

Emotion Recognition from Facial Expression using Deep Learning

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Abstract - Facial expression plays a crucial role in the analysis of emotions. Facial expression recognition involves the classification of various emotions like neutral, sad, anger, etc. This application is gaining importance in day-to-day life. There are different methods used for recognizing the emotions like machine learning and Artificial Intelligence techniques. Deep learning and image classification methods are used for recognizing expressions and classify the expressions according to the images. Various datasets are used for training expression recognition models. In this project, we are using a Convolutional neural network algorithm.

Key Words: Facial Expression Recognition, Convolutional Neural Network, Machine Learning, Artificial Intelligence, Deep learning

1. INTRODUCTION

Emotion recognition is that the method of identifying human emotion. Recognition of emotion using facial expression varies from person to person. It may also change from age to age. Through the use of technology, it has become easier to recognize the emotions of people. The use of technology to help with emotion recognition is a relatively upcoming research area. Generally, this type of technology works best when multiple nodules are used in that context. To date, most of the emotion recognition from expressions has been done on videos, spoken expressions from audios, and psychology which was measured using a wearable. But generally, these methods have low accuracy. The accuracy of emotion recognition can be improved, by using a combination of different methods to analyze human expressions from different forms of data such as psychology, audio, or video. Various emotions detected through the combination or integration of many methods have led to the emergence of technology of this so-called emotional or emotive internet.

1.1. The working of the project

Access to the webcam should be given before the system can be used. Run the program. A GUI window will open. Click on the "START" button to start the system. Make sure that your face is visible within the webcam window. The system then processes the live feed image from the webcam which it takes as input and tries to detect your emotions through your facial expressions. It will show you the detected emotion in the webcam window. If you want to stop the input-live feed, then you can close the

webcam window by pressing the "Q" button. The GUI gives you the option of viewing your overall fluctuation of emotions you showed during the input window. You can see the output in the form of a pie graph in addition to your performance analysis by clicking the "PIE GRAPH" button or in the form of a line graph by clicking on the "LINE GRAPH" button. Click on the "FILENAME" button to know the name of the result file. Clicking on the "HISTORY" button will open a new GUI window where you can select your previous result file and view your result in the form of a Line graph.

2. LITERATURE SURVEY

2.1. Existing System

The overview of the Facial Expression Recognition (FER) system is illustrated in the figure. The Facial Expression Recognition system includes the major stages such as face image preprocessing, feature extraction, and classification.

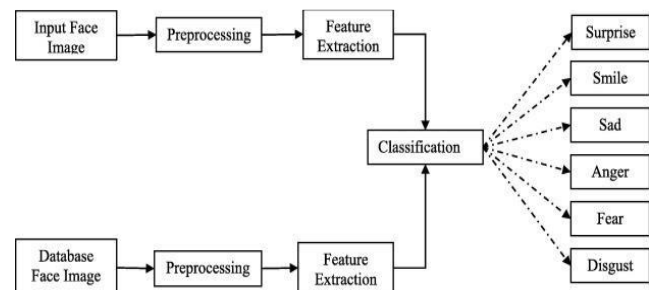


Fig 1: Architecture of Emotion Recognition using facial expression

Preprocessing: - Preprocessing is a process that is to be used to improve the performance of the Facial Expression Recognition system. It is carried out before the feature extraction process. This step includes differing types of processes like image clarity and scaling, contrast adjustment, and extra enhancement processes to enhance the expression frames. The cropping and scaling processes were performed on the face image during which the nose of the face is considered as midpoint and therefore the other important facial components are included physically. In FER, the ROI (region of interest) segmentation process is more suitable because it detects the face organs accurately.

Feature extraction: - Feature extraction process is the next stage of the Facial Expression Recognition system.

Feature extraction is finding and depicting positive features of concern within an image for further processing. In image processing, computer vision feature extraction could be a significant stage. Data depictions are used as an input to the classification.

Classification: - Classification is the end stage of the Facial Expression Recognition system during which the classifier categorizes the expression like a smile, sad, surprise, anger, fear, disgust, and neutral.

2.2 Convolutional Neural Network

Convolutional Neural Network is a Deep Learning algorithm that is a class of deep neural networks. It takes the input as the image and assigns the importance to various features/ objects/ characteristics in the image and can discriminate one from the other. It consists of three layers i.e., Convolutional layer - The kernel, Pooling layer, and Classification - Fully Connected Layer (FC Layer). The motive of the Convolution is to extract the important characteristics from the input image. It has been used to reduce the processing power and to get the main features. Even though CNN requires a training dataset, it is far less than compared to other classification algorithms. Also, CNN can learn from its real-time application and increase its accuracy.

