

ISSN : 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

**Volume No. 11
Issue No. 1
January - April 2024**



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A Study on Translating Speech into Python Code

[1] Anirudh Pandita, [2] Anusha V Salimath, [3] Anasuya Dutta
[1] [2] [3] Student, NHCE, Bengaluru, Karnataka, India.

ABSTRACT

The world we live in today has seen major improvements in the field of technology. Most of the task which required maximum human effort is now being done with the help of machines. One such area is the processing of human languages. Recent studies have come up with solution which only requires one's voice to achieve the targeted output. But there is one such application which can be one of the many possible problems out there. As we know this entire thing is possible with the help of our developers and they too tend to get exhausted after some time. The concept of speech recognition can be used to propose a solution using natural language processing. This combined with a special type of parser to convert human transcription into a language such as python and many more popular languages out there used by everyone.

Index Terms - Speech Recognition, Natural Language Processing, Recurrent Neural Network.

I. PROBLEM STATEMENT

An average developer tends to work for around 6-8 hours per day. It may be because of their job description or it's may be there project which is keeping them up. Often times, it becomes tedious to code for such a long time and can show effects such as carpal tunnel and so on. One possible solution to this problem is to have a helping assistant which is voice enabled and user friendly which can be used to ease out the work load on the developer. The basic idea is to have a desktop application which will listen to specific voice. In this case, it's going to be normal human speech. The idea is to convert the human speech into transcription which can be done used to achieve the desired output. The choice of conversion is python. Python, being a user friendly language, will be easy to convert the human speech to. Once the conversion takes place, we can automate the task of writing the code to any one of the existing editors such as VS Code or PyCharm. By having the ability to work with the existing editors, allows developer to not install separate ides and will also be able to use the existing features as well. Along with human transcription, there will be system where users will be sharing their codes to everyone such that it is accessible to all.

This system can be one of the possible solutions out of the ones currently available ones. Let's look into some of the technologies used mainly for conversion of human speech.

II. TERMINOLOGIES

1. Natural Language Processing

Natural language Processing refers to the branch of AI that gives the machines the ability to read, which understands & derives the meaning from the human language. It combines the field of linguistics & computer science to decipher language structure guidelines. It can make models which can comprehend, break down and separate significant details from text to speech.

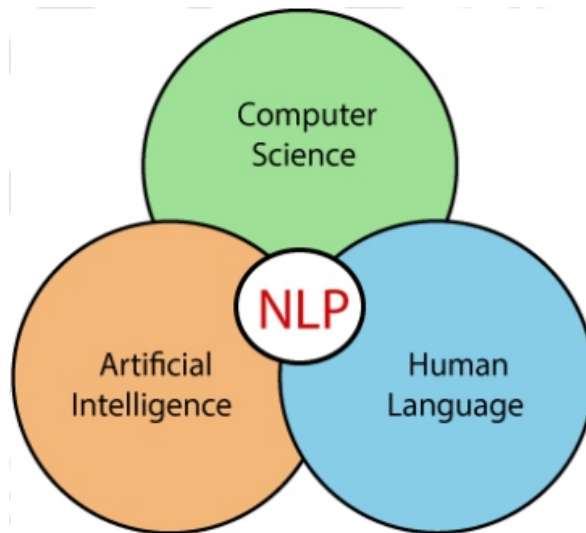


Fig 1. Natural language processing

As we know everyday people interact with each other through public media such as social networking sites, blogs and other social Medias which transfers huge quantity of free data that available to each other. This information are extremely useful in understanding the human behavior & habits. This data/information is utilized by the data analysts and machine learning experts to give the machines the ability to enact the human behavior & linguistic and it also helps in manpower & time as it does need to always have an individual person to be present to complete the other end.

NLP Tasks - It is extremely challenging to create software that reliably ascertains the intended meaning of text or voice data since human language is rife with ambiguity. NLP is used every day in seemingly normal & insignificant situations like:

Autocorrect: Helps in spelling a word correctly.

Plagiarism Checker: helps in detection of similar context in an article or thesis by searching through the web & find the published documents.

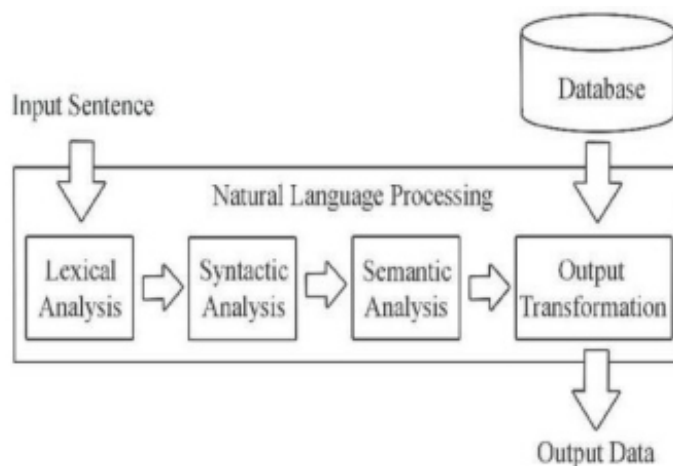


Fig 2. Sematic of Natural Language Processing

A General Question arise which is how does all work. The following shows the steps of NLP:

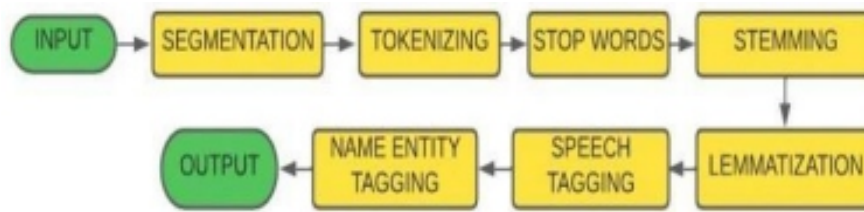


Fig 3. Working of NLP

Segmentation: It breaks the entire document into its constituent's sentences; this can be done segmenting the article along its punctuations like full stops and commas.

Tokenizing: It helps the algorithm to understand the sentences given in the document by breaking down the sentences given in the documents into tokens and store them.

Stop words: It makes the learning process faster by getting rid of non-essentials words like “are”, ”and”, ”the”, ”was”, ”in” and etc. which do not add meaning in the sentences given in the document.

Stemming: It helps the machine to understand the prefixes & suffixes which are added extra in the sentences.

Lemmatization: This help in identifying base words for different word tenses such as “mood”, “gender”, etc.

Speech Tagging: It explains the concepts of “noun”, “verb”, “article”, “prepositions” & other parts of the sentences to the machine.

Name Entity Tagging: It helps in introducing the machine with pop culture, famous personalities, & location. Some of the commonly used application of natural language processing in the current time is: Google Assistant, Grammely, Text Summarization etc.

2. Recurrent Neural Network

Recurrent Neural network belong to a class of Artificial Neural Network which works on the simple concept of adding output to its input. This type of behavior makes the neural network to have some amount of memory stored in it.

This allows the network to work on complex deep learning task such as handwriting recognition, speech recognition and so on. Due to its short term memory capacity, it is also used for sentence completion and language translation

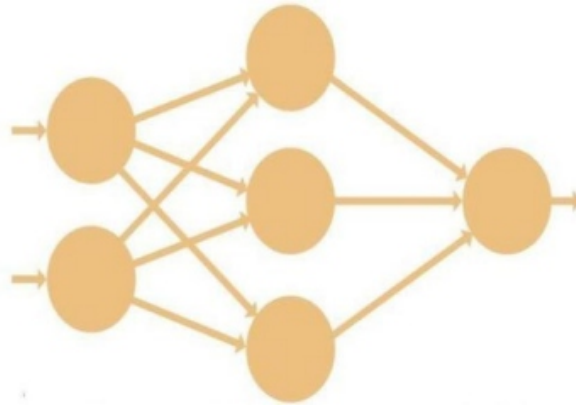


Fig 4. Feed Forward Neural Network Architecture

Based on Neural network design, recurrent neural network connects the output of all neurons to its input neuron. RNN has the ability to convert independent activations into dependent activations with the help of same weights and bias to all of its input layers. Therefore these three layers are joined such that the weights and the bias of its input layer be the same, hence forming the simple recurrent neural network. The calculation of the current state in which the recurrent neural network is present is given by this formula.

$$h_t = f(h_{t-1}, x_t)$$

Where h_t defines the current state, h_{t-1} defines the previous state; x_t defines the input state of the hidden layer. RNN's generally use the tanh activation function whose range lies between $[-1, 1]$.

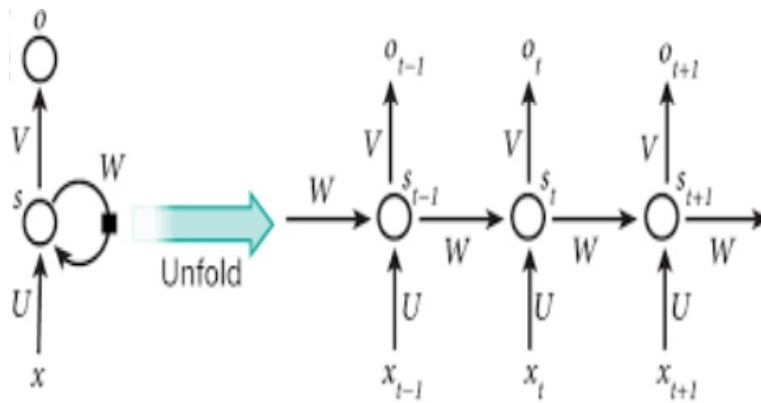


Fig 5. Unfolded view of a Recurrent neural network

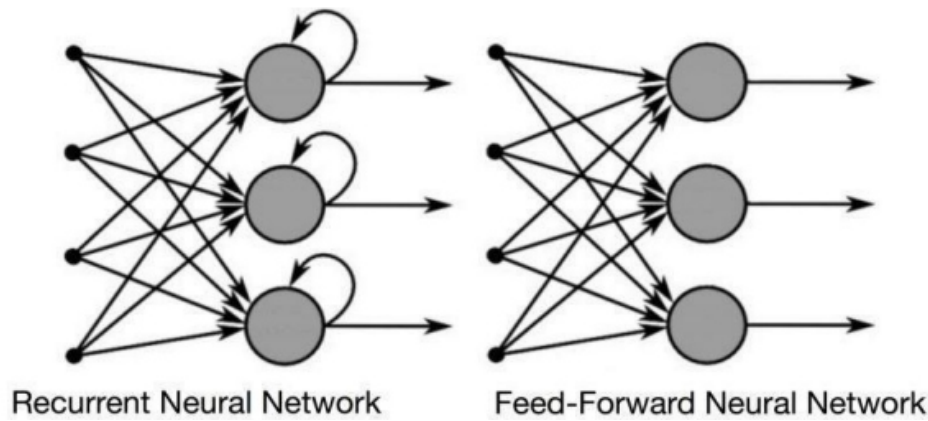


Fig 6. Recurrent Neural Network vs. Feed Forward Network

Although having memory capacity, RNN's tend to forget the most critical sequence when learning for long sequence of data (also known as the vanishing gradient problem). Therefore making it ineffective for long series data set. To tackle this scenario, the concept of LSTM (Long Short term memory) was introduced.

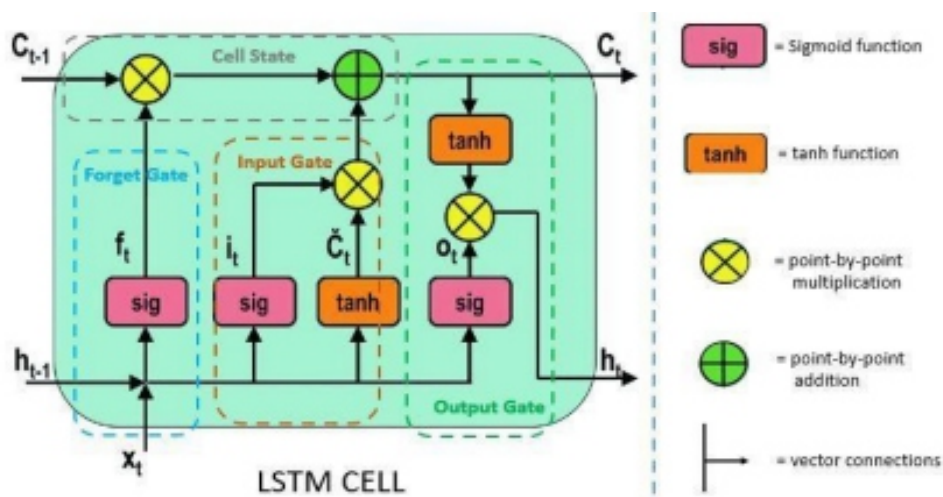


Fig 7. Long Short Term Memory Cell

Long Short Term Memory cell are used mainly to solve the vanishing gradient problem by using the concept of gates. This gating mechanism is used to determine whether a particular piece of information needs to be remembered or not. The opening and closing of the gates signifies the act of writing and reading. Activation Function such as Tanh and sigmoid are primarily used. Tanh function regulates the output value flowing through the network in the range of $[-1, 1]$ whereas sigmoid function values ranges from 0 to 1. If the value turns out to be zero, then the information is considered forgotten. It mainly constitutes of three gates. Input Gate:

This gate performs operations to update the status of the cell. Forget Gate: It decides whether the information from the previous iteration is off any use in the current state. Output Gate: This gate is used to calculate the output of the next hidden state.

III. LITERATURE SURVEY

Speech-to-Text Conversion:

Speech to text is the process of converting normal human spoken language into written text in the form of a string which can be interpreted by the computer. Earlier used as a synonym to speech recognition, it is now widely used for the process of speech understanding. One of the most popular models which is widely used is the Hidden Markov Model.

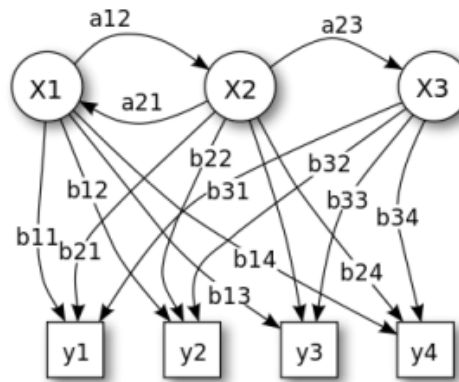


Fig 8. Probabilistic parameters of a HMM

The Hidden Markov model is a type of statistical model which follows the markov chain which states that the probability of each event depends on the state in which the model was in its previous iteration. This model has many applications in the field of thermodynamics, signal processing, speech tagging etc. This model depends on few of the parameters such as Recognition accuracy, Recognition Speed. The speech must undergo preprocessing of the speech signals which helps to remove unwanted waveforms from the speech signal to extract two kinds of acoustic features which are the Mel Frequency Cep- strum coefficients (MFCC) and Linear Predictive Coding Coefficients (LPCC)

Speech Recognition in Noisy Surrounding:

Due to the hustling nature of our surroundings, there are sounds such as noise's available along with normal sound. This makes the job of speech recognition little difficult as it is unable to differentiate from the both. Hence the need of a noise filter concept was introduced.

