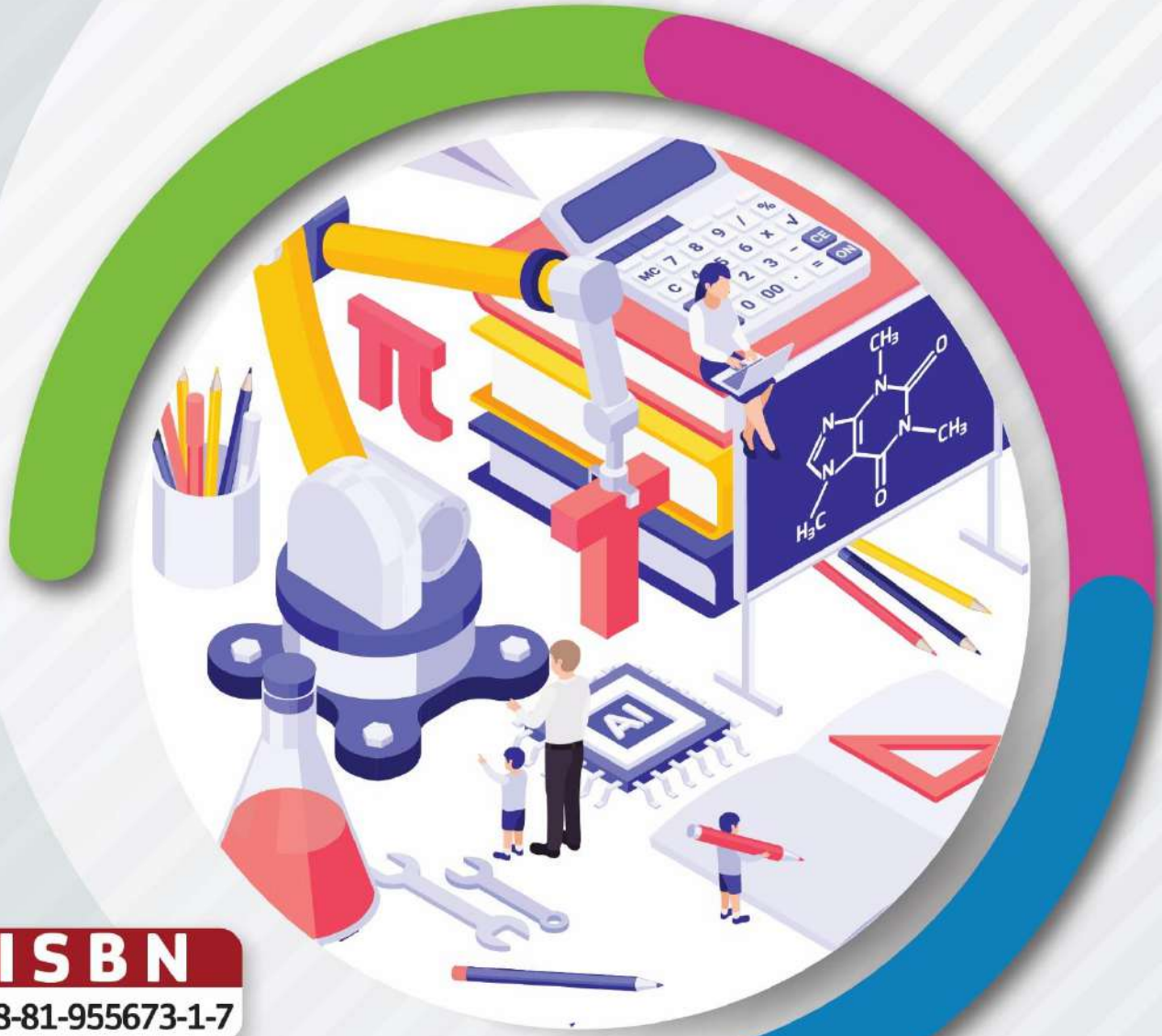
EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

IESEE 2022

International Conference on Emerging Trends & Innovation in Science, Engineering and Education

25th - 26th August 2022



PROCEEDINGS

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EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

International Conference on Emerging Trends & Innovation in Science, Engineering and Education (IESEE 2022)

25th – 26th August 2022

Organized by

Department of Computer Science and Engineering

East Point College of Engineering & Technology, Bangalore, Karnataka, India

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International Conference on Emerging Trends & Innovation in Science, Engineering and Education (IESEE 2022)

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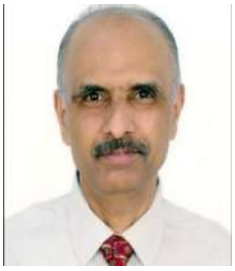
Message from Principal



Warm Greetings to all!

I congratulate Department of Computer Science & Engineering for organizing the International Conference on "Emerging Trends & Innovation in Science, Engineering and Education", during 25/8/2022 to 26/8/2022. Selected technical papers are published in the proceedings.

Conference helps faculties and students to get connected to other researchers and build trusting relationships, resulting in collaboration and be more productive and engaged. Such developmental opportunities create an environment where educators are able to experiment, innovate and lead.

The dedicated staff and HoD - CSE are striving to promote intellectually stimulating environment for students to become successful engineers and good citizens.

I thank all the delegates, participants, reviewers and industry leaders for actively participating and contributing to the success of this conference, and in the process fashion EPCET a truly distinct place.

Dr. T K Sateesh

Principal
East Point College of Engineering and Technology
Bangalore

Message from Head of the Department

The International Conference on Emerging Trends & Innovation in Science, Engineering and Education (IESEE-2022) is to bring all interested professionals together to discuss in-depth the issues surrounding emerging trends in engineering and technology, find solutions where they can be found, and pinpoint any areas thatrequire additional research. The overwhelming response received from all over the country is simply amazing. I appreciate all the authors for their exemplary contributions and in particular, the members of the programme committee for their proficient review of the manuscripts. It is also encouraging to note that foreign delegates of international repute in the field are going to deliver key-note address in this conference. I would like to express my appreciation toall the invited chairs and keynote speakers for their collaborative work on the event's planning and preparation.

I would like to congratulate the coordinators and organizers of IESEE-2022 for their tireless work and never-ending pursuit of making the conference reach new heights on behalf of theDepartment and on my own behalf.

I wish IESEE-2022 a grand success.

Dr. C. Emilin Shyni
Professor & Head
Department of Computer Science and Engineering

Message from the Conference Coordinator

It gives me great pleasure to extend a warm greeting to all of you at the "International Conference on Emerging Trends & Innovation in Science, Engineering and Education," which will take place at East Point College of Engineering & Technology in Bangalore on August 25th and 26th, 2022. Any conference is meant to debate pertinent and developing concerns in a specific area of education and raise awareness among other researchers. In the areas of education, multidisciplinary technologies, and applications, there have been notable advancements. I'm hoping that IESEE-2022 will unquestionably be the most significant international event and showcase the newest developments in multidisciplinary and educational innovation. We have asked eminent specialists to participate in the programme in order to offer the presenters at the conference an excellent research level.

During the two conference days, there will be plenary sessions with keynote speakers. I believe that IESEE-2022 will encourage you to think critically about the state of the art and provide you the chance to explore a range of educational problems and difficulties, including those in other multidisciplinary fields.

The success of this Conference is purely due to the commitment and hard work of many individuals who began working on the preparations for approximately six months in various ways to make this Conference a reality. Finally, I want to thank everyone personally and express my gratitude.

I wish IESEE-2022 a grand success.

Dr. R. Senkamalavalli
Associate professor
Department of Computer Science and Engineering

Message from the Conference Coordinator

IESEE offers a venue for the gathering of researchers, engineers, scientists, and experts in the various engineering research and development disciplines. Researchers, engineers, scientists, and experts in the numerous research and development disciplines of engineering and technology can gather at IESEE. The conference provides a setting for top professionals from across the world to come together and engage in in-depth discussion on themes related to management, computer science, information technology, and engineering technology.

I hope distinguished speakers will discuss the subject of computation and innovation from many angles. I have the honour of stating that this meeting will undoubtedly provide appropriate solutions to the world's problems.

I wish IESEE-2022 a grand success.

Kesavan M.V
Assistant Professor
Department of Computer Science and Engineering

Key-Note Speakers

 Dr. Ezra Morris Associate Professor University Tunku Abdul Rahman, Malaysia	 Ms. Nivitha Nixon Senior Business Consultant, TCS Singapore	 Mr. Anesh Dharma Sundar Founder & CEO, E5 Global Solutions LLC USA
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About the College

East Point College of Engineering and Technology was established in 1999 as a private educational Institute under the aegis of M.G. Charitable Trust founded by the dynamic business entrepreneur and eminent educationist Late Dr. S. M. Venkatpathi to provide higher education to build career in the field of Engineering and Management. EPCET offers an array of academic programs in a student-centered learning environment aid at graduate and Post Graduate Levels with a strong emphasis on technology. Education in EPCET is a highly committed and recognise to the current trends and needs in the global market & industry. The Institute conducts core domain training, provides many opportunities for campus placement. This Institution is committed to promote social, cultural and functional aspirations of all the sectors of the society.

About the Department

The Department of Computer Science and Engineering came into existence with the establishment of the institution EPCET in the year 1999, affiliated to Visvesvaraya Technological University, with the aim to impart state of the art technical education and to carry out cutting edge research. The four years under graduate programme in Computer Science is intended to train the students in both advanced areas in the core courses and specialized topics in the emerging technology. The department serves to create a centre of excellence for budding professionals so as to equip them with strong fundamental concepts, programming and problem-solving skills with an exposure toemerging technologies by providing hands-on experience. The courses offered deal with both theoretical and practical aspects of the theoretical foundations of computation and information processing, design and understanding of concepts behind computational processes and programming languages.

About the Conference

IESEE 2022 is planned to be organized at East Point College of Engineering and Technology, Bangalore, a Research Driven College, believes in inculcating Research Culture for development. IESEE 2022 aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Multidisciplinary Research and Innovation. IESEE 2022 is

dedicated in bringing together a significant number of diverse scholarly Individuals / Groups for presentation within the conference program. These 2 days would provide a lot of opportunities for Researchers, Faculties and Research Scholars to quench their thirsty for Quality Research. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns and challenges encountered providing Innovative and viable solutions.

CONTENTS

Mask Segmentation and Detection Techniques for Satellite Imagery Using RCNN with RPN

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ABSTRACT

Humans have always been curious to learn and explore new things and have achieved great things with that curiosity. "CURIOSITY IS THE WICK IN THE CANDLE OF LEARNING," said William Arthur Ward. With the advancing technologies and advancing human needs, automation has become a leading technology in the IT sector. In the year of 1959, the first ever man-made satellite, which could take pictures was launched for the purpose of observing our planet. This led to the widely used technology in the year 2022, The Satellite images play a very crucial role in the n day-to-day activities of humans. It's because of satellite imagery, the weather forecasting capabilities of humans have improved drastically. People can sleep without worrying about the next upcoming storm as it can be detected with the help of satellite imagery and machine learning algorithms. Thus, precautions for the same can be taken even before the storm is formed. GPS system is another widely used technology used for security and exploration purposes. Satellite imagery with GPS technology gave another revolutionary use for humans, such as live location tracking in a graphical map, detected and captured by satellites. An example of such an application is Google Maps. Google Maps use various type of satellite images and machine learning algorithms to automate the various operations for publicuse. With the help of these technologies, this article will give an overview that how satellite imagery helps us to detect objects he satellite images and furthto segment images in the satellite images using machine learningalgorithms like RCNN with RPN and U- NET.

Keywords – Satellite Imagery, GPS Technology, automation, RCNN, RPN, and U-NET

I. INTRODUCTION

We know that satellite imagery plays a vital role in our day-to- day activities. Right from research to security purposes, satellite images are very important to humans. It helped humans in various aspects and it will still continue to help humans' with improving technology in the field of AI and Data science. There are various operations that can be performed in satellite images based on our needs. Object detection and Image segmentation are such techniques of machine learning which can be applied to extract the necessary data from the satellite images. Object detection in satellite images can be used to categorize the objects in the

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Satellite images into different classes for research and developmental purposes. Image segmentation can be performed to study the satellite images more detailly and understand the images properly. Image segmentation is the process of dividing the digital images into different sub images known as segments. These segments can be used to break down the images and will be easier to read the images and extract useful data from it. The motive is to obtain useful information from the satellite images with the above- mentioned techniques and using machine learning algorithms. These data obtained from image segmentation and object detection can be used for research and developmental purpose in the weather forecasting field, globalmapping field, etc.

II. SATELLITE IMAGERY

A. Types of Satellite Imagery

The three types of Satellite Imagery are

- Visible Satellite imagery
- Infrared Satellite Imagery
- Water vapor satellite Imagery.

B. Visible Satellite Imagery

Visible satellite imagery is the type of satellite imagery in which, the images of the objects that can reflect sun light is detected. Most of the objects in Earth reflects sun light including clouds. Here application of object detection come to play. There are lot of object detection techniques available in machine learning and deep learning algorithms and one famous technique is using Convolutional neural networks (CNN). CNN is famous for its accuracy and result analysis, which can be used in visible satellite images to detect various objects such as buildings, roads, rivers, clouds, etc. from the satellite images and group them and store them as valuable data which could come handy when required. Object detection for various other purposes can also be achieved by the famous machine learning model, CNN. CNN is widely used not just for satellite imagery but also for various other purposes.

Fig.1.1 a visible satellite image from GOES-13 at 1745 UTC on June 3, 2012

C. Infrared Satellite Imagery

Infrared satellite imagery is the type of satellite imagery in which, the images of the Earth is captured using sensors which won't reflect sunlight, instead it captures the objects which emits radiation and heat. Basically, powerful IR sensors will be attached to the satellites, those satellites will capture the IR images of the planet Earth, the images of clouds, land forms, and different heat signals will be captured and stored as an image. Image segmentation technique comes into play to operate on such images. Image Segmentation is nothing but partitioning the images into different segments for clear understanding of the Images. The IR images contains crucial data on clouds with different heat signals, precipitation content which can be very well used to forecast weather, predict natural calamities. But there are lot of images to categorize and extract the required data from them. Image segmentation can be used to segment the IR satellite images to categorize it as per our needs. This technique can be achieved by various machine learning algorithms such U-NET architecture. U- NET architecture is a specialized architecture originally built to perform image segmentation in the human cells. U-NET architecture can be used to segment the images into different forms and it will be useful to extract the useful data for research and development purposes. Thus U-NET is one such algorithm which can be used to automate this process and help in saving time and resources.

D. Water Vapour Satellite Imagery

Water Vapor satellite imagery can be used to detect the moisture content in the upper atmosphere layer of the earth. The images will have white segments if the moisture content is high while it will be dark in color when the moisture content is low or dry regions. These images can be used to predict the upcoming heavy rainfalls and thunderstorms to prepare the land forms according to that and save or harvest rainwater as per the predictions. These task of predicting the rainfall and segmenting the images to extract the necessary data can be done using Image segmentation techniques and machine learning algorithms.

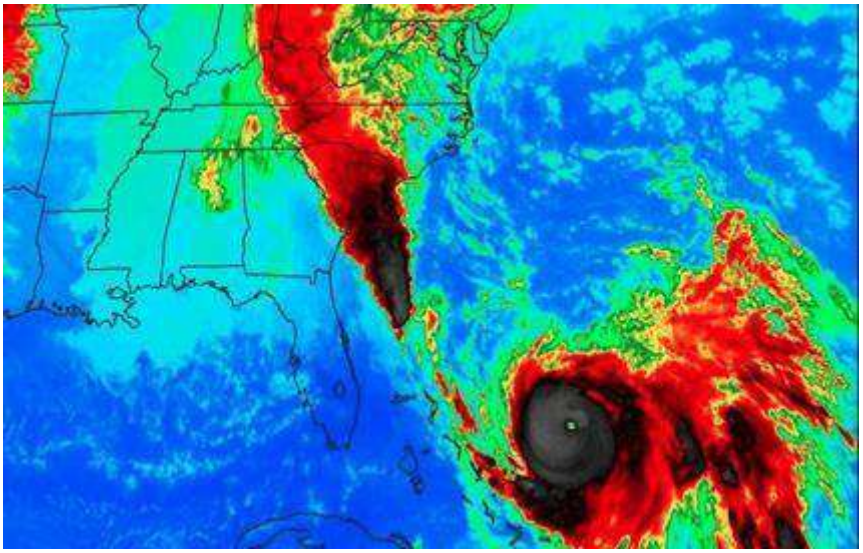


Fig 1.2 Infrared satellite image of the intense rainfall being funneled into South Carolina during the morning of October 3, 2015

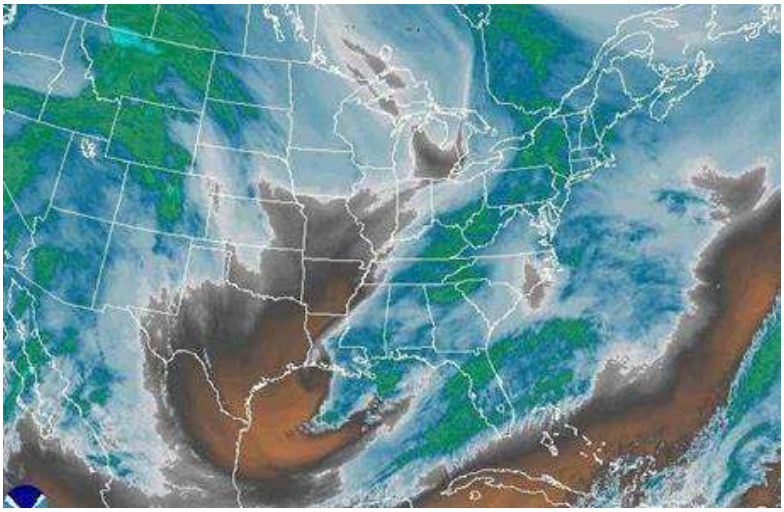


Fig 1.3 water vapor satellite imagery of Eastern U.S

III. IMAGE SEGMENTATION

Image segmentation is the method of breaking down of the image into different pixels and categorizing them into clusters of images to segment them and work on the image as per the user's needs. Image segmentation is a widely used technique in various real-life applications like fake detectors, satellite imagery, etc.

A. Machine Learning Algorithm - K-Means clustering

K-Means clustering is an unsupervised learning algorithm used for segmenting the pixels of the images into different clusters. The clusters are grouped together to achieve the segmentation of the image. Here 'k' is the number of clusters formed in the image. A thesis has been submitted by Nameirakpam Dhanachandra, Khumanthem Manglem and Yambem Jina Chanu on image segmentation using k-mean clustering. In this proposed thesis, they first took the input image and performed partial contrast stretching in the image, so they got a contrast stretched image, in which they performed subtractive clustering problem, through which they were able to identify the number of possible k clusters forming in that image. Now, the value of k is determined and using K means clustering algorithm the clustering of image into different category is performed. Then after the clustering of image is performed, it is then grouped into different categories andthe pixelated image is converted to normal RGB image and printed as an output. Here in K-means algorithm they used Euclidean algorithm to find distance between each centroid of clusters formed.

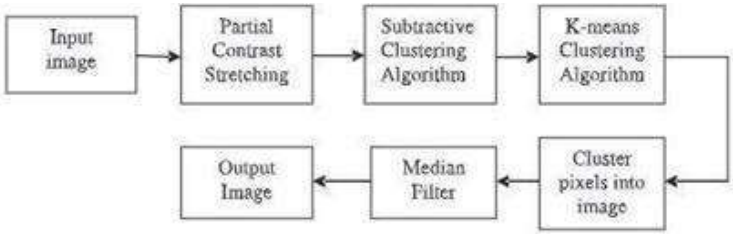
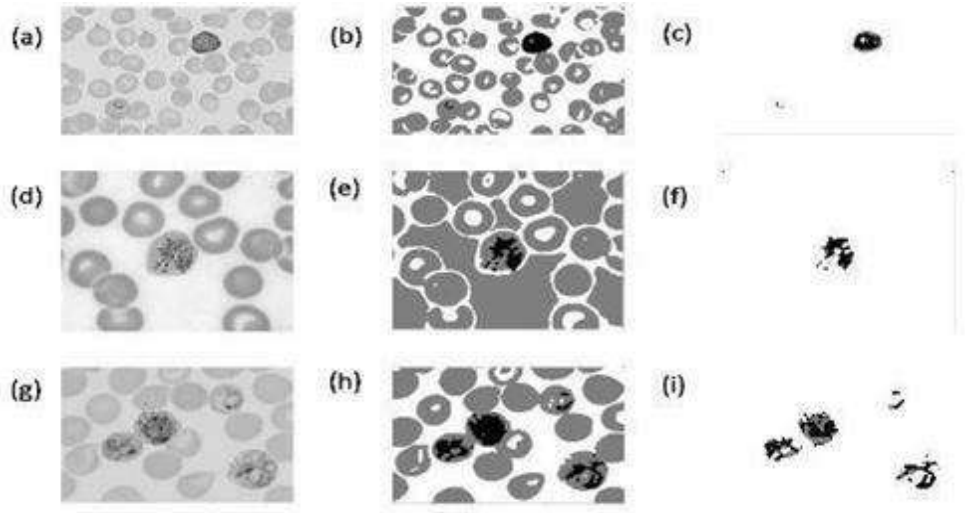


Fig 2.1.1 Block diagram of k-means clustering algorithm



(a)(d)(g) Input image, (b)(e)(h) Application of k means cluster algorithm, (c)(f)(i) Desired output.

Deep Learning Algorithm – Masked RCNN

CNNs are famous deep learning algorithms when it comes to image operations. One such division for image segmentation is masked – RCNN (MRCNN). This can automatically compute pixel wise masks for images and categorize them. Sharadha Prassanna Mohanty published an experimental thesis on using Deep learning satellite imagery, one such experiment is using Mask RCNN in satellite imagery, which can be used for image segmentation. The application of step-by-step mask RCNN is given below:

i. Anchoring and filtering: anchors of every step are created and visualized under a bounding box.
ii. Bounding boxes are placed after the CNN algorithm finishes object detection process.
iii. Masks for the objects detected will be generated and placed above the object layer.
iv. Then the activation tools and weight logging process can be used to activate the layers and give the exact output. Tensor Flow and histograms can be used.
v. All the above layers can be composed into single unit and the final result is produced, thus this how the image segmentation is achieved in Mask RCNN algorithm.

IV. OBJECT DETECTION

Object detection is a process of detecting a specific object from an image by means of artificial neural networks and convolutional neural networks or other deep learning and machine learning models. In objected detection, the image is split into different layers and the different layers are bounded into single category and the object in the image is detected.

A. Machine Learning Algorithm – HOG

Navneet Dalal and Bill Triggs presented the Historical Features of Oriented Gradients (HOG) in 2005. The Histogram of Oriented Gradients (HOG) is a feature definition used in image processing, especially in object

detection. A feature descriptor is an image or a clip that makes the image easier by extracting usefulinformation from it. With the HOG method, we will be able to find the location of a local image inside an input image with the distribution of gradients or edge directions. Exit x and y image (Gradients) are useful because the gradient dimensions are larger at the edges and corners due to the rapid change of intensity and itis evident that edges and gradients have more information about the local object then using circles. Therefore,histograms of gradient directions are used as elements in this descriptor. Now that we know the basic goal of the Histogram of Oriented Gradients, we will be getting into the way we calculate histograms and how these feature platforms, found in the HOG definition, use an SVM-like separator to determine the object involved.

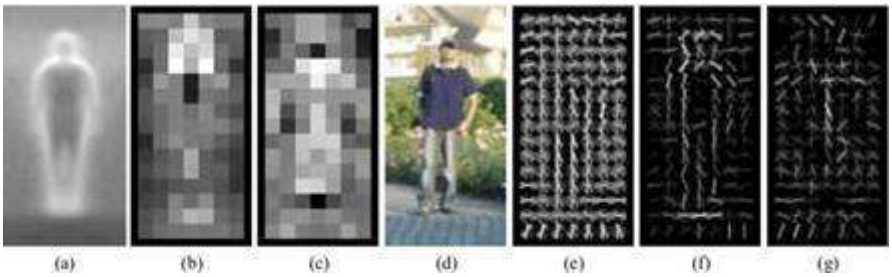


Fig 2.2.1.1.2 1: Human detection with HOG descriptors. (a) The average gradient image over the training data. (b) Each "pixel" shows the maximum positive SVM weight in the block centered on the pixel. (c) Likewise for the negative SVM weights. (d) A test image. (e) Its computed HOG descriptors. (f, g) The HOG descriptors are weighted by the positive and negative SVM weights, respectively.

V. METHODOLOGY

A. Image Segmentation using U-NET

U-NET was originally developed to classify the cells in human body for the micro biology researchers and medical purposes with the concept of semantic image segmentation. Which was later found to be more efficient when compared to most of the image segmentation algorithms and programmers started using it. U- NET model needs very less training time and test images and can produce good accurate results. Therefore, this experiment explains the application of U-NET for satellite image segmentation.

B. U-NET Architecture

UNET is a U-shaped network of encoder – decoder and decoder – encoder mechanism, in which the encoder doubles the filter and half the area while the decoder doubles the area and divide the channels installed into two.

Encoder

The encoder network works as a read and reads the data in the image with 3x3 convolutions. Then it uses ReLU to remove or skip a decoder block. Next, follows a 2x2 merger, which halves the area to reduce the calculation region by which training data input will also be reduced.

Skip Connections

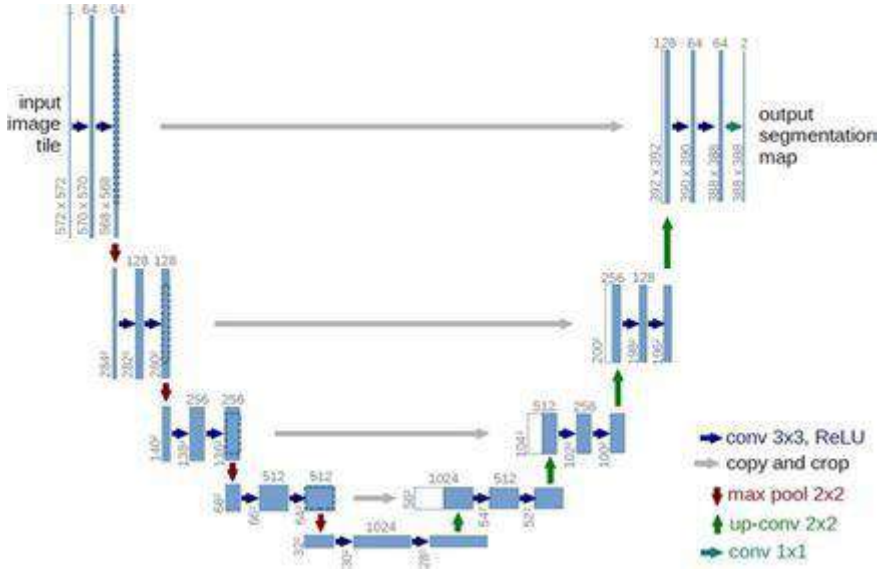
The skipping links will regulate the gradient flow by skipping unwanted levels or models without damaging the front layers. It will skip connections during backward propagation and also helps better representation of data.

Bridge

The bridge acts as a connector between the encoder and output network. It contains two 3x3 convolutional followed by ReLU activation.

Decoder Network

The decoder is used to capture the representations to perform semantic segmentation on the images. It starts with a 2x2 convolution. Then it is linked to a map with skipping features from embedded blocks. Next, it goes through 3x3 convolution which is followed by ReLU activation function. The final decoder passes through 1x1 convolution using sigmoid. A segmentation mask is provided by this sigmoid function which increase the resolution.



C. Image Segmentation using U-NET

In fact, UNets take pictures and make predictions in this small local window with no data near the leaflet boundary, so there can be large errors in the predictions initially made near and outside the window, and the predictions simply compile and look weird furthermore.

One solution is to scale the input and output during training and use one large CNN during testing, but this can be difficult to achieve, especially with libraries like Tensor Flow and Keras, where computer plots of CNNs are compiled mathematically. An easy way to solve this problem is to use a 2D transform between the scattered pads in the final prediction. This is what the current algorithm does. The algorithm also uses a lambda function that takes into account the image and the image size, the window size, the number of times you want to pass each other, and finally does a local prediction. Also, this method is fast because it uses a lot

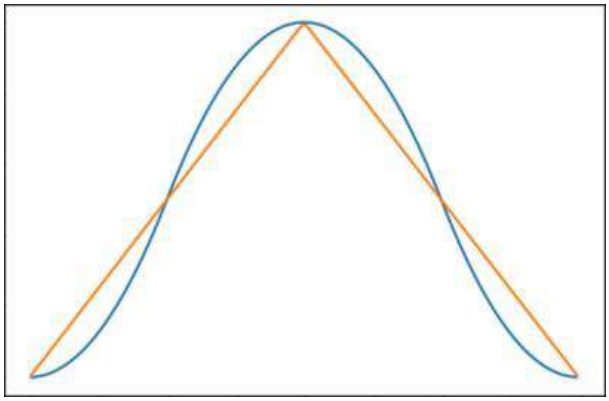
of GPU resources in the neural network. However, this method is not suitable for regular computers if the image is too large, as the 5D span can be large enough to fit the CPU RAM (GPU RAM usage is measured using cluster size variation in the previous prediction function). It's better to see the predictions for the pillows in the image than to merge the rectangles without translation.

Rotation and Mirroring

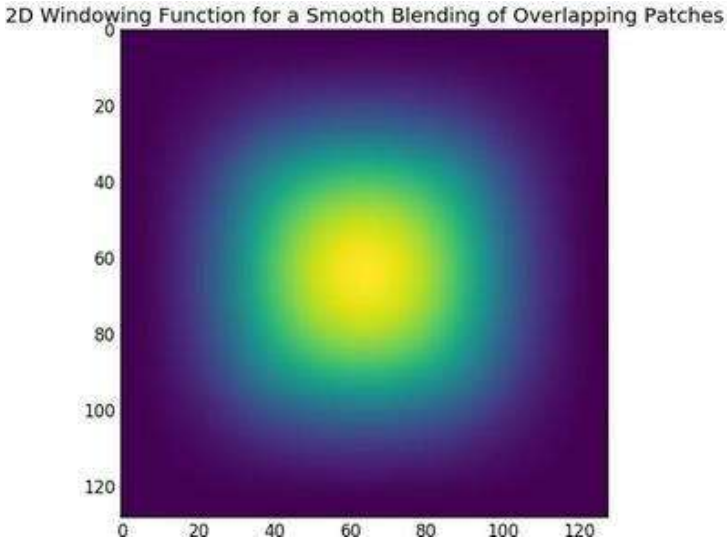
First, the algorithm uses rotations and mirrors to allow the neural network to view the image from several different angles. It is then measured to minimize the variability of the estimate. In particular, we use the dihedral group D_4. In other words, we use about 4 rotations of about 90 degrees and a mirrored version of this rotation to magnify the image 8x for prediction before merging the predictions.

Windowing for smooth predictions

To incorporate predictions, we use transforms with a simple quadratic spline window function. Measure pixels as you chain packets together. The amount of overlap between merged windows can be changed incode to get a full window prediction (50% overlap by default, almost no overlap). Here is what the window looks like compared to a regular triangular window:



The window comes in sizes based on the length of the window:



The window uses similar editing strategies than valid ones while predicting the images with same size as inserted one.

D. Image Segment using U-NET Architecture Datasets

In this study, we used publicly available datasets for research and study purpose from Kaggle. These set of datasets contains 144 images which has been divided into 8 tiles, each tiles containing 9 normal images and 9 masked images of satellite images. These are the aerial satellite images of Dubai, UAE taken by the satellites of Mohammed Bin Rashid Space Centre in Dubai, the UAE. These datasets are made publicly available by the Mohammed Bin Rashid Space Centre in Dubai, which has been annotated with pixel-wise semantic segmentation.

This pixel wise segmented image has been divided into 6 classes to perform semantic segmentation of any aerial imagery or satellite imagery.

The classes are: (<class_name>: <#rgb_color_codes>)

- Building: #3C1098
- Land (unpaved area): #8429F6
- Road: #6EC1E4
- Vegetation: #FEDD3A
- Water: #E2A929
- Unlabeled: #9B9B9B

These images are segmented by the trainees of Roia Foundation Syria.

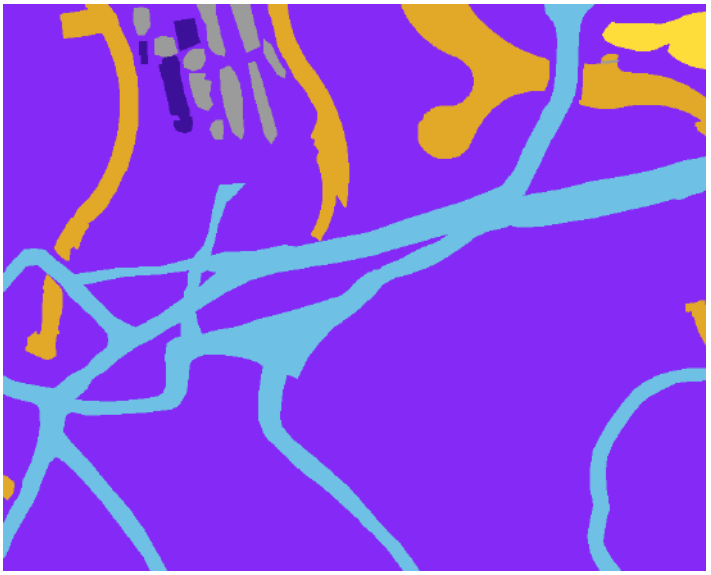


Fig 4.1.1.1 Examples of data set

E. Object Detection using R-CNN with RPN

Deep Learning is a powerful tool used in Computer Vision. We used Faster R-CNN for object detection incorporated with Regional Proposal Networks (RPN). The Faster R-CNN detector adds a region proposal instead of using a separate algorithm like Edge Boxes. Regional Proposal Networks use anchor boxes to detect the object in the Satellite Images.

Datasets

In this model, we have used three datasets which are listed below:

- The dataset containing all the Satellite Images
- A dataset containing all the descriptions of the objects present in the Satellite Images.
- A dataset containing the annotations of the objects (Annotations are done through software namely makesense.ai)

VI. IMPLEMENTATION OF MODELS

A. Implementation of Image Segmentation using U-NET Architecture

The images we receive in a dataset or the image that we get as an input to perform semantic segmentation is of many different resolutions and sizes. To perform semantic segmentation, every image has to be in same size. Down- scaling or up-scaling the image to a fixed resolution can affect the quality of the images drastically and hence pixel wise semantic segmentation can't be achieved properly. Therefore, the images can be cropped into a fixed resolution, and the cropped images can be segmented as per the classes and the output can be given. In our study, the images have to pre-processed into the sizes which is divisible by 256 and then divide all the images into patches of 256*256*3. Then the patches of images extracted will be converted from binary to hexadecimal value by the division of 16 and obtaining the quotient method. The converted hexadecimal value will be converted to RGB. The pixel wise RGB colours will be grouped and labelled under integer

values. The pixels which match with the arrays of RGB will be found and they are matched up with the pixels, the same RGB values will be converted into integer of same values and grouped together to form masked semantic segmentation of images.

Evaluation Methods

According to the traditional pixel-by-pixel segmentation metric using Precision (P), Recall (R), F1 Score (F1), and IoU, and the clDice metric (clDice) developed to evaluate the preservation of the topology. We evaluated the road detection results. See the next section for a brief description of these metrics. However, keep in mind that visual inspection is still the main method of evaluation. For this reason, dozens of images were randomly selected from each region to compare with the predictions for each model tested.

Intersection over Union

The IoU metric, also known as the Jaccard index, is an additional metric that quantifies the percentage of overlap between the predicted image and the corresponding ground truth image. Basically, between two finite sample sets of the predicted image and the ground truth image, using the number of "common" pixels in the ground truth and the predicted image representing the road surface divided by the total number of pixels representing the road. Measure the similarity of. In both pictures. It can be calculated using the following formula.

$$IOU = prediction \cap growth\ rate \qquad (1)$$
$$prediction \cup growth\ rate$$

Intersection over union computes the amount of intersection when two bounding boxes conjoint with each other.

- If the object is been detected - IOU >= 50%
- If the object is not been detected - IOU < 50%

The anchor box having an IOU value greater than or equal to 50% will be termed, foreground Classes.

CIDice Metrics

Accurate pixel-by-pixel segmentation of network-like structures such as roads is relevant to many areas of research. For such structures, topology or connectivity is the most important feature. A new similarity measure called centerline in mask dice coefficient or clDice was introduced. This has proven to be a reliable measure of topology accuracy. It is calculated at the intersection of the segmentation mask and its morphological skeleton, more precisely than suppose you have two binary masks, the ground truth mask (GT)and the corresponding predictive mask (PR). In the first step of the calculation, the skeletons SGT and SPRare created from GT and PR, respectively. Next, the percentage of SPR that corresponds to GT is calculated This is what the author calls Topology Precision or Tprec (SPR, GT) and vice versa.

Topology Sensitivity or Tsens (SGT, PR), and finally clDice is defined as:

$$clDice(GT, PR) = 2 * \frac{Tprec(S_{PR}, GT) * Tsens(S_{GT}, PR)}{Tprec(S_{PR}, GT) + Tsens(S_{GT}, PR)}$$

Loss Function: Dice Method

This is a common loss for calculating similarities between images and is similar to the Intersection over Union heuristic. Therefore, the dice factor fits the loss function such as dice loss.

$$DL(y,\hat{y}) = 1 - \frac{2y\hat{y}+1}{y+\hat{y}+1}$$

The general criticism is the nature of the resulting search space, not convex. Several changes have been made to make the solution's dice loss more manageable using methods such as LBFGS and stochastic gradient descent.

B. Implementation of Object Detection using Faster R-CNN with RPN

VGG Convolutional Neural Networks is a CNN Mode proposed by K. Zisserman. VGG is an innovative object recognition that supports up to 19 layers. In this model, we are not working with the fully connected layer present in the usual VGG CNN, since we want to use that in the RPN Layer.

Regional Proposal Networks

The regional Proposal Network is the area network where the object can be possibly found.

- The area where the object can be possibly found is labeled as the foreground class.
- The area where the object cannot be possibly found is labeled as background class.

The area where the object is found is sent to the foreground class. The step-by-step performance of the Algorithm is given below:

Step: 1 Anchor Boxes Generating

Anchor boxes are pre-defined boxing with some height and width. There will be a cluster of Anchor Boxes, which are smaller and bigger based on the object's size. According to Spatial Pyramid Pooling in Deep Convolutional Networks for Visual Recognition, by K. He, X. Zhang, S. Ren, and J. Sun, 9 anchor boxes have been set as the default no of anchor boxes for both Regression and Classification Layer. Since Classification is the main part of the Model, we neglected Regression Layer. The boxing Coordinates of Anchor boxes for the Classification process are 4x4. For Classification, we have used sigmoid as an activation function and for Regression, we have used linear as an activation function.

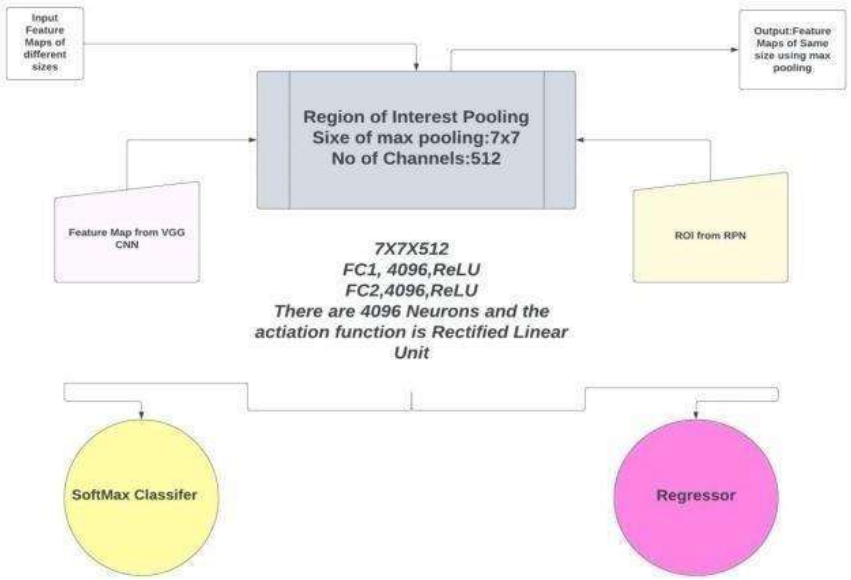
Step2: Intersection over Union (IoU)

Intersection over union computes the amount of intersection when two bounding boxes conjoint with each other.

- If the object is been detected - IOU >= 50%
- If the object is not been detected - IOU < 50%

The anchor box having an IOU value greater than or equal to 50% will be termed, foreground Classes.

Step3: Region of Interest Pooling



This ROI Pooling region takes the input from both RPN Region and the Feature Maps from VGG CNN. Then the max- pooling has been done with the size of the max-pooling as 7x7 and no of channels as 512. Then we used two fully connected layers with Rectified Linear Unit as an activation function, in which 4096 neurons are present in each of the fully connected layers. Then from the Region of Interest Pooling Region, we get two parts

- Softmax Classifier which is a binary classifier (0 or 1), uses a sigmoid as an activation layer
- Regressor uses a linear activation layer.

Since the model is designed to detect the objects present in the Satellite Imagery, we neglected Regressor. Thus the object is being detected with the help of Faster R-CNN with RPN.

VII. RESULTS AND ANALYSIS

A. Image Segmentation

As discussed in the implementation details, the following steps were implemented and the certain outputsand results were observed determining the working of the U-NET approach for image segmentation in satellite Imagery. U-NET is the one of the few architectures which can give highest accuracy with very few datasets comparatively to others. The approach is very simple. Firstly, the image is cropped in to a size which can be divisible or nearly divisible by 256. For this process patchify has been used. Patchify is a special pythonlibrary which is available to work on the scaling and dimensions of any image input. Both the images as well as masked images has been patched into 256*256*3 and sent for the next process. The next process is labelling the color codes of the classes as per testing images to enable pixel level semantic segmentation possible. Classes with same RGB labels as the testing image label will be segmented to a group or cluster and will be named after reviewing. Once the labelling process is done, the binary images have to be encoded to hexadecimal values and it has to be converted to RGB then it has to be converted into integer values to match

the mask and confirm the label of the dataset and confirm which class it belongs to and to show the class during output. It can be converted to hexadecimal code by dividing it by 16 and taking the quotient as first value and second quotient as second, this way we will obtain the Hexadecimal code.

To convert the hexadecimal to RGB color code, the following procedure has been followed:

1. Get the 2 left digits of the hex color code and convert to decimal value to get the red color level.
2. Get the 2 middle digits of the hex color code and convert to decimal value to get the green color level.
3. Get the 2 right digits of the hex color code and convert to decimal value to get the blue color level.

Now we have to replace all the RGB to integer values to be used as labels. Then we have to find pixels with combination of RGB for the above defined arrays, if it matches then replace all values in that pixel with a specific integer. Next, here the labels are integer encoded, which the pixels have integer value. But it should be one hot encoded to perform the training that is converting the labels to categorical. The below code snippet tells the conversion. Next the normal training process done with the minimum available datasets. This dataset contains about 144 images which has to been trained under 100 epochs value for good accuracy. Then the training and validation loss can be calculated for the analysis of the data. The loss is calculated with the above-mentioned method in the loss function and approach details. The validation and IOU will be calculated and the output of the U-NET segmented image will be printed.

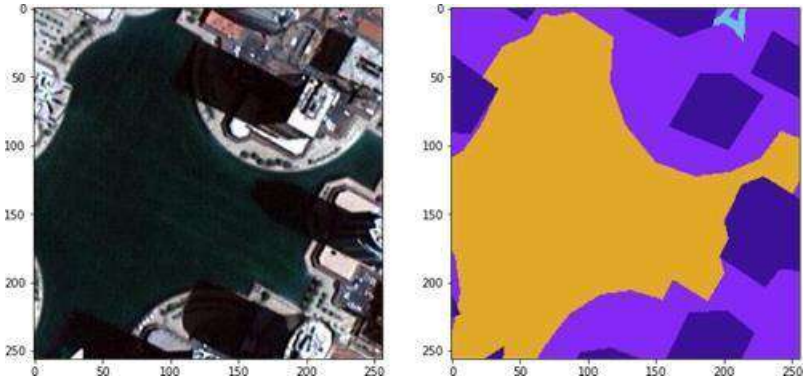
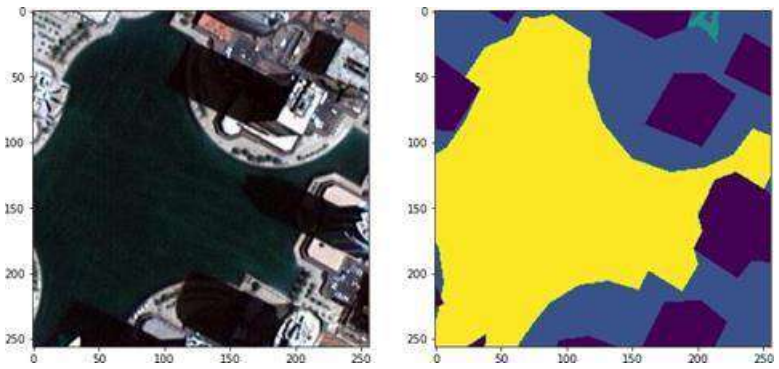
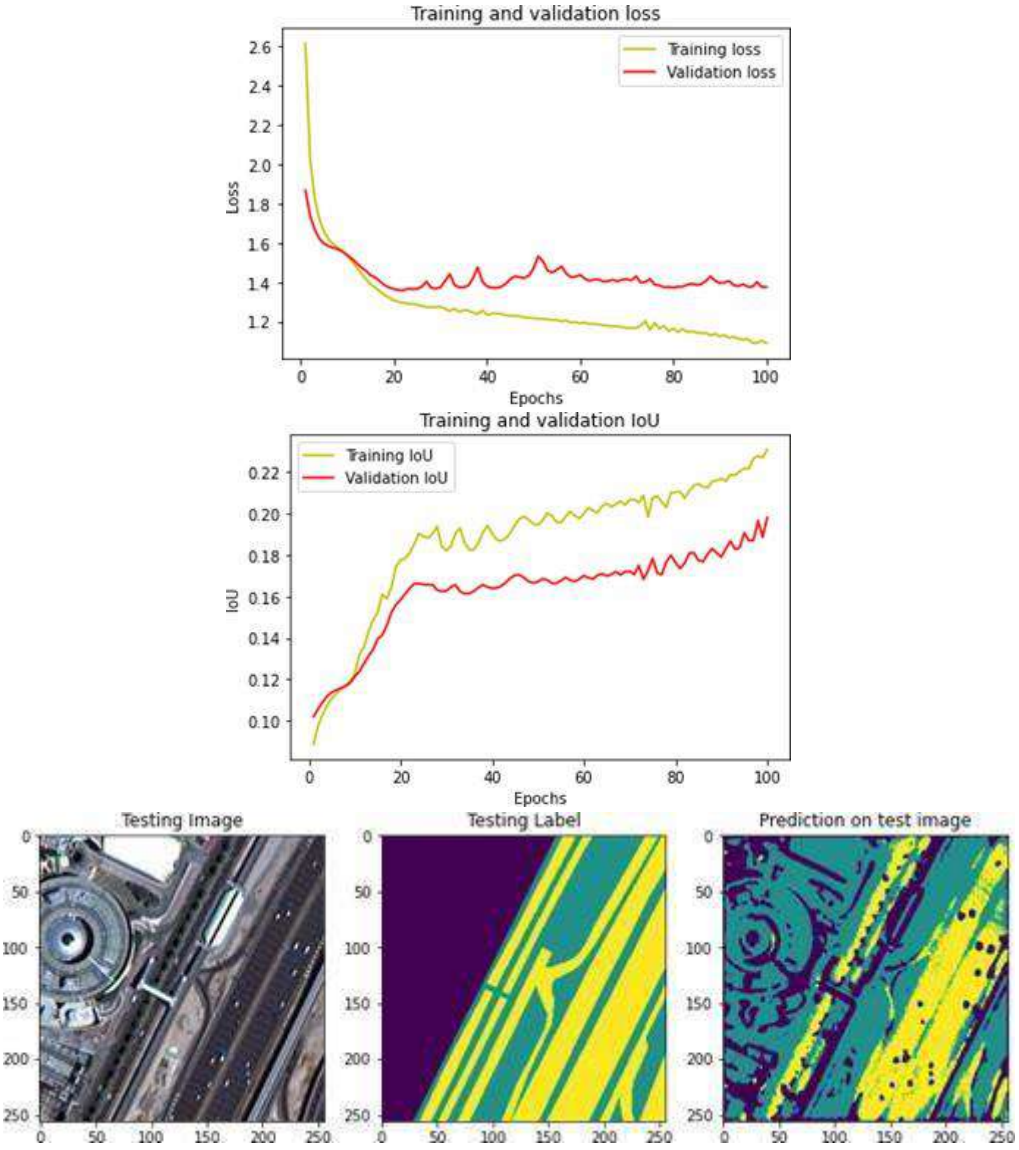


Fig 4.2.2 Labelled and cropped patches of images.





B. Object Detection

As the steps mentioned that, the anchor boxes are drawn in the image and IoU is found. Then with the help of IoU, the particular object namely trees, building, empty land and water are detected and the co-ordinated where the objects is present is also been came as output.


```
Image:(544, 509, 3)
Building
Coordinates:(318, 25),(182, 190)
Water
Coordinates:(7, 309),(11, 220)
Trees
Coordinates:(307, 284),(101, 55)
Trees
Coordinates:(316, 394),(38, 33)
Trees
Coordinates:(328, 488),(39, 22)
Trees
Coordinates:(335, 524),(31, 16)
Trees
Coordinates:(116, 30),(36, 31)
```

VIII. CONCLUSION

With The above topics and discussions, we have clearly and given a detailed on how satellite imagery can be used to do different applications in our day-to-day life and the methods to work on satellite imagery and to achieve automation in the same. Satellite imagery is a widely used features for leading a better and easier future. We have performed object detection and image segmentation in the above models using U-NET and CNN deep learning algorithms for better results in automation of these features. Here by we would like to conclude with saying object detection and image segmentation can be achieved by deep learning algorithms and can give a high result with very minimal datasets too. These technologies can be applied to our daily life to reduce the human errors and increase the efficiency of producing necessary data.

IX. FUTURE APPROACH

Here is the future implementation of Object detection in Satellite Imagery

Face detections and recognition:

Face detection perhaps is a separate class of object detection. We wonder how some applications like Facebook, Faceapp, etc., detect and recognize our faces. this is often a sample example of object detection in our day-to-day life. Face detection is already in use in our lifestyle to unlock our mobile phones and for other security systems to scale back the rate

Object tracking:

Object detection is additionally utilized in tracking objects like tracking an individual and his actions, continuously monitoring a ball within the game of Football or Cricket. As there's an enormous interest for people in these games, these tracking techniques enables them to know it during a better way and obtain some additional information.

Self-driving cars:

This is often one among the main evolutions of the planet and is that the best example why we'd like object detection. so as for a car to travel to the specified destination automatically with none human interference or to form decisions whether to accelerate or to use brakes and to spot the objects around it. this needs object detection.

Emotions detection:

This permits the system to spot the type of emotion the person puts on his face. the corporate Apple has already tried to use this by detecting the emotion of the user and converting it into a respective emoji within the smart phone.

Biometric identification through retina scan:

Retina scan through iris code is one among the techniques utilized in high security systems because it is one among the foremost accurate and unique biometric.

Smart text search and text selection (Google lens):

In recent times, we've encountered an application in smart phones called google lens. this will recognize the text and also images and search the relevant information within the browser without much effort.

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Decoupled Recommendation System with Provable Guarantees for Cold-Start Users

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ABSTRACT

Although the matrix completion paradigm provides an appealing solution to the collaborative filtering problem in recommendation systems, some major issues, such as data sparsity and cold-start problems, still remain open. In particular, when the rating data for a subset of users or items is entirely missing, commonly known as the cold-start problem, the standard matrix completion methods are inapplicable due the non- uniform sampling of available ratings. In recent years there has been considerable interest in dealing with cold-start users or items that are principally based on the idea of exploiting other sources of information to compensate for this lack of rating data. In this paper, we propose a novel and general algorithmic framework based on matrix factorization that simultaneously exploits the similarity information among users and items to alleviate the cold-start problem. In contrast to existing methods, our proposed recommender algorithm, dubbed DecRec, decouples the following two aspects of the cold-start problem to effectively exploit the side information: (i) the completion of a rating sub-matrix, which is generated by excluding cold-start users/items from the original rating matrix; and (ii) the transduction of knowledge from existing ratings to cold-start items/users using side information. This crucial difference prevents the error propagation of completion and transduction, and also significantly boosts the performance when appropriate side information is incorporated. The recovery error of the proposed algorithm is analyzed theoretically and, to the best of our knowledge, this is the first algorithm that addresses the cold-start problem with provable guarantees on performance. Additionally, we also are able to apply our algorithm in situations where both cold-start users and items are present simultaneously. We conduct thorough experiments on real datasets that complement our theoretical results. These experiments demonstrate the effectiveness of the proposed algorithm in handling the cold-start users/items problem and mitigating data sparsity issues.

Index Terms — Recommender Systems, Cold-start Problem, Matrix Completion, Transduction.

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I. INTRODUCTION

Due to enormous growth of user growth and with regard to this there is also exponential growth over many websites related to e-commerce and online websites. Now the problem is to make users for recommending their interest towards any products, books, movies etc.

1.1 Overview

Here recommender system has been made in order to give rating to an item and suggest those items. Now main focus on finding the best recommendation systems to solve this problem. Some of the recommendation system has been given below:

1) Content-based filtering (CB)
2) Collaborative filtering (CF)

Content-based separating (CB) and cooperative sifting (CF) are outstanding cases of suggestion approaches. As exhibited by its execution in the KDD Cup and Netflix rivalry, the best proposal strategy utilized is community oriented separating. This strategy misuses the clients' conclusions (e.g., motion picture appraisals) and additionally buying (e.g., watching, perusing) history keeping in mind the end goal to separate an arrangement of fascinating things for every client.

In spite of noteworthy changes in proposal frameworks, and specifically factorization-based strategies, these frameworks experience the ill effects of a couple of innate restrictions and shortcomings, for example, information sparsity and cold start issues. The investigations in the writing have moved toward the chilly begin issue from a wide range of edges, however they regularly abuse the helper data about the clients and things notwithstanding the rating information that are normally accessible. To start with, we bar the cold start things and clients and finish the rating grid. Next, we Trans duct the learning to cold start clients/things utilizing the recouped sub-frame work notwithstanding the accessible side data about the clients and things. Subsequently, there is no blunder engendering of consummation and transduction. Interestingly, past simply managing cold start issue, the proposed calculation additionally gives a compelling approach to abuse the side data about clients (or things) to moderate the information sparsity and make up for the absence of rating information.

1.2 Collaborative Filtering:

The primary thought behind CF is considered in Figure 1.1, which depicts 3 distinct users, every with a set of elements connected to them. Say the sets include movies that all the users enjoyed. All users enjoyed movies A, B, and C. Nonetheless, users 2 and three convey more movies in typical with one another than either has with user 1. Thus, it's possible to result in the assumption they've comparable tastes. Rather than recommending movie F to user 1, F is suggested to user three rather as user three is more prone to share exactly the same taste in movies as user 2 than user 1. As such, the terms recommendation and predictiontend to be used interchangeably when contemplating CF systems.

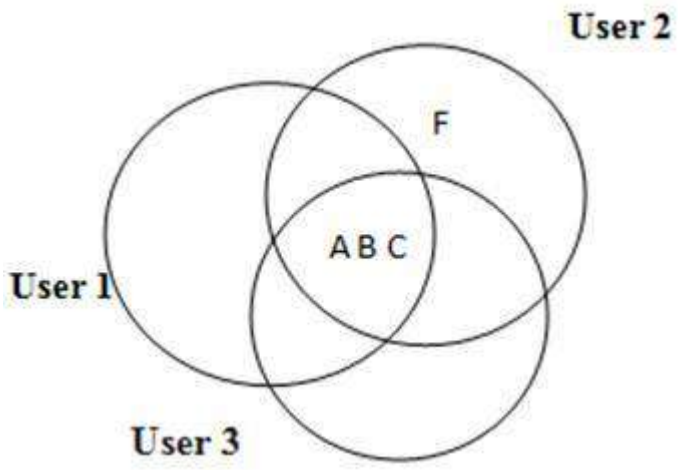

Figure 1.1: Screenshot of the third and fourth results returned by Google search for the query 'Jacques De St-Ferriol'

The primary architecture behind a CF Program normally contains a database which maintains all user profiles, records of user's interests in items. A mechanism is then implemented which compares a certain profile towards the profiles of other users to determine similarity. Lastly, it assumes a set of the very comparable profiles, and it uses details found in these phones recommend (or advise against) items to the target user.

1.3 Data Mining

Data mining is an interdisciplinary process of analysing from the step to "Knowledge Discovery in Database" process, which is sub-branch in computer science. The methodology of calculating and searching patterns functions artificial intelligence, mathematics learning, database system in huge data collection. The general objective of mining information is to concentrate data with a set of changing in information into a structure of reasonable to utilize.

Data mining is finished by utilizing diverse sorts of information mining application. These can be clear information mining programming or extremely specific with points and wide appointment that refine through more information to choose better part of information. For instance, if an organization is searching for data on specialists including their messages, fax, phone, area, and so on, those data can be mined by utilizing any of the data mining software programs. By gathering the data through information mining has permitted organizations to gain thousands and a large number of dollars in incomes by having the capacity to better utilization of the web to make business more knowledge that helps organizations settle on imperative business choice.

The noticeable book "Information mining: down to earth machines learning systems and methodology with java" (which covers generally machine learning things) at first to called as 'viable tool learning', and expression "Data mining" was incorporated for exhibiting reason. The generally more expansive terms "(huge ratio) examining content", or "examination" or when implying right strategies, synthetic brain power and tools study are generally suitable.

The data mining is one of the best ideas which tremendous development to collect the required data for the social affair with a few minutes. Web mining transformation which shows the ways to collect the social affair information and elevate the measures which indefinitely the security issues for the information.

Heaps helps to access the data individually on the web. To secure the data at the front line the web information mining will keep extensions. The authentic task of data mining is modified or self-loaderinvestigation of tremendous capacity of content heretofore darkness, interesting design, for example communal occasions of information collection (bunch audit), exceptional record (abnormality area), and quality (connection drilling). This ordinarily consolidates utilizing database frame works, for example spatial documentation. The arrangements would then able to be viewed as a sort of once-finished of the information,and might be utilized as a bit of further examination or, for event, insightful examinations and machine learning.

1.4 Motivation

The Overall goal of this paper is to propose a new approach to solve the recommendation problem with an efficient matrix factorization. In this paper focus is just not only on solving the cold start problems but also focused on cold-start users and cold-start items. This has no error as mentioned in existing methods with Trans duct stage of proposed approach.

1.5 Scope of the Project

The major problem in finding the proper recommendation in order to solve the cold-start problems. General framework which is used in this may also be applicable to other problems like network completion which has the matrix completion used in these problems. It also provides the theoretical performance which we experiment on dataset in order to get the better results. Our results have been efficient framework for solving the state-of-art cold start algorithms.

II. PROBLEM DEFNITION

A problem statement is concise information of the issues that should be labeled by issues solving teams and ought to be created by them before they endeavor to take care an issue. Then again, a statement of the issue is assertion of may be a couple of sentences that outlines the issues addressed by a study.

2.1. Objective

The main objective of the described project can be explained as follows.

The significant enthusiasm for managing cold start clients or things that are basically in light of abusing different wellsprings of data to make up for this absence of rating information. Through the novel and general computer system in light of grid factorization and parallel violations of the likeness data among clients and things to ease the cold start issue. (i) The consummation of a rating sub-network, which is produced by barring cold start clients/things from the first evaluating lattice; and (ii) The process of learning from existing appraisals to cold start things/clients utilizing side data.

This urgent distinction keeps the mistake proliferation of culmination and transduction, and furthermore altogether supports the execution when fitting side data is joined. The recuperation mistake of the proposed

calculation is investigated hypothetically and, to the best of our insight, this is the main calculation that tends to the cold start issue with provable certifications on execution. Furthermore, we likewise can apply our calculation in circumstances where both cold start clients and things are available all the while.

2.2. Problem Statement:

Although the grid finish worldview gives an engaging answer for the cooperative isolating issue in suggestion frames, some significant issues, for example, information sparsity and cold start issues, quite unfastened. Particularly, during appraisal of information consequence of the fact that fragment of clients or things is altogether lost, usually referred as the cold start issues.

The typical platform matrix completion techniques are not fitting because of variable checking of accessible appraisals.

2.3. Existing System

Since many algorithms exist which make use of methods such as matrix factorization, subspace learning, they also have the matrix representation and sharing knowledge from existing which has ratings to cold-start users and items

Disadvantages of existing system

- There is an error at transduction which cannot be controlled in any way
- In order to solve cold start problems, many state-of-art methods are just based on application and not provide any better framework.

2.4. Proposed System

A two-stage approach has been proposed in order to solve problems of existing methods, two stage method which divides into stages which decouples the completion and transduction.

Advantages of proposed system

- Initially it will reject the cold-start items and users and make the matrix representation
- Trans duct the knowledge to cold-start items and users and it's an efficient method to make users to get information about items.

III. RELATED WORK

The diverse methodologies can be generally isolated into the accompanying four classes. The first class incorporates gullible calculations that attempt to prescribe things to clients in light of their fame, or in view of an irregular determination.

- Naive methods

In this paper treat all cold start clients/things and accept that all clients/things contribute the same to existing methods. This has the impact of massively diminishing the precision because of an absence of any filtering.

- Warm-start methods.

In order to begin situations, recorded information is not available for accessible to either clients nor things, warm start strategies make solicit clients to rate a set from things or import their inclinations from another wellspring of assistant data with a specific end goal to extend the client profile.

Specifically, these techniques expressly request that another client rate k agent things keeping in mind the end goal to manage the essence of new client for managing cold start client issues. Additionally, another thing can be compelled to be evaluated by k agent clients in frosty begin thing situations.

Mohammad-Hosseinet al., [17] In order to discover recommender system, a well-known method is that the collaborative filtering, this technique considers the reviews of the clients those who provided same range of reviews. constantly, the reviews of the clients are figured out when vide range of clients reviews some posts. The problem part of this technique is how to help new clients who doesn't have much knowledge or who enters newly, this issue is referred as cold start issue. For finding solution for this issue many techniques are introduced one among those technique is called Ask–to-rate, this is achieved by asking the new client's interests, at first. Therefore, these methods divided as non-adaptive and adaptive techniques. Later, itsverified and evaluated.

Justin Basilico et al., [4] A tale, different method which gathers all the trail data like previously clients reviewed data, and interests of clients, for relating the cold start client's interest. The objective of proposed technique is to build a kernel among clients and things. This method suggests an online algorithm (J-Rank) which shows cold start learning. Untried outcome of all show facts situates immediate growth among typical methods.

Aditya Krishna Menon et al..,[40] In online promotion, reaction prophecy is a challenge for calculating the possibility to facilitate a promotion being accessed on the web blog. In this paper, here it shows hoe review systems cans be faced as a challenge of conclusion and finding solution for the issue by means of matrix factorization method commencing C-F.

Daniel Billsus et al…,[6], Agenda of this proposal is adaptive news access, on the basis of machine learning approach. Initially, should concentrate on structure plan and it's working. Later will explain the interface and plan of executives assigned for this assignment. During this attempt ¢rst agent will give internal information via web pages, this proposal assigned to wireless information devices like personal-digital-assistants also mobiles. client's reviews play main role, executives of this proposal utilize MLA in order to predict individual's interest. Provoked through outputs of other end-user's interest prediction models. in addition,our evolution goes through the problems facing while predicting users' interest, client data requires corrections as a undeviating outcome of communications between data sets. Practically weigh up the presentation of our system through the data composed normal system-users.

IV. SYSTEM DESIGN

This section explains about the necessary requirement contain architecture diagram. These also include the assumption that are made during the phase of development and the operational assumptions during the course of search operations. It will discover a unified engineering idea for the current design, comprehend the specialized issues, and decide the estimates for execution and cost of perfection. The guideline objective of framework is to set up a plan approach that gives the functions describe in the framework necessities report.

4.1 System Architecture

The architectural configuration process is worried about forming a fundamental system for a framework. The generative steps are divided into modules shown below:

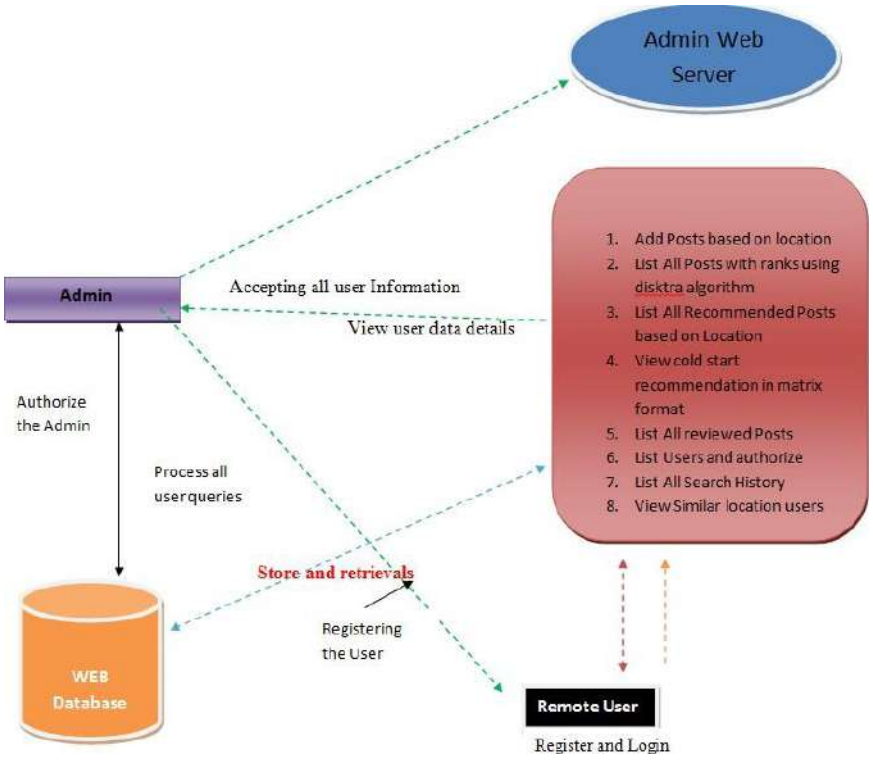

Fig 6.1 System Architecture diagram

In the above Figure 6.1, the overall architecture is described and divided into two modules namely user and admin module which explained in detail below:

Module 1-User: In this module, actual input is obtained and search for posts and view search history. The user tasks and role shown below:

- View your details and Search users based on location
- Search for posts and view specified post and recommend to your friend
- View my search History
- View recommends based on Locations

Module 2-Admin: In second step of our process Authorize and processing will be done by Admin with the help of web database and web server. The user tasks and role shown below:

- Initially Web Database should authorize the admin and process all user queries.
- Admin will accept all user information and user data details.
- View your details and Search users based on location.