2.3 Proposed System

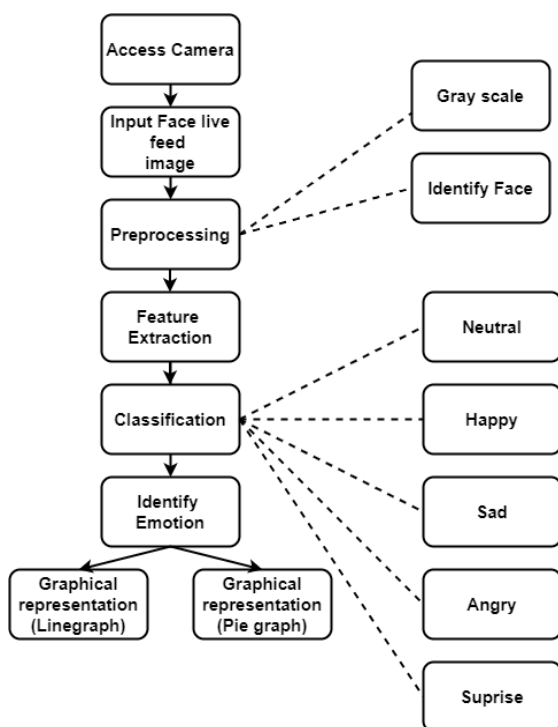


Fig 2: Proposed System architecture

- 1) Access Web Camera: Access to the web camera is given to the system.
- 2) Input Face Live Feed Image: Dataset contains infinite images which are used for facial expression recognition. These are sequential images of various

expressions which contain information of character expressions at interval time.

- 3) Preprocessing: In the preprocessing process, it involves rotation, scaling, and translation of the image. This process is called normalization. It's very sensitive for the expression representation of images.
- 4) Feature Extraction: Feature extraction involves reducing the image size but the characteristics of images remain the same. It is used for facial expression classification. The high pixel image is used for depiction for the expression of the face.
- 5) Classification: Expression classification is performed by a classifier. In this step, it accepts the given input images and produces output classification.
- 6) Identify Emotion: It will then identify the emotions. The emotions are classified as a surprise, happy, sad, anger and neutral.
- 7) Graphical Representation: According to the different emotions it will show the graphical representation. I.e. the line graph and pie graph can be used for many applications.

3. SYSTEM ARCHITECTURE

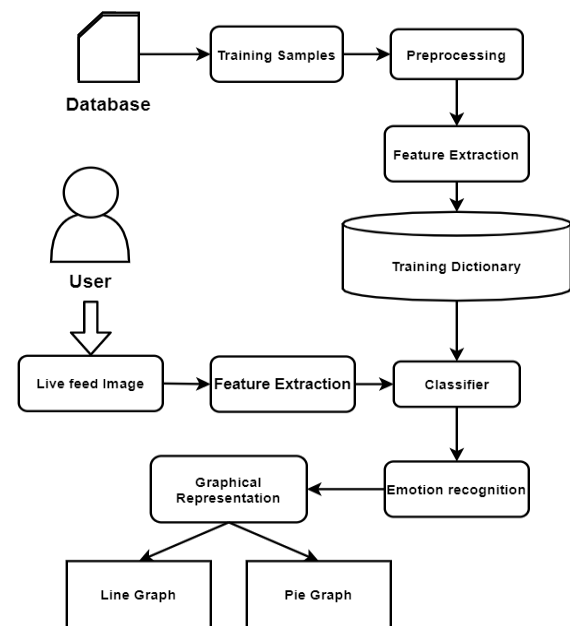


Fig 3: System Architecture

4. OUTPUT

Once you run the program, a Gui window will open with many buttons. Each button has its function.