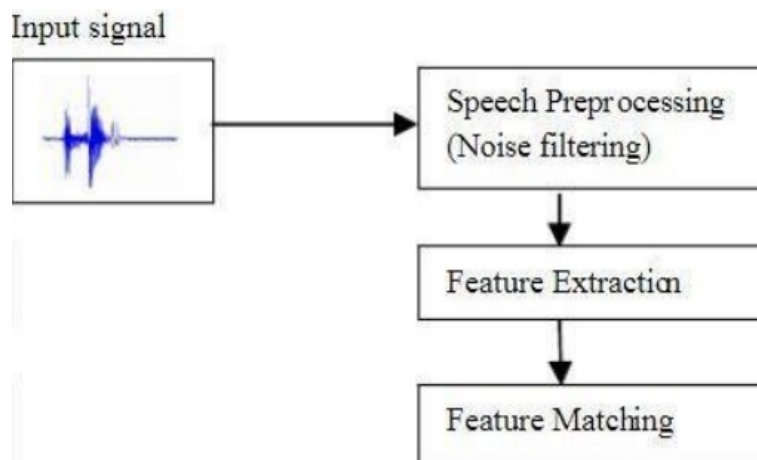


Fig 9. Sample of Features Extraction with noise filter

The traditional Approach of noise removal algorithms mainly used to find the frequencies that have higher levels of background noise and simply deleting it. This approach uses static filter and best suited for deterministic signals, making it ineffective in varying conditions. The industry standard used to remove noise is the Wiener filter which is used widely in technologies such as hearing aids, noise cancelling microphones in smartphones and etc. Further improvements were done by combining two complementary models i.e.: Repeating Weiner Filter and characteristics abandon model.

Speech to text with effective understanding and summarization:

During long hours of transcription of human speech, It is necessary that the output of the model should actually make sense when read. Certain measure have to be taken care of such that model is able to make an effective transcription which is easy to understand.

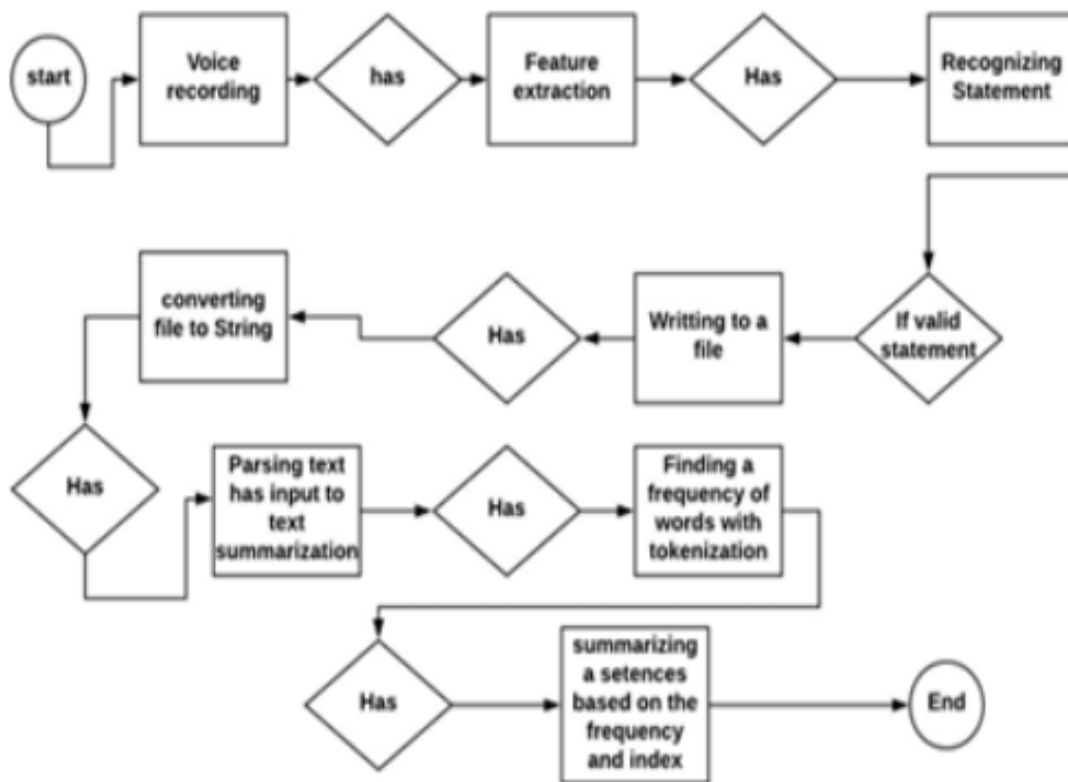


Fig 10. Proposed work for effective transcription and summarization

The above proposed system has followed the normal process of speech recognition and feature extraction. The basic idea is to introduce a pause delay of $2e+6$ microseconds or more. This delay allows adding punctuation marks such as period (.), question mark (?) and so on. If the time period exceeds the system wait for the second input for validation.

The type of punctuation used depends upon the type of conjunction the model is predicting. For example WhQuestions have to be terminated with the question mark (?) Once the formatting is finish, the output transcription can be done used for summarization. But the problem of synonyms still poses an issue. To overcome this, words with less significant is removed. This is done by keeping the words having good

number of repeated occurrence which is done used to process the important sentences using a ranked model.

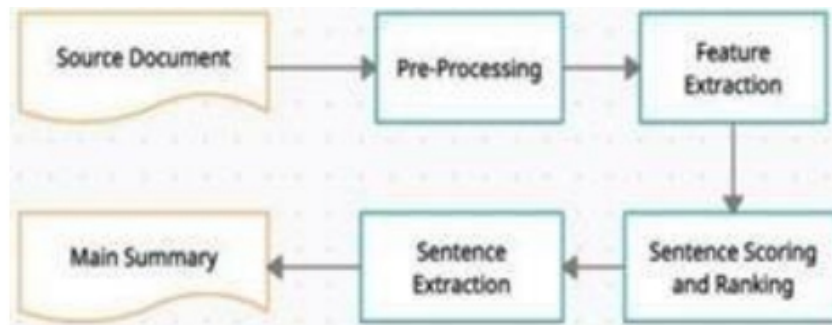


Fig 11. General Working of summarization

Automatic summarization, co-reference analysis, among other activities, serve as subtasks that help solve bigger problems. NLP is a topic of discussion today due to its many uses and recent advancements, despite the fact that the phrase wasn't even coined until the late 1940s.

Therefore, learning about the development of NLP, its history, and some current initiatives utilizing it would be intriguing. These features are the subject of this paper's second goal. The third goal of this essay is to discuss datasets, methodologies, assessment standards, and other NLP problems. The remainder of this essay is structured as follows. It discusses the first goal while referencing numerous key NLP and NLG concepts. It covers the background of NLP, its applications, and a rundown of current advancements in an unnumbered footnote on the first page.

IV. EXISTING SYSTEM

The existing system developed uses keyword identification to scan a collection of ready-made code from a database. This system comes along with a workspace which is plain and unlike the IDEs of today.

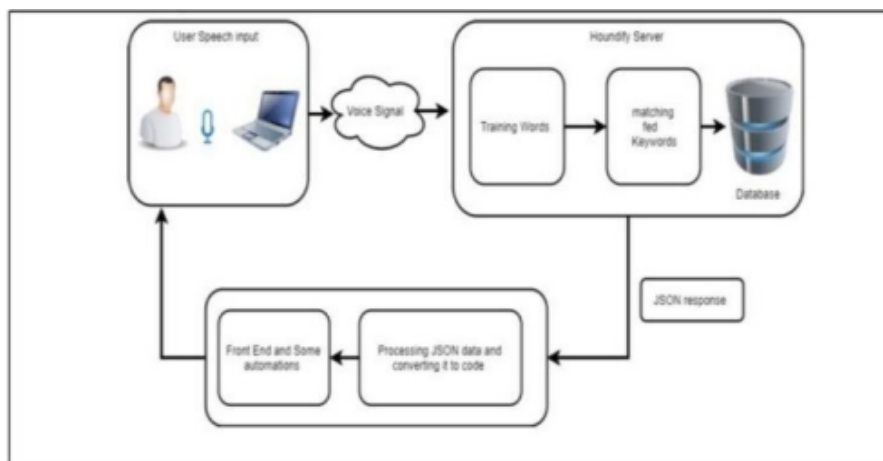


Fig 12. Existing System Architecture

The system consists of following modules:

Designing the User Workspace

Key word recognition is built into editors and notepads. The subsequent step is to retrieve the relevant code using these keywords. Through user voice commands, the resultant code can be compiled and run.

Recognition of voice

Through the use of a microphone, the system will identify the user's speech and print the associated keywords on the editor and terminal.

Using Editor and Matching Keywords

If the comparison yields a result of zero, the recognized keywords will be printed on the editor. The recognized keywords can be compared with the keywords that are stored in the database.

Assemble and run the code

Through user voice commands, the printed code can be assembled and run. The editor which comes along with this system has lack of features and functionalities compared to the existing Integrated Development Environment/ Code-Editors. So, the developers don't prefer to use this system.

V. PROPOSED SYSTEM

The proposed system involves developing a desktop application, which will not only retrieve the code snippets for certain a keyword. But, also will be able to parse single line transcription from the voice input. A dedicated transcription parser will be developed which will be able to parse sentences into equivalent python code.

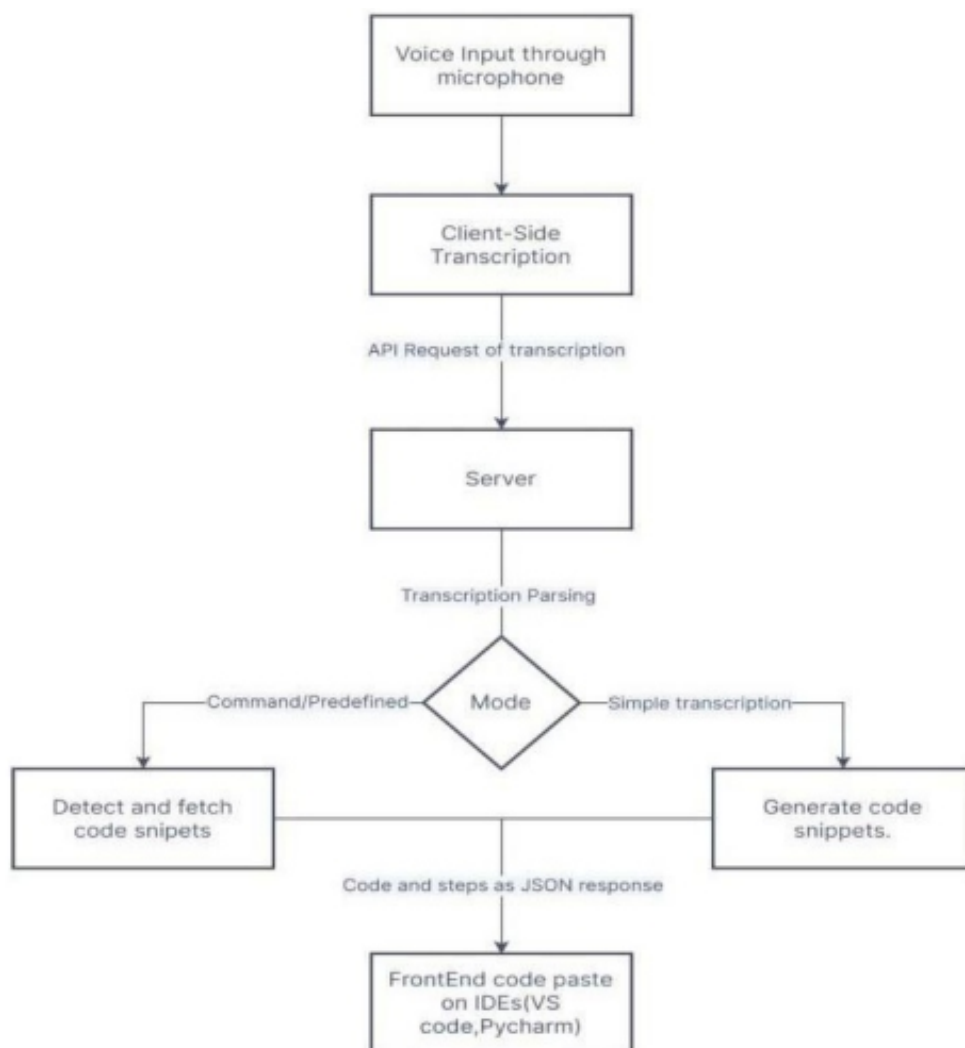


Fig.13. Proposed System Flowchart

The desktop application will not act as an editor but will be a helping assistant to the existing IDEs such as PyCharm and Code-Editors such as VS Code. The Speech-To-Text model will be trained to quickly identify some of the commonly used python keywords such as: input, def., for, while, if, else-if, class and so on. A particular syntax will be followed for each keyword so that the parser can parse the sentence correctly. The client and the server will be connected using web socket as it allows bi-directional communication between the two bodies. The server's main goal is to properly identify which sentences are to be parsed and which sentences to be scanned for code snippets in the database. The result generated by the server will consist of python code and steps for the Client side, which can be used to paste the python code on the desired IDEs/ Code-Editor.

VI. CONCLUSION

We have seen the existing techniques used to convert human speech into transcription and have also come up with an optimal solution over the existing system using natural language processing and web sockets. This solution can be used to help in lowering the overall workload on a developer and can boost productivity as well.

VII. ACKNOWLEDGEMENTS

We would like to thank Ms. Pramilarani for guiding us through this paper and assisting us in developing a workable solution by challenging us to go outside our comfort zones. We appreciate the opportunity to work on this paper and bring it to life.

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Human Emotion Based Live Music Using Deep Learning

[1] Dr D.V. Nagarjana Devi, [2] Kadava Yamuna, [3] Pallem Kartheek, [4] Gosu Likhitha

[1] Assistant Professor, CSE Dept, IIIT, RGUKT, Nuzvid, India

[2][3][4] UG student, IIIT, RGUKT, Nuzvid, India

ABSTRACT

It is often confusing for a person to decide which music he/she has to listen to from a massive collection of existing options. There are several music players like Wynk music, JioSaavan, Spotify, Gaana, etc. But they show us only weekly playlists or some singers' playlists. They all (Music Players) also use AI to recommend us songs that we used to like and play that zoner of songs. But sometimes we may feel irritated by listening to them as they do not match up with our emotions. The main objective is to play songs based on user facial expressions i.e, emotion which is captured from our PC webcam while we are working on it. It analyses the current emotion or mental state of the user. Sometimes our words may lie, but our facial expressions never lie (i.e, will never hide our feelings).