4.2 Data Flow Diagram

- DFD is an basic graphical protocol which can be utilized to show a structure by methods for input data to the framework, different preparing that are completed on the given information, and yield information which is produced by the framework.
- It is the standout amongst the most essential modeling apparatuses. DFD is utilized to show the components of system. These components from the process of system, the information the processutilized an external element which communicates with the structure and the information streams in the system.
- DFD indicates how the information goes through the structure and how the adjustments are made through a series of progression changes. It is the graphical strategy which progression of changes that are performed as information flows input end of the output.
- It could be used for representing a framework in any phase of reflection. DFD can be allocated into steps which speak to expanding information stream in framework and its utilitarian detail.

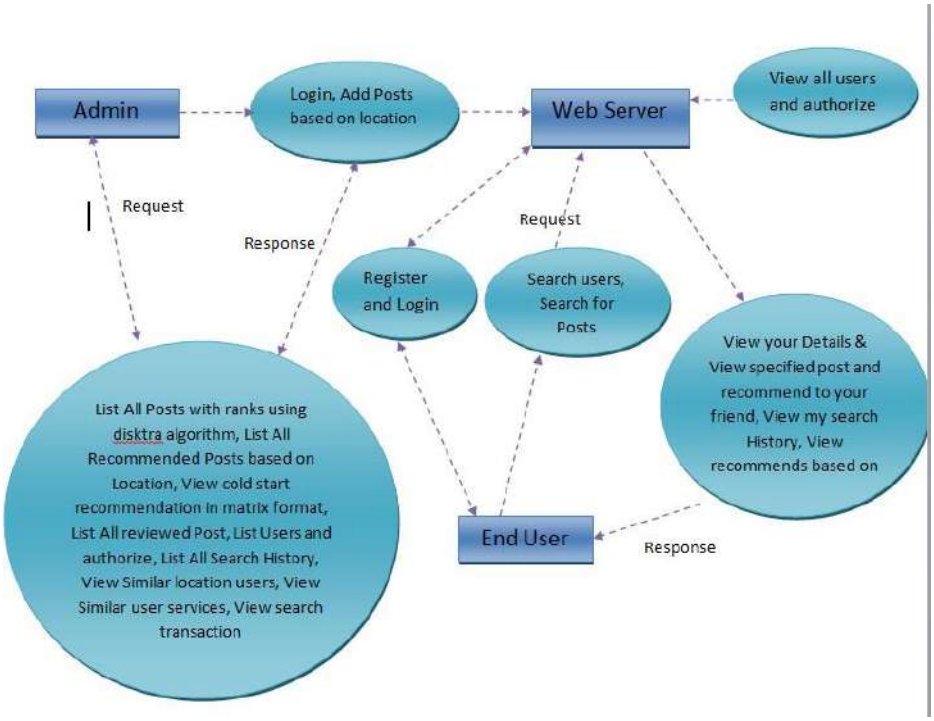

Fig 6.2Data Flow diagram

- Admin registers himself as an owner of the site, login using user id and password, admin can add posts based on locations.
- Once the End users registered to the site, the web server will authenticate the user and allows to access the services,
- Administrator will authorise the registered users,
- End users can request web server as request to search for the posts or users on a particular location,
- As response web servers will give useful information to the end user.

4.3 Class Diagram

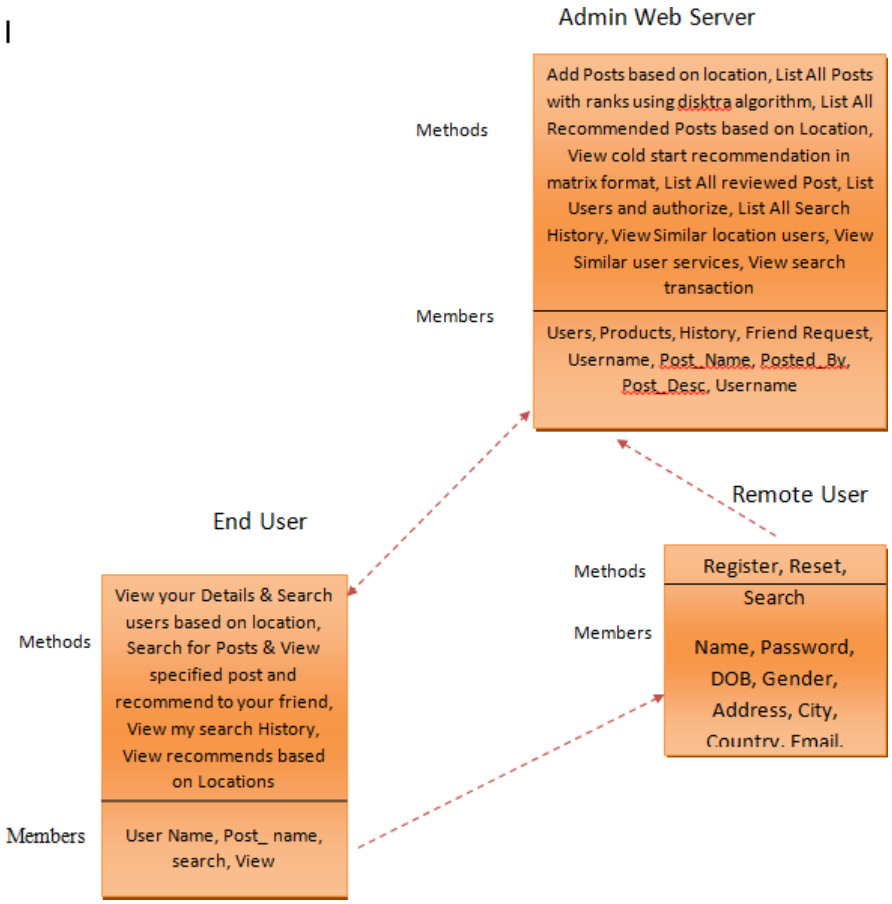

Fig 6.3 Class diagram

Admin Web Server:

Web server which displays and controls the contents of an administrator, Admin web server has the information's like Add Posts based on location, List All Posts with ranks using Dijkstra's algorithm, List All Recommended Posts based on Location, view cold start recommendation in matrix format, List All reviewed Post, List Users and authorize, List All Search History, View Similar location users, View Similar user services, View search transaction.

End User:

End users are the benefiters of the site, they can view all the posts and the friends based on the locations, also they can view their search history.

Remote User:

Users can register by giving all the necessary information, remote users can search for the posts and also recommend posts based on the locations, it will get store in the web server which is useful for the cold start users.

4.4 Flow Diagram

The entire flow chart diagram is divided into two flowcharts with regard to user and admin and the execution steps also been divided which is shown in Figure 6.3 and Figure 6.4

4.4.1. User Module

- Client should register before playing out any operations.
- When client enlists, their points of interest will be put away to the database. After enlistment effective, he has to login by providing the name and authorized password.
- When Login is success client can play out a few operations like View your Details and Search clients in light of location, Search for Posts and View determined post and prescribe to your friend, view my pursuit History, View suggests in view of Locations.

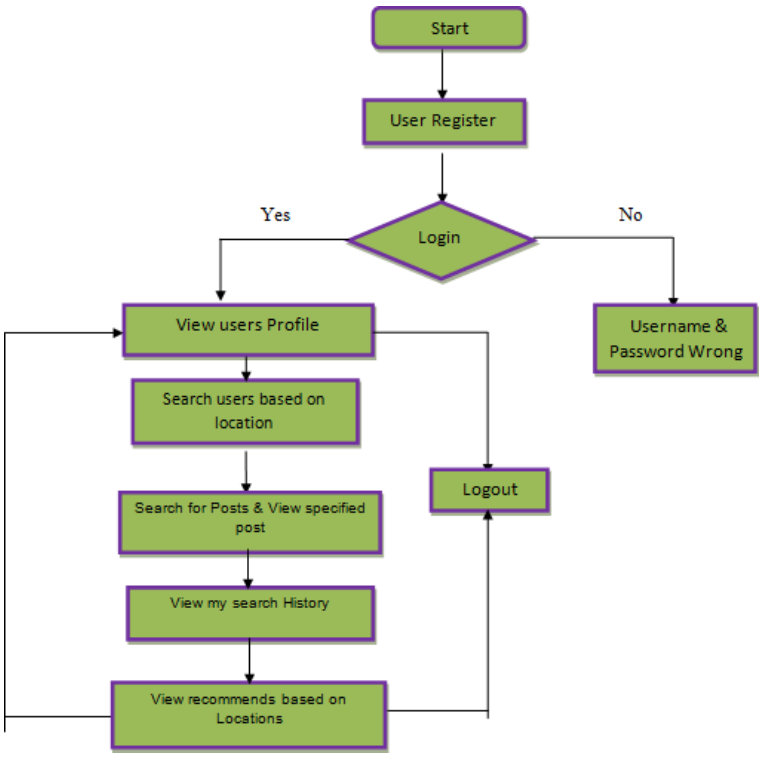

Fig 6.3Flow chart of User Execution Steps:

1) Survey Profile Details

In this module, the client can see their own particular profile subtle elements, for example, their address, email, portable number, profile Image.

2) Hunt Query by catchphrase and Display Exact and Subgroup Results

- In this, the client can scan for post by inquiry watchword and the outcomes will showed in as two gatherings.

- The one is precisely coordinated posts and the other is posts which are all has a place with coordinated post's classifications.
- The client can like or despise and can prescribe discovered presents on their companions by giving their assessment on that post.

3) View all other client Recommended Posts to You

In this, the client can see every one of his companions prescribed presents on client.

The client can see suggested post points of interest with a companion assessment on that post.

4) View other client Products Consumes points of interest with their pictures

In this, the client can see every one of his companion's items expends subtle elements that is, if thecompanion enjoyed or suggested on any post, those points of interest will be appeared in an outline with companion points of interest.

4.4.2. Admin Module

In this module, the admin needs to login by authorized name and password provided earlier.

After login success he can play out some operations, for an example, see and approve clients, Add Posts in view of area, List All Posts with positions utilizing, Dijkstra's calculation, List All Recommended Posts in view of Location, View icy begin, suggestion in grid organize, List All looked into Posts, List Users and approve, List All Search History, View Similar area clients, View Similar client administrations, View seek exchange.

V. METHODOLOGY

Let us Consider the rating matrix as well as side sequence matrices both compared to certain range, these things are described in future, exchanging hidden data; i.e., the row and column vectors in R exchanges fundamental sub-space traversed through the noted eigen-vectors forth similarity matrices A and B, correspondingly. These considerations are there since similarity matrices given supplementary data of clients as well as articles; without these things we could not gain from this information in dealing cold-start issues.

5.1 Sub-space allocation and Error transmission Prior to the algorithm, we should know about matrix co-factorization technique used for the resemblance of data. These techniques are considered as one of the efficient methods for managing cold-start issues, it provokes begin this algorithm. A basic for utilizing, sharing information of similarity matrices t, from the mutual matrix factorization for mutually gain knowledge of a familiar separation of root vectors in support of evaluation matrix R and the correspondence matrices A and B of the clients and things as described in subsequent optimization problem:

$$\begin{aligned}\min_{\substack{\mathbf{U}\in\mathbb{R}^{n\times r},\mathbf{V}\in\mathbb{R}^{m\times r},\\ \mathbf{W}\in\mathbb{R}^{n\times r},\mathbf{Z}\in\mathbb{R}^{m\times r}}} & \frac{1}{2}\|\mathbf{R}-\mathbf{U}\mathbf{V}^{\top}\|_{\mathrm{F}}^{2}+\lambda(\|\mathbf{U}\|_{\mathrm{F}}^{2}+\|\mathbf{V}\|_{\mathrm{F}}^{2})\\ &+\frac{1}{2}\|\mathbf{A}-\mathbf{U}\mathbf{W}^{\top}\|_{\mathrm{F}}^{2}+\frac{1}{2}\|\mathbf{B}-\mathbf{Z}\mathbf{V}^{\top}\|_{\mathrm{F}}^{2} \qquad (1)\\ &+\lambda(\|\mathbf{W}\|_{\mathrm{F}}^{2}+\|\mathbf{Z}\|_{\mathrm{F}}^{2}),\end{aligned}$$

Here λ is the balance factor on behalf of average solution matrix as well as regular hidden break demonstration are obtained with the identical matrix W and Z.

There are few drawbacks of this method are, culmination of unrecognized in rating matrices R also sharing of information from this to cold start clients and things are carried out parallelly. So, these completion and transduction omissions are being occurred regularly.

As solution for this problem there is a different method in this algorithm, to reduce the above risk of sharing information from sequence matrices to rating matrices through a retainable submatrix M.

This algorithm decouples the completion and transduction, it aggregates in two levels: (i) Commencing submatrix M without any error and huge prosperity, (ii) Sharing information from the submatrix for cold start clients as well as things.

5.2 A Decoupled Solution

Consider a equilateral matrix UA=[u1A,…..u8A] € Rnx8where column cells classifies row cells in rating matrices.

There is another equilateral matrix UB=[u1B,…..u8B] € Rmx8 where column cells classifies the column cells.

In order to create mathematical spaces UA and UB , it uses forth s eigen vector equivalent to the s large eigen value for the sequential matrix A and B.

Further to extraction of submatrix M, now we should get redeemed M̂ by using matrix factorizing formula which got huge success among other matrix techniques.

$$\widehat{\mathbf{M}} = \arg\min_{\mathbf{X}\in\mathbb{R}^{p\times q}} \|\mathbf{X}\|_* \quad \text{s.t. } \mathbf{X}_{ij} = \mathbf{M}_{ij},\ \forall\ (i,j) \in \Omega_{\mathbf{M}}, \tag{3}$$

Here ΩM represents collection of examined ratings of M.

As observed matrix completion method assures inferior matrix M is suitably retrieved so that examining count are satisfactory.

The Transduction stage: Let us retrieve the matrix R =Σri=1 uiviTagainst submatrix M also subspace UA and UB retrieved by similarity matrix A and B of clients and things.

Algorithm : Factorization with Decoupled Completion and Transduction

1: Input

1. R € Rnxm ,r: observed matrix and its Rank
2. A€ Rnxm : the users similarity matrix
3. B € Rmxm: items similarity matrix

2: Extract the maximal recoverable rating sub-matrix M € Rpxq

3: Complete the sub-matrix M to get M̂

4: Decompose M̂ as M̂ = iT

5: Exact suspense UA and UB by spectral clustering from similarity matrices A and B Respectively

6: Compute aî =(ŨATU) †ŨAT ui,̂ i= 1,2,….,r

7: Compute bî =(ŨBTŨB) †ŨBT ûi, i= 1,2,….,r

8: Compute R̂ = UA (iT) UBT

9: Output R̂

The complete transitions are shown in the algorithm.

Further, the evaluating data from the retrieved matrix M̂ are shared to the clod start clients and things. Forward to the R* matrix, i.e, uil and vil are extremely traversed sub-spaces UA and UB, this can be represented as,

uil= UA ai , vil = UBbi , i=1,2……,r. (4)

Here ai € Rs and bi € Rs , i= 1,2…….r represents the equilateral extension of singlular vector to the respective sub-space.

Let's substitute the Equation (4) to decoupled R* results:

R* = Σri=1UA ai biT UB = UA (Σri=1ai biT) UBT (5)

This derivation shows the method for retrieving matrix R* as averaging the vectors

ai bi , i=1,2…..r.

Now we have to know how to get submatrix M̂ also the sub-space retrieved by using similarity matrices, it will be useful for our findings.

Let's take decoupled retrieved matrix M̂ =Σri=1 uiviT. the average of vectors ai bi , i=1,2…..r. from Eq (5). Matrix R* are represented below,

Submatrix for UAbe UA € Rpxs here the exampled rows are equivalent to row sub-set matrix M̂.

Likewise, Submatrix for UBbe U € Rqxs here the exampled rows are equivalent to column sub-set matrix M̂.

A sample ai bi,i € [r] vector retrieved by equilateral representation of matrix Mfor UAand UB sorted using optimization:

$$\widehat{\mathbf{a}}_i = \arg\min_{\mathbf{a}\in\mathbb{R}^s} \left\|\widehat{\mathbf{u}}_i - \widehat{\mathbf{U}}_\mathbf{A}\mathbf{a}\right\|_2^2,$$
$$\widehat{\mathbf{b}}_i = \arg\min_{\mathbf{b}\in\mathbb{R}^s} \left\|\widehat{\mathbf{v}}_i - \widehat{\mathbf{U}}_\mathbf{B}\mathbf{b}\right\|_2^2. \quad (6)$$

Finally, Evolution of R* is :

R̂* =UA (Σri=1aĩ b̃iT) UBT

= UA (UATUA)† UAT (Σri=1u ṽiT) UB(UBTUB)† UB,

Here at the last line, we can see the facts (UATUA)† U T u͂I and (UBTUB)† UBṽi both are the optimal solutions for Eq 6.

As conclusion the evaluated rating matrices R̂ is shown as R̂= R̂*.

VI. CONCLUSION

In this work, it is anticipated a tale factorization demonstrates, called as Dec-Rec to facilitate undeniably misuse the convenience statistics regarding patrons and belongings en route for alleviate cold start issues. Two explanation components for Dec-Rec are the end result of a sub-network of the evaluation pattern, which is created with without cold start clients as well as things since the collection of patrons, along with

transduction succession commencing recouped sub-framework's offered clients and things for the individuals of cold start.

Purposely, Dec-Rec divides the realization for the information transduction, this will retain error cause of conclusion as well as transduction. There also a theoretical implementation results on the inference error of Dec-Rec although a huge segment of the current mechanisms doesn't give any theoretical help.

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Face Detection and Recognition in Real-Time Video Using OpenCV-DNN

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ABSTRACT

In recent times, face recognition has become one of the best technologies for computer vision. Face recognition is always a difficult task in computer vision. It is a software that will automatically detect the faceusing the image or video. In this paper we introduced a model which will recognize the face automatically using the DNN's model. It will perform face detection, face extraction and recognize the face using the model.We used DNN Models like Torch and Caffe, Torch will recognize the Face which is detected by the Caffethen we will classify the faces using Logistic Regression. However, the camera is continuously detecting the face every frame. We apply a model to match the geometric Characteristics of the human face.

Keywords: caffe, Torch, OpenCV and DNN

I. INTRODUCTION

Human faces play a crucial role in the cause of security's like unlocking the mobile phone and to detect the type of customer by the shop Security team. Also used in applications such as security systems, credit and debit card verification surveillance on identifying criminal public places. The main objectives of the system is to create a facial recognition system that can be emulated and eventually overcome this human capacity. This system will capture the faces from all the possible sides. Multiple face recognition algorithms have been developed and each has its own strength. Most of the time we look at a face and are able to recognize it instantly if we are already familiar with the face. This natural ability, if possible, can be justified and can be used for real life applications. That time there were many face detection algorithms. The first one is a local face recognition system, which uses facial features of a face to in timidly the face with a person. The second approach or global face recognition system uses the entire face to recognize a person. The above twoprocesses have been implemented one to another way by another algorithm. This way classification is also used to classify the face while the input in the form of collection of faces.

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II. RELATED WORKS

A. Haar Cascade- Classifier:

We have plenty of ways to recognize the Face with a high accuracy. Algorithms like Haar-Cascade Classifier and Neural Networks will give the higher accuracy. But in case if we want to classify the data especially in Three way classification all the previous work won't give accuracy above the 75-80%. Haar cascade will be used to detect single or multiple faces which is present in the frame but it won't recognize the faces. Here we calculated, the first feature selected seems to focus on the property that the region of the eyes is often darker than the region of the nose and cheeks. The second feature chosen is based on the eye's darker characteristics than the bridge of the nose. However, you do not need the same window that applies to your cheeks andother places.

B. Face Detection

Face Detection is an initial step to recognize the face. We should detect the face if we want to recognize the face. For face detection we have plenty of ways all the models will detect the face. [3] It may be single face detection or multi face detection based on the algorithm that we use; the faces will be detected by the model. Face detection using the Frame, or picture is easy for humans but it's little bit complex to teach the model to detect the unknown one with a high accuracy because face detection has many risks to detect the faces based on the angle they are facing, light level, clothing, hair colour, makeup, age and so on. When we give the photograph as the input then the output will contain the faces which are covered with the help of a bounding box around the face. When the normal images or video are given as the input then the model will return the output with the bounding box on the face of the person.

Figure1: Face Detection

C. Face recognition

Face Recognition is a computer vision technique where a system will recognize the face of people when the face is trained. This technique has the capability of matching a human face to the digital image which is taken from the picture or from the video frames.

[1] This face extraction is done after detecting the face once the face is detected in the frame or from the photograph. Then the faces which are detected will be extracted and then the extracted faces will be converted in to the numerical using the computer-generated filters and based on the numerical it will be compared with the already trained faces.

If there is any matching between extracted and the trained image, that particular name will be generated as the output. Normal images will give the pictorial explanation about how the faces are extracted from the images or frames of the video. Where the faces are detected based on the various fields which are present in the faces like eyes, nose and soon. Once the faces are detected then that will be extracted for the processing tothe model. Figure 2 will represent now the output looks.

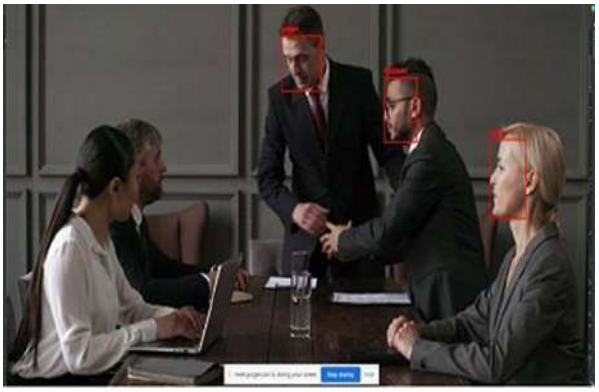

Figure2: Face Recognition

III. METHODOLOGY

A DNN model comprises three layers: Input, hidden and output layer. In the structure of DNN Each layer has multiple nodes which are connected hierarchically with the nodes in the subsequent layer. In general, Input and the output layer are single layers whereas the hidden layer may have two or more layers. The Features are taken from the input layer by the hidden layer and it will process the feature after the output layers will give the prediction values. The weights are calculated using the activation functions which are used in the hidden layer. Each hidden layer has its activation function which will receive the input as the weighted sum of nodes and it will convert that into the valid values.

We have many activation functions like ReLu , Step, Linear and sigmoid . Rectified Linear unit (ReLu) is the most used activation layer. It will give the value which equals the weighted sum of nodes exceeds or equals to zero otherwise it gives the value equals to zero. ReLu will predict the weight by repeatedly modifying the value for each DNN's Training. The weight modification happens in the reverse order like output layer to the input layer using Back propagation until the cost is minimized. The cost function can be defined as the sum ofsquares of difference between observed and predicted value.

A. Design Methodology

DNN is an ANN's with multiple layers between the input and output Layers. There are different types of neural networks and they have some similar components: neurons, synapses, weights. These components will

work like a human brain. If we give an image to the model, it will recognize the face using the predefined model present in the DNN. So that the user can review the results.

DNN has many layers so that the model is called a deep network. We are using DNN models like Touch, Caffe and the open-source computer vision Library OpenCV. figure [3] will gives the working flow of the model well how the model detects the image, using which technique it extracts the image and what are the models used in this paper to recognize the face of the person.

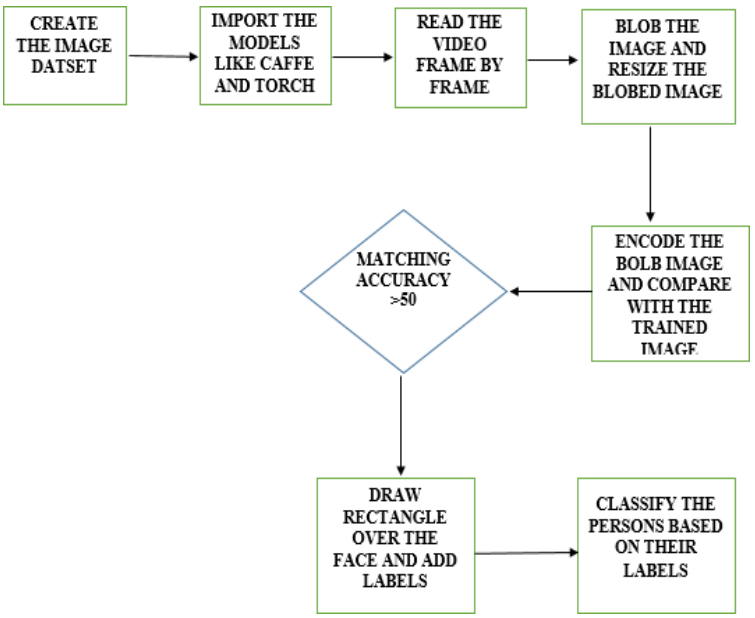

Figure 3: Working Flow of Training Model

B. OpenCV Method

OpenCV is an open-source computer vision Library. Computer vision will act as a bridge between Computer software and visualization around us. It allows computer software to learn the visualization using the training data Example: [8] Based on the shape, color and the size the model will predict the name of sample so for that we should gather data then we perform the pre-processing for the data and then train the model using the pre-processed data so that the model will understand the basic information about the data. If the data is Fruit, then it will understand the color, size of the fruit so that we can recognize the new data. We used the featuresof OpenCV which contain the DNN Frameworks like Caffe and Torch. By using Caffe we can detect the image and then the detected images will be converted into Blob Image then the Bolbed image will be given asan input to the Torch model so based on the image model will be compared with the trained data if any matches found model will print as an output.

C. Caffe Framework:

We have plenty of method to recognize a face like OpenCV is also one of the computer visions models but when we use only the computer vision models, we won't got high accuracy to get the high accurate result we

combined Deep Learning model with the computer Vision for that we have two methods like Caffe and Tensor flow. In this paper we used caffe model. For loading the Caffe model we used Cv2.dnn.readNetFromCaffe() then we should give the appropriate parameters so that the model will detect the face and using the Blob the image Cv2.dnn.blobFromImage() it will extract the images which is detected. Once the model will get the input and the label of the input then it will extract the image in term of matrix and the features like eyes, nose and ears are encoded which in terms of matrix so using the matrix the model will be trained and when we start our testing dataset the faces will be detected by the caffe it will extract the face from the image so that the features will be extracted and that will be encoded then the features are encoded.

D. Classifier

In this model we used three different classifiers to classify the faces based on the confidence of the face. Here we are given a condition that if the faces have a confidence of 0.5 which means 50% of accuracy is detected then only it will move to the further classification. Here we used a three-way classifier which classified the customer or person in terms of primary CUSTOMER (CLASS A), SECONDARY CUSTOMER (CLASS B) and finally UNKNOWN.

When the faces is captured from the live video camera then it send further for facial extraction then the extracted faces which is in the form of matrix then that matrix will be compared will the encoded form of training database then that training will be send through any of the Classification model then based on the result from the classification model the labels will be printed using OpenCV.

IV. IMPLEMENTATION

A. Support Vector Machine

Support Vector Machine is an algorithm specifically for small samples, high dimensional facial recognition problems. [11] It is one of the classifiers which is developed from generalized portrait algorithms. Because of its excellent performance in the text classification. In facial recognition we are using SVM to classify the extracted faces and to find the hyper plane for distinguishing different faces.

For the initial iteration we used SVM but it's not given good results for the three-way classification because it is special for the two-way classification and when we give the large dataset it won't classify the images correctly. [9] Because it uses the Two-Dimensional plane when we try to classify in three dimensions it gives the accuracy close to 40-50%. It's not enough for us when we implement it in the real time application.

The table 1 is used to represent the accuracy of the SVM classifier. We trained with the two samples (sample1 and sample2) sample1 has only a sample count below 10 for each class whereas insample2 we have 100 samples for each class. In this model we are using only a three-dimensional plane which will classify the facesinto three categories.

Accuracy table of SVM

Label	Data Count	Data Count	Accuracy (In%)
Mathew	6	100	40-45
Mary	5	100	45-48
Adam	7	100	50-55
Unknown	12	60-70	45-50

Table 1

When we train the sample1 we will get the Total Accuracy mean close to 45-50%. For individual label we got the accuracy like for Matthew we have 40-45, for Mary 45-48, for Adam 50-55 and the unknown class have 45-50 percent of accuracy. But in cause when we try to fit the sample two which contain large database of each sample contain close to 100images but SVM is not fit for the large database and it gives very low accuracy percentage.

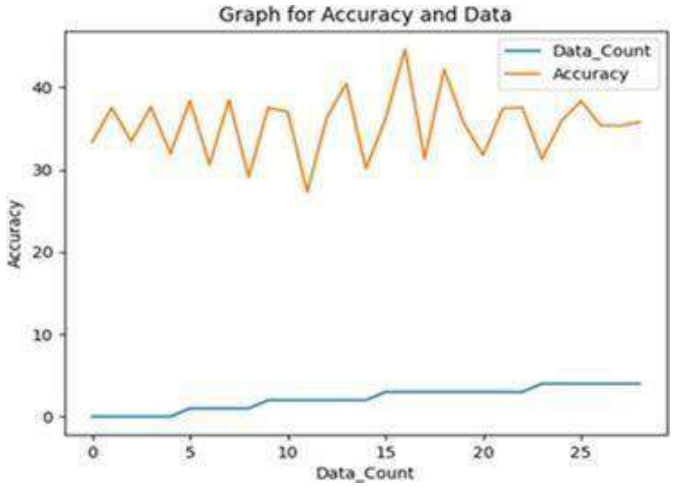

Figure 4 Graph for Accuracy and Data Count using SVM

The above will give the accuracy results about the training performance of the model. We took 30 iterations of data and at that time we got the maximum of 50-50% accuracy. But it's not good to use this classifier in the real-time application.

But this too has certain limitations that includes Due to the training data limitation we can't use this for real time face recognition. If we use the small sample the samples from the outside of the training data may be closer to the segmentation line then the data in the training set. This paper mainly focuses on the three-way classification and may be further classification in the future based on requirement.

B. Logistic Regression

Logistic Regression is one of the supervised learning classifiers where it will classify the data into two sets. If the nature of the format is in binary then it will be(0'sand1's) or in the case of face recognition it will be like(known and unknown).we have different types of logistic regression to classify the face based on the

requirements. Compared to SVM we can use this classifier for the larger database and it contains different classifiers so that we can classify among them. If we want to predict the unknown and known we can make use of a binary classification model.

But now we need an unordered classification like customer A, customer B, Unknown so we used Multinomial so that we can predict faces with a high accuracy compared to the Support vector machine. We have some constraints that should be followed to get a high accuracy in the Logistic Regression. Make sure that the model doesn't have any multi co linearity which means the independent variables means the labels should be independent of each other. In this paper we have used Multinomial Logistic Regression so that we can predict three or more classifications in an unordered manner. In case of Logistic Regression, the linear function is used as an input and the relation g in the following relation.

Accuracy and Data count for Logistic Regression

Label	Data Count	Accuracy (In%)
Mathew	10	60-65
Mary	10	60-65
Adam	10	60-65
Unknown	10	60-62

Table 2

Here we used both small as well as the large sample where the large sample contains 100 samples for each item and Logistic Regression gives the accuracy maximum of 60-65 but in case of real-time application, we can't use these kinds of classifiers to classify the faces.

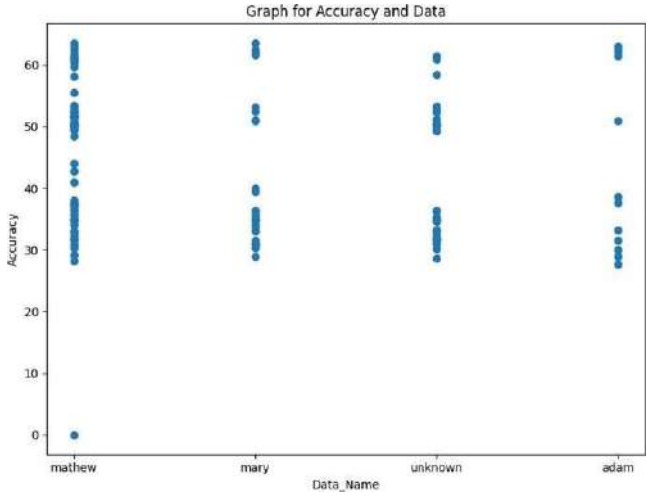

Figure 5 Graph for Accuracy and Data Count using Linear Regression

Here in the above given graph for the accuracy of each label. Multinomial Logistic Regression gives the accuracy for each label maximum of 60-65. For Mathew (60-65), for Mary (60-65), for Adam(60-65) and finally it gives low accuracy for unknown(60-62). But it's not a good result when we work on real time projects so we move on to the next Classification model.

C. Random Forest Classifier

Random forest is one of the popular machine learning algorithms that belongs to supervised learning. It can be used for classification and also for regression problems. It will be suitable for both small as well as the large sample. It works based on the ensemble learning which means it will combine the multiple classifiers to solve the real time complex problems to improve the performance of the model. Random Forest will split the given set into different subset so based on the solution of the subset it will find the mean for the accuracy of the subset then it returns the overall accuracy. If we use the large number of trees, it will give high accuracy and will prevent the model from overfitting. The random forest combines multiple trees so that If one tree may give wrong output and another will give the correct output but in the cause of overall results it will give the correct output only when the input images or training images have very low correlations. The database should contain some actual values so that the model will give a high accuracy instead of a guessed result.

Random forest will work in the two phases initially it will create the random forest by combining the n decision tree and second it will make predictions for each tree created in the initial stage. The Major advantage of using the Random Forest is it will take only less to train the model and gives the accuracy at the high rate when the training dataset is in the clear format.

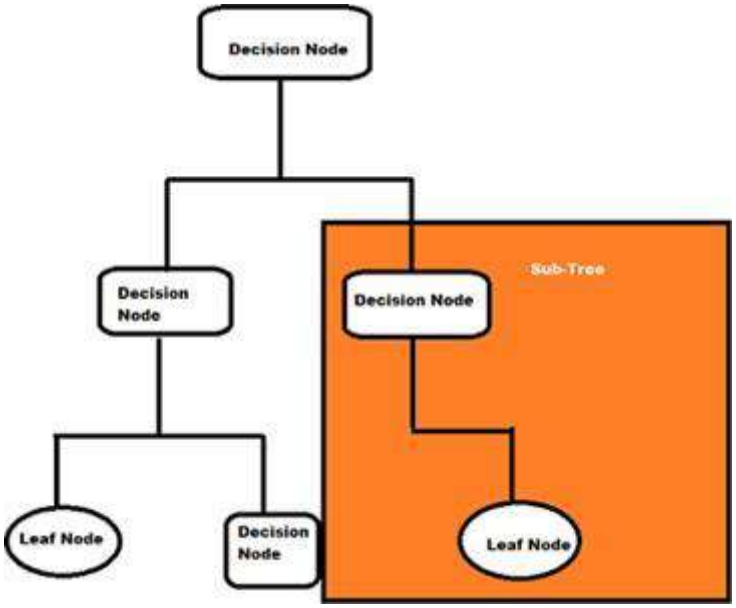

Figure 6: Classification

The above figure gives the Pictorial representation of random forest where this type of classifier will divides the given testing set in to different point based on the RANDOM STATE specified by the user input and then the divided set will be evaluated which means the divided set will be compare the extracted features with the trained feature (it will continue for each and every set taken) so based on the mean of the result the label will be printed so using this model we will got the high amount of accuracy.

Accuracy and Data count for Random Forest

Label	Data	Accuracy
Modi	100	80-85
Musk	100	85-87
Obama	100	80-85
Trump	100	78-82

Table 3

In table 4 we classify the given training into three parts so when we compared to the other two models like Logistic Regression and the SVM they gave the accuracy maximum of 60% but here in random forest it gives the accuracy with a high rate. When we compare to the previous works if we predict the model with on three-way classification mostly the accuracy will be maximum of 75-80 but for us, we got the accuracy close to 80-85 for each label when we implement it.

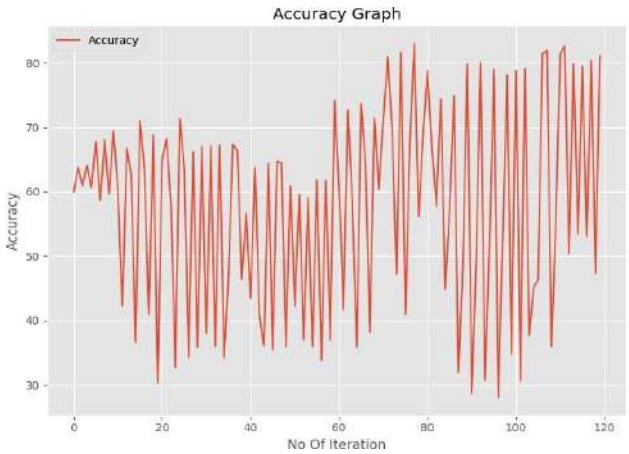

Figure 7: Random Forest accuracy and the Iteration

The above given graph represents the graph which gives the accuracy of the Random Forest classifier and x-axis denotes the count or no of iteration and y-axis denotes the accuracy of each iteration. So, we can use this because of the large database and in the real time recognition we can use this classification model.

V. COMPARISON MODULE

Comparing the above algorithms and their performance the below table gives the comparison between the three types of classification model that we tried in this face recognition model. SVM gives the accuracy maximum of 45-50 then we move to the Logistic Regression gives the accuracy of 60-65 and then finally we got the high accuracy using the Random Forest algorithm. Random Forest classifier gives maximum of 80- 85% accuracy.

Comparison between the classifiers:

LABEL	SVM	LOGISTIC REGRESSION	RANDOM FOREST
Mathew	40-45	60-65	80-85
Mary	45-48	60-65	85-87
Adam	50-55	60-65	80-85
Unknown	45-50	60-62	78-82

VI. DATASET

In this study we used publicly available data sets for research and study purposes from kaggle. We used two different samples; one is self-created dataset and the other data set was taken from kaggle.
First one is a small dataset which contains only 45-50 samples and it's mainly for the SVM classifier and then the external sample which is taken from kaggle contains almost 470 images which are classified into five parts (Musk, Modi, Trump, Obama, Unknown).

DATASET 1 Large Sample

DATASET 2: Small Sample

VII. CONCLUSION AND FUTURE WORK

With the above topics and discussion, we have clearly given a detail on how the face recognition model can be used to do different applications in our day-to-day life and the method to work on face recognition and to achieve automation in the same.

Face Recognition is nowadays mostly used in computer vision techniques. We used OPEN-DNN models like Caffe and torch with the help of three different classifiers which are used to classify the images and finally we selected one of the classifiers which suits our model.

Which is the classifier which works on the three-way classification and in the large dataset which is Random Forest so using this we achieve a max of 80-85%accuracy.

We can use this face recognition for attendance verification and also for the security purpose for the house, crime detection and in any other working places.

Now we classified this model as a three-way classification (for the customers) we have enhance this model to the multiple level classification so that we can use this type of security for the webpage like in the login page itself we can use this kind of login and also used for some important examination.

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Study on Financial Management Model for Scientific Research

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ABSTRACT

Research activities have become an important part of today's society. How to effectively manage scientific research funding is the purpose of this research. This article first analyzes the necessity of establishing scientific research financial management model, and then introduces the content of scientific research financial management. Finally, it designs a simple and practical model for the scientific research financial management. The practical application shows that this model is of great help to the promotion of scientific research financial management in Indian colleges and universities.

Keywords— Financial Management; Models; Scientific Research; funding.

I. INTRODUCTION

to Research funding has played a crucial role in promoting scientific research and technological development, and technological achievement transformation and promoting technological innovation. All along, withIndia's increasing emphasis on the development of scientific and technological innovation, the government's investment in scientific research has been increasing Scientific research activities have become an important part of social activities and an important means to promote social development and progress. The management of scientific research projects includes project application management in the early stage, mid- term research management, and later-stage results management. The management of scientific research fundsis an important link in the management of scientific research projects. It always runs through the early, middle, and late stages of scientific research.

In recent years, the government has increased its support for scientific research activities. The proportion of research funds in the total social budget has increased year by year. At the same time, the government has also introduced a large number of financial management policies and strengthened the management requirements for scientific research funds. In order to adapt to the society and make the scientific research activity process meet the government's management requirements, it is necessary to seek an effective financial management model for scientific research management. The projects are divided into vertical scientific research projects and horizontal scientific research projects according to the sources of funds for scientific research projects. The vertical scientific research projects refer to scientific research projects funded by government departments, which are divided into national-level key projects, national-level projects, provincial-municipal-level key projects, provincial and municipal-level projects, and division-level projects, school-fund projects and so on, according to different levels of funding. The horizontal research projects refer

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to scientific research projects that are funded by enterprises. Because of the diversity of funding sources for scientific research projects, there are different financial management requirements. Different levels of vertical scientific research projects have specific document provisions and specific financial management regulations. Horizontal research projects are only required to meet the objectives of corporate research in accordance with the contract, and are looser in financial management than vertical research projects. However, in the actual financial management process, the funds for vertical scientific research projects cannot be fully implemented according to the relevant documents, and the horizontal research projects also have breach of contract responsibility. Therefore, we need to find a financial management method so that scientific research activities can be carried out in an orderly environment of guaranteed quality and quantity.

II. CONTENTS OF FINANCIAL MANAGEMENT FOR SCIENTIFIC RESEARCH

The ultimate goal of financial management for scientific research is to maximize the benefits of the project sponsors, project undertakers, and the unit of the undertaker. As the financial management runs through the whole process of establishment, implementation and final acceptance of scientific research projects, therefore, the content of financial management for scientific research includes formulating project budgets according to the purpose of scientific research, supervising project management and project contracts, supervising the expenditures during the execution of projects, and finalizing the project funds when the project acceptance ends, and processing the balance funds and so on.

A. Financial Management for Scientific Research in the early stage

In the project establishment phase of the scientific research, the key to financial management is to properly formulate the project budget. The so-called rational budgeting is to realistically evaluate the cost of scientific research projects according to the needs of project implementation. At present, there are obvious problems in the financial management for scientific research in the project establishment stage in India, which is mainly reflected in the fact that the budget for the project cannot fully reflect the costs necessary to obtain the expected results. Expenditure terms included in the budget are often inconsistent with the costs incurred in the actual implementation of the project. The reason for this distorted budget is that the originally reasonable budget expenditure clause may contradict the ongoing national policy at this stage. For example, in the budget category, most projects do not allow the inclusion of labour costs in the budget, except for certain special item categories that clearly specify the labor costs. In practice, it is a well-known fact that all projects have a non-proportionate amount of labor expenses during the implementation process. Even in the categories of projects where the labor service fees are allowed to be included in the budget, the calculation method and the limitation of the expenditures are still not scientific and reasonable. Therefore, the core content and difficulty of scientific research financial management in the project establishment stage lies in how to formulate a reasonable budget system and budget standards.

B. Financial Management for Scientific Research in mid-term stage

The financial management of the project implementation stage is the execution and continuation of the budget and its main basis is the specific provisions on the use of funds by the State's financial accounting policies and project contracts. The financial management at this stage mainly belongs to the technical level and is an important aspect of the process management of scientific research projects. The main content of financial management at this stage is to supervise the project undertaker to implement it in accordance with the provisions of the project budget, and to ensure that the country's relevant financial accounting system is strictly observed during project implementation. The main purpose of financial management in the implementation of the project is to ensure that the funds are in accordance with the stipulated expenses of theproject sponsors in the project contract, and at the same time to avoid the risk of funding that the scientific research project may bring to bear the unit.

C. Financial Management for Scientific Research in final stage

The scientific research management in the final stage includes the acceptance of the results and the final accounts. In the case of the normal implementation of the first two phases, the main content of the financial management in this stage is to prepare the final accounts report on the technical level. At the policy level, management policies should be formulated for the project financial final accounts. From the consideration of the unit's interests, the project must avoid risk operations during the implementation process. Therefore, the undertaking unit must establish an early-warning mechanism for the expenditure in the first two phases of the management policy. The main content of financial management in the final accounting stage is to formulate the reasonable distribution proportion of surplus funds.

III. FINANCIAL MANAGEMENT MODEL FOR SCIENTIFIC RESEARCH

Through the foregoing introduction, we have already understood the content that scientific research financial management needs to solve. The author designs a set of financial management model which runs through the whole process of scientific research activities. Specifically, it includes a series of activities such as application for funds for scientific research projects, project implementation, project inspection and project final accounts.

A. Model for Funds application

A funding model is a methodical and institutionalized approach to building a reliable revenue base that will support an organization's core programs and services. While it is common practice among most non-profits to seek funding from multiple sources, research has shown that 90 percent of the largest non-profits have embraced funding models built around a single dominant source of revenue (such as a government group, a corporation, or an individual donor). As we all know, both vertical and horizontal research projects must prepare financial expenditure budgets at the beginning of their application. Government departments or enterprises find the most reasonable way to compare the budgets they have compiled to fund or cooperate.

Then, if we want to obtain funding for scientific research, the preparation of a set of competitive budgets is a key step. How can you complete the task accurately and quickly? We need to establish a financial budget

model for project application. We illustrate the application of a vertical research project as an example. First of all, we have to collect a large amount of historical data of the projects that have been approved for this project types used to build an expert database.

The main content is the proportional relationship between the various expenditure expenses and the total expenses, i.e., the determination of the cost coefficients. Second, it is necessary to familiarize with various regulations and set adjustment parameters for various expenditure budgets in accordance with the latest regulations. If there is data to show that the proportion of personnel expenses required by the government is enlarged, and the control of material testing fees is strengthened, then the proportion of material testing fees will be reduced and added to personnel expenses.

In addition, it is necessary to consider that different disciplines have different characteristics. For example, the proportion of travel expenses in the humanities discipline is greater than the proportion of travelexpenses in engineering disciplines, and the proportion of material test fees in the same engineering disciplines is greater than that in the humanities disciplines.

The data model which describes above concept is explained as follows with equation.

The data model is as follows:

Set total Funding = Qi; expenses = Ai, Bi, Ci, ...; cost factor = WA, WB, WC, ..., then:

Other cost factors WB, WC, ... are also calculated as above.

After calculating all the cost factors W,we can calculate all the budgets of the projects that we want to apply for

The calculation model is as follows:

$$W_A = \frac{\sum_{i=1}^{n} Ai\ Q_i}{10} * 100\ \% \qquad (1)$$

Let's take the cost A as an example. Set the adjustment parameter = ZA, then:

A = Q*(WA + ZA) (2)

The other costs B, C, ... are also calculated as above. The sum of the various types of costs A, B, C, ... calculated above is the total budgeted expenditure Q.

After the budget calculation database is established, as long as the total amount of funds for the application project is determined, the budget plan for the application project can be accurately and quickly completed.

B. Adjustment of research budget management model

After the project application is approved, the approved funds are often different from the reported budget amount, and adjustments need to be made accordingly. At this time, we can also use the above application budget model to adjust the budget. The new budgetary expenses can be calculated by multiplying the total amount of funds approved by the superior and the various cost factors determined in the budget. Calculating the adjusted budget in this way is often very easy to approve, scientific research funding will naturally be put in place quickly, and scientific research work will be carried out smoothly.

C. Management model of scientific research funds

In general, project funds are allocated in batches. When the government's first batch of funds is in place, the finance department should immediately establish a separate project code for each project according to the special fund-specific principle. Under the corresponding project code, a financial index account is established according to the amount of project budget, and the expenditure of project funds is controlled. At this time, the control is on the total amount, because different periods of time, scientific research projects have different funding needs, it is impossible for the equal proportion of expenditure in each period. Therefore, we can only control the total amount. Afterwards, the funds can be directly accounted for under the established project code. We need to use the accounting process model for project accounting.

The block diagram of this model is shown in Fig.1.We have defined the funding budget for scientific research projects at the beginning of the project, and also defined the total amount of expenses for various types of expenses through a computer program. Even if the scientific research project undertaker forgets the amount of the project budget, our financial management model will also prompt to ensure that the scientific research project is executed strictly in accordance with the budget and the contract. After the expiry of the implementation of the scientific research project, the project will be completed and the use of funds for research projects will be reported. For funds, it is to check whether scientific research funds are used in accordance with the requirements of the budget and require the production of true financial statements for project expenditures. Because of the control and management of the above steps, the expenditure on scientificresearch cannot exceed the budget. Therefore, for the final accounts, as long as they are collected and summarized according to the contents of the accounting treatment, a complete and true financial statement can be obtained.

The term ‘funds’ has a variety of meanings. It may be taken as ‘cash’, and in that case, there is no difference between a Funds Flow Statement and a Cash Flow Statement. The International Accounting Standard on ‘Statement of Changes in Financial Position’ recognises the absence of single, generally accepted, definition of the term. As per IAS, the term ‘fund’ refers to cash and cash equivalents or to working capital.

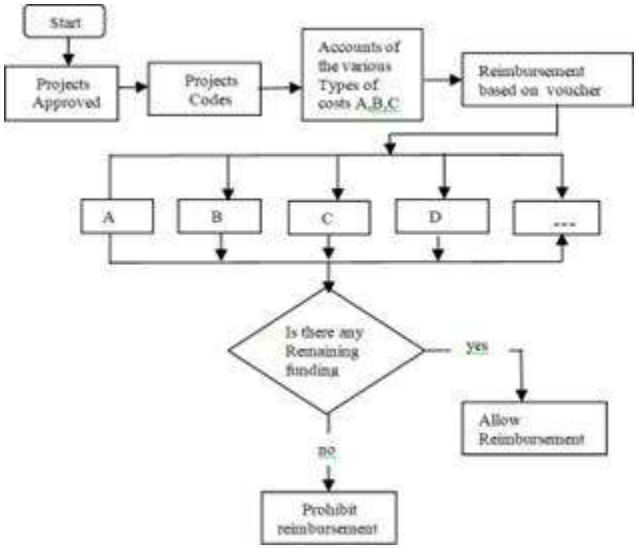

Fig. 1. Block diagram of management model of scientific research funds

IV. FUNDS AND CASH FLOW ANALYSIS

A. Fund flow statement

This is one type of statement of flow of funds widely used by financial analysts, credit granting institutions and financial managers. The Income Statement and the Balance Sheet have limited role to perform as far as the question of analysis of financial position is concerned. The term 'funds' has a variety of meanings. It may be taken as 'cash', and in that case, there is no difference between a Funds Flow Statement and a Cash Flow Statement. The International Accounting Standard on 'Statement of Changes in Financial Position' recognises the absence of single, generally accepted, definition of the term. As per IAS, the term 'fund' refers to cash and cash equivalents or to working capital. Here, with regard to working capital, it means net working capital. The term 'flow' means change and the term 'flow of funds' means 'change in funds' or 'change in Working Capital'.

This means that any increase or decrease in working capital is 'Flow of Funds'. In business some transactions cause increase of funds while others decrease the funds, and some may not make any change in the position of funds. Where a transaction results in increase of funds, it is called a 'source of funds' and where a transaction results in decrease of funds, it is an 'application or use of funds.

B. Cash flow statement

A cash flow statement depicts the change in cash position from one period to another. It explains the reasons for inflows or outflows of cash, and helps the management in making future plans. A projected cash flow statement or a cash budget will help the management in ascertaining future cash requirements to meet the obligations to creditors, payment of bank loans and payment of dividend to the shareholders. Planning ofcash resources enables the management in managing situations of cash shortage or to find productive avenues in case of surplus cash etc.

C. Difference between cash flow analysis & funds flow analysis

The following Table 1 depicts the major difference between cash flow Analysis and fund flow Analysis.

Table 1 Comparison of cash flow analysis & funds flow analysis

Cash flow	Fund flow
Concerned with change in cash position between two balance sheet dates	Concerned with changein working capital between two balance sheet dates
It is merely a record of cash receipts and disbursements.	For a better understanding of short- term solvency of a business, cash balance aswell as other current assets are also to be considered
Serves as a financialanalysis tool in short periods	It is a financial analysistool for a long period
Inflow of cash resultsin inflow of funds.	Inflow of funds may notnecessarily result in inflow of cash.

An increase in a current liability or decrease in a currentasset (other than cash) result in increase in cash andvice versa	An increase in a currentliability or decrease in acurrent asset result in decrease in working capital and vice versa

D. Uses of cash flow analysis & funds flow analysis

1) Uses of fund flow: Funds flow statement is a tool for analysis and understanding changes in the distribution of resources between two balance sheet dates.

It explains the financial consequences of business operation. It gives reasonable answers for intricate queries such as regarding the overall creditworthiness of the business, the sources of repayment of the term loans, funds generated through normal business operations, utilisation of funds etc. It acts as an instrument for allocation of resources. It serves as a test of effectiveness or otherwise use of working capital.

2) Uses of cash flow: Cash Flow Statement is a short- term planning tool. Analysis of different sources and applications of cash help the management in making proper cash flow projections for the future. The advantages of cash flow analysis are in the areas of Cash Management Internal financial management, Cash movements, Cash planning.

V. CONCLUSION

The conclusion that science and technology are productive forces has been fully demonstrated in today's society. Scientific research activities have an increasing impact on the society. Only by using scientific research funds well can we promote the rapid and healthy development of the society. In this paper, a set of financial management model of scientific research is established according to the actual situation of scientific research in Indian universities. The practical application shows that this model is of great help to the financial management of scientific research in colleges and universities.

By comparing both Scientific Management and Human relations Model it is evident that scientific management maximise productivity through structure, rules and regulations where as Human relations looks at how work and home life can affect productivity. Lastly, the influences of scientific management are still visible in today's modern business. This is shown mainly in the fast-food industry where there is a set procedure to be followed. Overall, this model has demonstrated that it is successful in the past and in the modern business of today.

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A Survey on Machine Learning Algorithms for the Detection of Chronic Kidney Disease

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ABSTRACT

Artificial Intelligence and Machine learning (AI/ML) can make a tremendous contribution to the early prediction and detection of various diseases. Chronic Kidney Disease (CKD) is now a global health problem with a high mortality and morbidity rate as it shows no visible symptoms in the early stages of this disease. This survey aims to study previous research work aimed at the application of machine learning and artificial intelligence for the prediction of CKD in its early stages. The accuracy and areas of application of various algorithms are studied and compared. The objective of this literature review is to provide an overview of the studies used for the prediction of CKD in the recent past and identify the gaps for future research. Comparative analysis is done on the accuracy of different machine learning algorithms for the early prediction of CKD. Cases of application of such algorithms into commercial mobile-based applications for health professionals for the detection and prediction of CKD are also being studied. Based on the study, possible research areas that could add to further developments in the application of AI/ML for CKD prediction are identified.

Keywords— Healthcare, Chronic Kidney Disease, Machine learning, Algorithm, Literature Survey

I. INTRODUCTION

The failure of the kidneys to filter the blood effectively shows its damage, and this condition is termed Chronic Kidney Disease (CKD), which is the leading cause of death and misery in the 21st century. Kidneys remove waste from the blood, which if not removed, causes fluid imbalances, weakness, high blood pressure, vomiting, anaemia, and exhaustion. The main risk factors that cause renal disease are diabetes, heart disease, high blood pressure, and also a family history of kidney damage. Different tests need to be conducted to determine the exact cause of CKD, and the doctor's suggestion for treatment depends on the cause of kidney failure. More than 800 million people worldwide—more than 10% of the total population—are sufferingfrom CKD, which is a degenerative disorder. CKD is a condition that is more common in women, older people, people with diabetes and high blood pressure, and racial minorities. [1]

The National Kidney Foundation (NKF) is a non-profitable organization that works for people's health. Its mission mainly promotes renal research and conducts public health education programs on kidney diseases.

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According to this foundation, kidney disease is classified into five different stages. This allows doctors to provide the best care possible, as each stage necessitates different tests and treatments. The Estimated Glomerular Filtration Rate (eGFR), a mathematical formula that is calculated with a person's age, creatinine level in the blood, and gender, helps the doctor to determine the various stages of kidney disease and treat it accordingly. [2] [3] CKD is divided into 5 stages and they are listed below.

TABLE 1 DIFFERENT STAGES OF CKD

Stages	Description	eGFR	Kidney Function
1	Normal or high GFR	90 or above	90-100%
2	Mild CKD	60-89	60-89%
3A	Mild to moderate CKD	45-59	45-59%
3B	Moderate to severe CKD	30-44	30-44%
4	Severe CKD	15-29	15-29%
5	End Stage CKD	Less than 15	Less than 15%

An important criterion of kidney function is creatinine, a waste product of muscle activity in our body. When the kidneys function well, they eliminate creatinine from the blood, and whenever the kidneys fail to function effectively, blood creatinine levels rise. Doctors usually suggest a creatinine test to reveal the proper function of the kidneys. [4] A creatinine test or serum creatinine test can be conducted with urine and blood. In the blood test, doctors estimate the GFR, and in the urine test, they measure the amount of creatinine in the urine. Testing for the presence of blood and albuminuria (the appearance of high-level albumin) in the urine can also reveal the possibility of kidney disease. If kidney disease is suspected, imaging examinations such as ultrasound, CT, or MRI scans may be recommended by healthcare professionals, and kidney tissue and cells may be taken for biopsy for a precise diagnosis. [5]

CKD is very difficult to identify in the early stages as it shows no visible symptoms. The majority of cases remain undiagnosed till they reach the end stage. This increases the delay in patients' treatment. Early detection of this disease is crucial to reducing risk and ensuring patients receive appropriate treatment. [6] AI/ML applications in clinical research are growing day by day. These technologies are attributed to the advancements in the prediction, classification, and recognition of disease. This in turn helps healthcare professionals in the early detection of renal diseases.

Medical databases used in hospitals today contain heterogeneous patient data and undergo data mining techniques to predict CKD in patients. This technique helps to identify hidden patterns from the available data. The need for an accurate, reliable, and effective predictive model helps healthcare professionals make better decisions about the prognosis of CKD. Feature selection is another basic and important step in data pre-processing to recognize the most significant risk factors related to a particular disease from the available dataset by removing redundant data. This helps to understand the underlying trends that generate the data used in prediction, which in turn improves the accuracy of classification. [6]

Machine learning (ML) techniques are highly effective at predicting CKD in patients. The current study and research provide approaches that include data pre-processing—a method for recognizing the hidden values, data aggregation; and feature extraction from clinical data for predicting the disease. Some commonly used algorithms in machine learning and data mining are K-nearest neighbour, Naive Bayes, logistic regression, support vector machine, etc. have been widely used in the prediction of CKD, but there is limited research into ensemble techniques that can improve accuracy. [6] [7]

This paper aims at conducting a literature review with various machine learning algorithms predicting CKD with the accuracy that is incorporated in one paper with commonly used machine learning techniques. According to existing research, this work also analyses the best algorithms that may predict CKD effectively and with more reliable accuracy.

II. RELATED WORK

This section concentrates on a related literature review on machine learning techniques for diagnosis and early detection of CKD.

Twarish et al. [8] used the following machine learning algorithms: Artificial Neural Networks (ANN), Logistic Regression (LR), Jungle of Decisions (DJ), and Forest of Decisions (RF) for predicting CKD. The data mining method employs the CRISP-DM® model, and the models that are chosen are trained using the Azure tool. We employ about 3,73,770 anonymized sample datasets. This study compares the aforementioned algorithm studies. Data balancing is accomplished via SMOTE algorithms. In this study, they achieved an accuracy of 75% and 80%, respectively, but failed to show high performance against the multiclass decision forests (RF) algorithm, which obtained an accuracy of 92% in the classification of the dataset.

Chittora et al. [9] researched the prediction of CKD based on the full and important features of the CKD dataset and dataset taken from the UCI repository. This study used the LASSO (least absolute shrinkage and selection operator) regression method, the wrapper method, and correlation-based feature selection. Logistic regression, C5.0, artificial neural network, Chi-square automatic interaction detection (CHAID), K-Nearest neighbours, linear support vector machine (LSVM), and random tree are the machine learning techniquesthat are applied for prediction of the CKD. For each classifier, results are computed based on selected features using all the mentioned feature selection methods and also full features. To increase performance and achieve maximum accuracy, they utilized the SMOTE system. In this study, LSVM achieved the highest accuracy in CKD prediction with 98.86% in SMOTE with full features. This study also used the same dataset for modelinga deep neural network that achieved the highest accuracy of 99.6%, which is a better performance than other models.

Almasoud et al. [10] In this study, the researchers aim to predict CKD by modeling machine learning algorithms with a small subset of features. Different statistical tests like the Cramer's V test, the Pearson's correlation, and the ANOVA test are conducted to remove the redundancy in features. Classifier algorithms such as random forest, gradient boosting algorithms, logistic regression, and support vector machine algorithms are modelled, trained, and tested with a 10-fold cross-validation method. This study focused on

specific gravity, haemoglobin, and albumin features for the prediction of CKD. This research work achieved an accuracy of 99.6% for predicting CKD with ensemble feature gradient boosting algorithms, and all other models attained an accuracy of greater than 97%.

Ekanayake et al. [11] focused on two-step data pre-processing, training the models, and model selection. In the first step, data pre-processing of 20% of missing values were filtered out and the researchers conducted Little's MCAR test to handle the missing values. To clarify the missing value, the Chi-square test was applied to quantitative data obtained from the MCAR test. In the second step, the feature selection process isconducted, and, in this process, out of 25 features, 20 features are selected and 5 features are eliminated as a part of handling the missing values. Here 11 models are considered for training and the models are SVC witha linear kernel, k-Nearest Neighbor (KNN) algorithm, logistic regression, SVC with RBF kernel, random forest classifier, decision tree classifier, XGB classifier, Gaussian NB, a classical neural network, extra trees classifier, and an Ada boost classifier. According to the prediction, the extra trees classifier and random forest classifier shows 100% accuracy in the detection of CKD with less bias.

Nikhila et al. [12] explored the possibilities of an ensemble machine learning algorithm to find CKD in the early stages. Here, the models are trained with data that is obtained from the UCI repository. The dataset primarily contains the results of the patient's blood test and urine test, as well as general information like age, gender, appetite, etc., 10-fold cross-validation techniques were used for training and validation of the dataset. As per this study, four ensemble techniques like Bagging, AdaBoost, Gradient Boosting, and Random Forest are modelled to achieve the best performance. AdaBoost and Random Forest achieved an accuracy of 100%. Considering the data imbalance problem, bagging and gradient boosting attained an accuracy of 97.29%.

Jongbo et al. [6] proposed a structure for a machine learning model for detecting CKD. This structure includes modules like data pre-processing, building and testing the model, prediction of ensemble models, and evaluation of performance. Datasets from the UCI repository were used for this study. About 400 instances are utilized from the dataset; 250 instances are without CKD and 150 instances are with CKD. Data pre- processing involves missing value handling, data splitting, and data scaling. The researchers conducted studies with individual classifiers such as KNN, Decision Tree, and Naïve Bayes and also with ensemble techniques like bagging and random subspace ensemble to aggregate the results of other machine learning models. In this research, KNN showed the best performance with an accuracy of 95%, and with the Random subspace ensemble technique, the KNN model achieved 100% accuracy.

Desai et al. [7] found that the consistent presence of protein in urine is a key indicator of occurring CKD. Early detection can avoid worsening the disease to kidney failure. The researchers in the study applied data mining techniques to the patient's medical data to predict CKD in the early stage. Here they collected about 400 instances of medical data from the UCI repository. The data mining algorithm, Boruta analysis, ismodelled to detect CKD in the initial stage. This analysis is freely available, which helps the detection of disease more economically. In this study, approximately 24 features are chosen for disease prediction, and the nominal data are converted to numerical data such as 0 or 1. If the features are "Present", "Good", and "Normal" are assigned "1" and "Not Present", "Bad", and "Abnormal" are assigned "0". This study demonstrates

that with Boruta analysis they achieved an accuracy of 100% with all features and 99.19% accuracy with some hidden features.

Revathy et al. [13] proposed a framework that includes data collection, data pre-processing like cleaning, data extraction and data transformation to an appropriate format, modeling of the machine learning algorithms, and performance evaluation. Training datasets are accessed from the UCI repository. This study looked at disease prediction using three major machine learning algorithms: SVM, Random Forest, and Decision Tree. The R programming analytics tool is used to build the framework. The researcher analyzed the Random Forest model, which showed the best performance, with an accuracy of 99.16% in the prediction of CKD.

Krishnamurthy et al. [14] developed a machine learning model and trained the model with data accessed from Taiwan's National Health Insurance Research Database to find the occurrence of CKD after a period of 6 to 12 months. About 72,000 people without CKD and about 18,000 patients with CKD were chosen for training the model. The researchers achieved the goal by developing a predictive model using Convolutional Neural Networks. For this study, they used Scikit-learn packages for structuring the model. This package includes algorithms such as decision trees, logistic regression, LightGBM, random forest, and TensorFlow (Bi-directional long-short term memory and convolutional neural networks). This study used five-fold cross-validation for the partition of training set data into 80% and 20%. Data pre-processing, data aggregation on a monthly and quarterly basis based on requirements, and evaluation are also done. After the performance evaluation of various models, the researchers concluded that CNN showed the best performance with an AUROC metric of 0.957 and 0.954 for 6 and 12 months.

Rashed-Al-Mahfuz et al. [15] divided the disease prediction process into different stages such as data collection, pre-processing, training the model, selecting important attributes, and model evaluation. The dataset is obtained from Apollo Hospitals, Tamil Nadu, which is available in the UCI repository. About 400 instances are used for training the model. The dataset is divided into two parts: the training set and the testset (360 instances in the training set and 40 samples in the test set). Different machine learning algorithms are included in modeling the structure, such as gradient boosting, random forest, XGBBoost, and support vector machine models. A primary module in this study is important to attribute selection, which helps to reduce the cost of the diagnosis of CKD. Shapley Additive explanation techniques (SHAP) are used for selecting the main attribute from the training data set and test data set. Based on this technique, the database sets are classified into DBI, DBII, DBIII, DBIV, and DBV. The models are trained based on this data set. From all the ML classifiers, the RF algorithm shows the best performance with an accuracy of 99% with DBI as it holds primary attributes.

Wang et al. [16] researched "Predicting the Risk of Chronic Kidney Disease (CKD) using Machine Learning Algorithms". They developed the structure for predicting CKD with Random Forest, which is a Bagging Tree Model, an Xgboost relates to Boosting Tree Model, and Resnet, based on a Neural Network Based Model. In this study, they utilized 1 million samples obtained from the National Health Insurance Sharing Service (NHISS) for training the model. They built a regression model for predicting the creatinine value from 23 features. The developed ensemble model achieved the best performance with an R2 value of.5590.

Qin et al. [17] proposed effective machine learning classifiers to predict CKD. The dataset for training the model is accessed from the UCI machine learning repository. KNN imputation techniques are used for completing the missing values. For the effective prediction of CKD, they built the structure with algorithms such as a support vector machine, KNN, logistic regression, naive Bayes classifier, random forest, and a feed- forward neural network. Considering all the models, random forest attains the best accuracy of 99.75%. The combination of logistic regression and random forest improves the accuracy to 99.83%.

Sobrinho et al. [18] developed an application based on a User-Centered Approach, including patients and healthcare professionals. Data is collected from patients along with healthcare professionals in the form of deep interviews and questionnaires. The agreement between the application and the nephrologists is evaluated using Cohen's Kappa coefficient statistics. The mHealth app developed by the researchers assists healthcare professionals to detect CKD at an early stage. The Java programming language is used for app development focused on the Android platform, and the data is maintained with an SQLite database. The global kappa value for the agreement among three doctors and the app is 0.7119. In the methods of app development, they follow medical guidelines, interviews, specifications, development, evaluation, and usability tests.

