity and permeability, altering the topology of its proteins and making disturbances across the respiration chain, hence show synergistic activity in a combination of fluconazole [27].

Chitosan, an algal polysaccharide, derivatised with

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double Schiff bases showed profound antifungal activity compared with chitosan against *Fusarium oxysporum* f. sp. *Niveum* and plant pathogenic fungi[28].

5. Novel drug delivery systems and herbal formulation

Herbals as a novel delivery system are potential candidates as their side effects are minimal. Moreover, the natural compounds show a synergistic effect due to the presence of a complex mixture of molecules. Traditionally the natural components are known to be less toxic and their probability to develop resistance is mere. Many formulations like antifungal phytosomes (Zanthalene), liposomes (neem extract), nanoparticles (in candidiasis), micro and nanoemulsion (Quercus extract), microspheres (curcumin), neosomes(chitosan), transdermal delivery system (plumbagin), ethosomes(Tridax), transferomes(cholchicines), hydrogels (synthetic antifungal) are the few to name.

6. Conclusion and prospects

Natural products derived from medicinal plants with traditional or folklore medicines are promising candidates for the treatment of fungal diseases. The sighted isolates of phytochemicals showed overwhelming sensitivity against many clinical fungi. The clinical effect of antifungals was neither restricted to any particular class of phytochemical nor any particular plant family. These reviewed preclinical studies deserve the paramount attention of the pharma industry for further detailed studies to identify more clinically useful agents. In addition, mechanistic studies revealed that these natural chemicals exert their effects through multiple mechanisms, unlike synthetic standard antifungal agents. Studies revealed that plant product with different receptor sites and mechanism of action, have less proven resistance and have better tolerability to manage the current emergence of resistance to numerous synthetic agents. The newer techniques in the drug discovery for natural product further encourages researchers to isolate and characterize phytopharmaceuticals may lead to some exceptional molecules. Moreover, the Development of novel drug with effective preliminary study including an effective site for action, safety and better clinical profile is today the requirement of immunocompromised subjects, as well as MDR crisis covid era for better lifecare.

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Threshold Voltage Performance Modelling for 3D FD SOI MOSFET with Back Gate Bias

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Abstract:
The threshold voltage of semiconductor devices changes because of SCE when a Fully Depleted SOI MOSFET is scaled in nanometer state. For controlling threshold voltage, vary the back gate bias and thickness of the oxide of back gate. In this work, mathematical modeling with three dimension of threshold voltage with SOI MOSFET is presented. The method, separation of variable is used to calculate the 3-Dimensional poisson's equation, analytically with suitable boundary conditions for Double Gate SOI MOSFET and applying a back gate voltage. When oxide thickneess of back gate is lesser than the critical thickness as per back gate voltage, threshold voltage will be less as SOI film thickness is reduced, because of capacitive coupling between back gate and SOI layer. Due to this fact, the fluctuations in threshold voltage because of the thickness variation in SOI film, are getting reduced by optimizing the thickness of back gate oxide by controlling the back gate voltage.

Keywords: FD Silicon on insulator technology, Three Dimensional analytical model, SCE, back gate voltage control.

Abbreviations: FD, fully depleted; SCE, short channel effect; DG, double gate; SOI, silicon on insulator.

1. INTRODUCTION

For performance of good device speed and better integration densities, scaling of the semiconductor devices has to be done. But due to scaling, there will be degradation in the characteristics of a MOSFET. Still, Bulk CMOS technology will stay for submicron gate ULSI systems. A new technology has taken up the place of BULK CMOS that is Double gate SOI MOSFETs. These DG SOI MOS fabricated with very thin silicon film layer will have excellent electrical performances because DG SOI MOSFETs will have excellent latch-up immunity, better control of SCE, boost isolation and decreased parasitic capacitances as compared with other technology [1].

To improve performance of semiconductor devices during scaling, there is a requirement of suppression of SCE so as to have better reliability of semiconductor devices[3,4].

When the channel length reduces to nanometer, controlling power of gate over the depletion region of channel of MOSFET reduces and give rise to charge sharing from source region and drain region of MOSFET[6-8]. Many reliability issues takes place because of SCE like change in threshold voltage with respect to channel length occurs and pinch off condition in channel. There are many ways to minimize the SCE like control of SCE by double gates, thinner gate oxide thickness and by applying back gate voltage.

In this paper, a new model is developed which is based on threshold voltage for FD DG SOI MOSFET by using separation of variable method for solving the three dimensional poisson's equation and calculate the effects of both front and back gates bias on the threshold voltage of DG SOI MOSFET. Drain voltage effect is also included in study.

2. MOSFET WITH SOI TECHNOLOGY

Technology from Bulk MOSFET switched to SOI MOSFET as there are various benefits of SOI technology like high device density, latch up

elimination, very low leakage current, very high speed of operation, small power dissipation, easy device isolation structure [2] etc.
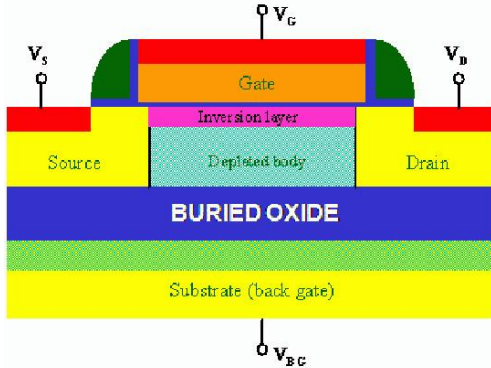