Most of the users believe that at a certain point in time it is very difficult to choose and play a song from their vast music playlist. Developing this Emotion Aware Music player, helps the user to choose the song easily and helps to reduce their level of stress. In this racing world, time is very precious, and with our project user need not search for a song that suits his current mood, it will play automatically the best music according to the user's mood.

Keywords— Human, Emotion, Live Music, Deep Learning

I. INTRODUCTION

Generally, people express their emotions through their facial expressions. And people like to listen to music to enlighten their feelings. So, capturing the user's emotions and playing appropriate songs according to his emotion can increase the calmness in his mind. This project aims to capture user emotion expressed through his facial expression which is taken by the inbuilt camera available on our computer. It will segregate the emotion from this captured picture into a few categories like Angry, Happy, Sad, Fear, Neutral, Disgust, and Surprise and plays music based on the categorized emotion.

2.1 Purpose

The project aims to lighten the mood of the user, by playing songs that cope with the user's emotions. There is a saying that music can heal wounds that medicine cannot touch. Music pleases us and releases our suffering (mental and sometimes physical suffering also). It helps to overcome depression and sadness. Many health risks can be avoided through music and there are chances to bring the mood of the user to a better stage.

2.2 Overview

This is a Python-based application that helps the user to play a song based on the emotions that he currently carries. Nowadays listening to music while working became a habit for all. So, to listen to

music, he/she needs to search for them, but our project helps users to listen to music without searching. It will play automatically based on user emotion.

2.3 Scope

The scope of this application is wide as it can be used by anyone, anywhere, and anytime. This application helps the user to change his/her mood to a joyful one as music helps people to change their mood. This application also acts as a stress booster which boosts emotions to a great extent.

II. ANALYSIS OF EXISTING AND PROPOSED SYSTEMS

2.1 Problem Statement

Music is one of the most effective media as it can install deep feelings and swamp listeners with subliminal messages. It deftly plays with our emotions which in turn play at mood. It can aid us when we are feeling low and empower us. To enhance the mood of the user by designing a system that detects the emotion and plays the music accordingly. The main aim of this project is to play a song based on the emotion of the user who uses the application.

2.2 Existed System

The existing system will play a song based on the user's request that he/she requests the player play this song or that song. He manually requests the song. It saves the user data that he/she likes which they prefer more and suggest that type of song all the time. And it plays songs that relate to the singer which he used to listen to most of the time. Or it plays a song based on recent hits, weekly, and monthly hits.

2.2.1 Disadvantages of Existed System

Manual

Manually searching the desired song from plenty of playlists.

Cached & History Based Cached-based songs and typing history will lead to suggestions for some sort of songs, but it's not based on the current emotion of the user.

Random Pickups

Random Weekly/Monthly hits suggestions from music application

Ex: Spotify, Wynk, etc.

III. PROPOSED SYSTEM

Considering the issues in the existing system our proposed system benefits us to present interaction between the user and the music player. The purpose of the system is to capture the face properly with the camera. Captured images are fed into the Convolutional Neural Network which predicts the emotion. Then the emotion derived from the captured image is used to get the playlist of songs using an audio tool. The main aim of our proposed system is to provide a music playlist automatically according to the user's moods, which can be happy, sad, angry, fearful, disgusted, or surprised. We chose the Jupyter platform which solves all the issues of the previous system. So, it can avoid manual systems.

3.1 Advantages of the Proposed System

Automatic Recommendation of the music

Accuracy around 90%

Easy to use Accessible from any where

IV. MODEL

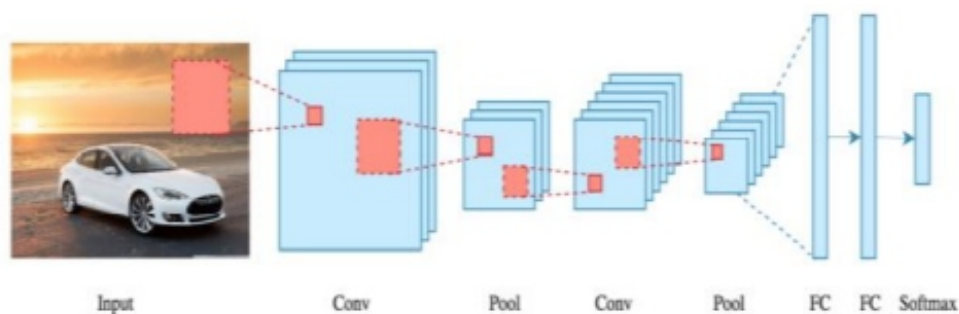
In our model, we are using deep learning CNN Algorithm and sequential model. As we know CNN algorithm works better for image-related training and testing. We are using the CNN algorithm rather than other algorithms.

4.1 Deep Learning

Deep Learning is a kind of machine learning which includes many neurons for dealing with a big amount of data with good accuracy. Deep learning is an element of data science, which includes statistics and predictive modeling. It helps the data scientist who has to work with a large amount of data. It makes their task easier and faster. Machine learning algorithms are linear whereas deep learning algorithms are stacked in a hierarchy of increasing complexity and abstraction. Therefore, deep learning works better than traditional machine learning when working with complex feature inputs and a large amount of data.

4.2 CNN Algorithm

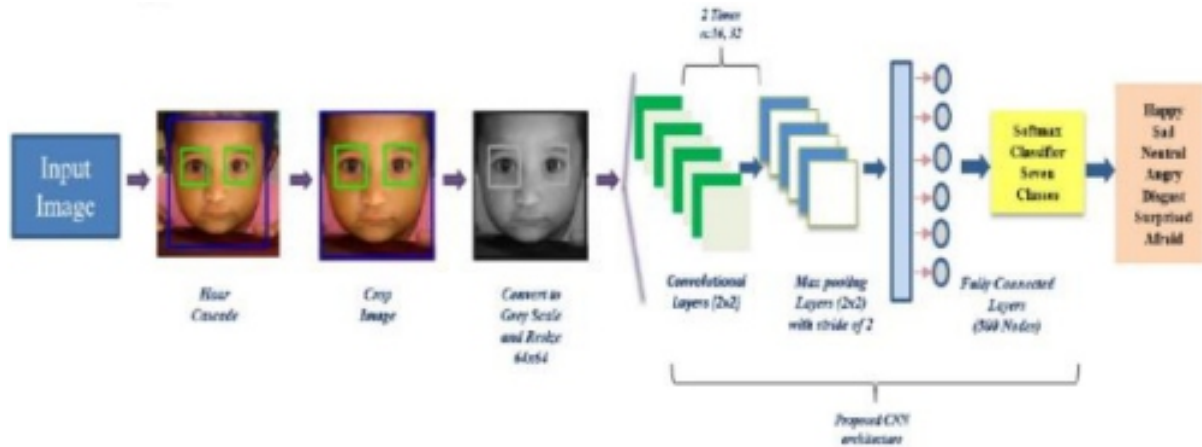
In deep learning, a convolutional neural network (CNN/ConvNet) is a class of deep neural networks, mostly applied to analyze visual images. It works best when we are working with images rather than other algorithms. CNN uses a special technique called convolution instead of matrix multiplications like the other neural networks.



Convolutional neural networks consist of one input layer, one output layer, and many hidden layers. These layers are composed of many artificial neurons. Artificial neurons are mathematical functions that calculate the weighted sum of multiple inputs and output an activation value. When we give input to ConvNet, each layer generates several activation functions that are passed onto the next layer to activate the neurons in that layer.

The first layer usually extracts basic features from the input image such as horizontal or diagonal edges. The output of the previous layer moves on to the next layer which determines more complex features of that image such as corners or combination edges. As it moves deeper into the network it can identify even more complex features from it such as the faces of people.

Based on the activation map of the final convolution layer, the classification layer outputs a set of confidence scores (probability values between 0 and 1) that specify the image likely to belong to a “class”.



4.3 Sequential Algorithm

A sequential algorithm executes sequentially from starting to ending one layer at a time. In the CNN algorithm, a sequential model means, it is an arrangement of a linear stack of layers of ConvNet.

4.4 Layers and Activation functions

Our model consists of several layers and to activate neurons in those layers we have used a few activation functions. The layers are the Convolution layer, Max Pooling, Dropout, Flatten, and Dense. Activation functions used are Relu and Softmax. While compiling we have used adam optimizer, categorical cross-entropy loss.

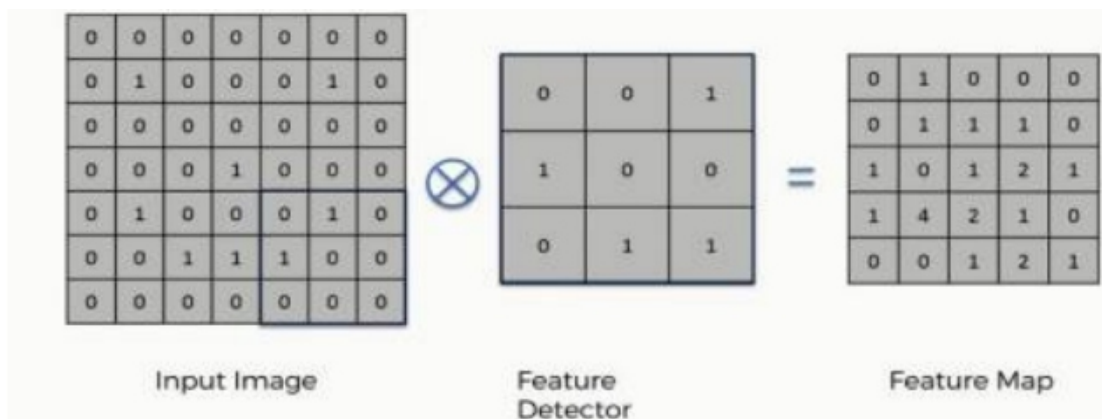
In the convolution layer if our input image is of size $N \times N$ and the kernel w is of size $m \times m$ then our output of the convolution layer is $(N-m+1) \times (N-m+1)$. The mathematical function for this layer is

$$x_{ij}^{\ell} = \sum_{a=0}^{m-1} \sum_{b=0}^{m-1} \omega_{ab} y_{(i+a)(j+b)}^{\ell-1} \quad [8]$$

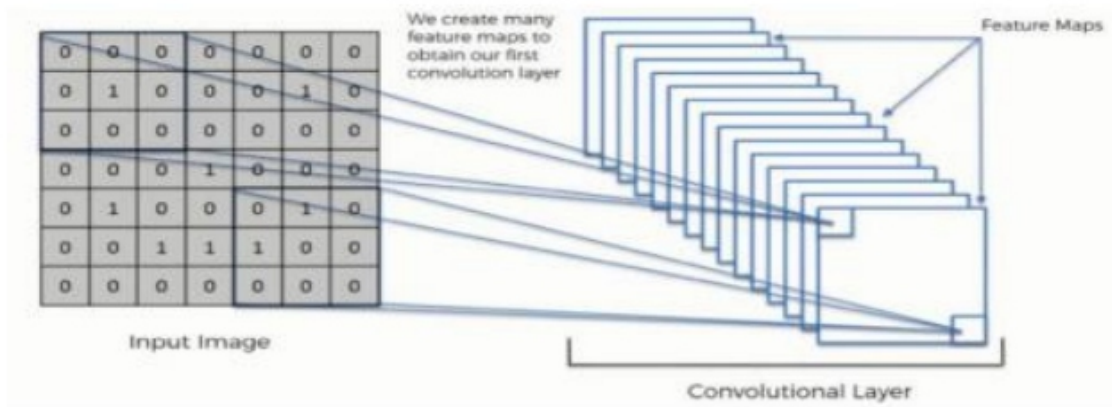
$$\text{conv2}(x, \omega, \text{'valid'})$$

Then, the convolutional layer applies its nonlinearity:

$$y_{ij}^{\ell} = \sigma(X_{ij}^{\ell}) \quad [8]$$



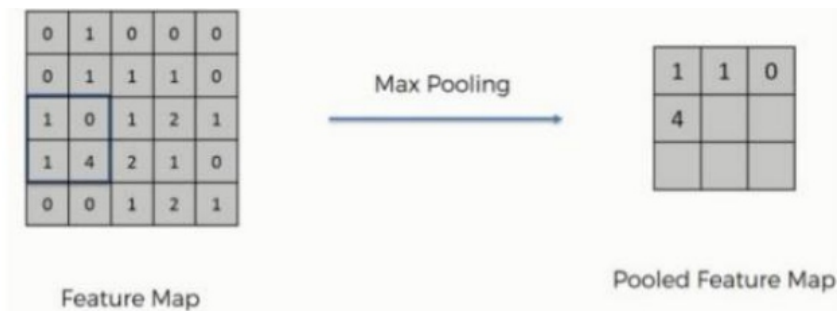
Feature Map generation through convolution operation [9]



Creation of Convolution Layer [9]

In jupyter notebook, `classifier.add(Conv2D(32, (3, 3), input_shape = (128, 128, 3), activation = 'relu'))` (3,3) is the kernel size and the input shape of the image is given as (128,128,3), and to activate the neurons we are using the relu activation function.

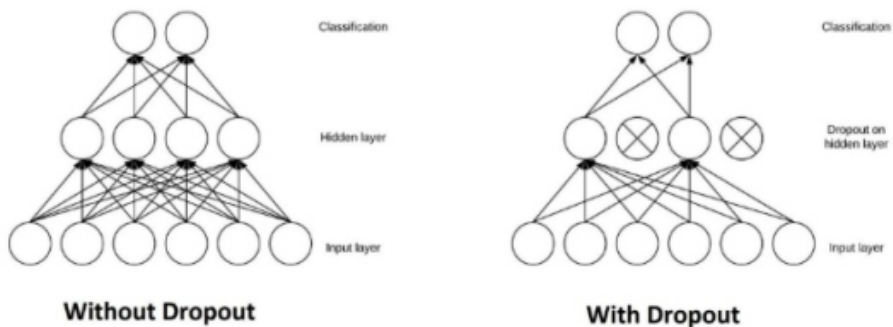
Max pooling is a pooling operation in which it selects the maximum elements from the region of the feature map covered by a filter.



Maximum Pooled Feature Map [9]

Dropout determines which neuron should be considered for further layer. It randomly deactivates some neurons. So, it reduces the complexity.