III. COMPARATIVE STUDY

TABLE 2 COMPARATIVE STUDY OF DIFFERENT MACHINE LEARNING ALGORITHMS

Author	Researched on	Methodology	Outcome
Twarish et al	Implementation of Machine Learning Models for the Prevention of Kidney Diseases (CKD) or Their Derivatives	Artificial Neural Networks (ANN), Logistic Regression (LR), Jungle of Decisions (DJ), and Forest of Decisions (RF)	This study results in an accuracy of 75% and 80%. Failed to show high performance against the multiclass decision forests (RF) algorithm
Chittora et al.	Prediction of chronic kidney disease-a machine learning perspective	Logistic regression, C5.0, artificial neural network, Chi-square automatic interaction detection (CHAID), K-Nearest neighbors, linear support vector machine (LSVM), and random tree	LSVM achieved the highest accuracy in CKD prediction with an accuracy of 98.86% using SMOTE with full features. Deep neural networks achieved the highest accuracy of 99.6%. Models are trained only with data from the UCI repository, which is not adequate.

Almasoud et al.	Detection of chronic kidney disease using machine learning algorithms with the least number of predictors	Statistical tests like Cramer's V test, the Pearson's correlation, and the ANOVA test are conducted. Random forest, gradient boosting algorithms, logistic regression, and support vector machines algorithms	Gradient boosting algorithms result in an accuracy of 99.6 and with other models, 97%. Tested with a smaller number of available data.
Ekanayake et al.	Chronic kidney disease prediction using machine learning methods.	Little's MCAR and Chi-square test were applied. Linear kernel, k-Nearest Neighbor (KNN) algorithm, logistic regression, SVC with RBF kernel, random forest classifier, decision tree classifier, XGB classifier, Gaussian NB, a classical neural network, extra trees classifier, and an ada boost classifier.	The random forest classifier achieved 100% accuracy.
Nikhila et al	Chronic Kidney Disease Prediction using Machine Learning Ensemble Algorithm	10-fold cross-validation techniques were used. Bagging, AdaBoost, Gradient Boosting, and Random Forest	AdaBoost and Random Forest achieved an accuracy of 100%. Bagging and gradient boosting attained an accuracy of 97.29% with a data imbalance problem.
Jongbo et al.	Performance Evaluation of an Ensemble Method for Diagnosis of Chronic Kidney Disease with Feature Selection Technique	Missing value handling, data splitting, and data scaling. KNN, Decision Tree, and Naïve Bayes and also with ensemble techniques like bagging and random subspace ensemble.	KNN showed the best performance with an accuracy of 95%. Random subspace ensemble technique, the KNN model achieved 100% accuracy. Test conducted only with UCI repository data.
Desai et al.	Early Detection and Prevention of Chronic Kidney Disease.	Boruta analysis	Boruta analysis achieved an accuracy of 100% with all features and 99.19% accuracy with some hidden

			features.
Revathy et al.	Chronic kidney disease prediction using machine learning models	SVM, Random Forest, and Decision Tree. The R programming analytics tool used	Random Forest model achieved an accuracy of 99.16%. Trained the model only with the dataset from the UCI repository.
Krishnamurthy et al.	Machine learning prediction models for chronic kidney disease using national health insurance claim data in Taiwan.	Scikit-learn packages for structuring the model. Five-fold cross-validation for dataset partitioning. Decision trees, logistic regression, Light GBM,random forest, and TensorFlow (Bi-directional long-short term memory and convolutional neural networks).	CNN showed an AUROC metric of 0.957 and 0.954 for 6 and 12 months.
Rashed-Al-Mahfuz et al.	Clinically applicable machine learning approaches to identify attributes of Chronic Kidney Disease (CKD) for use in low-cost diagnostic screening	Gradient boosting, random forest, XGB Boost, and support vector machine models. Shapley Additive explanations techniques (SHAP) are used for main attribute selection.	The RF algorithm shows the best performance with an accuracy of 99% with the primary attribute.
Wang et al.	Predicting the risk of chronic kidney disease (CKD) using a machine learning algorithm	Random Forest, which is a Bagging Tree Model, an Xgboost relates to Boosting Tree Model, and Resnet, based on a Neural Network Based Model	The developed ensemble model achieved the best performance with an R2 value of.5590. In some cases, accuracy is reduced due to variationsin creatinine value.
Qin et al.	Design and evaluation of a mobile application to assist the self-monitoring of chronic kidney disease in developing countries	Logistic Regression, Random Forest, Support Vector Machine, K-Nearest Neighbours, Naive Bayes, and Feed Forward Neural Network	The developed model with the RF algorithm gives an average accuracy of 99.83%. Failed to diagnose the severity of CKD

Sobrinho et al.	Design and evaluation of a mobile application to assist the self-monitoring of chronic kidney disease in developing countries	Java Programming Language and Database are managed by SQLite database.	The mHealth app is developed based on the UCD approach. The global kappa value for the agreement among three doctors and the app is 0.7119.

IV. RESEARCH GAP

From the literature review, it is observed that the current research approaches in data-driven healthcare informatics are largely based on a single source of data for any specific medical condition. It is also observed that most of the research approaches use a single machine learning or analytics algorithm for deriving predictions from data. The proposed research is about addressing the aforementioned research gaps by developing a data-driven predictive analytics engine for healthcare informatics, which would be based on multiple data sources as input, like scanned uploads of lab report documents, data feeds from IoT-based vitals monitoring devices, and symptoms reported by patients from time to time. From this survey, it is observed that the datasets for model training are used from the UCI repository and are less collected directly from hospitals, which may improve the reliability and efficacy in predicting CKD. Research can be more focusedon Indian medical conditions as the number of CKD cases reported is increasing day by day. The Ensemble Machine Learning technique can be used to combine multiple machine learning algorithms and thus generatean effective and efficient prediction on the previously mentioned dataset.

V. CONCLUSION

This survey on machine learning algorithms explores the best model for the prediction of CKD. Chronic kidney disease is one of the diseases that have a high fatality and morbidity rate. Early diagnosis of this disease can reduce the mortality rate and prevent it from leading to comorbidity diseases. IoT, ML, and AIplay a big role in different areas of the healthcare field. This research emphasizes the importance of ML algorithms for the prediction of CKD in the early stages. The commonly used machine learning algorithms for modeling are Random Forest, XGBBoost, Artificial Neural Networks, Logistic Regression, KNN, Decision Tree,Naive Bayes, linear support vector machine (LSVM), and gradient boosting algorithms. Research for other machine learning techniques is also being done. This study supports the fact that the Random Forest and Gradient Boosting algorithms provide the best performance in the prediction of deadly CKD. Most of the researchers used the dataset from the UCI repository for training the model, which has about 24 features and 400 instances with a lot of missing values. Other techniques are applied for filling in the missing values and

also for the feature selection. In the performance evaluation, most of the studies maintain accuracy of between 98% and 100%. This survey also mentioned a mobile application developed to assist healthcare professionals predict CKD in the early stages. In the future, this research may assist doctors to predict CKD in its early stages and thereby reduce the mortality and morbidity rate.

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Preventive Mechanism Against DDoS Attack Using Net Flow in Software Defined Networking

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ABSTRACT
These One of the most promising technologies for the future of networks that can achieve the parting of the control and data plane is the software-defined network. Reliability, availability and fault tolerance remains a great challenge in Centralized Software-defined network. A distributed denial-of- service attack aims to overload the target in a malicious attempt to disrupt normal traffic on the SDN network or its surrounding infrastructure with more amount of Internet data. DDoS attack has increased drastically along with SDN. DDoS attack affects the availability of the network. In this paper, first we established a metric to measure the spread and association type of attack. Then, utilising SDN's capabilities, we created a straightforward detection technique based on a response system and statistical inference model, as well as how SDN may be utilised to defeat bot- based DDoS attacks. At last, we developed an application to carry out our idea, and we evaluated its performance on a simulated network using sample network traffic. The results show our system successfully recognise DDoS flooding attacks that started in an SDN environment. We tested with OpenDaylight Controller in the Mininet emulator.
Index Terms - SDN, DDoS, Botnet, netFlow.

I. INTRODUCTION

Your Year after year Software Defined Network (SDN) is the jargon word in IT Industry. Initially when the industries started using SDN in real-time, many raised doubts about how it can serve like a traditional network device. SDN is a technology and management approach for networks that encourages flexible and effective network setup. By centralizing the network and dividing the control plane from the data plane, SDNincreases network reliability.

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Basic SDN Architecture diagram

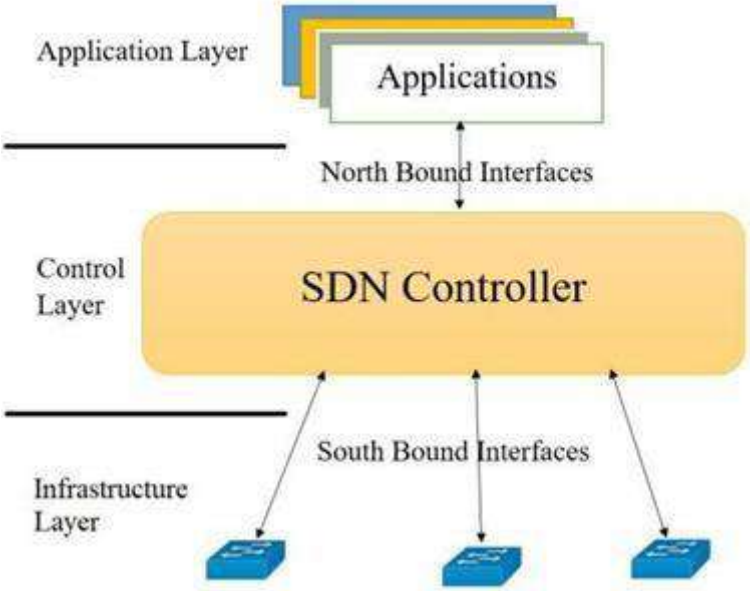

Fig.1 Basic SDN Architecture

A recent article on SDN market shares for 2022 According to predictions, the SDN industry would reach $35.6 billion by 2026 and increase at a compound annual growth rate of 25.4% from 2022 to 2027.

Some of the list of SDN Controllers

NOX/POX
ONOS
Open vSwitch
OpenDaylight
Floodlight
Ryu

In the above, NOX/POX is a Python-based controller, ONOS is a Java-based controller, Open vSwitch is also a Java-based controller, and OpenDaylight is written in Java; we utilised this controller in our work. Floodlight again a java-based controller and Ryu is a python-based controller.
NetFlow defines a mechanism for exporting flow records. A flow record summarizes a group of packets with similar attributes, it has byte count, ingress inference, source IP address, destination IP address, source TCP/UDP port, IP protocol, destination TCP/UDP port, IP ToS, start time, end time and packet count.
[1] SDN architecture is susceptible to various attacks which leads in resource exhaustion and stops SDN controller serving legitimate users. One such attack which is growing rapidly is Distributed Denial of Service (DDoS) attack. The servers can be the target of a DDoS attack by flooding the network with a massive volume

of traffic, which can exhaust the network's resources. As IoT is taking various new forms various devices are added to internet. Attackers can therefore utilise a variety of DDoS attacks by using a large number of bots that are located all over the network [1].[2] Attackers create numerous new flows that are sent from a single source (DoS) or multiple sources(DDoS) but contain spoof IP addresses.

Types of DDoS attacks
SYN Flood, Ping of Death, UDP Flood, ICMP (Ping) Flood, etc.

SYN Flood
The "three-way handshake," in which a SYN request is made, followed by a SYN-ACK response from the host, and finally validated by an ACK response from the requester, is known to be unreliable. A SYN flood DDoS assault takes use of this weakness. In a SYN flood situation, the requester pushes further SYN requests while either ignoring the host's SYN- ACK answer or sending the SYN inquiries from an erroneous IP address. In both cases, the host system keeps waiting for a response to each request, tying resources until no further connections can be established, and eventually takes to denial of service.

Ping of Death
A "ping of death" assault (or "POD") entails the attacker delivering several malicious or distorted pings to a machine.

UDP Flood
By definition, a UDP flood is any DDoS assault that inundates a target with User Datagram Protocol (UDP) packets.

ICMP (Ping) Flood
An ICMP flood sends packets as quickly as possible without stopping to wait for responses, overwhelming the target resource with ICMP Echo Request (ping) packets.

II. RELATED WORKS

In paper [3] the author used some of the machine learning methods such as support vector machine (SVM), artificial neural network (ANN) to mitigate DDoS in SDN along with OpenFlow protocol and favoured these strategies, saying that they offer excellent DDoS attack management research opportunities. S.Lim et all [4] presented an OpenFlow-based SDN controller-based DDoS blocking application. When the server is about to crash, the application gives it an updated IP address. Any further client arriving by now is redirected to the new IP address. A unique technique for differentiating Flash crowds and DDoS attacks was put out in Paper [5] and was depending on the mix of the metrics reflecting their contrasting behaviour patterns. These criteria include the requested web page, client validity, and flow similarity. Attack patterns are substantially

more comparable than normal users since they are all managed by a single-master. This is referred to as flow similarity. When it comes to client legitimacy, it mostly shows that a small number of people make more requests for attacks than a large number of people do for a flash crowd, and that attackers tend to come from fresh client clusters however flash crowds are more likely to come from well-known client clusters. The web page asked for mirrors the distinction between attackers or bots, who visit pages at random, and regular human users, who constantly attempt to access hot pages. OpenFlow-based technique to reduce TCP SYN flood assaults in contradiction of web servers was put out in Paper [6]. The controllers and switches function in a manner that a request for the formation of a TCP connection is only sent to a TCP server after the host making the request has established its legitimacy. Controllers take on the role of a proxy and give the requesting host a SYN ACK in response. If the anticipated subsequent When an ACK is received, the host receives a RST message, and the controller issues the switches a rule allowing this access.

III. PROPOSED WORK

Here we to quantify the key components of a DDoS flood attack caused by bot, we developed a 2-dimensional metric called spread-association degree. This metric measures the degree to which a flow is spreads and associates on one dimension, as well as the flow's intensity in the other dimension. We give spread association degree as a 2-dimensional tuple (x, y). We take the degree of spread and association of destination flow fj. With help of the DCN Controller we will get the live topology information with the global view. There are n nodes in our network. Node set N =
{Ni|Ii = 1…n}, So that element Ni stands for the i-th node.

$$let: A = \bigcup_{i=1}^{n} N_i$$

$$\forall f_j \in A: x_j = \sum_{k=1}^{n} J\ (f_i \in N_k)$$

$$\text{Where}: J(f_j \in N_k) = \begin{cases} 1 & f_j \in N_k \\ 0 & f_j \notin N_k \end{cases}$$

Algorithm Detection ($N_1, N_2, \ldots N_n$: d-flow)
Input: $N_1, N_2, \ldots N_n$ nodes
Output: Q Result of normal traffic without attack

$$P: = \bigcup_{i=1}^{n} N_i$$

$Q: = \varnothing$
$m: = |P|$
for i: = 1 to m do
$x_i : = 0$
$y_i : = 0$

For j := 1 to n do
if ($f_i \in N_j$) then
$x_i = x_i + 1$
$y_i = y_i + F_j(f_i)$
End if
End do
if ($x_i \geq T_i$ && $y_i \geq T_y$) then
Call sliding_window_queue_response(S)
else if ($x_i \geq T_x$ && $y_i < T_y$) then
Call sliding_window_queue_response(R)
Else
$add\ (x_i, y_i) to\ Q$
Abolish occurred response of flow(j)
End if
End do
Return Q

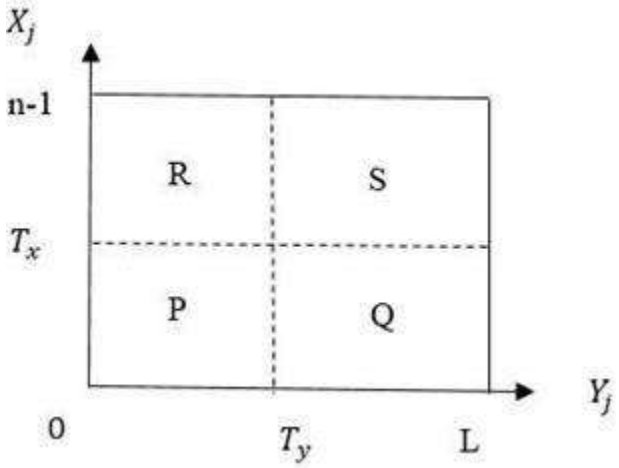

Fig.2 tow-dimension perception plot

We make a 2D perception plot as shown in Fig.2. If the co- ordinates present in location P, it shows that d-flow j is normal. If the co-ordinates in region Q is related to how a small number of users of fast Internet service generally go about downloading movies or other items. If the co-ordinate is in R and S it is considered as an attack traffic flow and trigger drop action to minimize it or preventing queue action to reduce it.

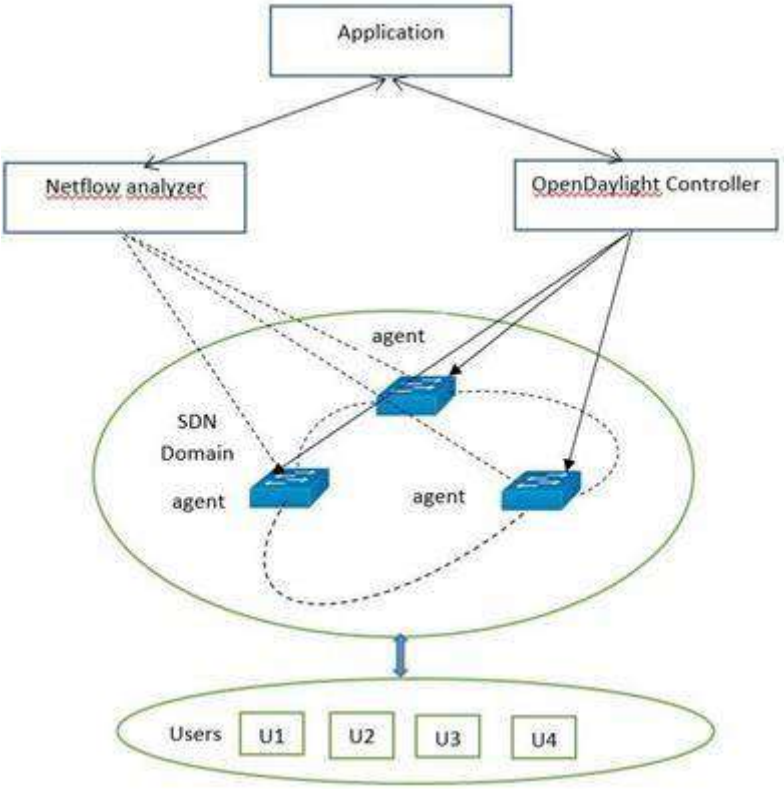

Fig.3 Deployment Scenario

This is implemented in SDN environment as a software application in Northbound API. This is how the application we suggested is implemented, and Fig.3 shows the deployment scenario. The application uses both OpenDaylight Controller and ManageEngine netFlow analyzer which gathers the details of the data plane and sends the appropriate switches a response.

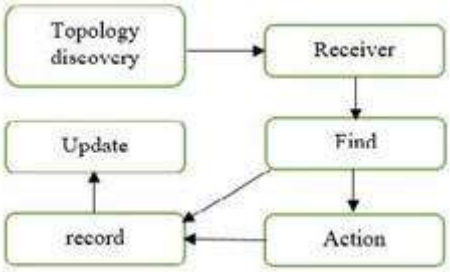

Fig.4 Application Schedule

The application has six levels shown in Fig.4. The Topology discovery and receiver are mostly in-charge of gathering the required data. Topology discovery provides the receiver with a glimpse of the global network topology and based on this outlook receiver schedules the netflow-agents on each switch to obtain the destination flows. The data are then put together to form set N, which is then sent to the find module. Find module uses the detection algorithm to analyse the set. The find module will provide the appropriatecommand and information, along with the IP of the attack source and target and intensity of the flow, to the

action module in accordance with the judgement result. Then, in accordance with the network topology, a response shall be initiated to add traffic- flow entries to appropriate switches by a SDN controller. As the find module observes an attack has terminated, it passes on the information to the action module to remove the flow entry entered earlier and issue normal flow entry. Record and update module are used to alter the parameters in detection module.

Experiment

The emulation network has 21 computers and 4 switches. One aggregation switch is linked to three access switches in a tree- like topology. The 21 hosts are connected to the 3 access switches seven for each. Then we set the sampling rate to one and configured the netflow agent for each access switch. We used virtual OS Ubuntu 21 LTS and Mininet emulator.

Initially normal traffic without DDoS attack based on botnet, for instance, this network comprises 15 different d-flows at a certain moment, of 15 various destinations, in this 15 d-flows 9 d-flows have x as 1, 4 d- flow as 2, and 2 d-flow as 3. This demonstrates that the majority of users are connected to distinct destinations. Moreover, we see that top speed of destination-flow is around 1 Mbps. The result of 2 D perception plot is show in Fig.5.

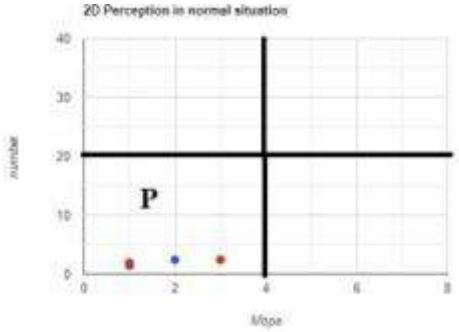

Fig.5 2D Perception in normal situation

Then using the hping3 tool, we launched a botnet-based DDoS attack, which used 15 nodes to overflow a virtual web server machine with at 10.0.0.2 with TCP SYN data at a pace of 5 Mbps from each node. We set θ to be equal to 0.1 and T to be equal to 100 Mbps because the bandwidth of the egress structure in which we obtained 1 Gbps as sample traffic. The result with DDoS flooding attack is shown in Fig.6

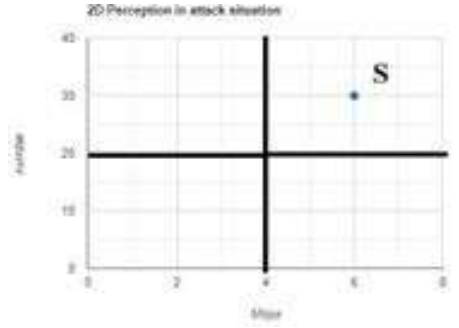

Fig.6 2D perception in attack situation

IV. CONCLUSION AND FUTURE WORK

In a strict sense, our experiment merely shows that our approach is practical and efficient. However, if the average number of d-flows for a typical user is Q and there are R nodes, then the theoretical complexity of the computation is O(Q^2 xR^2). Through combining the strength of SDN and netFlow, we investigated the defence mechanism against DDoS flooding from a botnet that began an SDN environment. To measure the spread-association and intensity of flow, this mechanism defined a two-dimensional metric known as spread association degree. Then, in order to build the entire mechanism, we devised a detection algorithm and a response scheme. Finally, we implemented it using an application built using the SDN controller and netFlow collector's APIs, and tested it on Mininet emulator platform. It could stop the DDoS attack in its tracks and prevents damage to the internal network service or its spread to other networks. In future we need to try this mechanism with bigger SDN network. We did it only with a minimum node in emulated network. Also, in our experiment the Botnet operates on a single SDN domain and bots of Botnet can be distributed in different SDN networks. Still our application is capable of handling multiple SDN domain as logical single domain.

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A Short Review on Tomato Maturity Detection and Identification Using Machine Learning and Deep Learning Approach

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ABSTRACT

During recent years, technical developments in robotics have contributed to the expansion of agriculture. Most agricultural robotic improvements rely on machine vision technologies to avoid risks, detect crops, and even decide when they are ripe for harvest. As per this, tomato maturity detection at various stages is a difficult process. For this challenge, we require a deep learning-based robotics system for the identification of mature tomatoes in agriculture. Most advanced visual tomato identification technology basically focused on ripe tomatoes, which have a different colour over its surroundings. In this study, aim to build deep learning- based model for tomato maturity detection. First, using YOLOv5 algorithm to detect the ripe and unripe tomato on the tree with the help of appearance learning feature, and with this we are also counting ripe tomatoes and unripe tomatoes. That's how many tomatoes ripe as well as how many unripe tomatoes on the plant. Second, deep sort method is used to track the position of tomatoes in the cluster. It also has the ability to continuously identify the tomato position, moreover, it helps to count the total number of tomatoes on the plant with the support of monitoring. Here, the total tomato fruits in the field are being counted in real time. If the ripe tomato exceeds the threshold value, the border box will be red in color, and harvesting will proceed, otherwise, the plant will be discarded. In the term of result mAP of 98.7% as well as F1 score of 97%,recall of 96%, and precision respectively, 96.5%. The YOLO-Deep Sort model have an impressive accuracy with all the state-of-the art algorithm for tomato detection in deep learning.

Keywords—Deep Learning, Tomato Maturity Detection, YOLOv5.

I. INTRODUCTION

According to this scenario, Tomato harvesting is growing to be fast in the field of agriculture. So here day by day the ripeness of tomato detection and classification with the accurate result is more efficient but now this time, in different weather condition, the tomato harvesting is challenging and other ways different stages of tomatoes have different colors shown in figure 1. If tomatoes are green, so it is the unripe tomato, and yellow mean tomato is semi-ripe, and color of tomato surface is red so, it classifies with Ripe Tomato. Tomatoes provide numerous vital and helpful elements to humans, including antioxidants as well as vitamins A and C. Tomatoes are rapidly being cultivated in plants as demand for them rises. Manual harvesting, on the other

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hand time- consuming as well as expensive, and labour prices rise, the implementation of agriculturalautomated systems is unavoidable [13]. But by the digital harvesting of tomatoes, the result is more efficientor accurate. and another thing is the comparison of time and cost, automatic maturity detection and harvesting in agricultural is more suitable than manual harvesting.

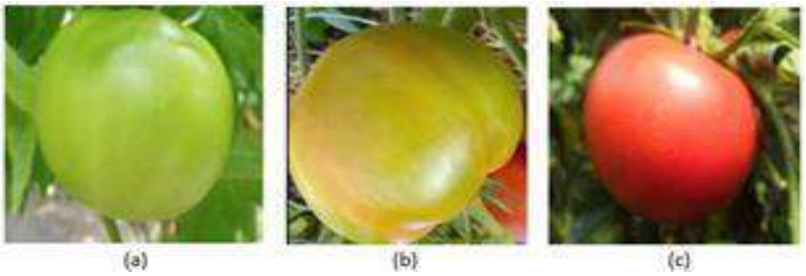

Figure 1. Stage of tomato: (a) Unripe tomato, (b) Semi-ripe Tomato, (c) Ripe Tomato.

I have study in this fields, we have received a research gap in the field of tomato maturity detection. In current scenario the tomato counting and tracking is a very necessary part in the agriculture. due to many of the farmer predict the total crop volume, according to market demand and earn profit, at the mature stage with the help of fruit counting. By this technique farmer calculate the overall turnover in annual and he can compare the total production with previous year. Second the tracking is most important part of the counting, because many of the tomato occluded by leaf and branches in the cluster form so, it creates the challengestask for the machine to detect the tomato. So currently, no any author's complete research work in this area. According to this problem we proposed a deep learning-based model YOLOv5 for tomato maturity detection and counting for both Ripe, and Unripe classes on the particular tree. In order to the Deep-sort algorithm get help to track the position of the tomato in the frame and perform the overall counting on the overall images and video. This proposed model fills the research gap with high accuracy and precision.

According to the problem our contribution in this study to provide the modern version of method to detect, track and count the tomato fruits

- Improve the accuracy and efficiency applying YOLOv5 technique for the better productivity.
- Counting the number of ripe tomato and unripe tomato on the plants, and how much tomato are ripe and how much unripe shown on the validation images
- Tracking the position of the tomato inside the video using deep sort approach.
- Tracking and counting the overall tomato inside the field.

This work divided into many sections. First section, Introduction part of this paper, section 2. shows the review study and contribution of all author's, section 3. deployed the applied methodology in this work, section 4. presents the Result and compression of the model, and finally section 5. describe conclusion port of this paper.

II. LITERATURE REVIEW

This review study divided into two parts shown in figure 2.

Figure 2. Literature review in field of Machine learning and Deep learning.

A. Tomato detection and classification in deep learning.

1) Detection using YOLO approach

Magalhães et al. Prevented for identifying tomatoes, four pre- trained SSD algorithms from TensorFlow library were used, as well as YOLOv4 Tiny as from Darknet repository. A stereo camera has been used to collect the data within the tomato greenhouse. INESC TEC Research And data Library has made the dataset freely available. As per the results, the F1-score was 66.15%, the mAP was 51.46 %, and the inference time was 16.44 milliseconds [1]. Parico et al. applied to create a strong real-time pear fruit tracker for smartphone platforms by combining RGB data with cutting- edge object identification classifiers (YOLOv4 models) and also the MOT method Deep SORT. With respect of accuracy, a YOLOv4-CSP approach was found to be the best, with an AP@0.50 of 98%. YOLOv4-tiny of even above 50 FPS in terms of speed or computing expense [2]. Lawal et al. used to recognize tomatoes in difficult environmental settings, a YOLOv3 model dubbed YOLO-Tomato simulations was used. The improved YOLOv3 framework was changed using densely layout incorporation, spatial pyramid pooling, as well as Mish function. A maximum of 125 tomato photos having a quality of 3968 x 2976 pixels, RGB colour space, with JPG storage type was taken and separated into an 80% training dataset and a 20% validation dataset YOLO-Tomato-C with AP 99.5% with a recognition period of 52 milliseconds [3]. Gai et al. adopted an advanced YOLO-V4 learning algorithm to obtain cherry fruit. This model is suitable for small-scale cherry fruit. It is proposed to expand the network based on the YOLO-V4 CSPD, Darknet53 backbone network, and integrated with DenseNet Overcrowding, a priori box in the YOLO-V4 model, is converted into a round marker box according to size of cherry fruit. Total 400 cherry images with 3000 x 4000-pixel resolution were collected and split into training and testing sets in three phases, unripe, semi-ripe, and ripe. Based on the upgraded YOLO-V4 model, the output feature says upgraded,and recovery speed improved [4]. Rong et al. developed YOLOv4-Tiny model to acquire in real-time at a constant long-distance detector, and peduncle cutting target localization and pose estimation. The maximum

of 1528 images with such a resolution of 1280 x 720 pixels were obtained, with 828 shots recorded by the camera at distance of 0.5–0.7 meters from the cherry tomatoes as well as another 700 images at 0.25–0.35 metres. A precision is 92.7% and an identification speed of 0.109s per frame [5]. Lawal et al. used YOLOv3 model which addon YOLODenseNet and YOLOMixNet to solve the illumination variation, and leaf overlapping, and batch of tomato. The obtained 425 photos at a resolution of 3968 x 2976 pixels. To constructed the natural scene dataset, this was divided randomly between 80% training data and 20% testing dataset. an accuracy tested of model YOLODenseNet at 98.3% and 98.4% with YOLOMixNet on the natural arena. So, performance is better like YOLOv3 and YOLOv4 is to respectively 96.1% and 94.6% [6]. Z. Xu et al.Prevented an improved YOLOv3-tiny model to increase the precision of method as well as backbone network,using image enhancement to gain the detection capability of the algorithm in complicated scenes. Total 1000 tomato photographs in JPG format having 416 x 416 dimensions were obtained. As a result, f1 score forapplied method is 91.92% which is 12% over than YOLOv3- tiny [7].

2) Detection using CNN approach

Wang et al. proposed a method to get small tomato fruits with a color close to the tomato by R-CNN. Used ResNet50 as the backbone of the feature, and the output feature map is developed by Convolutional Block Attention Module. Then, Feature Pyramid Network is used to integrate upper-level acceptable features. Decrease the miss detection rate of occluded fruit by using Soft Non – Maximum Suppression. Inside the agriculture virtual nursery, 2235 images of tomatoes immature fruits with a resolution of 3000 x 3000 px were obtained. And the mAP is gone to the 98.46% and average detection in single image 0.084s [8]. Hsieh et al. determined Binocular imaging technology and R- CNN to classify the maturity and place of tomatoes in the greenhouse. It contains three-part, image aquation, object detection, and position identification of ripe fruits. 255 images were captured both learning and verification categorization. The training set contained 205 images, whereas the validation set contained 50 images. The precision, recall for ripe fruits of 95% [9]. P. Das et al. used CNN for automatic grading system to grade the tomato maturity with the help of color classification. Green and red tomato are classified with ripe and unripe tomato. The sample of 150 images were taken with each class. accuracy of the model is 99.67% [10]. Sun et al. analysed multi-dimensional compound with high-quality semantic features to obtain small-sized tomato organs to improve the level of recognition. the repulsion loss combined to replace the actual L1 loss function. The number of 8929 RGB pictures of flowers, ripe red tomatoes, and unripe green tomatoes were captured, having images length 1080 x1920 pixel resolution with 100 dpi. Accuracy is improved 90.7% to 99.5% [11]. Alajrami et al. Conducted the deep learning algorithm CNN to classify various type of tomato detection and identification. According to dataset, there are 3950 images from Kaggle dataset with resolution of 150×150 pixels. The testing model accuracy of 93% [12]. C. Hu et al. applied tomato sections were separated from the backdrop using the Gaussian density function H as well as S inside the HSV colour space, proceeded by degradation and flexibility of the tomato body to detach the surrounding tomatoes. Draw little circular boxes on ripe tomatoes,as well as detect the edge of the tomato, the adaptive threshold intuitionistic fuzzy set was developed, and it performs well for finding blurred edges in isolated places. Under complex scenes, 800 images on tomato trees

with a size of 640 x 480 pixels in jpeg extension were captured [13]. P. Das et al. applied transfer learning method to improve the degree of automatic tomato ripening based on color and texture, proposed model to divides tomato images into eight different categories. The dataset includes a number of 4,419 photos divided into eight unique categories. A well-as proposed network has been verified with 100% accuracy using artificial images [14]. Das et al. used Create a low-cost method for Ripe tomato Grading that provides the greatest performance in terms of accuracy. In each of the three development phases (Red, Yellow, and Green),a dataset of 200 colour photographs with such a quality of 1920x1080 bytes was gathered from the market place. Their accuracy was 100% [15]. Tenorio et al. Used image processing algorithms to speed up and simplify the tomato harvesting conditions. farms. Two different deep learning models are trained and integrated with calculation methods to produce a harvested monitoring program using embedded applications using the Intel® MovidiusTM and a commercial RGB camera. The sample is separated among learning, testing, and verification dataset based upon those 254 photos [16]. Liu et al. proposed to improved DenseNet, DNN Architecture conducted to solve the challenges of the complex tomato in images. Accuracy of the proposed model is to 91.26% [19].

B. Tomato detection and classification in deep learning.

Vaibhav G B et al. perform analysis with SVM and raspberry pi to identify ripeness of the tomatoes [18]. Liu et al. provided Histogram of Oriented of Gradients Descriptor have prevented to train the SVM classifier and false-color Removal (FCR) technique to avoid the false positive detection. To integrate the overlapping results, Non- Maximum Suppression were applied. The accuracy, and The F1 score for the proposed approaches of 94.41%, as well as 92.15% [20]. T. Yoshida et al. used RGBD camera to capture the peduncles, as well as an edge grabber picks the tomatoes just at determined cutting point by the harvester robots. To begin, the tomato locations are classified and clustered in order to restrict the search area. The result performance dependent on the length of peduncles [21]. Peng Wan et al. added computer vision technology to detect the maturity level with (Green, orange, red) color on tomato. For dataset these are carried to the laboratory, where 150 images were taken of tomatoes samples from each type. The experiment employed a total of 247 photos at a dimension of 3648 x 2056 pixels, and 100 photographs were chosen at random from the collected images for the set, 72 images for validation set, and also the remaining 75 images for testing. The result performance for average accuracy is 99.31%, standard deviation is 1.2% [22]. Lee et al. proposed a photographic and practical process based on artificial intelligence using multi- stage detection by intelligent separation of fruit pattern in an image that can measure size. The simulation results showed a lot of high correlations between size and weight, indicating that synthetic algorithms could successfully capture this complex physical relationship to measure final weight. A total of 651 pictures and physical data values across 2521 samples were collected, so there are 73 % data for training, 15% for validation, plus 12% with test set. The result of model respect to Precision as well as accuracy both are 92.28% and 99.2% [17]. Zhao et al. Recognized mature tomatoes using standard colour pictures has been devised. Haar-like characteristics, an AdaBoost method, as well as an APV-based colour assessment were used to employ shape, surface, and color features. For data set there are 180 images with resolution of 3872 x 2592 pixel. Detection accuracy of model

96% with false negative 10%. It has a limit 3.5% tomato not detected [23]. Yamamoto et al. Used a traditional RGB digital camera with machine learning methodologies, build a system to accurately identify single undamaged tomatoes fruits on a plant, includes ripe, unripe, and small fruits. used total 154 images,13 for model training and rest of the testing. the result in term of precision and recall is 0.88 and 0.80 [24]. Pacheco et al. determined K-NN, MLP, and K- Means Clustering algorithm to detect tomato maturity and classify the tomato. Used 5 megapixel with resolution of 2592 x 1944 camera with raspberry pi. The accuracy is greater than 90% [25]. According to the above literature survey we concluded that the machine learning and deep learning technique using YOLO and CNN played a vital role in detection of maturity of tomato. CNN work faster in 2 stages method for classification among the mature and immature tomato. The limited computing technology of CNN allowed YOLO in introduction. As YOLO is the advance technology which works onlarge dataset as fast as possible. The feature detection like shapes, color, size works similar as manual work done by the human.

III. PROPOSED METHOD

A. Dataset Construction

The tomato datasets included in this study were obtained from sources on the internet, and they fall into two categories: green tomato (unripe tomato) and red tomato (ripe tomato). The photos were obtained with the use of a computer browser while visiting various websites that are provide tomato images. All of the images in the dataset have a resolution of 720x1080 pixels which are in JPEG file. Many of the photos were acquired with varying natural bright conditions, along with the difficulty of the developing environments: lighting change, occlusion, overlap, and tomatoes cluster. These enhances the problem of detecting ripe and unripe tomatoes inside the field of deep learning. A total of 510 tomatoes photos were manually downloaded andsplit into two parts, 80% training dataset and 20% test dataset. Each image was recorded at random and consisted of a single tomato without an occlusion, a single tomato surrounded with leaves and branches, several tomatoes with or without occlusion, and so on. Several image sample from the collected dataset in various environments are shown in Fig. 3.

Figure 3. Tomato images with various environments: (a) single tomato and no occlusion, (b) multiple tomatoes with occlusion, (c) clusters of tomatoes, (d) illumination variation, (e) shaded Situations, and (f) multiple tomatoes without no occlusion.

Corresponds to an aspect ratio of the source (Raw) pictures These are done to keep the original photo aspect ratio. Labeled data, namely the class-label and location (coordinates) among all ground truth bounds box in training photos, are needed during YOLO model training. While labelling of images is a manual method, annotation, or even the design of ground truth bounding boxes, became facilitated because the quantity of datasets created for each class is minimal. The graphical image labeling program labelling (https://www.makesense.ai) has been used to manually label many of the ground truth bounding boxes, including annotation files stored in YOLO Form, such as Label.txt format, and annotation shown in figure 4.

Figure 4. Augmented image.

B. Proposed Model

In the research study we have proposed two approaches for detection and tracking, for the ripe and unripe tomatoes.

1) YOLOv5 Architecture

YOLOv5 abbreviated 'You only look once, is an algorithm for finding something that separates images into a grid system. Each cell in the grid is responsible for searching objects within it. YOLOv5 network [26-28] is the most recent result of the YOLO design series. The identification precision of this organization model is high, and the deduction speed is quick, with the quickest recognition speed ultimately depend on 140 edges each second. Then again, the size of the weight document of the YOLOv5 target identification network model is little, which is almost 90% small than YOLOv4, demonstrating that the YOLOv5 model is appropriate for organization to the installed gadgets to execute constant discovery. Thusly, the benefits of the YOLOv5 [26] network are its high location exactness, lightweight qualities, and fast detection rate on the same time. The YOLOv5 system includes four structures: YOLOv5s, YOLOv5l, YOLOv5m, and YOLOv5x [26,28].

In (figure 5) the YOLOv5 splits an input image in to the N x N grids and then recognises bounding boxes to relating confidences of detecting a class object [2]. In which it predicted the coordinates and class probabilities by an image concurrently, and remove bounding boxes with minimal confidence by fixed limit point. As a result, probabilities higher than the threshold level are accepted as detections.

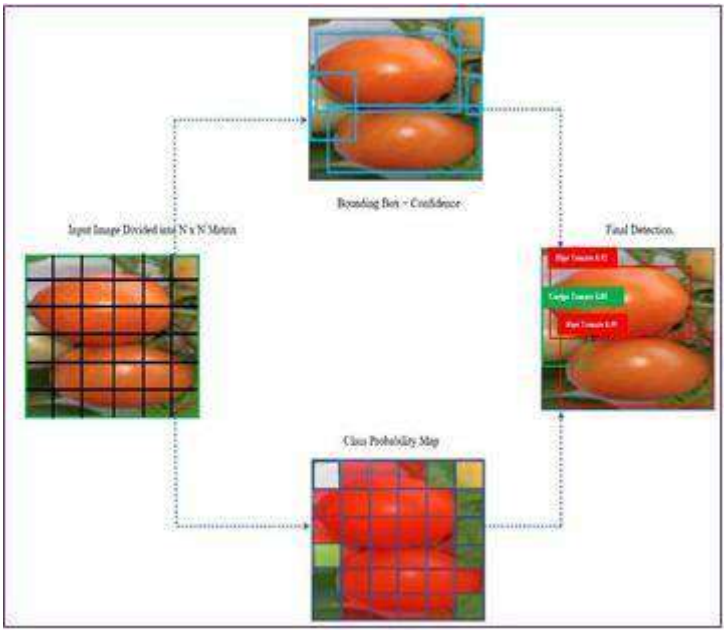

Figure 5. Detection Function of YOLOv5.

The YOLOv5 Architecture contains a convolutional neural network with three parts for object detection.

Backbon : The Model Backbone is widely used to extract important features from an embedded image. CSP (Cross Stage Partial Networks) [26] is used as the backbone of YOLOv5 to extract the rich and useful features of the embedded image.

Neck: The Model Neck is widely used to make feature pyramids. Include pyramid auxiliary models in successful assembly when it comes to objective measurement. It helps to identify the same thing in different sizes and scales. Feature pyramids are very useful in helping models work effectively with previously unseen data [26]. Some models, such as FPN, BiFPN, and PANet, use different types of pyramid methods. PANet is used as a necklace in YOLOv5 to get the pyramids installed.

Head: The model head is very responsible for the final step of acquisition [26]. It uses anchor boxes to create final vectors with class opportunities, objection points, and binding boxes.

2) Deep Sort for Tracking and Counting

Deep SORT has verified to be one of the quickest and yet most durable techniques for tracking numerous objects [29]. It began with the Real-Time Monitoring (SORT) method [2, 30], which has been designed totake a simple strategy to detection-based continuous monitoring, focusing on effectively matching object detections on every frame. It takes use of CNN great reputation for reliably identifying things. Furthermore,as tracking elements, the Kalman filter [32] as well as the Hungarian algorithm [31] were incorporated, whichare two famous approaches regarding motion prediction and data association. Deep Sort was Twenty times quicker than other cutting-edge trackers owing to its poor complexity [30]. Inside the Multiple Object Tracking) Applying Faster R-CNN [33] as such detector, it also outperformed typical online tracking algorithms. In the figure 1. shows the detection and tracking function of the deep sort model with the ripeand unripe tomato images.

Firstly, the number of frames arriving at the front of YOLOv5 model, and trained YOLOv5 detect the number of tomatoes in the frame shown in figure 6. After detection, the deep-sort method will start to track and count the tomato, and predict tomato using Kalman filter. After tracking the tomato has assigned unique identification key.

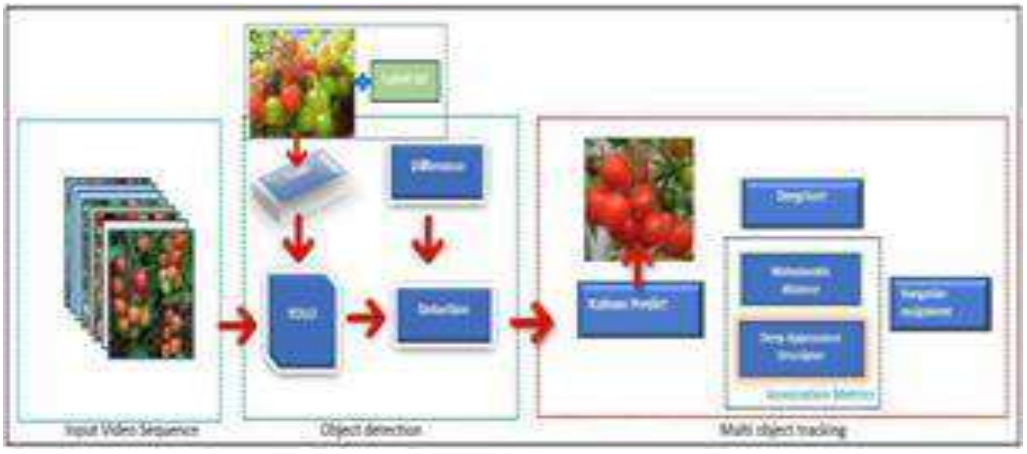

Figure 6. Architecture of Deep Sort technique.

C. Training Details.

Based on a Dell desktop pc (Intel (R) Core (TM) I3-1005G1 CPU, 1.20GHz, 8 GB memory; NVIDIA GPU, 16GB video memory), using Google Colab participation. To complete the training and testing of the tomato's ripeness identification model for the tomato harvesting robot, the framework of deep learning PyTorch was constructed on the google Colab platform, and Python has been used to build the model and use CUDA, and OpenCV, as well as other essential libraries.

IV. RESULT AND DISCUSSION

A. Result Evaluation Parameter

In the work study, the main objective evaluation parameter such as Precision, Recall, F1 score, and mAP (mean average precision), has been used to measurement the efficiency of the trained tomato ripeness detection and tracking architecture. The calculations are as follows.

$$\text{Precision} = \frac{\text{No of True Positive}}{\text{No of True Positive + No of False Positive}} \quad (1)$$

$$\text{Recall} = \frac{\text{No of True Positive}}{\text{No of True Positive + No of False Negatie}} \quad (2)$$

$$F1 = \frac{2}{1/(\text{Precision}) + 1/(\text{Recall})} \quad (3)$$

$$\text{Mean Average Precision} = \frac{1}{C}\sum_{k=1}^{N} P(k)\Delta R(k) \quad \ldots$$

Here p(k), R(k) is Precision and Recall. C reflect to the no of tomato target categories. K means IOU threshold value, and N represent no of IOU thresholds.

1) Result

According to the study the Precision, Recall, F1-Score, and below. Figure 11 (a) depicts the training loss curve and (b) validation loss curves combined, showing that such loss value reduced fast in the first 150 epochs of network training and, in general, tends to remai n stable beyond 140 epochs of training.

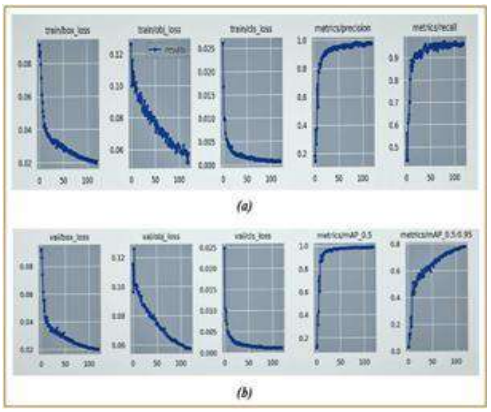

Figure 7. Training and Validation Loss curve.

In this study the figure 8 show the confusion matrix of the proposed model. the confusion matrix shows the wrong detection and right detection about the model training and validation that are indicated in the Figure.8. True Positive is 0.99 for Ripe tomato and also 0.98 for Unripe tomato.

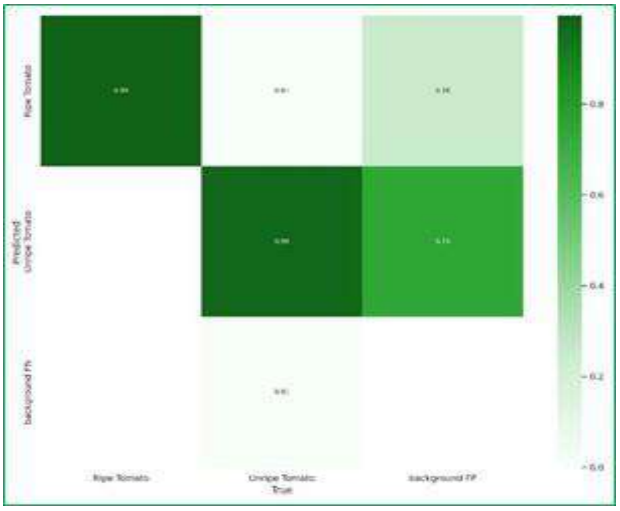

Figure 8. Confusion Matrix.

From the figure 9. Concluded that the ripe tomato measure turns out more precision than the unripe tomato from all classes. The data shows that the scale of ripe tomato lies in the ranges between 0.8 to 1.0.

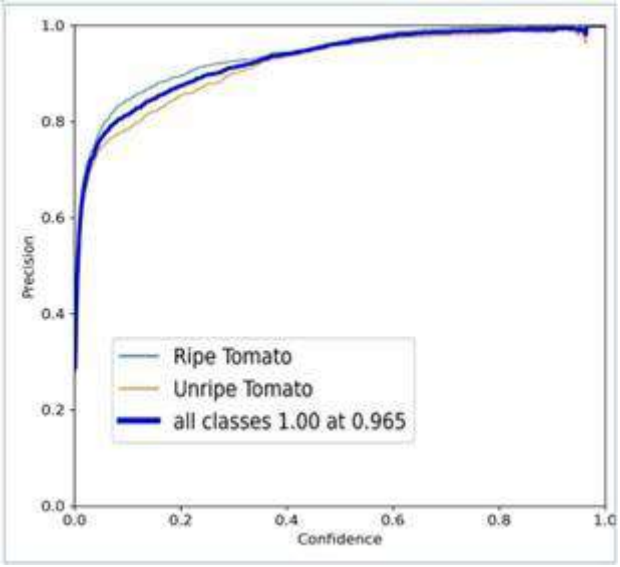

Figure 9. Precision.

The figure 10. presented the Recall of the model, for the both ripe and unripe tomato classes, this model accrue high recall during the training of model.

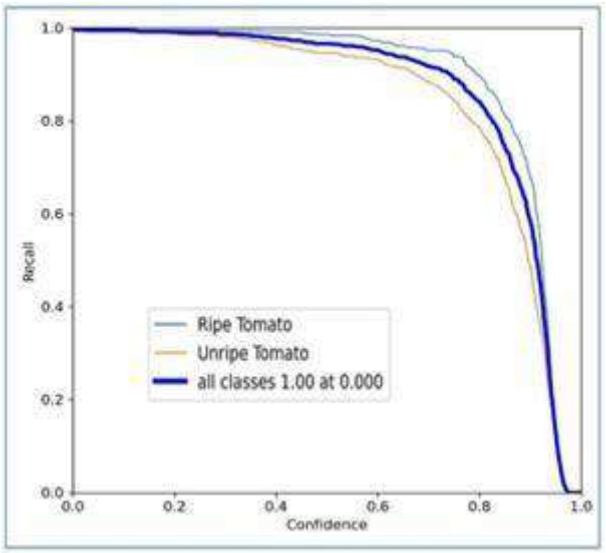

Figure 10. Recall.

In the term of the F1-Score of the proposed model has high accuracy for the ripe and unripe tomato. But ripe tomato recall is greater than unripe tomato because unripe tomato has a background variation with same color of leaves. The F1- Score is 95.7% appreciated in the Figure 11.

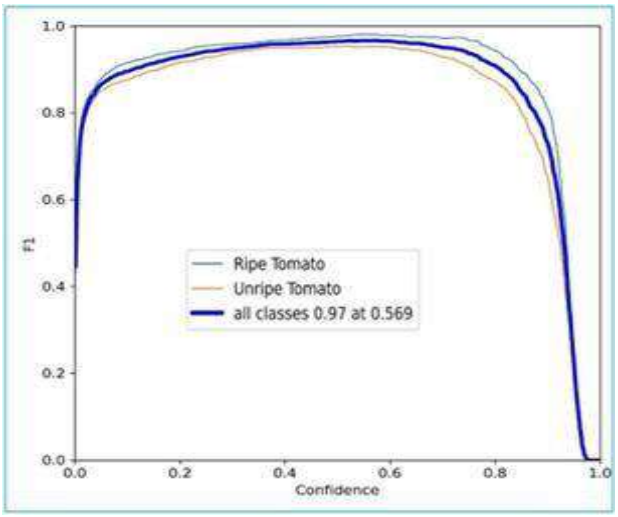

Figure 11. F1-Score.

In the study the suggested model mean Average Precision is high compression to the modern tomato maturity detection and counting algorithm, so conclude better than other approaches score. The mAP is lies between 98.6% out of 100%, and the ripe tomato accuracy is 99.3% as well as unripe tomato is 98% shown in figure 12.

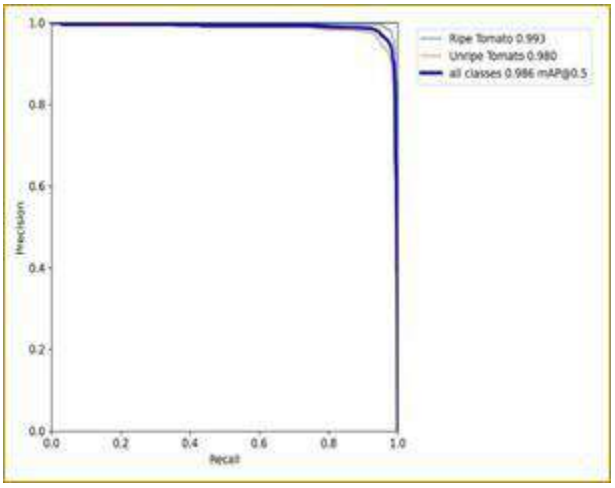

Figure 12. PR Curve (mAP).

2) Result Compression

Table 1. shows the trained YOLODenseNet, YOLOMixNet, YOLOv4 Tiny, SSD Inception v2, and SSDResNet50 models that have been evaluated and compared and use an image resolution of 416 x 416 pixels and a batch size of 4 with 150 epochs. This is to keep the training resolution of the image consistent. It's comforting to know that such ripe tomato scenario has improved. Table 1 compares the results of the experiments on mature and immature tomatoes. Our algorithm successfully detected the quantity of tomatoesinside the test dataset, despite the fact that illumination and occlusions impacted the images. Unfortunately, the acquired results differ *between* the models that were examined.

TABLE I. RESULT COMPARISON

Model	mAP (%)	Precision (%)	Recall (%)	F1- Score (%)
YOLODenseNet [6]	98.30	91.00	97.00	94.00
YOLOMixNet	98.40	91.00	97.00	94.00
YOLOv4 Tiny [1]	47.48	88.39	49.33	63.32
SSD Inception v2	48.54	85.31	50.93	63.78
SSD MobileNet v2	51.46	84.37	54.40	66.15
SSD ResNet50	42.62	92.51	43.59	59.26
SSD ResNet101	36.32	88.63	38.13	53.32
Our Model	98.60	96.50	95.90	97.00

Table 1. demonstrates that the YOLOv5, Deep sort, Tomato detection models are significant increase for Precision and Recall, mAP resulting in an improvement in the F1 score based on ripe and unripe tomato findings. In the term of mean average precision (mAP) is significantly increase with 0.30 % and 0.25% for YOLODenseNet as well as YOLOMixNet in [6] work, similarly 47.6%, with SSD MobileNet v2 and 50.2%

over to SSD Inception v2. The precision of our proposed model gains 5.50% with both models YOLODenseNet and YOLOMixNet, and 4.49% is also increase with [1] highest model ResNet50. The recall ofour model is 1.1% is lower than of YOLODenseNet and YOLOMixNet but also it gains high recall values withcompare with rest of the model in the table 1, YOLOv4 Tiny, SSD MobileNet v2, SSD MobileNet v2, SSD ResNet50, and SSD ResNet101 is lower with respect to 46.5%, 45%, 41.5, 52% and 57.7% with proposed model. Finally, the F1 score of our model is greater than with existing model YOLODenseNet and YOLOMixNet with 3.0% for both models. And other end 30.8% is increased with SSDMobileNet Model, the SSDMobileNet model his highly score gain in the [1] study. According to the above result compression, our proposed model is better with all the existing model in the field of tomato maturity detection and classification, due to high mAP, Precision, Recall, and F1- Score.

According to the model validation the result of YOLOv5 model and Deep Sort are shown below. In figure 13. shows the validation result for the mature and immature tomato of YOLOv5 model. The YOLOv5 model successfully detect the tomato for both ripe and unripe categories, and also other hand count the tomato for particular class inside images. In the term of Deep sort, the output shown in figure number 14. Here the output images describe the tracking of all tomato class with the help of unique id, and count the total numberof tomatoes in the frame.

The result of our proposed model YOLOv5, Deep sort completely detect and track as well as count the tomatoes are shown figure 15. The detection and counting per class done by YOLOv5, and deep sort have to track and count the overall tomatoes in the video frame and images.

Figure 12. Output of YOLOv5 Algorithm

Figure 14. Output of Deep Sort Algorithm

Figure 15. Output of YOLOv5 and Deep Sort Algorithm with tracking and counting.

In figure 16. The trained model has assigned the labelled image for the testing to measure the accuracy and performance. Figure 17. The model has predicted the no of tomato classes for ripe and unripe tomato, with their confidence level for each predicted tomato inside the frame.

Figure 16. Labelled images for Ripe and Unripe tomatoes

Figure 17. Predicted result for Ripe and Unripe tomatoes

V. CONCLUSION/ FUTURE SCOPE

Using modern object identification models YOLOv5 and the MOT algorithm Deep SORT, to create a robust tomato ripeness detection and tomato counter to recognize and count the tomato for each class. We also presented a methodical and practical strategy for selecting the best model for a certain use in agricultural economics for future use. With an AP of 98.6 %, YOLOv5 has been the best model with respect to accuracy. As far as speed and computational expense, YOLOv5 showed an extremely encouraging presentation at a similar rate with YOLODenseNet, YOLOMixNet, and YOLOv4 Tiny at the lower network goal. If considering the equilibrium as far as exactness, speed and computational expense, YOLOv5 was viewed as themost appropriate. YOLOv5 was picked as the recognition model for the tomato counting framework with Deep sort. The Precision, Recall, and F1-socre of our proposed model of 96.5%, 95.9%, and 97% separately. Our model successfully detects the no of ripe and unripe tomato in the video and image, and other hand the deep sort performs the tracking and counting of tomato inside the image. We received a drawback for our model, in the model the detection of unripe tomato is few less accurate due to the collabs the background colour with the fruits color. But our model is also better precise and detection capability to detect, track and count the tomatoes.

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Hybrid Federated Learning with Deep Multiclass Classification IDS for IOT

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ABSTRACT
IoT has demonstrated a rapid track of growth with intelligent nodes which forms Internet of things environment, open wireless transmission nature and resource constraints made them prone to threats. Intrusion Detection System assists in detecting attacks and performs essential respond to promise the secure and trustworthy function. the proposed Deep Multilayer classification system is capable of detecting both inside and outside attacks effectively. K-Means Clustering is engaged to perform pre-processing and Modified Principal Component Analysis (MPCA) is utilized for feature extraction, to extract more features that are informative. Then, Enhanced Whale Optimization algorithm is used to select significant and removes the superfluous features from the dataset. It improves the classification accuracy through the best fitness value. Then the intrusion detection is done by using DMCNN model is used to detect the attacks efficiently. The experimental outcome proves that the introduced EWO-HFLMCNN method offers better intrusion detection system with regard to superior accuracy, precision, recall, f-measure and lesser False Positive Rate.
Keywords— Intrusion Detection System, Enhanced Whale Optimization (EWO), Hybrid Federated Learning Deep Multilayer Classification (HFLDMC), K-Mean Clustering.

I. INTRODUCTION

to IoT is a critical field that endow with an extensive technical evolution at privileged status with data as prime force. It has March into a further aspect along with electronics, devices, sensors, software; communication modules to enhance involvement, compilation, data communication [1] as a replacement for of broad competence, practically 80% of IoT devices are out to range of cyber intrusions. Moreover, they are vulnerable to various threats such as DoS, DDOS, wormhole, sink hole, and data stealing [2].

The IDS plays vital role in anomaly-based detection for examining network traffic and system information from spiteful actions to identify patterns deviate from normal or base line behavior and providing warning,by applying statistical method to scrutinize deviation as a protecting policy in the field. Intrusion prevention system combined along with IDS to evade intruder from performing harmful action to the model [3].

On the other hand, because of vast ranged devices involved in IoT, the deployment intrusion detection solution in centralized system will leads devices for threats; therefore, eventually residual IoT is also bare to threats since the central intrusion system is convinced [4]. Deep learning algorithms have established importance in speech recognition, image processing, natural language processing, and numerous domains [5]. The federated learning modelling is an unsupervised learning in ML which engages automatic finding and examines and report a breach based on the intrusion's behavioural features notorious in the dataset NSL_KDD that replicate real modern typical behaviour with synthetically created attack actions [6]. The proposed deep learning model incorporates CNN; with regularize multi-layer perceptron, as a substitute of a convolutional neural network (CNN). As contradictory with CNN, DNN uses convolutions a statistical operation which involves conventional hyper parameters such as extent of filter, quantity of filters, and step for generating the output matrix. To handle diminishing tensor dimensions as the input propagates through multiple convolutional layers, this brings in input padding. The pooling layer is utilized involving successive convolutional layers to diminish the feature dimensions across the layers. At last, a fully connected layer with regularization is declared then goes after through the classification output layer [7].

Here initially we have chosen the Convolutional Neural Networks for multiclass classification due to their low computational cost and great strength. We used the concept of federated learning to train the model to deal with the complexity of high- dimensional data from IoT network.

Intrusion detection system in NIDS is a data collector that accumulates real-world network information by congregation of packets in the network. It provides the support to remove the superfluous values with the aim of making the effective system. Throughout the training phase, feature selection search for viable feature set from input sample which are mandatory for classifier training [8].

Feature selection is generous prominence with process of removal of redundant values which decreases learning efficiency, increasing the generalization effect, and also achieving data visualization. It also decreases the number of dimensions in the dataset with core aim of solving the issue is to find an right feature which consists information related to output class at the maximum to reducing processing, which makes it simpler to understand and inspect data. The popular feature selection algorithms are filtering, wrapper, embedding, and hybrid schemes [9].

The process of identifying the absolute labels is classification process to categorize the data with respect to training and attribute values. The model is engaged for determining the class labels and testing the fictitious model through test samples; therefore, accuracy of classification policy is anticipated [10]. The supervised/ unsupervised algorithms like clustering, classification is employed for constructing Intrusion Detection System with the help of Deep Learning (DL) based algorithms to concentrate to get better prediction accuracyover the IoT [11].

The main challenge of this research work is to detect intrusion over the complex and time-varying dynamicIoT network, here the intrusion samples are cohesive with normal samples hence the leads to insufficient model training samples and also detection results will might consists of high false detection rate.

To overcome above challenges a lot of exploration and techniques are popularized but the Distributed Generative Adversarial Network based IDS accuracy has not accomplished greatly.

The current trendy is that generally the NIDSs are designed through anomaly detection to examine network traffic are non-interpretable for further improvement and robustness. conversely; an anomaly detection- based NIDS has several challenges such as accuracy is depending on training data quality, it is still difficult recognizes the attack category automatic without human intervention, lack scalability, hence the significant enhancement on the ML models is mandatory for training a new model in privacy sensitive scenarios. The majority of the existing methods have constraints on computational complexity and imprecise IDS classification outcome. In order to crack the challenges DMCNN+ANN is proposed to improve detection performance. In this proposed DMCNN intrusion detection Model. Here we constructed an enhanced deep neural network model to classify the network traffic.

II. RELATED WORK

In [12], author examines algorithms to identify and eradicate the security risk in the Internet of Things, they designed an artificial immune system based on immune theory to IoT environment to detect intrusions called, Antidote, and also they described Immature, nature and memory detectors to identify threats in Internet of Things. To adapt to the complex and dynamic setting of Internet of Things, detectors adjust strongly for identifying mutated and fresh threats of IoT. Hazard information gathering and identified are treated as threat information to warn the administrator of Internet of Things.

In [13], proposed rapid network intrusion detection based on federated learning which is mainly focus on privacy preserving of individual IOT devices information. They designed a simple efficient Federated Learning -based NIDS. The proposed model is evaluated the DDoS attack classification, and the result exhibitsthat the proposed NIDS with federated proved to achieve better performance compared with locally trained NIDS whereas drastically dropping the communication cost.

In [14], suggested novel IDS by employing MinMax K-means clustering algorithm that overwhelms sensitive shortage in early centers of K-means method, and enhance the clustering quality. Countless evaluations were performed on PCA by utilizing many classifiers for two standard databases such as UNB ISCX, KDD CUP. Outcome of assessment indicated that principal components are efficient for classification.

In [16], Ring et al. presents an extensive summary of network intrusion detection datasets, focused on 15 characteristics in the investigation. They proposed a directive in determining appropriate public datasets for an explicit goal, they discussed as a precise overview as well as a detailed discussion. Furthermore, they performed investigation various sources for data, such as data repositories and traffic generators. At last, they depict various conclusions that are significant for similar research concerning NIDS datasets.

In [17], Li et al (2019) paying attention on IoT system that has developed steadily, establishing services of IoT and telecom functions. Fatalities caused by the security challenges are highly intense in the networks which have network data and physical things. Resource deficiency in IoT, network complexity and open wireless transmission nature prone to threats.

In [18], developed an algorithm which can be implemented on NIDS to conquer the high complexity and incorrect labelling of unknown attacks. They proposed a variation of the Anomaly based classifier EFC to

execute multi-class classification. It consists of single layer, with low temporal complexity, and can correctly classify both known attacks and unprecedented attacks efficiently. They conducted experimentation flow-based Intrusion detection datasets: CIDDS-001 and CICIDS2017 to assess the classifier's ability to perfectly label unknown attacks.

In [19], designed an innovative IDS structure using Hybrid Multi-Level Data Mining (HMLD), assessed on the KDDCUP99 dataset. The classification phase deals with filtering each attack with an explicit classifier trained to detect the attack. They preferred SVM-linear classifier for detecting DOS attacks. ANN-logistic for Probe, here ANN-can recognize for U2L and ANN-relu for R2L. The overall model precision in the KDDCUP99 dataset was 96.70%. In this work they create a special class for unknown intrusions, achieved a lower temporal complexity than ANN and SVM.

In [20] propose an efficient Federated Learning - based Network Intrusion Detection system. In particular, they influence the attribute of network traffic data, by modification of small change without affecting the natural feature, and apply data binning to extract feature data on clients. These feature data are applied for training the classifier at the server end.

In [21], proposed a new local-global computation paradigm, FEDFOREST, a novel learning-based NIDS by combining the interpretable Gradient Boosting Decision Tree (GBDT) and Federated Learning (FL) framework. Specifically, FEDFOREST is composed of multiple clients that extract local cyber-attack data features for the server to educate models and detect intrusions. A privacy- enhanced strategy is also plannedin FEDFOREST to further conquer the privacy of the Federated Learning models. Widespread experiments on 4 cyber-attack datasets of diverse tasks expresses that FEDFOREST is valuable, competent, interpretable, and further implementable.

The above-mentioned deep learning techniques in the IoT network intrusion detection have achieved adequate results. However, still it is very difficult in achieving zero attack efficiency in the problem of insufficient data for training and complex high dimensional data collected from IoT network.