Fig 1: DG SOI MOSFET with back gate bias

Analyze the DG SOI MOSFET structure, the interface of front interface of silicon-silicon oxide is set at x=0 and the back interface of silicon-silicon oxide interface is set at $x = t_{si}$

To solve the expression of 3D Poisson's equation is:

$$\frac{\partial^2 \Psi(x,y,z)}{\partial x^2} + \frac{\partial^2 \Psi(x,y,z)}{\partial y^2} + \frac{\partial^2 \Psi(x,y,z)}{\partial z^2} = -\frac{\rho(x,y,z)}{\varepsilon_{si}}$$

(1)

Here, $\Psi(x, y, z)$ is the potential in the SOI film at a particular point x,y,z and $\rho(x, y, z)$ is the 3-dimensional charge density in the SOI film is marked at a point x,y,z. Now, Separate equation (1) into 1-Dimension Poisson's equation, 2-Dimensional and 3-Dimensional Laplace equation, we get

$$\frac{\partial^2 \Psi 1(x)}{\partial x^2} = -\frac{\rho(x)}{\varepsilon_{si}}$$ (2)

$$\frac{\partial^2 \Psi 2(x,y)}{\partial x^2} + \frac{\partial^2 \Psi 2(x,y)}{\partial y^2} = 0$$ (3)

$$\frac{\partial^2 \Psi 3(x,y,z)}{\partial x^2} + \frac{\partial^2 \Psi 3(x,y,z)}{\partial y^2} + \frac{\partial^2 \Psi 3(x,y,z)}{\partial z^2} = 0$$ (4)

where,

$$\Psi(x, y, z) = \Psi 1(x) + \Psi 2(x, y) + \Psi 3(x, y, z)$$

(5)

$\Psi_l(x) \rightarrow$

$$\Psi 1(x) = \Psi_b + E_b(t_{si} - x) + \frac{qN_a}{2\varepsilon_{si}}(t_{si} - x)^2$$

(6)

$\Psi_2(x,y) \rightarrow$

$$\Psi 2(x, y) = \frac{1}{\sinh(\alpha_m L_{eff})}\left[V'_m \sinh(\alpha_m y + V_m \sinh(\alpha_m(L_{eff} - y))\right]\left[\sinh(\alpha_m x) + \frac{\varepsilon_{si}}{\varepsilon_{ox}} t_{oxf}\alpha_m \cos(\alpha_m x)\right]$$

(7)

$\Psi_3(x,y,z) \rightarrow$

$$\Psi 3(x, y, z) = \sum_{m=1}^{\infty}\sum_{p=1}^{\infty}\left[G_{mp}\cosh(\alpha_{mp}z) + H_{mp}\sinh(\alpha_{mp}z)\right]$$

$$\frac{\sin(\alpha_m(y - L_{eff}))}{\cos(\alpha_m L_{eff})}\left[\sin(\alpha_p x) + \frac{\varepsilon_{si}}{\varepsilon_{ox}} t_{oxf}\alpha_p \cos(\alpha_p x)\right]$$

(8)

3. THRESHOLD VOLTAGE MODEL WITH BACK GATE VOLTAGE, V_{bg}, FOR SOI MOSFET

To enhance scalability of MOSFET technology, we can use the ultrathin (UT) body and buried oxide (BO) thickness to provide the better control of Short Channel effects. The control of threshold voltage can be done by the voltage of back gate as there is a strong coupling effect between back gate to front gate of the device [14-16] and the use of different concentration of channel doping is not needed to control of threshold voltage[17-19,21] and we can avoid the changes occur due to the fluctuations of random dopants.

Simulation tool with high accuracy is required to exploit the advantages of Fully Depleted SOI with ultrathin (UT) body and ultrathin (UT) box transistors[9-11]. The very important device parameter is the threshold voltage, which is used for the modeling of drain current compactly and low frequency noise.

The 2-D charge sharing concept has been proposed for analytical modeling of the threshold voltage for fully depleted-SOI MOSFET[12,13]. In this concept, there is a charge sharing between the gate region and source-drain regions, which leads to the underestimate threshold voltage roll off. The 2-D Poisson's equation get solved by the techniques

three-zone Green's function for determining both (front and back) surface potential from which the expression of threshold voltage was derived [20]. These methods are suitable for the limit of the channel length down to $0.1\mu m$.

Threshold voltage models for SOI MOSFET is developed using Poisson's equation at the interface of silicon body front gate and front gate, 2-dimension potential was derived in the silicon body [25]. For asymmetrical Fully Depleted-SOI MOSFET, an analytical threshold voltage model has been suggested which depends on the lateral variations of the both surface potentials [26]. As per this , threshold voltage is a voltage on gate when surface potential becomes two times of Fermi potential from midgap. But for modern devices, this statement of threshold voltage is not suitable for silicon body (undoped) with short length of channel. Recently, a new model of threshold voltage [22-24,27] was developed for undoped symmetric DG MOSFET. In this model, the effect of interface roughness and voltage at back gate at the threshold voltage is included. In the same method, iteration method is using to determine the threshold voltage, which comprises parameters derived by solutions of other equations.

The expression for threshold voltage for silicon in insulator MOSFET with back gate voltage is expressed as

$$V_{fg} = V_{fbf} + \left(1 + \frac{C_s + C_{itf}}{C_{fox}}\right)\Psi_f - \frac{C_s}{C_{fox}}\Psi_b$$
$$- \frac{Q_{eff} - 2q\sum_{s=1}^{n} N_{As}t_s}{2C_{fox}}$$

$$(9)$$

(3.84)

and

$$V_{bg} = V_{fbb} + \left(1 + \frac{C_s + C_{itb}}{C_{box}}\right)\Psi_b - \frac{C_s}{C_{box}}\Psi_f + \frac{Q_{eff}}{2C_{box}} - V_b \qquad (10)$$

Now substitute the value of $\Psi_f = 2\varphi_{sf}$, $V_b = 0$ and $\Psi_b = \Psi_{bA}$ in above equation 10 to obtain the value of V_{bgsbA} which is equivalent to V_{bg} corresponding to

Ψ_{bA}, with the condition that the front gate is in inversion state.