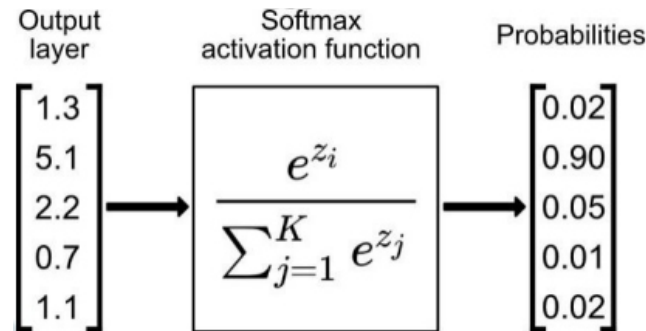
$$q=1-p$$



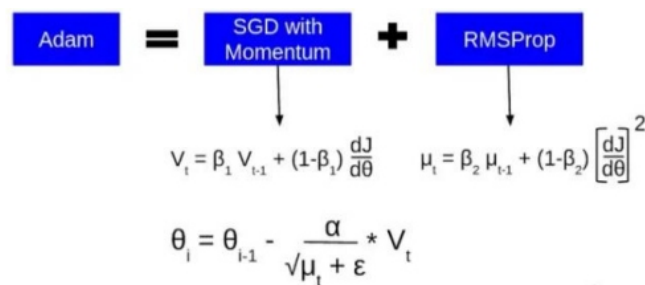
Flatten layer is used to convert the 2D into 1D for inputting into the next layer.
 The dense layer is used in the final stage of the neural network to classify the image.
 Relu is simple to compute it outputs the input directly if it is positive and zero if it is negative

$$f(x) = \max(0, x)$$

Softmax is used to convert the raw outputs into probability values.



Adam optimizer is used for optimizing gradient descent. Adam optimizer is a combination of RMSProp and SGD with Momentum optimizers.



Adam optimizer function [10]

V. MAIN FUNCTIONALITY

Emotion Aware Music is a Python-based application, which helps the user (player) to play a song based on his/ her current emotion and helps the user to get more focussed on work. Emotion Aware Music acts as a medium to make users more focused on work by playing some music based on their emotions. The application does not tell the user that it was capturing the image. This makes the application capture the original natural facial expression so that better accuracy can be achieved.

5.1 Image Capturing

To utilize this application, the user has to give access to the webcam. Then the image is captured from the webcam without the user's intimation to record the natural emotion. Based on the image captured, the emotion is detected.

5.2 Image Classification

After successfully capturing the image, the emotion is classified into 6 different types: Happy, sad, anger, surprise, fear, and disgust. The image is passed on to the neural networks which classify it into one

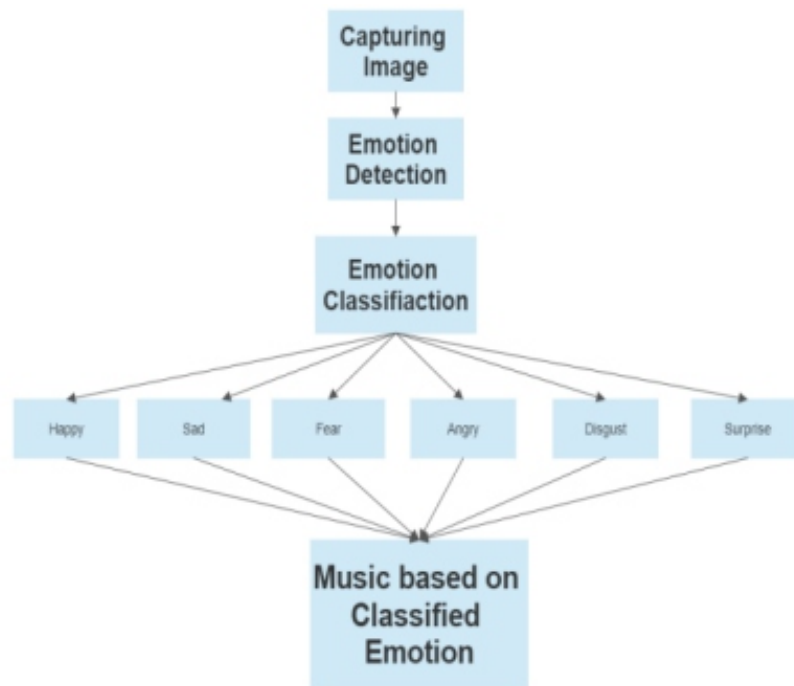
of these six emotions and the music is played based on the classified emotion.

5.3 Music Based on Classified Emotion

The classified emotion is recommended to the user and the song related to the emotion will be played from the music library.

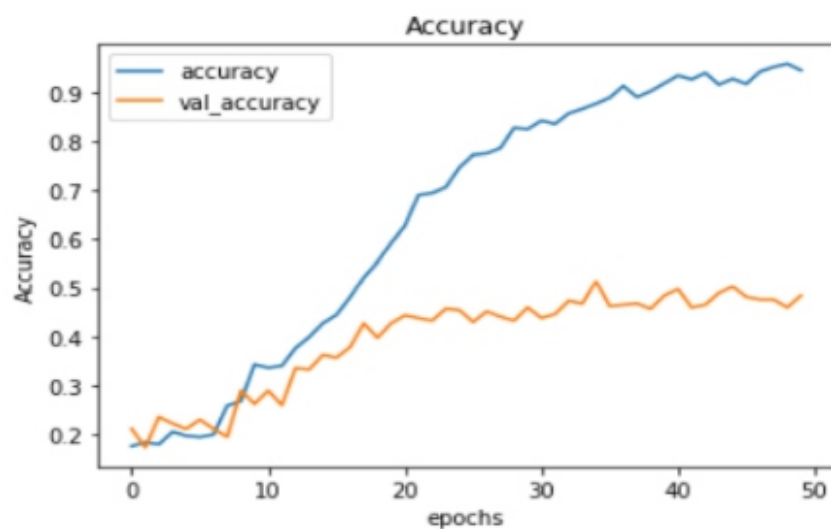
VI. ARCHITECTURE

Architecture diagram

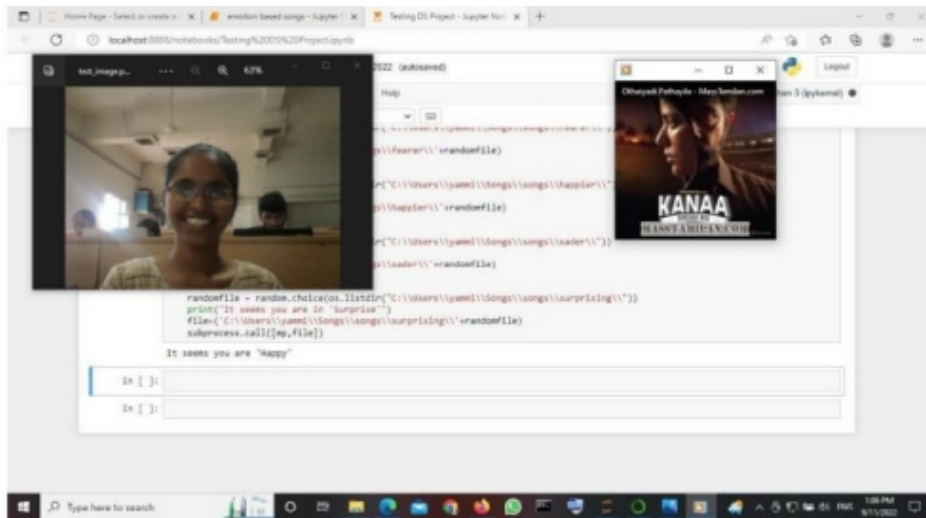


VII. ACCURACY

We have used Adam optimizer and categorical cross entropy as loss. We have got an overall accuracy of 94% on the training set and val_accuracy of 49% on the validation set.



VIII. OUTPUT



IX. CONCLUSION AND FUTURE SCOPE

Our application is a one-stop solution to all the issues and disadvantages of the existing system of various music players and music websites which don't use user emotion and use a search bar to play songs. This saves a lot of time and energy for the users. This enables the user to listen to the music without searching for it. This is just an application of the idea based on the disadvantages of the existing music player system. There are a lot of scopes to improve the application by training different users.

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Breast Tumour Detection using Deep Convolutional Neural Networks

[1]Himashri Mehra, [2]Anushka Singhania, [3]Anu Narera, [4]Neha Singh
[1][2][3][4] Indira Gandhi Delhi Technical University for Women, New Delhi, India

ABSTRACT

Breast cancer is one of the most fatal cancers for women. Because of its high mortality rate, it is becoming a necessity for the researchers to come up with models for precise detection of disease and subsequent treatments. By doing this, the researchers will not only promote the new technology but also contribute to the mankind. We are also trying to do the same. This paper proposes the semantic image segmentation of breast tumour using ResUNet model. The proposed model attained a high accuracy of 0.9871 on our training dataset. The complete empirical analysis along with the exhaustive literature review is presented in the paper.

Keywords— Breast Tumour, ResUNet, Semantic Image Segmentation, U-Net.

1. INTRODUCTION

Worldwide cancer ranks foremost reason for death before the age of 70 years across 91 out of 172 nations. As stated in the GLOBOCAN report of 2018, 9.6 million deaths were documented and 18.1 million new cancer patients were reported globally. The 2018 report on medical certification reveals cancer as the fifth prominent reason of death by estimating 5.7% of all deaths in India [1]. In India, GLOBOCAN data 2020, breast cancer accounted for 13.5% of all cancer cases and an estimated 10.6% of all deaths with a cumulative risk of 2.81% [2]. There is a rapid upsurge in breast cancer cases both in rural and urban areas. Survival rates of cancer patients decline with the higher stages of cancer growth. In India, stage 3 and stage 4 breast cancer affects more than 50% of female patients. According to statistics, Indian women had a 60% post-breast cancer survival rate compared to an 80% rate in the USA. The younger age group is reported to have a higher incidence of breast cancer. Moderately 50% of all cases are in the 25-50 demographic range. The above-cited concern depicts the lack of awareness among the masses which led to delays in diagnosis and higher mortality rates. Another prominent reason for the low breast cancer survival rate is low-grade early screening and diagnosis rates. The efficiency of screening programs relies on considerable elements and one of them is a fitting instrument for diagnosis to accurate execution. That can be accomplished by the application of data science methods in image processing as image segmentation.

II. LITERATURE REVIEW

One of the utmost perplexing problems in medical image analysis is distinguishing the pixels of organs or lesions from background medical pictures like CT, MRI, or Ultrasound Images in order to provide essential information on the shapes and volumes of these organs. Hesamian et al. [3] proposed models that have been examined over the years that presented diverse automated segmentation systems by applying available technologies. The exemplified approach encloses Convolution Neural Network (CNN), 2D CNN, 2.5 CNN, 3D CNN, Fully Convolution Neural Network (FCN), Cascaded FCN (CFCN), FCN for multi-organ segmentation, Multistream FCN, U-Net, V-Net, Convolutional Residual

Networks (CRNs), Recurrent Neural Networks (RNNs) that have utilised deep-learning techniques for medical image segmentation. Deeper networks are proven to have adequate performance regardless there are some challenges in conditioning deep models like overfitting, training time, gradient vanishing, and 3D challenges.

For the categorization of breast ultrasound images, Inan et al. [4] constructed an end-to-end integrated pipeline and evaluated image pre-processing techniques including K Means++ and SLIC, furthermore four transfer learning models such as VGG16, VGG19, DenseNet121, and ResNet50. The combination of SLIC, U-NET, and VGG16 exceeded all other incorporated sequences by a Dicecoefficient score of 63.4% in the segmentation step and precision and the F1-Score (Benign tumour) of 73.72% and 78.92% in the classification stage. The proposed automated pipeline can be successfully implemented to aid medical practitioners make precise and prompt diagnosis of breast cancer.

Tarighat[5] presented breast tumour segmentation employing a DCNN by U-Net. This postulated U-Net model contains an asymmetric expansion path for precise localization and a contractile path to capture the background, yielding an IOU of 68% and an all-around accuracy of 91%.

Aimed at the objective of segmenting breast mass in full extent mammograms, Zaho et al. [6] presented an unexplored adaptive channel and multiscale spatial context network. The two open datasets, CBIS-DDSM and INbreast, a ResNet model and a detailed ACMSC component are incorporated and tested. The network can understand different feature maps because of the ACMSC module's multilevel embedding, which yields 84.11% INbreast and 82.1% CBIS DDSM of dice coefficients correspondingly.

Anand et al. [7] suggested a ResUNet model for breast tumour segmentation. The suggested framework includes the residual network technique that improves performance and exhibits an enhanced training procedure and implementation of ResUNet, which was examined with conventional U-Net, FCN8, and FCN32. On the MRI dataset, the suggested model's overall accuracy was 85.32%, with a dice coefficient of 73.22%.

A two-stage approach suggested by Wu et al. [8] uses contrast images for the segmentation of breast tumour, constructs the breast ROI, and then directs an attention network to differentiate between carcinogenic regions and healthy breast tissue. The suggested model delivers a compelling cancer segmentation resolution for breast analysis operating DCE-MRI, resulting in a 91.11% Dice coefficient for breast tumour segmentation.

As a means to solve the sparse data reconstruction problem, Zhang et al. [9] introduced a unique DL-MITAT way and used it to identify breast cancer. The system used is the domain transform network termed FPNNet + ResUNet. To evaluate the efficacy of the DL-MITAT strategy, ex-vivo and simulation tests using breast phantoms were performed.

Generated images give in-depth explanations on the capacity and limitations of the suggested method and are of preferable quality and contain fewer artifacts than those produced by a traditional imaging method.

In order to accurately segment mass lesions in mammogram images, Abdelhafiz et al. [10] suggested a residual attention U-Net model, succeeded by a ResNet classifier to categorise the identified binary segmented lesions either benign or malignant. To retain the more dimensions and contextual data, which helps the network to tackle gradient disappearing challenge and have a multi layered structure, residual attention modules were introduced to the U-Net model.

III. METHODOLOGY

Flowchart of the proposed methodology is shown in Fig. 1.

A. Dataset Description

The dataset, which analyses ultrasound scan images of breast cancer, was obtained from Kaggle [11].