III. METHODOLOGY

In this work, hybrid federated learning with deep multilayer classification model is proposed for intrusion detection over IoT. The proposed work involves the construction Deep multi-layer classification model, data pre-processing, auto encoding, mining and assortment of feature, classification and feedback modules.

After a lot of analysis and experimentation on diverse architecture we designed a proposed the architecture as shown in Figure 2. We design as novel two CNN models: first one is Binary (BCNN) CNN and MulticlassCNN (MCNN), in which first model performs for binary classification, and the consequent second model is employed to perform multiclass classification of intrusion attacks. In the proposed architecture for the deep neural network, in hidden layer the model consists of a total of 5 convolution layers, 2 pooling layers, and 4 fully connected layers. The input layer is an 11* 1*1 matrix form as per NSL-KDD data set in which one input layer which has 44 features passed as input to the neural network as those emerged from the feature engineering. The input layer is followed by 8 hidden layers with 140, 120, 100, 80, 60, 40, 20, and 120

nodes correspondingly. The final layer is the output layer orsoftmax layer, which produces the probabilities for the 13 classes where the prediction takes place [22]. To initialize of the weights in all of the Dense layers we applied the lecun-uniform initialization, whereas for the output layer we employed the glorot uniform initialization, designed ReLU as a activation function for full connected layers, after testing different activation functions it produced the best results in relationship with the previously noted activation functions[23].

3.1 Data Pre-Processing using Improved K-Means Clustering (KMC) algorithm

Here, KMC algorithm is employed for performing data pre-processing to enhance the accuracy of ID for specified Human Activity Recognition (HAR) database. It aims to absolute handling of missing data, adjust noise, and correct volatility for given database considerably. K-means is an efficient clustering approach utilized to split identical data to collection derived from premature centroids of clusters [24]. It utilizes Euclidean distance design to calculate centroids of the clusters. Ranging from random partitioning, procedure iteratively first it calculates current cluster centers and then Reallocates every data item to cluster of which center is near to it. It concludes while there are no reassignments. Finally computes, intra-cluster variance, which is sum of squares of distinction among data features and their related cluster centers is narrowly reduced.

In this work, number of cluster number is made equalto class numbers. Calculate the Euclidean distance for finding the centroids of the clusters using the given below formula in equation 1.

$$d(i,j) = \sqrt{\sum_{i=1}^{n}(x_i - y_i)^2} \qquad (1)$$

Where xi and yi are Euclidean n-space twopoints

3.2 Feature Extraction using Modified Principal Component Analysis (MPCA)

In the MPCA method, we reduce the eigenvectors influence subsequent to huge Eigen values via standardizing the jth elementyij, of ith feature of vector y regarding its standard deviation, $\sqrt{\lambda j}$. as a result, new feature vector y' modified as

$$y'_i = \left[\frac{y_{i0}}{\lambda_0} \frac{y_{i1}}{\lambda_1}, \ldots . \frac{y_{i(r-1)}}{\lambda_{r-1}}\right] \qquad (2)$$

Standardized feature vectors are utilized to build new feature subspace. In this approach, it first normalizes the feature vectors by the square root of subsequentEigen values, and afterward computes the distance between the training and testing features

Generally, the linearly transform (PCA) might be stated as ensuing equation:

$Y = TX$ (3)

Here T is transform matrix, X is an original vector and Y is a transformed vector to determine the transform matrix T, the next equation

$(\lambda I - S)U = 0$ (4)

Is utilized, here matrices I , S, U and λ are square matrix with unity on its diagonal, original image covariance matrix, eigenvectors and Eigen values. Uj And $\lambda j(j = 1,2, \dots m)$ may be calculated by equation (2), with the Eigen values ordered as $\lambda 1 \geqslant \lambda 2 \geqslant \cdots . \geqslant$
λm. Eigen vectors U perhaps stated as$U = [U1, U2, \dots \dots , Um]$.
In the proposed MPCA, the training samples are related for a given functions are chosen from a IDS dataset, and the transformed matrix T' was acquired from these training samples. It may possibly be reported as succeeding equation:

$$Y = T'X \qquad (5)$$

$$V_N = b_1u_1 + b_2u_2 + \dots . + b_Nu_N \qquad (6)$$

$$S = \sum_{i=0}^{1} b_1u_1; 1 < N \qquad (7)$$

The MPCA is a numerical algorithm that employs linear alteration to connect data from huge dimensional space to less dimensional space. MPCA successfully reduces the high dataset dimension via including high variance value coordinates and avoidlow variance of acquired input data as normal and intrusion data have features such as mean and standard deviation

(i). Mean= sum of no of data /total number of data (8)
(ii). Standard deviation: also denoted as root- mean square deviation since it is the square root of means of quadrangles deviation from arithmetic mean.

$\square = \sqrt{(\sum (x - x^{\cdot\cdot})/n)}$ (9)

3.3 Feature Selection using Enhanced Whale Optimization (EWO) Algorithm

In this work, EWO is introduced for efficient selection of features over IDS dataset. The aim of feature selection is to detect relevant features from the given data to identify the presence and absence of intrusion and non-intrusion features [25]. The enhanced Whale Optimization Algorithm (WOA) is used for many optimization problems to discover the optimal solution and select relevant features [26]. Enhanced WOA algorithm focused to select relevant features and indicated that EWOA performance of can be enhanced further to produce improved results, and used for feature selection in IDS datasets for accurate detection [27- 28].

3.4 Intrusion detection through Hybrid Federated learning Deep Multiclass classification

The proposed model fuses single Dimensional Binary Convolution Neural Network (BCNN) and multiple layers Multiclass (MCNN) network. The main inspiration in this leveraging first CNN layer is to permit the system to automatically extract features of raw data and in addition it assists in enhanced extraction of coarse-grained features at the beginning of the network [29]. The CNN and max pooling layers are combined together for parameter distribution and spatial differences.

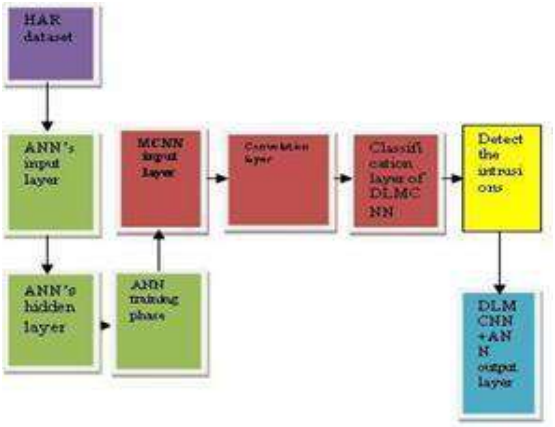

Fig. 1. Working model of HDLCNN+ANN

BCNN is utilized for collecting information by discovering which has three layers namely, input, hidden and output. The Input layers 11* 11 * 1 matrix gathers input images and is analyzed and produces 'n' inputs. Here S=1 to represent the input image side, either height or width. Hidden information is extorted by hidden layer from input layer and move towards output layer once hidden significant information is extracted. And also to overcome image shrinkage and loss we increase the number of feature maps according to the network intensity and by applying padding values in each and every convolution layers along with batch normalization [30]. In this proposed MCNN model the first convolutional layer takes input in the form of input an S * S *1 image. The second convolution layer consist of input as S * S * 8. Finally input image applied to the tensor at this stage based on the inspiration of skip connections used residual networks which used for rapid learning process and conquer a vanishing gradients issue which arises during the training of ANN to deep learning by applying back propagation algorithm.

Training Phase

However, the ANN has long duration for training and testing process. To overcome these problems, deep learning-based CNN is hybrid with ANN over the MCNN. MCNN is combined with ANN for more accurate intrusion detection with less computation time. The basic MCCNN contains an input and output layer, in addition to many hidden layers. A Hidden layer of MCNN usually contains convolution, pooling and fully connected layers. Introduced MCNN contains input, convolutional and classification layers. Introduced approach has evident advantages for analyzing data with high dimension. Fig 2. Shows the basic DMCNN architecture.

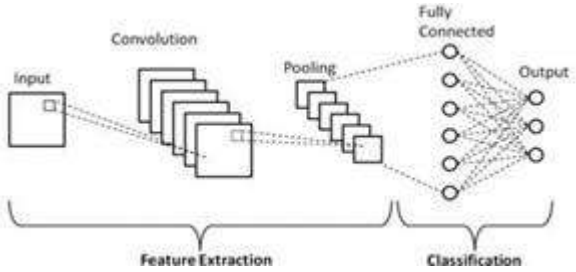

Fig. 2. Basic DMCNN architecture

Input layer takes intrusion features from training examples and translate the data to united form to distribute the data to successive layers suitably. Here initial parameters are defined as the scale of the local receptive fields and dissimilar filters

Activation function is determined in each convolutional layer. Activation function is employed to map an output to a set of inputs that crafts the network structure to be non-linear. Starting connection weights are initialized to entire feature values. New input prototype is used and output is calculated as

$$y(n) = f(\sum_{i=1}^{i=N} w_i(n)x_i(n) \quad (10)$$

Where $f(x) = \begin{cases} +1 & if\ x \geq 0 \\ -1 & if\ x < 0 \end{cases}$ (11)

Where n is the index for iteration

Connection weights are revised based on

$$w_i(n+1) = w_i(n) + \eta(d(n) - (n)x_i(n), \quad i = 1,2,..N \quad (12)$$

Here η is gain factor

After that use SD

$$\sigma = \sqrt{\frac{1}{n} f_i(x_i - \overline{x})^2} \quad (13)$$

The weighted intrusion features are fed into established ANN network and acquired original accurate classification result. Polynomial distribution function proves key findings of the investigations executed on analogous data set. Once the data passes through many convolution layers, output feature maps' size constantly reduces. For the classification layer, each feature map contains single neuron and turn out to be a feature vector. Vector is fully connected with the classifier. This proposed work setup the bench mark for classifications using the various classification algorithms such as Decision Tree, Random Forest, KNN, and SVM.

Testing phase

Classification Layer: In our model, we performed optimization with two optimizers: Stochastic Gradient Descent and Adam and finally confirms that Adam produces better results. The loss function determined by categorical cross-entropy loss, as a default function to estimates the actual probability that the input belongs to a particular class in multiclass classification. The proposed model set with learning rate as lr = 0.001. We adapted distribute learning algorithm called federated learning applied in training model which allows data of other participants which eliminates data sharing between them. So, there is no mandatory for central unit since server holds model and clients holds training data. The servers share the model to clients for trainingthe model with their specific data and finally accumulate back the streamlined weight.

Hence, each IoT client device execute its actual real- time data and also FL can be deployed in the situations that data have private information such as attack data which is tough to collect and share among them. We integrate NIDS with FL which makes NIDS classifier can learn additional cyber-attack characteristics from various parties which can facilitate to build efficient learning-based NIDS. FL frameworks are focus on training the NNs model based on horizontal FL setting, called FedAvg.

IV. EXPERIMENTAL RESULT

In this experimentation, daily activity recognition dataset is employed which consist of 30 subjects under various genders, ages, heights, weights, fitness values, heart beat samples, blood pressure through Smart sensor devices combined with smart phone[31]. We split the database of features in to two major divisions such as training and test database in 4: 1 ratio. The over experimentation and evaluation is conducted in IOT simulation environment and implemented using python language.

Performance Measures

4.1 Accuracy

Accuracy is inferred as the total correctness of system and is calculated as:

$$\text{Accuracy} = \frac{T_p+T_n}{(T_p+T_n+F_p+F_n)} \qquad (14)$$

Where Tp is true positive, Tn is true negative, Fp is false positive and Fn is false negative

4.2 Precision

Precision is computed as

$$\text{Precision} = \frac{\text{True positive}}{\text{True positive+False positive}} \qquad (15)$$

Precision is viewed as computation of accuracy or quality.

4.3 Recall

$$\text{Recall} = \frac{\text{True positive}}{\text{True positive+False negative}} \qquad (16)$$

4.4 F-measure

$$F = 2 * \frac{PR}{P+R} \qquad (17)$$

4.5 FPR

$$FPR = \frac{FP}{FP+TN} \qquad (18)$$

4.6 Computational Complexity

The proposed method offers less computational complexity

Table 1 shows the comparison values for IDS dataset using existing and proposed methods.

Methods/ Metrics	Centralized GAN	D- GAN with ANN	Proposed D-GAN with EWO-HFLCNN+ANN
Accuracy (%)	76	85	91
Precision (%)	71	82	89
Recall (%)	67	74	82
F-measure (%)	69	78	85.5

FPR (%)	34	20	11
Time complexity (sec)	55	41	22

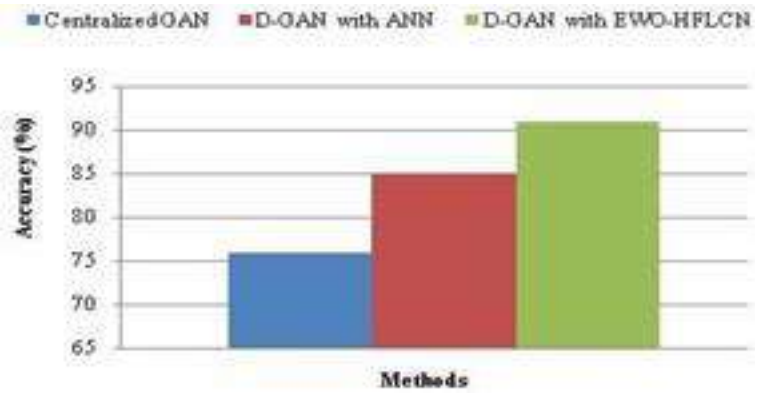

Fig 3.a) Accuracy

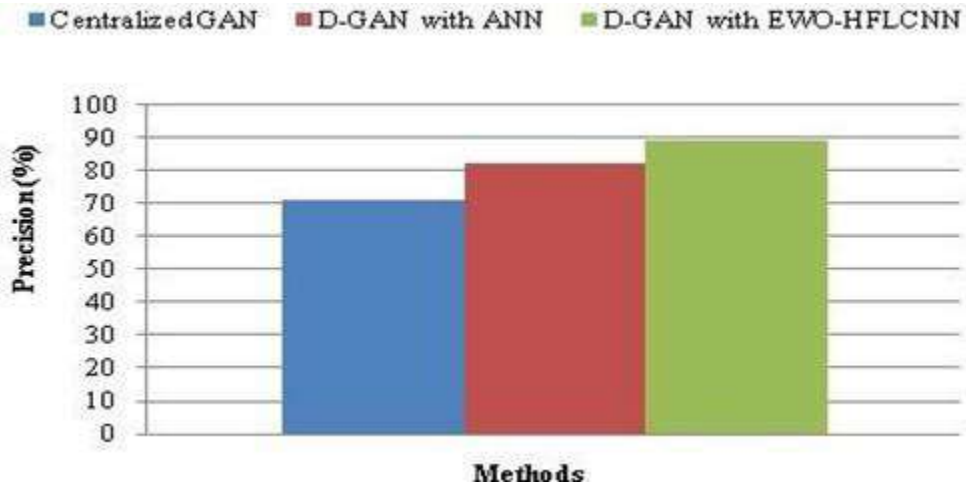

Fig 3. b) Precision

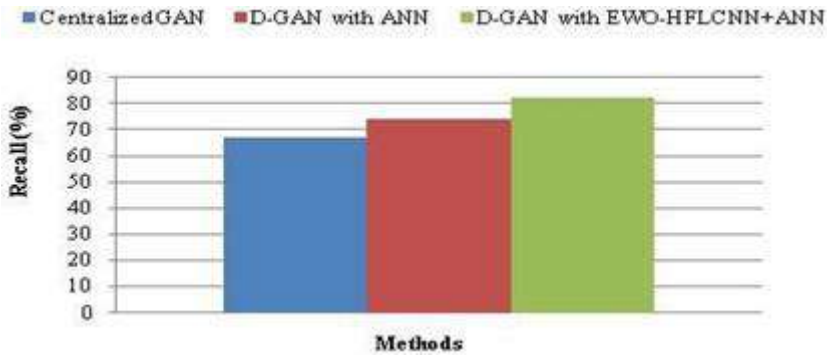

Fig 3.c). Recall

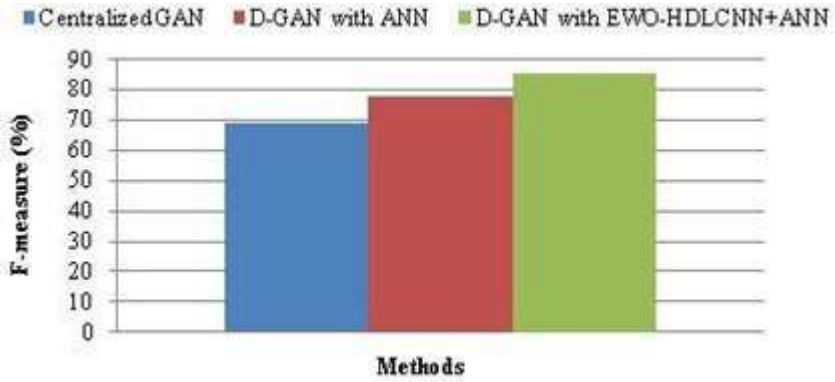

Fig 3.d-Measure

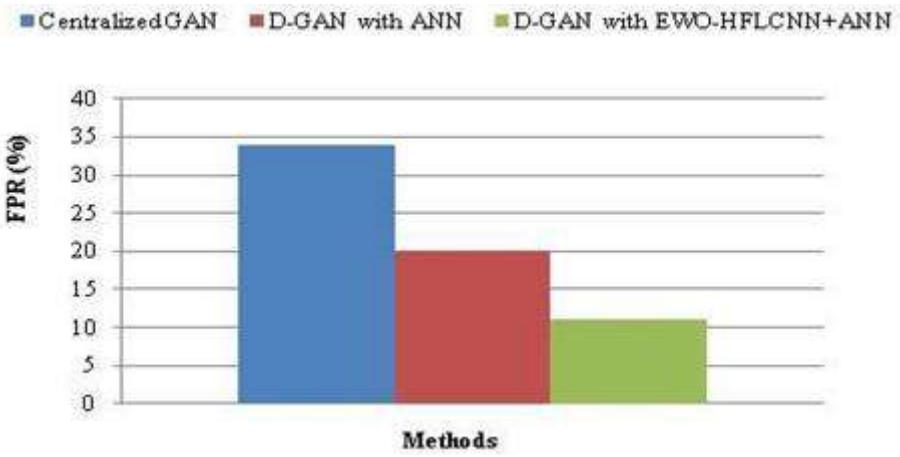

Fig 3.e). FPR

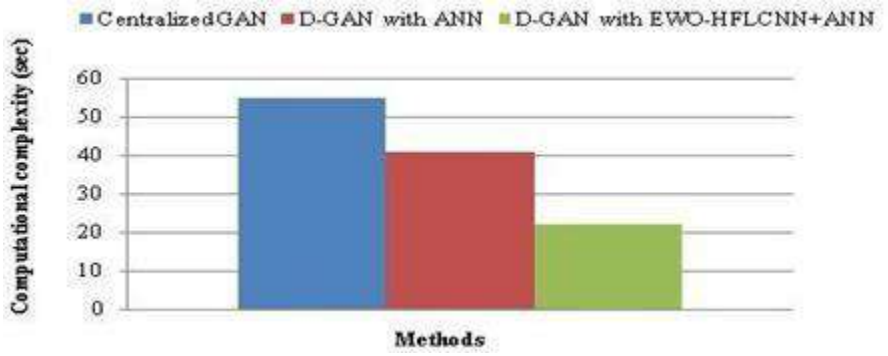

Fig . 3 f). Computational Complexity

V. CONCLUSION

In this paper, a proposed technique is used to detect the intrusions effectively. The solution indicates that introduced method offer better performance by means on superior accuracy, precision, recall, f-measure and lower false positive rate, computational complexity comparing with the existing algorithms. In future work, consider creating an exciting, dexterous, and lightweight distributed method to execute it in the end devices of Internet of Things Networks.

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Classification of Erythemato-Squamous Diseases of Skin Using Various Conventional Machine Learning Methods

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ABSTRACT
In the recent era, Machine Learning and Artificial Intelligence have come to a very great development point as we can use ML algorithms to predict the type of Erythemato-Squamous (Skin) diseases of the skin. In Dermatology, differential diagnosis of skin diseases is quite challenging in real life because most skin diseases share many histopathological features. And in this work, Psoriasis, Lichen Planus, Seborrheic Dermatitis, Chronic Dermatitis, Pityriasis Rosea, and Pityriasis Rubra Pilaris are among the skin illnesses for which eight different algorithm analytical comparison is done. Moreover, each classifier algorithm is discussed in detail with its pros and cons. The machine learning algorithms like Support Vector Machine, Decision tree, RandomForest, KNN, Naïve Bayes, Gradient Boosting, XGBoost, and Multilayer Perception have been proven to be successful in preserving state information through exact segmentation/classification. Random forest, Gradient Boosting, and XGBoost outperform all other methods and give an accuracy of 100% on the given ESD dataset. While Support Vector Machine gives the least accuracy of 72.97%. The paper alsodiscusses the difficulties connected with skin disease segmentation or categorization. Furthermore, the study proposes future potential directions that include real-time analysis.
Keywords: Erythemato-Squamous Diseases, Machine Learning, Classification, Skin Diseases, Comparative Analysis

I. INTRODUCTION

In recent times we observed that many people are suffering from skin diseases or skin cancer which can be curable at an early stage but now they are not curable thus after watching the continues advancement and development in technology and especially in AI & ML we decided to combine them and take the help from various machine learning algorithms to predict the skin diseases at the earliest stage so that patient can be cured within time and it can also help all medical field and especially in dermatology to predict the diseases atthe earliest stage. Many times, doctor is not able to get the type of skin disease in the earlier stage because at the beginning stage all types of skin diseases show the same symptoms and also share the same histopathological features so identifying in the earliest stage is also a very challenging task for the doctors

thus this time is wasted and can cause the disease to grow very quickly and can cause to death and cancer. This wasted time is very crucial for the patient and in this time if our algorithm can make the accurate and right decision then we can save the life of the patient. The provision of high-quality services at reasonable prices is one of the most difficult difficulties that health-care institutions (hospitals, medical facilities) confront today. Quality service include appropriately diagnosing patients and giving effective therapies [1]. Most hospitals currently employ some kind of hospital information system to manage their healthcare or patient data. These systems generally produce massive volumes of data in the form of statistics, text, charts, and pictures [2]. Regrettably, these data are rarely used to guide clinical decisions. The outcomes can be obtained by utilising relevant computer-based information and/or decision support tools. This presents a crucial question: "How can we turn data into valuable information that allows clinicians to make informed therapeutic decisions?" This is the primary incentive for this study. Erythemato- squamous diseases (ESDs) arevery prevalent skin conditions. “Psoriasis, seboreic dermatitis, lichen planus, pityriasis rosea, chronic dermatitis, and pityriasis rubra pilaris are the six distinct types.” They all have the medical indications of erythema and scaling, by actual slight exclusion. [3]. Psoriasis - Psoriasis is assumed to be a problem with the immune system. Scales and itchy, dry spots emerge as skin cells stack up and create scales. Infections, stress, and the common cold are all triggers. A rash on the skin is the most common symptom, however, the rashcan also affect the nails or joints. The treatment's purpose is to remove scales and reduce the pace at which skin cells multiply. Topical ointments, light therapy, and medications can provide relief. [4]. Seborrheic dermatitis - This skin ailment is characterised by flaking patches and red skin, mainly on the scalp. It can also appear on oily body parts like the face, upper chest, and back. Seborrheic dermatitis can create obstinate dandruff in addition to scaly patches and red skin. Self-care and medicinal shampoos, creams, and lotions are used in the treatment. Treatments may need to be repeated [5]. Lichen planus -An inflammatory skin and mucous membrane disease. When the immune system mistakenly targets skin or mucous membrane cells, lichen planus develops. Lichen planus shows on the skin as reddish, itchy pimples with a flat top. It creates lacy, white patches on mucous membranes, such as the mouth, and sometimes severe ulcers. Lichen planus is frequently self-resolving. Topical treatments and antihistamines may help if symptoms are bothersome [6]. Pityriasis Rosea - A hasty that twitches as a huge spot on the abdomen, chest, or back and then spreads out into a pattern of smaller lesions. The cause of pityriasis rosea is unknown, but it is thought to be caused by a viral infection. The illness creates a rash on the torso, upper legs, and upper arms that is mildly irritating. Pityriasis rosea is frequently self-resolving. Antihistamines, steroid cream, and, in rare situations, antiviral medicines can all assist [7]. Chronic dermatitis - Dermatitis is a word used to define a group of itchy, inflammatory skin disorders marked by epidermal abnormalities. Dermatitis affects one out of every five people at some time in their lives. It can be caused by a range of factors and has a variety of patterns. The phrases dermatitis and eczema are frequently confused.

Eczematous dermatitis is a term that is sometimes used. Dermatitis can be acute, chronic, or a combination of the two. Acute eczema (also known as dermatitis) is a fast-progressing red rash that can blister and swell. Eczema (or dermatitis) is a long- term irritating skin condition. It's usually darker than the rest of the skin, thicker, and scraped a lot [8]. Pityriasis Rubra Pilaris (PRP) – It is a term used to describe a collection of rare

skin illnesses characterized by scaling patches that are reddish- orange in colour and have well-defined edges. They can cover the entire body or convinced parts like the prods and laps, palms, and soles. Islands of sparing are patches of uncomplicated skin, especially on the stem and limbs, which are frequently seen. The palms and soles are commonly affected, becoming swollen and yellowish in appearance (palmoplantar keratoderma).PRP is frequently misdiagnosed as psoriasis or another skin disorder [9].

Infection with one of these skin diseases results into the worsening of skin cells (squamous) and origins redness of the skin (erythema). Dermatologists often inspect patients clinically as well as on the basis of histopathological components [10]. Clinical inspections include examination of color, existence of pimples, size, position of, and other symptoms. All the above inspections lead to 12 clinical and 22 histologicalvariables for each person/patient. The investigation of these parameters may lead to indefinite and indistinct consequences, as they may intersect, especially in the early phases of ESD. So, there is a need to identify the appropriate classification technique to solve this problem and give a better result/prediction. This paper reviews all conventional techniques present to perform the differential diagnosis of ESD and also to identify the challenges existing with approaches. The contributions of this study are as follows:

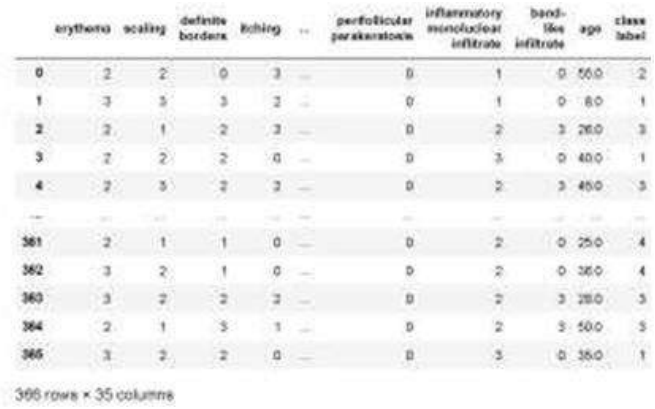
(i) Analytical comparison of all relevant conventional machine learning techniques for differential diagnosis of ESD is done.
(ii) Also, the challenges and issues associated with each technique is identified.
(iii) The study discusses the future potential directions that include real- time analysis.
(iv) Discuss the difficulties connected with skin disease segmentation or categorization.

The structure of this paper is as follows: The description of material and methods used in this comparative analysis is given in Section 2. Section 3 contains the result and discussions of the analysis. Prominent challenges and future scope are described in the Section 4 and lastly Section 5 concludes the study.

II. MATERIALS AND METHODS

A. Materials

We used a standardized dermatology data set from the “University of California, School of Information and Computer Science's machine learning repository, or UCI. It has 34 properties, 12 of which are clinical and 22 of which are histological”. Age and family history are continuous characteristics in the data set, with values ranging from 0-1. “Every additional clinical and histological feature was assigned a degree from 0 to 3, with 0 indicating that the feature was not present, 3 indicating the maximum amount possible, and 1, 2 indicating relative intermediate values”. Naive Bayes, Random Forest, Support Vector Machines, XGBoost, Multi- layered perceptron, K-nearest neighbors, Decision tree, Gradient boosting DT are among the ML Classification Algorithms investigated in this paper. Figure 1 shows the extract of the dermatology data set from the University of California, School of Information and Computer Science's machine learning repository,or UCI [10].



	erythema	scaling	definite borders	itching	...	perifollicular parakeratosis	inflammatory monocluclear infiltrate	band-like infiltrate	age	class label
0	2	2	0	3	...	0	1	0	55.0	2
1	3	3	3	2	...	0	1	0	8.0	1
2	2	1	2	3	...	0	2	3	26.0	3
3	2	2	2	0	...	0	3	0	40.0	1
4	2	3	2	3	...	0	2	3	45.0	3
...	...	...	...	...	...	...	...	...	...	...
361	2	1	1	0	...	0	2	0	25.0	4
362	3	2	1	0	...	0	2	0	36.0	4
363	3	2	2	3	...	0	2	3	28.0	3
364	2	1	3	1	...	0	2	3	50.0	3
365	3	2	2	0	...	0	3	0	35.0	1

366 rows × 35 columns

Figure 1: Visualisation of the dataset.

Table 1: Six classes of ESD

Keys	Values (Class Labels)
1	Psoriasis
2	Seborrheic Dermatitis
3	Lichen Planus
4	Pityriasis Rosea
5	Chronic Dermatitis
6	Pityriasis Rubra Pilaris

B. Methods

a) Support Vector Machine (SVM)

The SVM's goal is to discover the hyper plane in n- dimensional space, where n is the number of variables. The hyper-plane is chosen such that the distance between the nearest data points and support vectors of the two separate modules is as little as possible. We may think of the hyper plane as a line in two dimensions and a plane in three dimensions. Hyper plane separates the data points of two different classes [11]. Numerous of the prevailing (non)convex soft-margin losses can be observed as one of the substitutes of the L0/1 soft- margin loss. SVM have gained huge consideration for the last two decades due to its wide-ranging usage, so many researchers have established optimization procedures to solve SVM with various soft-margin losses [12]. For the prediction corresponding to a new input can be obtained using Equation 1:

$f(x) = B0 + sum(ai * (x, xi))$ (1)

Where f(x) is used to calculate the inner dot product which is the sum of the multiplication of each pair of the input values i.e., x as the new input and xi as each of the support vectors present in the training set. B0 and ai are the coefficients evaluated from the training data [12]. Figure 2 shows the visuals of the Support Vector Machines (SVMs) Model with all necessary features like absolute hyperplane with maximum margin, hyperplane with positive and negative trends and the nearest data points as the support vectors.

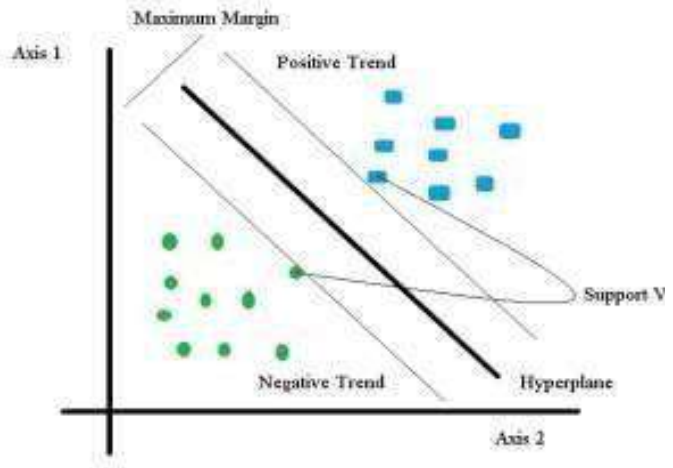


Figure 2: Visualization of Support Vector Machines (SVMs) Model [13]

b) Random Forest

It is, as the name implies, a group of various decision trees, each of which predicts some class, and the class having the most votes is accepted as the predicted class. These decision trees produce distinct outcomes relatively. This concept is highly effective in the reduction of prediction errors if predicted through a single decision tree. In this approach, an individual tree may be in the wrong direction but the common direction could be in the right direction [14]. The Figure 3 demonstrates the formation of the multiple decision trees with differently specified branching conditions to form a random forest and each decision tree having its own prediction.

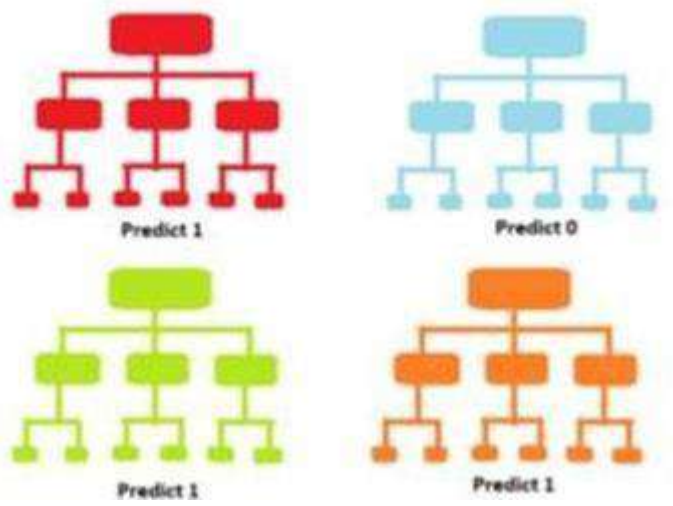


Figure 3: Visualization of a Random Forest Model [15]

c) Naive Bayes

This classifier is based on the Bayes theorem and approaches the probabilistic strategy in classification through prediction. Equation 2 states the approach of Bayes theorem:

$P(A|B) = P(B|A)\ P(A) / P(B)$ (2)

Where we discover the chance of happening of A assuming that B had already occurred. In this concept A is considered as the hypothesis and B is considered as the evidence. This approach is best when the features are not affected by each other [16]. The Figure 4 shows the visuals of Naive Bayes Classifier Algorithm.

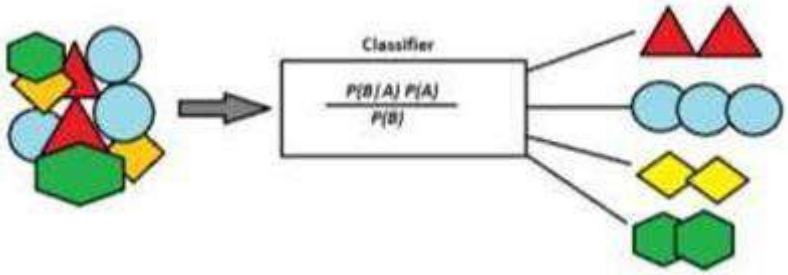


Figure 4: Visualization of Naive Bayes Classifier Model [17]

d) Decision tree

As the name suggests, we can find an analogy between a tree and a result tree. A result tree is similar to a tree by having split conditions as a node, directing edges as branches, and decisions as leaves. The formation of a tree involves feature decision and branching conditions and holds the decision by preventing further branching. This approach follows the greedy concept by splitting the branches with lower prediction cost i.e., the class with the maximum data points should be classified initially at 0 level/root node [18]. The Figure 5 demonstrates the formation of a decision tree with root node, sub-tree having branching from decision nodes and predicted outcomes as Terminal nodes.

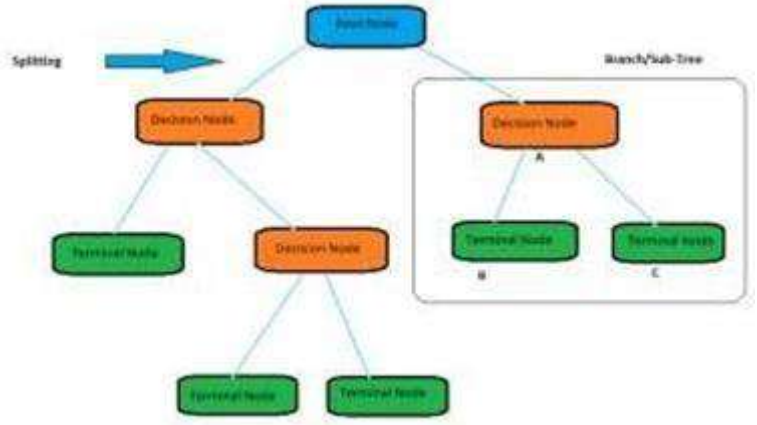


Figure 5: Visualization of Decision Tree Model [19]

e) K-nearest neighbors

As the name suggests, this algorithm finds the separate clusters of data points present in proximity i.e., near to each other based on the distance between the two data points. In this classification approach, the K refers to the number of neighbors as the class labels and the mode of k labels is considered as the predicted outcome. The efficiency of this algorithm decreases with an increase in the number of predictor variables [20]. For a new input having real values, the distance is most likely to be measured through Euclidean distance given by Equation 3:

$EuclideanDistance(x, xi) =$

$sqrt(\ sum(\ (xj - xij)\text{^}2\ )\ )$ (3)

Where x is the new input and xi is the existing point covering all the j input attributes [21]. The Figure 6 visualizes the formation of clusters of data points in proximity representing the nearest neighbors in K- Nearest Neighbors Model.

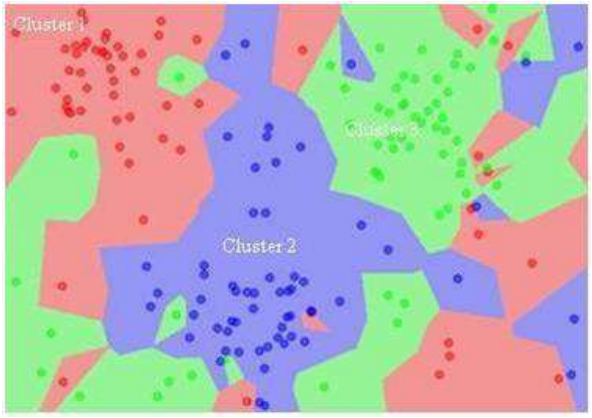


Figure 6: Visualization of K-Nearest Neighbors Model [22]

f) Gradient boosting DT

As the name suggests, in this approach small steps are initiated from a point in a direction by enhancing the weak learners to make them strong. It consists of a cost function, feeble leaner, and preservative sequential approach to improving the presentation of the predictive model [23]. This classifier algorithm is highly used to optimize the user-defined cost functions by using the gradients in the loss function to make them controlled and realistic [24]. The Figure 7 demonstrates the process of gradient boosting by the formation of efficient decision tree with repetitive error elimination from the previous decision trees.

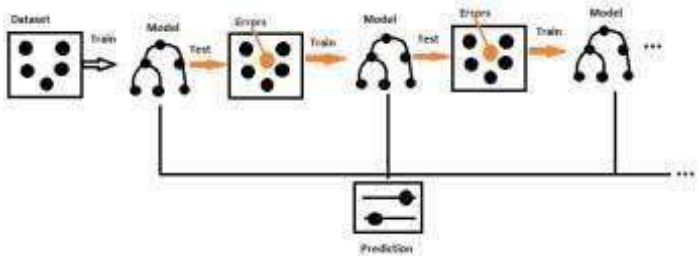


Figure 7: Visualization of Gradient Boosting DT Model [25]

g) Multi-layered perceptron

As the name suggests, it refers to the neural networks or system of input, output layers, and various hidden layers between them with multiple neurons connected. A perceptron is referred to as a neuron with a random activation function. This algorithm uses the technique of backpropagation, a repetitive approach of combining the weights and the inputs which are achieved through the threshold function to minimize the cost function [26]. The Figure 8 Shows the working of the Multilayer Perceptron Model by supplying weightsand inputs to the activation functions iteratively in the hidden layers to produce an output.

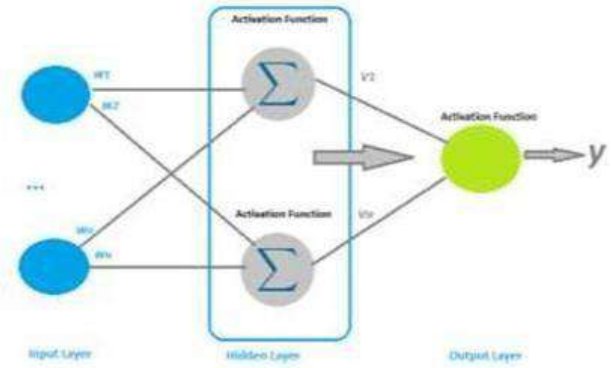


Figure 8: Visualization of Multilayer Perceptron Model [27]

h) XGBoost

This is known as an extreme gradient boosting algorithm. In this approach the framework of gradient boosting is conserved. It is a highly optimized algorithm in terms of software as well as hardware resources usage for supercilious prediction outcomes in a quick time with minimal computing cost. This approach involves Gradient descent methodology as gradient boosting for strengthening the weak learners like CARTs [28]. The Figure 9 describes the internal processes of XGBoost Model like interface compatibility, feature importance analysis, extendibility, flexibility, cross validation & model tuning, system processes, parameter tuning, optimization algorithms.

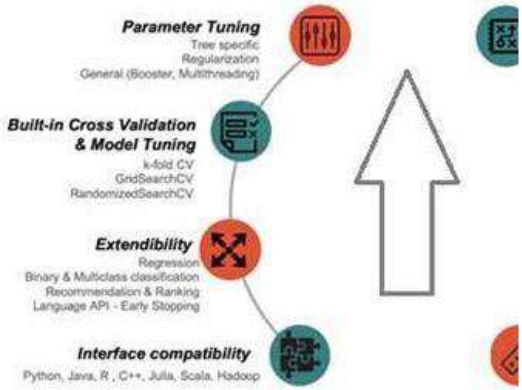


Figure 9: Visualization of XGBoost Model [29]

III. RESULTS AND DISCUSSION

This section will analyse all the classifier accuracy and performance using the confusion matrix and will give the proper comprehension regarding the best classifier algorithm. To do this analysis few pre-processing step is to be applied on used dataset. First the count of null values of attributes will be checked, which is shown in Table 2. So, we can clearly see that there are 8 rows of age attribute with null values. Now, describe the dataset to check the composition of the dataset. After this, the descriptive statistics of the dataset is collected, which is shown in Table 3.

Table 2: Number of null values in attributes

Attributes	Null Values
erythema	0
scaling	0
definite borders	0
itching	0
koebner phenomenon	0
polygonal papules	0
follicular papules	0
oral mucosal involvement	0
knee and elbow involvement	0
scalp involvement	0
family history	0
melanin incontinence	0
eosinophils in the infiltrate	0
PNL infiltrate	0
fibrosis of the papillary dermis	0
exocytosis	0
acanthosis	0
hyperkeratosis	0
parakeratosis	0
clubbing of the rete ridges	0
elongation of the rete ridges	0
thinning of the suprapapillary epidermis	0
spongiform pustule	0
munro microabscess	0
focal hypergranulosis	0
disappearance of the granular layer	0
vacuolisation and damage of basal layer	0
spongiosis	0
saw-tooth appearance of retes	0
follicular horn plug	0
perifollicular parakeratosis	0
inflammatory monoluclearinfiltrate	0
band-like infiltrate	0
Age	8

Table 3: Description of dataset without replacing null values

Parameters	Values
count	358.000000
mean	36.296089
std	15.324557
min	0.000000
25%	25.000000
50%	35.000000
75%	49.750000
max	75.000000

Now, in lieu of the null values with the median value of the attribute and describe the dataset again. Table 4 describes the altered dataset, after replacing the null values present in age attribute.

Table 4: Description of dataset after replacing null values

Parameters	Values
count	366.000000
mean	36.363388
std	15.037366
min	7.000000
25%	25.000000
50%	35.000000
75%	48.000000
max	75.000000

Now, it can be clearly seen that there is only a slight difference in the mean frequency of the dataset. Mean frequency difference percentage = 0.18%. Now, import all the 8 classifier algorithms i.e., Naive Bayes, Support Vector Machines, Random Forest, XGBoost, Multi-layered perceptron, K-nearest neighbors, Decisiontree, Gradient boosting DT. By meeting the internal classes ration in both sets, divide the dataset into a train set and a test set with a test size of 0.1. Now, the next step is to check the distribution of classes in trainingand test set. Figure 10 show that the distribution of both the training and test set are in proportion.

Figure 10: Class distribution in training and test set

The internal ratio of classes is same in both the sets as shown in Figure 10. After training these models with various classifier algorithms mentioned above and test for the accuracy scores. Figure 11 describes the accuracy scores of the classifier algorithms. It is the number of correct predictions made divided by the total number of predictions made, multiplied by 100 to turn it into a percentage [30]. Now, plot the confusion matrices for the various classifier algorithms mentioned above. Confusion Matrix is a performance measurement for machine learning classification. Well, it is a performance measurement for machine learning classification problem where output can be two or more classes [30]. The Figures 12 shown beloware the confusion matrices of the classifiers algorithms which compares the predicted class of ESD byclassifiers algorithm to the actual class of ESD for a particular set of attribute values from test set.

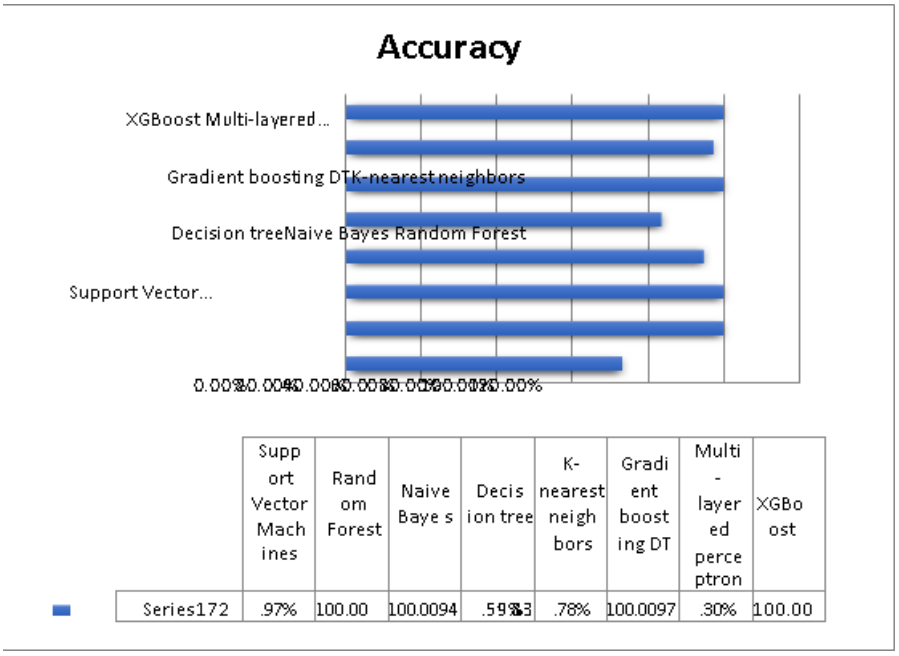
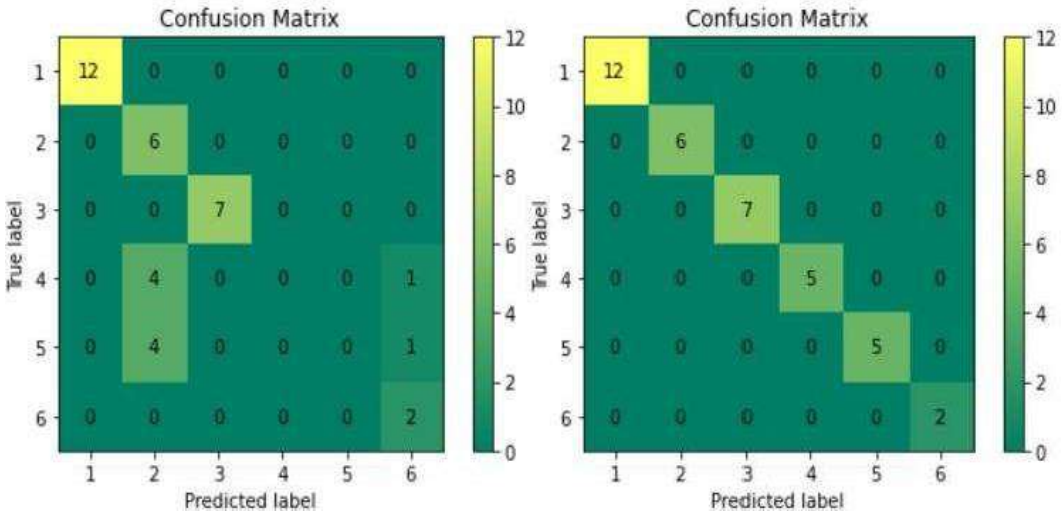
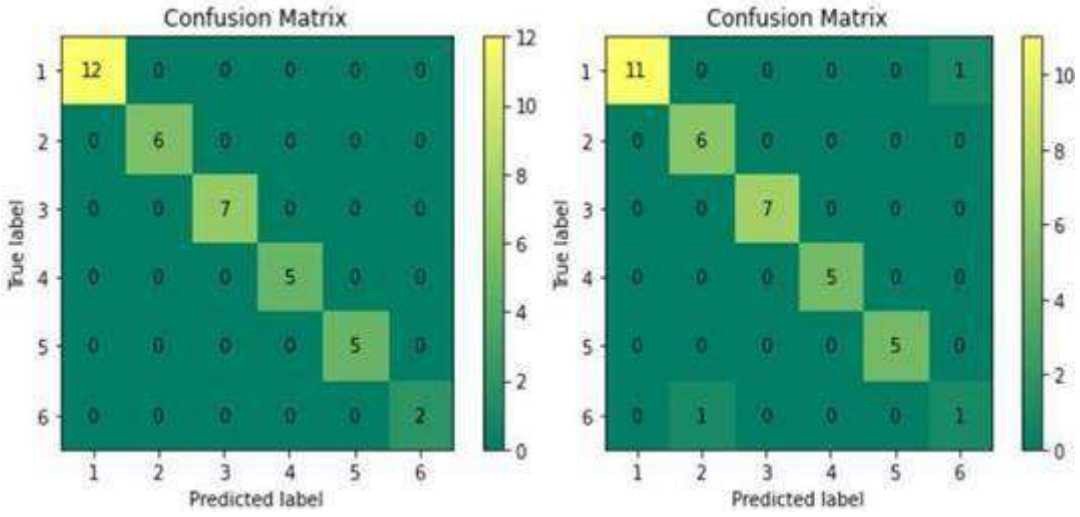


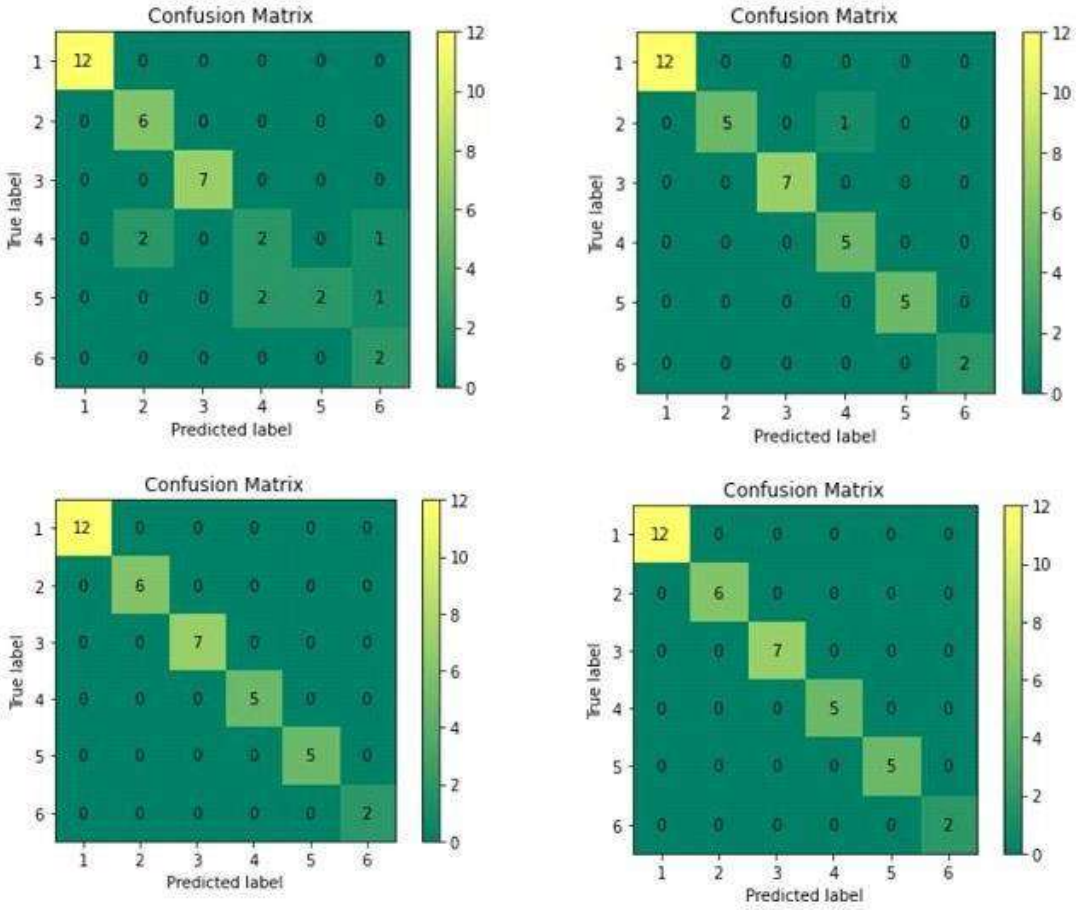
Figure 11: Accuracies of classifier algorithms



(a) (c)



(b) (d)



(e)(f)(g)(h)

Figure 12 (a): SVM Confusion matrix, Figure (b): Random Forest Confusion matrix, Figure (c): Naive Bayes Confusion matrix, Figure (d): Decision tree Confusion matrix, Figure (e): KNN Confusion matrix, Figure (f): Gradient boosting DT Confusion matrix, Figure (g): MLP Confusion matrix, Figure (h): XGBoost Confusion matrix

From the above confusion matrices, we can clearly see predictions as per the accuracy scores of all the classes of ESD. The algorithms with 100 percent accuracy or the Ensemble of classifier algorithms with the best accuracies were employed for better classification about the prediction of the differential analysis of erythemato-squamous diseases constructed on their accuracies (ESD). By satisfying the internal classes ratio in both sets and checking the classification distribution in the trained and trial sets, the dataset was divided into a train set and a trial set with a test size of 0.1. After that, we can see that the internal class ratio is the same in both sets, and we also trained these models using the various classifier techniques discussed above, and we tested their accuracy: "Support Vector Machines (72.97%), Random Forest (100.0%), Naive Bayes (100.0%), Decision Tree (94.59%), K-nearest neighbors (83.78%), Gradient Boosting DT (100.0%), Multi- layered perceptron (97.3%), and XGBoost (100.0%) were the most popular".

IV. CHALLENGES AND FUTURE SCOPE

Challenges in the current study is as follows: (i) In the data set, there is 2.2 percent missing data for the age attribute. The mean frequency was used to replace missing data with true values. As a result, training M.L. model would have been more effective if we had used real data. Our dataset size is small so it can lead tomany problems like overfitting, Measurement errors, Missing values, Sampling Bias, etc. Due to this model accuracy will be low and can produce very bad results also at sometimes. Like in if have the biased data thenit can lead to the worst prediction [30]. (ii) The system will take time even if we use the best method with massive data. In some circumstances, this may result in the use of more CPU power. Furthermore, the data may take more storage space than is available. (iii) Vast quantity of data for training and testing is acquired. As a result of this technique, data inconsistencies may emerge. This is due to the fact that some data is updated on a frequent basis. As a result, we'll have to wait for more information. If this is not the case, the oldand new data may produce contradictory results.

Future scope of the current study is as follows: (i) Automatic diagnosis of these illness groupings could aid physicians in making decisions. (ii) Medical testing in hospitals must be kept to a minimum. They can achieve these results by utilising appropriate computer-based info and/or decision-making technology. (iii) We can improve our app by using a larger dataset and creating an app that can predict a huge number of diseases. (iv) We can establish the link between clinical and histological features using our feedback methodologies.

V. CONCLUSION

"Psoriasis, seboreic dermatitis, lichen planus, pityriasis rosea, chronic dermatitis, and pityriasis rubra pilaris are all classified as erythemato-squamous disorders (ESD), is possible with an artificial-intelligence-based approach through machine learning models using different classification algorithms, including Support Vector Machines, Random Forest, Naive Baye." We can see from the preceding calculations that utilizing the attribute's median to replace missing values results in a very small percentage change in the dataset's mean frequency. Furthermore, while comparing eight other classification methods, we can find that XGBoost fared

exceptionally well with a 100% accuracy rate for three of them, namely Random Forest, Naive Bayes, and Gradient Boosting DT. XGBoost could be useful since it uses a mixture of software and hardware enhancement methods to provide supercilious prediction results with minimal computer assets in a small quantity of period.

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An IoT Based Smart Water Quality Monitoring System Using Cloud

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ABSTRACT
The Internet of Things (IoT) is the community of physical devices, vehicles, domestic appliances, anddifferent items embedded with electronics, software, sensors, actuators and connectivity which allows these matters to join and exchange data. The range of IoT units has improved 31% year-over-year to 8.4 billion in 2017 and it is estimated that there will be 30 billion units by 2020. Water air pollution is a major environmental hassle in India. The greatest supply of water air pollution in India is untreated sewage. Other sources of pollution encompass agricultural runoff and unregulated small-scale enterprise that result inpolluting most of the rivers, lakes and floor water in India. In this paper, An IoT Based Smart Water Quality Monitoring System the usage of Cloud and Deep Learning is proposed to display the quality of the water in water-bodies. In traditional systems, the monitoring process involves the guide series of pattern water from various regions, observed via laboratory checking out and analysis. This process is ineffective, as this manneris hard and time consuming and it does not grant real-time results for a longer period. The quality of water needs to be monitored continuously, to ensure the secure supply of water from any water our bodies and water resources. Hence, the layout and improvement of a low-cost system for real-time monitoring of water fine the use of the Internet of Things (IoT) is essential. Monitoring water quality in water bodies by the use ofInternet of Things (IoT) helps in combating environmental problems and enhancing the health and residing requirements of all dwelling things. The proposed system video displays units of exception of water relentlessly with the help of IoT devices, such as ARDUINO UNO. The in-built Wi-Fi module is connected inARDUINO UNO which permits web connectivity transfers the measured statistics from sensors to the Cloud. The prototype is designed in such a way that it can screen the number of pollutions in the water. Multiple sensors are used to measure quite a number parameters to determine the water quality from water bodies.The outcomes are saved in the Cloud, deep learning techniques are used to predict whether the water is appropriate or not.

I. INTRODUCTION

Wireless sensor networks are turning into popular among the lookup neighbourhood for their low-cost design and easy structure factor. The state-of-the-art developments in wireless technological know-how enhance giant area statistics acquisition and reliability in opposed environmental conditions. Moreover, the

lookup neighbourhood focuses on the form factor and enlargement of the wi-fi node involving in remote manner monitoring and automation. Internet of Things (IoT) is the mixture of a bodily object, controller, sensor, actuators, and Internet. IoT performs a vital role in Industry 4.0. Actuators and sensors are the devices that have interaction with real-world bodily objects and collect data from the environment. Actuators and sensors, process the electrical enter and radically change into tangible action. IoT devices accumulate a big quantity of data that are valuable and beneficial which must be stored, geared up and processed. The fundamental structure of IoT is based totally on three layers: i) Physical Layer, ii)Network Layer, and iii)Application Layer. In the bodily layer, sensors measure the records from outdoor surroundings and turn them into valuable data. After records collection, time-sensitive data need to be processed immediately. Otherwise, the facts have to be deeply processed and analysed to be saved in the Cloud to keep away from community clutter. In the community layer, the raw facts are amassed from more than a few sensors to be aggregated and transformed to digital streams for data processing. For records processing, Data Acquisition System(DAS) [21] is the most appropriate manner to sample the indicators from the real-world objects to convert the results into digital numeric values that can be manipulated with the computer. The working precept of data acquisition is to convert analog waves into digital values for information processing. Internet gateway receives the aggregated and digital records via Wi-Fi, WLANs, etc. The utility layer providesparticular offerings to the user.

Subsequently, the information can be safely saved in the server or Cloud for analysis. When IoT is augmented with sensors and actuators, the technological know-how will become a extra general class of Cyber-Physical Systems (CPS), that also encompasses applied sciences such as clever grids, virtual power plants, clever homes, clever classrooms, intelligent transportation, smart hospital, clever traffic, and smart cities. IoT specifically exploits general protocols and networking technologies. However, some of the major enabling applied sciences and protocols used in IoT are RFID, NFC, low-energy Bluetooth, low-energy wireless, low energy radio protocols, LTE-A, and WiFi-Direct. Also, the chemical reagents prices are typically excessive that leads to an expansion in the take a look at cost. The researchers focus on developing a real-time water excellent monitoring machine to measure the solvent and pollution in the water of our bodies and ensure real-time information acquisition to the database the use of the Internet of Things (IoT) for stay water first-rate analysis.

II. LITERATURE SURVEY

Environmental air pollution is the major motive to measure and recognize the toxic, chemical and organic quality parameters of water. Most of the water in our bodies is polluted by humans. Almost 71% of the Earth's floor is covered by water, and over 96% of water is saline in the oceans. Water looks to be one of the principal sources for all the forms of life, along with human beings, animals, plants, trees, birds, etc. on earth for survival. On Earth, solely 2.5% of water is determined to be clean water. Albeit, 0.3% of freshwater is existing in lakes, wells, rivers and dams. In a year, about 95% of the accessible freshwater is entering into drains from households [27]. Nearly 4 gallons of water is getting wasted through leakage in faucets and other domestic use. About 80% of water is polluted because of industrial wastage which is dumped into lakes, rivers

and buried beneath deep oceans barring any proper treatment. A lot of poisonous marketers and chemical substances are getting dissolved in freshwater as a consequence making it highly contaminated. The human beings in rural areas now do not have awareness about these contaminations. Around 70% of groundwater is being utilized for agricultural functions in the world. It is predicted that water demand is going to rise by 50% in the future. While the usage of polluted water for agriculture, the land is additionally polluted which causes serious damage for all the structured dwelling matters [6]. As the water our bodies pollute the land, it creates an imbalance in the surroundings biosphere. Any imbalance in the water will have an effect on its satisfaction that severely influences the ecological system amongst the species [5]. Most nuclear reactor wastage is sealed and buried underneath the ocean; if any leakage happens, the complete sea will become unsafe and every dwelling component in the sea will be affected. During the 19th century, water samples had been gathered from a range of places and have been examined in the laboratory. The effects were astonishing [9]. A study by way of water resources estimated that 41% of human beings residing in city areas stay barring adequate sanitation. Nearly 80% of disorder unfolds through polluted water. Some of the ailments might not reflect immediately, it will have an effect on the internal organs of the living things and later have serious effects. In some countries, a lot of human beings no longer have access to easy water due to lack of authority's prioritization, lack of committed funding, shortages in human sources and the exacerbating effects of local weather exchange on water availability and great [17]. There are about one hundred and one main parameters to check the water fine initiated by the environmental protection organization [24]. If any of the values crosses its parameter degree then it is an imbalance in water and it is not appropriate for home usage. To grant an achievable and cost-effective answer to this problem, sensors are considered. With the assistance of sensors, an answer is offered that can drastically minimize the costs, as nicely as provide the competencies to display the water quality uninterruptedly. There comes a lot of challenges to monitor the fine of water owing to human disaster, population increase and surprising adjustments in the environment. IoT will become the generation of sensing the environment consistently in real-time and capable of providing accurate results. The use of automation for continuous monitoring reduces the guide strength and for that reason reduces the price too. This mechanism is being designed and developed with a low value superb monitoring machine for the essential parameters in real-time. In the proposed work, pH, Humidity, Temperature, Co2 sensors are used to measure the amount of water continuously. In addition to pleasant parameters, poisonous chemical substances are additionally being monitored with the useful resource of the MQ-9 sensor. Nowadays, it was amended to display the water in our bodies to proceed to have exact fitness for all varieties of lifestyles in the world and to balance the ecological machine in the biosphere. In this work, the sensors are related to the ARDUINO UNO microcontroller that transmits the sensed statistics to the cloud. Furthermore, the saved records in the cloud can be retrieved and used for similarly evaluation the use of deep learning mechanisms.

III. RELATED WORK

Fiona Regan et al. have mentioned a clever quality monitoring gadget in figuring out the records to be sent wirelessly. Fiona Regan et al. have proposed a concept of achieving the goal by amassing the statistics from all the nodes wirelessly. It discusses the series of water quality parameter facts from clever sensors and sends the data to the device. In this system, the gathered records are given to a far-off server via the GPRS network. So, the consumer can view the information remotely. The sensors were present in the water faucet to measure whether or not the parameters of water. Fiona Regan et al. have noted that this system becomes especially scalable, quicker and user-friendly. But some problems have been observed in the current methodology that smart sensors turn into incredibly high priced and any of the nodes fail in the network, then the route of transmission will be lost. Moreover, the measurement of the sensors is no longer dependable in the water tap. ZulhaniRasin et al. [26] have described the importance of a water best monitoring gadget with Zigbeeprotocol based totally on Wireless Sensor Network. In this system, some sensors are linked to the Zigbee ZMN2405Hp module to measure the first-class water. It is implemented thru WSN proposing excessive power transmission Zigbee based totally technological know-how and additionally with IEEE 820.15.4 like- minded transceiver. On the receiver side, Zigbee is linked to the Personal Computer that shows the GUI of the circuit. The excessive energy Zigbee is used in this machine and it can be utilized for small place networks. Data storage in the base station is necessary. ZulhaniRasin et al[26] have observed some problems in the existing methodology in measuring the presence of gasoline present inside the water and water bodies. NazleeniSamihaHaron et al. [15] have proposed an idea in creating a far flung water best monitoring system using wi-fi sensors for the removing of cost consuming jobs of guide monitoring. The proposed work usually focuses on the aquaculture for prawn farming. The measured values are accrued through the facts kit which sends the statistics to the processing unit thru GSM modem. NazleeniSamihaHaron et al[15] have centered on monitoring the pH, temperature and dissolved oxygen in water. EZ430-RF2500 is the hardware module used which consists of two components one is the quit gadget and another is an get admission to point. The statistics from exclusive sensors are monitored in the information processing unit and continuously compared with the steady parameter values. With the help of GSM modem every time the sensor fee crosses the threshold parameter value, then an alert message is sent to the farmer. If the water does not meet its quality parameter value, then, an alert sign is related to the buzzer. In the proposed work, a mobile cell phone is required for testing functions and the telephone acts as the client. The proposed machine [15] is greater environment friendly in monitoring the prawn pond in aquaculture. Nazleeni SamihaHaron et al [15] have determined that is no longer appropriate for long-distance and also it works for solely single unit of the water source. Without a cell phone, the farmer may not get hold of an alert message in case of the unavailability of phones. If the phone is damaged, then it would end up a major problem with this system. Dong He et al.[3]have mentioned the water quality monitoring gadget primarily based on Wireless Sensor Network (WSN). Dong He et. al., have proposed a thinking to monitor the water exceptional primarily based on WSN the use of the wireless network and far off facts center. WSN collects the data about the nice of water from

special areas and transfers the records to a far-off statistics core with the assist of GPRS DTU, which is constructed upon the TCP/IP protocol used for facts transmission. In the proposed machine the WSN is built on Zigbee protocol, it is typically used for personal area networks and in a peer-to-peer community and so the transmission is very high. According to the function, the nodes of WSN are divided into three parts: coordinator, router, terminal. The duty of the coordinator is to receive and to switch the information to GPRS DTU. Router node typically has no impartial feature of collection, it will switch facts from the terminal node to the coordinator node. Finally, the terminal node has different sensor modules like pH module, Pollutant levels, temperature, turbidity and so it will acquire and transmit the data. With the assist of the records accumulated from the data center is analysed and used for in addition processing. This system can be used for the lengthy time period due to the fact it is stable and real-time water best monitoring. However, this method isn't always a low-priced answer for a massive area. Kulkarni Amruta et al. [10] proposed a thought of developing a solar-powered water nice monitoring system primarily based on wi-fi sensor networks. In this system, Kulkarni Amruta et al broadly speaking targeted on quality parameters like pH, oxygen degree and turbidity through WSN science that has been powered the use of a solar panel. In the proposed work, the simulation work was done to analyze the nice parameters for first-rate control with VB and MATLAB to measure the graphical and numerical record. In this system, the nodes acquire the data from one of a kind wi-fi sensors and switch the statistics to the base station. With Zigbee protocol, the nodes can transfer the measured records to the base station that is powered by the photovoltaic panel. With the assistance of the photovoltaic panel, the system always receives energy supply and will become more efficient.The machine is pricey as nicely as, if the solar panel can't be charged or acquired broken due to the fact of any environment threats then the gadget will cease working.