Likewise, substitute the value of $\Psi_f = 2\varphi_{sf}$, $V_b = 2\varphi_{sb}$ and $\Psi_b = \Psi_{bI}$ in above equation 10 to obtain the value of V_{bgsbI} which is equivalent to V_{bg} corresponding to Ψ_{bI} , with the condition that the front gate is in inversion state. And from equation 11 , we get the value of φbf.

$$\varphi_{bf} = V_t \ln\frac{N_{A1}}{n_i} \qquad\qquad (11)$$

The silicon on insulator substrate operates in three different modes[28-32]. For a corresponding value of back gate voltage, V_{bg} , the value of Ψ_b depends upon the different modes in which the SOI substrate is operating. The procedure of calculating the value of Ψ_b for a corresponding value of back gate voltage,V_{bg} at three different modes of operation are given as:

Case I: when the SOI substrate in accumulation state, $V_{bg} \geq V_{bgsbA}$

In this accumulation state of operation, the voltage drop in substrate is 0, $V_b = 0$. From above equation 10, we can obtain the value of Ψ_b at any value of back gate voltage, V_{bg} with $V_b= 0$ and $\Psi_f = 2$ φbf

Case II: when the SOI substrate in inversion state, $V_{bg} \leq V_{bgsbI}$

In this inversion state of operation, the voltage drop in substrate is $2\varphi_{sb}$, $V_b = 2\varphi_{sb}$. From the equation 10, we can obtain the value of Ψ_b at any value of back gate voltage, V_{bg} with $V_b = 2\varphi_{sb}$ and $\Psi_f = 2$ φbf.

Case III: when the SOI substrate in depletion state, $V_{bgsbA} > V_{bg} > V_{bgsbI}$

In this depletion state of operation, the voltage drop in substrate lies from 0 to $2\varphi_{sb}$, $0 < V_b < 2\varphi_{sb}$. From the equations 10, we can obtain the value of Ψ_b at any value of back gate voltage, V_{bg} with $\Psi_f = 2$ φbf.

Now obtain the value of Ψ_b at a particular value of back gate voltage, V_{bg} by identifying SOI substrate mode in which it is operating and there is a particular

procedure for different types of modes, which is going to be followed. After that, threshold voltage, Vt is obtained at a particular value of back gate voltage, V_{bg} by putting the value of Ψ_b in the equation given below:

$$V_t = V_{fbf} + \left(1 + \frac{C_S + C_{itf}}{C_{fox}}\right) 2\varphi bf - \frac{C_S}{C_{fox}} \Psi_b - \frac{Q_{eff} - 2q\sum_{S=1}^n N_{As}t_S}{2C_{fox}} \quad \textbf{(12)}$$

4. RESULTS AND DISCUSSIONS

The threshold voltage [5,11] is defined as the gate voltage at which significant current starts to flow from the source to the drain. Experimental values used: t_{si}=15nm, t_{oxf}=2nm, t_{oxb}=30 nm, N_A=1×10^{17}/cm^3 at V_{ds}=1V, V_{bg}=-2V.
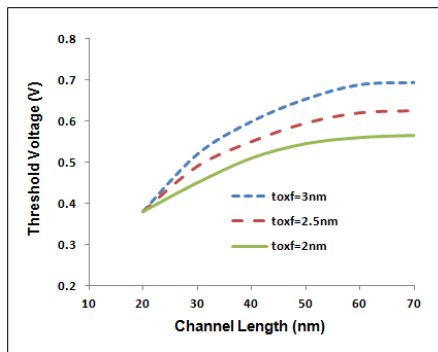

Fig 2: Variation in V$_{th}$ with channel length for t$_{oxf}$

Fig 2 shows that slope shift downwards as the front gate oxide thickness reduces, ie Threshold voltage can be control with a combination of channel lenght and gate oxide thickness.
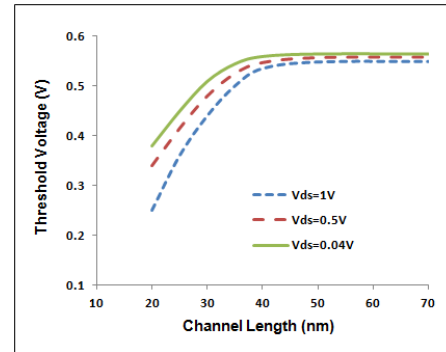