Breast ultrasound images taken among women between the ages of 25 and 75 are part of the preliminary information. In total, there are 600 female patients. The collection consists of 780 photos, each measuring 562 by 471 on average. The images are PNG files. In addition to the original images, ground truth images are also displayed. Three categories - benign, malignant and normal, are further used to group the images

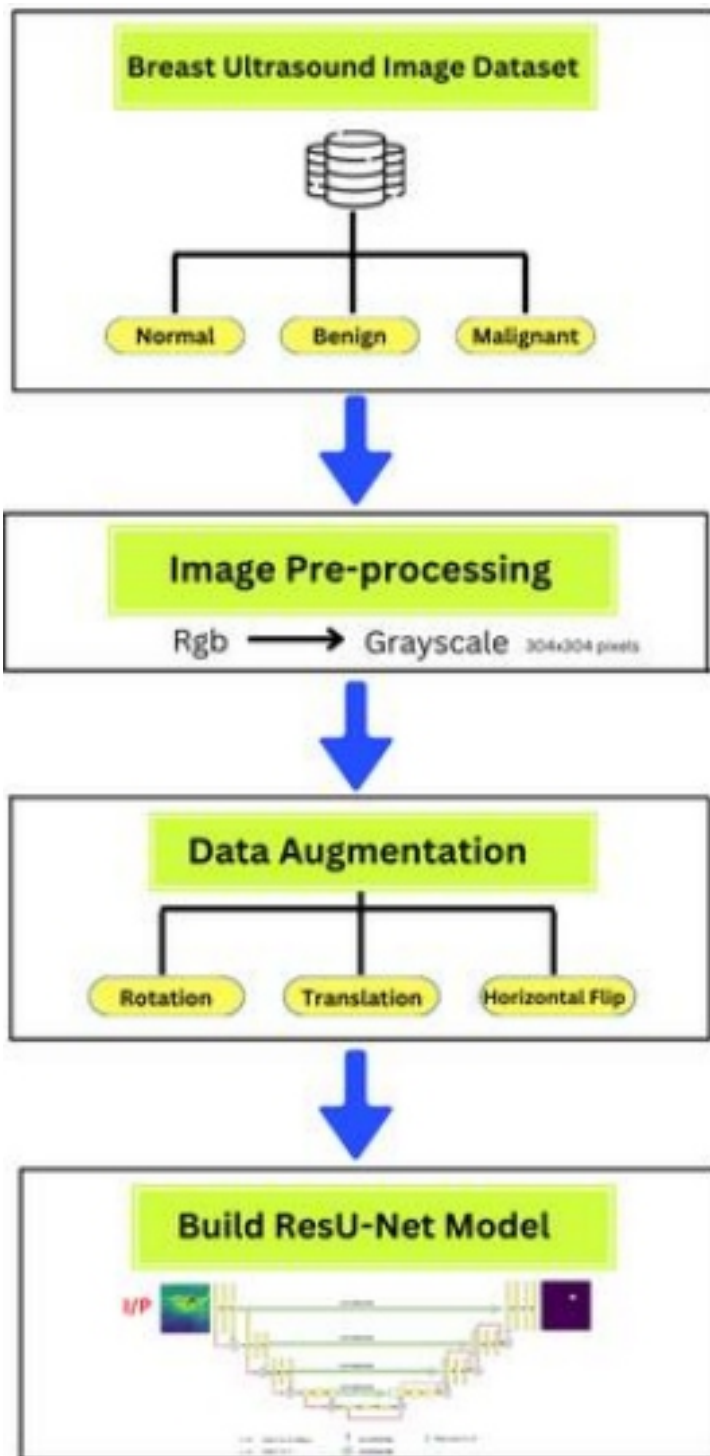




Fig. 1: Flowchart of the proposed methodology

B. Image pre-processing

Since every image in the dataset has a different shape, there is a possibility of occurrence of an error when the images are run through the proposed framework. To address this issue, we converted all of the breast ultrasound images and mask images into (304 x 304) forms. The mask images were converted from RGB format into grayscale to save time. In Fig. 2 and Fig. 3, we can see a set of original and modified images respectively.

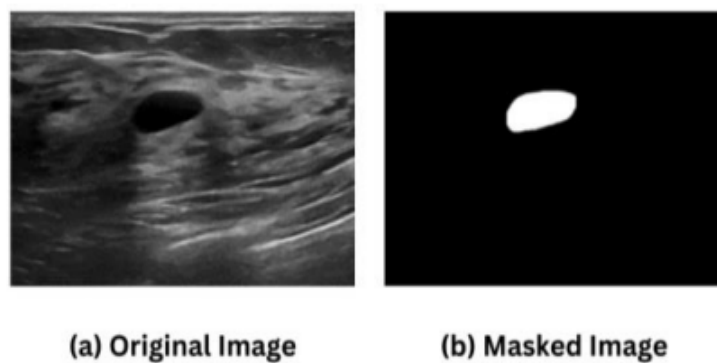


Fig. 2: Original (a) Breast Ultrasound image of size (562 x 471 x 3) and (b) Masked image of size (562 x 471 x 3)

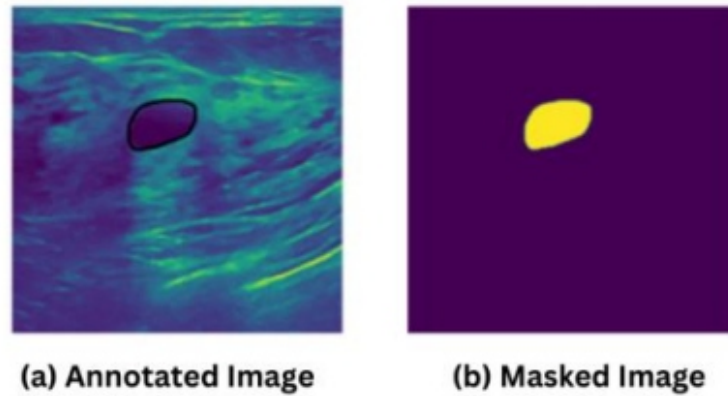


Fig. 3: Modified (a) Annotated Breast Ultrasound image size (304x304x3) and (b) Masked image of size (304x304x1)

C. Data Augmentation

One of the most efficient ways for increasing the amount of dataset is to use the image augmentation technique, which is a method of altering the original images through the application of several transformations, along with the generation of numerous altered versions of the same original image. For the purpose of preventing our proposed method from resulting in a fragile solution that will fail because it was trained only on a small image dataset, augmentation is performed on the dataset so that every single new batch that is passed over to the proposed method observes a slight variation in the dataset each time. Even though the data will change constantly, as a result, this will allow the proposed method to be able to generalise solutions and unseen data effectively. For performing image augmentation, KerasImageDataGenerator class has been applied. The input of the original image data is obtained using the KerasImageDataGenerator, which transforms the input data randomly, and produces a result that solely comprises the newly altered data. With the ImageDataGenerator, two distinct functions were defined: one for the original images and the another one for masked images. For the purpose of increasing the generalisation of the model entirely, data augmentation is carried out using the Keras picture data generator class. Through the image data generator, the data augmentation operations involving rotations, translations, shear in, scale adjustments, and horizontal flips, were performed randomly.[12]

D. Proposed ResUNet approach for Semantic Segmentation

In this study, we propose the Deep Residual U-Net (ResUNet) [13] for semantic segmentation of breast ultrasound images. In view of the advantages of the U-Net [14] architecture and Deep Residual Learning, we have proposed the ResUNet architecture. The architecture of ResUNet combines ResNet [15] architecture's residual block with the U-Net architecture. The residual block, pooling layer, and convolutional layer have all been adjusted. The residual block is included after an up-sampling layer to handle the segmentation of intricate structures and two convolutional layers to regenerate the feature space, prior to fusing the down sampling layer's feature map. The residual block improves the learning effectiveness and even reduces disappearing gradient problems when introduced to the U-Net architecture. It has two distinct branches, namely the trunk branch and the mask branch. The trunk branch comprises the convolution layers, Batch Normalisation processes (Bns), and Rectified Linear units (ReLus). In the absence of the skip association, the residual block is useless. The skip connection

block are depicted in Fig.4. Within the mask branch, in order to establish identity mapping, the input and output are connected using the skip connection.

If x denotes the input, a complex mapping function is denoted by $H(x)$ between the input images and the output feature maps, and $F(x)$ denotes the residual training function; we get

$$F(x) := H(x) - x \quad (1)$$

$$\text{which implies } H(x) := F(x) + x \quad (2)$$

The residual block is formed by stacking the residual units in a sequential form, with the output of i th layer y_i of the residual unit [16] being defined as:

$$y_i = h(x_i) + F(x_i, W_i)x_{i+1} = f(y_i) \quad (3)$$

Where f denotes the activation function, W_i indicates the weight of the network that needs to be learned. If all the continuous layers are considered, f corresponds to identity mapping, where, $x_{i+1} \equiv y_i$, then we have

$$x_l = x_i + \sum_{j=i}^{l-1} F(x_j, W_j) \quad (4)$$

Using the back propagation rule, the gradient of (4) can be calculated:

$$\frac{\partial \epsilon}{\partial x_l} = \frac{\partial \epsilon}{\partial x_l} \frac{\partial x_l}{\partial x_i} = \frac{\partial \epsilon}{\partial x_l} \left(1 + \frac{\partial}{\partial x_l} \sum_{j=i}^{l-1} F(x_j, W_j) \right) \quad (5)$$

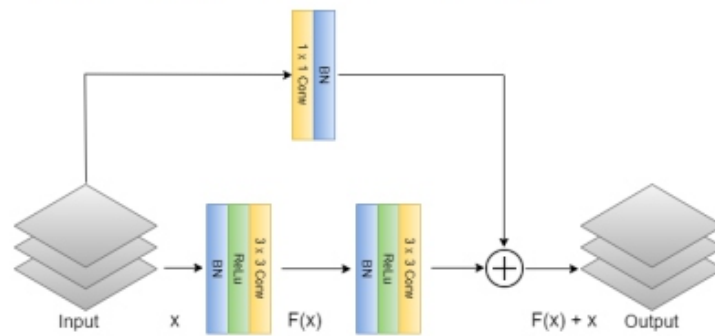


Fig. 4: Skip connection and residual block

The gradient $\frac{\partial \epsilon}{\partial x_l}$ will never be zero if the term $\frac{\partial}{\partial x_l} \sum_{j=i}^{l-1} F(x_j, W_j)$ is not -1 , which in practical terms, cannot always be -1 for every sample in a small batch. This makes sure that while the network is being trained; the gradient always runs smoothly and disappears less frequently. In the residual block, the tensor size undergoes no change. To ensure computational performance, the ResUNet has a consistent number of convolutional layers throughout all the residual blocks.

For this study, the feature map before and after the convolution are combined, in order to effectively combine the overall image features with its intrinsic features. The output of convolution utilizes the feature maps from the two components of concatenate after the feature maps have been combined. Convolutions are used in this procedure to obtain high dimensional features while preserving the initial dimensional features, hence, effectively fusing features at various scales and confirming accurate

segmentation.

The dimensions of the feature map and the amount of convolution filters are increased by a factor of two each time the feature map is applied to a residual unit. For confirming that forward processing is generated on the same gradient as the maximum, the data are batch normalised at every residual unit. The proportion of sample data utilised in the backward computation will also be similar to that of the forward computation. This produces a uniform distribution, enables significant adjustments in weight, and prevents the issue of disappearing and exploding gradients during training.

E. Model Architecture and Training

Fig. 5 illustrates the entire system architecture of the proposed ResUNet model. Each convolutional block throughout the network's encoding unit is made up of Recurrent Convolutional Layers (RCLs), to which 3 x 3 convolutional filters are incorporated. These are accompanied by batch normalisation layers, which are preceded by ReLU activation layers. With the support of the activation layer ReLU, the sparse model is able to more effectively extract pertinent features and fit the data for training to enhance the convergence of network. A 1 x 1 convolutional layer is applied in between each of the convolutional blocks for downsampling, followed by a 2 x 2 Max Pooling layer. Each convolutional block in the decoding unit is composed of three types of layers in total, consisting of a concatenation layer, a convolutional transpose layer and two convolutional layers.

Then, using 1 x 1 convolutional filters and a sigmoid activation function, the features are projected to the feature map for output. The parameter threshold (T) is empirically adjusted at 0.5 to form the segmented region. The training involves the validation of 10% of the sample data. We keep track of the losses during evaluation and set the patience as 10. The batch size is specified as 6, owing to the physical memory limitations of the GPU. The Adam optimizer [17] is for training the model and the learning rate is set as 1×10^{-4} .

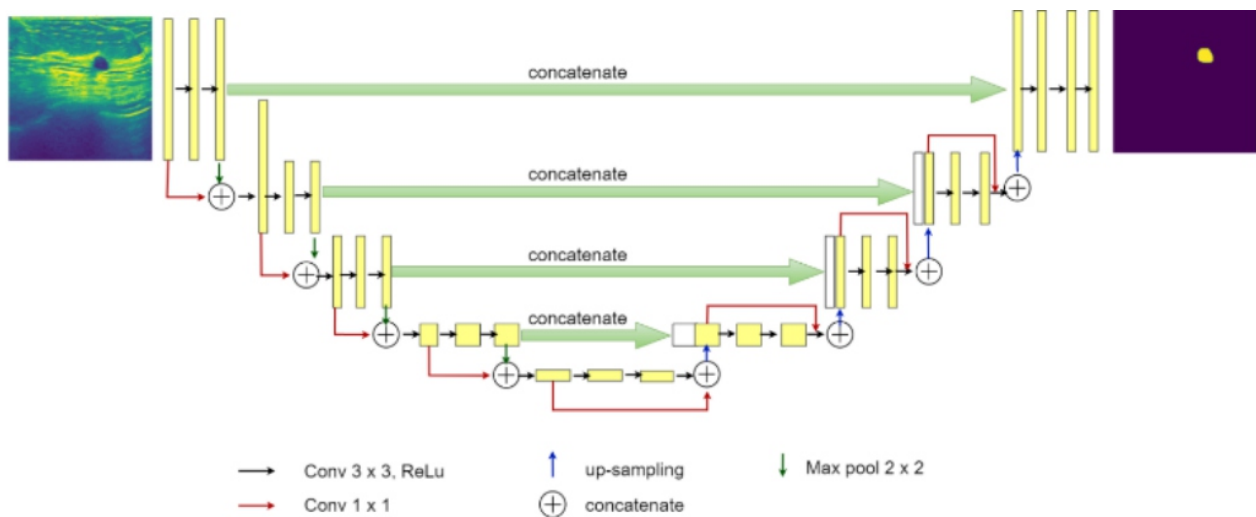


Fig. 5: ResUNet Architecture

F. Evaluation Metrics

A variety of metrics are taken into consideration for conducting the quantitative analysis of the experiment, including Binary Cross Entropy Loss (log loss), accuracy (AC), dice coefficient (DC), specificity (SP) and sensitivity (SE), Area Under the Curve (AUC) and Receiver Operating

Characteristics (ROC) curve. Semantic segmentation aims to predict whether pixels in an image belong to an object or not. As a result, this problem can also be described as a pixel-by-pixel binary classifier problem. Therefore, for both training and validation, the loss function based on Binary Cross Entropy is used. If the prediction of model for an input image, is taken as z and its ground truth is y , then the Binary Cross Entropy or log loss J for a batch of n images is as follows:

$$J = \frac{1}{n} \sum_{i=1}^n -(y_i \log z_i + (1 - y_i) \log(1 - z_i)) \quad (6)$$

The accuracy and sensitivity are calculated using (7) and (8) respectively.

$$AC = \frac{TP+TN}{TP+TN+FP+FN} \quad (7)$$

$$SE = \frac{TP}{TP+FN} \quad (8)$$

Moreover, specificity can be calculated using (9).

$$SP = \frac{TN}{TN+FP} \quad (9)$$

Where TP indicates True Positive, TN refers to True Negative; FP and FN refer to False Positive and False Negative respectively.

According to [18], DC is stated in (10). The terms "ground truth" (GT) and "segmentation result" (SR) are used here.

$$DC = \frac{2|GT \cap SR|}{|GT| + |SR|} \quad (10)$$

IV. RESULTS AND DISCUSSION

Table I shows the experiment results for both U-Net and the proposed ResUNet. The proposed ResUNet model observes an accuracy of 0.9871, which exhibits an improvement over the accuracy of U-Net, which is 0.9703, by 1.73%. Similarly, the values observed for sensitivity and specificity by ResUNet are higher than that of U-Net. ResUNet observes a much higher AUC, which is 0.9688, 50.41% higher than that of U-Net. In addition, for ResUNet, the average DC calculated in the validation phase is 0.4352, which is significantly better in comparison with U-Net. The log loss obtained for ResUNet is considerably less than that for U-Net.