IV. METHODOLOGY

In this system, we are the use of arduino as the microcontroller. The complete device is designed in embedded-C and simulating the written code the usage of Arduino IDE. For facts series on PH, water level, temperature and leakage of the surrounding atmosphere, the water first-rate monitoring machine employs sensors. These data can be accessed by way of licensed customers by means of the use of a consumer ID and password on the internet server by means of logging into their accounts. The gathered data is saved and analysed and transmitted in real-time. A rectifier, relay and a transformer are linked with the microcontroller.The ESP8266 is a low value wi-fi module consists of a full TCP/IP stack wi-fi chip and a microcontroller chip arduino, which facilitates the information storage in IOT cloud. The wi-fi module makes use of transmitter and receiver serial pins for sending and receiving data, for altering wi-fi module settings and for altering the serial question commands. The information from the sensors will be displayed on the LCD display. The code boots from exterior flash without delay at some stage in the processing of the program, thereby increasing the gadget overall performance and storage necessities due to their optimized cache capacity. Finally, we can get admission to the data on the internet utility the usage of non-public android phones.

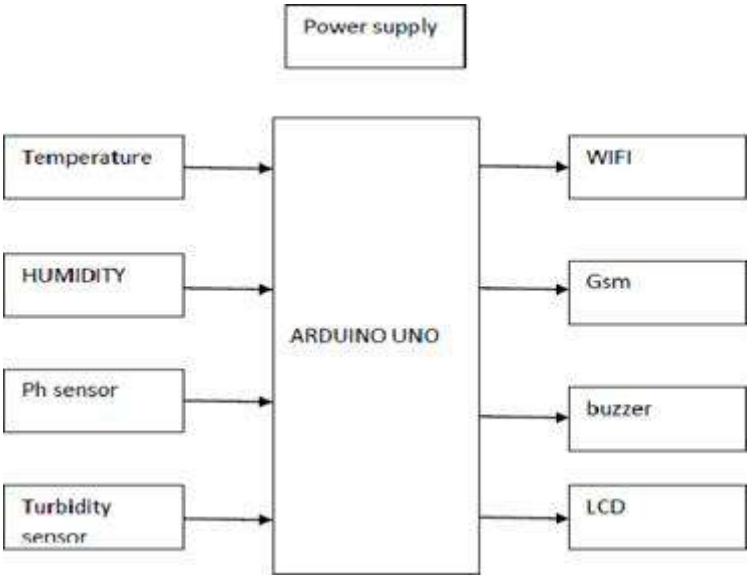


Fig1: Block diagram of Water monitoring

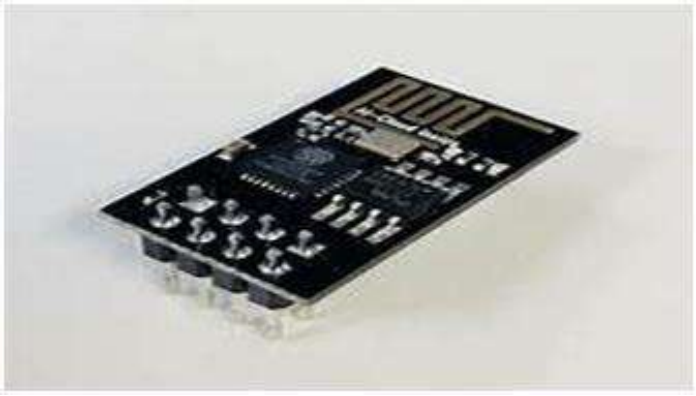
V. SOFTWARE AND HARDWARE

Arduino Mega 2560:

The Mega 2560 is a microcontroller board similar to the ATmega2560 (data sheet). It has fifty-four stepped ahead data/yield pins (of which 15 can be used as PWM yields), sixteen easy facts sources, 4 UARTs (gear consecutive ports), a sixteen MHz treasured stone oscillator, a USB affiliation, a electrical energy jack, an ICSP header, and a reset button. It consists of all that every day to help the microcontroller; if fact be informed, confederate it to a PC with a USB connection or electrical energy with an AC-to-DC connector or battery to start. The Mega is feasible with most protections proposed for the Arduino Duemilanove or Decimal. The Mega2560 changes from all first sheets in that it would no longer use the FTDI USB-to-constantdriver chip. Taking the entire element into account, it includes the ATmega16U2 (ATmega8U2 in the alteration 1 and change two sheets) redid as a USB-to-constant converter. Update two of the Mega2560 board has a resistor pulling the 8U2 HWB line to ground, simplifying it to put into DFU mode.

Fig2: Arduino Mega

ESP8266:



ESP8266 is a low-cost WiFi module that belongs to ESP's family which you can use to manipulate your electronics duties someplace in the world. It has an in-built microcontroller and a 1MB flash enabling it to be a part of a WiFi. The TCP/IP protocol stack lets the module speak with WiFi signals. The most working voltage of the module is 3.3v so you can't provide 5v as it will fry the module.

GSM:

Fig8: Gsm

GSM (Global System for Mobile correspondence) is a computerized versatile commercial enterprise company that is generally utilized by the usage of phone cellular telephone smartphone clients in Europe and one-of-a-kind components of the world. GSM makes use of a range of time division notably get acceptable entry to (TDMA) and is the most appreciably utilized of the three computerized approaches of dialog innovations: TDMA, GSM and code-division extraordinarily a range get perfect of entry to (CDMA). GSM digitizes and packs information, at that factor sends it down a channel with two one-of-a-kind surges of purchaser information, every and each and every time enabling opening. It works at every 900 megahertz (MHz) or 1,800 MHz recurrence band.

LCD:

LCD stands to get Liquid Do crystal Display. LCD is discovering giant unfold utilization substituting LEDs (7 region LEDs or desired multipurpose section LEDs) as a Result of These motives: The diminishing charges of LCDs. They manage to showcase characters, numbers and images. It will be in distinction to LEDs, that can be limited via portions plus a couple figures. Incorporation of the sterile manipulator into the LCD, consequently relieving the CPU of this Endeavor of sterilizing the LCD. By comparison, the LED has to be delighted with the CPU to hold exhibiting the info. Benefits of programming to get snapshots and characters. All these factors have been "technical" due to the reality of used in mixture with the micro-controllers, that potential they may additionally moreover now no longer be prompted by way of capacity of ordinary IC circuits. They're Used for composing outstanding messages onto a tiny LCD.

TEMPERATURE:

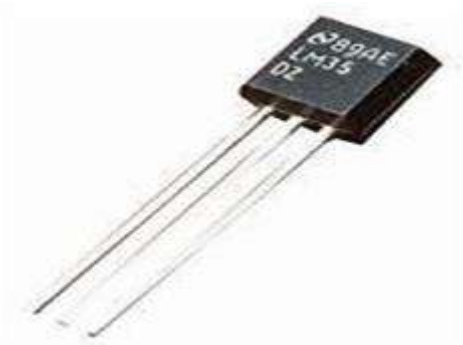


Fig8: LM35

LM35 is a temperature measuring machine having an analog output voltage proportional to the temperature. It affords output voltage in Centigrade (Celsius). It now does not require any exterior calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage moreover increases.

HUMIDITY:

Humidity sensors are digital devices enabling you to measure the environment's humidity and convert the data into a corresponding electrical signal that can be used for brilliant purposes. You may additionally have heard a one of a type humidity sensor name: Hygrometers! They are moreover recognised as hygrometers alternatively "humidity sensor" is higher common. Humidity is genuinely the presence of water in the environment. It is imperative to measure the volume of water vapor in the air on account that it can have huge penalties on our lives as correct as distinctive manufacturing processes. So the subsequent time anyone asks: "what is a humidity sensor and why does it matter?" You then understand how imperative they are in each and each element of our day-to-day existence due to the truth humidity has an impact on chemical, biological, and bodily processes. Air humidity sensors measure this volume and convert it into a readable shape of data for exterior uses.

BUZZER:

Fig10: Buzzer

An audio signalling computing device like a beeper or buzzer may additionally moreover be electromechanical or piezoelectric or mechanical type. The most necessary attribute of this is to convert the sign from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the particular designs, it can generate one-of-a-kind sounds like alarm, music, bell & siren. The pin configuration of the buzzer is proven below. It consists of two pins in precise, extraordinarily exact and negative. The amazing terminal of this is represented with the '+' picture or a longer terminal. This terminal is powered with the useful resource of 6 Volts whereas the horrific terminalis represented with the '-'symbol or fast terminal and it is related to the GND terminal.

PH SENSOR:

Fig10: Ph sensor

PH is a digital system which is used for measuring the pH stage in water. It consists of three sorts of probes (i) Glass electrode (ii) Reference electrode (iii) aggregate of gel electrode. pH is described as the bad logarithm of hydrogen ion awareness in water.

pH=-log[H+]

A pH meter consists of distinctive probes which are connected to a digital meter that would show the reading. If the pH degree is much less than 7 then it is acidic in nature, if the Ph level is increased than 7 then it is alkaline in nature, and generally the variance of pH is 0-14pH. Operating range: 0-14.Operating temperature: 0-45. Operating voltage: -5 to 5 v. Output voltage: analog.

WATER LEVEL SENSOR:

Fig10: Water Level

Water leakage sensor is designed for detecting water levels in reservoirs and overhead tanks. This is broadly used in sensing the water leakage, water stage and the rainfall. It consists of mainly three parts: 1MΩ resistor, an digital brick connector and quite a few strains of naked conducting wires. It works by way of having a sequence of uncovered traces which are connected to ground. This is additionally interlaced between grounded traces and the sunstrokes. A susceptible pull up resistor of 1MΩ is present. 1MΩ resistor pulls up the sensor value until a drop of water shorts the sensor hint to the grounded trace. This can measure the water droplet/water dimension by using a sequence of uncovered parallel wires. The characteristics are it has low strength consumption and excessive sensitivity.

TURBIDITY SENSOR:

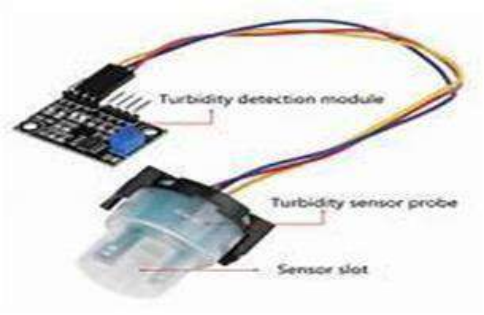
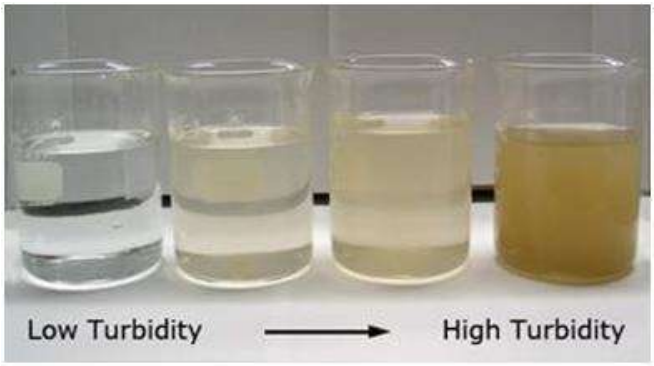


Fig10: Turbidity sensor

Turbidity is the cloudiness or haziness of a fluid prompted with the aid of giant numbers of man or woman particles that are usually invisible to the bare eye, comparable to smoke in the air. The dimension of turbidity is a key take a look at of water quality.



Turbidity is induced by means of particles suspended or dissolved in water that scatter mildly making the water show up cloudy or murky. Particulate dependence can encompass sediment, specifically clay and silt, satisfactory natural and inorganic matter, soluble coloured natural compounds, algae, and different microscopic organisms.

Arduino IDE:

Arduino is an open-source PC tools and programming association. The Arduino Community is recommended to the activity and patron mastermind that constructions and occupations are microcontroller-based motion sheets. These alternate sheets are recognized as Arduino Modules, which are open furnish prototyping stages. The smoothed-out microcontroller board suggests an assortment of increased board packs. The transcendent drastically perceived programming method is to use the Arduino IDE, which organizes the C programming vernacular. This offers you access to an Arduino Library that is industriously making draw close to open furnish network.

VI. EXPERIMENTAL RESULTS

The hardware set up is made as per the above figure. When the cutting-edge grant is given to the set-up, the step-down transformer reduces to 12-15V and the bridge rectifier will convert Ac to Dc supply. This isrelated to the Arduino microcontroller. The values from the sensors particularly Ph, temperature, water degree and water leakage sensors will be displayed on the LCD show which is related to the microcontroller. The values are analysed, transmitted and stored in the cloud using the use of a wi-fi module for actual time applications.

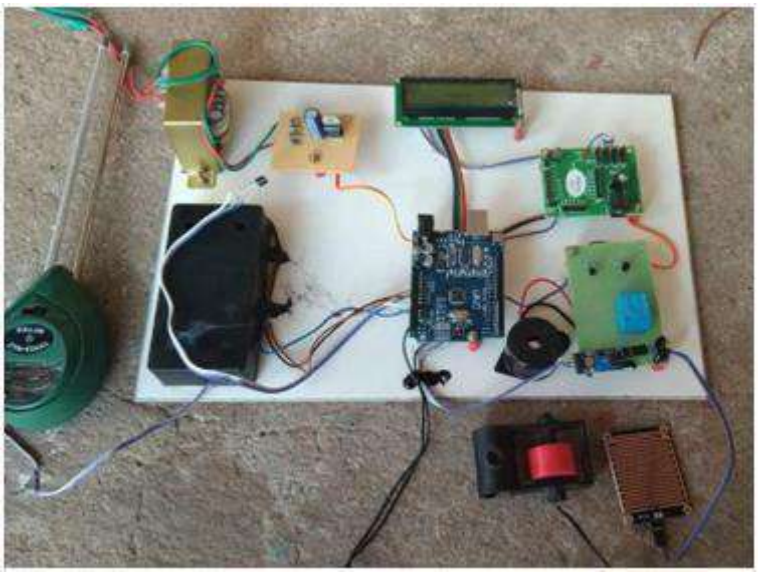


Fig -3. Water monitoring system

Fig -3. Home page

Fig -3. Sensor data

VII. CONCLUSION

In this project, it explains elements of the mission and the use of the sensors and cloud storage approach and equipment used for the clever cities water exceptional monitoring device and the use of the IOT platform. We used PH, temperature, water stage and water leakage sensor for measuring and understanding the quality of the existing water. The statistics values of the sensor are received and are displayed on the LCD display screen display. The future strategies and thoughts can be developed from this basis. It is achieved in conversational applied sciences and can be introduced as a software program interface for in addition uses. So that it helps human beings to raise their very own work at the identical time and can view the actual time facts values from anywhere and at any time the usage of the clever cell phones. It prices much less and is small in size. It can be used anywhere, even at an industrial level. It checks the water degree and the qualityof all specific tanks with different liquids. We can additionally use this in greater stage projects. The essential gain is that it offers enough furnish of water with excellent water for protected drinking. By implementing this approach, there will be secure ingesting of water in future and the pleasantness of the water is monitored and checked wherever we are.

VIII. FUTURE SCOPE

In the upcoming generation, this proposed device by embedding a synthetic brain will be beneficial in making the system self-sustaining with defining some kind of policies and regulations with excessive standards. This will convey the use of automatic and clever distribution of water barring the use of human invention. The trouble springing up can be without difficulty sorted out with automated notification to the faraway handling device to the accessed user. It can be used for industrial purposes. In industry, we can use ultrasonic sensors in place of steel wires which offers greater correct information. It may additionally be used in the flood susceptible areas and in dams for the humans to be secure with the aid of understanding the water stage best and it can be knowledgeable through a notification. Therefore, if the degree of water is abovethe saturated level, it will ship notification upon the app so that we can alert the people. From this, many verbal exchanges applied sciences can be delivered based on our want of requirements.

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A Bibliometric Analysis to Diagnose Cardiovascular Diseases Using Biomedical Signal Processing

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ABSTRACT

Aim: Analysis of research activities plays a very important role to develop advanced, enhanced, and adaptive measures. This paper's study goal was to evaluate studies on the importance of Photoplethysmography (PPG) signals for cardiovascular disease detection, with a focus on wearable devices, which have revolutionized the traditional way of the healthcare system.

Background: A bibliometric method was applied using PubMed, Medline, Scopus, Crossref, and Google Scholar. Documents on wearable devices, photoplethysmographic signal, and cardio health with machine learning-related literature. The study period was more than 20 years.

Keywords — Cardiovascular Disease (CVD), Photoplethysmography (PPG), Digital Signal Processing, Sensors, Biomedical Application, Bibliometric analysis

I. INTRODUCTION

A bibliometric investigation is one of the famous techniques utilized lately for the identification of important documents in the field of research. Based on the keywords or topics like "Diagnosis of Cardiovascular Diseases using Photoplethysmography (PPG) signal processing and machine learning techniques, biomedical signal processing, wearable devices for diagnosis of cardiovascular disease (CVD)". Open access articles were collected first, then from various databases, this collection applied inclusion and exclusion criteria, to shortlistthe huge collection, then documents were used for further analysis. Authors employed Data science tools for the following:

- Analysis and visualization of a large number of articles
- Determined the average number of citations
- studied the usage pattern of documents, examined the rate of collaborative research, to identify the productive authors, the growth rate of publications, the number of citations of authors and co-authors, etc.

The working of Bibliometric Analysis (BA) is shown in Figure 1 which helped to focus on the research domain and perform science mapping to our topic. First, the authors extracted papers by adopting criteria as mentioned in the above paragraphs. Metadata of these downloaded papers were extracted. The authors analysed to qualitatively and quantitatively review the progress at the global level and use the analysed

results to evaluate research trends and scholarly networks to obtain the most relevant papers from the literature. The process is depicted in Figure 1 to extract information in terms of research content, geographic distribution, affiliations, countries, time of the related publications, highly cited paper, self-citation, & co- operation, etc. The bibliometric study highlights the structure of scientific disciplines as well as the connections between them. Bibliometric data and indicators can be utilized as tools, or at the very least as a tool, for describing and explaining scientific concerns [1] and specific technological areas in healthcare specifically; cardiovascular disease detection and monitoring. One can minimize any subjective biases, authenticate expert inferences, highlight leading perspectives, and reveal the interconnected links between them by examining aspects of publications such as keywords, output, geographic distribution, and affiliation. With this quantitative type of analysis, the authors tried to draw valuable conclusions to guide further research. Results of this analysis are obtained in the form of graphs and tables [3] – [58]

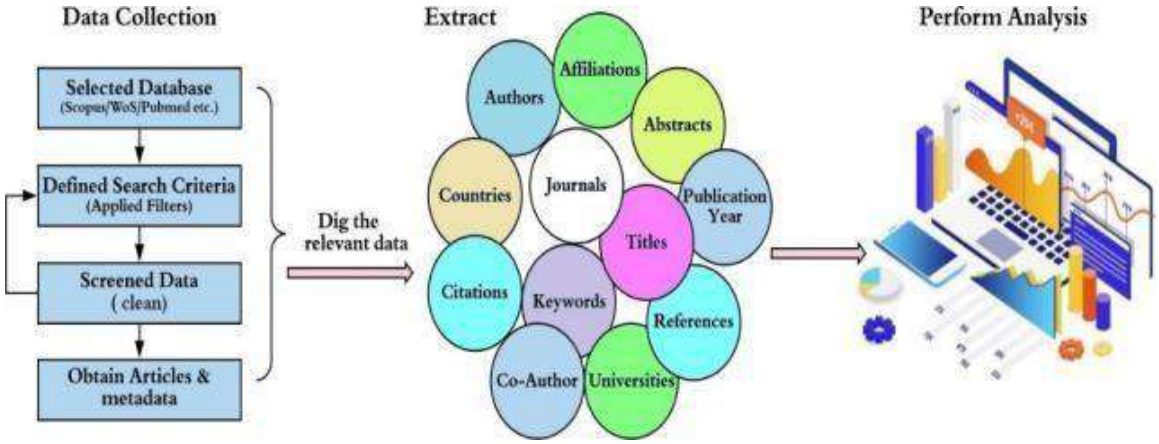

Fig. 1: Bibliometric Analysis Process

Relevance

According to a literature search utilizing databases and search engines such as the Scopus database and Google Scholar, there is a lot of bibliometric study on the medical domain and its implications on many sectors of healthcare treatments, diagnostic processes, or adaptation. However, no bibliometric research papers on PPG signal and machine learning techniques for CVD detection have been published. Sample Search metrics is shown here keywords "wearable devices, PPG, ECG, cardiovascular disease detection machine learning"

- Publication years: 2012-2021
- Citation years: 10 (2011-2021)
- Papers: 1562
- Citations: 26243
- Citations/year: 2624.30
- Citations/paper: 26.24
- Authors/paper: 3.61/4.0/4 (mean/median/mode)
- Age-weighted citation rate: 8324.60
- (sqrt=91.24),2557.09/author

- Hirsch h-index: 73 (a=4.92, m=7.30, 17017cit
- Egghe g-index: 144 (g/h=1.97, 20786 cites=79.2% coverage)
- hI, norm: 37
- hI, annual: 3.70
- Fassin hA-index: 41

The authors carefully selected the words for searching articles from databases such as cardiovascular disease detection and monitoring, diagnosis of cardiovascular diseases using Photoplethysmographic signal, Heart disease detection using PPG and machine learning, etc. This search resulted in a total 1,562 number of articles. Out of the total, only 9 authors have their data-sets, 283 authors had received grants from various funding agencies, 117 authors have patented their findings, around 493 authors had conducted clinical trials for their research. Figures 2 and 3shows the number of articles published each year, that the number of published articles is rising year after year, and the rate of increase is pretty fast. It implies that the number of published articles on this subject will continue to increase rapidly in the coming years too. According to data, 1,562 papers were published by a total of 300 research categories. Only 150 categories with more than 7 articles published were included in the study to illustrate the relationship between these research categories more clearly. Figure 4 lists the top ten research categories with the most articles published in the subject [3] – [58]

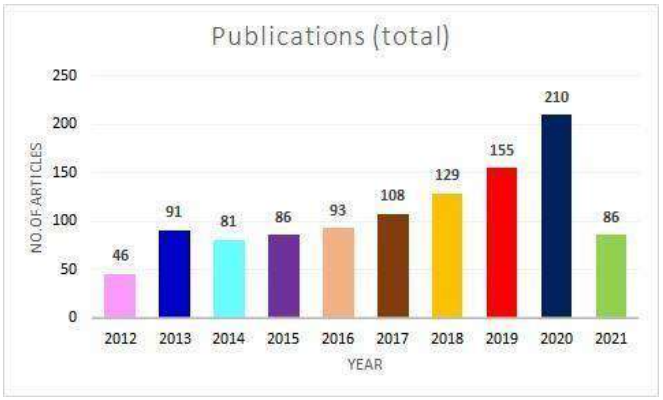

Fig. 2: Published articles considered for Initial Study

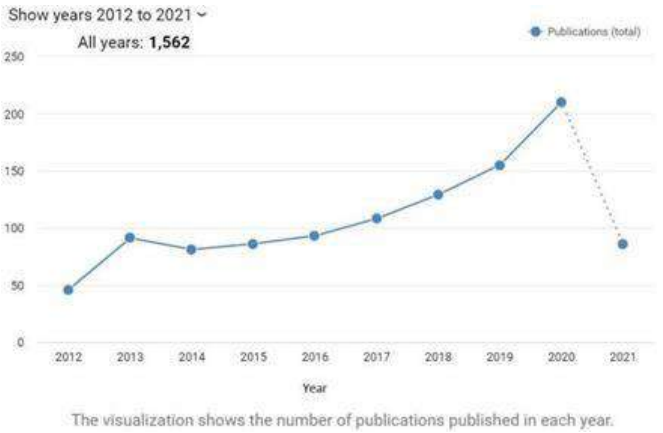

Fig. 3: Annual publications Trend

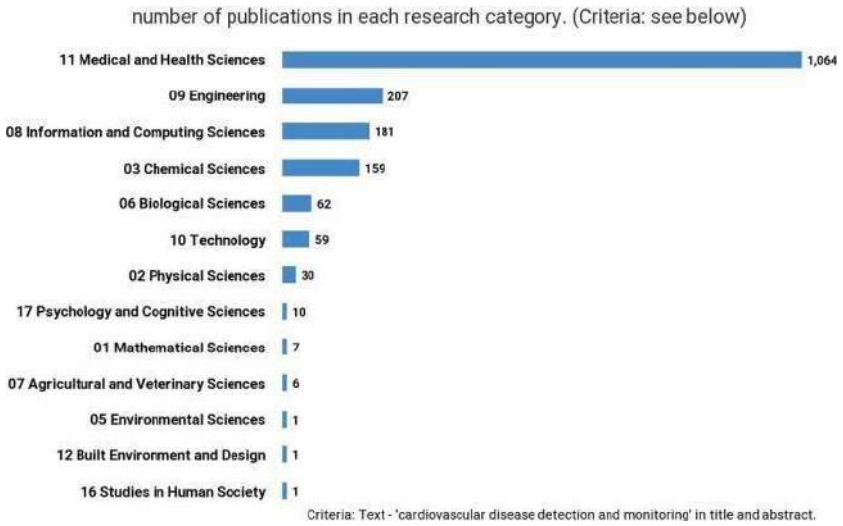

Fig. 4: Categorization of published articles under research categories

Obtained the following top-rated journals from the categories above Top – Journals

1) Sensors (Basel, Switzerland)
2) JMIR mHealth and uHealth
3) Scientific Reports
4) International Journal of Environmental Research and Public Health
5) Elsevier
6) Biomedical Engineering Online
7) Physiological measurement
8) PLoS ONE
9) Herzschrittmachertherapie & Elektrophysiologie
10) Nature Reviews. Cardiology
11) Biosensors
12) Europace

Citation Analysis

A reference is an acknowledgment given by one document to another, whereas a citation is an acknowledgment received by one document from another. Using analysis units such as author, document, sources, organizations, or nations, this study investigates the relationship between cited and citing documents.The authors used this analysis, which served as a backbone for reading and identifying methodology and features etc. Articles with a high citation serve as the foundation of study in a given subject, and we may learn more about the evolution and background of research by analyzing these papers. Applied well-known Prince Law (Note: Mp= 30, Npmax = 1562) obtained 560 articles as shown in Figure 5 with a cited frequency of over 20, as high cited frequency papers. The authors of this study conducted a co-citation analysis of the papers depicted in Figure 6 and developed a co-citation map, as well as a relational analysis of the top 560 articles with a high cited frequency and a clustering analysis on the map's related content.

The authors of this study performed a co-citation analysis of papers and generated a map of co-citation relation analysis of the top 560 articles with a high cited frequency, as well as a clustering analysis on the comparable content in the map [2]. Co-author analysis assesses collaboration trends and identifies leading scientists and organizations. For co-author analysis, the papers with a maximum number of authors per document as 25, with a minimum number of papers per author to be 2 were selected. Out of 300 authors, 129 met the threshold. The full counting approach was used, which means that a co-authored article is counted with a full weight of one for each co-author, implying that a publication's overall weight is equal to the number of writers. This resulted in Figure 7. This analysis is used as a measure of scientific influence and productivity. The scientific collaboration patterns spread across institutions or organizations can be identified by this analysis. Either the authors belong to the same college/university/department are different, as shown in Figure 8. A total of 283 authors were obtained after shortlisting, on this data a threshold of the minimum number of documents of an organization to be 5 with a minimum number of citations as 7 was set. The nodes that are closer to each other are more similar than the nodes that are farther apart [3] – [58]

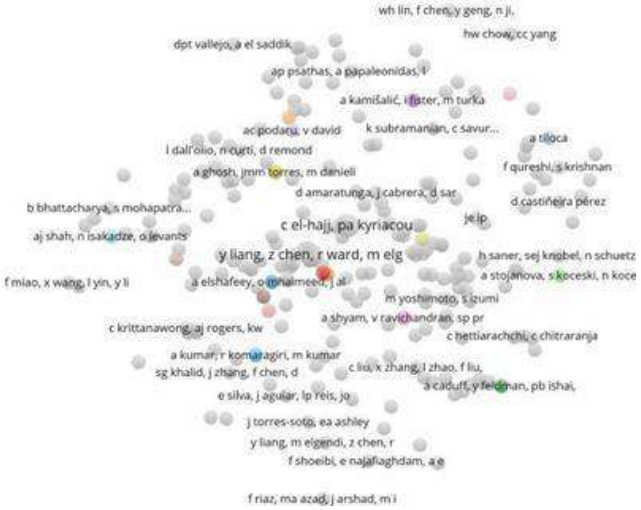

Fig. 5: Author-Citation Analysis

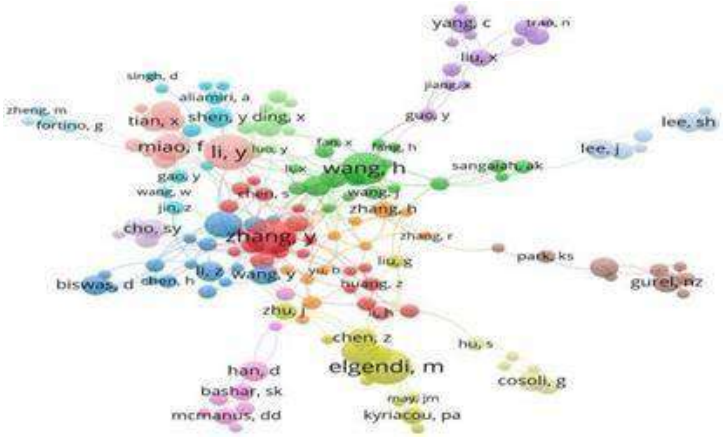

Fig. 6: Co-Author Coupling

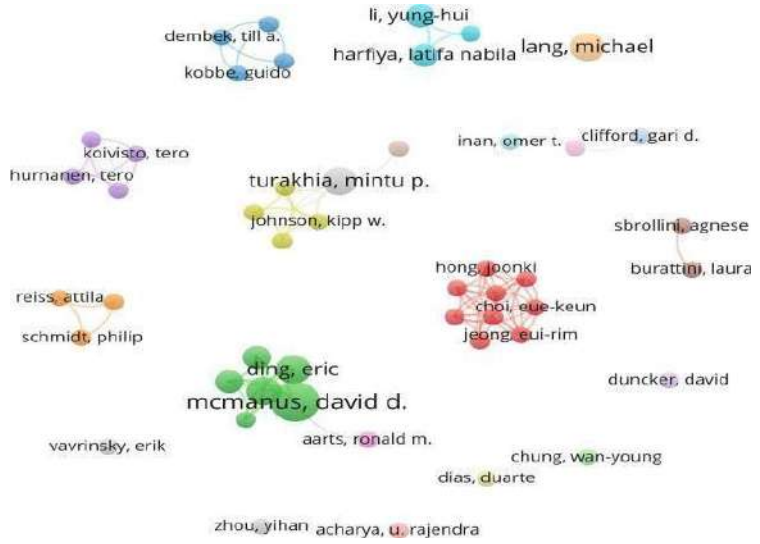

Fig. 7: Author Citation Network

Fig. 8: Citation based Organizations who have published a greater number of articles

The relational networks (Figure 9) will aid in depicting the structure of research in many disciplines and sub-fields of science, as well as observing all of the relationships formed between countries and/or subjects of science with greater clarity than statistical tables. It is possible to establish the relative roles of different- sizedcountries in global scientific cooperation using visual representations of organizations [1].

Citation analysis is a statistical research method in which authors conduct comparisons, inductions, summaries, and abstracts to analyse the state of citing and cited scientific journals, papers, and authors, and touncover their quantitative characteristics and inherent laws using logical methods such as applied mathematics [2] – [58]. The obtained top countries and authors from the above analysis are as shown below.

I. TOP – COUNTRIES – BASED – ON – CITATION – ANALYSIS

1) China
2) Italy
3) Singapore

4) Taiwan
5) United State
6) India

II. TOP – AUTHORS

1) Parreira, Pedro
2) Cunha, Marina
3) Marques, Alda
4) Querido, Ana
5) Martins, Anabela C.
6) Pinto-Gouveia, Josao
7) Mendes, Fernando
8) Tomas, Catarina
9) Mendes, Pedro
10) McManus, David D.
11) Manico, Lisete M.
12) Andrade, Isabel

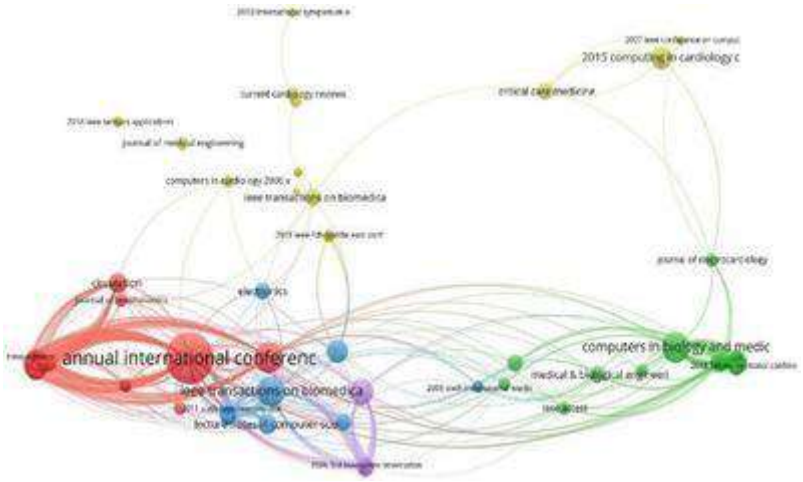

Fig. 9: Co-Citation based cited sources

Keyword Co-Occurrence Analysis

The keywords in scientific papers are derived from the titles, abstracts, and texts; these words and phrases may suggest the paper's topic or concept, while the distribution of keywords reveals the most common study themes and methodologies used in current research [2]. The keyword co-occurrences are shown in Figures 10and 11. These networks were constructed with the help of a software program. The distance between two nodes in Figure 10 reflects the relationship strength between two nodes. A lesser distance indicates a stronger relation. Nodes with the same colour belong to the same cluster. The total link strength of a node is the sum

of the link strengths of this node. This metric looks at how often two specific words ("co-words") in this field are used together in papers or patents. The frequency of each term, as well as its co-occurrence with other words, is examined [1], [3] – [58]. The question terms are tailored to each research topic and are carefully chosen.

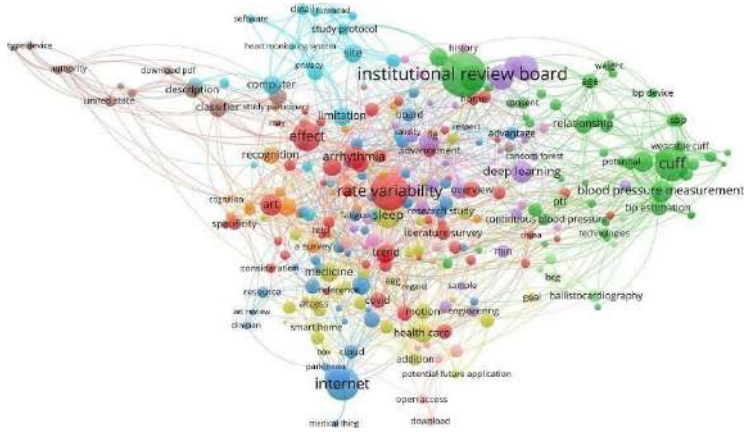

Fig. 10: Keyword Co-Occurrence Analysis

The method's basic idea is that co-words can be utilised to discover and illustrate concentrated research topics. The occurrence of these words in scientific articles and patents indicates that researchers share similar intellectual notions. As a result, this relational network denotes associations that can be expressed using lexical graphics (also known as "leximaps"). The frequency of word connections is used to create maps (strategic diagrams) that show the major themes of the field under investigation, their relationships, and to locate hot research keywords [1] and [3] – [58].

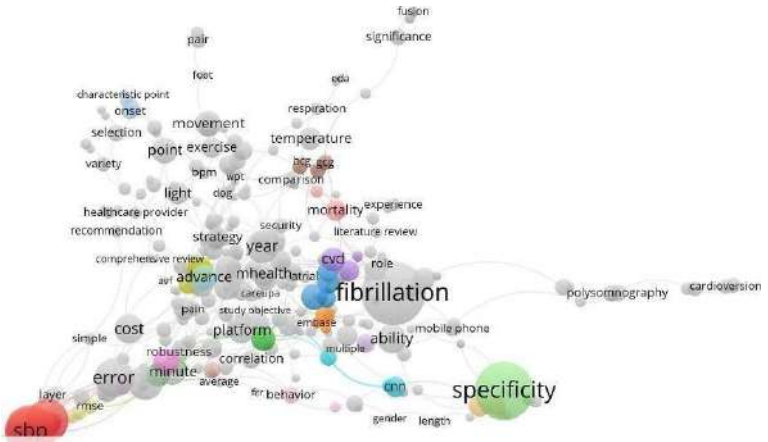

Fig. 11: Keyword Co-Occurrence Analysis

II. LIMITATIONS OF THE STUDY

Scopus bases its whole analysis on the number of distinct connections found in the texts. As a result, a publication with multiple authors from the same country was only counted once. On the other hand, a paper with two authors and two separate nation connections was only counted once for each country.

Even if the authors from that country were not the principal authors, increasing international research collaboration has improved the research output of several countries. The analysis did not account for self-citations, which could contribute to a bias in the number of citations for countries, publications, and individuals.

Finally, the search query was created with cardiovascular disease and human health in mind. Healthcare, wearable, and machine learning algorithms have a vast and complicated concept and reach. As a result, ensuring that all material on both themes to include is difficult. However, the author made every effort to incorporate all relevant material while excluding as many irrelevant documents as possible

III. CONCLUSION

The bibliometric analysis of the top-cited articles allows for the detection of notable advancements and development in the field of cardiovascular disease monitoring and diagnosis, which may aid in identifying important cardiovascular disease research, accelerates the progress of the study, and reveal investigation patterns such as the relevance of wearable gadgets, photoplethysmography, and machine learning algorithms. Biomedical signal processing is an essential link between engineering research and clinical diagnostics;technical improvements in this area may have a direct impact on future non-communicable disease diagnosticcapabilities. These patterns provide baseline data in the healthcare domain for academicians and health providers in Cardiovascular research disease.

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Feature Selection for Covid-19 Detection Using Genetic Algorithm

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ABSTRACT
The COVID-19 pandemic has had a lasting impact on humans across the world. Even after multiple vaccinations and restrictive measures, the contagious virus mutates and spreads, causing distress and death. Several mathematical models have been proposed that predict whether an individual has contracted the life-threatening virus depending upon various medical symptoms. One of the significant challenges in the medical domain is the extraction of comprehensible datasets that can be utilized as input for the machine learning models. The use of evolutionary computation can be employed to discover the optimal subset of features (symptoms) that helps improve the accuracy by removing redundancies from the dataset. This paper proposes Genetic Algorithm for feature selection resulting in accurate classification of infected and healthy patients.
Keywords - COVID-19, Genetic Algorithm, Feature selection, Machine learning

I. INTRODUCTION

The COVID-19 outbreak was on a global scale [1]. In India during the initial stages of the pandemic the rate at which the virus spread was faster than the rate at which it could be curbed [2]. The main diagnostic test conducted worldwide to confirm the infection is Real-Time Reverse Transcription Polymerase Chain Reaction (RTPCR) [3,4]. This test often resulted in false results [5,6] and since these tests were primarily performed on symptomatic patients, there was an urgent need to expand diagnostic testing capabilities to enable the screening of asymptomatic patients that contribute to the spreading of the disease. Another common issue was the cost associated with each of these tests as financial losses due to self-isolation and dwindled income had created a problem [7].The nature of the virus which would mutate over a period oftime needed intensive research to make an accurate testing mechanism like RTPCR which resulted in delayedmanufacturing and hence testing of the virus. Due to these issues, a much faster and more efficient way to test patients was required [8].
An efficient way for testing a greater number of patients would be to rely on artificial intelligence to perform the prognosis [9]. To do so would require the medical information of said patients that accurately represents the symptoms and relevant attributes of the patient. This information would be fed to an AI model that needs sufficient accurate data for gaining knowledge in its training process. This training process decides how intelligent the model will become and is solely dependent on the input data.

There have been multiple predictive Machine Learning models that attempt to predict whether an individual has contracted the virus [14, 15, 19]. Deep Q-learning with genetic algorithm was applied to predict Covid-19 government actions [16]. Enhanced KNN with hybrid feature selection is also a viable method [17, 23]. Many more CNN based Deep Learning Algorithms have also been implemented to solve this problem [22, 24, 25, 26, 27]. Some of the Machine Learning Algorithms are Random Forest Classifier, Support Vector Machines [18], K Nearest Neighbour, and Naive Bayes Classifier. The Deep Learning approach implements Convolutional Neural Networks in predicting the diagnosis. Other feature selection techniques have also been used such as Recursive Feature Elimination, Extra Tree Classifier, and Restricted Boltzmann Machine.

In recent times the cost of data collection has decreased significantly. Medical Datasets tend to originate from a singular database at the source level that includes numerous attributes which may not be disease-specific. [10,11,12] When applying Machine Learning models to these datasets results in degradation of performance and facetious results. There has been a huge amount of research to solve the above-mentioned problem. Determining the optimal set of features that are disease-specific that can be incorporated to boost the performance of machine learning models without affecting the bias and variance has become one of primal importance [13, 28].

To create this subset of symptoms (features) we take advantage of an evolutionary algorithm, Genetic Algorithm to carry out feature selection. In the proposed system our Learning Agent improves over generations to reduce the vast dataset of symptoms to specific subsets of features which results in improving the base Machine Learning models to accurately predict whether an individual has contracted the life- threatening virus. The algorithm is designed to improve the underlying Machine Learning model and hence can be extended as a general methodology in improving the feature selection process of a vast dataset which would normally be done only on the basis of human intelligence introducing human errors into the predictions. This paper is divided into the following sections: Literature Review, Data understanding and pre-processing, Proposed framework and evaluation metric followed by our results and conclusion.

II. DATA UNDERSTANDING AND PREPROCESSING

Data description - Our Dataset consists of 124,150 patients, with 88,166 infections and 18,177 hospitalized patients. Patient symptoms, disease severity, and morbidity were taken into account.

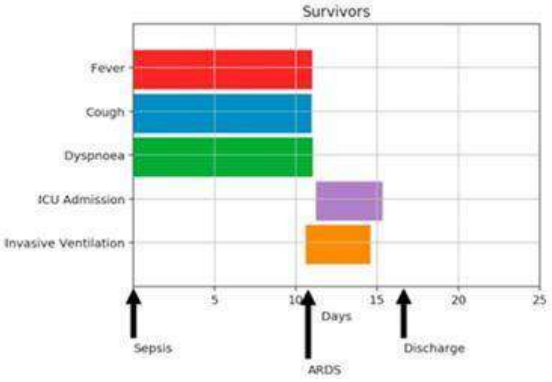

Fig 1.1 Graph for survivors Symptoms vs days

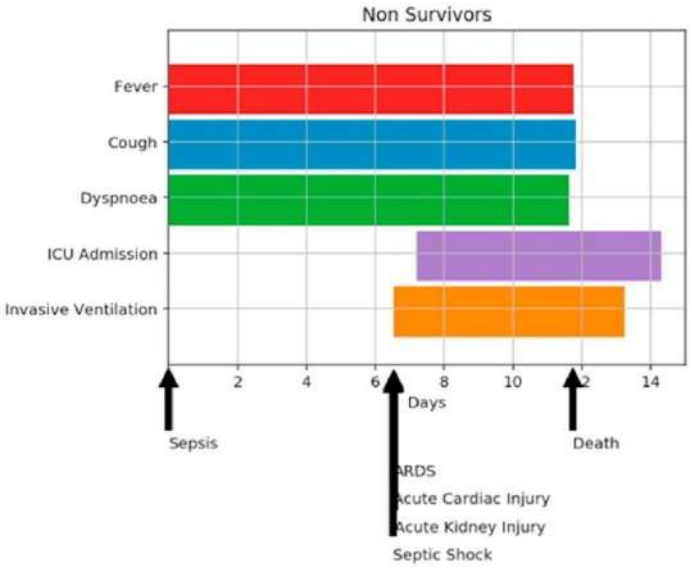

Fig 1.2 Graph for non-survivors Symptoms vs days

Data cleaning was performed in order to prepare the data for further analysis. Exploratory Data analysis was performed to visualize information like Infection and mortality rate, common symptoms, and health complications or comorbidities among survivors and non-survivors. Symptoms and Patient timelines were analysed in detail for information on when a patient was transferred into the intensive-care unit or when a patient expired.

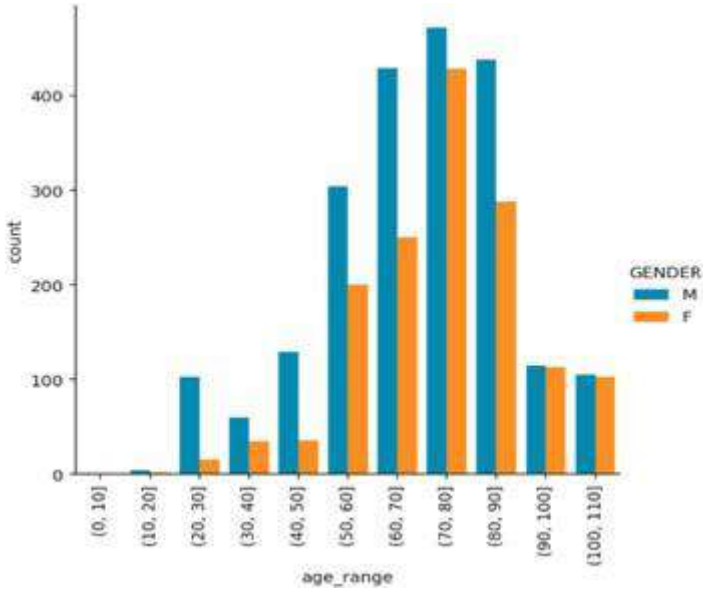

Fig 1.3- Graph of age dynamics of patients

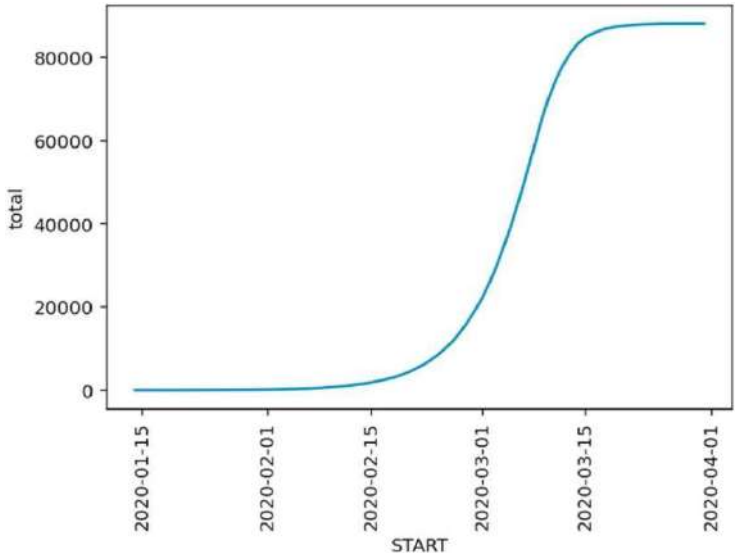

Fig 1.4 Graph of patient count vs dates

III. THE PROPOSED FRAMEWORK AND EVALUATION

Genetic Algorithm is a class of evolutionary algorithms that are used to solve optimization problems. It's based on the idea of natural selection and implements the concept of human evolution. The concept of a Genetic Algorithm is based on improving the selection of chromosomes available in each generation. Each generation consists of a fixed number of steps that enhance the quality of these chromosomes. These steps consist of fitness evaluation, selection, reproduction, and mutation. Our proposed Genetic Algorithm for Feature Selection (GAFS) framework is implemented in the following way:

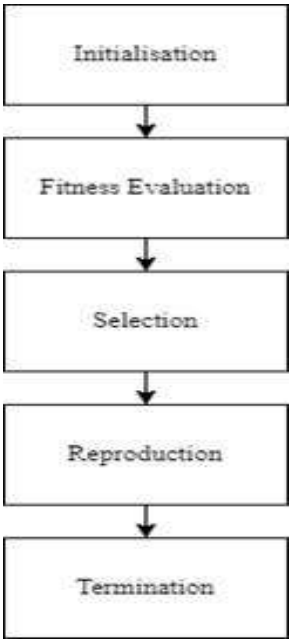

Fig 2.1 Algorithm Flow

1. Initialization

A gene is the smallest possible unit in the Genetic Algorithm. In the case of feature selection, each symptom in the dataset is considered a gene. A series of genes together form a chromosome that represents one possible subset of features. A group of chromosomes together form the population. A large population consisting of numerous chromosomes leads to slowing of the algorithm whereas a small population size can result in being lack of diversity in the population thus selecting the ideal size of the population is important.

In GAFS each chromosome in the population is initialized by a random combination of 0s representing the gene is left out or 1s indicating the gene is present in the subset. Thus, a pool of chromosomes forms the initial population. We have set the initial population size to twice the number of available attributes

2. Fitness Evaluation

The fitness function evaluates how "fit" a chromosome is. We define fitness by the F1 score generated by the chromosome. The F1 score is used as an accuracy metric for the following reason: The dataset is relatively imbalanced and using precision score can show a slight majority class bias. A high f1 score indicates a good classification. Therefore, better model performance. This F1 score is calculated by passing only the features present in the chromosome to our machine learning model. Various machine learning models are available to classify the patients. In the table Fig 2.2 below we display the comparative results generated by the same.

Model	F1_Score
Random Forest	81.5
Support Vector Machine	80.61
K Nearest Neighbour	80.35
XG Boost	82.24
Light GBM	82.87

Table 1.1 - Performance comparison of different models

3. Selection

Chromosomes are selected from the population to be parents for the crossover process. This is one of the most crucial steps in order to produce the next generation. There are multiple techniques for this selection.[29, 31] GAFS implements a selection technique called Roulette Wheel Selection where the pointer selects a fixed point in a pie chart. The pie chart is constructed proportionately on the basis of the fitness values of chromosomes. The wheel is spun multiple times with the chromosome pointing to the dot at the end of each spin being selected for reproduction.

4. Reproduction

Reproduction is the process of creating new off-springs from the parents. The parents are selected in the selection phase and reproduce a new chromosome whose features are better than the parent chromosomes. Reproduction consists of two steps:

a) Crossover:

This is the main process in the reproduction phase. There are several crossover techniques [30].GAFS implements a two-point crossover where after selecting the best chromosomes from the population two random integers are selected. The genes of the two chromosomes are interchanged till the specified integer positions resulting in the child chromosome having a combination of attributes from both the parent chromosomes.

b) Mutation:

The mutation is another refinement step in the reproduction phase that randomly changes the value of a particular gene based on a probability value. GAFS keeps the probability of mutation to a minimum to maintain the integrity of the populations. GAFS implements a mutation probability of 1 percent

5. Termination

Termination is the last stage of the proposed architecture. GAFS terminates generating a new population if there is a lack of growth in the F1 Score over multiple generations. A lack of growth concludes that the population has reached its optimal subset of features.

IV. RESULTS

Model	F1_Score	After Genetic F1_Score
Random Forest	81.5	85.37
Support Vector Machine	80.61	83.78
K Nearest Neighbour	80.35	84.12
XG Boost	82.24	86.77
Light GBM	82.87	87.93

Table 1.2 - comparison of performance after genetic

Thus as Light GBM gave the best classification accuracy it was selected as the fitness evaluation model for the dataset and after applying genetic algorithm it helped reduce the number of attributes in the dataset from 20 to 10 and improved the F1_Score of prediction from 82.87 to 87.93.

V. CONCLUSION

Based on the comparative studies of algorithms shows that the Genetic Algorithm improves the accuracy of the base Machine Learning Algorithms by eliminating and reducing vast datasets to optimal subsets of features. Hence, the Genetic Algorithm can be extended to other domains as well improving the overall performance in classification problems.

VI. REFERENCES

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Low Power Wide Area Network Technologies: A Comparative Study for IoT Applications

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ABSTRACT

The rapid advancements in the world of the Internet of Things (IoT) have extended the opportunities of IoT-based techniques in various fields including smart metering, smart city, smart agriculture, industrial automation, and smart building. Wide coverage, high capacity, longer battery life, low device cost, and deployment cost are the characteristics of LPWANs. For IoT-based applications that need low power consumption, low cost, and greater range, the low-power wide-area network (LPWAN) is the best choice. Three leading LPWAN technologies are Sigfox, LoRa, and NB-IoT. This paper presents a comparative study of these three LPWAN technologies and also describes the success factors of the Internet of Things (IoT). Considering application scenarios explains the best suitable technology choice for these applications.

Keywords: IoT, LoRa, LPWAN, NB-IoT, Sigfox.

I. INTRODUCTION

Large coverage, less power consumption, and cost- effectiveness are the particular needs of IoT applications. For long-range transmission, ZigBee and Bluetooth are not used as these are short-range radio technologies. Cellular communications give a large coverage area however the power consumption is more. For IoT applications, LPWAN is most suitable as a result of its low cost, less power consumption, and greater range capabilities [1]. LPWAN communicates over a long distance up to 1-5 kilometres for urban and 10-40 kilometres for rural. LPWANs are energy economical and cheap. LPWAN is usually appropriate for IoT applications transmitting data over a long distance [2]. Cellular and Non- cellular are the two sorts of LPWAN technologies. These days Sigfox, LoRa, and NB-IoT are the most usually used technologies. The Narrow-band IoT (NB-IoT) is cellular technology, whereas Sigfox and LoRa are non-cellular technologies. This paper describes the technical distinction between Sigfox, LoRa, and NB-IoT technologies. These 3 technologies are compared considering IoT performance factors. This paper is structured into five sections. Section one gives a detailed introduction. Section two explains the technological difference between Sigfox, LoRa, and NB-IoT. The comparative study of Sigfox, LoRa, and NB-IoT based on IoT parameters is presented

in Section three. Section four describes various applications and which technology is appropriate for these applications and section five contains a discussion and conclusion.

II. TECHNICAL DIFFERENCES OF LPWAN TECHNOLOGIES

2.1 Sigfox

The most widely used LPWAN technology is Sigfox. The Sigfox Company (Labege, France) developed this in 2009. Sigfox provides large network coverage and allows bi- directional communication for IoT devices [3]. In Sigfox communication, a frequency band of 100 Hz is used, which increases the total number of nodes at the expense of data rate. Small packets are used in the Sigfox technology. The frame would have 26 bytes for a payload of 12 bytes on air. The energy consumption decreases as the protocol frame is reduced, increasing network capacity [4]. Sigfox communication protocol provides high-level performance [5].

2.2 LoRa

LoRa is a proprietary LPWAN modulation technique developed by the LoRa Alliance. LoRa offers long-range and secure data transmission. Since data packets are small and transmitted infrequently, the energy required for the transmission of a data packet is less. Lora is simply an implementation of the physical layer. There are a total of six spreading factors in LoRa (SF7- SF12). The amount of spreading code applied to the original data signal is known as the spreading factor (SF). The spreading factors and bandwidth determine the data rate. The data rate achieved using LoRa C-SS modulation ranges from 0.30 to 37.50 kbps, while the data rate achieved using frequency-shift keying (FSK) is 50 kbps. While a high spreading factor (SF) improves network efficiency, it also reduces scalability and data rate [6].

There are two types of LoraWAN networks. The first is a private network operated by individuals, and the second is a public network that provides access to paying subscribers. The adaptive data rate (ADR) technique is used in LoRaWAN nodes to change the spreading factor to choose a higher data rate. With ADR, base stations can support over 10, 00,000 nodes. LoRa uses a bandwidth of just 125,250,500 kHz in practice. Since LoRa is an open standard, users are free to create their high- level protocols [7].

2.3 NB-IoT

NB-IoT is a rapidly evolving wireless technology. NB-IoT provides less energy consumption, cost efficiency, improved indoor coverage, and optimized network architecture. NB-IoT offers reliable security and better scalability. NB-IoT is more reliable and provides guaranteed quality of service as operates in a licensed spectrum. NB-IoT leverages direct-sequence spread spectrum (DSSS) modulation technology [7]. LoRa allows data transmission up to 243 bytes, NB-IoT up to 1600 bytes. Sigfox, on the other hand, has the shortest payload length of around 12 bytes. NB-IoT supports a communication range of up to 100kilometres in the rural area.

III. COMPARISON BASED ON IOT FACTORS

Battery life, communication range, cost, latency, network coverage, payload length, Quality of service, and scalability are considered while selecting the LPWAN technologies for IoT applications. This section compares Sigfox, LoRa, and NB-IoT based on these considerations.

Battery life and latency

Due to synchronous communication, NB-IoT end devices consume a lot of energy and reduce the lifetime of the end device. The NB-IoT protocol allows high data rate and low latency hence it is the most suitable choice for applications requiring high data rate and low latency. LoRa is preferred for applications thatrequire transferring a small amount of data and are responsive to latency [8, 9].

Network coverage and range

Since the NB-IoT deployment is restricted to 4G/LTE base stations, it's not available in remote areas without cellular coverage. The NB-IoT has less coverage and low range capabilities (range less than 10km). Sigfox has large coverage and long-range (i.e., >40 km). Using a single base station, the complete town can be covered. Deployment of the LoRa network covers a whole town with three base stations as the LoRa has a short-range (less than 20 kilometres) [8].

Cost

LPWAN applications are sensitive to deployment, spectrum, and end-device costs. As seen from Table 1, Sigfox and LoRa have the advantage of low cost as compared to NB-IoT. An application requiring long-range, high scalability and high-cost budget NB-IoT is preferred. LoRa is used for moderate data rate and low costare the requirements. LPWAN supports a large number of nodes, but the expense of nodes makes deployment impractical for organizations with small budgets. The modulation technique affects the cost of the network and energy consumption. For channel access methods spread- spectrum is used [1].

Table 1 Cost comparison

Technology	Deployment cost/base station	Spectrum cost (in €)	End-device cost (in €)
Sigfox	>4000 €	free	< 2
LoRa	>1000 €		
	>100 € / gateway	free	3-5
NB-IoT	>15000 €	> 500M/ MHz.	> 20

Quality of service

LoRa and Sigfox use asynchronous communication protocols and unlicensed ISM bands and hence low load scalability. Whereas, NB-IoT provides the best QoS. Thus, the applications which need to be guaranteed

Quality of service (QoS), NB-IoT is preferred. Sigfox and LoRa are used for applications that do not have a quality-of-service constraint. [10, 11].

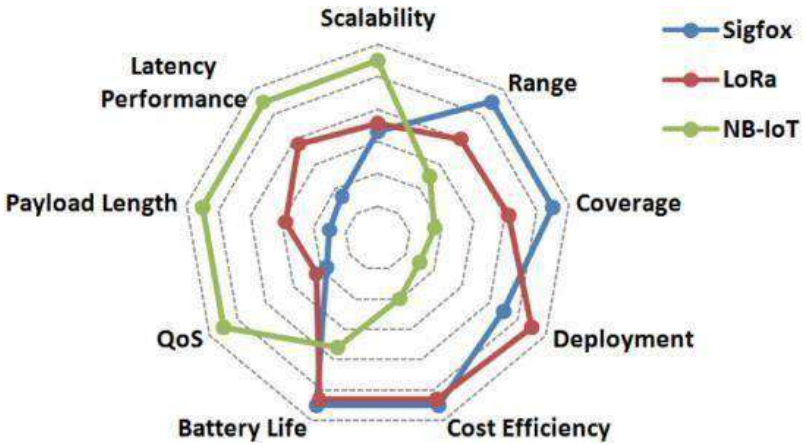

Figure 1. Comparison of LPWAN technologies

Deployment model

Currently, Sigfox is deployed in thirty-one countries and LoRa in forty-two countries. NB-IoT needs more time before the establishment of the network as NB-IoT standards published in 2016 [12, 13]. For Sigfox user has to pay the subscription charges because it is deployed by network operators. Whereas LoRa has no subscription charges as deployed as its independent network. Worldwide deployment of Sigfox and LoRa is inthe rollout phase [11].

Scalability and payload length

Scalability refers to the device's ability to adapt to the changes within the surroundings and fulfill the changing needs within the future. Scalability makes the device a lot of reliable and economical, Scalability is the system's ability to maintain QoS as it grows [1].

Table 2 Specifications of LPWAN

Specification	NB-IoT	LoRa	Sigfox
Modulation used	QPSK	CSS	BPSK
Technology	open standard	proprietary	proprietary
License spectrum	Yes	No	No
Downlink capacity	unlimited	very low	very low
Maximum payloaduplink	>1000 byte	242 byte	12 byte
Data rate	27000 bps	5470 bps	100 bps
Maximum range incity indoor	<500 m	<500 m	>1000 m
FEC	No	Yes	Yes

Message Bandwidth	180 kHz	125, 250 or 500 kHz.	100 Hz.
Frequencies	LTE Licensed	433/868/780/ 915 MHz ISM	865-924 MHz
Bandwidth	180 kHz	<500 kHz	100 Hz
Data rate (Max)	200 kbps	50 kbps	Less than100bps
Payload (Bytes)	1600	243	12
Data per message	> 1.000 B	51 B	12 B
Range in km (urban)	1	5	10
Range in km (rural)	10	20	40
Latency	<10 s	1-10 ms	10-30 ms
Localization	No (under specification)	Yes (TDOA)	Yes (RSSI)
Battery life(in years)	More than 10	10	4
Private network allowed	No	Yes	No
Standard	3GPP	LoRa- Alliance	Sigfox
Advantages	Easy to deploy and maintain. Works in licensed spectrum.	Low power consumption. Allows setting up private network.	High reliability. Low device complexity
Limitations	Low interference immunity	Longer latency. Weakest signal range. Small size	Mobility is difficult.
Applications	Smart agriculture, Industrial automation	Fire detection, Smart building, Air pollution monitoring	Smart metering

The network devices like gateways and access stations will enhance the scalability. NB-IoT provides better scalability [15]. Furthermore, the scalability of the LPWAN network may be improved using multi-channel and multi-antenna supported techniques [14].

As seen in Table 2, Sigfox only supports low data rates (less than 100 bps), so it cannot be used for applications requiring high data rates. For real-time applications that need low latency and bonded jitter values, the LoRa cannot be used since it has a small data packet size and long latency. For NB- IoT the maximum data rate is 200 kilobits per second, with long battery life. The use of existing cellular networks by NB- IoT reduces the expense of communication infrastructure as well as the time it takes to deploy applications [7, 18].

IV. APPLICATIONS

Each application has its own set of requirements. The selection of communication technology depends upon the needs of the applications. In this section, different applications and technology which fit best arediscussed. Table 3 provides the relevance of characteristics to applications [16].

Table 3 Applications and relevant characteristics.

Application	Coverage	Low power	Cost	Capacity	Enhanced characteristics
Smart City	High	Medium	High	High	High
Smart Environment	Medium	High	High	High	Medium
Smart Water	High	Medium	Medium	Medium	Low
Smart Metering	High	Medium	High	High	Low
Smart Gridand Energy	High	Medium	Medium	High	Medium
Security and Emergencies	High	High	Medium	Low	High
Retail	High	Low	High	High	Medium
Automotive and Transportation	High	Low	Medium	High	High
Industrial Automation	Low	Low	High	High	Low
Smart Agriculture	High	High	Medium	High	Low
Smart Building	High	Low	Low	Medium	Low

Smart metering

To achieve true grid intelligence requirements for smart metering are reliable networks and real-time communication. Because of its low latency, Sigfox is not suitable for real-time grid monitoring. Electric meters are often set up using Class-C LoRa, which has low latency. But because of its faster response time, NB-IoT is the best match for such systems than LoRa. Electric meters, on the other hand, are commonly located in stationary locations in heavily populated regions. NB-IoT has a wide range of coverage. Since NB- IoT devices rely on LTE cellular coverage, they work well indoors and in heavily populated regions.

Smart city

Controlling street lighting, available parking spaces, and environmental conditions is a part of a smart city application. A power line can be used to power the nodes. It is possible to change the batteries in battery-operated systems. The requirement for low power consumption is moderate. For a smart city, large numbers of nodes are required and hence network should have large capacity and scalability. NB-IoT is suitable for

this application as it supports a large range of data rates, large coverage, low cost, and enhanced scalability [16].

Smart Agriculture

Sensors in agriculture operations are located at a remote location, making it difficult to replace the batteries. Batteries those last 10+ years without recharging are needed for such applications. NB-IoT is a better option for smart agriculture because it supports high data rates and less energy consumption.

Industrial Automation

Some applications in industrial automation need sensors that are low in cost and power consumption. In this scenario, LoRa and Sigfox are more appropriate. Other applications necessitate frequent data transmission and high QoS. NB-IoT is the most suitable option for such applications. Hybrid solutions could also be used for various requirements.

Retail

Electric power is readily available in such an application, and power consumption may be considered of low priority, but low latency is a strong requirement. As a result, NB-IoT is a better option for such types of applications.

Smart building

The smart building provides real-time assistance to users and helps to enhance comfort, space, and resource utilization. The sensor used in IoT solutions monitors multiple environmental conditions such as temperature, humidity, light intensity, motion detection, shock, and water leaks in commercial buildings. Used sensors require low cost and low power, and they don't need quality of service. Mobile network connectivity is not needed in such applications. The LoRa Technologies will most likely be best used [19].

Aquaculture monitoring

Insufficient coverage, high cost, high power consumption, and a large number of terminal equipment, are major current issues related to Aquaculture monitoring. NB-IoT enables the use of devices with batteries for data transmission over a wide area with less energy consumption. As a result of its wide coverage, low cost, low power consumption, and broad link size, NB-IoT is the best option for aquaculture [17].