Fig 3: Variation in V$_{th}$ wrt channel length for different V$_{ds.}$

Fig 3 shows that slope is shifting downwards for lower values of drain to source voltage, ie Threshold voltage can be control with a combination of channel lenght and drain to source voltage.
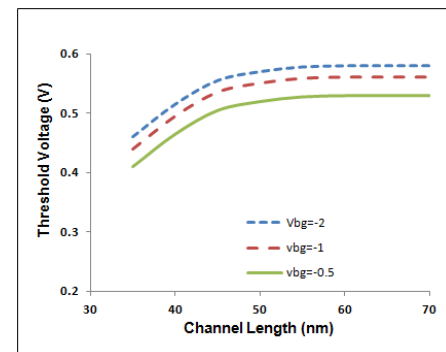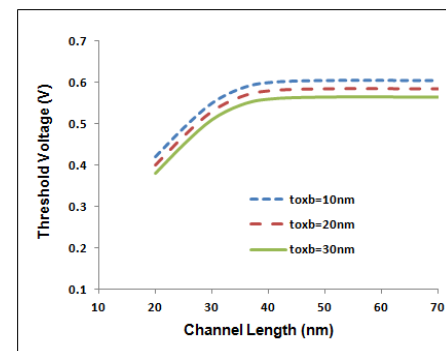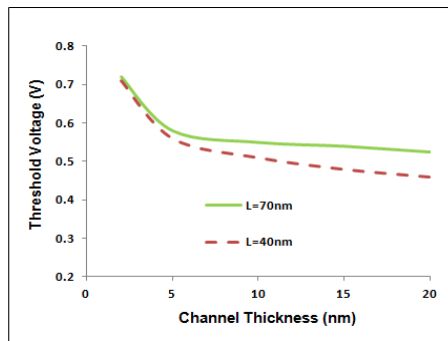

Fig 4: Variation in V$_{th}$ wrt channel length for different V$_{ds.}$

Fig 4 shows that slope shifts downwards for lower values of back gate bias voltage**.**

Fig 5: Variation in V_{th} wrt channel length for different t_{oxb}.

Fig 5 Shows that slope shifts downwards for higher values of back gate oxide thickness denotes control of threshold voltage.

Fig 6: Change in V_{th} along channel thickness for channel length

Fig 6 Shows that slope shifts downwards, hence controlling of threshold voltage for lower values channel length.
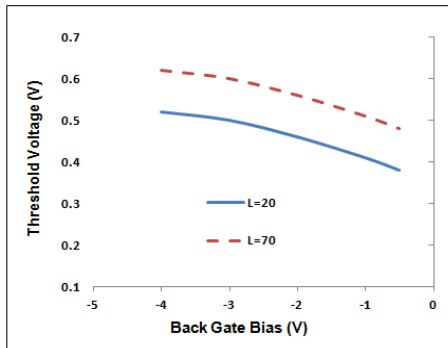
Fig 7: Change in V_{th} with V_{bg}.

Fig 7 shows that threshold voltage decreases with more bias voltage and Slope shift downward for lower values of channel length.

5. CONCLUSION

The effects of front and back gate control on the threshold voltage for FD SOI MOSFET has been presented using MATCAD 13. This result has been experimentally verified by using 3D ATLAS software that back gate voltage controls the performance of device and is used to suppress the effects of short channel effect and performance of device is improved. Threshold voltage behavior with Channel thickness shows better control with 70nm channel length, threshold voltage degrades as channel length reduces shown in Fig 6. Back gate bias controllability with threshold voltage is given in Fig 7, shows incremental changes with respect to bias voltage.

When oxide thicknesss of back gate is lesser than the critical thickness as per back gate voltage, threshold voltage will be less as SOI film thickness is reduced, because of capacitive coupling between back gate and SOI layer.

6. Future Scope

Work in this field can be explore further as only few work has been done so far, expected future work scope can be listed as below,

Multiple Gate Structure can be explore for achieving further performance improvement and have better reliability.

Here in this work Threshold voltage behavior is analyzed which can be extended to explore capacitance variation and impact of frequency, Hence switching performance can be analyzed.

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Volume 1 / Issue 1

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Role of ICT in Higher Education

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Abstract

Education is a very eugenically or philosophically focused task and excellent education has conventionally been associated with active teachers having high degrees of individual interaction with scholars .ICT has emerged as an intrinsic part of today's teaching learning methods. Productive and optimum use of technology can stimulate students, make our classes more zestful and compelling and renew teacher eagerness as they learn new expertise and approach. The role of ICT in higher education is becoming more and more prominent and this prominence will continue to grow and progress in 21st century. The utilization of ICT in education not only enhance classroom teaching learning methods, but also impart the facility of e-learning. The adoption and employment of ICTs in education have a constructive and positive impact teaching, learning and research. The use of ICT will not only improve learning atmosphere but also develop next generation for future lives and careers .The hard work in this paper call attention to the various effects of ICT on higher education and search into different prospective near future progress.

Keywords:-Information and Communication Technology, Higher Education, eugenically

1. Introduction

" The University is an appliance, whereby education facilities are provided to all those who are thoughtfully and theoretically sound of using those facilities to be the best asset but who cannot make use of themselves of those facilities for desire of monetary value or for other handicaps in life". Individuals in university teaching structure the conduct; intelligence and the social and moral values of the student population .Right and best use of technology can inspire and persuade students, make our classes more zestful and compelling and renew teacher

eagerness as they learn new expertise and approach. Technology is also serving the students to understand any hypothetical concepts clearly. ICT has become an essential part of today's teaching learning procedure. The incorporation of ICTs in teaching in general and teacher education in particular is the demand of the day. The use of ICTs can make meaningful changes both for teaching and training mainly in two ways; firstly, the rich depiction of information modify learner's viewpoint and understanding of the conditions. Secondly; the large spread and easy process access to information can alter the relationships between teachers and taught.ICT can also provide strong backup for educational novelty and creativity.

In the last few decennary, we have seen an growing number of youngsters gaining admittance to higher education .This procedure reflects a shift at a global level ,which is mainly because of democratization and advancement of societies, the up gradation of living style and structures ,the demand for a highly qualified performance both in professions and citizenships we have, therefore noticed a change both in terms of quality as well as quality in the student community ,reflected in the moderate loss of the supercilious and orthodox character of higher education through the admission of individuals from all social classes. "The self-dependent and transformative chance of the ICT in higher education in India has helped grow the country's demand of higher education through part- time and distance learning modes. It can be used as a instrument to overcome the subjects of cost, smaller number of teachers and low quality of education as well as overcome time and distance hurdles."