For qualitative analysis, the overall segmentation results obtained by U-Net and the proposed ResUNet are shown in Fig. 6 and Fig. 7 respectively. The input images are displayed in the first column, the ground truth in the second, the predicted outcome in the third, and the predicted binary outcome in the fourth. In most of the segmentation results generated by ResUNet, with nearly the same shape as the ground truth, the targeted lesions are satisfactorily segmented.

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TABLE I: Experimental results of U-Net and ResUNet for Breast Ultrasound Images Semantic Segmentation

Metrics	Model	
	U-Net	ResUNet
Log loss	0.4351	0.0350
AC	0.9703	0.9871
AUC	0.6441	0.9688
SE	0.6863	0.9763
SP	0.6444	0.9999
DC	0.0494	0.4352

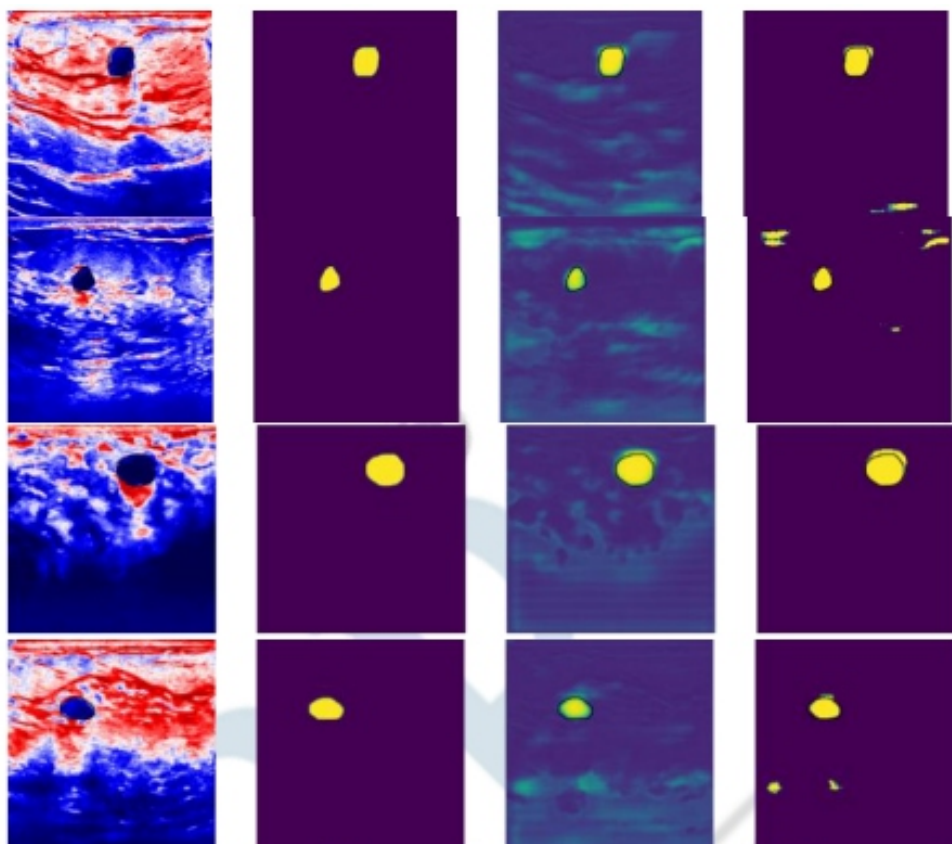


Fig. 6: Input Image, Ground Truth, Image Predicted, and Image Predicted Binary of the U-Net model

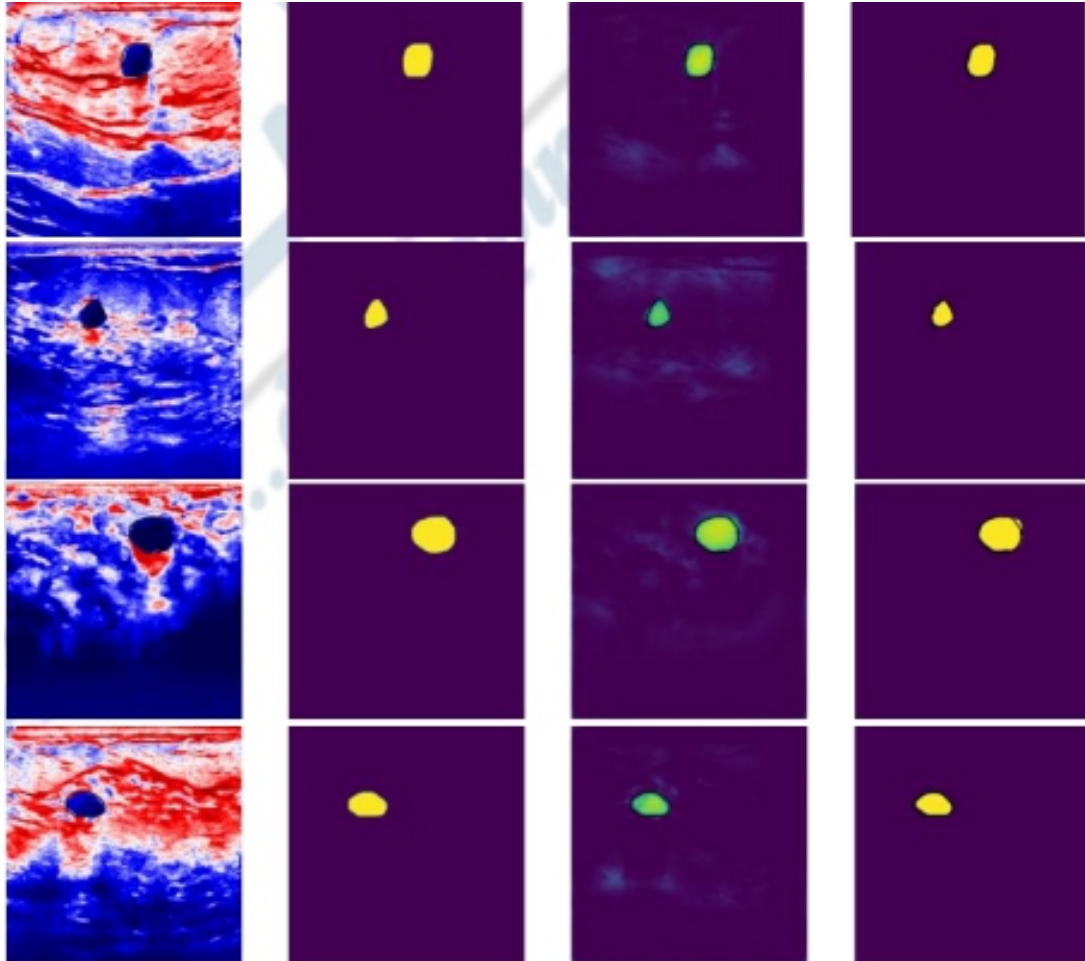
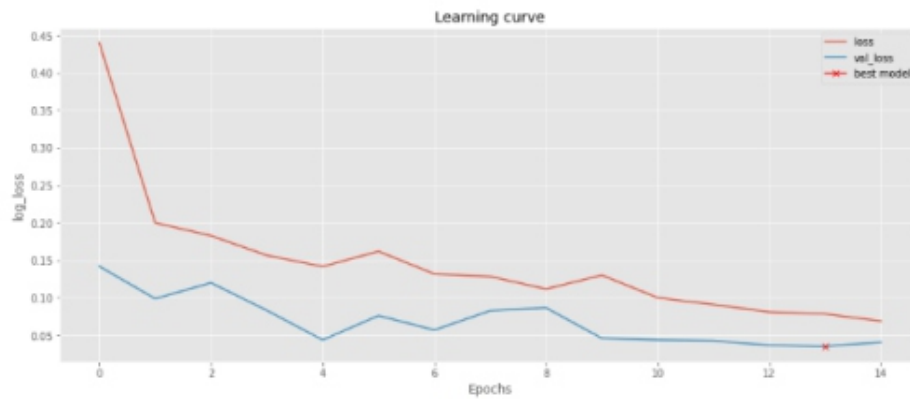


Fig. 7: Input Image, Ground Truth, Image Predicted, and Image Predicted Binary of the proposed ResUNet model for the same set of input images as in Fig. 6

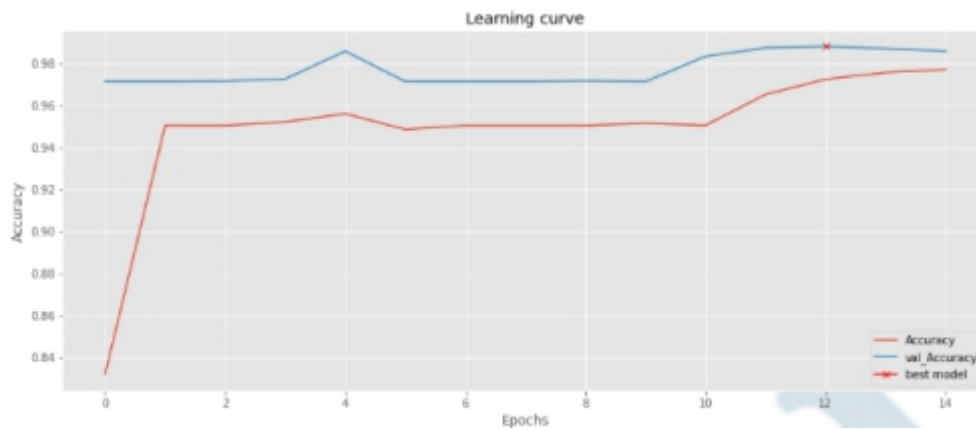
Obviously, U-Net roughly distinguishes the lesions, but because of its complex structure, it is unable to accurately identify solely the targeted region. For instance, U-Net can easily misinterpret some lymph nodes and the surrounding tissue for lesions. The proposed ResUNet is able to comprehend the images from a variety of perspectives and offers better segmentation accuracy than the traditional UNet, due to its powerful feature extraction capability.

Fig. 8 shows the plot of log loss, accuracy, dice coefficient and ROC curve during training and validation when using the dataset with ResUNet. Fig. 9(a) and Fig. 9(b) show that the proposed ResUNet model provides lesser loss and better accuracy respectively, in comparison with U-Net for both the training and validation phases. Fig. 9(c) shows the remarkable improvement of ResUNet for the values of DC over U-Net. The ROC with AUCs for U-Net and the proposed ResUNet are shown Fig. 9(d). In comparison

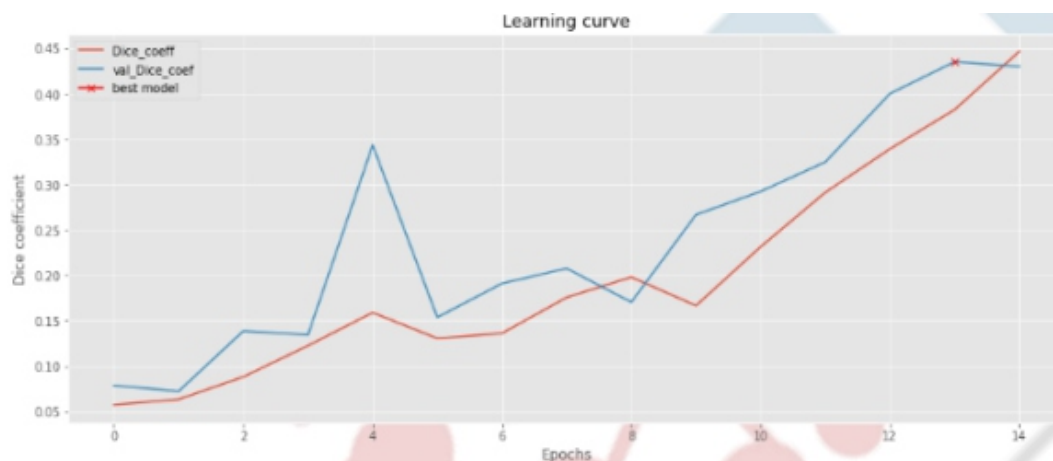
with U-Net, the proposed ResUNet achieves a higher AUC. This eloquently underlines the reliability of the proposed ResUNet model in the overall image based semantic segmentation problems.



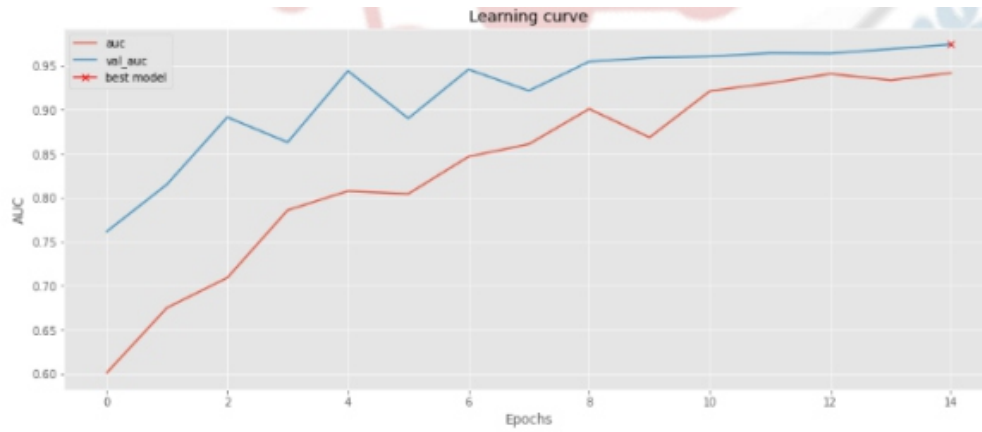
(a)



(b)

