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EMOTION DETECTION (IMAGE, VIDEO, LIVE STREAME): USING MACHINE LEARNING

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Abstract
Image processing is a technique of changing an image into a digital form and then processing it to understand the image better or extract helpful information from the image. Facial expressions are non-verbal means of communication that deliver social information among humans, nearly all mammals, and some other animal species. Facial expressions can be picked up by human beings voluntarily or involuntarily, with involuntary facial expressions occurring when the individual is ill, hurt, or uneasy. There are eight universal facial expressions, namely neutral, happy, sadness, anger, contempt, disgust, fear, and surprise. Emotions played a significant role in being detected on the face. Our system proposes a monitoring system for elderly people with the aid of technology recognizing emotions from video images. This paper proposes video analysis technology to monitor the living conditions of elders in real-time. It sends the message to their relatives and children in case of emergency. Keywords—Facial Emotion Recognition, Local Binary Pattern Histogram LBPH Algorithm, Convolutional Neural Networks(CNN).

Keywords:
Facial Emotions, Emotion Recognition, Emotion Detection, Sentiment Analysis, Natural Language Processing (NLP), Social Media Analysis, Text Mining, Affective Computing, Emotion Classification

1.INTRODUCTION:

Facial[1] expressions refer to the movement of muscles under the skin of the face.[2-3] They are a form of non-verbal communication. The human face is capable of expressing a wide range of emotions,[4-5] all without the use of language.[6-8] While many non-verbal body language cues remain open to misunderstanding, facial expressions are universally understood by all people. Expressions for happiness, sadness, anger, surprise, fear, and disgust are universal. [9]That is, they are the same in all cultures. These movements of muscles convey a person's emotions to onlookers. They form an important source of non-verbal social information in human beings. [10-12]Facial expressions also exist in a lot of other mammals and some animal species. Facial expressions can be generated by human beings both as a result of voluntary action and involuntary action. [13-15]Most of the involuntary actions are generated when a person is sick, experiences pain, or is in discomfort.

Fig1: Different types of emotions

Basically, affective computing is the study and development of such systems and devices that could have the ability to recognize, interpret, process, and simulate human emotions. The affective computing technologies could detect the feelings of the user through several means, including sensors, microphones, and cameras, and then respond through the completion of certain predefined features of a product or service.[16-18] From one perspective, affective computing can be perceived as human-computer interaction, whereby a device may recognize and then respond to the set of emotions as expressed by the user.

Emotion recognition is crucial for monitoring the emotional well-being of users and detecting physiological and mental illnesses related to emotion. Emotions of a human being are not only expressed through behavior [19]but by different physiological changes occurring involuntary in a body. Therefore, such physiological signals are used to infer the genuine feelings of individuals. Physiological signals that have provided good results in emotion recognition include the electrocardiogram, the galvanic skin response, the electroencephalogram, the respiratory-suspended particulate, and the blood volume pulse. Of these, ECG is of special significance for its insight into heart activities with changes in emotions.[20-22] Good development in emotion recognition from ECG data has been achieved by researchers; Heart Rate Variability from the ECG is an important parameter in this area. Our objective is to implement real-time emotion detection using images captured by a live webcam. The webcam will continuously stream video, identifying faces in each frame by analyzing facial landmarks—the eyes, eyebrows, nose, mouth, and outline of a face. [23-25]These facial landmarks were used in extracting features, making the facial emotions easier to identify. Image processing techniques will be used to assess any signs of discomfort in the detected emotions. We look for any discomfort in the emotions through image processing techniques.

2. LITERATURE SURVEY

Emotion recognition is one of the most important lines of work in terms of improving the interaction between humans and machines.Emotion complexity increases the acquisition task, which gets difficult from one work to another. Quondam works propose to capture the emotion through a unimodal mechanism to study the components. [26-28]More recently, the inception of the idea of multimodal emotion recognition increased the accuracy rate of detection by the machine. In addition, by using the deep learning technique with the neural network, the ability of the machine to recognize emotions was extended to improve its success ratio. [29]Recent works using deep learning techniques have been done on various kinds of input of human behavior, such as audiovisual inputs, facial expressions, body gestures, EEG signals, and related brain-waves. Still, very little progress has been made in this development. In this paper, an attempt has been made to review the relevant significant[30] works on their techniques and effectiveness of the methods and the scope of improvement of the results.