2. Review of related literature

Ozdmemir and Abrevaya (2007) clearly and firmly said that ICT is lowering the cost per scholar and increasing the enrolments and makes the conditions for employers and supports unending learners. In the paper ICT in Indian

Universities and Colleges, Snehi Neeru indicates transformation of higher education in the country in terms of access, equity and quality due to usage of ICT in education. In this regard the opportunities and challenges posed by integration of ICTs in various aspects of higher education in the present scenario are discussed. Also the factors regarding future development in ICT in education sector are also highlighted. UttamkrPegu studied "ICT in higher education in India: challenges and opportunities" (2014). The detail study unveil that ICT enabled education will finally lead to the democratization of education and it has the potential for revolutionizing higher education in India. Mahisa, Anju studied "The job of ICT in higher education in India" (2014) . The research unveil that ICT play crucial role as a competent agent for change among various educational practices.

3. Major ICT initiatives in Higher Education

Several initiatives in the field of ICT in Higher Education has been taken as major initiatives in order to provide content and online based education via Information and Communication Technology. For confirmation it was seen that GyanDarshan was launched in 2000 in broadcast educational programs for school kids, university students and adults. Similarly GyanVani was another such crucial step with airing programs provided by institution such as IGNOU and IITs. Under the UGC country wise classroom intiative, education programs are broadcast on GyanDashawn and Doordarshan national channel every day. E-Gyankosh which intent at continuing with digital learning resources is a knowledge storehouse propeld by IGNOU in 2005.Almost 95% of IGNOU's printed content has been digitized by uploaded on the storehouse. The national programmer for technology augmented learning (NPTEL) launched in 2001 is another joint opening move of IITS and IISC which education through technology. Recently according to Union Minister for Human Resource, Dr. Ramesh Portrayal 'Nishank' in a written reply in the Rajya Sabha told that various initiatives such as development and dissemination of ICT curriculum for students and teachers, ICT textbook, Cyber safety and security guidelines, SWAYAM prabha DTH TV channel 'Kishore Manch, All India Audio Video festival and ICT Mela, National ICT awards to school teachers were taken to leverage the capability of ICT to make the right quality content available to all learners in the country, free of cost.

4. Advantages of ICT in Higher Education

Implementation of ICT in pedagogy presents a distinctive chance to solve myriad of challenges quickly as well as at low rate. The benefits/ advantages of ICT in education are enormous. Its advantages are easy to discover and easy to implement. Here is a list of advantages of an ICT:-

1. Enhanced the modes of communication
2. Cost-efficient
3. Better teaching and learning methods
4. Enhanced data and information security
5. Minimize cost and save time
6. Easy student management
7. Preprogrammed answers to manual paper-based process and procedures
8. Inter-mutual and collective teaching and learning methods
9. Direct classroom teaching
10. Spread awareness of the social impact of technological change in education
11. Enhance E-learning and learning management system (LMS)
12. Independent learning platforms for students
13. Teachers can guide with better audio-video aids while delivering lessons
14. Educators can create engaging, interesting and well-designed classroom activities
15. Improve the administration and enhance the quality and efficiency of education
16. Promote and improve the digital culture in schools, colleges, and universities

5. Recommendations

The excellence of various programs as assess by suitability for purpose should keep growing, if the team members anticipate the various educational programs matching and fulfilling their needs and expectations. ICTs performs its duty to provide the means for activities to understand the probable potential in human beings.. Furthermore, ample funds must be supplied to start, develop, raise, review and implement ICT policies in the educational sector to bring about an up-gradation on ICT utilization, through computer apprentices courses. In today's time of declining GDP, the price of ICT equipment and materials will continue to be enormous. It becomes highly obligatory for all team members of education to tempt industrial foundation, politicians, big business tycoon, entrepreneur, entrepreneurs, NGO and the community at large to help different institutes in the provision of

ICT equipment and materials and well finished digital labs.

6.Conclusion

ICT play crucial part as a powerful representative for modification among many educational exercises i.e. conducting online examinations, paying online fees, accessing online books, magazines and journals. Thus ICT in Higher education enhance teaching learning methods, provides the provision of online learning to thousands to thousands of learners who cannot take the advantage of the benefits of higher education due to several barriers, such a time, cost, geographical location etc. Once again ICT serve to provide the means for much of this activity to notice the potential it holds.

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Healthcare Chatbot System using Artificial Intelligence

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Abstract

Artificial intelligence (AI) is now a days increasingly being used in healthcare. Here, AI-based chatbot systems can act as automated chat bot system, capable of abet health, providing education, and potentially prompting behavior change. Exploring the motivation to use health chatbots is required to predict intake; however, few studies to date have blown their acceptability. This research aimed to explore participants' willingness to engage with AI-based health care chatbots. With India's growing population, rising birth rate, and declining death rates due to advances in the medical field have found that the numbers of doctors have dwindled to meet the growing demand for the population. This situation can be better understood when we travel to cities in public hospitals where low availability of doctors is a major cause of improper treatment of patients and in some cases the resulting death. Sometimes even doctors can make the mistake of providing appropriate treatment results in a patient's death. To deal with such cases there is a need for a smart chatbot and Intelligent that can give advice to doctors and sometimes even patients about what to do in such situations that ultimately lead to the saving lives of hundreds of people. A situation because sometimes doctors can make a mistake while looking for symptoms but a specially designed machine cannot make such a mistake. This AI-based medical discussion can make a decision based on the patient's request. In this case, it uses its own database and, in some cases, where something is not available in its database at the request of the user, it collects information from a search engine like Google and provides it to the user in Audio format as Google does.