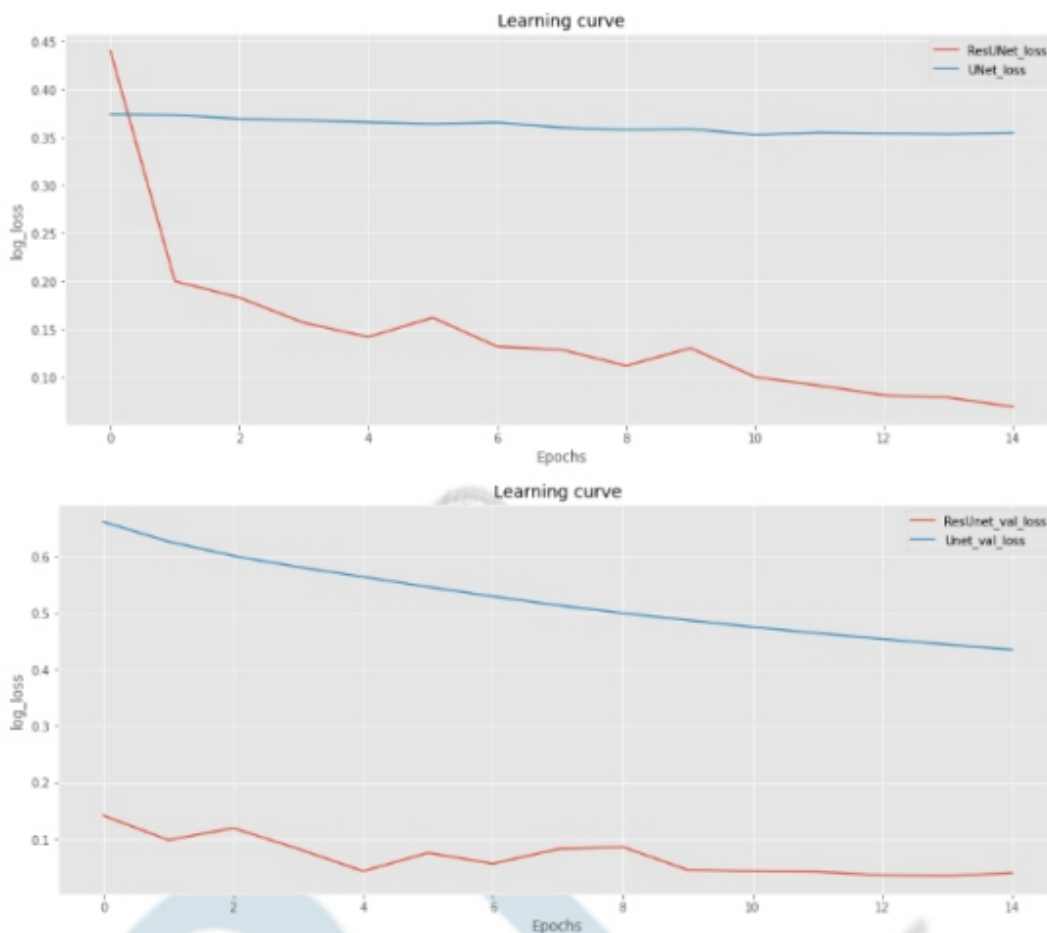


(c)

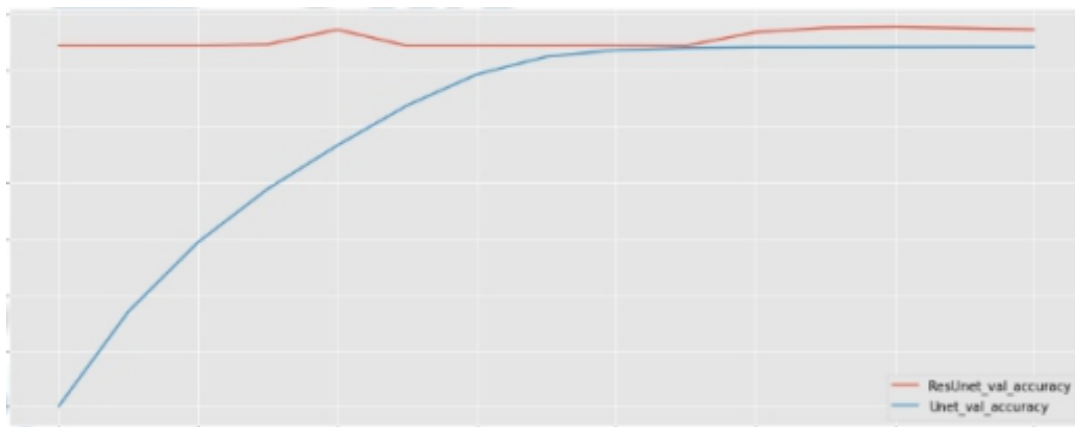
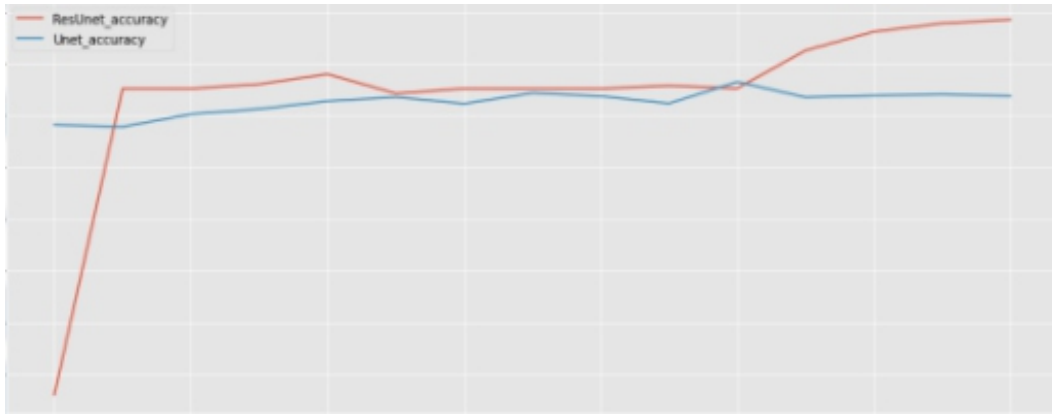


(d)

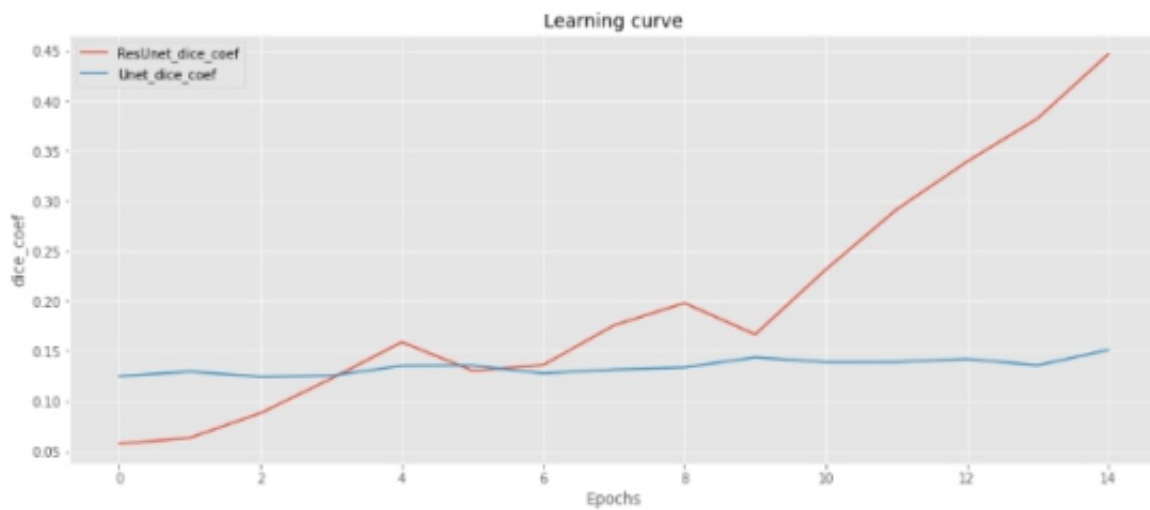
Fig 8: Plot of (a) loss, (b) accuracy, (c) dice coefficient and (d) ROC curve during training and validation when using the dataset with ResUNet

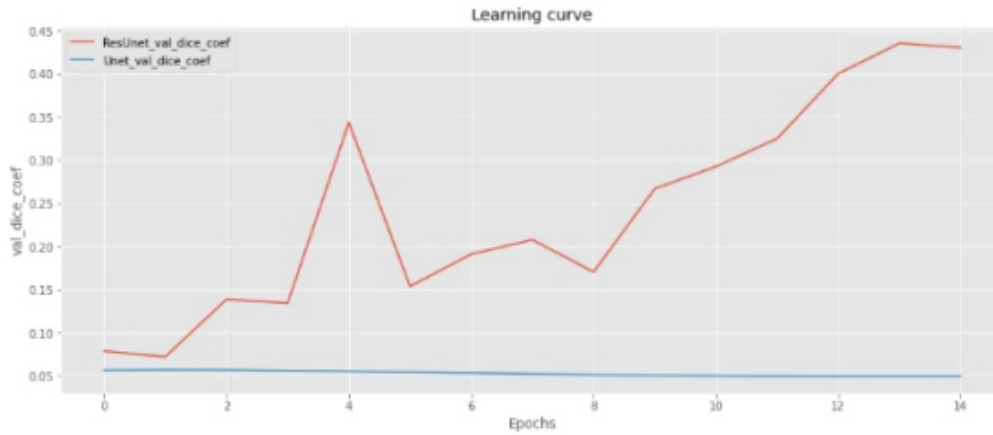


(a)

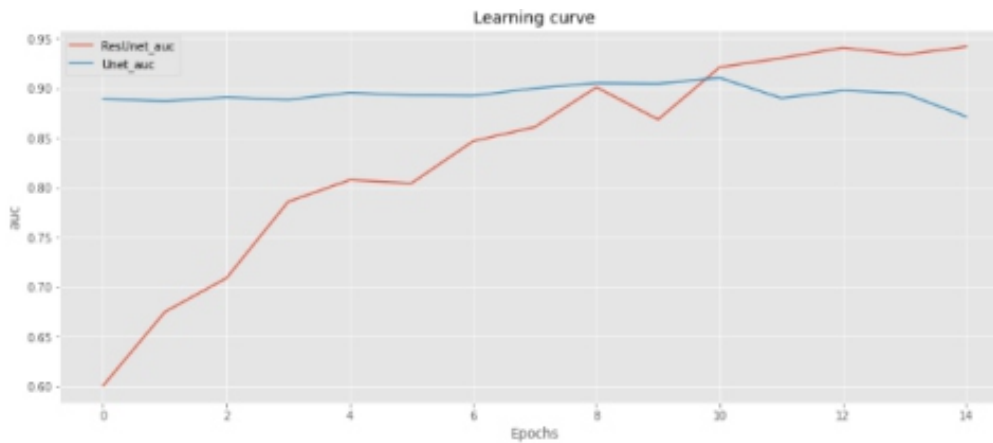


(b)





(c)



(d)

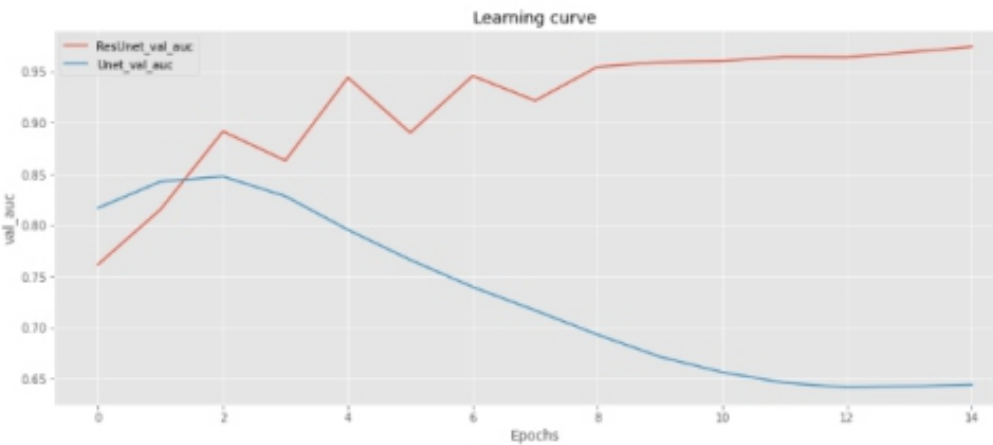


Fig. 9: Plot of (a) loss, (b) accuracy, (c) dice coefficient and (d) ROC curve during training and validation when using the dataset with ResUNet and U-Net.

V. CONCLUSION

In this modern era, people are prone to radioactive waves and avoid the consumption of healthy food, so

the chances of developing a cancer are increasing exponentially. Several programs are being conducted to provide awareness about breast cancer and its symptoms, prevention, and therapies. One should maintain vigilance for the detection of breast cancer and consult their doctor if they notice any changes in their breasts, such as a new lump or skin changes. People can take certain measures to prevent this disease, such as limiting their alcohol consumption, maintaining a healthy weight and exercising regularly.

Breasts hold an important role in a woman's life. In some cases, during the treatment, they are advised to remove them, which affects their physical as well as mental health. So earlier stage precise detection is essential as the treatment process becomes much easier and the chances of survival also increase. In this case, accuracy is crucial because many cases go undetected. Therefore, in this paper we have proposed the ResUNet model which provides an accuracy of 0.9871 which is more than the accuracy of U-Net and similarly improves all other aspects in comparison with U-Net.

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The Concepts of Law and Fact

Dr. Bhagyashree M. Deshpande

Assistant Professor, Bharati Vidyapeeth Deemed University, New Law College, Pune,
India

ABSTRACT

The question of fact and the question of law are the indispensable fundamentals of the adjudicatory process. The question of fact and the question of law are directly related with the process of administration of justice because the wrong question of fact and the erroneous question of law will lead to injustice. The question of fact deals with the physical condition or circumstances which can be proved or disproved with the help of empirical evidence. The question of law pertains to the ascertaining of the specific meaning of the legal provisions in the cases of uncertainty and ambiguity. The question of law is always answered by the courts with the help of legal principles. The legal provision includes the facts and the leading consequences of it and the underlying liability. Mistake of law is not a recognized legal defence however mistake of facts is a legal defence to the criminal liability. The question of fact and the question of law both are necessarily involved in the issues of the case as well as the ratio decidendi of the case.

Keywords--- *Question of law, question of facts, mistake of law, mistake of facts, justice, criminal law, civil law, procedural law, substantive law, international law, national law*

1. INTRODUCTION

The question of law and the question of fact are the two most important aspects which are involved in the process of the adjudication process followed by the judiciary. The decisions of the courts are based upon the questions of facts and question of law. A humble attempt is made to elucidate the varied dimensions of the question of fact and question of law along with their role in the process of adjudication followed by the courts of law.

The question of law. The concept of question of law presupposes the understanding of the term of law; hence let us first in brief deal with the meaning of law. In simple words law prescribes a code of conduct applicable to the individuals in a society. It is the law which prescribes the rights, duties, liberties etc. on the individuals. So also, the law confers powers on the officials of the state. The question of law involves whether the individual has the legal right or not, or whether the state official has committed any act which is ultra-varies to the powers which have been prescribed by the law. The implications of question of law depends upon the types of law.

Types of laws.

a. Criminal law and civil law.

A law is prescribed as a criminal law when the following aspects are fulfilled. When the law prescribes punishment for the wrong doer; in the form of fine, punishment, forfeiture of property or capital punishment. Further the criminal law protects the rights – in – rem that is the rights are available against the entire society. So also, under the criminal law the state initiates the legal proceedings. The Indian Penal Code is considered to be the substantive criminal law of India. When a law prescribes for the payment of compensation or damages such a law is described as a civil law. The civil law protects the

rights – in – personam; that is the rights are available against the private individuals. The proceedings are always initiated by the individuals in the civil law. Law of Torts, Law of Contract, Company Law are regarded as civil laws.

b. Substantive law and procedural law.