- *Machine learning*

Machine Learning is a technique that enables one to study algorithms and models that let a computer system perform a particular task without requiring any external instructions. These algorithms create a mathematical model based on sample data, which may be used in making predictions or decisions independently of external influences. Machine learning can be categorized into several types. In supervised learning, a

mathematical model is built from a dataset containing both[31] the inputs and the expected outputs. This includes classification and regression algorithms. The output for classification algorithms is restricted or limited to[32] a specific set of values. Regression algorithms are suitable in cases with continuous outputs as they return values over a defined range. Semi-supervised learning algorithms build mathematical models from incomplete training data, where some input samples lack labels. In unsupervised[33] learning, the algorithm builds a mathematical model from the input data that lacks the desired output labels.

- *Image recognition*

Image recognition is a technology that identifies locations, logos, people, objects, buildings, and other aspects which[34] are within images.Being a subfield of computer vision, image recognition undergoes processes to detect and identify objects in [35]digital images or videos. Computer vision is defined as techniques of gathering, processing, analyzing data from video and still images obtained from the natural environment.[36] This data is high-dimensional translated into numerical or symbolic information used to make decisions. Apart from image recognition, the computer-based application [37-40]encompasses the aspects of event detection, learning, object recognition, video tracking, and reconstruction of images. The human eye views an image as a series of signals, which then get processed by the visual cortex in the brain. Image recognition seeks to do just that. An image is either in raster format or vector format as viewed by the computer. Raster images are sequences of pixels, each with a discrete numerical value representing the color. Vector images are made up of color annotated polygons.[41-44] To interpret images geometric encoding is converted into constructs which represent real world features and objects, which are logically then examined by the computer for analysis. Organization of data includes classification and feature extraction. While classifying an image, a simplification of the image is done.[45-48] This is done by extracting only the critical information in the picture while at the same time eliminatingdetails that are not important. After the simplification, a classification algorithm is then used to create a predictive model.[49-52]In this step of the classification algorithm, the algorithm has to be trained using thousands of images. These images may either be related or not related to the image under scrutiny. A predictive model is created with the assistance of neural networks.[53] A neural network is a hardware/software hybrid, much like the human brain that approximates functions with a large amount of unknown inputs. Some algorithms for image classification are Support Vector Machines, face landmark estimation, K-nearest neighbors, and logistic regression. The third step is image recognition. The picture data will then be organized into a training set and a test set, making sure there are no duplicates.The model receives this data and uses the data in recognizing images. [54]Now, the classifier is trained to recognize who the subject is by measuring the closest match with a fresh test image.

- *Feature extraction*

Dimensionality reduction is a technique that provides that the initial set of raw data is streamlined for processing. Features characterize the behavior of an image and refer to patterns such as points or edges. [55]Therefore, in this case, the process will be helpful in reducing the resources used in processing, only maintaining the most critical information that is relevant. Feature extraction reduces the amount of redundant data. The techniques used are thresholding, resize, normalization, and binarization. All these image preprocessing techniques are done to the sampled image before feature extraction. Feature extraction is done using several various techniques to help in image classification and recognition. Some of the feature detection algorithms used include the ORB and the Color Gradient Histogram. It is a technique that fuses FAST with the BRIEF approach in the detection of corners on images effectively. FAST features detection operate by applying a threshold to the amount of brightness encountered in a certain circle. Specifically, if more than eight pixels in a ring of pixels are either brighter or darker than the central pixel, that point is considered a feature. [56]The BRIEF component makes a binary feature vector out of the points identified by the FAST component. The Color Gradient Histogram method determines the proportions of red, green, and blue values in an image in order to find similar color distributions; this technique can be modulated by binning these values. Corner detection is a process by which computer systems extract features that help in inferring the contents of an image. Applications of corner detection include motion detection, image registration, video tracking, image mosaicing, 3D modeling, and object recognition. Here also, the Harris corner detector and Shi-Tomasi corner detector find wide application. The Harris Corner Detector identifies those windows, which upon being shifted in both X and Y directions—that is, gradients—result in high intensity shifts. With every detected window will be an associated score, R calculated after which

thresholding is applied to select and mark important corners. The Shi-Tomasi corner detector works with the same principle where the score is obtained in identifying the top N corners, which is of great help when all corners need not be detected. The following formula shall obtain.