V. CONCLUSION

This paper compares the technological differences between three LPWAN technologies: Sigfox, LoRa, and NB-IoT. LPWANs are newer technologies that were developed specifically to resolve the issues of IoT applications. LPWAN technologies, in general, allow for a greater range of communication. Low power radiosand low-cost batteries are used in these technologies. LPWANs aren't all made equal. Some LPWANs use either unlicensed (Sigfox, Lora) or licensed spectrum (NB-IoT) to communicate. Each method has its benefits and limitations. Energy consumption is a big concern for NB-IoT. When it comes to Sigfox and LoRa, coverage, quality of service (QoS), and scalability are the most important factors to consider. Sigfox and LoRa are good options for remote monitoring, smart metering, smart building, and facility management. These are best suited to applications that aren't time-sensitive or need high bandwidth. A limited amount of data

volumes should be transmitted frequently in aquaculture monitoring, and NB-IoT is more appropriate for transmitting the data. NB-IoT enables the use of devices with batteries for transmission over a wide area with relatively less consumption of power for frequent data transmission especially the transmission of small data volumes.

VI. ACKNOWLEDGMENT

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Analysis of Side Channel Attacks and Defenses in Cryptography

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ABSTRACT

Side Channel attacks aim at extracting secrets from a chip or a system, through measurement and analysis of physical parameters. Supply current, execution time and electromagnetic emission pose a serious threat to modules that integrate cryptographic systems, as many side-channel analysis techniques have proven successful in breaking an algorithmically robust cryptographic operation and extracting the secret key. The analysis techniques that can be applied on various side-channel parameters to retrieve cryptographic keys has been proposed. The possible countermeasures, based on design modifications, to mitigate side-channel attackshas been described.

Keywords : CSCA, SPA, DPA, RSA, CRT, encryption, decryption

I. INTRODUCTION

In the past, an encryption device was perceived as a unit that receives plaintext input and produces ciphertext output and vice-versa. Attacks were therefore based on either knowing the ciphertext or knowing both or on the ability to define what plaintext is to be encrypted and then seeing the results of encryption known as chosen plaintext attacks. In 1943, a teletype machine was meant to allow secure, encrypted communications, but even a third party who was close enough able to read its electromagnetic emissions could potentially decipher its secrets. Any secret process or communication that produces unintended but meaningful signals, the vibrations could be observed can reveal a conversation that happened nearby. Modern cybersecurity depends on the machines which keeps secrets. It led a hacker who can read those unintended signals can extract the secrets they contain, which is known as side-channel attack.

Side channel threat is a form of cryptanalysis that takes advantage of secret information leaked during program implementations, through measurement and evaluation of systematic parameters, such as execution time, power consumption and electromagnetic field (EMF) radiation. It is a security exploit (is a part of a codeor a program that maliciously takes advantages of vulnerabilities in software or hardware to initiate the different types of attacks or install malware) that aims to gather information from or influence the program execution of a system by measuring or exploiting indirect effects of the system or its hardware, rather than targeting the program or its code directly. Side-Channel attacks (SCAs) are powerful cryptanalysis techniques that focus on the underlying implementation of cryptographic ciphers during execution rather than attacking the structure of cryptographic functions.

The information related to execution, can leak through unintended side channels during computation is shown in Fig.1. [1] Side-channel attacks can be either hardware-based (attacker requires measurementequipment to get physical parameters) or software based (attacker uses software instead of measurement equipment to steal information such as memory access patterns or fault occurrence). Some of the common attacks which use side channel analysis:

Timing attack is based on measuring the time takes for a unit to perform operations which can lead to retrieve secret keys information. The total time can provide data about the state of a system or the type of process it is running. The attacker compares the time length of a known system to the victim system to make accurate predictions.

Electromagnetic attack, where attackers measure the electromagnetic radiation, or radio waves given off by a target device to reconstruct the internal signals of that device. They focus on modern side-channel attacks on measuring the cryptographic operations of a system to try and derive secret keys.

In the Power Consumption Attack, the hacker measures the power consumption of a device or subsystem, by monitoring the amount and timing of power used by a system or one of its subcomponents. The power analysis attacks is necessary to map data values that are processed by the attacked device to power consumption values.

In Acoustic Cryptanalysis, the attacker measures the sounds produced by a device and gains information by listening to the sounds emitted by electronic components as well.

The remainder of this paper is organized as follows: Section 2 introduces the Cache-based side channel attacks. Section 3 shows the RSA public key cryptosystems implementation followed by Side Channel Attackson RSA in Section 4. In Section 5, we explore detection techniques and discuss the characteristics of defending strategies by comparing the model with existing defences. Finally, the conclusion of the paper in Section 6. In this paper, we will provide a high-level overview of the studies of cache side channels to help identify research problems that have not been addressed so far.

CACHE-BASED SIDE CHANNEL ATTACKS

Cache attacks are based on the attacker's ability to monitor cache accesses made by the victim in a shared physical system as in virtualized environment or a type of cloud service. It works by monitoring security critical operations either by modular exponentiation or multiplication or memory accesses. By deducing the encryption keys, the attacker can able to recover the secret key depending on the accesses made (or not made) by the victim.

Cache Side channels [4] area type of attack vectors through which an adversary infers secret information of a running program by observing its use of CPU caches or other caching hardware. Cache based timing channels enable to reveal secret program information, such as private keys, by measuring the runtime cache behavior of the victim program [6]. The differences in the cache side channel attacks are presented in the following aspects: the vulnerabilities the attack types, the type of cache, the pattern of probing the cache state and the collocation range that the attacker and the victim co-reside in. These are key elements that constitute the cache side-channel attack model.

Side-channel attacks based on [4] CPU utilize shared CPU caches within the same physical device to compromise the system's privacy. Hardware as well as software-based cache-partition strategies proposed countermeasures against cache-based SCAs, these reduces performance because of cache reservation [6]. Hardware –based requires specialized features that uses cache allocation technology (CAT). Software-based like page colouring requires system level modifications.

The attacks are more powerful enough to exploit stored passwords in a browser, emails and business critical documents. The covert-channels allow attackers to retrieve information from kernel memory with no direct contact with the victim. The review of complete leakage hierarchy, identifying different execution contexts at different levels of cache hierarchy, the taxonomy of various attacks that exploit these leakage opportunities, in software execution, in order to extract secret information from various implementations of RSA cryptosystem has been proposed in this paper.

RSA PUBLIC KEY CRYPTOSYSTEMS IMPLEMENTATIONS

In RSA, encryption keys are public, while the decryption keys are not, as a result, a person with correct decryption key can decipher an encrypted message. RSA have been developed for secure cryptographic implementations, but they have been exploited when deployed in hardware. The encryption and decryption keys are made, in such a way that the decryption key may not be easily deduced from the public encryption key.

Algorithm

Private Key is a pair of numbers (N, d); the public key is (N, e) whereas N is common to the private and public keys. The sender uses the following algorithm to encrypt the message: $C=P^e \bmod N$, where P is the plaintext, C is the ciphertext. The receiver uses the following algorithm to decrypt the message: $P = C^d \bmod N$, where d and N are the components of the private key.

Choosing Public and Private Keys:

- Choose two large prime numbers p and q.

- Compute N = p * q
- Choose e (less than N) such that e and (p-1)(q-1) are relatively prime (having no common factor other than 1).
- Choose d such that (e * d) mod [(p-1)(q-1)] is equal to 1.

For example, if we select two prime numbers p = 11 and q = 3, then N = 11 * 3 = 33. Now compute (p - 1)(q - 1) = 10 * 2 = 20 and choose a value e relatively prime to 20, say 3. Then d has to be chosen such that ed = 1 mod 20. One possible value for d is 7 since 3 * 7 = 21 = 1 mod 20. So, we get the public key (N= 33, e= 3) and the corresponding private key d = 7. We discard the original factors p, q. Factoring breaks RSA because if an attacker can factor N into p and q, can use the public value e to easily find the private value d. To encrypt a plaintext message M, we compute C = Me mod N, where C is the encoded message, or ciphertext. To decrypt the ciphertext C, we compute M = Cd mod N, which yields the original message M. Continue with our previous example where the public key (N= 33, e= 3) and the private key d = 7. Suppose we want to send a message M = 19.

Encryption generates an encoded message C =Me mod N = 193 mod 33 = 28. The sender would send the encrypted message C = 28. To decrypt message C, the receiver uses the private key d and computes Cd mod N = 287 mod 33 = 19, which must be the original message M. The decryption works thanks to a result from number theory known as Eulers Theorem [7]. Another use of RSA is to generate digital signatures whichserve to verify the source of the message. Signing uses the private key d and is the same mathematical operation as decrypting. The receiver uses the public key e and performs an encryption operation to verifythe signature. For some attacks, it is possible to achieve more than 50% of bits, and other bits are recoveredby (CRT) Chinese Random Theorem.

SIDE CHANNEL ATTACKS ON RSA

The harm of the cache side-channel attacks [1] is that the attacker uses this channel to secretly transmit sensitive information, posing threats to the system. The threat of cache side-channel attacks are disclosure of sensitive information such as privacy, deliver the results of malicious code execution and Denial of Service. The difficulty of inverting the RSA function on random inputs implies that given {N, e, C} an attacker cannot recover the plaintext M. However, a cryptosystem must resist more subtle attacks. It should be intractable to recover any information about M, known as semantic security.

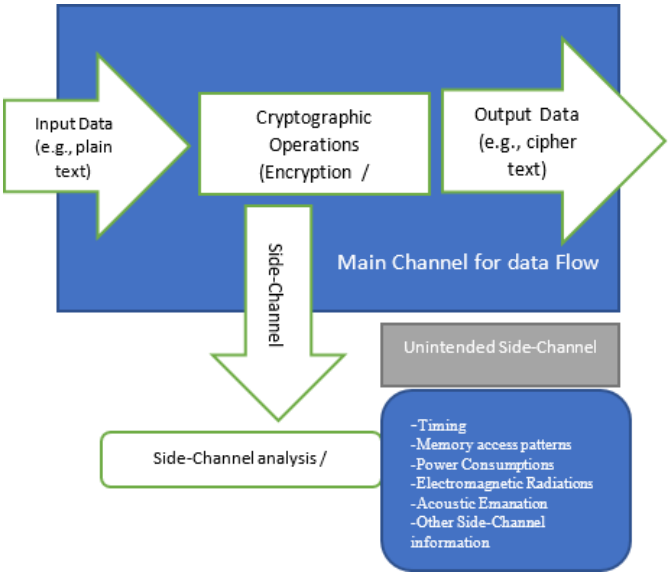

Fig. 1 Unintended Side-channel Information Leakage [1]

Timing attacks exploit the timing variations in cryptographic operations. Because of the performance optimizations, computations performed by a cryptographic algorithm often take different amounts of time depending on the input and the value of the secret parameter. Sometimes statistical analysis can be applied to recover the secret key involved in the computations. For a timing attack, the attacker needs to have the target system compute C^d mod N for several carefully selected values of C.

By precisely measuring the amount of time required and analyzing the timing variations, the attacker can recover the private key d one bit at a time until the entire exponent is known. The attack is in essence a signal detection [9] problem. The signal consists of the timing variation caused by the target exponent bit, while the noise consists of the inaccuracies in the timing measurements and the random fluctuations in timing, particularly over a network. The number of timing samples required is thus determined by the properties of the signal and noise. In any case, the required sample size is proportional to the number of bitsin the exponent d [9]. As there are only a limited number of bits in the private exponent d, the attack is computationally practical.

```
x = C
for j = 1 to n
x = mod(x², N)
if dⱼ == 1 then
x = mod(xC, N)
end if
next j
return x
```

Fig 2: Square and multiply algorithm

RSA implementations use Montgomery algorithm to perform the multiplication and the square operations, which takes a constant amount of time, independent of the size of the factors. But if the intermediate results exceed the modulus N, an extra reduction is performed [10]. This causes the timing difference for different inputs which leads to retrieve the secret key. For example, the attack against CASCADE smart cards, where the smart cards are the kind of hardware security token. The attacker makes it relatively easy to measure the running time of cryptographic operations.

A 128-bit key could be broken at a rate of 4bits/second using 10,000 samples. The attacker can reveal a part of secret key, even if the samples were not enough to recover the complete key. The modular exponentiation in RSA consists of a large number raised to a large exponent which is a time-consuming operation. These attacks illustrate that cryptosystems that rely on modular exponentiation may be vulnerable to timing attacks.RSA blinding method are defended against these timing attacks.

Time-driven attacks result in quantifiable execution information related to timing. It can be comprehended as the number of cache hits and misses relaying timing execution information throughout the encryption process. The active attacker is well informed about the victim's timing information and can manipulate the victim's machine. Whereas, the passive attacker has no access to the victim's machine and thus it is not ableto influence the victim's machine directly or indirectly.

Trace-driven cache attacks aims to access the cache line that has been used by the victim by analyzing and reviewing the cache state repeatedly. If a good trace of information related to the victim has been obtained, trace-driven attacks are more effective, resourceful and refined than time-driven attacks. They are destructive in case of simultaneous multi-threading (SMT) that enable the hardware to execute several threads simultaneously. This can be hazardous as the threads use the same processor resources. The attackers can retrieve information by observing L1 activity of RSA encryption on multiplication and squaring operations based on Chinese Remainder Theorem (CRT) [11]. The RSA decryption is slower than encryption because while decryption, the private key parameter "d" is large. Whereas, the values of pa and q are very large numbers.

The CRT in RSA is very effective to accelerate the process of decryption of the message even though the value of the modulus n which is used differently. Decryption speeds have increased by about 3-fold comparedwith the use of RSA. The shortcomings exist in key generation process of RSA and RSA-CRT 4096 bits [11] because of the time it takes much longer.

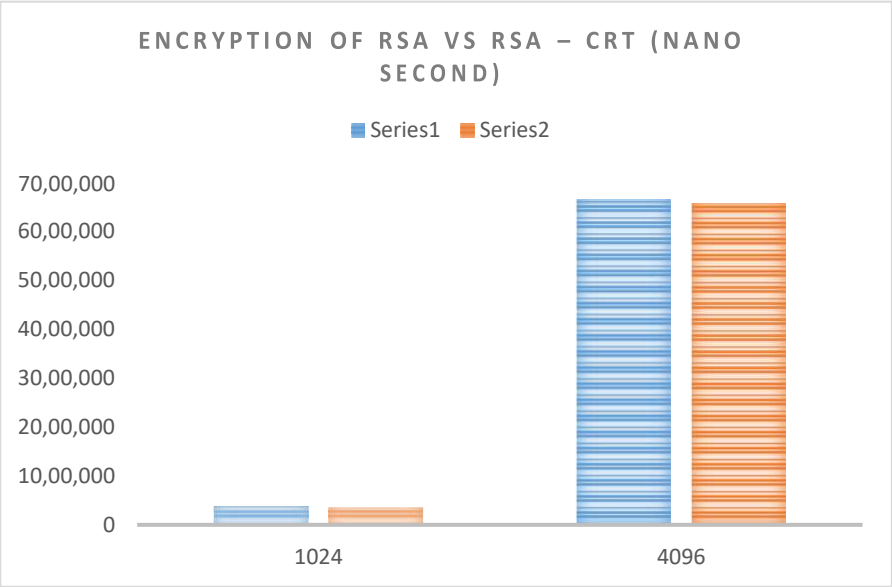

Fig.3: The Results of comparison Time Encryption RSA and RSA-CRT [11]

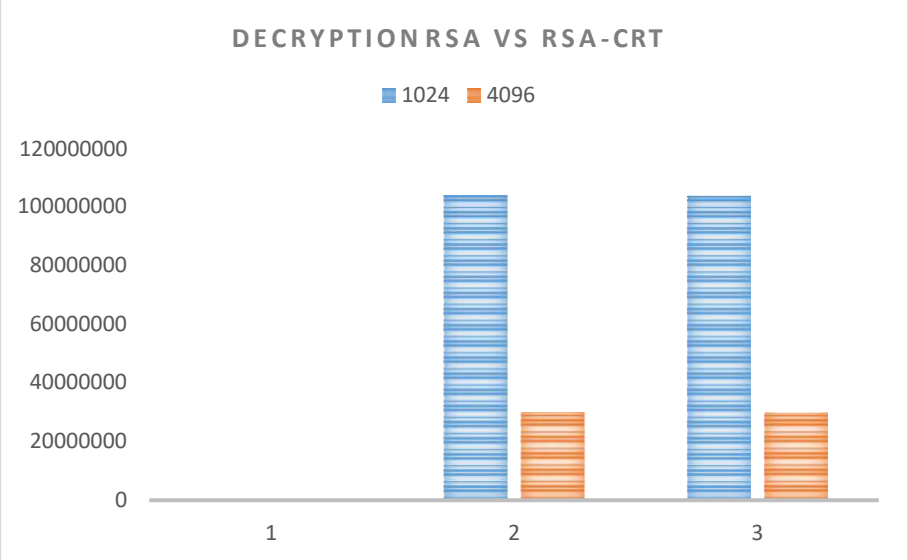

Fig.4: The Results of comparison Time Decryption RSA and RSA-CRT [11]

Results graph of the time complexity of the encryption process in Fig 3 shows that the difference between the encryption process on RSA and RSA-CRT did not experience much change although the modulus n which is used differently. It can be observed that [11] the RSA algorithm can refund the value of ciphertext into plaintext (decryption) techniques requires quite a long time. The CRT produces a short period of approximately three times faster in performing decryption on ciphertext.

The Modular exponentiation is implemented by performing large-integer square and multiply operations. As per the algorithm stated in [12], BN_mod_mul(r,r,r,m) for squaring and BN_mod_mul(r,r,ct[wval],m) for

multiplication. The test bits of the secret information is to determine if the next operation will be squaring or multiplication and what operands should be used,

```
wval<<=1;
wval+=BN_is_bit_set(d,b);
```

In the power analysis attack, the attackers extract secret information from signals created by electronic activity within computing devices as they carry out computation. Either to collect a few number of power traces and analyse them visually or logically to figure out basic information about the cryptosystem known as Simple Power analysis (SPA) attacks or collect a large number of traces and with statistical analysis methods reveal out the secret key used by the cryptosystem known as Differential Power Analysis (DPA) attacks.

The encryption portion of the RSA algorithm takes the message to be encoded as a number 437265 and raises it to the power of the public key e modulo n: $((437265)^{e} \bmod n)$ = ciphertext. The decryption portion takes the ciphertext and raises it to the power of the private key d modulo n: $((\text{ciphertext})^{d} \bmod n) = 437265$.

The acoustic cryptanalysis attack which can extract full 4096-bit RSA keys from the popular GnuPG software, within an hour, using the sound generated by the computer during the decryption of some chosen ciphertexts. A new key extraction attack which can find the full 4096-bit RSA secret keys used by GnuPG running on a laptop computer, within an hour, by analyzing only the sound picked up by either a plain cellular phone places next to the computer, or by a sensitive microphone from a distance of 10m.Our attack extracts each of the key bits in sequence by crafting a special chosen RSA ciphertext that cause numerical cancellations deep inside GnuPG's modular exponentiation algorithm. This causes all-zero words to appear frequently in the innermost loop of the algorithm, thereby causing a specific branch to be taken there, but only if the attacked key bit is 1.

A single iteration of that loop is much too fast for direct acoustic observation, but in our attack the effect is repeated and amplified over many thousands of iterations, resulting in a gross leakage effect that is discernible for hundreds of milliseconds and distinguishable in the acoustic spectrum. Thus, our attack causes key-dependent side channel leakage in RSA implementation and moreover utilizes own code in order to amplify the aforementioned leakage. This allows us to create a clearly observable low-bandwidth leakage which reveals the attacked key bit.

COUNTERMEASURE ON SCAs

RSA is in constant danger and a solution in GnuPG is highly desirable because it does not address the issue of maintaining isolation and preventing information leakages. Hardware developers' efforts have targeted efficient utilization, maintained coherency and optimized further hardware solutions is not possible.

Software-based countermeasures which are required, that are quick and efficient solutions to the problem of information leakage, which compromises the confidentiality and integrity of systems.

Countermeasures involves introducing desynchronizations during the encryption process so that the power traces no longer align within the same acquisition set. Techniques such as fake cycles insertion, unstable clocking or random delays can be employed to induce alignment problems. To counter these, signal processing can be employed in many cases to correct and align traces. Countermeasures with respect to electromagnetic radiation, is to increase the signal-to-noise ratio enough for DPA to work. It is in the countering of countermeasures that more involved processing techniques become more important.

TABLE I. SIDE CHANNEL ATTACKS COUNTERMEASURES

Side-Channel Attack	Measured Parameters	Analysis Methods	Countermeasures
Power Analysis	Current signature and power consumption patterns	Simple power analysis (SPA) Differential power analysis (DPA) Correlation power analysis (CPA)	Power consumption masking Power consumption hiding
EM Analysis	Intentional and non-Intentional electromagnetic emission	Simple EM analysis (SEMA) Differential EM analysis (DEMA)	EM emission shielding EM noise generation modules
Fault Analysis	Invalid outputs, underpowered behaviour, and Laser/UV Glitching responses	Comparative approach to analyse responses before and after fault insertion	Error detection schemes Anti-tamper protection modules
Timing Analysis	Operation delays, time elapsed when different input patterns are applied	Analysis to relate operation delay to the nature of the function	Randomized operational delay Fixed operational delay

The decreasing effort to perform these attacks, and diminishing cost of the measurement instruments make it easy to exploit side-channel vulnerabilities and help break traditional cryptographic systems. These countermeasures have also evolved overtime in their effectiveness and cost, and are being increasingly deployed in new devices to protect against diverse forms of side-channel attacks.

CONCLUSION

Cryptographic algorithms that rely on modular exponentiation such as RSA may be vulnerable to timing attacks. If the exponentiation operation which involves the secret key can be timed by an attacker with reasonable accuracy, the key can be recovered using selected input values, the number which is proportional to the length of the key. The issues that arise when trying to implement cryptographic primitives that should offer resistance against side channel attacks. Side channel attacks tells us that even if a cryptographic scheme is mathematically strong, it may not be secure in practice depending on the way it is implemented and on the design of the system as a whole. Strong cryptography gives us security only if it is implemented and used in ways that complement its strength.

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Investment Recommendation System

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ABSTRACT
One of the most important necessities to sustain in today's world is money. People are always trying to save their money or wealth for future needs and comforts. This arises the need to develop a system that can help them do this efficiently and conveniently. The best way to save money for future or in the long-term is investing it, because inflation can affect the value of money over a long-term period. This system provides insightful recommendations to users. It helps to suggest users the top investment choices. The user can get ridof the hassle of spending heavy charges for finding investment recommenders as this system will not charge them any fees. The system also helps the users to review and adjust their details periodically.

I. INTRODUCTION

In today's world people have the opportunity to invest money themselves considering their convenience, but most of the professional investors charge heavy fees to help them take the right decisions. Due to which they might end up nt seeking help from professionals or taking advice from their friends or family which might not necessarily be efficient. The purpose of the system is to provide the ordinary audience to invest their money efficiently and help them obtain a maximum profit based and an intelligent recommendation for the users. The system will recommend the users the fields in which they can invest their money, based on any minimum amount that the users wishes to invest. The user will be recommended in various fields including stocks, gold, bank deposits, real estate etc. which will be done by training ML models to do the same. Basedon the response from various parameters such as location, flats, area, bank details and amount to invest. Basedon more value of predicted price in future the system will recommend the best option the user should go withfor investment.

II. LITERATURE SURVEY

The main objective of the survey is to find already existing applications, compare their functionalities, discuss their pros and cons, and find solutions to existing problems. We examined the existing systems and technologies as well as referred to papers and articles which helped us in gaining an insight onto different technologies and solutions for investments are used.

A. Improving the existing solutions by adding new features to the it by using different algorithms such as collaborative filtering, knowledge-based algorithm. We have studied and examined various papers as well as articles to understand the working and technologies used. [18]

Knowledge-based recommender systems focus on formal- sizing the knowledge about a domain based on its speci- ficity, various constraints of items. The information about a user is usually collected by a knowledge acquisition in- terrace, personalized recommendation is calculated based on the representation of knowledge about the user and available items. The advantage of knowledge-based methods is that the recommendations rely only on the domain-knowledge and constraints of the user preferences; furthermore, they are easy to be explained. On the other hand, the knowledge base itself should be built up and maintained, which can be a significant overhead in operating such an interactive decision support systems and the conflict should be resolved by heuristics when there is no matching item based on the actual constraints.

B. Portfolio management of users. [2]

As portfolios can contain various assets, the portfolio man- agreement is heterogeneous. Although the churn rate may vary by the type of do-mains, we consider it low, because the assets are purchased for long-term investment. On the other hand, portfolios are basically unique and they always change if reallocation is performed. Assuming an interactive user interface, the interaction type is explicit, because in-vestors can specify both their preferences or the desired weight of assets in portfolios. The stability of user preference may vary overtime, but it is less unstable than stock exchange, because portfolio sare typically composed for long-term investment. The risk of such investment is still high and explanation is desired in this domain.

C. Need of Decision support system as investment recom- mending system. [3]

From a business perspective, a common challenge that several financial institutions are facing is the lack of an intelligent decision support system. As sales activities of financial products require expert knowledge, recommender systems offer great benefits for financial services by either improving the efficiency of sales representatives or automa- tizing the decision-making process for the clients. Therefore, a significant demand is observed for these decision support systems. Recommendation systems have been developed to help users make wise investment decisions, lowering the chances of overall default. Generally speaking, recommender systems are useful in any domains, where a significant amount of choice exists in the system and users are interested in just a small portion of items. The relevant literature is investigated based on two directions. First, a domain-based categorization is discussed focusing on those recommendation problems, where the existing literature is significant. Second, the appli- cation of various recommendation algorithms and data mining techniques is summarized. As the object of recommendations are usually related to money spending transactions, we con- sider all financial domains; therefore, the demand for proper explanation about the recommendations is significant.

D. Main motive behind developing investment recommending system [4]

Money is an essential commodity that helps you run your life. Money has gained its value because people are trying to save wealth for their future needs. For longer-term goals, you may want to consider investing because inflation can seriously affect the value of cash savings over the medium and long- term. The stock market tends to do better than cash over the long-term providing an opportunity for greater returns on any

money invested over time. There is a major segment of the finance industry that no one has touched as yet, the stock and investment segment. Investing in stocks using the stock trading app can be quite risky, and identifying the right agent to help you with the stocks can be difficult. Investing app, helps people make the right investment and earn profits. Whether you are an investor or a naive investor, this app will help you.

E. Real-time Recommendation System for Stock Investment Decisions [18]

In this paper, a recommendation engine for stock market is proposed that integrates semantic similarity assessment among investors, to incorporate their behaviour and areas of interest, with a technical analysis of the companies considered for investment. The system brings together the advantages of collaborative filtering and content-based recommendation and improves the accuracy of the system's suggestions. The results of this paper show that that a recommended stock must occur minimum six times in top 40 percent most similar investors. Lowering the relevancy criterion would decrease this accordingly. The results have been compared to ones obtained with alternative embedding algorithms. Better results could be yielded, if the whole graph was considered in calculations instead of subgraph, but it would affect the response speed simultaneously. The system uses the attributed network em- bedding concept. The domain of investors is modelled and their stock decision is given with a labelled property graph which is then appropriately queried for a given user,and the obtained subgraph is embedded onto a low-dimensional vector space. After obtaining the suggestions for potential companies to invest in, it incorporates the technical analysis of the candidate stocks to produce the final recommendations in near real-time.

F. Application of Machine Learning in Collaborative Filtering Recommendation System for Financial Recommendations [18]

This paper proposes the idea of developing recommender systems model of finance which will reduce the difficulties of equity traders. Collaborative filtering is used in to predict the Nifty 50 equity of daily trade quantity. This paper aims to use a machine learning approach for recommenders in finance of company's equity. A methodology of how machine learning can be used in finance has been proposed. This paper presented companies equity recommendation by applying our financial recommendation model that can be used for recommending the different company's trade equity to the end user for understand the financialstock market. The result shows that the model can be used for large dataset by extending number of users.

G. Survey of related works [18]

Kim and Han in [19] built a model as a combination of artificial neural networks (ANN) and genetic algorithms (GAs) with discretization of features for predicting stock price index. The data used in their study include the technical indicators as well as the direction of change in the daily Korea stock price index (KOSPI). Tey used the data containing samples of 2928 trading days, ranging from January 1989 to December 1998, and give their selected features and formulas. They also applied optimization of feature discretization,as a technique that is similar to dimensionality reduction. The strengths of their work are that they introduced GA to optimize the ANN. First, the amount of input features and processing elements in the

hidden layer are 12 and not adjustable. Another limitation is in the learning process of ANN, and the authors only focused on two factors in optimization. While they still believed that GA has great potential for feature discretization optimization.

III. EXISTING TECHNOLOGY

A. Olymp Trade

Olymp Trade is an application recommended for beginners who are wanting to invest for the first time. These users can benefit from features such as a low minimum deposit and the access to a demo account. Another striking benefit is the wealth of resources available as well as the Olymp Traders' Club for communal learning. The application requires registration as a first-time user and a minimum trade amount of dollar 1 and minimum deposit has be to at least dollar 10. Users can choose free-floating currency pairs, majors like EUR/USD or minors like USD/NOK. They are especially suitable for short-term trading. Or you can invest in commodity values, such as crude oil or precious metals. More options are stock prices of publicly traded companies, like Facebook and BMW, or indices representing the value of a certain group of stock.

B. Acorns

Acorns is an already existing app that works by rounding up our spending. You can link as many credit or debit cards to your account and the round ups accumulate. The round ups have to be dollar 5, then the moneyis withdrawn from our linked checking account and invested. Acorns recommends portfolios for you based on your personal info and goals. The money in your Acorns Invest account is invested in twelve different exchange-traded funds (ETFs). These funds include stocks, bonds and other securities. The most important draw- back of this system can be its monthly charges on all accounts.

C. Fidelity investments

Fidelity is a top brokerage with extensive resources for long-term and retirement-focused investors. With a Fidelity account, you can access some of the best education and research resources available among brokerages. The firm is a standout for its focus on retirement education, including retirement calculators and other tools. The Fidelity mobile app integrates with both Apple Watch and Google Assistant for even more features. The brokerage offers a few of its own mutual funds with no transaction fees or recurring fees. It's also one of the only major brokerage firms to offer fractional share investments. It also requires a specific amount for phone trades.

D. SOFI

SoFi started as a student loan lender and quickly grew into a full-service finance company with lending, banking, and investing managed in one convenient mobile app. SoFi is great for beginners because it includes investment education and allows you to start small with fractional shares, which it calls Stock Bits. Sofi Invest users can trade stocks, ETFs that are on a curated list, and cryptocurrencies. Stock and ETF trades are free.

SoFi Invest also offers a managed portfolio product with no added investment management fees. Overall, SoFi offers some impressive accounts that are well priced and easy to use. That's a winning combination. Though this system might contain mostly what a user desires, there are no advanced research tools and also limited investment assets

IV. PROPOSED SYSTEM

In today's fast pace life, it is very essential to invest money in right and secure way for common people but sometimes it becomes difficult to make a right choice since most of the professional investor's charge huge amount for suggesting people. To eliminate these issues, we have proposed a system where it would recommend people how they can invest their money in stocks.

A. Dataset

Data is collected from the internet using web scraping to get the tickers of the respective companies listed at Nation Stock Exchange and a part of the financial Index Nifty 50. At runtime historical data of the tickers is being pulled from the NSE library, historical data ranges from date 1st January 2000 to closing of markets on the latest business day, Frequency of the data is in days. A serialized pickle file is used to store the ticker data, if a pickle file containing ticker data is not present locally, a new file will be created to hold the data.

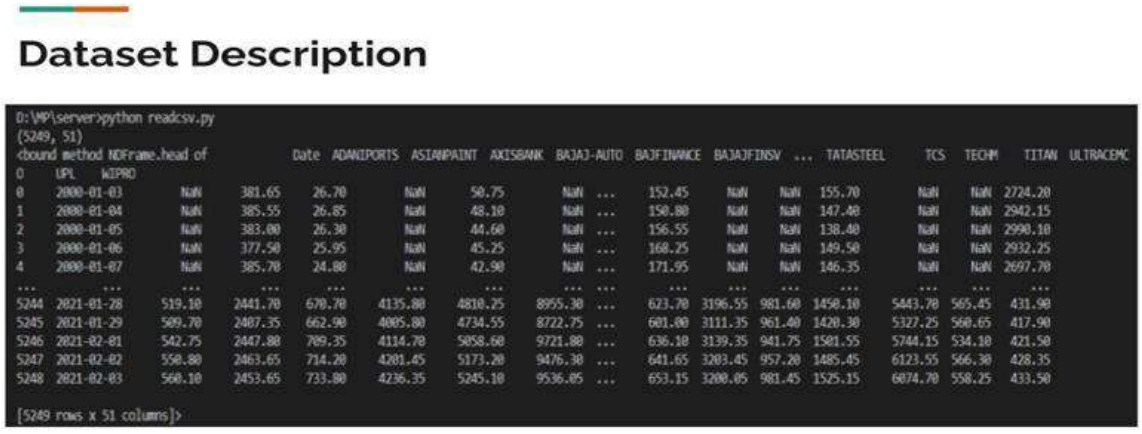

Figure 1. Dataset description

B. Charts

Visualization dashboard is a react component to view the graph of the nifty 50 stocks. This panel pulls data from trad- ingview, a trading platform which provides API and plugins to fetch and display latest stock data. This is a responsive component providing features such as viewing data by choice of frequency by day, week and month.

C. Processing

The process of selecting a potential stock for investing involves few factors, from which most important ones are equity returns, risk/reward ratio, dividend yield of the company, include one more if you're interested in idea of capital gains i.e., the category of stocks i.e., Growth or Dividend paying stocks among the blue-chip stocks. It will not be a wise decision to pick a high dividend paying stock with a yield percentage of 5 but with a higher risk reward and a negative percentage of -7 on equity returns of a period of time, this will eventually cause principal losses.

1) Earnings Per Share: EPS is calculated as follows: EPS = net income - preferred dividends / average outstanding common shares
2) Dividend yield: Dividend yield measures the quantum of earnings by way of total dividends that investors make by investing in that company. It is normally expressed as a percentage. The formula for computing the dividend yield is Dividend Yield = Cash Dividend per share / Market Price per share * 100.
3) Returns of investments: ROI is calculated by subtracting the initial value of the investment from the final value of the investment (which equals the net return), then dividing this new number (the net return) by the cost of the investment, and, finally, multiplying it by 100.
4) Risk Reward: To calculate risk/reward, we divide your net profit (the reward) by the price of your maximum risk.

D. Flow diagram

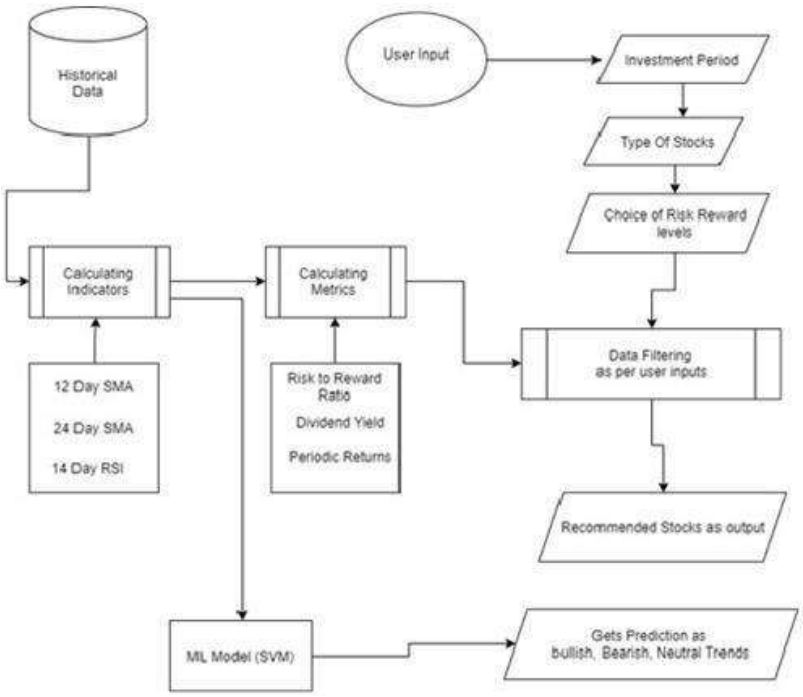

Figure 2. System flow diagram

The stock recommender prompts users for inputs to understand the users motive and choice of investment strategy. Inputs consist of the principal amount users want to invest in markets, then the tenure of the investment, a tenure of investment can be anything from a month (swing trade), 6 months, more than a year (long term), next is the type of stock they are interested in and the last one is the risk/reward ratio. To rescue the users from the math under the hood risk/reward ratio has been categorized into 3 categories which are low, mid and high. A stock with a risk/reward of .33 is an ideal asset for long term investment, stocks with ratio ¿.33 and ¡1 are the ones from mid risk and anything above 1 comes with high volatility, with great rewards there is always a chance of facing greater risks.

These inputs are sent to the python backend and processing begins for decision making. The store historical data of nifty 50 is crunched according to the tenure entered by the user, for example if the user wants to invest for 2 years, then the daily data of all the stocks will be resampled for 2 years and equity returns of each stock will be calculated, risk/reward ratio and dividend yield of the companies are already calculated and stored, after getting the returns data these ratios are then associated with the dataset. After getting all the necessary numbers, now the dataset is filtered according to the user choices and the filtered stocks are returned along with their returns.

1) Algorithmic Trading using Machine Learning: SVM's are used here to automate the process of decision making, whether the stock is in sell mode or buy mode. Algorithmic trading is being practiced and improved everyday by professional investors, statisticians. This way of trading provides the users an upper hand in the chaos of the market as it interprets the conditions keeping all the factors under consideration and boosts the process of decision making. This technique of trading uses stock data such as close prices, volume, and few indicators of users' choice (performance of this technique totally depends on users choice of duration, indicators. These are the hyperparameters which requires userinput and fine tuning to provide best results). It helps to enter the trade at the correct entry point and make proper exits, also it can improve the number of times a user hits stop loss by making safe exits.
2) Strategy used: SMA crossover strategy, when the shorter sma is cut above the longer sma the trend is bullish and the intersection is a correct entry point and opposite is true for bearish trend.
3) RSI: A trader might buy when price and the Relative Strength Index are both rising and the RSI crosses above the 50 Line. Similarly, a trader might sell when the price and the RSI are both falling and the RSI crosses below the 50 Line. When rsi is above 70 it is in an overbought zone and goes down any time. When rsi is below 30 it is in an oversold region and bullish trend can appear anytime soon.

V. RESULTS

A. User interface

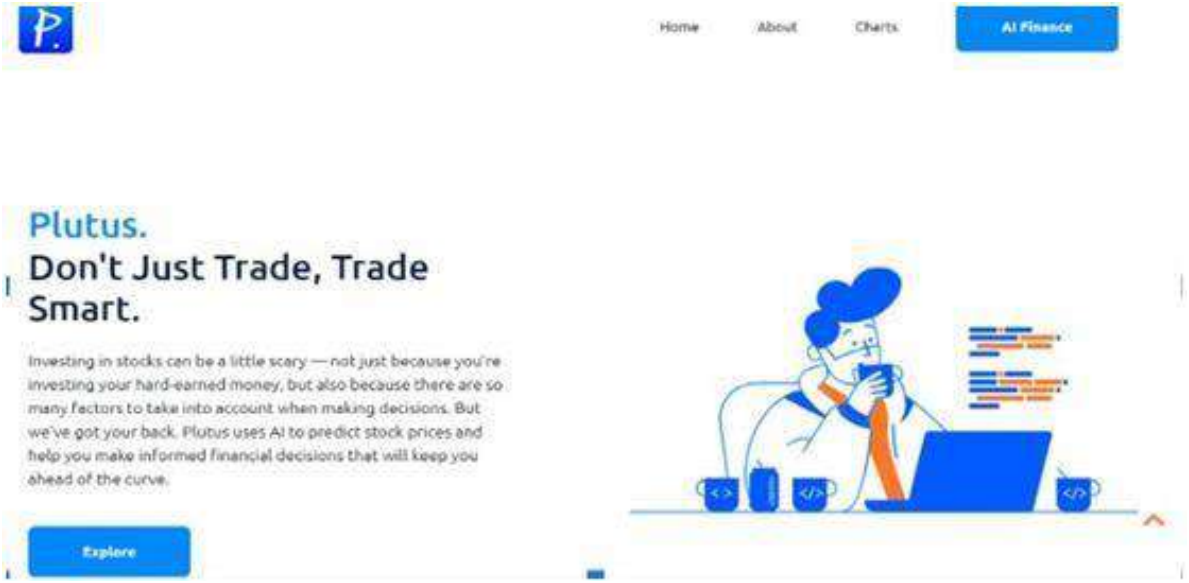

Figure 3. User interface with different options.

In the Figure it can be seen there are different options for traversing through the website of stock recommendation and the user can explore more about stocks .

Figure 4. SMA Crossover strategy.

In the Figure3 the blacktesting plot can be seen when the model is generating bullish signals and bearish signals, the green trailing lines indicate profitable trades and red ones indicate the loss.

B. SVM Rbf Kernel

The SMA crossover strategy is used, when the shorter sma is cut above the longer sma the trend is bullish and the intersection is a correct entry point and opposite is true for bearish trend. The SVM RBF kernel is used to fine tune the model. It is used to develop similarity features using the other features fed, these new features describe the other features much better, reduces ambiguity in data and multicollinearity to make more accurate predictions. The calculated indicators are used as input features to the model, they are used to train the model to generate bearish or bullish signals.

Figure 5. SMA Crossover strategy.

In the Figure2 it can be seen while the SMA crossovers occur in upper direction the trend is bullish indicated by the positions (graph line) and the opposite holds true for bearish trend.

Figure 6. SMA Crossover strategy.

In the Figure3 the back testing plot can be seen when the model is generating bullish signals and bearish signals, the green trailing lines indicate profitable trades and red ones indicate the loss.

C. Fine Tuning Model

Fine tuning includes looking at the rules for allocating investment money and when to make changes to the allocations. It also includes improvements to the coding of algorithmic-based strategies. In the Figure4 below fine tuning over time is shown, where y axis gives the loss.

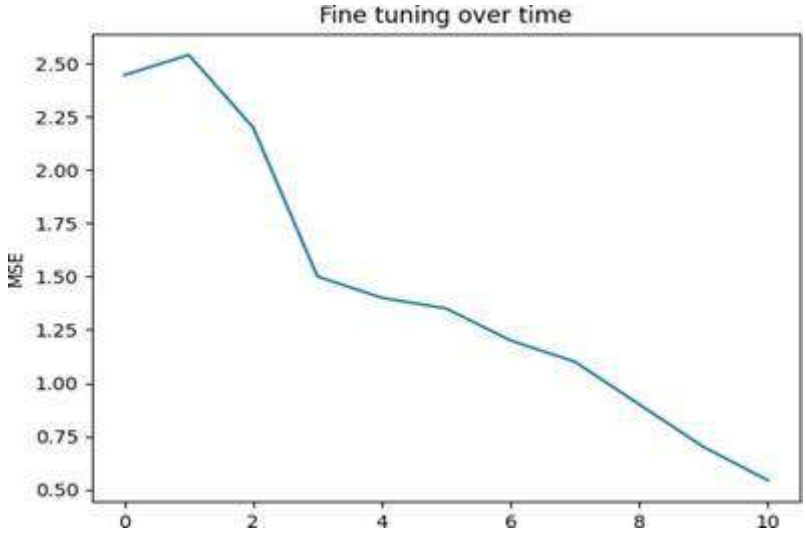

Figure 7. Fine tuning over time.

Considering figure5 it can be concluded that the best performance of the model is achieved just before the val loss crosses the train loss above. Hence, we consider the model with mse loss of .5432. The calculation of MSE is as shown below. $MSE=1/N+(Y-Y)^2$

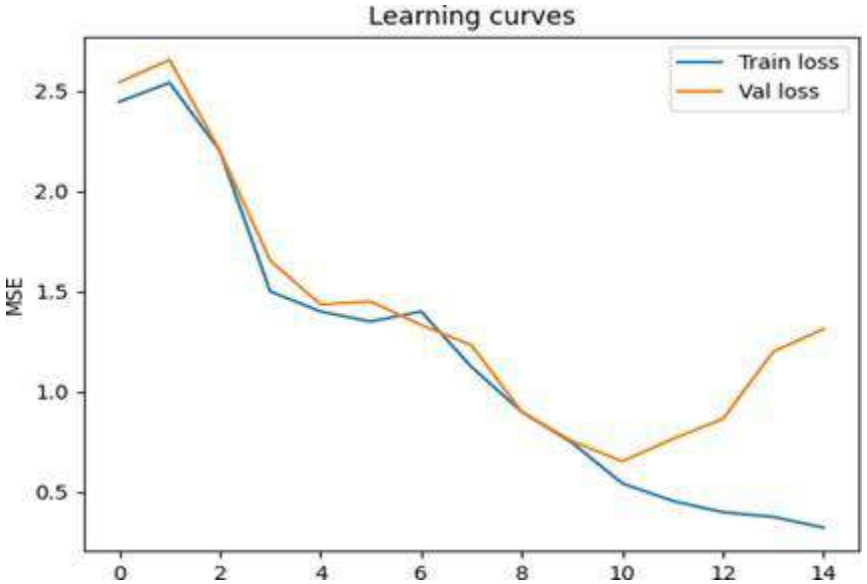

Figure 8. Fine tuning over time.

D. Output

In the figure below it is showing returns of recommended stocks over 15 months. In the figure below it allows the user to enter type of stock, how much you want to invest, tenure of investment.

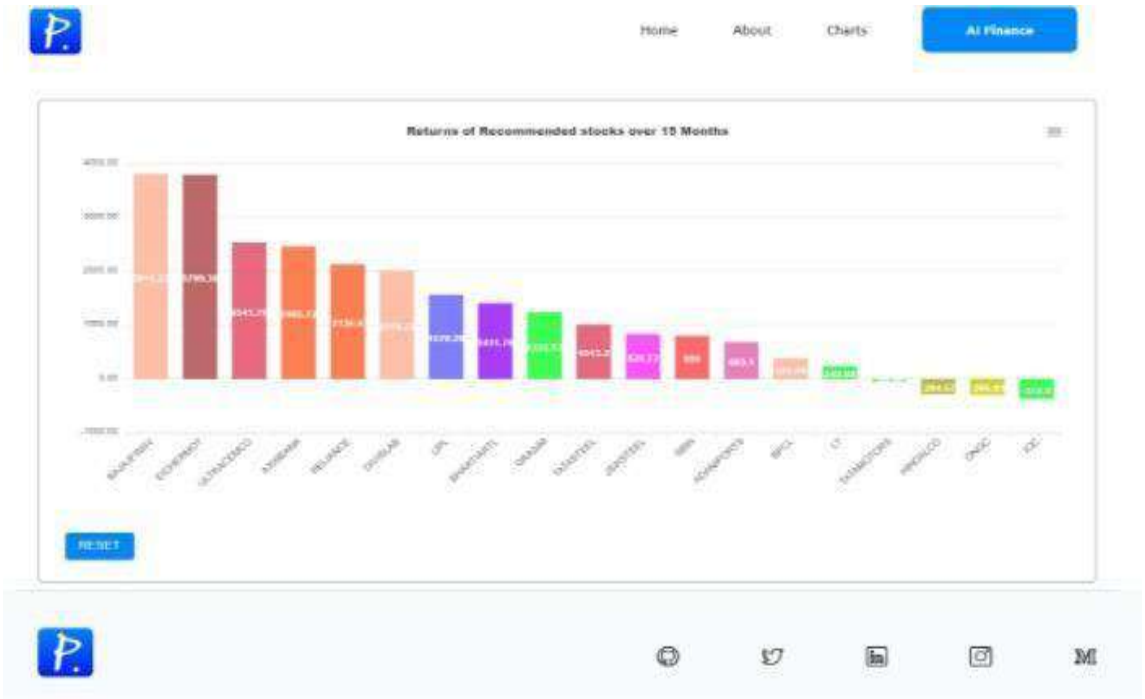

Figure 9. Graphical representation.

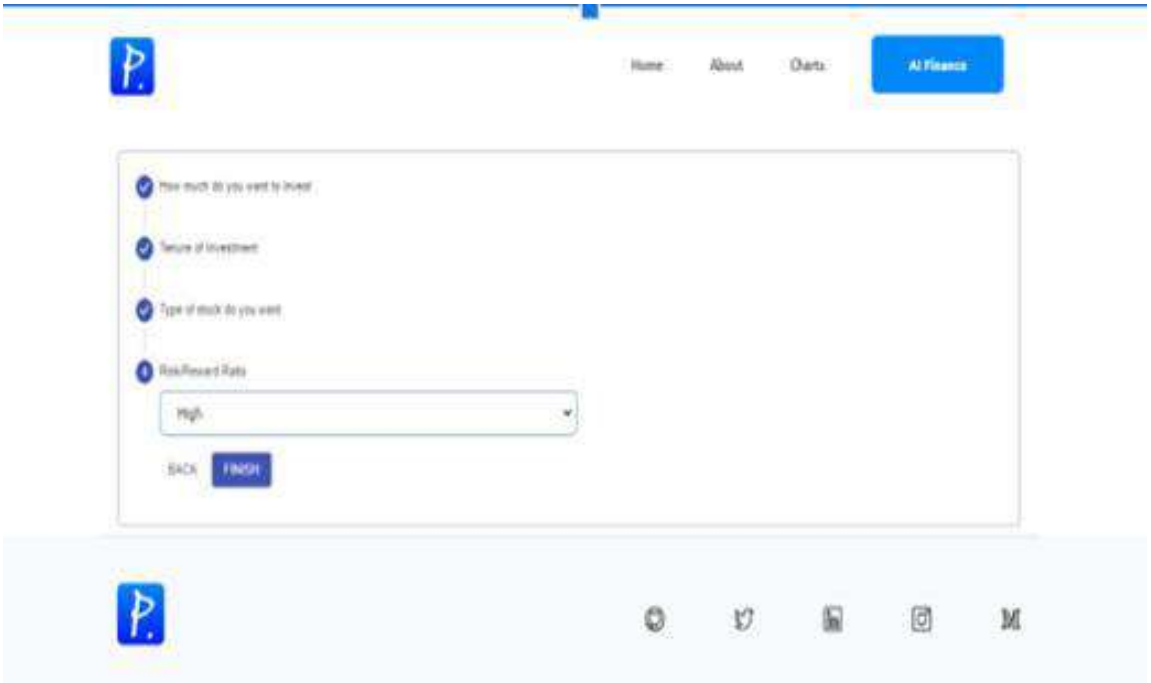

Figure 10. Graphical representation.

VI. CONCLUSION

After going through all the existing systems and thorough literature survey, we used algorithmic trading with machine learning. Algorithmic trading is being practiced and improved everyday by professional investors, statisticians. This way of trading provides the users an upper hand in the chaos of the market as it interprets the conditions keeping all the factors under consideration and boosts the process of decision making. The proposed system is a stepping stone towards the stock recommendation systems and the development of such a system will overcome the problems of the existing systems and provide efficient solutions to the same.

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A Survey on Personalized Recommendation Systems Based on Deep Learning Techniques

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ABSTRACT
With the rise in intelligent based technologies, and also the massive information available over the internet, users find it difficult to extract the appropriate information they require from the web. Although Personalized search utilizes user interests/behavioural pattern to extract and optimize results, the data extracted every now and then seems to be noisy(irrelevant). This is often because of the User(s) clicking on irrelevant data or links while trying to search out the needed information. Deep learning has been receiving alot of attention nowadays due to its outstanding ability to extract the hidden features of users' things and incorporate them effectively, resulting in significant advances to the recommender system. It resolves thecold start problem and the sparse matrix problem that exists in traditional recommendation system. In this paper, a survey is done on various deep learning-based recommendation systems based on the techniques of traditional recommendation
Keywords: Recommender systems, Collaborative filtering, Content based, Deep learning, Autoencoder, LSTM, Autorec, GRU

I. INTRODUCTION

The surge of information in recent years has escalated due to the quick growth of smart sensors, storage capacity, computing, and cloud platforms. However, as size of data grows, users must deal with the issue of having too much information, which makes it more challenging to make accurate decisions. This scenario is what is called as Information overload. One of the major problems in big data analysis is the use of artificial intelligence to extract abstract information from massive data and turn it into knowledge. In order to solve the problem of information overload, recommender system emerges as the times require[10]. Its main idea is to analyze the user's historical behavior and preference information, establish a model, and automatically recommend the items or products of interest to the user, then get a personalized list for the user [4].
The recommendation systems are broadly classified as content-based recommendation, collaborative filtering-based recommendation, and hybrid recommendation . Content based recommender system does the work of filtering or sorting recommend items by finding the match or relevance among the item attributes and user attributes. The basic goal of content-based techniques is to attempt to develop a model that can validate the observed user-item interactions based on the "features" that are already accessible. Collaborative

filtering techniques create the system by taking into account the user's previous actions (ratings are given to those items, previously queried or selected items), as well as similar decisions made by other users. Thesystem then uses this information to determine the item or other rating that the user may be interested in. Methods of hybrid recommendations [7] strive to achieve the best recommendation outcomes by combining content-based and collaborative filtering-based recommendation approaches. However, these techniqueshave limitations. Content based approach cannot handle massive user profiles due to privacy issues. Collaborative filtering approach on the other hand finds it difficult to recommend when the matrix is sparse, that is it cannot recommend when there are no ratings given by a user.

Due to its exceptional capacity to extract the hidden characteristics of users' objects and efficiently incorporate them, deep learning has recently drawn a lot of attention, leading to major improvements in the recommender system. It fixes the issues that conventional recommendation systems like cold start problem and sparse matrix problem.

Deep learning is a new area of study in machine learning. Its goal is to investigate ways to extract multi-level feature representations from data automatically. Its core concept is to extract features from data by combining low-level characteristics to construct richer high-level semantic abstractions, hence avoiding the challenge of manually designing features in classical machine learning[16].

By addressing the limitations of traditional approaches, recent advancements in deep learning- based recommender systems have drawn a great deal of attention. However, it detects the complex relationships within the data source, using a variety of widely available data sources including contextual, textual, and visual data.

II. RELATED WORK

[10] proposed an e-learning recommender system based on a logic approach called APARELL (Active Pairwise Relation Learner), which has been applied in the used automobile sales area. The similar technique might be applied to an e-learning system to assist students in selecting the best content based on their interests. We also propose a material content taxonomy based on the various learning styles. [15] hasproposed two emotional objectives for recommender systems in this study: surprise and curiosity, specifically used the notion of surprise and will implement it into a recommender system in two ways. Knowledge-based strategy in which we presume that statistical co-occurrence likelihood will aid in the identification ofunexpected suggestions and the Adaptive Knowledge-Based method, which strives to increase customer satisfaction by adaptively combining real-time feedback from users into suggestions. The content- based recommender system for an online store was proposed in this study[8].

The recommender system employs a collaborative filtering mechanism for proposing appropriate things and an expert system for determining item popularity. To mitigate the effect of the cold start problem, the system also provides an algorithm for presenting goods from comparable users after the first login. [22] This work describes an efficient method for retrieving data of relevance to users. In this work, we presented a tagging approach for the dataset as well as a novel user- profile architecture. The user's tags will be updated on a

regular basis, and relevant information will be recommended to the user each time the user signs in. To solve this issue, we developed a method for formatting the data in the dataset utilising POS- taggers and the NLTK framework.

[11] presents a research-paper recommender system that employs a collaborative filtering strategy to provide a user with the best research papers in their domain based on their queries and the similarities identified from other users based on their queries, hence saving the user time. [26] describes a system designed to filter out WordPress themes based on the ratings or reviews of other similar users, using an item-based collaborative filtering technique, and to provide user-specific recommendations for Theme forest, the largest online marketplace for web templates that is part of the Envato marketplaces.

[16] author has proposed the ADADRIFT method, which uses tailored learning rates based on profile information to cope with user and item-based drifts in adaptive recommender systems. Using stream-based recommender systems (ISGD and BRISMF).[3] In this paper HybA is presented as a hybrid recommender system for automated playlist continuation that combines Latent Dirichlet Allocation with Case-Based Reasoning.

III. TRADITIONAL RECOMMENDATION SYSTEMS

Recommender systems estimate users' preference on items and recommend items that users might like to them proactively [2]. Recommender systems are broadly classified into two methods. They are collaborative filtering, content based.

CONTENT BASED FILTERING:

Content based recommender system does the work of filtering or sorting recommend items by finding the match or relevance among the item attributes and user attributes. The basic goal of content-based techniques is to attempt to develop a model that can validate the observed user-item interactions based on the "features" that are already accessible. The difficulty of these algorithms lies in how to find user preferences based on the contents of items[9]. Contrary to a collaborative filtering system, where the predicted ratings can always be compared with actual ones, evaluating a content- based recommender system on the basis of statistical measures can be a daunting problem. This is mainly due to the absence of any 'ground truth 'regarding its predictions[37] A natural limitation of content-based filtering is the need to have a generic and rich representation of the content of the items, which is not the case for items characterized by their great extent and variety.[21,30] Moreover, this type of system generally suffers from the problem of overspecialization; for example, when a user clicks and sees a video, it doesn't not mean he wants to see it again. However, using a content-based approach, the system will suggest him to come back a second time to the same video with the same type of information even though he is least interested.

COLLABORATIVE FILTERING

One of the most popular recommendation systems is collaborative filtering (CF).Contrary to content-based methods, Collaborative Filtering solely considers each user's item ratings. It does predications on the idea that people who have given the same items with similar ratings are probably going to have similar tastes. Collaborative filtering recommends item based on the interest of other like- minded users or identify items similar to those previously rated by the target user. It uses statistical techniques to find the similarity between the user or item vector. CF methods can be classified into two categories Memory-Based and Model-Based[9]

IV. DEEP LEARNING TECHNIQUES

Deep learning is a subcategory of machine learning with three or more layers that tries to mimic the human brain. The typical defining essence of deep learning is that it learns deep representations, i.e., learning multiple levels of representations and abstractions from data[11].Let us try to look into the various techniquesthat help in implementing the concept of deep learning.

AUTOENCODER

Autoencoder (AE) is an unsupervised model attempting to reconstruct its input data in the output layer[].The middle layer, known as the hidden layer, is typically utilised to represent the input data's significant feature. There are many versions of auto encoders such as denoising autoencoder, marginalized denoising autoencoder, sparse autoencoder, contractive autoencoder and variational autoencoder [8]. Autoencoder reconstructs the input data to learn the latent feature of the data through coding and decoding process[22].

RESTRICTED BOLTZMAN MACHINE

A visible layer and a hidden layer make up the two-layer neural network known as the Restricted Boltzmann Machine (RBM)[32]. It is simple to mount to a deep web. Restricted here indicates that neither the visible layer nor the concealed layer may communicate with each other.

MULTILAYER PERCEPTRON (MLP).

A feed-forward neural network having several (one or more) hidden layers between the input layer and output layer is known as a multilayer perceptron (MLP). In this case, the perceptron does not have to be a purely binary classifier and can use any activation function. MLPs may be seen as learning hierarchical feature representations by stacking layers of nonlinear transformations. Universal approximators are another characteristic of MLPs.

CONVOLUTION NEURAL NETWORK

A unique variant of feed - forward neural network with convolution layers and pooling operations is called convolutional neural network (CNN) [17]. It has the ability to collect both global and local characteristics,

significantly improving accuracy and efficiency. When processing data with a grid-like architecture, it works well.

RECURRENT NEURAL NETWORK

Sequential data modelling is appropriate for recurrent neural networks (RNN). In contrast to feedforward neural networks, RNNs have loops and memory to keep track of previous calculations. RNNs are often employed in voice recognition[5], label creation[20], and machine translation [33].

RNN architecture comprises of input units, output units, and hidden units. RNN is mostly applied in sequential data processing

V. SURVEY OF DEEP LEARNING IN RECOMMENDER SYSTEMS

Deep learning is a subcategory of machine learning with three or more layers that tries to mimic the human brain. The typical defining essence of deep learning is that it learns deep representations, i.e., learning multiple levels of representations and abstractions from data[11].The idea of deep learning was introduced by Hinton et al. in 2006[10].

[22]predicts "core parametric function approximation" as basic technology for Feed Forward Deep Network. Feed forward neural networks are used as the foundation for several contemporary neural networks, including Deep Belief Network, Convolutional Neural Network, Recurrent Neural Network. These systems are widely used across many different sectors, primarily for speech recognition and NLP (natural language processing) [23].

DEEP LEARNING USING CONTENT BASED RECOMMENDER SYSTEM

The primary basis of a content-based recommender system is additional data on users and items. It is possible to consider a wide range of extra data, including texts, images, and videos. The primary benefit here is when dealing with content-based recommendations. When modelling users or items on the web, where multi- modal data is typical, this is unavoidable. For instance, when dealing with textual data and image data. The information from the user is extracted and then the deep learning method is often used to obtain the user's feature information [4].

DEEP LEARNING USING COLLABORATIVE FILTERING RECOMMENDER SYSTEM

Collaborative filtering is now one of the most used strategies in recommender systems. The most significant strategy in collaborative filtering is calculating the similarity between users or items. Many experts have suggested various ways for calculating similarity based on this.[15]. In real- world applications, the rating matrix is typically relatively sparse, leading CF-based approaches to perform noticeably worse in terms of recommendation performance. Some enhanced CF approaches make use of an increasing quantity of side information to address both the data sparsity and the cold start problems. But, owing to the sparse quality of the user-item matrix and the auxiliary information, the trained latent variables may be ineffective.

AUTOENCODER BASED COLLABORATIVE FILTERING

Auto-encoders are neural networks that are ideal for unsupervised learning tasks such as generative modelling, dimension reduction, and effective coding. In numerous disciplines, including machine learning, speech recognition, and language modelling, it has demonstrated advantage in learning underlying feature representation[14]. Given that information, new recommender system has included auto encoders, opening up more possibilities for re-inventing user experiences to achieve customer satisfaction[towards data].

Autoencoder can be seen as a alternative of the traditional multi-layer perceptron, which was initially proposed by Rumelhart et al. [8]. Through the coding and decoding processes, the autoencoder rebuilds the input data in order to understand the hidden characteristic of the data.

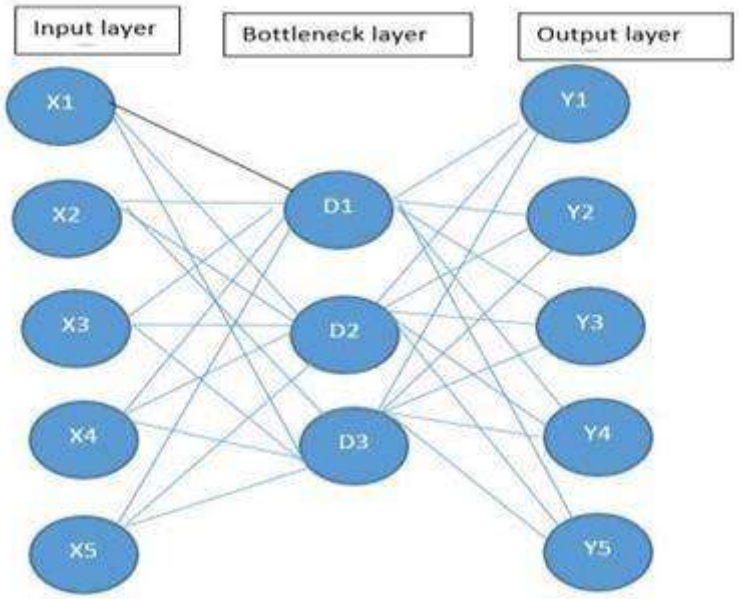

Fig 1.1 Autoencoder Framework

The autoencoder is a three-layer network in which the number of neurons in the input layer equals the number of neurons in the output layer and the number of neurons in the middle layer is less than the numberof neurons in the input and output layers. While training of the network, a new signal is created at the network's output layer for each training sample. The goal of network learning is to make the output signal as close to the input signal as feasible. The reconstruction error represents this similarity.

By cascading and layer-by-layer training, an autoencoder may create a deep structure. Fine tuning may be conducted after the deep model has been trained using layer-by-layer optimization by letting the complete network to rebuild. The ranking prediction of the autoencoder-based collaborative filtering recommendation approach is generated by adding the sums of the five vectors and scaling by the maximum rating K.

In recent years, various forms of AE have appeared in deep learning literature. Meanwhile, many variants of AE are used in RSs. Now, we briefly introduce four common variants of AE in RSs: denoising AE, stack

denoising AE, marginalized denoising AE and Variational AE[fcs] Stacking numerous autoencoders together improves accuracy marginally as well.

However, the autoencoder-based collaborative filtering recommendation approach has two drawbacks: it cannot handle non-integer ratings, and the decomposition of partly observed vectors increases the sparsity of input data, resulting in lower prediction accuracy.

Training deep auto encodes suggested that using both well-established and relatively new deep learning approaches, autoencoders may be effectively trained on very minimal quantities of data. Furthermore, they proposed iterative output re- feeding, a strategy that enabled them to make dense updates in collaborative ltering, boost learning pace, and improve prediction performance on the goal of predicting future ratings, their model surpasses previous algorithms even when no extra temporal cues are included.

While this technology supports item-based models (such as I-AutoRec), they believe that user- based models are more practical (UAutoRec). This is due to the fact that in real-world recommender systems, there are typically many more users than products. Finally, when developing a personalised recommender system and confronted with scalability issues, it is allowed to sample things but not users.

CONVOLUTION NEURAL NETWORKS

Deep learning is quite effective for sequential modelling problems. CNN is a feed-forward neural network that includes convolution layers and pooling processes. It is capable of capturing both global and local features, considerably improving the model's efficiency and accuracy. It is extremely effective at analysing unstructured multi-media data. CNN may be used to extract picture characteristics. What Your Images Reveal examines the effects of visual characteristics on POI recommender systems and presents a visual content augmented POI recommender system. This method uses CNN to extract picture characteristics and is based on Probabilistic Matrix Factorization, which investigates the interplay between visual information and latent user/location factors.

A relative deep learning model with CNNs for picture recommendation is proposed in Comparative Deep Learning of Hybrid Representations for Image Recommendations. The network is made up of two CNNs for image representation learning and one MLP for user preference modelling. CNN may be used to extract textual characteristics.

Automatic Recommendation Technology for Learning Resources with Convolutional Neural Network creates an e-learning resource recommendation model that employs CNNs to extract item characteristics fromlearning resource text information such as the introduction and content of learning material.

CNN is capable of extracting characteristics from audio and video. The well-known CNN-based model ResNet is used in Collaborative Deep Metric Learning for Video Understanding to extract audio characteristics. The suggestion is carried out in the collaborative metric learning framework, which is comparable to the CML stated above.

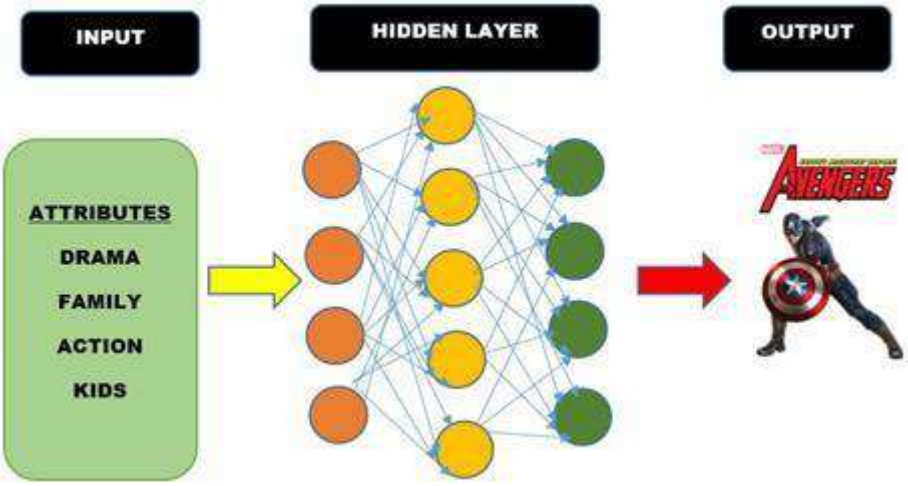

Fig 1.2 Convolution Neural Network Framework

RECURRENT NEURAL NETWORKS

The recurrent neural network (RNN) is well- suited to visualising sequential data. RNN, apart from feedforward neural networks, has loops and memory to recall previous calculations.