Keywords: Health care, Chatbot, AI, Symbols, Database, Google**.**

1. Introduction

Chatbots, as a part of AI devices, are natural language processing structures performing as a digital conversational agent mimicking human interactions. While this generation remains in its developmental phase, fitness chatbots may want to probably growth get right of entry to to healthcare, enhance doctor–affected person and clinic–affected person verbal exchange, or assist to control the growing call for fitness offerings consisting of through faraway testing, remedy adherence tracking or teleconsultations. The chatbot generation permits for such sports as precise fitness surveys, putting in place non-public fitness-associated reminders, verbal exchange with medical teams, reserving appointments, retrieving and analyzing fitness facts or the interpretation of diagnostic styles considering behavioral signs consisting of bodily activity, sleep or nutrition. Nine Such generation may want to probably modify the shipping of healthcare structures, growing uptake.

Now the day posts may be visible at some stage in the enterprise to manual the consumer in keeping with their want. They are to be had at IRCTC with Disha chatbot's name, at banks, and at diverse on-line journey corporations consisting of MakeMyTrip. As we pass closer to digitalization in which marketplace call for maintains to develop every day all of the time. Increasing Indian costs and the supply of junior medical doctors to serve the want for an enlargement populace is a main purpose of the want for scientific

dialogue with inside the scientific enterprise. Even at any other time, Physicians could make a mistake while you make a decision approximately the purpose of signs in a affected person and as a consequence endanger a affected person's fitness. For example, all through the last decade of the 90's Mohammed Benaziza additionally called the 'splendid killer' changed into one of the main bodybuilders withinside the Bodybuilding enterprise. She died due to Hypokalemia (which means excessive tiers of potassium) in her frame. Because of this excessive potassium level, he changed into getting frame aches. The medical doctors could not apprehend what changed into going on and arrived at the belief that Mohammed has no potassium which creates cramps with inside the frame. So the medical doctors have positioned an excessive amount of potassium in his frame main to the unfold of a cramp closer to his coronary heart and in the end death. Here it's far too many instances in which even medical doctors can do it in blunders. Therefore, to keep away from this kind of scenario there may be a want for a scientific chatbot which can manual medical doctors approximately what to do in such important situations. Its use isn't restricted to as much as medical doctors however also can be used automatically someone as an emergency in which It can display the consumer approximately the right primary remedy the individual being handled changed into taken. And a disorder, without a doubt via way of means of risk affords solutions to 3 questions requested via way of means of the chatbot, it could choose the kind of disorder someone is struggling from. After all if one desires to recognize approximately protection measures and treatments to be taken while chatbot chat can and offer info concerning it.

2. Literature Review

Sometimes, sufferers' patients [1] have hesitation to proportion their issues comfortably. That's why it may happen that the doctor fails to identify the disease and cannot provide satisfactory diagnosis. AI [2] based healthcare system provides a suitable way for patients to communicate without hesitation by text-to text conversation where by using natural language patient can share their symptoms so that based on their symptoms our system identifies disease and provide necessary solution and also day to day healthcare advice so that patient can avoid diseases and get more

information about their health. The Chatbot system will act as a digital medical doctor and allow patients to interact with the virtual doctor. For the development of this Chatbot natural language processing and pattern matching algorithm is used. It is developed using the Google Dialog flow. The Chatbot will act as a virtual doctor and make it possible for the patient to interact with the virtual doctor. Our gadget focuses entirely at the evaluation of nlp to extract signs, that could make it less complicated for elderly, less technical users to communicate. [4] The Natural Language Processing permits users to ask a query. The machine understands the important elements from the users input that may relate to particular features in a data set, and gives an answer. The stored information contains the text file like the symptoms related to particular disease on the basis of which we can predict the disease. Paper uses Artificial intelligence for prediction of the disease based on the symptoms and gives the list of available treatments. [5] Pattern matching strategy is utilized as a part of most Chatbot and it is very regularly being referred to as a reply framework relying upon coordinating kinds. Patterns can be created by one self-using logical operators that are AND, OR, NOT. [6].] The researcher A. S., John D discusses a survey on Chatbot Design Methods in Text Conversation Systems.

User dialogue is a straightforward continuous design from the issue of symbols to the symbols map, where available describes the corresponding symptom and diagnoses the disease patient where it is a major or minor disease. Saradar, Deshpande,[9] introduces a Medication Chatbot, A General Practitioner of Pediatric Medicine Chatbot. Pharma Bot, which is a chatbot to discuss that is designed to provide, suggest, and provide information on its generic medicines for children.

3. Methods

There is a demand of this kind of machine that's beneficial in analysis and might make the analysis smooth and interacting like informal chat. We suggest a machine which is able to hack a communication with the consumer. We suggest a Chatbot so one can ask

questions from customers to diagnose his or her trouble. It permits the affected person to at once have interaction with it and inform his or her trouble openly. The vintage Chatbot can be a patron verbal exchange machine and their fine attempt can be a query and solution web page on a web site . in the proposed machine the Chatbot will acquire records from sufferers related to their conditions. the information ought to attain the proper analysis. The machine facilitates customers to post their court cases and queries concerning their fitness. The Chatbot will make clear the consumer's signs with a chain of questions and consequently the symptom affirmation is going to be done. Each symptom being entered is as compared to the signs of the not unusual place illnesses in the listing of illnesses in the database. The illnesses are shortlisted supported the pinnacle customers enter at the query evaluation. The correct disorder is diagnosed and certain to the pinnacle consumer via way of means of the Chatbot.