- *Existing system*

Neural networks for the recognition of different facial emotions—such as happy, sad, angry, fear, surprised, neutral, etc.—in terms of their complexity, intensity, and meaning. The existing system can analyze the limitations of the existing system of Emotion recognition using brain activity.Emotion recognition is the process of identifying human emotion. People vary widely in their accuracy at recognizing the emotions of others. Use of technology to aid people with emotion recognition is a relatively new research field. Generally, the technology works best if it makes use of multiple modalities in [57]context. To this day, most of the work conducted has been on automation of facial expression recognition from video, spoken expression recognition from audio, written expression recognition from text, and physiology as measured by wearables.

- Disadvantages of existing system

What has[58] generally been missing in terms of software engineering is methods for determining what software engineering tasks are better done by automation, and which have requirements for human-in-the-loop or human approaches.

3.PROPOSED METHODOLOGY

A general architecture of proposed system of emotion detection through machine learning will comprise of following modules:

- ✓ *Data Collection***:** Gathering the data related to emotions, such as Facial expressions in image or video form Speech record statements in audio form Text data in the form of social media posts, reviews etc.
- ✓ *Physiological signals*: heart rate, skin conductance, etc.; data preprocessing by cleaning, filtering, and transforming the data into a form so that it can be fed into some machine learning algorithm; and feature extraction, wherein some relevant features should be extracted from the data that may describe emotions, including facial features.
- ✓ *Model Selection***:** Selection of a proper machine learning algorithm with respect to the the task of emotion detection will be done in the following areas :
- ✓ *Supervised learning*: for example, support vector machines, random forests
- ✓ *Deep learning*: for example, Convolutional neural networks or Recurrent neural networks
- ✓ *Unsupervised learning*: for example, Clustering or Dimensionality reduction
- ✓ *Model Training***:** The preprocessed data is fed to the selected algorithm to learn patterns between features and emotions. Model Evaluation A trained model is used on the test dataset to test its accuracy and robustness. Emotion Classification The trained model is used to classify new, unseen data into respective emotion categories like happy, sad, angry, surprised. System Deployment The usage of this emotion detection system is very diverse. Some of them are: Virtual assistants Mental health diagnosis Marketing research .Human–Computer Interaction Some of the more common machine learning algorithms for emotion detection include: Convolutional Neural Networks (CNNs) Recurrent Neural Networks (RNNs)

Advantages

Better Accuracy: Machine learning algorithms learn complex patterns in emotional data and increase their accuracy in detecting emotions.