In practical terms, Long Short-Term Memory

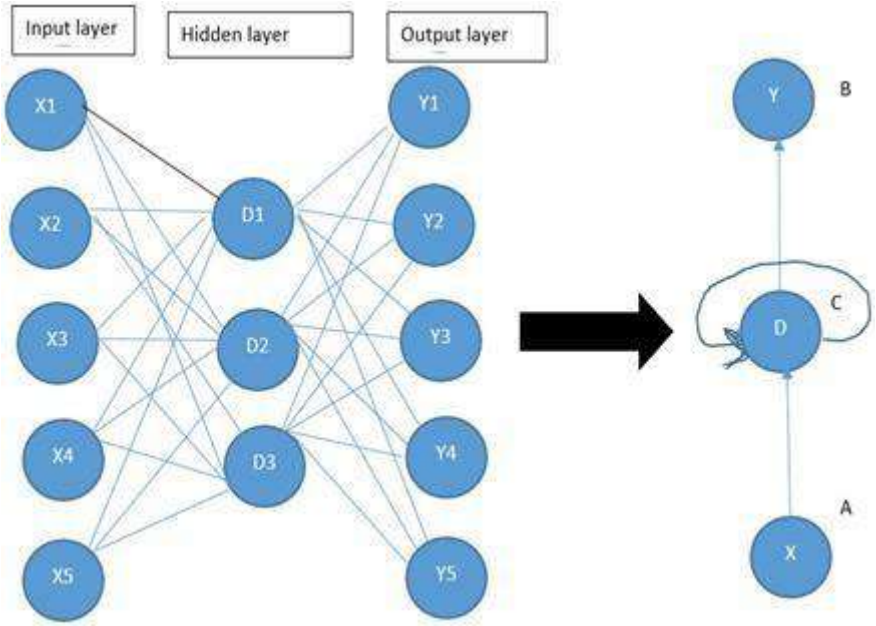

Fig 1.3 RNN Architecture

(LSTM) and Gated Recurrent Unit (GRU) networks are frequently used to address the vanishing gradient problem. The primary idea behind RNN-based collaborative filtering is to utilise RNN to model the influence of the user's previous sequence behaviour on the user's present behaviour, and then recommend and anticipate the user's behaviour. [78].

The RNN iteratively traverses the sequence of things consumed by a user. At each time step, the input is the current item's one-shot encoding, and the output is a softmax layer with a neuron for each item in the catalogue. The k items with the most neurons activated are utilised as the k suggestions.[]

5.6.1 RNN FRAMEWORK

The most advanced recurrent neural networks are "gated" RNNs, in which the internal state of the RNN is controlled by one or more tiny neural networks called gates. The LSTM[9] is the original gated RNN, although it has generated other versions [3, 7].

In comparison to standard recommender systems, RNN-based recommender systems can use deep learning techniques to automatically learn user and item feature vectors by combining multiple forms of diverse multi-source data, modelling user behaviour sequence patterns, more accurately representing diverse user tastes, and increasing recommendation accuracy.

VI. CONCLUSION

The significant growth in the volume of data needs the development of smart techniques and applications that are efficient in accurately and smartly storing, processing, accessing, and analysing information for optimized user access. Deep learning-based recommender systems are the most rightful techniques in supporting the data retrieval process.

Deep learning-based recommender systems may learn the hidden features of users and items from large amounts of data, then build a recommender prototype and provide an effective suggestion summary for the user. Deep learning- based recommender systems, as in contrast to traditional recommender systems, can use deep learning techniques to train and validate the hidden patterns of a user and an item by implementing wide variety of large volumes of data from various sources, prototype the patterns sequences of user behaviour, quite efficiently ponder the user's preferences, and enhance prediction accuracy. This paper a survey of various Traditional Recommender Systems techniques and its limitations has been discussed by analysing various proposed work and how deep learning techniques can be integrated with Recommender systems to gain prediction accuracy.

This review is intended to help us to understand the evolution of Deep learning recommender systems and how it solves the traditional problem of Sparsity matrix and cold start.

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Kisan-Zone: A Farming Assistant Web Application Using Salesforce Platform

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ABSTRACT
Kisan-Zone: A farming assistant web app aims at creating a platform where the end users, farmers can buy or sell all the agriculture related products at a single place. It also includes the features such as renting and buying agricultural tools, communicating with the experts, weather reports, calling facilities, live chats etc. It also has multilingual availability, which provides a necessary help to the farmers in their mother tongue, which helps them to know about the recent innovations, its related product functionality, and its usage as per their requirements. By implementing and using our system, we will create a platform, which will help the farmers by providing all the resources at single place, which will come in handy with or without the availability of mobile phones, by accessing it at the nearest Farmer Zonal Help Centre with the assistance of a technical person.
Keywords— Salesforce.com, Android, Farmers, Customers, CRM, Compatible

I. INTRODUCTION

Farming is the Prime Occupation in India. In spite of this, today the people involved in farming belongs tothe lower class and are in deep poverty. The Advanced techniques and the Automated machines which are leading the world to new heights, is been lagging when it is concerned to Farming, either the lack of awareness of the advanced facilities or the unavailability, leads to the poverty in Farming. Even after all the hard work and the production done by the farmers, in today's market the Agents, leading to the poverty, cheating the farmers. Agro-marketing would make all the things automatic, which make easier serving as a best solution to all the problems.

Kisan-Zone is a project that primarily focuses on the ease of providing resources for the farmers and providing all their needs at one place. This project mainly focuses on equipping and helping farmers. Kisan- Zone is a service to help the farmers working with the motive of greater profitability by direct communication between, farmer-to- supplier and farmer-to-farmer.

Kisan-Zone will serve as a way for the farmers to sell their products across the country just with some basic knowledge about how to use the internet. The site will guide the farmers in all the aspects, the currentmarket rate of different products, the total sale and the earned profit for the sold products, access to the new

farming techniques through e-learning and centralized approach to view different government's agriculture schemes including the compensation schemes for farming.

II. PROBLEM STATEMENT

Providing a user-friendly interface and a shopping cum consultancy website which will enhance the user experiences and will provide all resources at one place.

Kisan is a project that primarily focuses on the ease of providing resources for the farmers and providing all their needs at one place. This project is mainly focused for equipping and helping farmers.

e-Kisan is a service to help the farmers working with the motive of greater profitability by direct communication between; farmer-to-supplier and farmer-to-farmer. This service boosts business communication and brings transparency in the system. This innovative project allows for good farmer, retailer and supplier communication. It allows farmers to login and communicate to respective dealers. Whensellers publish an advertisement or offer, the respective farmers get the update in their viewing items list. All the items listed will be updated regularly. And any change in prices would also be mentioned with a discount.The farmers may also submit their grievances and complaints to respective dealers or authorities using their farmer login on a separate complaints page and authorities will get access to that page regularly using their login id and passwords.

We are creating a project on salesforce which will broadly classify the utilities and tools required by a normal farmer in their day to day lives. This project will have multiple options which will include all the services that will sum up all of needs for cultivating and farming.

III. LITERATURE SURVEY

"Krishi-Mitra: Expert System for Farmers" [1] by Ms. Prachi Sawant, tells, in today's rapid changing world of internet, we should focus on the people especially from the rural areas. The main Aim behind this is that the people in rural areas are far away from internet technology. Therefore, in order to get all the information about agriculture collectively, we have developed a Website and an Application, which will help the farmerin many ways.

In the system, they have made such an interface which can be accessed by semi-literate people. Also, there are options of Marathi as well as English language. So, that if any farmer is English illiterate, they can get the information in Marathi through one more advantage of Krishi-Mitra Website is that for registered user there is FAQ's facility and also, he can type his Queries, which will resolved in specific duration.

Inspite of this, if any farmer faces difficulty in accessing the Krishi-Mitra Website he can use Krishi-Mitra Application which contains iconic based interface as well as information in speech format i.e., audio clip. Also, if he has some other queries, he can directly contact to expert calling.

"E-FARMING" [2] by Sindhu M R helped the farmers to perform agro marketing and provides an interface for the users to create an account and generate bills regarding their purchases made in the interface. It also

provides the users with SMS services even in the internet deprived areas of India. With the help of this website, Government will put forward the new schemes for the farmers. Compensation will be provided for the farmers in case of any loss to the production due to some natural calamities.

"Kisan Seva Android Application" [3], International Engineering Research Journal (IERJ) by Mr. Shridhar R. Sarate tells, is an android app developed to help farmers by providing good platform to sell the crops and can get the information on weather of current day and next 5 days. They can also get details of dealers, market prices, agro advisories, plant protection etc. The unique feature of this android app developed is extreme weather alerts and market prices of commodity in nearest area and the maximum price in state as well as India. The Kisan seva android application is best platform for the farmer to selling their products/crop. It purposes to give profit to the farmer. It allows farmer to sell their crop at own price. It provides direct link to farmer and customer. Farmer will get more profit as compare to the manual existing system. Farmer need not go to the market for selling product. Market is assigning the multiple taxes in farmer product. But our application avoids multiple taxes.

"Kisan Monitoring System Focused on Android based Application" [4] by Swati Narkhede, which tells, ICT(Information and Communication Technology) in agriculture which plays an important role in the development of agriculture sector in India for connecting rural areas to rest of the country. The Kisan Monitoring System plays the Administrator role which is the owner of the system and this communication is handled via use of Android mobile or tablet pc application development. Kisan Monitoring System Provides (Administrator) features like Soils and fertilizers update, contact us, Help information, Crop details with proper price, also the user (customer) search available with their proper feedback or comment. ICT in agriculture means Information and Communication Technology that helps in agriculture for connecting the people, who are living in villages to the urban cities. Kisan or Farmer to dispatch their food in a proper way tothe particular customer ICT is useful. ICT is already touching to the rural areas by ATM,TV and Radio Stations, etc. But Moreover, Mobile based Technology is also the fastest or proper way for people's satisfactory requirement now a days which also provides facility towards agricultural improvement. Kisan Monitoring System is the new approach towards the development of agriculture. This provides all important features which are necessary for the enhancement of the application which is useful for the farmers in their day-to-day life and for the profit in very less amount of time. Communication between the farmer and user is important, the Kisan Monitoring System plays the Administrator role, which is the owner of the system and this communication, is handled via use of Android mobile or tablet pc application development.

IV. EXISTING SYSTEM

A. List of websites

There are several steps taken by the Government of India that helps the farmers and provides them with different types of services and resources. These applications and websites attain these with high level success rates.

- Farmer's Portal [11]: It is a one stop shop for farmers. It consists of different sections: "Input", in this seeds, fertilizers, pesticides and farm machinery can be bought. Crop Management, Post-Harvest, Risk Management are some other categories. There is no transparency. No facility is present for the farmers to know the product rates at different markets where they can sell their products for achieving high profits. There are Map Views and Weather details are also present. It also gives news reports, mobile app facilities, etc. it shows the map of India marked with different colors on their farming scale. Programming Schemes gives the farming strategies. In Major Crops the seeds products and General information about the crops are also provided.
- e-Kisan [10]: This website allows farmers to apply for schemes, with news and events. This website helps them file grievances, help them take important judgements and report problems. This website includes plant protection which directs to ministry of agriculture & farmers welfare department of agriculture, cooperation & farmers welfare directorate of plant protection, quarantine & storage. It also has Tele Agriculture and Kisan Call center which helps the farmers to establish communication with the experts and can also ask them for market advice. The farmer can also make use of insurance advice and can check out updated market prices online. It also has input supply chain which is the group of farmers whogive in products for supplying. Quality control is another feature which is added along with messaging services, e-learning, weather forecast, krishi video advice, etc. It is not just an interface for farmers but it also includes department of fishery, irrigation, drought relief and live stocks.

B. Drawbacks of existing system

TABLE 1. DRAWBACKS

Existing Systems	Drawbacks
Farmer's Portal	Not restricted to agricultural activities
	Usually takes longer processing and response time
	Farmers can't buy or sell online
	Chat Bots and Live Chat systems are not present
eKisaan	It is not a multilingual system
	No chat bots and live chat system
	Functionality to sell products is not available
	Most options are not functioning
	Very few services and information provided before registration
	News and events columns are not updated

V. PROPOSED SYSTEM

In Kisan-Zone, we aim at providing a one place destination for buying and selling of products and renting of tools along with the consultation services, which will be given by the experts, people who will have the permissions to access the complaints and queries from the farmers.

This project will address problems like weather conditions, confusions and pricing details. It will provide a user-friendly user interface which will offer the page to be accessed in multiple regional languages. This platform will also update the user about new availability of resources and weather condition, through e-mails and SMS alerts. This project allows for good farmer and expert communication. It allows farmers to login and communicate to respective dealers.

When sellers publish an advertisement or offer, the respective farmers get the update in their viewing items list. All the items listed will be updated regularly. And any change in prices would also be mentioned with a discount.

A. ARCHITECTURE OF PROPOSED SYSTEM

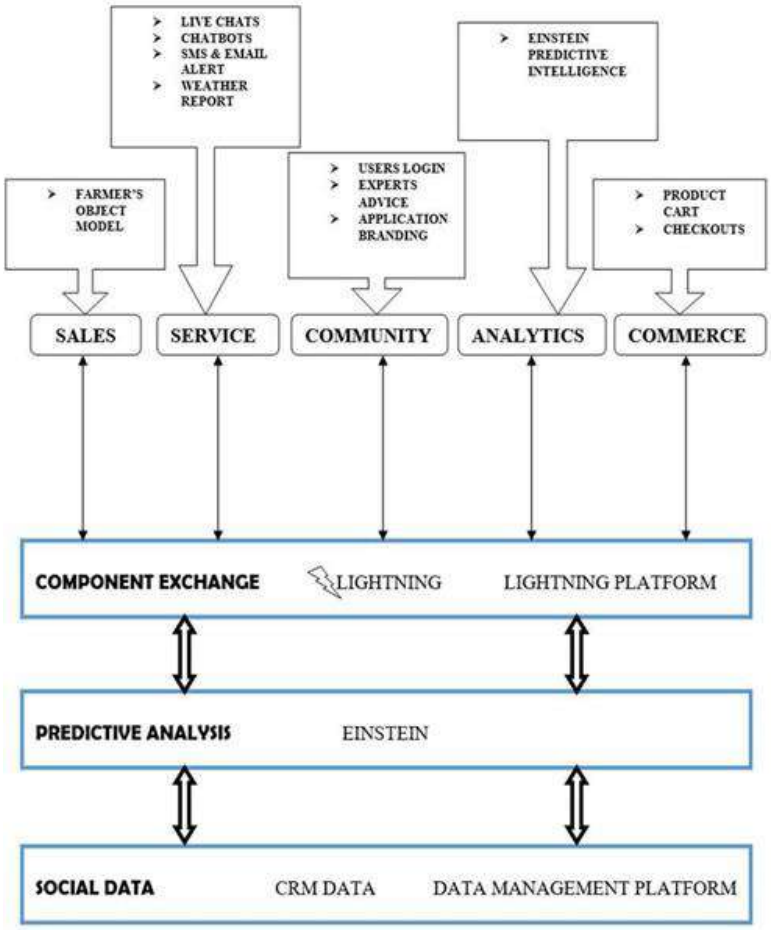

Fig 5.1: Architecture of the proposed system

As the above figure depicts this project is divided into three layers on top of which the cloud application sits. The bottom layer is the CRM Database Management platform that will handle all the users, logins, products and by-products data. The middle layer is the AI Platform of Salesforce called Einstein. The predictive analysis will be implemented for weather reports and chat bots. The first layer is the Lightning Platform through which approval process, workflows and process automation will be done. The cloud applications will be used to serve various front and back-end process as shown.

B. ARCHITECTURE OF SALESFORCE.COM

Salesforce is a customer relationship management solution that brings companies and customers together. It's one integrated CRM platform.

Salesforce.com, Inc. is an American cloud-based software company headquartered in San Francisco, California. Though the bulk of its revenue comes from its customer-relationship management (CRM) service,Salesforce also sells a complementary suite of enterprise applications focused on customer service, marketing automation, analytics and application development. Salesforce.com is customer-relationship management (CRM) service comprises several broad categories:

- Commerce Cloud
- Sales Cloud
- Service Cloud
- Data Cloud (including Jigsaw)
- Marketing Cloud
- Community Cloud (including Chatter)
- Analytics Cloud
- App Cloud
- IoT with over 100,000 customers.

C. DATA FLOW DIAGRAM OF KISAN-ZONE

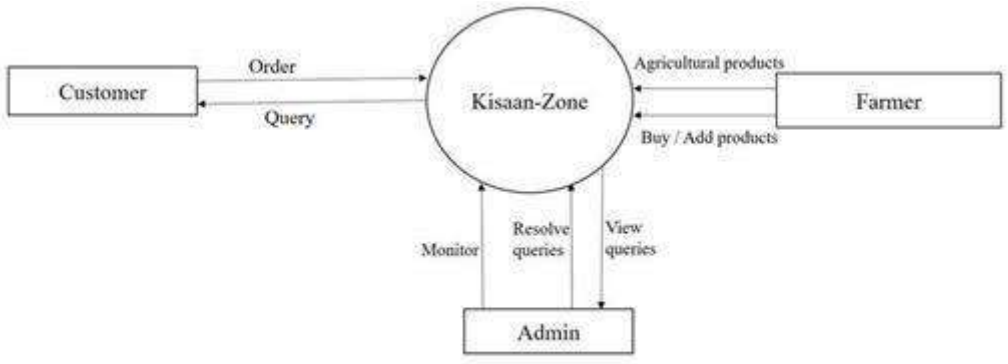

Fig: DFD Level-0

Fig. 1. Data Flow Diagram (Level 0)

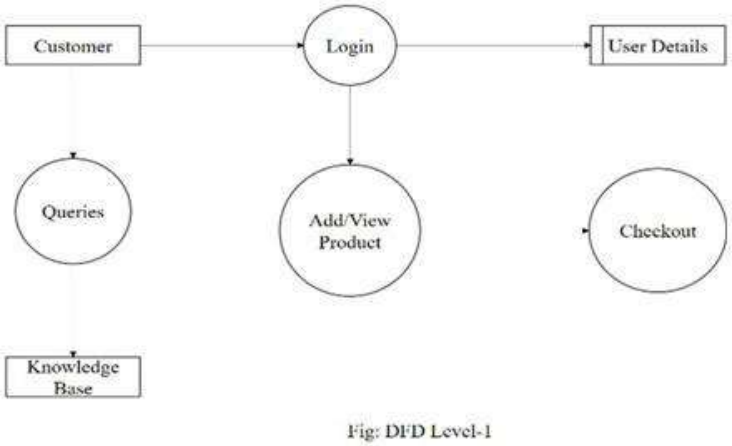

Fig. 2. Data Flow Diagram (Level 1)

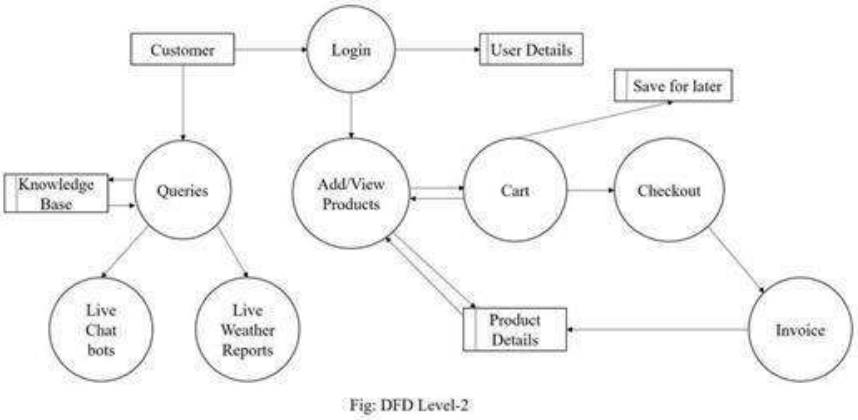

Fig. 3. Data Flow Diagram (Level 2)

D. UML DIAGRAM OF KISAN-ZONE

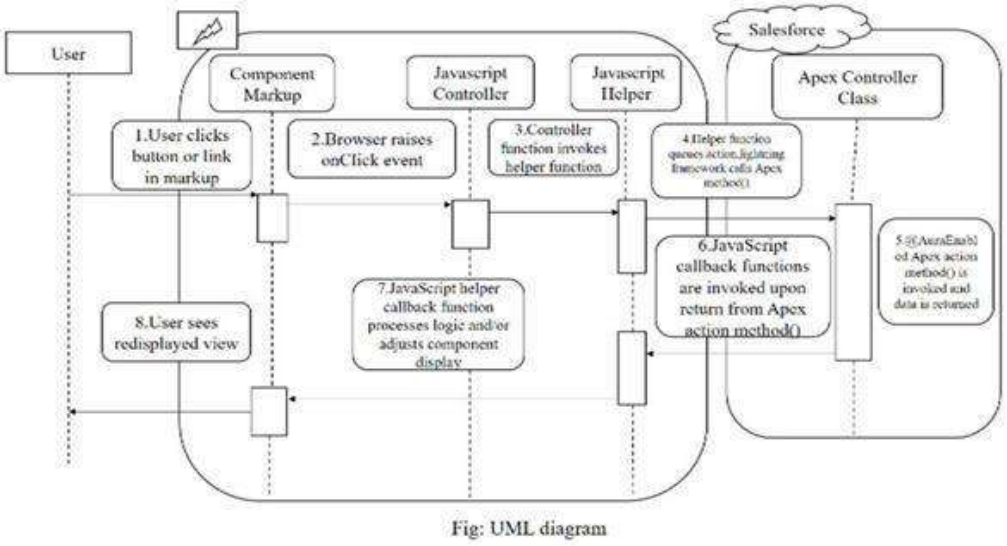

Fig. 4. Unified Modeling Language Diagram

E. ADVANTAGES OF PROPOSED SYSTEM

- Available in Multiple regional languages.
- Doesn't take up storage in user's devices.
- Live chatting and Chat bot options will be made available. It will also contain FAQs related to the users search needs.
- Chat bot can help the user with whereabouts of details in the platform. Live chatting helps the users with interface details.
- SMS and E-mail services will be used to update the users.
- For any assistance live calling, helpline numbers and help centers can be used.
- Fair price will be provided to both customers and farmers with quality check.
- Crop image classification can be used for identifying the crops.
- Seven days advanced predicted weather update is provided.
- Help centers are provided with address and map directions so they can easily follow the directions and reach the center.
- Farmers can add crops for customers and can also buy tools and other agricultural products needed for farming.

VI. INTERPRETATION OF RESULTS

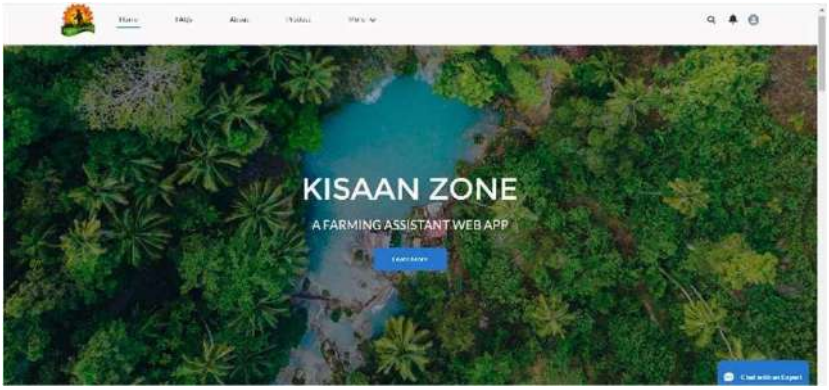

Fig. 5. Home Page of Kisan-Zone

Fig. 6. Government Schemes

Fig. 7. Trending Articles from Knowledge Base

Fig. 8. Einstein Image Classification

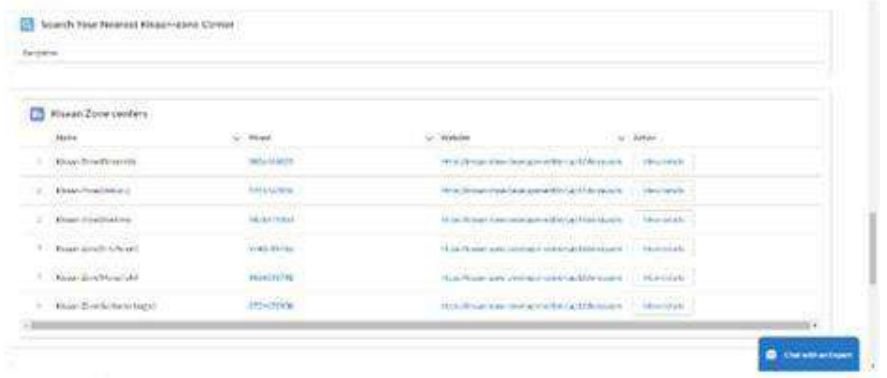

Fig. 9. Searching Nearest Kisan-Zone Center

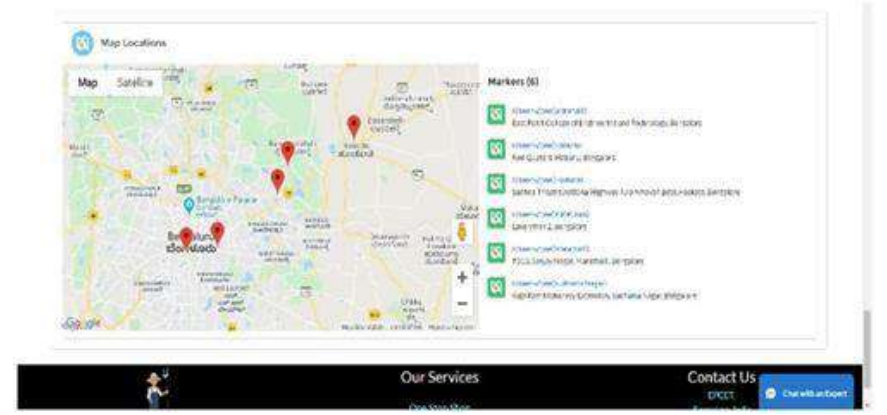

Fig. 10. Locating the Kisan–Zone Centers On Map

Fig. 11. Add Products Page

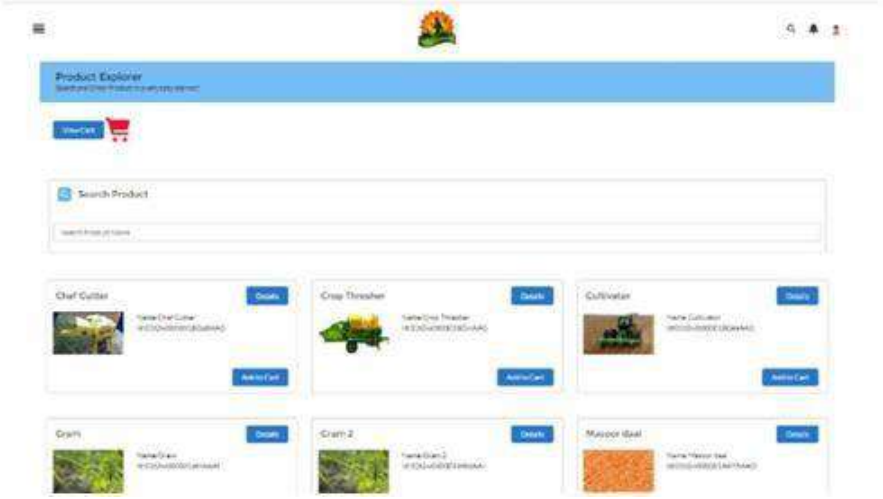

Fig. 12. View Products Page

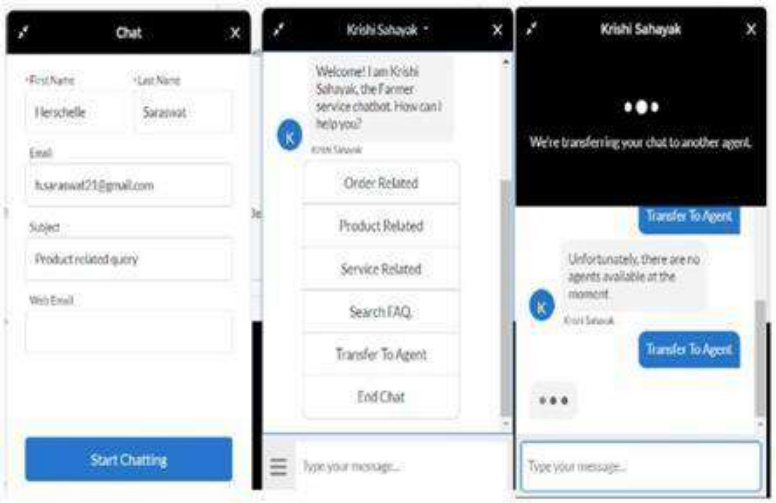

Fig. 13. Live Chat

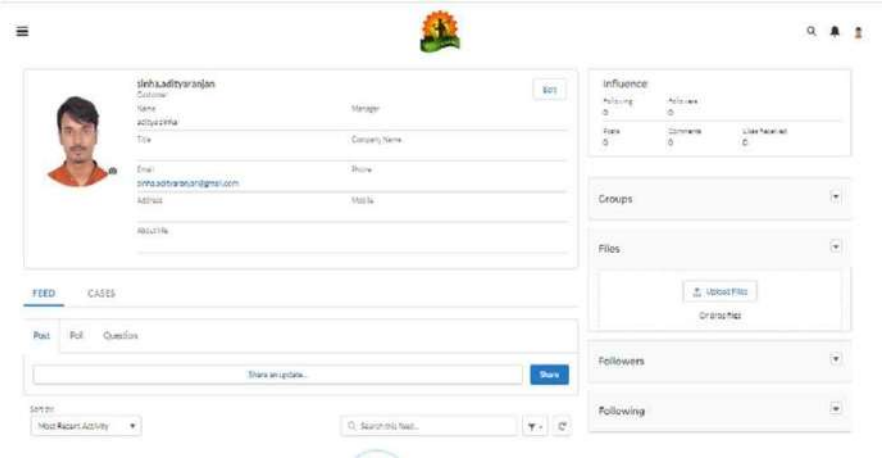

Fig. 14. User Profile

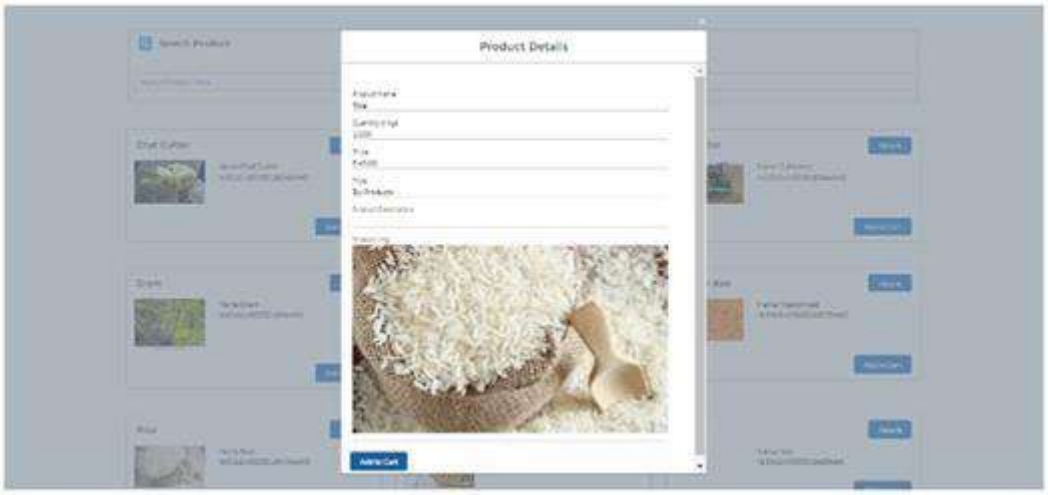

Fig. 15. Product Details View

VII. CONCLUSION

The basic ideology behind this project is to make the farmers be aware of the new technologies available in the market. With the implementations of these technologies in our day to day lives, many complicated and sophisticated tasks can be done easily, and easily. Transparency is the key to any communication. And with the help of this platform, the integrity and transparency can be maintained between the buyers and the sellers.
Through this project, farmers can get acceptable prices for their crops, with less effort and great platform by creating the direct bridge between customer and farmer. Also enhance farmer income, raise in productivity and revenue by using this technology because agriculture has been one of the important sectors in many countries for connecting rural areas to other countries.
This project will be helpful for farmers to know more about market information, will act as unique interface of schemes and compensation. Through this, they will be always in touch of new technique and trends of

farming. But to some extent, new user may feel uneasy about its usage. Overall, this system is faster, secure and comfortable.

VIII. FUTURE WORK

- Loan facility provided from variety of banks with different approval systems.
- Unique features like extreme weather alerts and market prices of commodity in nearest area and the maximum price in state as well as India have been added to empower farmers in the best possible manner.
- Develop a read aloud functionality in their regional language for illiterate people.
- Crop Census could be extended for more years.

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Leukocytes Classification Using Convolutional Neural Network

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ABSTRACT

Maintaining a healthy life is very important in today's world. Our body has ability to fight against contagious diseases with the aid of white blood corpuscles (WBC) which generates natural immune system. Preserving a good WBC count is crucial as it leads to various haematological problems one among them is Leukemia, a condition which results in blood cancer, huge accumulation of WBC cells in bone marrow, an abnormal growth of WBC cells, hinders natural immune system fighting against infectious diseases. White blood cells can be categorised into Eosinophils, Lymphocytes, Monocytes, Neutrophils and Basophils. In this paper, automatic classification of WBC cells is carried out by LeNet a pre trained Convolutional neural network (CNN) architecture. It efficiently classifies WBC cells from the given input sample blood cell images compared to other pre trained models such as Alex-Net and custom-built CNN called white capsule net. The hyper parameters LeNet are fine tuned to yield higher accuracy. The Pre trained CNN models are trainedwith huge number of different blood sample images and this model is deployed using Django web framework.The accuracy of pre trained CNN model such as AlexNet and capsule network-based CNN such as white capsule Net results in low accuracy when compared to LeNet which yields 96% accuracy

Keywords— CNN, Lymphocytes, Monocytes, Neutrophil, Django, Deep learning, blood cells

I. INTRODUCTION

Blood contains different kinds of cells. Blood cells are composed of two broader categories one is RBC (Red Blood corpuscle) Erythrocytes and another one is WBC (White blood corpuscle) Leucocytes and another component is platelets. WBC plays a vital role in human immune system, which fights our body against different diseases whereas Erythrocytes carries oxygen to the tissues and platelets helps to clot blood. A human body has an average of 10 to 12 percentage of Lymphocytes cells, Monocytes occupies 3 to 8 percent of WBC, Neutrophils is about 60 to 70 percentage of WBC, Eosinophils is about 2 to 4 percentage of WBC andBasophils is about 0.01 to 0.3 percentage of WBC. WBC's are produced in bone marrow and found in blood and Lymph tissues. This system will extract different white blood cells such as Eosinophils, Lymphocytes, Monocytes Neutrophils and Basophils by using pre trained CNN models for the discovery of dissimilar typesof white blood cells in a structured way. WBC (white blood cell count) has to be checked periodically for

maintaining a healthy immune system. For new born the range should be 9000 to 30000, children under 2 years age 6200 to 17000, for adults and children above 2 years it is 5000 to 10000.

Initially collecting images and splitting it into training and testing set then Pre-Processing the images using Sequential model. Building classification model and predicting the blood cell type. Feature Extraction is to diminish the number of parameters in a dataset by building novel features from the existing ones. Comparing with pre-trained models like Alex Net, Le-Net and White capsule Net [8].

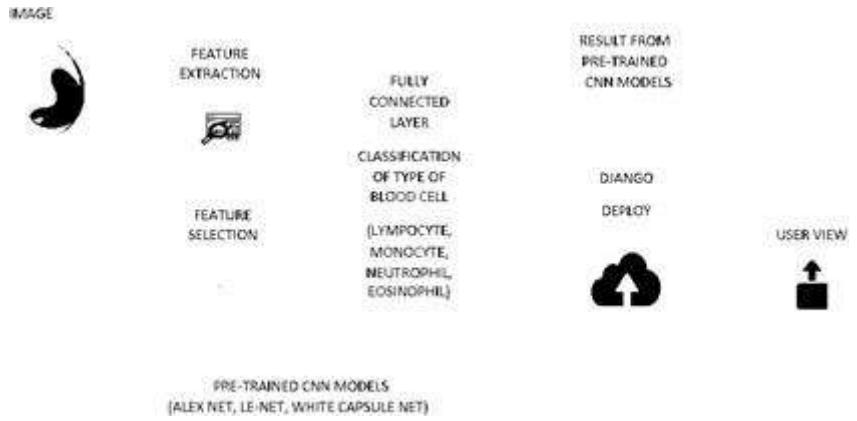

Fig.1 System Architecture

II. LITERATURE SURVEY

G. Sharma R. Kumar etal. Proposed a binary and multi class classification problem for WBC classification using 5-2D convolutional layers with varying filter size. [1]. The size of the dataset is 364 WBC cells. Non- linear digital filter was used to reduce noise in input image. Data is augmented to increase the size of dataset from 364 to 12,439. It is implemented in MATLAB. Various hyper parameters were considered to get better accuracy of the model. For binary classification the testing accuracy was 99.76% and for multi class it was 98%. The training time is 0.21 sec. Wei Li, etal.[2] Pixel-pair method is used for hyperspectral images where pixel by pixel comparison is done and final result was based on voting policy. The results were good when compared to traditional deep learning methods. The datasets used were Salinas and Indian pines data and university of Pavia. This model was implemented using techniques like K-NN, SVM, ELM and CNN. The accuracy is good for CNN 98.4%. The performance of the overall model was good but with increase in computational cost. Changhun Jung, Etal. [3] Proposed a novel CNN model called W-Net which classifies WBC into 5 classes. It outperforms other CNN models such as VGGNET, AlexBNet and RNN models. It uses GAN (generative Adversarial Network) to generate artificial WBC blood sample images which looks similar to original images [3]. The experiment was done on 6562 real images. This model achieved 97% accuracy. Vigueras-guill, et al. [4], this model uses a CNN architecture called capsule networks for classifying WBC cellswhich overtakes the pre trained models such as ResNeXt-50 which is implemented on public WBC dataset. Different layers of capsules are used to increase the efficiency of the network helps in cell level diagnosis specially to detect blood cancer due to over production of WBC cells. Hyper parameters like optimizers used

is Nadam for capsule networks. The training time is more when the number of capsule layers are more. A. Kumar and J. Kim [5], proposed ensemble CNN architecture which extracts rich features from given input image by fine tuning of hyper parameters. This method gives higher accuracy when compared to pre trained CNN models such as Alex Net, Google Net. It achieves maximum accuracy on large trained datasets. The dataset used is Image CLEF 2016 medical images. Of size 6776 training and 4166 testing images. Data augmentation was followed to generate more sample datasets of size 67760 similar to real dataset of size 6770. The dimensionality reduction was done by Principle component analysis (PCA). Classifiers like SVM and softmax yields good results. X. Yao, K. Sun, X. Bu, C. Zhao and Y. Jin et al.[6] implemented two DCNN for WBC classification which outperformed VGG16, VGG 19, Inception V3, Resnet-50 , MLP, DT, RF on public BCCD dataset. Accuracy was good for low resolution and unbalanced dataset. Ostu segmentation was used. In future more number of optimizers can be used to avoid overfitting problem. J. Yao et al. used Faster RCNN and Yolov4 [7] for classifying WBC cells on BCCD dataset. The accuracy obtained by both methods are 96.25% and 95.75%. Data augmentation method called geometric transformation and neural style were adopted to enhance the accuracy of the model. R. Baig, A. Rehman, and A. Almuhaimeed et al. [8] Deep learning-based leukemia detection with hybridized CNN. For image pre-processing 2 methods are followed Image intensity adjustment and adaptive histogram equalization methods. Two CNN's are used to identify exact features needed. The outputs of two CNN's are concatenated using Canonical Correlation Analysis method to further find most important features to improve training time and efficiency. Classification algorithms like SVM, Bagging ensemble, total boosts, RUSBoost, and fine KNN to compare the accuracy of each classifier. Among all, Bagging ensemble reached 97.04%. accuracy. Dataset 4150 images with 3 categories (i) Acute lymphoblastic leukemia (ALL), (ii)Acute myeloid leukemia (AML) (iii) Multiple myeloma (MM). M. Yildirim et al. [9] In this study, the eosinophil, lymphocyte, monocyte, and neutrophil types of white blood cells are distinguished using a convolutional neural network (CNN), one of the most widely used neural networks. In turn, Alexnet, Resnet50, Densenet201, and GoogleNet were coupled with the CNN, which was then trained using the Kaggle Dataset. The images in the database were then individually subjected to the Gaussian and median filters. CNN classified the updated images once more for each of the four networks. The outcomes from applying the two filters to the images were superior to those from using the raw data. The findings of the study facilitate the diagnosis of blood-related diseases.

A. Rehman e.tal [10] The classification of ALL into its subtypes and reactive bone marrow (normal) in stained bone marrow images was proposed in this study. Convolutional neural network deep learning techniques are used to train the model on bone marrow images, which yields accurate classification results. Thus, experimental results were obtained and contrasted with those of Naive Bayesian, KNN, and SVM classifiers. According to experimental findings, the suggested method had an accuracy rate of 97.78%. The obtained results show that the suggested strategy may be used as a diagnostic tool for acute lymphoblastic leukemiaand its subtypes, which will undoubtedly be helpful to pathologists. C. Cheuque et al. [12] offered a more effective hybrid approach for classifying WBC leukaemia. It first uses VGGNet, a potent CNN architecture that has been trained on ImageNet, to extract features from WBC images. The extracted features are then filtered using a Salp Swarm Algorithm that has been statistically improved (SESSA). This bio-inspired

optimization algorithm eliminates highly correlated and noisy features and chooses the most pertinentfeatures. Using the suggested method on two open WBC Leukemia reference datasets, we were able toachieve high accuracy while also reducing computational complexity. Only 1 K out of 25 K features extracted with VGGNet were chosen by the SESSA optimization, which simultaneously increased accuracy. The outcomes are some of the best on these datasets, and they outperform a number of convolutional network models. We anticipate that the union of CNN. This study aims to create a deep learning-based computerised
[13] WBC category system. Transfer learning has been used in many of the models that have been suggested so far for this application by optimising ResNet, Inception, and VGGNet. The dataset used in this applicationis completely different from the ImageNet dataset on which all of these models were trained. So, without using transfer learning, we have proposed a deep learning model for the task of classifying white blood cells.

III. DATASET DESCRIPTION

It consists of 2000 images of the leukocyte cells (Neutrophil, Eosinophils, Lymphocytes, monocytes) taken from the publicly available from dataset. The size of the images should be 320*240. The given input image from the dataset is preprocessed. Data augmentation techniques like cropping, resizing and normalizing the given blood cell image. Train the model for feature extraction and selection for taking only necessary feature required from the image to predict the exact type of cell. Finally, by comparing the 3 modules (White CapsuleNet, Alex-Net and Le-Net) which are pre-trained models detects cell type accurately from the given input image and predicts the correct type of leukocyte cells and produce the output. This dataset contains approximately 2000 train and 376 test image records of features extracted, which were then classified into 4 classes:

1. Eosinophils
2. Lymphocytes
3. Neutrophils
4. Monocytes

Deep learning-based leucocyte classification using Convolutional neural network algorithm is very efficient in analyzing different types of WBC. The different layers in CNN processes the input image and predicts the exact output. The kernel in CNN first extracts the relevant features of the input image called feature map, needed for prediction. The next layer in CNN called pooling layer selects largest, further processes the images to reduce dimensionality of convolved input image (feature map) using one of the kinds of pooling layer called max pool layer which decreases computational cost. The pooling layer sits between convolutional layer and fully connected layer (FC). Fully connected layer with weights biases and neurons is placed before the output layer. The fully connected layer connects neurons of two different layers. The actual classification of input image is performed here.

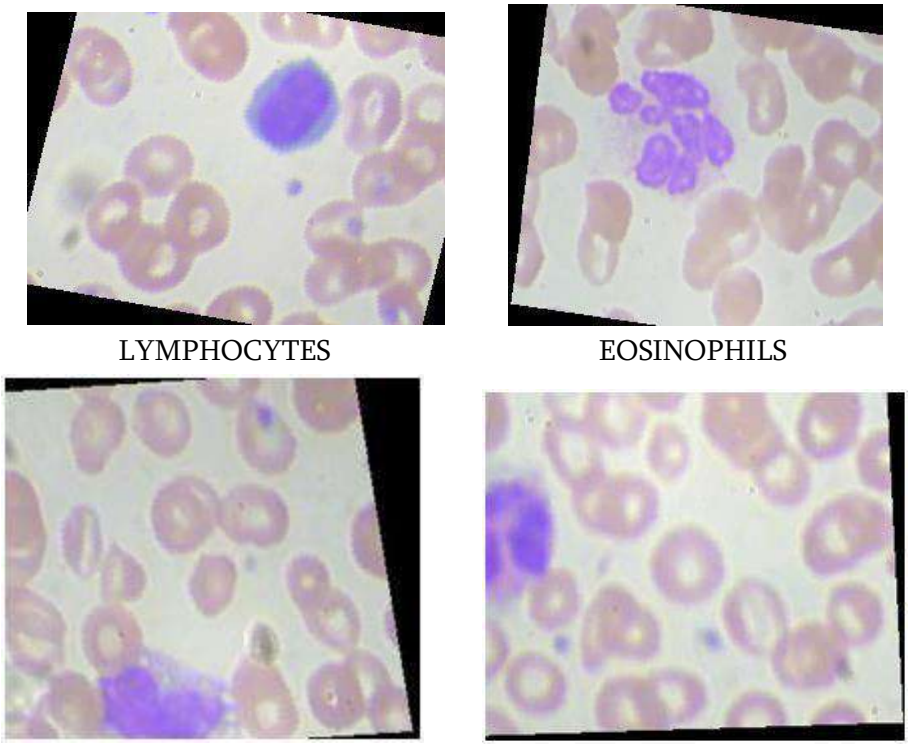

Fig 2. Types of Leucocytes

Using the keras preprocessing function called data generator, which performs data augmentation operations like size, rescale, range, zoom range, and horizontal flip. Then use the data generator tool to import the folder containing the preprocessed image dataset. In order to build a new CNN model using pre-trained models that already exist, the following parameters training, testing, validation setting target size, batch size, class-mode and adding layers to CNN can be customized from this function so that a new CNN model can be created from already existing pre trained models.

IV. EXTRACTION OF FEATURES AND FEATURE SELECTION

The process of turning unprocessed raw data into numerical features that may be processed while keeping the original data set's information intact is referred to as feature extraction. Compared to using machine learning on the raw data directly, it produces better outcomes. The choice of the appropriate diagnostic feature is crucial for pattern recognition. Using the texture, geometrical, and statistical analysis of the image to describe the image using numerical values and enable the automatic system to conduct the recognition. After that, features were extracted utilizing the feature fusion of pointwise in 2D CNN Convolutional layer. By using only pertinent data, feature selection helps to limit the number of input variables for the model. When creating a predictive model, it reduces the amount of input variables.

V. PRE-TRAINED CNN MODELS

1. ALEX-NET

One of the pre-trained convolutional neural network models, Alex-Net, has a significant impact on the medical industry, particularly in the use of deep learning. The first convolutional neural network model to use a graphics processing unit (GPU) to enhance network performance was Alex-Net. Different convolutionallayers, max-pooling layers, normalization layers, fully connected layers, and a softmax layer make up the Alex-Net architecture. Convolutional filters and the nonlinear activation function RELU are both present in every convolutional layer. Max pooling is carried out using the pooling layers.

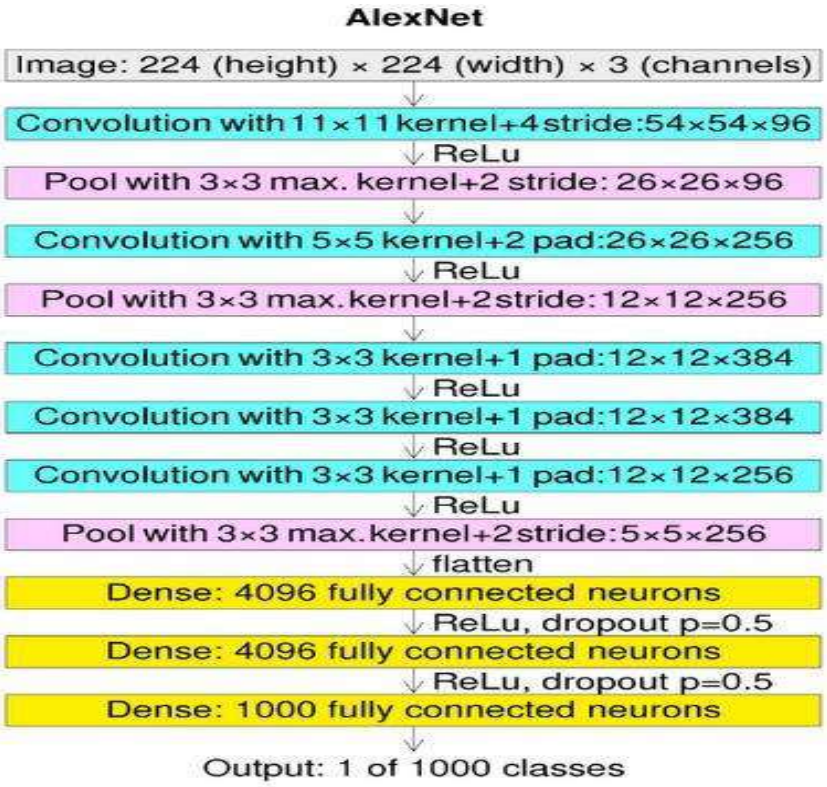

Fig 3. Architecture of ALEX-NET

2. LENET

Le-Net was the final product after several compelling iterations. The LeNet-5 CNN has a seven-layer architecture. Le-Net, one of the first convolutional neural networks, is included in the layer composition because it helped to advance deep learning. The final product was given the name Le-Net after many years of analysis and many compelling iterations. The LeNet-5 CNN has a seven-layer architecture. 3 convolutional layers, 2 subsampling layers, and 2 fully connected layers make up the layer composition.

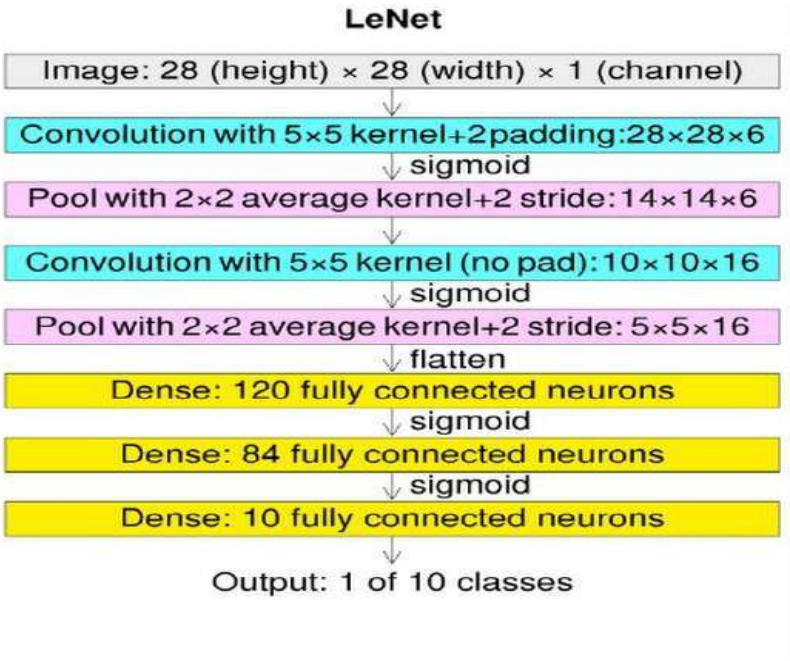

Fig 4. Architecture of LENET

VI. FINAL LAYER OF CNN

The final layer in CNN, fully connected layers, are used to flatten the results prior to classification. This is comparable to the Multilayer Perceptron's output layer. The fully connected layer consists of neurons, weights, and biases. Images are classified using training into various categories. Here, in the image below, the flatten layer "flattens" the output of the preceding layers into a single vector that can be an input for the following step. The resultant 2-Dimensional arrays from pooled feature maps are all flattened into a single, lengthy continuous linear vector. To classify the image, the flattened matrix is fed as input to the fully connected layer.

VII. STATISTICAL ANALYSIS

A table known as a confusion matrix is frequently used to describe how a classification model, also known as a "classifier," performed on a set of test data for which the true values were known. Were,

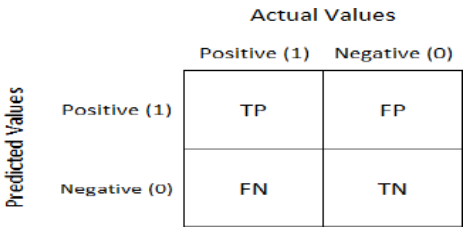

Fig 5. Matrices of Actual Values

True Positive is TP.
False Positive (FP)
True Negative, or TN
False Negative, or FN

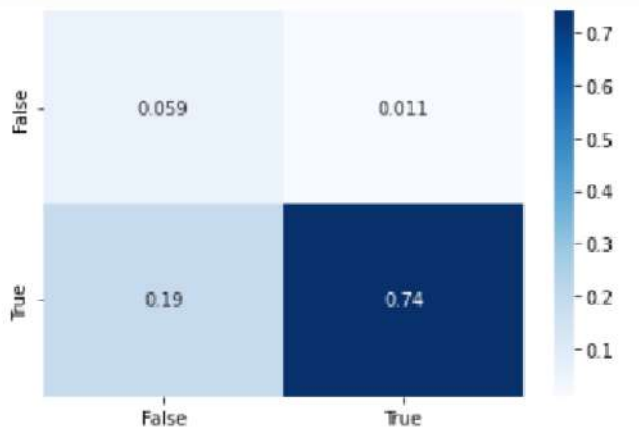

Fig 6. Probability of predicting positive and negative cases

Leukocyte images show
74% are TPs, or true positives.
11 percent are false positives, or FPs.
19% of the data is True Negative.
False negatives make up 59% of the data.

(i) Accuracy

Based on the input, or training, data, accuracy is a metric used to determine which neural network model is effective at identifying relationships and patterns between variables in a dataset. The following formula should be used to determine accuracy:
TP + TN / TP + TN + FP + FN
In this model, classification accuracy is 56% accurate.
Which neural network model is effective at identifying relationships and patterns between variables in a dataset is determined by accuracy, a metric.

(ii) Precision

One measure of a machine learning model's effectiveness is precision. It is the property of a successful model prediction.
The following formula should be used to determine precision:
TP / TP + FP
This model's overall accuracy is 0.84761.

(iii) Recall

The proportion of accurately predicted positive outcomes to all positively expected outcomes.
The following formula should be used to determine recall:
TP and TP plus FN
This model has an overall recall of 0.2367.

(iv) F1 Score

The harmonic mean of recall and precision is the F1 Score. It accounts for both false positives and false negatives.

```
Accuracy                        : 56.1170220375061

confusion matrix                 :  [[89.0, 16.0], [287.0, 1112.0]

precision score                  :  0.8476190567016602

Recall and sensitivity score     :  0.23670212924480438

F1 score                         :  0.3700623728653426

Specificity                      :  17.0
```

Confusion matrix is used to calculate the true positive, true negative, false positive, and false negative values, making it simple to distinguish between the model's classifications.
The following formula should be used to determine F1 Score:
F1 Score is equal to 2 * (Precision * Recall) / (Precision + Recall).
This model's F1 Score is 0.3700.

VIII. WHITE CAPSULE NET

There are two layers in the White Capsule Net architecture. Max pooling layer and one convolutional layer make up the layer composition. This is a base model that will be used to train and test the dataset's images in order to determine the accuracy and identify the different types of leukocytes (Eosinophil, Lymphocyte, Monocyte, and Neutrophil). Because there are only two layers in this architecture, epochs run the batch size in a very short amount of time and produce results immediately. The main benefit is that it takes a lot of time and is more accurate than Alex-Net.

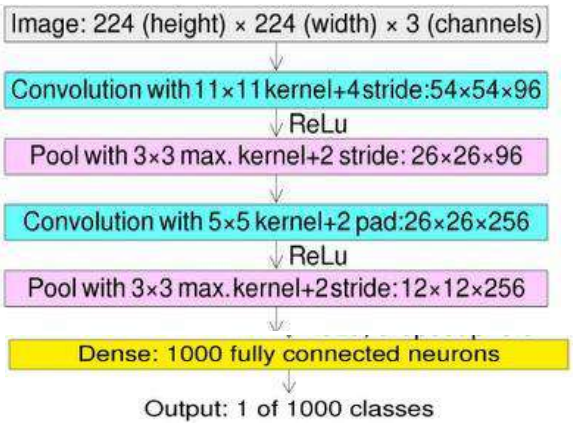

Fig. 7 Architecture of White capsule Net

IX. RESULTS

By comparing the various CNN Architectures, based on their accuracy and loss, The graphical representation for ALEX-NET is shown in fig.8 and fig. 9.

ALEX-NET Model Accuracy and Loss

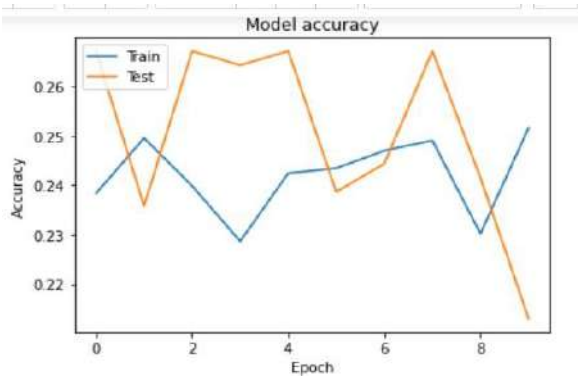

Fig 8. Accuracy Graph

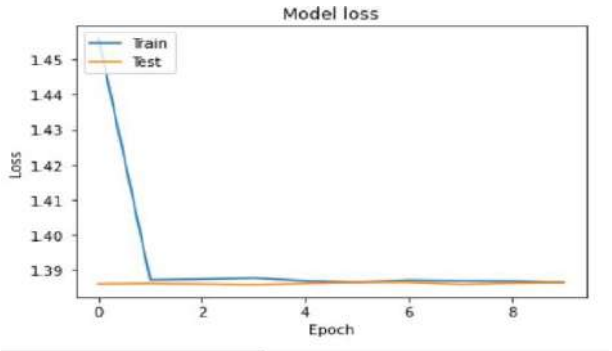

Fig 9. Loss Graph

Accuracy is very important in detecting right type of blood cells. Here comparison of pre-trained algorithms and obtained the results for Alex-Net which gives 25% of accuracy and loss.

LeNet Model Accuracy and Loss

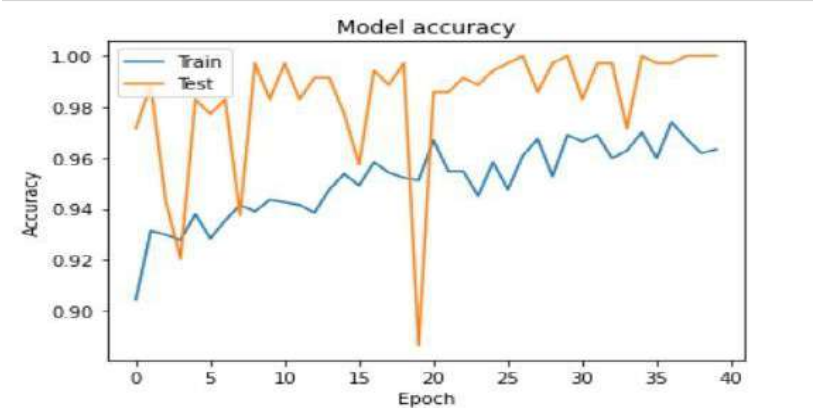

Fig 10. Graph of Accuracy

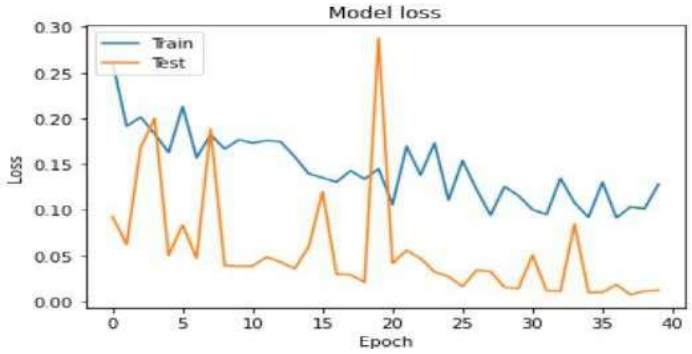

Fig 11. Model Loss

In LeNet model the accuracy is 96% in testing images and loss is 0. 1279.This Pre-trained model gives more accuracy by comparing with others. In existing system, they have used MGCNN which yielded 94% of accuracy. In this model we have achieved more than the existing model.

X. ACCURACY OF WHITE CAPSULE NET

In White capsule Net the accuracy is 73% and loss is 0. 664.Therefore by comparing all the three algorithms Le-Net yields more accuracy with less loss hence by using the Le-Net we detect the right type of Leukocytes.

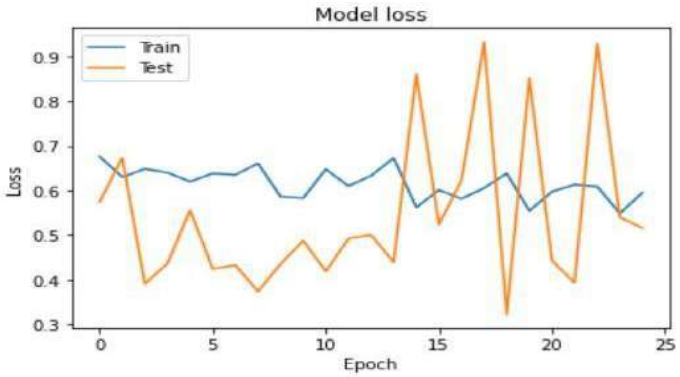

Fig 12. White Capsule Net Model Loss

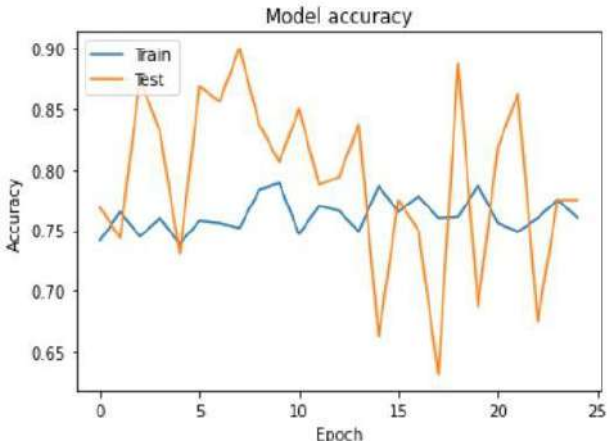

Fig 13. White Capsule Net Model Accuracy

XI. CONCLUSION

In this paper, leukocytes types are identified over static cells images using deep learning techniques was developed. This is a complex problem that has already been approached several times with different techniques. While good results have been achieved using feature engineering, this paper focuses on feature learning, which is one of Deep learning promises. While feature engineering is not necessary, image pre- processing boosts classification accuracy. Hence, it reduces noise on the input data. Nowadays, Blood Cell detection software includes the use of feature engineering. A solution totally based on feature learning does not seem close yet because of a major limitation. Thus, blood cells classification could be achieved by means of deep learning technique.

XII. FUTURE ENHANCEMENT

Further improvement on the network's accuracy and generalization can be achieved through the following practices. The first one is to use the whole dataset during the optimization. Using batch optimization is more suitable for larger datasets. Another technique is to evaluate blood cells one by one. This can lead to detect which types are more difficult to classify. Finally, using a larger dataset for training seems beneficial.

However, such a dataset might not exist nowadays. Using several datasets might be a solution, but a careful procedure to normalize them is required. Finally, using full dataset for training, pre-training on each blood cells, and using a larger dataset seem to have the possibility to improve the network's performance. Thus, they should be addressed in future research on this topic.

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MRI-Based Brain Tumor Image Detection – A Review

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ABSTRACT

Digital imaging is a growing field for studying complex diseases such as pathology, brain tumor, cervical cancer, lung cancer, breast cancer, ovarian cancer, and kidney stones. Recognition of brain tumor is considered a very important task. Various approaches are used to scan specific body parts, CT scans, X-rays, and Magnetic Resonance Imaging (MRI). Numerous studies have been performed in the analysis of brain tumor using different methods and combined approaches. Early detection of brain tumor can help improved treatment options and increase patient survival. Medical imaging is a powerful technique that providesinsight into medical abnormalities by creating visual representations of internal organs or tissues in the body and using them for clinical diagnosis. Automated classification and segmentation of brain tumor has the potential to further improve the diagnostic accuracy of all acquired medical images. Machine learning approaches are becoming increasingly popular due to their ability to self-learn. This review focuses on different techniques used for tumor pre-processing, Feature Extraction, Segmentation and Classification. We discussed the challenges in processing MRI images of the brain and the advantages and disadvantages of existing methods for tumor analysis.

Keywords—Brain Tumor; Classification; Segmentation; Machine Learning; MRI

I. INTRODUCTION

A tumor is a mass of tissue surrounded by a collection of abnormal cells. A brain tumor is an abnormal collection or mass of cells in the brain. Developing in such a small space can pose problems. Brain tumors can be cancerous or benign. The development of benign or threatening tumors can increase the weight of the skull. This can damage the brain and is usually dangerous. With the advancement of medical standards, medical imaging technology plays an increasingly important role in medical diagnosis and medical research. Diagnosis of brain tumors is usually based on image data analysis of brain tumor images. Accurate analysis of brain tumor images is an important step in determining a patient's status. The most preferred type ofdiagnostic method is Magnetic Resonance Imaging (MRI). MRI images are widely used for high-quality imaging, mainly in brain scan images as brain tumors can be easily identified from these images. MRI provides a high-quality digital representation of tissue properties that can be obtained at any tissue level. These MRI scans help easily identify, detect, and classify tumor areas in the brain. Digital methods of presenting images can clarify detection compared to manual detection. It can provide information about the shape, size and location of human tissues and organs without highly ionizing radiation. The images obtained

are very sharp and accurate. Brain tumors can be imaged using a variety of Magnetic Resonance (MR) arrays. T1-weighted, contrast-enhanced T1-weighted, T2-weighted, and FLAIR (Fluid-Attenuated Inversion Recovery) images. Different serials can provide correlative data for studying different subregions of glioma. Glioma is the most common brain tumor that arises from glial cells. They are of two basic types: Low-Grade Gliomas (LGG), which tend to be benign and tend to have a better prognosis for patients, and High-Grade Gliomas (HGG), which tend to be malignant and more aggressive. Information is gathered from complex medical images using a technique called segmentation. Its main purpose is to divide the image into different partitions. Manual segmentation of tumors in MRI images is time consuming and biased as it relies on operator skill and experience. Automated computational methods may provide more objective segmentationof tumors and enable analysis of large-scale multimodal MRI data within reasonable processing times.