4. Methodology

The health-Care Chat Bot System have to be written in Python and run Google conversation platform Google Dialogue flow, GUI hyperlinks and a easy, reachable community API. The machine ought to offer a potential parallel operation and machine layout have to know no longer introduce scalability problems in regards to the quantity of floor computers, drugs or presentations linked at anybody time. The stop machine has to additionally permit for seamless recuperation, without facts loss, from person tool failure. There ought to be a sturdy audit chain with all machine moves logged. While interfaces are really well worth noting that this machine is probable to comply to what's to be had. With that during mind, the maximum adaptable and transportable technology have to be used for the implementation. The machine has criticality in to this point as it's far a stay machine. If the machine is down, then clients ought to now no longer note, or note that the machine recovers quickly (seconds).The machine ought to be dependable sufficient to run, crash and glitch loose extra or much less indefinitely, or facilitate blunders recuperation sturdy sufficient such that system faults are by no means discovered to its stop-customers.
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5. Data Analysis

This segment describes the evaluation for each thematic class. Each segment ends with a precious of the findings from the literature evaluation.

Bot Response: This class consists of research on consumer-communication chatbots interplay, focusing on adaptive conversational behavior expressed through conversational retailers in healthcare. Chatbots are certainly gaining self-gaining knowledge of capacity via purpose category and sample matching to deliver herbal interplay.

Bot Personality: The research targeted on consumer domination and undertaking with the bot even as concerned in the interplay.

● Character-pushed communicate. Chatbot communique is based on text. The bot should increase smooth connection with customers and deliver, even complex, statistics at some stage in a digestible manner. This creates content material local to the bot medium, on the grounds that customers chat with the bot as they may with a lover.

● Speaking in sure voice tone. Users connect to a bot earlier than beginning a communication: the name, profile photo and bot description make a contribution in growing expectancies closer to the communication. Research has explored the electricity of conversational retailers to decide a social bond with customers through showing behaviors indicative of worrying and empathy.

● Speaking in one-to-one space. Research has proven that friction would possibly stand up from electricity variations among customers and consequently the device (the bot), in particular while concerned in one-to-one communication. Users would possibly try and exert their manipulate over the device or display aggressive attitudes closer to the bot agent Bot character should outline steps to manual customers to discover and control their intention. The bot has to be one step earlier than the consumer and infer consumer traits to evolve its reaction. for instance, the bot has to nation which subjects it covers while greeting the consumer, as underneath:

Bot: I can help you song your each day food regimen and workout.

This manual results in one a number of the furnished alternatives being decided on through the consumer. we would want to recognize what motivates

NAVACHAR

JULY-DEC 2021

RKG Publishing Ltd.

Volume 1 / Issue 1

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customers inside a communication and the manner this could be programmed into chatbot conduct. Bot character should replicate the suitable area it is employing. for instance, if the chatbot is gathering preliminary consumer records, then it have to gather the information step-through-step, as illustrated underneath.

Bot: you may insert your age underneath
User: I'm 30 years antique
Bot: Right, 30 years antique, and what does one have nutritional restrictions?

Response Flexibility: Conversational retailers have to take care of crucial cases, like out of doors context questions. They targeted on human-to human vs human-to-bot communique and consequently the impact of each techniques for instance, through offering one-of-a-kind blunders messages as reaction to an equal query posed through the consumer. The bot have to cowl abnormal cases, like a key-word related to any other department of the selection tree or a key-word it really is absolutely inappropriate to the context. If the consumer asks a random query or hints the bot with unrelated questions, then it is vital that the bot now no longer repeat itself with a reaction inclusive of:

Bot: Sorry I didn't pretty get that!

If the bot maintains to deliver no records on exchange path of action, then the chance that a consumer will go away the bot is extraordinarily high.

Conversation Flow: on this the consumer-bot again communication factors that must be incorporated into the communication glide Moreover, if the consumer can't discover a method to his/her query, it's miles practical to characteristic an alternative for the consumer to deliver comments approximately the query. the motive is to prevent customers from getting annoyed and deliver steering instead of time and again saying "Sorry, I failed to recognize that", as underneath

User: what number sports do I even ought to carry out today?
Bot: you still have the following sports to carry out: act1, act2, act3, you may write the pastime to report.

Conversation Length: that is regularly related to the number of statistics introduced through bot messages and consequently the manner it is structured. In fact,

the whole chatbot structure is based on communication glide. All approximately humans are speaking with the bot for prolonged durations, the communicate lacks vocabulary richness Unlike, GUI that defines policies for each interplay which regularly frustrates customers, CUI should be releasing of their familiarity, e.g.,

Bot: I can song your food regimen, sleep, tension and workout. Please pick out your alternatives: User: Anxiety Management

Dialogue shape: Dialogues have to be specific to a site and a demographic. This considers diverse functions to shape the communication in a manner that it considers consumer engagement and correctly covers the task. People generally tend to fashion their communique to healthy that of a chatbot . Using a communique tone that suits with consumer preferences, emotional nation, conduct and demographics will increase the opportunity of bot achievement to construct the proper interplay. To attain this, researchers use numerous modelling languages, speech popularity and different herbal language knowledge tools. The intention is to have a effective ontology capable of construct communique communicate and stumble on consumer emotional states and intents. Chatbot scripting languages, inclusive of Chat Script and AIML (Artificial Intelligence Markup Language) are utilized in phrase matching in opposition to a selection of debate styles to provide a coherent solution following a number responses related to such styles . For example, the sample may want to be:

User: What became my workout plan remaining month.
Bot: Preparing all beyond workout plans.