System architecture

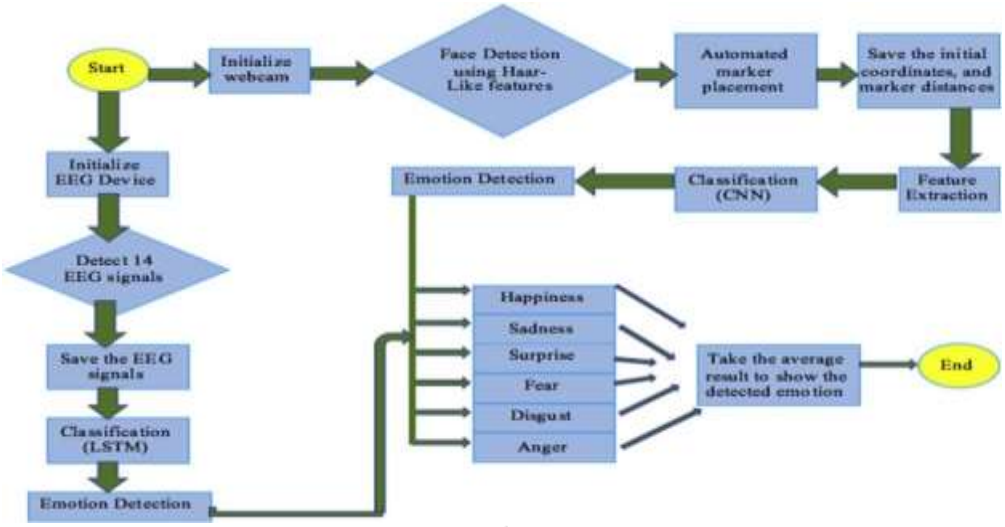

Fig 2: System Architecture

UML DIAGRAMS :

CLASS DIAGRAM :

Classes in the outline are really the cornerstones of event-driven data exploration. Its availability is required for both broad practical verification of the precision of an application and fine-grained demonstration of the translation of a model into software code.The other option for data visualisation is the class graphs. The similar classes in the class diagram represent main components, application participation as well as the class modifications. Classes with three-participant boxes are said to be "integrated into a framework," and each class has three distinct locations:

What is shown at the bottom is a range of techniques or actions that might be used or rejected by the class.

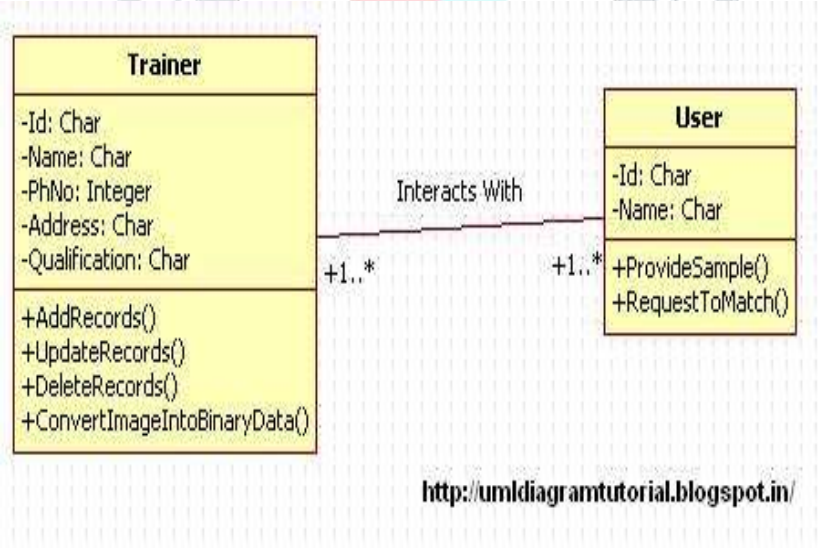

Fig3: Shows Class Diagram

USECASE DIAGRAM :

A use case diagram in Unified Modeling Language describes a behavioral diagram that is bounded and produced from a use-case analysis. This diagram represents a graphical overview, which is supposed to portray the functionality provided by a system in respect to an actor, their goals—represented as use cases—and any dependencies between those use cases. Thus, a use case diagram mainly shows the functions of the system done for an actor. It can also represent the roles of actors in the system.