Image processing is the strategy of converting an image into digital form and performing certain manipulations to enhance the image or remove valuable data. The purposes of image processing are visualization, image sharpening and restoration, image retrieval, pattern measurement, and image recognition. Various imaging techniques and methods have been used for the diagnosis and treatment of brain tumors. Segmentation is a key process in imaging strategies and is used to separate regions of infected brain tissue from MRI. Numerous semi-automated and automated segmentation techniques and methods have been used for tumor segmentation. Machine learning (ML) has been implemented in various fields and has proven to be highly accurate in classifying and identifying diseases. ML is widely used in healthcare to improve healthcare services and disease diagnosis. Deep learning (DL) also plays an important role in medical image processing. Because deep learning involves more hidden layers than neural systems, effective use of DL can bring ML closer to artificial hypotheses. This review paper provides an overview of various methodologies, techniques, frameworks, and significant research using ML techniques for segmentation and classification. The main purpose of this paper is to show that how ML and DL techniques have impacted the field of medical imaging. The rest of the work is organized as follows. A literature review is described in Section II. Brain tumor detection, brain tumor segmentation, and brain tumor classification are described in Sections III, IV, and V, respectively, with final conclusions in Section VI.

II. LITERATURE SURVEY

Hao Dong et al. [1] described a fully automated brain tumor segmentation method being developed using a U-Net-based deep convolutional network. Data augmentation and elastic warping are applied to improve network performance. A U-Net is implemented for segmentation and trained with stochastic gradient-based optimization. Cross-validation shows that the method can efficiently achieve promising segmentation. Dmitri Rakino et.al. [2] described a deep cascade approach for automated segmentation of brain tumors. The implementation is based on a neural network where Z-score normalization and B-spline transformation are applied. The cascaded U-mesh architecture processes the input image at multiple scales and extracts scale-specific features and scored cube values. Sergio Pereira et.al. [3] formulated an automatic segmentation method based on a convolutional neural network (CNN) that examines small 3x3 kernels. Pre-processing

includes bias field correction, intensity, and patch normalization. Aside from beneficial results against overfitting, a smaller kernel allows us to plan deeper designs due to the lower number of loads in the network. Vinay Rao et. al. [4] described the work of applying a Deep Neural Network (DNN) to train the network on randomly selected patches of approximately 25,000 pixels using stochastic gradient descent. The final representations learned by the four CNNs are used to train a random forest classifier using scikit-learn.

J. Seetha and S. Selvakumar Raja [5] proposed automated brain tumor detection using CNN classification. Small kernels are used to design deeper architectures. Exploratory results show that the CNN has 97.5% accuracy at low complexity. Zahra Sovania et. al. [6] evaluated different angles of MR images of the brain and applied different networks for segmentation. The impact of using networks for segmentation of MR images is evaluated by comparing results with single networks. Experimental evaluation of the networks shows thather Dice score of 0.73 is achieved for one network and 0.79 for multiple networks. Tommoi Hossai et al. [7] proposed a method to extract brain tumors from 2D MRI by fuzzy C-means clustering algorithm. Following this, Keras and Tensorflow were used, and traditional classifiers, namely Support Vector Machines (SVM), K- Nearest Neighbors (KNN), Multilayer Perceptrons (MLP), Logistic Regression, Naive Bayes, and Random Forest were scikit was implemented and also proven that CNN achieves his 97.87% accuracy. Manjunas et.al. [8] proposed a task involving extraction to classify tumors as related classes. The complexity of the task comes from converting the extracted images to symbolic data and using a CNN. This experiment works with Back Propagation Neural Network (BPNN) and CNN classifiers. Alpana Giggia et al. [9] proposed an efficient method based on CNN. The images are preprocessed with a median filter and batch processing is performed. CNN classifies images based on various factors such as intensity, shape, etc. to detect tumors. The water cycle algorithm is applied in CNN and gives an optimal solution with 98.5% accuracy.

P. Chinmai et al. [10] proposed DNN where the first step is the preprocessing level. An anisotropic diffusion filter with 8-connected neighborhoods is applied to remove noise. The tumor area is displayed with a bounding box on the MRI image, and the FBB (Fast Bounding Box) algorithm, which selects the center as a sample point for deep learning by CNN, achieves an accuracy of 98.01%. Jibi Belghese and Sheeja Agustin

[11] described pattern neural networks (PNN) for tumor segmentation. PNN uses small kernels to avoid overfitting. The overall performance of the configuration pattern generation network takes less time than other methods such as clustering. Yuehao Pan et al. [12] studied brain tumor grading using multiphase MRI images and compared them with different DL structures and neural networks. The MRI images are used directly in the learning machine, with some mixed tasks between polyphase MRIs. The results show a significant 18% improvement in the classification performance of CNN and NN as a function of sensitivityand specificity. Donnier et. al. [13] proposed a deep learning framework that automatically extracts features from multimodal preoperative brain images. A 3D CNN and a new network architecture for using multichannel data and learning from supervised functions are proposed. In addition to key clinical features, SVM is used to predict whether a patient will have a longer or shorter overall survival (OS). Experimental results showed that the method can achieve an accuracy of up to 89.9%. Li Sun et al. [14] proposed a deep learning-based framework for glioma brain tumor segmentation and survival prediction using multimodal MRI scans. Tumor segmentation uses an ensemble from three different 3D CNN architectures, resulting in

robust majority-rule performance. This methodology can sustainably reduce model distortion and improve performance. Use decision trees and cross-validation to select and extract strong features. Finally, build a random forest model to predict the patient's overall endurance. Lucas Fido et al. [15] proposed a new scalable multimodal DL architecture that uses nested structures to explicitly influence deep highlights within or between modalities. ScaleNet imposes an inappropriate structure on the architectural backend where cross-highlighting and cross-modality changes are separated. A scalable network structure has the potential to make deep networks more reusable in medical imaging. Muhammad Sajjad et al. [16] created a new CNN- based multigrade brain tumor classification. First, we segment the tumor region from the MR images using deep learning techniques. Extensive data augmentation is then used to effectively train the proposed system. Finally, the pre-trained CNN model is fine-tuned using advanced data for brain tumor grading.

LiyaZhao and Kevin Jia [17] described a CNN-based automated brain tumor segmentation method. A three-stream framework, called multiscale CNN, is designed to automatically identify different scales of a region. King Guotae et al. [18] designed a fully convolutional neural network to fragment multimodal MR images. The system contains various layers of anisotropic and expanding convolutional filters to reduce false alarms. Residual connections and multi-scale prediction are used in these networks to improve segmentation performance. Hossman H. Sultan et al. [19] proposed a DL model based on CNN to classify different brain tumor types using the two publicly available datasets. The dataset is preprocessed and augmented after being split into training, validation and test datasets followed by the hyperparameters, regularization method, and optimization algorithm. Shaik Basheera and M.Satya Sai Ram [20] described a new approach using CNNs to classify brain tumors into normal and three different types. Tumors are first sectioned from MRI images usingan improved ICA mixed model. Depth features are extracted from the segmented images and grouped. Hai Thanh Le and Hien Thi-Thu Pham [21] proposed model-based learning for brain tumor segmentation from multimodal MRI protocols. This model uses a U-Net-based convolutional framework to extract highlights from a multimodal MRI training data set, and after some time applies them to the ExtraTrees (ExtraTrees) classifier to associate them with brain tumors. A morphological filter is then used to remove misclassified markers. Mohammadreza Soltaninejad et al. [22] planned a new 3D supervoxel-based learning strategy for tumor segmentation in multimodal MRI mental imaging. For each supervoxel, a selection of highlights is removed containing a histogram of texton descriptors designed to use many Gabor filters and statistical features. These highlights are fed to a Random Forest (RF) classifier, which groups each supervoxel intotumor centers, edema, or healthy brain tissue. Ali ARI and Davut Hanbay [23] described their method with three stages: preprocessing, Extreme Learning Machine-based tumor classification (ELM-LRF), and image processing-based tumor region extraction. A neighborhood smoothing strategy was used to remove possible noise. In a subsequent phase, ELM-LRF is used to classify cranial MR images as benign or malignant. MatthewCamp et al. [24] proposed a neural network to detect and highlight brain tumors present on MRI. Adadelta is used as the optimizer because it is more robust and does not require manual tuning of the learning rate. The model uses fewer layers and convolution filters to reduce prediction time and allow fast convergence to a stable solution. Additionally, the model hyperparameters are fine-tuned in an iterative process, ideally increasing the accuracy of the segmentation.

P. Mohammed Shakir et al. [25] introduced neural network-based brain tumor detection using wireless thermal imaging sensors. A machine learning-based backpropagation neural network is analyzed using an infrared sensor imaging technique for brain tumor classification. Features are extracted using a fractal dimensional algorithm, followed by selection of the most important features using a multifractal recognition technique to reduce complexity. The area of the tumor is calculated, classified as class I or class II, and its accuracy is also estimated.

III. BRAIN TUMOR DETECTION

Figure 1 shows the brain tumor detection process. The classification of brain tumors is divided into twostages: training and testing. The number of images are classified into different categories using label names such as tumor and non-tumor brain images. First, the training image set is referenced. The training phase performs preprocessing, feature extraction, segmentation, and loss function classification to create a predictive model.

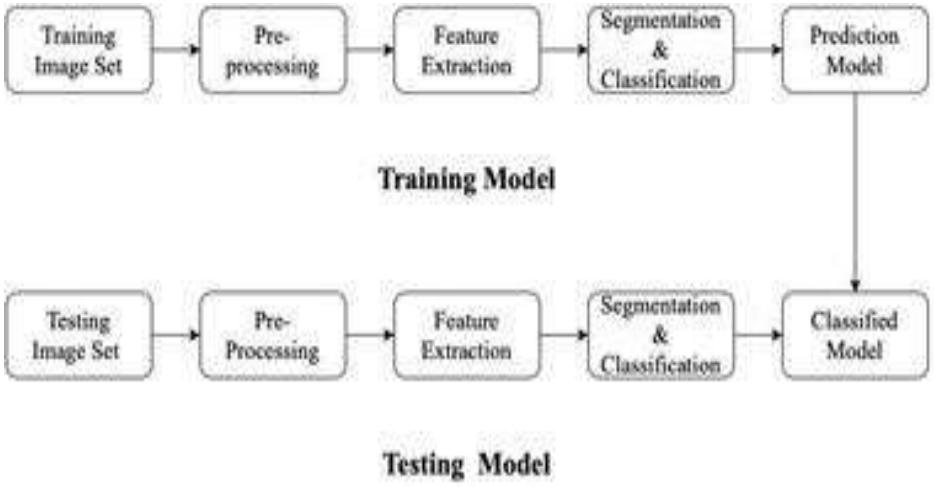

Figure 1. Steps involved in Brain Tumor Detection

Preprocessing enhances the image to acquire better quality. In addition, feature extraction extracts related features to form a feature vector. A segmentation or classification process is applied to classify normal and abnormal images in the prediction model. In the testing phase, a classification model is created that will ultimately produce brain tumor classification results.

IV. PREPROCESSING

In medical image processing, image preprocessing is very important so that the extracted images are free of impurities and more suitable for subsequent processes such as segmentation and feature extraction. The purpose of preprocessing is to improve image data, suppress unwanted distortions, or enhance important

image features for further processing. It converts the original image to a grayscale image, removes unwanted noise, reconstructs the image, and enhances the image. Image processing techniques use various filtering methods to enhance images. Its primary use is to change the contrast, brightness, resolution, and noise level of an image. Contouring, image sharpening, blurring, embossing, and edge detection are typical image processing functions. These processes improve image quality and can be used for segmentation.

V. FEATURE EXTRACTION

Feature extraction is a key step in automated procedures based on machine learning approaches. Feature extraction methods aim to remove non-dominant features, reduce the training time and complexity of the developed classification model accordingly, and represent relevant information in a low-dimensional space. A feature is defined as a function of one or more measurements that specify a quantifiable property (i.e. color, texture, or shape) of the entire image. The extracted features should contain information that can distinguish different classes. Relevant features are extracted from objects to form a feature vector. These component vectors are used by the classifier to recognize input units and target output units.

VI. SEGMENTATION

Segmentation plays an important role in image processing. It is used to divide an image into meaningful parts with similar features and characteristics. The purpose of image segmentation is to divide an image into multiple parts/segments with similar features or attributes and extract her ROI (Region of Interest) for image analysis. Less information makes analysis easier. There are several image segmentation techniques that splitan image into multiple parts based on certain characteristics such as pixel intensity values, colors, textures,etc. These techniques are classified based on the segmentation method used. This technique is regularly used to divide an image into different parts and distinguish objects and other important data in digital images. Segmentation serves two purposes. i) Break down the image into parts for further analysis ii) Create variationsof expressions i.e. the pixels of the image should be organized into efficient high-level units for further analysis.

VII. CLASSIFICATION

Classification is the process of finding which group (subpopulation) of a category belongs to given a training set of information with a known perception (or instance) of classification. In other words, classification is used to classify each element in a set of data into one class or group from a predefined set of classes or groups. The goal of classification is to accurately predict the target class for each case in the data. After extracting features from the dataset, these features are passed as input to the classifier. Classification is used to find out which category a particular tested data belongs to.

VIII. BRAIN TUMOR SEGMENTATION

Perform brain tumor segmentation is used to extract tumor regions from images so as to further classify and predict brain tumors. Various machine learning and deep learning methods have been proposed for cell segmentation. Some ML methods use manually segmented images for training, which is costly and time consuming. Therefore, Deep Learning techniques are used for segmentation. Methods include CNN, DCNN, and Cascaded U-net. Convolutional neural networks have a powerful learning ability to learn perceptual and contextual information when multiple deep layers of variant structure are added to the network architecture, providing more robust results. Deep U-Net architecture is trained in different image orientations without using data augmentation techniques. Cascade U-net recognizes tumor regions and DCNN segments patch- based intra-tumor structures. The adaBoost algorithm modified classifier weights based on various parametersalso used to improve the performance. Table 2 describes various existing segmentation techniques

TABLE 1. VARIOUS SEGMENTATION TECHNIQUES

Methods	Pros	Cons
Contour-based segmentation	Tissues are isolated in a few simple steps.	Results are less than satisfactory for noisy, uneven and bright images
Contour-based segmentation	Uses both intensity and texture information present within active contours to overcome problems in capturing large areas in images	Not fully automated
Edge based segmentation	Sans the image pixel by pixel	Region border thickness.
Edge based segmentation	The fuzzy inference system provides maximum robustness, illumination variation, and avoidance of double edge overlap.	Edge thickness increases
Region Growing	The lesion region is easily identified by area splitting and merging.	Complicated and Expensive
Region Growing	Increased sensitivity and specificity due to spatial overlap	Responsiveness to noise
Hybrid	The resilience of the hybrid algorithm is substantially enhanced.	Hybridization causes a rise in complexity.

Morphological based segmentation	Suitable for low-intensity images	Produces excessive results compared to segmentation
Hybrid	ROI, expanding region, and morphological action (Dilution Erosion)	Requires more time for training
Hybrid	Combination of threshold-based segmentation and single seed region growth	Tuning a large number of different parameters for a particular application
Atlas-based methods	Has the ability to segment any of the various brain structures for no additional charge	The method's accuracy depends on the topological graph priors'accuracy.
Atlas-based methods	It is meshfree, which eliminates the hassle of handling meshes.	No image enhancement by preprocessing
Threshold Based Methods	For homogeneous images, gamma-law transformation offers improved segmentation.	Choosing the best threshold is challenging.
Threshold Based Methods	Threshold based approaches primarily choose intensity values from a given image as their threshold.	Not an automatic process

IX. BRAIN TUMOR CLASSIFICATION

The task of predicting what an image represents is called image classification. Image classification models are trained to recognize different classes of images. The classification stage usually depends on the classifier method. As a general methodology, image features are extracted and passed to a classifier for prediction. Medical image classification is one of the most important problems in the field of image recognition, and the goal is to classify medical images into different categories. Table 3 describes various existing classification techniques.

TABLE 2. VARIOUS CLASSIFICATION TECHNIQUES

Methods	Pros	Cons
Probabilistic Neural Network-Radial Based Function (PNN-	Effective way to identify the tumor location in its earliest stage.	Slower at categorizing new cases than multilayer

RBF)		perceptron networks
3D CNN	Effectively manage classifications of huge data from many centres.	Enormous volume of datasets is necessary
RELM classifier	ELM has demonstrated advantages in terms of quick learning and acceptable generalization performance.	Manual parameter setups still exist in the training phase and are not adequately addressed, which adds time costs to learning.
MI-ASVD (Mutual Information-Accelerated Singular Value Decomposition)	Presents supervised and unsupervised learning methods that can be combined to create a helpful CAD system that helps speed up the diagnosis process.	It only use certain kinds of datasets.
DWA-DNN (Deep Wavelet Autoencoder)	DWA offers a comprehensible method for keeping the essential elements of the input image for categorization.	There is no sub-image decomposition for lower resolution images.
SVM (Support Vector Machine)	Works a little better in places with high dimensions and whenthere is a distinct line separating the classes.	Requires feature scaling and takes a lot of effort to train
DNN	Includes two dropout layers in its 16 layers to prevent overfitting, followed by a fully connectedlayer and a softmax layer to anticipate the output.	Due to the range of imaging angles, the dataset is relatively small.
CNNBCN (CNN based on complex network)	The modified CNNBCN model's test loss of brain tumour categorization is lower than that of other models.	It produces an unreliable random graph.
Ensemble Classification (Bagging Algorithm	By lowering variance, it aids in preventing overfitting.	Ensemble approaches typically cost a lot to compute.
CNN	CNNs are very good at cutting down on the number of parameters without sacrificing model quality.	In order to increase the network's capacity for generalization through augmentation, more subjects are needed.

X. CONCLUSION

In recent days, there has been much work on the segmentation and classification of the MRI images of brain tumors using different approaches. We discuss various methods, advantages, limitations, and accuracy, and provide insight into different techniques. Nevertheless, MRI is a challenging field with room for further research. Both segmentation and classification give clinical experts a great advantage as a second opinion, depending on the automated results and rapid response time of the analysis. In this paper, a number of studies have been used to conduct a review showing how Machine Learning and Deep Learning techniques can bring excellence to all aspects of medical image processing, especially in the areas of brain tumor analysis, segmentation, and classification. There is no doubt that methods to segment brain tumors show great potential in the future, with all the amazing advances mentioned in this field. Improvements in advanced tumor assessment such as tumor volume estimation, estimation of tumor progression, and multiclass tumor classification will facilitate advances in current technology.

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Utilization of IoT for Aiding People with Autism

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ABSTRACT
Autism Spectrum Disorder (ASD) is a common word used to describe a group of neurodevelopmental conditions. Autism spectrum disorder (ASD) is a neurological and developmental disorder that influence how people interact with others, communicate, grasp, and act. People with ASD often have difficulties in social communication and conveyance, as well as constrained or repetitive behaviors or interests. IoT (Internet of Things) has become the trending technology as it is progressively growing to make people's living greater and effortless. IoT is defined as "The physical objects are embedded with sensors to transfer data with other devices over internet". The IoT is helping children with autism in numerous ways from learning to supporting them in social interaction. IoT technology and home automation can also help create the proper atmosphere, with certain music and lights that helps to feel them calm. The concepts of smart homes, and wearable devices helps them to live better. In this paper, the authors presented a various application that the autism people can use in their day today life for betterment.
Keywords: IoT, ASD, Sensors, P2P, AIoT, ABA

I. INTRODUCTION

Autism spectrum disorder (ASD) is a neurological and developmental disorder which affect behavior and interaction of a person. The symptoms of this disorder range from slight to extreme. The symptoms mainly appear in the spoken language and the social interactions with the others. Various symptoms possibly are dyslexia, hyperactivity, epilepsy, sensory difficulties, obsessive compulsive disorder, bipolar disorder, anxiety disorder [1][2].

Kids having autism have struggle in communications, interactivities, and connections. This can force the kids to redo their activities again. The result of this repeated actions leads to frustrations gradually. There are high chances of getting disturbed by these kids if there is any change in daily routines. They behave strangely in many situations. The early-stage detection of autism can be done by analysing whether the baby is achieving their main milestones or not like babbling, main mobility skills like scrolling, sitting, walking and whether they are able to identify the objects etc. There is no rule that all kids have to achieve all the milestones. Still, many of the major one's won't achieve or there is a visible delay. Babies with ASD may be very delicate to certain things like some noises, touches, smells, temperature differences, and also with some colours [3].

These kids may develop uncommon language and social skills. In some cases, they have not developed their languages [10]. They are little bit inactive with cognitive abilities. It doesn't aim that these kids are incapable.

They have capabilities, what we need to do is identify and untie their capabilities out of them and improve their potentials.

The feasible reasons of autism are genetics, accidents during pregnancy time, abnormal neural development, mercury preservatives, environment, bad parenting, and traumatic
experiences in kids. Recent studies show that exposure to electromagnetic spectrum also leads to autism. It includes use of mobile phones, two-way radios, wireless devices near new born can be reason of producing autism.

Kids having autism spectrum required regular monitoring for their abilities and difficulties, in order to get correct therapeutic and academic goals that meet their educational objectives. The various symptoms like dyslexia, hyperactivity, anxiety disorder and sensory difficulties can be analyzed from school environment since their activities and interactions starts from there. New methodologies should be implemented in educational system that helps in these kinds of kids to achieve their educational goals in an easy way. The internet of things is a very easy to use and at the same time smart tool in the hands of teachers, therapists, parents, and caregivers to approach, evaluate and interpret in autism spectrum disorder. Specifically, a combination of new technologies emerges in a general context like artificial intelligence, automation etc. can do drastic changes in a positive way. These technologies help to replace to some extent a deficit in the attention, interaction, and communication of these children.

Internet is an ingenious creation of previous decades. It is drastically varying into different types of software and hardware. It is a kind of interconnected communication between either human to human or human to devices. Internet of things is a coordination of electronic systems in which devices are interconnected and interrelated. It consists of a number of sensors and smart devices. All types of digital and mechanical devices and machines have the ability to pass information to interconnected networks. There is no requirement for the interaction of humans in this system.

The smart system contains a computer, internet, and sensors. With the help of smart devices and sensors the parents or caretakers can track the movement of children and get a real time reaction and have a picture of their sensory profile. In addition, it can trigger and synchronize the sensory systems so that there is a sufficient level of alertness. These activities make it calmer to respond to the learning context through visual perception activities by providing stimuli such as vibrations in the chair, adjusting appropriate lighting and smells in the space. In addition, the lack of understanding of other people's feelings and thoughts (empathy)as well as the difficulty of neurotypicals in interpreting their own feelings was supplemented and aided bythe significant contribution of internet devices. The design was holistic and therefore included bio-sensory, behavioral data as well as techniques applied to social psychology. The materials used for this purpose and helped in its implementation were a clock worn by the child for measurement, touch and pressure sensorsfor the observation of body movements and facial expressions, and a camera to record the moments. Additionally, receptors were placed on specific toys. With the help of the internet, the relationship between the child's contact and behavior such as his preferences and feelings could be recorded.

II. IOMT SERVICES FOR AUTISTIC PEOPLE

The Internet of Things, has a impacts on medical industry as well. This has leads to a new term, Internet of medical things or IoMT, which mention to healthcare items. IoMT can be defined as a system in which medical devices interlinked and communicate each other using computer networks. These devices and applications store the data collected on cloud platforms from where it is easily accessible by healthcare providers. They can use these data to perform real-time analysis and take timely medical action. Thecollected information also used for research and analysis purpose.

IoMT that has transfigured the field of healthcare by enhancing treatment and improving patient prognosis. Similarly, IoT contributes to disorders such as Autism Spectrum Disorder (ASD). We can find IoMT functions in the treatments of autistic individuals in the following scenarios.

1) Emergency services

If the autistic person who is using an IoT device met with an accident or any emergency situation then alarms will be given to the parents or caretakers about the condition of the individual. The notifications are transferred in real-time resulting in the timely and valid intervention of the caregivers.

2) Patient information management

A very useful pillar served by the help of the internet of things in healthcare is the management of patient information. The medical history is stored online along with old patient data. In this way, the person receives the necessary treatment.

3) Remote monitoring and real-time medical assistance

The internet of things and the many portable devices with sensors that people with autism or patients, in general, can wear enable their caregivers to know every minute the correct data about their health and to intervene at the right time. In addition, the internet of things helps people with disabilities stay in the comfort of their own homes and stay connected to professional doctors in real-time.

4) Research and Data Analysis

According to the Internet of Things solutions, medical research can easily and quickly gather huge amounts of data. If done manually, this process would take years. With the use of Internet of Things technologies, detailed data are recorded about each patient's illness, symptoms, and treatment plan. Then after entering the data of each patient into a database, they give valuable information in the field of medicine. They help develop better treatments but also help health care centres make faster treatment and diagnosis decisionswith less chance of error. [12]

Based on the above, the Internet of Things and specifically the Internet of Medical Things is a very important discovery for patients, people with disabilities, caregivers, and their doctors. With IoMT devices they have a better quality of life and acquire many capabilities.

III. SMART HOMES

It is an internet-connected house in which 24-hour remote monitoring, supervision, and control of all electronic devices have been enabled [2]. It is all about IoT. All home electronic devices can be organized and supervised by using the internet. In recent times, IoT has progressed forward to monitor, control, and supervised every device from fingertip movement and also with voice. This can command a device how to respond and work i.e., when it should turn on and off. Through this way one can set a schedule, set smart TV for videos and music, control smart thermostats control time, money, convenience for benefits, produce alerts and notification on mobile whenever some unexpected event occurs [5]. It is a tension-free system in which one can get rid of failure of electricity, burning fire, and water leakage. These can be the major alerts. It is the new group of smartphones and artificial intelligence. This technology can use Wi-Fi signals to increase its capacity. Through this technology, every light switch, each security system, electrical and electronic devices can communicate with each other [6][7].

The system of a smart home generally works by the internet connected hub and can direct signals to every device for its operation and working. Even these devices can be controlled and supervised from millions of miles away from home with mobile phones and voice commands. In this way, precious time and money can be saved [5]. Bedroom temperature can be monitored from your office then actually you are fantasizing about an IoT-based smart home. It can also provide statistical data of using all devices and their electricity bills for payment. Smart home automation can acquire owner's habits and behaviours to modify all settings. With IoT based smart homes locks and garage doors can be opened and closed on the wish of owners with just simple voice commands from anywhere [6].

Smart cameras, smart motion sensors can also be applied to enhance security. Kitchen appliances, make grocery shopping lists and create recipes for cooking, smart refrigerators, and smart coffee makers, keep track of expiration dates, control of cooking devices, washing machines and dryers, sense of a voltage upsurge, sense of water failures, and turn off the water tap in time and every other work related to a home are the most important works for a smart living. A smart home has shown below in the following Fig. 1.

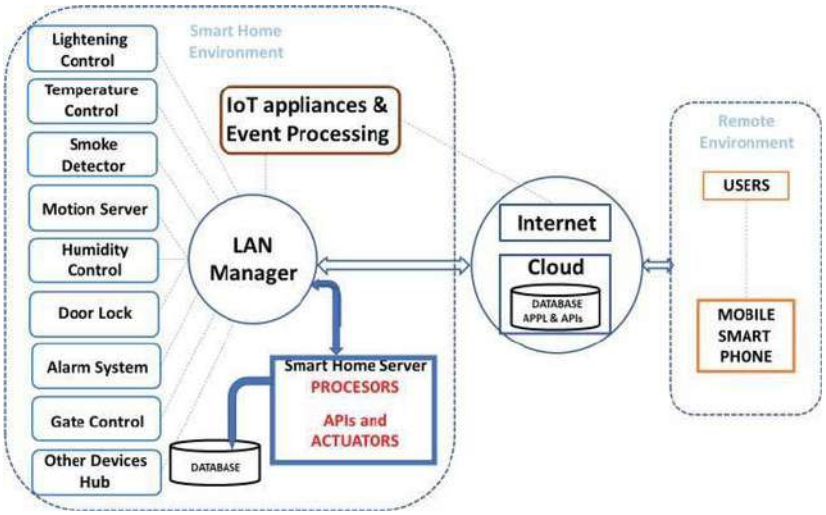

Fig 1: Smart Home

IV. PEER-TO-PEER (P2P) COMPUTING

A framework P2P communication amongst kids their parents and therapists is very effective nowadays in autism [13]. In this framework, every peer has an equivalent advantage and can participate in all applications equally. This complete system is said to form a peer-to-peer network of nodes. This framework has been used to provide a predictable, concrete, and self-paced learning environment and encourages excellent visual information processing [15]. It can analyse the behaviour of kids with autism. It can store all the data and then therapists can use them for the betterment of the child. Autism is a source of unease, nervousness, and anxiety for kids and as well as for parents. This technology helps these kids to understand friendship, to understand scripts, characters, images, and visuals, to present real-world rehearsal and practice, to build comforts and interests.

There are always challenges for kids with autism. A newer system for supporting ASD children based on IoT and P2P technology has been introduced. This system uses the JXTA-Overlay platform and Smart Box device to monitor the children and create P2P communication between children, caregivers, and therapists [11]. This system has been Implemented on medical support system using P2P and IoT technologies [9]. IoT systems can provide a programmed monitoring frameworks by using sensors and IoT devices, for children with autism. These systems keep track of all data gathered by sensor readings. The data has been obtained from the brain signals of ASD kids. The analysis is performed based on collected data and a report isgenerated for the therapists. IoT-based health monitoring systems for ASD patients have been worked efficiently [7]. This health monitoring system can be applied as a real-time observation for vital health parameters of ASD children. AutiTRACK is one of the IoT-based monitoring frameworks for ASD children [14].

V. APPLIED BEHAVIOUR ANALYSIS (ABA)

It is a scientific and systematic methodology to understand the behaviour of children with autism. ABA necessitates the implementation of well-known and recognized learning principles, behaviour stratagems with environmental adaptations for the improvement of the present behaviours and to teach new future behaviours. This tool was designed for a complete team to help kids with autism. Numerous members of the ABA team must be involved to make this methodology perfect for the needs of these children [6]. This therapy helps to improve new skills and abilities, shape and refine previously learned skills, and decrease socially significant problem behaviours. Applied Behaviour Analysis (ABA) therapy is an important tool used in autism. It is a type of intensive therapy that focuses on the principles and techniques of learning theory to help and improvement in the social behaviour of the child. This therapy helps them in developing new skills,shaping and refining their previously learned skills, and in decreasing their behaviour problems socially.

VI. USE OF IOT BASED ROBOTS IN AUTISM

Robots can be used in autism as a new therapy tool for children. It is one of the most promising areas in which robots have been introduced for ASD children. Robots have proven their importance in engagement and producing new social behaviours in teenagers and children with autism in novel scientific research. The use of robots in robot therapy is called socially assistive robotics (SAR). SAR can develop robots to comfort people with autism through social interactions [8][9].

VII. WEARABLE IOT BASED DEVICES

To manage anxiety, people with autism need wearable devices. These devices have proved their authenticity in autism, they are game-changers. A pair of the bracelet, watch, google glasses, necklace, shoelaces, reveal and GPS tracking system can confirm the safety of ASD children [10]. ASD children have a natural difficulty in noticing a danger, in understanding someone's expression, and in judging someone's thinking and feelings precisely. An ASD child can be inspired to escape from a situation that can overstimulate him or her by moving to a safe place in their schools and homes on their own. An IoT-based tracking tech can make this possible.
Due to this the location of a child can be monitored if they have moved elsewhere. The software of face recognition has been used in these glasses with a front cam. This tech can sense the facial cues of a stranger and interpret them in the right or left corner of these glasses. ASD kids can see happy and sad emotions through these glasses [15]. Therefore, they can develop social skills to recognize strangers. Reveal is an advanced wearable tech with a simple bracelet design. It can sense emotional instants and translate them intouseful information. It can sense heart rate, sweat levels, body temperature, and other parameters. This data can transmit to further connected smart devices. In this way, parents can observe the stress levels of their children [12]. ASD melt-down issues can grow fast without any reason. It is very hard for parents to identify the real reason for meltdowns. These traumatizing meltdowns can be due to their environment, mind, overstimulation, and interactions. Reveal can track the precise times when they felt most stress [13]. In this way, they can reverse-engineer this fact with the help of reveal to determine the exact reason for a meltdownand avoiding it in the future.

VIII. AIOT

The Internet of Things and Artificial Intelligence are two of the most emerging technologies in the world right now.
AI applications, or artificial intelligence plays an essential role in the operation of IoT applications as it is located in many areas such as vision sensors, to locate the location but also to help devices learn and process information like a human. Artificial intelligence powers IoT applications. The combination of Artificial Intelligence with IoT is known as AIoT. AIoT promises internet users a connected future, intelligence along

with data. Many AI projects have been created to enhance the Internet of Things. Some of them is a system that helps detect traffic accidents and illegal parking but also a system that helps ambulances reach their destinations by changing traffic signals. In addition, with the above technologies, a class monitoring system has been created. This system scans the room every 30 seconds. The algorithm is then able to identify each student's emotions (sad, happy, angry, or bored) along with their behaviour. This explains his good or bad performance in his lessons. The whole idea of artificial intelligence is to capture more active data from IoT devices [17].

AI and the Internet of Things are used in many medical applications and autistic people can be helped by the proper use of automated systems. In addition, it is well known that early detection of autism can ensure the early treatment of individuals. This can be achieved with the processing power of AI. IoT devices such as cameras, sensors, and virtual reality can be very useful in analysing the expression and monitoring the behaviour of an autistic person. Continuous therapy can also be ensured using AI sensors and digital devices. An additional feature that helps individuals is the visualization of the material used by their therapists. Therefore, AI-enabled games can add a new dimension to this field and the acquisition of skills by individuals. Everyday life leads to a smart society with thousands of smart devices replacing clocks, brooms, and household appliances that opened at the touch of a button. Nowadays, devices with the possibility of artificialintelligence are everywhere. People through them do not need to intervene in various fields and human intervention is reduced by a physical presence in the space. Accordingly, it would be beneficial to design these devices for people with autism, as human intervention could be significantly reduced and individuals' skills would be enhanced. IoT devices will contribute to the self-service of individuals and will live independently with the help of these devices. In this way, their integration into society will take place. Research has shown that mobile applications can be effective in treating ASD by acquiring the necessaryskills and one of the greatest achievements of the research was the treatment of hoarseness in autistic people as well as being visible through applications and recognizing emotions of autistic people.

There is interest in how Artificial Intelligence can be combined with the Internet of Things. To make that happen, data collection is important, in any project that is to be implemented, data is initially collected. Determining the quantity, quality, and type of data is vital to the development of Artificial Intelligence on the Internet of Things.

AIoT is mutually supportive of both AI and IoT technologies. AI adds value to IoT technology through machine learning capabilities and on the other hand, AI can benefit from IoT through the connectivity and low power processors that smart devices provide. Additionally, useful for AI from IoT solutions are signallingand data exchange as there is a large number of unstructured human-oriented and machine-generated data. AI structures and analyses the data provided by the IoT solution and gives value to the information provided by this data.

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Early Prediction of Diabetes Using Machine Learning

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Abstract

Diabetes is a metabolic disease caused by the increase in the level of blood sugar. The human body breaks down the food into glucose (sugar) and releases it into blood. When the level of blood sugar increases, it instructs the pancreas to release insulin. But if the body is not making the required level of insulin, a much higher level of sugar stays in the blood and if proper care and medication is not taken at the initial stages, it may lead to severe problems like kidney failure, heart failure, stroke, and even blindness. As per the World Health Organization (WHO), currently a population of around 422 million people are suffering with diabetes and each year, about 1.5 million deaths are because of diabetes. Machine Learning has proven itself to be an effective tool in the field of healthcare. This paper focuses on the early prediction of diabetes with features like 'age', 'gender', 'polyuria', 'polydipsia', 'weight loss', 'weakness', 'polyphagia', and many more. The algorithms like, Decision Trees, Random Forest and XGBoost have been used for the classification.

Keywords: Decision Trees, Diabetes, Machine Learning, Random Forest, XG Boost

I. INTRODUCTION

Diabetes, is a chronic disease which is spreading at faster rate than one has ever thought of. As per the International Diabetes Federation (IDF), by 2030, total population suffering with diabetes is expected to be around 643 million. Today every 3 in 4 adults are diagnosed with diabetes [1]. Fig. 1 shows the spread of the disease (2021) around the world [2].

Fig.1 Spread of diabetes around the world in 2021

Types of Diabetes

- Type 1: The autoimmune reaction is the main cause of this type of diabetes. This reaction halts the production of insulin in the body. People diagnosed with type 1 diabetes, need to take insulin on a daily basis. This is most commonly diagnosed in children, teens and youngsters.
- Type 2: Broadly, an unhealthy lifestyle and inadequate level of workout are the main reasons for type 2 diabetes. In patients diagnosed with type 2 diabetes, the body doesn't make proper use of insulin and thus the blood sugar level is not maintained. This can be prevented by following a healthy life style habit such as losing weight, eating healthy food and regular exercise.

- Gestational diabetes: Pregnant ladies, who never had diabetes are more exposed to this type. It increases the health risks in the new born child too. This can even lead to type 2 diabetes further.

II. LITERATURE REVIEW

W.R. Sakshi et al. have worked with dataset having features like number of pregnancies, Glucose Level, Blood Pressure, Insulin, BMI (body mass index), Skin Thickness, Blood Pressure, Diabetes Pedigree. They have used algorithms like kNN, SVM and Random Forest [3]. M. Aishwarya et al., have proposed a model for the prediction of diabetes. This model included few external factors along with the basic factors like glucose, BMI, Insulin etc [4]. R. Jyoti has used different algorithms like SVM, kNN, Random Forest for the prediction of diabetes and then compared the accuracy of all the used models [5]. Gupta et al. have calculated the accuracy, sensitivity and specificity of the different classification methods and also compared and analysed the results of the different classification methods available in WEKA [6]. Xue et al., have used SVM, Naïve Bayesian classifier and LightGBM to train the data collected from 520 patients and potential diabetic patients aging between 16 to 90 [7]. Krishnamoorthi R et al., have used decision tree based random forest algorithm and SVM for the diabetes prediction. They have proposed a prediction framework and have claimed an accuracy of 83% with the minimum error rate [8].

III. METHODOLOGY

For the proposed work, three different algorithms have been used. The process flow is shown in fig.2.

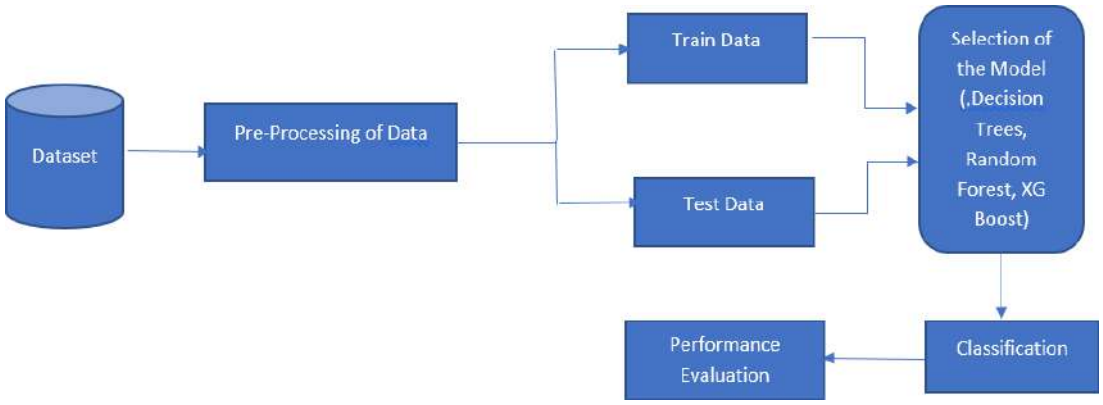

Fig.2 Proposed Model

The dataset has been taken from Kaggle (a Google data repository). The dataset has various features like age, gender, polyuria, polydipsia, sudden weight loss, weakness etc. The dataset was then pre-processed to check for any null values (Fig.3).

After checking for the null values, the data is split into test and training data. Then the different algorithms are applied.

A. Decision Trees

Decision Trees looks like a tree structure with the internal nodes representing a test done on an attribute or feature while the leaf nodes represent the class label, the branches of the tree represent the coexistence of the features that contributed to the class label. It works on a top-down approach [9].

age	gender	polyuria	polydipsia	sudden_weight_loss	weakness	polyphagia	genital_thrush	visual_blurring	itching	irritability	delayed_healing	partial_paresis
False	False	False	False	False	False	False	False	False	False	False	False	Fals
False	False	False	False	False	False	False	False	False	False	False	False	Fals
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Fig. 3 Dataset with no null values

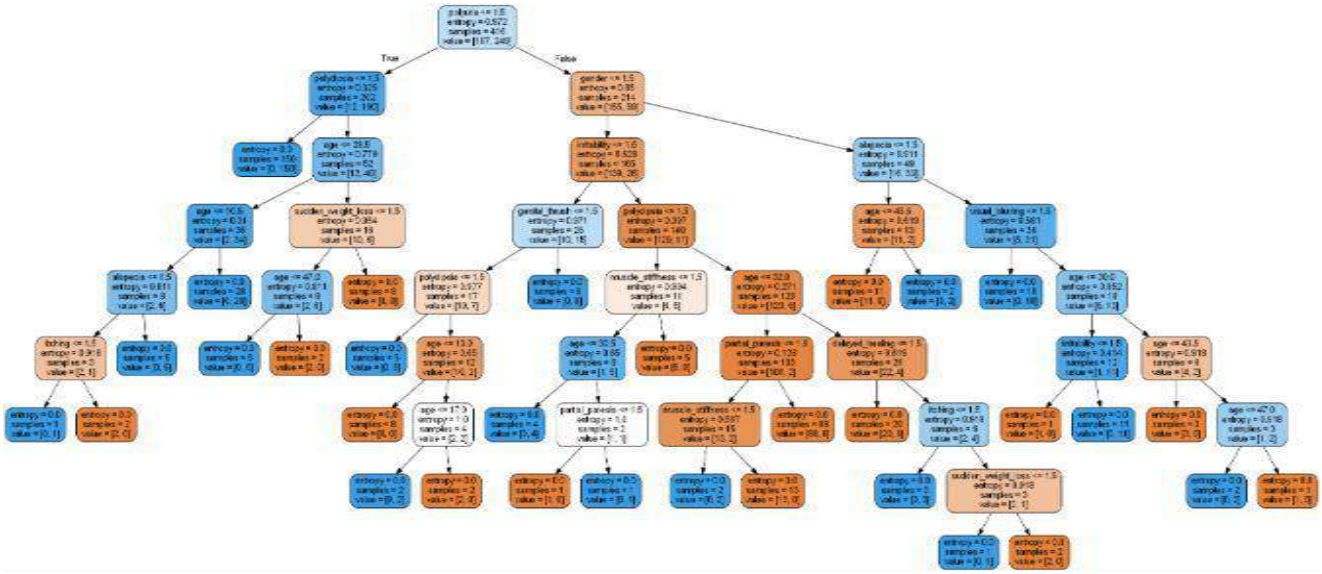

Fig. 4 Decision Tree for the proposed model

B. Random Forest

Random Forest is a cluster of un-pruned classification or regression trees that are made through the random selection of samples from the training data. Classification is done through aggregation (majority vote for classification) [10]. Random Forest follows specific guidelines for developing the tree structure, tree combination, self-testing and post processing. It is vigorous to overfitting and is assumed to be better performing even in the presence of the noise or outliers [11].

C. XG Boost

XGBoost works on the basis of gradient boosting. In this algorithm, the process of adding the weak learners does not take place one after the other rather it's a multi-threaded process with proper utilization of the CPU and hence results in better speed and performance [12].

IV. RESULTS

The data was first visualized to understand the total number of patients with diabetes. Fig. 5 shows the bar chart for the results.

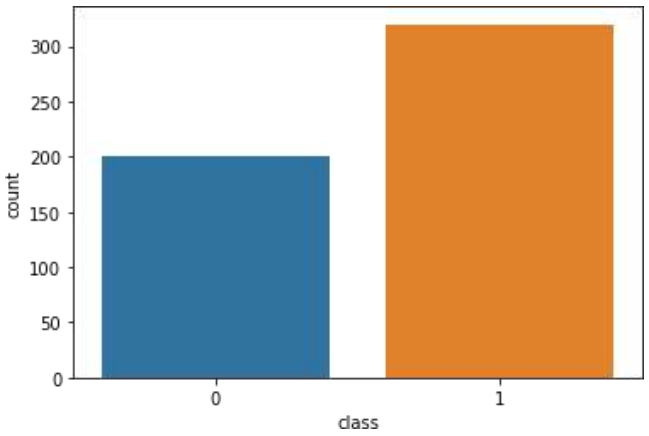

Fig. 5 Total number of cases

Also, to understand the count on the basis of the gender (Fig. 6) and age (Fig.7)

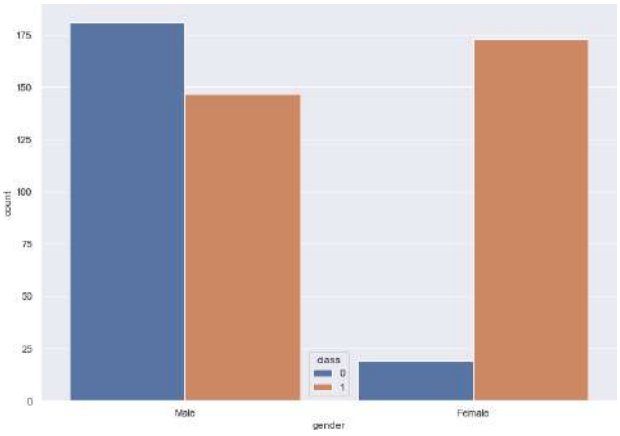

Fig. 6 Total number of cases with respect to gender

The below table shows the comparison of the accuracy for the prediction of diabetes using the different machine learning algorithms:

Sl. No.	Algorithm	Accuracy
1	Decision Trees	97%
2	Random Forest	98.7%
3	XG Boost	98.07%

The mean absolute error was evaluated as 0.0192 and the mean squared error was also evaluated as 0.0192 while the root mean squared error was 0.138.

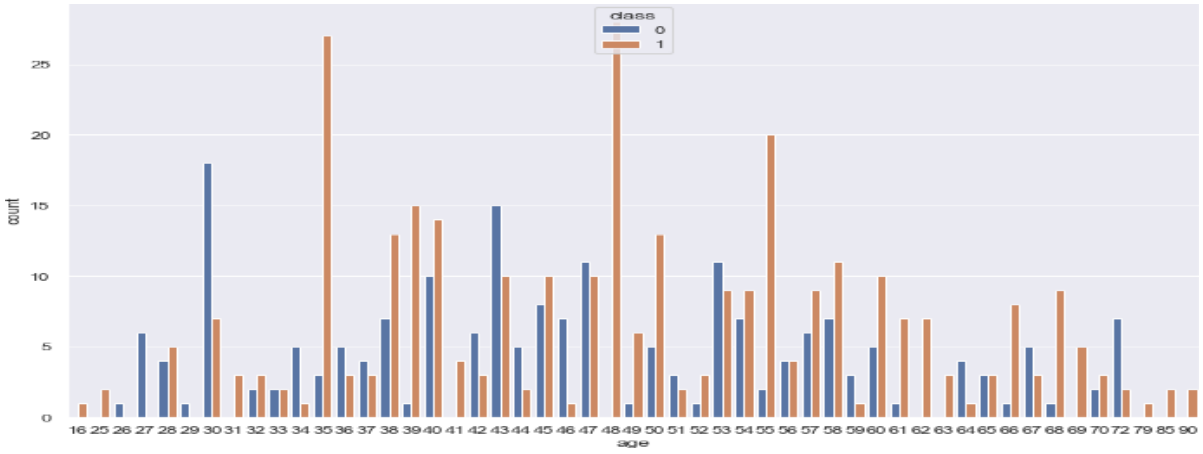

Fig. 7 Total number of cases with respect to age

V. CONCLUSION AND FUTURE WORK

The proposed work shows that Random Forest and XG Boost were able to give almost the same accuracy for the prediction of diabetes. The work can be further done with the usage of Neural Networks or the Bayesian classifier for comparing the accuracy.

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Secure Mutual Authentication Scheme IoT-Based Healthcare

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Abstract

The Internet of Things (IoT) interconnects smart objects and sensors with the internet. These IoT-enabled smart devices exchange data through a variety of new technologies that make up the intelligent management system. A wireless sensor network (WSNs) is an important technology of the IoT that has been used in various applications, e.g., smart healthcare, smart cities, and smart monitoring. Various existing frameworks have been designed to guarantee the accuracy of data and are easily accessible to trusted entities in medical IoT networks. However, the authentication of doctors' and patients' devices is still a critical issue in medical IoT networks. To enhance security, we have proposed a mutual authentication session key protocol for smart IoT medical networks. Our proposed scheme uses multi- factor authentication that not only protects the doctor and patient data but also provides an authentication mechanism.

Keywords : Internet of Things (IoT), Wireless Sensor Net- work (WSNs), Security, Authentication, Healthcare.

I. INTRODUCTION

The medical application is intended to improve existing health and monitoring services, especially for the elderly and children. A component of the healthcare system is the collection, transmission, storage, and retrieval of healthcare data. Security must be guaranteed across medical application scenarios [1]. Medical records should be private. e-Healthcare is a relatively new concept in healthcare and medical science. Smart Health IoT helps monitor and track elderly patients in hospitals and homes. Smart Health also offers to monitor vital body parameters for athletes or the elderly. This is achieved with sensors in Wireless Body Area Networks (WBSNs) [2] [3]. The IoT can also be used to make information available to patients, doctors, and medical staff. The smart health application includes patient identification to reduce incidents such as misprescribing and drug overdose by patients. The IoT sensor device is a low-computational processing device and is located close to the data generation node [4].

The main challenges of IoT include security and privacy issues. These issues should be addressed. Authenticity, confi- dentiality, and privacy are some of the important parameters for IoT success used in large-scale of deployments [3]. This is because is a heterogeneous network with many connected smart objects compared to the existing IoT network [5]. Therefore, there is a need for high-end computing and storage facilities with lower latency and better application quality of service. The Internet of Things faces a number of trust issues. The design of and the development of lightweight trust mechanisms for IoT applications are required and these challenges are important and must be addressed [6].

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To better understand the e-Healthcare and privacy aspects, it is necessary to understand the architecture of the e-Healthcare system. Addressing privacy concerns requires addressing se- curity issues such as access control, authentication, non- repudiation and accountability [7]. All of these are necessary for the to ensure end-to-end data protection.During these days, the Internet of Things is widely used to extract useful information for medical applications for scientific research and business purposes. Medical data is confidential because it con- tains patient personal information. Therefore, data protection is an important issue for medical applications. The healthcare component (i.e., WBAN) of the Internet of Things is focused on improving people's quality of life. Healthcare services focus on Internet of Things (IoT), improving the quality of human health [8].

A secure mutual authentication and key agreement (MAKA) system for the Internet of Medical Things is an important security aspect for protecting users' health information while providing efficient healthcare services [9]. In recent decades, many MAKA schemes have been introduced to ensure user privacy. Many of his subsequent MAKA schemes were devel- oped to overcome these security flaws using the smart card and bio- metrics [10]. However, these schemes store sensitive user data in the server database. So, if the data stored on the server is disclosed to an attacker, the entire system will collapse. For the Medical Internet of Things, several authen- tication protocols have been developed to ensure user privacy. However, these protocols do not protect against verifies theft or verification table leak attacks, nor do they provide secure mutual authentication, anonymity, or untraceability [11].

The Internet of Things (IoT) allows objects to connect and communicate over the Internet. Through the use of various new technologies such as radio frequency identification (RFID), sensor technology and embedded system technology, the IoT will realize the concept of intelligent identification and man- agement to life. Wireless sensor networks (WSNs) are an important technological backbone of the Internet of Things,providing data sources for Internet of Things applications.

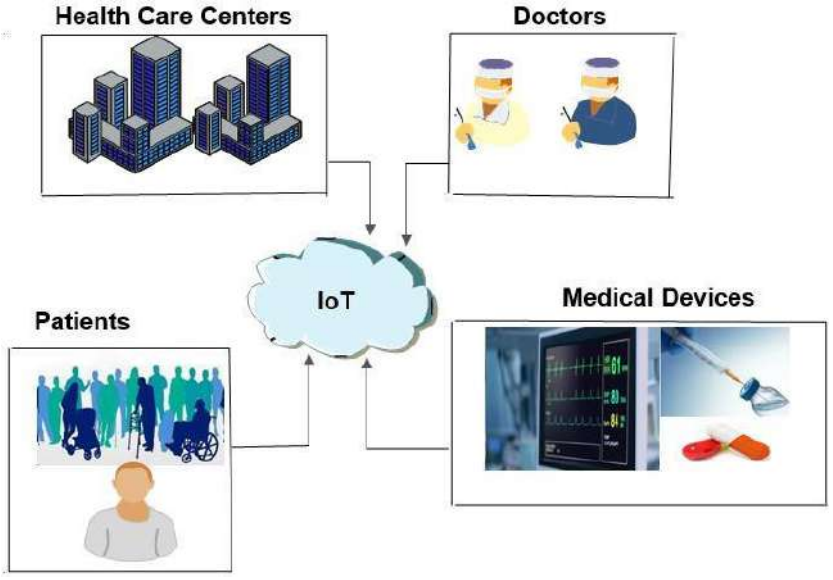

Fig. 1: Medical-IoT System

[12]. A WSN typically consists of multiple sensor nodes that communicate with each other over a wireless network. It is typically used to monitor environmental conditions in a specific area based on information

gathered from sensor nodes. The overall WSN architecture has three participants: users, gateway nodes, and sensor nodes [13].To collect environmental parameters, deploy a sensor node in the region of interest and transmit these parameters to the gateway node via a wireless channel. Authorized users can access this data, and the combination and analysis of this data helps managers make the right decisions. Currently, WSN has important applications in many industries, such as health monitoring, intelligent transportation, environmental monitoring [14].

The remainder of this paper is structures as follows: Section II describes related work. Motivation and Contribution of this work is described in Section III. System and threat model is illustrated in Section IV. The detailed working of the proposed scheme describes in the Section V, Finally, Section VI concluded with the conclusion and future work of the proposed scheme.

II. RELATED WORK

The authors in [15] proposed security vulnerabilities and proven not immune to impersonation, sensor node theft, and leaking verification table attacks. They also prove that it does not ensure anonymity, secure mutual authentication, and untraceability . They propose LAKS-NVT for the medical Internet of Things without requiring a server verification table to resolve these security weaknesses. LAKS-NVT also protects against stolen sensor nodes, impersonation, and replay, as well as providing anonymity, secure mutual authentication, and untraceability [16]. In addition, if the server verification table is leaked, LAKS-NVT is still secure because it does not store the user's authentication parameters and sensitive data in the server's database [17]. They performed (mathe- matical) formal security analysis using the Real–or–random (ROR) model to prove session key security and verified that LAKS-NVT provides secure MA using widely accepted Bur- rows–Abadi–Needham (BAN) logic [18] [19]. They also per- formed a formal security review of the proposed LAKS-NVT using the popular widely-accepted "Automated Validation of Internet Security Protocols and Applications (AVISPA)" soft- ware tool to show that it is safe. They analyse the performance of their scheme compared to other state-of-the-art schemes, and then perform simulation analysis using the NS2 simulator [16].

Servers are generally considered trusted nodes. However, an attacker could look up all parameters in the server's database except Kser, which is the server's master key. An attacker can also eavesdrop, delete, replace, inject, and replay data transmitted over public channels [18]. This case is referred to as the Dolev-Yao (DY) Threat Model. They suggest that the sensor node (SN) is unreliable. Once the sensor node is captured, an attacker can use a power analysis attack to extract and obtain the data stored in the SN, and use the acquired data to carry out other potential attacks. [14].

The Xu et al. scheme comprises three phases: (i) Initial- ization Phase: The system administrator establishes system parameters in this phase, first generating the server master key, Kser, and then storing it in the server memory [20].

(b) Registration Phase: This phase registers Sensor Nodes and intermediate access points; and (c) Mutual authentication and key agreement (MAKA) Phase: The Sensor Node and Server Node authenticate each other and generate the current session key to access useful medical services [21]. The formal security verification of the proposed scheme (LAKS-NVT) is performed using one of the widely-accepted automated validation software tools, known as the "Automated Validation of Internet Security Protocols and Applications (AVISPA)" tool [22].

TABLE I: NOTATIONS AND THEIR SIGNIFICANCE

Symbol	Significance
PWD_i	Password of the doctor.
BIO_i	Biometric identity of the Doctor.
$randN$	Random Number.
Key_{secret}	Secret Key of the Doctor end.
$DID_{Gateway}$	Doctor gateway identity.
T_{id}	Time-stamp id .
$MAS_{gateway-id}$	Gateway identity of the Medical authentication server.
$Token_{id}$	Short authentication identity .
||	Concatenation operation.
h()	Hash function.

aggregated through the SMG over the insecure channel. Where as, the medical authentication server verifies and authenticates each and every request of medical staff.

Patients: Patients are persons who are admitted to the hospital for treatment. The patients are equipped with various smart IoT sensor nodes that gather and communicate the real time health data of the patients. These IoT enabled sensor nodes are low power devices with limited battery constraints.

A. Threat Model

The security of the threat model is considered one of the important issues when sending data over insecure wireless channels. The authentication and validation of the user may be vulnerable to various threats. The threat model generally consist of active and passive attacks. The attacker can per- form such attacks, and affect the communication as well as processing of the medical IoT network. The attacker can alter use-full data that generated from the smart medical IoT nodes. Moreover, they can also impersonate the doctor device and forge the secret information from it.

To improve and overcome from such issues, it requires a substantial technique that not only protect the network but also authenticates each and every user's device. In this paper, we have assume Dolev-Yao (DY) threat model [23] [19]. In the DY threat model, an attackers are capable to intercept and capture the important secret identities exchanges between the trusted Doctor/user and the smart medical center. The attacker can also perform inside threats to forge the device data.

III. PROPOSED SCHEME

To eradicate the security issues, this work proposed a secure scheme for smart IoT based e-helath care system. This scheme gives the secure key agreement and maintain the privacy. The proposed scheme consist of multiple phases are follow as:

1) Registration Phase

2) Login and Authentication Phase

3) Password Update Phase

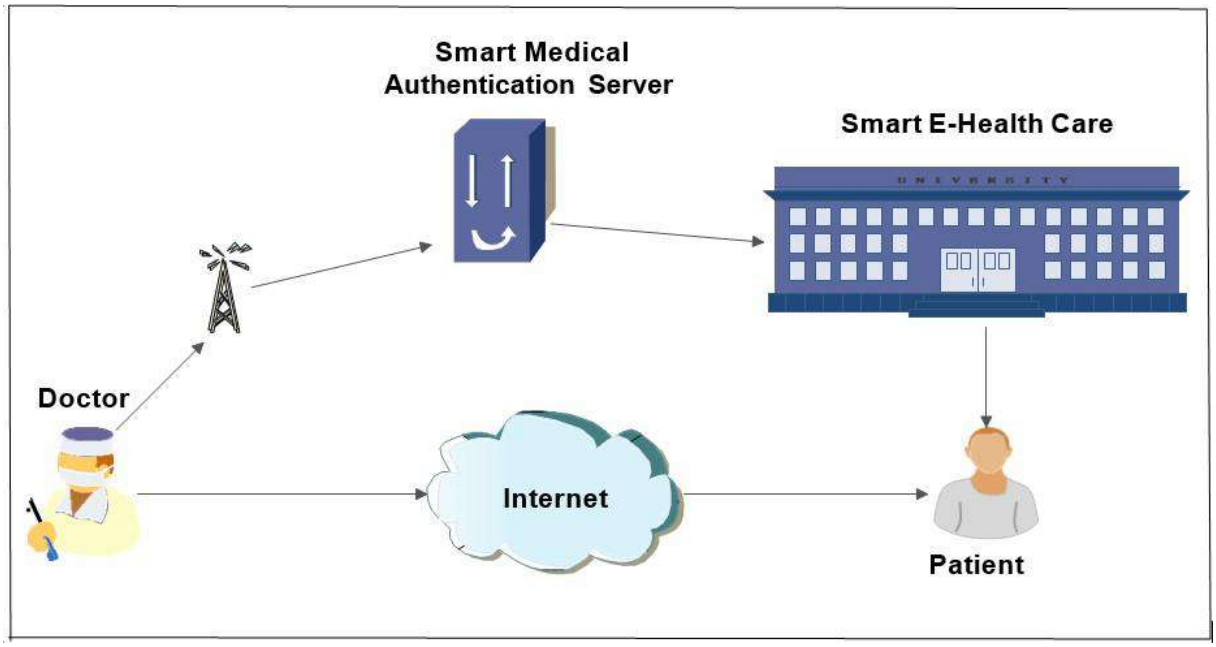

Fig. 2: System Model

1) Registration Phase (RP):

- R_1*:* The Doctor chooses the identity (D_{id}) and passwordPWD_i. Then it chooses the bio-metric id's Bio_i, withthe timestamp value T_i into the smart devices as a bio- metric format shown in Table 2.
- R_2*:* Doctor's smart device computes these identities as $RP_1 = h(D_{id} \| PWD_i \| Bio_i)$, $RP_2 = h(R_1 \| r \| T_i)$, and $RP_3 = h(T_i \| RP_2)$, then send these secret identity to the medical server via secure channel
- R_3*:* The medical authentication server receives the re- quest sent by Doctor end. Medical authentication server first verifies the timestamp value $(T_2 - T_1) < T$, if true, it continue, otherwise, it discard the request. After verification of the timestamp , the medical server first calculates $RP_4=h(BIOi \| PWD_i \| N \| T_i)$ and $RP_5 = RP_4 \oplus (A_1 \| PWDi \| T_i)$ and store these identity into its key table.
- R_4*:* After verification these of identities, the medical authentication server granted an unique Token identity ($TOKEN_{id}$), $RP_6=h(PWD_{id} \| T_i \| N \| Token_{id})$ and send these identity to the Doctor end using the secure channel.
- R_5*:* After the receiving the values from medical server,the Doctor verifies the timestamp $(T_2 - T_1) < T$, if true, it continue, otherwise discard the message. Then, the Doctor computes and stores these entities in his/herdevice smart card.

2) Login and Authentication Phase (LP): In this phase, it provides the working of login and authentication working of our proposed scheme. Table 2, demonstrates the steps of this phase.

- LP_1*:* The Doctor uses its smart device and enter its bio-metric, and PWD identity $h(D_{id} \| r \| PWD \| BIO_i)$, then computes $L_1=h_{BIOi}(T_{id} \| ID_{gateway})$, $L_2=h(L_1 \| r \| T \| Key_{secret})$, $L_3=h(Token_{id} \| Ti \| n \| L_2)$, and then $L_4=HBIO_i \| D_{id} \| r \| PWDi \| L_2$. Doctor sends the $E[L_4 \| T_{id}$ to the

medical server end for further authentication process.

- *LP_2:* On receiving the message form Doctor gate- way end, the medical authentication server extract and computes secret identities from the message L_4 and timestamp value to protect

the secret iden- tities from adversary. After verification the times- tamp, the authentication server extract some secret id's from message (D_{id}, PWD, BIO_i, $TOKEN_{id}$), $L_5=h(T_i||R||DID_{gateway}||D_{id}||Key_{secret})$.

- LP_3: After computing and verifying the secret identities,Smart medical authentication server stores these identitiesin their key table. Then, the medical authentication servercomputes received password, Token identity and other secret identity, $L_6=h(PWD_i\ Token_{id}\ T_{id})$ and verifies$TOKEN_{ID} = TOKEN_{ID}$ and $PWD_{ID}= PWD_{ID}$ if true, it continue, otherwise, it discard the request.
- LP_4: After authenticating the identities, the medical authentication sends granted message $L_7=h(PWD_i || Granted || T_{id} || Key_{secret} || MAS_{gateway-id})$to the Doctor gateway end by computing.
- LP_5: After getting the message, the Doctor end verifiesthe timestamp using $[T_2 - T_1 T]$. if true, it continue, otherwise discards the packet. Now, the Doctor is capableto access the medical authentication server.

TABLE II: Summary of access control procedure between Doctor and Medical Authentication Server

Doctor End	Medical Authentication Server
STEP 1: Compute $RP_1 = h(D_{id}\|\|PWD_i\|\|Bio_i)$, $RP_2 = h(R_1\|\|r\|\|T_i)$, and $RP_3= h(T_i\|\|r_i\|\|RP_2)$,	
	STEP 2: The medical server first calculates $RP_4=h(BIOi\|\|PWD_i\|\|N\|\|T_i)$ and $RP_5 = RP_4 \oplus (A_1\|\|PWDi\|\|T_i)$ and store these identity into its key table. Where $[T_{id} - T_{current} < \Delta T]$
STEP 3: Medical authentication server granted an unique Token identity ($TOKEN_{id}$), $RP_6=h(PWD_{id}\ \|\|T_i\|\|N\ Token_{id})$ and send these identity to the Doctor end using the secure channel.	
STEP 4: The Doctor uses its smart device and enter its bio-metric, and PWD identity $h(D_{id}\|\|r\|\|PWD_i\|\|BIO_i)$, then computes $L_1=h_{BIO_i}\|\|(T_{id}\|\|ID_{gateway})$, $L_2=h(L_1\|\|r\|\|T\|\|Key_{secret})$, $L_3=h(Token_{id}\|\|Ti\|\|n\|\|L_2)$, and then $L_4=HBIO_i\|\|D_{id}\|\|r\|\|PWDi\|\|L_2$	
	STEP 5: $(D_{id}, PWD, BIO_i, TOKEN_{id})$, $L_5=h(T_i\|\|R\|\|DID_{gateway}\|\|D_{id}\|\|Key_{secret})$
	STEP 6: Medical authentication server computes received password, Token identity and other secret identity, $L_6=h(PWD_i\|\|Token_{id}\|\|T_{id})$ and verifies $TOKEN_{ID}= TOKEN_{ID}$ and $PWD_{ID}= PWD_{ID}$ and granted message $L_7=h(PWD_i\|\|Granted\|\|T_{id}\|\|Key_{secret}\|\|MAS_{gateway-id})$. Access granted to user.
STEP 7: User access the service using secure channel.	

Password update Phase: The password update phase initiated when login and authentication phase completes. The validation scheme can be gives the element of updating secret password PWDid. The password update feature able to Doctor/user to updates their password at regular interval with out affecting the network.

The Doctor enter the secret identities at his smart device terminal and provide the h(PWDold Did) and enters the bio-metric identity PUP=h(BIOold Dgateway Tid Did), and this request send to the medical authentication server end.

After receiving the identities from the Doctor end, the authentication server extract and verifies the all secret identities h(BIOold Dgateway Tid Did), it also verifies PUP=PIP' if true, it continue, otherwise, discard the request. Finally, the authentication server allow user to change their password and bio-metric identity.

IV. CONCLUSION

Healthcare organisations nowadays require greater protec- tion for that data. Data privacy techniques help assure the privacy of a person and keep the information in parts. The privacy preservation of data will increase information utility in the future. Using one technique alone does not solve all privacy problems, so it is not sufficient to protect WSN or IoT privacy. In the future, privacy will play an important role in our daily life. This work can be used for medical advancement and can be further improved by the application of other core data privacy techniques. IoT applications will change the scenario of our work culture and our lifestyle. The Internet of Things can become a reliable technology for the in the future if the existing components of the can be combined in new ways on a common platform.

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