6. Implementation

In this project, the movement of the robot is controlled by
Bluetooth HC-05 with Smartphone app. The application
Developed in such a way that it alters the voice command
to write and translate text to Bluetooth connected
Device. Bluetooth is connected to the audio board
Receives a text from the Android app as characters and saves it as a character unit on a shared string.
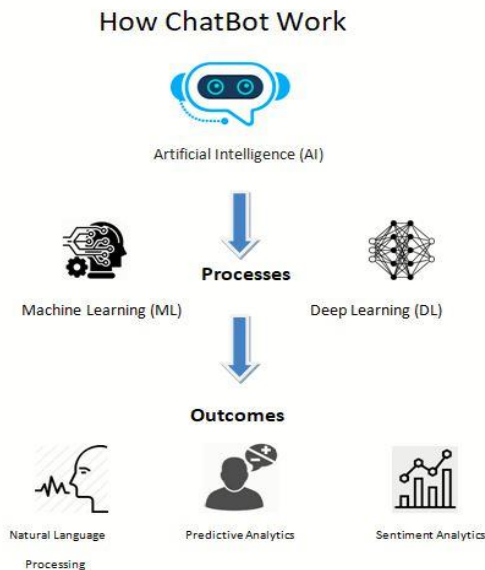
Fig 1. How Chat Bot Works

The mic is our input device and the speaker is the output device. The microphone sees input from the patient. Patient input is in speech format, and this speech is converted to text format to authenticate it to the database to provide the expected response in speech format. We are connecting the Google server with the database so that if the genius does not find the input in the database it will retrieve data from the Google server.

7. Results

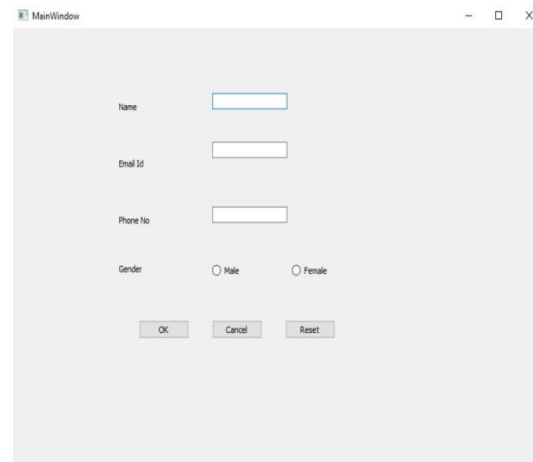Snapshot of Result:

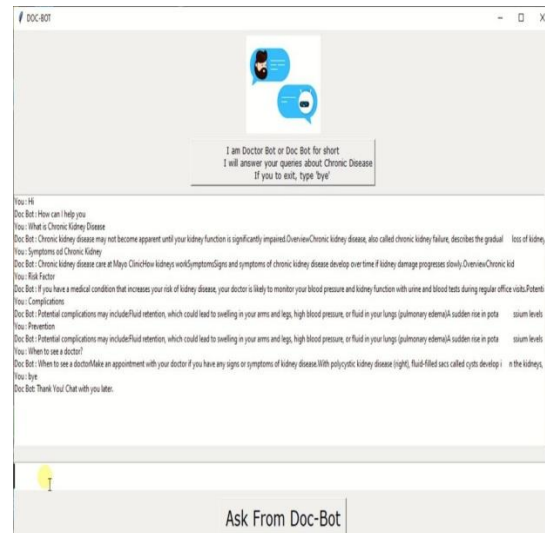- Snapshot

- Analysis of Result

Figure 1 Registration page

Figure 2 Chatbot Dialog box

8. Conclusion

Our medical discussion provides medical assistance to patients with some common diseases such as colds, flu, typhoid, malaria, jaundice, etc. We are developing a system due to the need for population growth country. Such programs are available in some countries but not in our country. The use of chatbot is a medical field indeed otherwise our thoughts. We are covered almost every point deserves a medical

chatbot to support the needs of the patient. A few years ago there are many models of medical dialogue that have been around an invention that was too expensive for the average person but we have tried to overcome this back in our healthcare chatbot program. At present, the proposed chatbot is within the design phase, which can be followed up by total design into code soon, with plans to launch this app within the next few months. Initially, we might wish to release the basic version soon, especially within the context of the severity of this pandemic of the novel coronavirus. We are developing this chatbot engine in Python, and Watson because the AIML platform. After releasing this bot into the market, supported user feedback, further updates are going to be possible for at least 3–4 months.

9. Limitations And Future Studies

Due to preprogramming, chatbots can be adhere if an unsaved inquiry is presented in front of them. This can head to customer frustration and result in loss. It is also the multiple messaging that can be challenging for users and collapse the overall experience on the website.
Chat-bots are installed with the motive to speed-up the response and improve customer interaction. However, due to fix data-availability and time required for self-updating, this process appears more time-taking and costly. Therefore, in place to manage several customers at a time, chatbots appear unclear about how to communicate with individuals.

Chat bots are a thing of the future which is yet to discover its potential but with its arise in popularity and craze among companies, they are bound to stay here for long. Machine learning has alter the way companies were communicating with their customers. With new platforms to build various types of chat bots being introduced, it is of great excitement to witness the growth of a new domain in technology while surpassing the previous threshold.

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