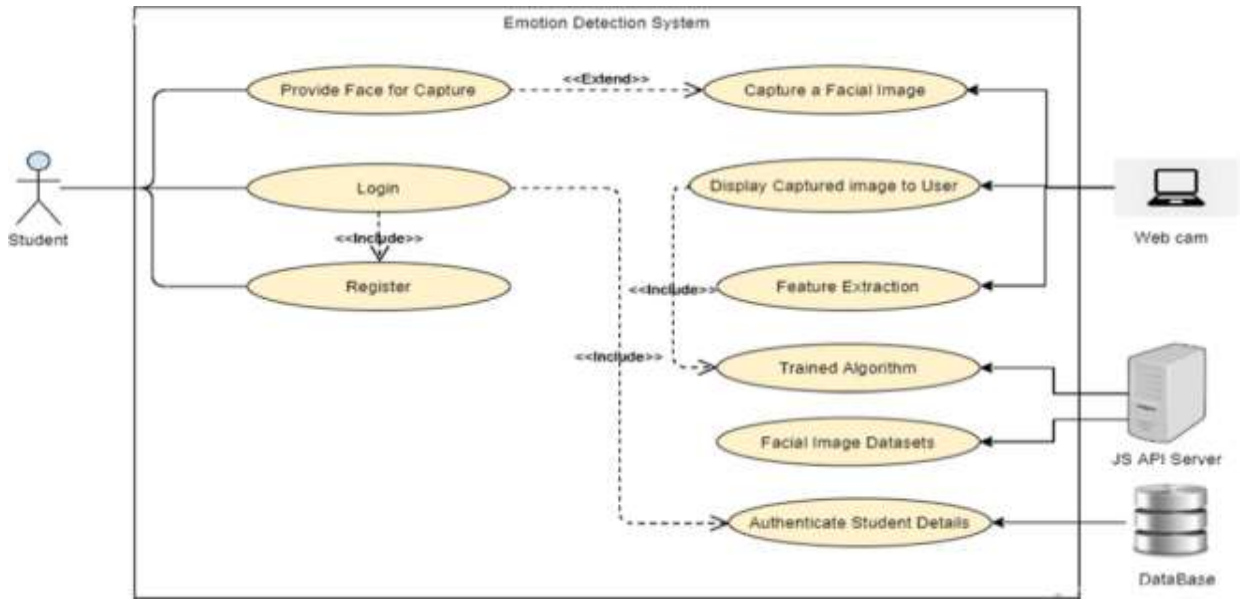

Fig4: Shows Use case Diagram

SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language is a kind of interaction diagram featuring and detailing how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

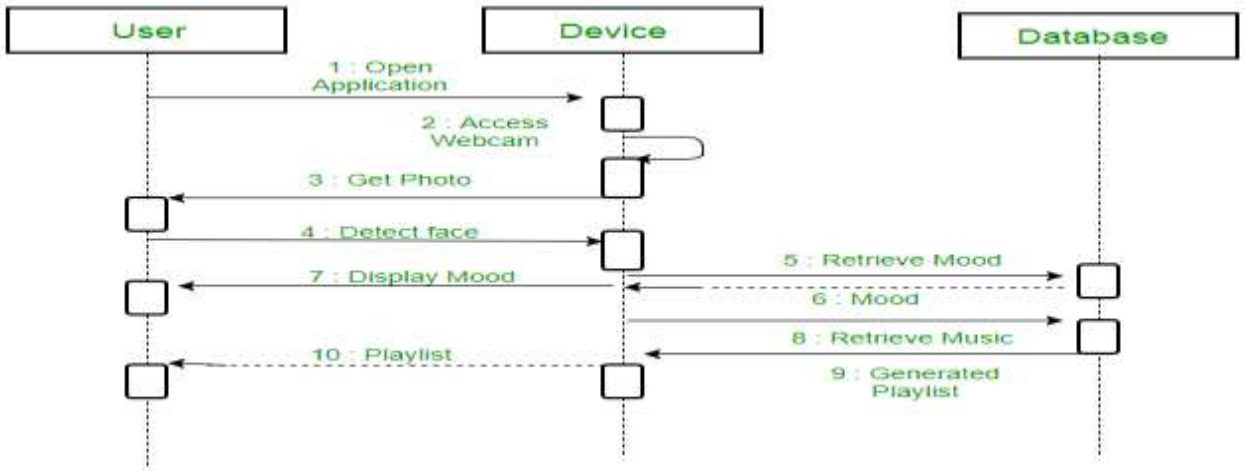

Fig5: Shows Sequencce Diagram

4.RESULTS:

Output Screens

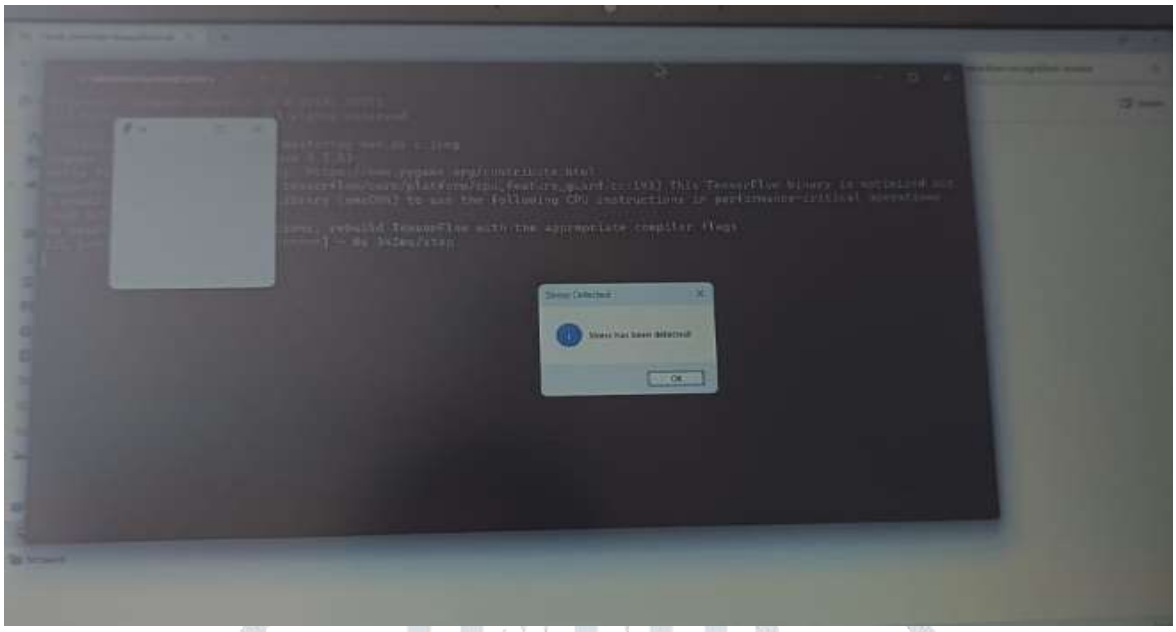

Fig6: Shows command prompt

Open the main code copy IP address.

Execute the code in corresponding IDLE by installing required libraries. Webcam is displayed on screen and detects the facial emotion.

Fig 7: Emotion Detection

It detects stress and conveys it through awebcam.

In the above figure facial emotion is detected as stress by the web cam.

Actual / Predict	Anger	Disgust	Fear	Happiness	Sadness	Surprise
Anger	90.91	1.69	8.33	0	17.86	0
Disgust	4.55	96.61	0	0	0	0
Fear	0	0	66.67	0	0	0
Happiness	0	0	12.50	100	0	1.20
Sadness	6.82	1.69	12.50	0	78.57	0
Surprise	0	0	4.17	0	3.57	98.80

Fig8: Preprocess the dataset

In the above graph at the top, we can see the names of columns, and in boxes, values with minus symbols are not important, and only positive column values are important, and the ML algorithm will train only with positive values, and now close the above graph to get the below screen:

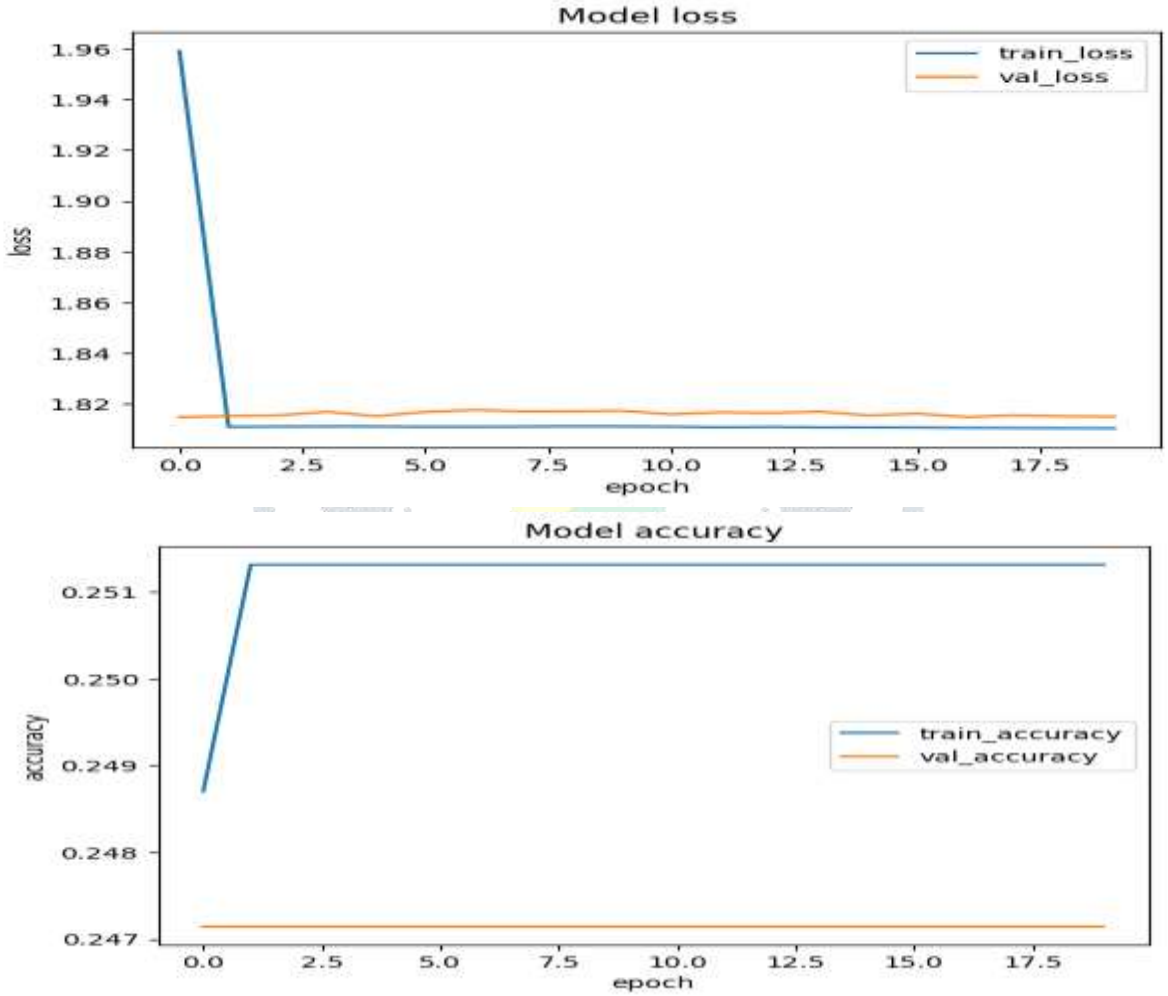

Fig9: Accuracy Comparision Graph

In the above screen, for each test lab record, ML will predict whether the disease is positive or negative. Now, click on the 'Accuracy Comparison Graph' button to get the below graph. In the above graph, the x-axis represents the names of the ML algorithms and the y-axis represents the accuracy of all those algorithms, and from the above graph, we can conclude that extension EML is giving better accuracy.

5. CONCLUSION

The article addressed an important HI-with-ML topic in software engineering by proposing an efficient new method approach related to software engineering, identified in prior research studies, using original data sets collected during the last 3 years from a Palestine hospital. This methodology allows the developers to analyze and develop software for the HI model and create a space in which software engineering and machine learning experts can work together on the machine learning model life-cycle, with special emphasis on the health field. In this sense, this manuscript proposed a framework that includes a theoretical framework comprising four modules: software, machine learning model, machine learning algorithms, and health information data. Testing was done on the new methodology against three system engineering methods: Vee, Agile, and SEMLHI. The results from this testing exercise returned an outcome of one-shot delivery for the new methodology. Results from laboratory testing on the MAM component in the framework SEMLHI with five algorithms to test ICD-10 result accuracy using equations were obtained, and the accuracy of the ML models was evaluated with a sample size of 750 patients. The results from MAM were that SVG equated to a value of approximately 0.57.

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