A law is classified as substantive law when a law confers rights duties, powers etc. on the individuals. The Constitutional Law, Administrative Law, The Indian Penal Code are regarded as substantive law. When these rights are violated then the procedure to be followed by the lawyers, individuals and the court officials is prescribed by a law and such a law called as a procedural law. For example, the Criminal Procedure Code, Civil Procedure Code, and the Evidence Act are classified as procedural law.

c. National and International law.

A national law is said to be the law of land of a particular state. The law which deals with the relationship between two states is called as international law. The question of law revolves around the nature of law and the interpretation of law.

Issues of question of law

The question of law involves the ascertainment of the provisions of law. Once the facts are proved beyond the reasonable doubt then the next step in the legal proceedings is to apply the provisions of law to the existing law. Now let us give a glance to the issues involved in the aspects of question of law.

- i. The first aspect of question of law is that -the courts of law are bound to answer the questions of law which are raised in the proceedings of the case. The answer which the courts of law forwards is regarded as the decision of the courts.
- ii. The question of law is always involving the ascertainment of the meaning of law that is what the legal provision means and whether that meaning is applicable to the facts which are before the court.
- iii. The question of law is always answered with the help of law. Question of law means what the law is on a particular issue and the meaning of law can be answered only with the help of the principles of law.
- iv. Question of law arises out of the uncertain meaning of law and not due to the existence of law.
- v. Question of law may include the ascertainment of scope of the discretionary powers.
- vi. Question of law is answered with help of the provision of law but it is done only after the facts have been proved.
- vii. The higher judiciary generally deals with the question of law.
- viii. The question of law includes the issues like weather the law requires strict interpretation or liberal interpretation depending upon the fact and circumstances of the case. Mostly the question of law deals with the interpretation of the law.
- ix. Weather a right exists or not and if it's exists what would be the scope of such a right is a question of law.

Question of facts.

- i. Facts means a set of circumstances, or events or conditions which have existed or are existing. Facts are physical in nature.
- ii. As the facts are physical in nature, they can be proved by empirical evidence.
- iii. Facts can be proved with the help of facts, and the law of evidence plays important role in the proving or disproving of the facts.
- iv. The proving or the disproving of the facts is done by the individuals, but the accepting or the rejecting of the facts is based on the evidentiary proof and the law of evidence is done by the judiciary.

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- v. A particular set of facts are proved are disproved in order to attract a provision of law.
- vi. Question of fact include for instance in the case involving the charge of murder facts like blood stain, nature of injury, the defence of alibi etc. or in the case of infancy weather the child is of seven years or above seven year is a question of fact.

Implication of question of law and question of fact. The question of fact exists and is first solved by the courts. It is to be remembered that the facts are argued by the parties and the accepting or the rejection is done by the courts with the help of law. After the question of fact is settled then the courts address itself with the question of law. The question of law is answered with the help of law but it also depends upon the question of fact. The question of facts depends upon the evidence. The issues of the case which are farmed by the court involve both, the question of law as well as the question of fact. So also, the ratio decedendi involves the material facts of the case and the legal principles applicable to those facts. So even if the question of fact and the question of law are different still, they become intertwined as far as the issues of the case and the ratio decedendi are concerned. Weather a child is of seven years or above seven years is question of fact after the age of the child this proved then the court addresses it self with the question of the liability of the said child. Weather the child gets the defence of doli capex or doli incapex depends upon the fact that is the age of the child. Some times the question of fact may be proved by the individuals and those facts might be accepted by the courts. But there may be two interpretations which may be applicable to those proved facts. Then the question of law arises as to which interpretation of law would be most suited to those facts, and this has to be decided by the courts.

The difference between question of fact and question of law

- i. The question of facts can be proved or disproved with the help of empirical evidence and the question of law can be solved only with the help of legal principles.
- ii. The question of fact is a legal defence for criminal liability whereas question of law is no defence for criminal liability. The mistake of fact is included in the chapter of general defenses, and section 79 of the Indian penal code, as a general defence. The mistake of fact is a defence because of the following aspect.
- a) The accused misrepresents the facts.
- b) As the accused misrepresents the fact's he has no knowledge, neither the intention to commit the offence.
- c) Further the act which the accused has committed was legal and reasonable.

The criminal liability is based upon the principle of actus reus coupled with mens rea. The criminal liability is negated because of the absence of mens rea in the case of mistake of fact.

Mistake of law is no defence because there is presumption that every individual has to know the concerned relative law. So also mistake of law would be an easy defence for the law violators. Some times a question may be regarded as mixed question of law and fact. This happens when the issues of the fact and the law dealing those facts become inseparable. Erroneous interpretation of question of law and question of facts may lead to injustice.

II. CONCLUSION

The adjudication process followed by the judiciary revolves around the question of law and question of fact. The question of fact can be proved by factual or empirical evidence in accordance with the principles of law of evidence. Where as the question of law pertains to the exact provisions of law or the

the specific meaning of the legal provision in the cases of uncertainty or ambiguity of the said legal provisions. The question of facts has to be proved or disproved by the concerned parties to the case, however whether the fact is proved or disproved will be decided by the legal courts. The question of law is always address to the courts and is answered by the courts with the help of legal principles. The answer of the question of law depends upon the question of facts; and the question of facts depend upon the empirical evidence. The issues of the case framed by the court and the ratio decedendi involves both the question of law as well as the question of facts. The criminal law recognizes mistake of fact a defence to the criminal liability. However, mistake of law is not granted as a defence to the criminal liability. Some times the question of fact and question of law are so intertwined that is become difficult to identify both and again the legal principle is relied upon. The question of fact and the question of law play an important role in the dispensing of justice because the exact law applied to correct facts lead to justice.

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The Essential Attributes of Law

Dr. Bhagyashree M. Deshpande

Assistant Professor, Bharati Vidyapeeth Deemed University, New Law College, Pune,
India

ABSTRACT

Today the law has to play a major role in a society because the human activity has expanded and consequently the role of the law has increased and has become more crucial. Not only the role has increased but it has also changed in a considerable manner. In the ancient period the nature of law and the functions of law were different; however, the nature and functions of law of today have changed because the law revolves around the society and the society is of dynamic nature which keeps on changing. Custom as a source of law is very important because customs and morality are regarded as internal agencies of control where as legislation is considered to be an external agency of control and that is why it is subject to limitation. The law has to perform some functions out of which justice, stability, and peaceful change are very important. Those stability and peaceful change are seemingly opposite concept still the law has to skillfully achieve and maintain both of them.

Keywords— Customs, Traditions, Morality, Religion, Principles of natural justices, Conventions, Precedent, Legal maxims, Legislation, Principles of equity, Constitution, Rights and liberties

I. INTRODUCTION

The term ‘law’ generally brings an apprehension of fear in the mind of a common man. In the ancient times when an individual uttered that “I will drag you to the court”, it was regarded as a threat. Times have changed and so has the image of law changed and now going to the court has become right in itself and every now and then the law is sought to declare and enforce rights.

The different legal systems of the world.

1) The common law legal system.

i. Unwritten law: - The classic feature of common law legal system is that the law prevails in an unwritten form, that is the law is not enacted and codified. The provision of law is scattered in the various sources of law such as law, legislation, customs, convention etc.

ii. The sources of law: - The sources of law in the common law system are many such as legislation, customs, convention, morality, religion, precedent, legal maxims etc.

iii. Bar and bench relationship: - In the common law system there is a unique relationship between the bar and bench. The lawyers of the bar can become judges and join the bench. Similarly, the judges can quit the bench and join the bar to commence legal practice in the court of law. In the common law legal system there is no prohibition from quitting the bar and joining the bench, and from quitting the bench and joining the bar.

iv. Judicial activism: - In the common law system the judges play an active role in evolving and developing the law. The original of the judiciary is to adjudicate and if necessary, interpret the law. Hence the judges can make the law through interpretation and indulge in judicial activism.

v. No separate administrative courts: - In the common law legal system only one apex court prevails which is empowered to adjudicate upon all the matters and its decision is binding upon all.

India, United Kingdom, and United States of America follow the common law legal system.

2) The civil law legal system.

The features of civil law legal system are as follows.

- i. Written and codified law: - The main feature of the civil law legal system is that the law always prevails in a written and codified form. The civil law legal system recognizes legislation as the only source of law and no other source of law is considered to be a valid source of law.
- ii. No relationship between the bar and bench. In the civil law legal system, a lawyer cannot become a judge and so also a judge cannot become a lawyer. So, unlike the common law legal system, in the civil law legal system there is no relationship between the bar and the bench.
- iii. Inquisitorial system: - Absence of judicial activism. In the civil law legal system, the judges play an active role during the conduction of inquiry. Once the inquiry is over the judge has to only apply the law which exist in the statute. In the civil law legal system, the judges cannot make the law through interpretation, hence the judges play a passive role and do not indulge in judicial activism.
- iv. Separate administrative courts prevail: - The distinguishing feature of the civil law legal system is that two sets of courts prevail. One set of court deals with the ordinary matters which involve the individual's rights and the other set of courts deals with the administrative matters involving in the state.
- v. Germany and France follow the civil law legal system.

3) The traditional legal system.

- i. The traditional legal system was the most ancient legal system however in the recent times, this legal system does not exist independently.
- ii. The traditional legal system is based on the religious tenets.
- iii. The main feature of the traditional legal system is that it is founded on the duty notion. According to the traditional legal system the ruler and the subjects have to perform their duties sincerely and faithfully. The underlying principle is that if everybody performs the duties then automatically the corresponding and co-relative rights are enforced.
- iv. The traditional legal system existed under the Hindu rule and the Mughal rule.

The sources of law.

The source of law means the aspects from where the law originates or the source on which the law is based upon. The sources of law depend upon the nature of the legal system, that is whether a source is recognized as a legal source of law or not depends upon the nature of a legal system. So, it becomes necessary to identify the sources of law according to the nature of the legal system.

- i. The sources of law recognized in the common law legal system: -

Precedent: - In the common law legal system precedent is most important source of law. The majority of the English law is developed and evolved by the judiciary in the form of precedent.

Even in India the precedent as a source of law plays an important role and much of the law is evolved by the judiciary in the form of precedent.

Conventions: - In the United Kingdom many of the constitutional principles prevail in the form of conventions. In the common law legal system convention are regarded as important source of law, however convention play a less significant role in the Indian legal system.

Legislation: - Legislation is the most important source of law in the present times, because it is made by the people's representatives. In England after The Crowns Proceedings Act legislation has secured a conspicuous position as a source of law.

In India also legislation is considered to be a prime source of law. The legislation made by the legislature

is called as a supreme legislation and the legislation in the form of rules, bye laws, made by the executive is called as the subordinate legislation. The supreme legislation as well as the subordinate legislation is a considered to be a source of law.

Customs: - Customs play a prominent role as a source of law in the legal system. A valid custom is recognized as a source of law independently, that is it does not require the legal coverage.

Religion: - Like customs religion is also considered to be a dominant source of law. India was a traditional legal system previously and hence religion played a very important role as it was considered to be the form of law.

Legal maxims: - the principles of law are considered to be embodied in the legal maxims. Today also many common law principles prevail in the legal maxims.

Opinion of the legal scholars: - some times the opinion of the legal scholars is referred to ascertain the exact or the perfect meaning of the ambiguous or vague legal terminology.

Principles of equity: - The principles of equity have played a very crucial role in dispensing justices in the past times. In the present times also the principle of equity is recognized as a valid source both in the United Kingdom as well as in the Indian legal system.

ii. The sources of law recognized in the civil law legal system.

The civil law legal system recognizes only one source of law that is the written and codified statutory enactments. The civil law legal system dose not recognize any other source of law. If a particular custom or a religious tradition is considered to be important for the society then it necessarily has to be incorporated in a statutory enactment. The judges are prohibited from making the law while adjudicated and hence there is no place for the precedent to be recognized as a valid source of law.

iii. The sources of law recognized in the traditional legal system. The traditional legal system is essentially based upon traditions and customs.

Hence obviously customs, traditions, morality, religion, principles of natural justices are considered to be the sources of law. In fact, the law prevails in the form of customs, tradition etc.

Legislation in the form of royal orders played a very insignificant role.

The functions of law.

i. Justice: - Justice is the prime object of every law. In fact, all the legal systems exist in order to achieve justice. If no justice was to prevail then there would be no purpose of any law or legal system. The connotations of justice differ from place to place's and from time to times; hence the concept of the justice differ from legal system to legal system. So also, what was regarded as an essence of justice may be injustice latter on, never the less every legal system is founded on the fundamental object of justice. The concept of justice has essentially originated from the principles of natural law as it was stated to be in consonance with the consciousness of a human being. Hence sometimes the principle of justice was described to run parallel with the principles of morality. Where as other times justice was used in a narrow sense to mean what the courts do. It means here that; every order of court is in consonance with the principles of justice. The main theme of justice is to protect rights and to enforce duties. Corrective justice demands the enforcement of imposing of penalties or granting of civil and criminal remedies. Distributive justice ensures the equitable distribution of benefits and burdens.

ii. Stability: - The second function of law is to achieve and maintain stability. Stability is an inherent desire of a human being, because chaos and confusion or ambiguity and insecurity are essentially disliked by human beings. The law has to provide stability to the society.

iii. Peaceful change: - The third function of law is to provide a peaceful change. Stability to the point of monotony is undesirable, and hence some change is aspired by the people. This change has to be channelized by law so also it has to be a peaceful change. For instance, the provision of elections after every five years ensures peaceful change.

iv. Limits of law: - The basic function of law is to enforce limitations on the powers, rights, liberties so that justice prevails. Justice demands that every concept in a legal system should be bridled with limitations. Even the law is subject to limitation.

Constitution: - The constitution imposes limits on law and no law can prevail which is violative of the constitutional provisions.

Rights and liberties: - The law has to protect the rights and liberties and hence any law which violates the rights and liberties is set to be invalid law.

Public opinion: - Is also a limitation on the law because the law has to consider the public opinion especially in England where the public opinion is very strong and organized.

Religion and tradition: - Religion and tradition is also a limitation on law. However, sometimes a law may be made in contravention to the religion for some social cause.

II. CONCLUSION

Today law has gained tremendous importance as it has influenced all actions of humans. The sources of law depend upon the nature of legal system and hence defer from legal system to legal system. The precedent as a source of law play's a dominate role to evolve and develop the law in the common law legal system; whereas precedent is not recognized as a source of law. The law has to perform substantial functions such as justice, stability, and peaceful change. The law exists to perform the prime function of achieving justice. Another precarious function which the law has performed is to achieve stability and peaceful change simultaneously. The law imposes limits on the individual as well as the state officials but are there any limitation on the law itself? The answer is in the affirmative because no concept can prevail limitless in a legal system so the law is also subject to limitations.

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