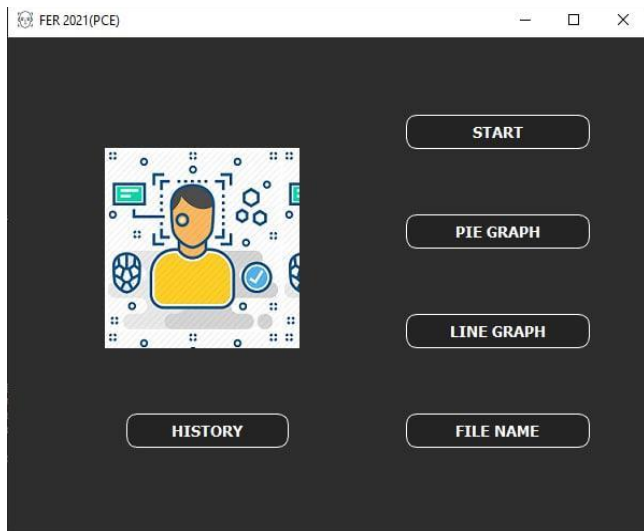


Fig 4: Emotion Recognition for the Interview process

Once you click on the "START" button the camera will begin. It will recognize the different emotions of the person.

Different Emotions: -

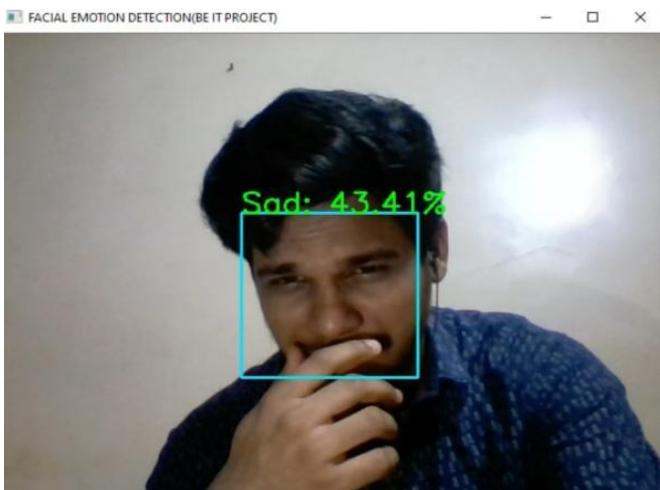


Fig 5: Sad Emotion

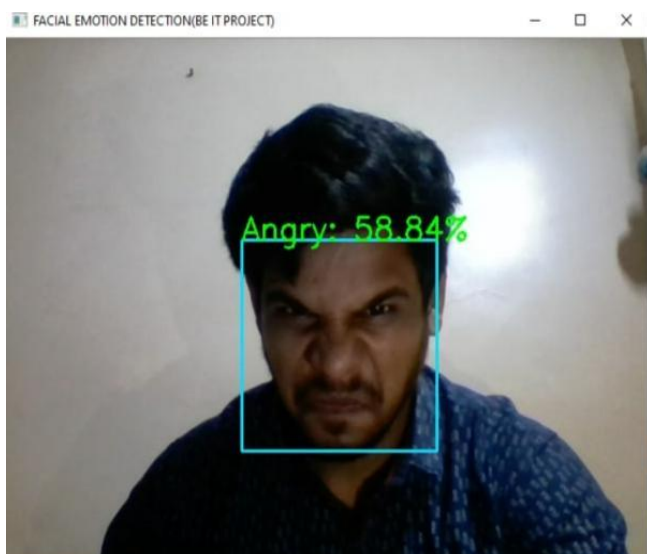


Fig 6: Angry Emotion

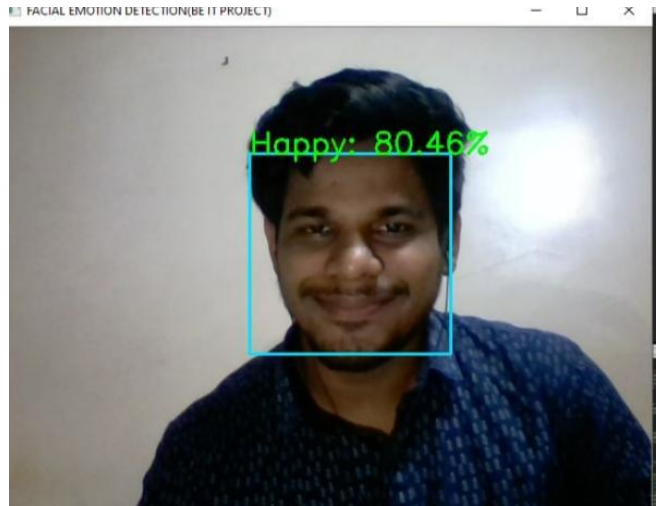


Fig 7: Happy Emotion



Fig 8: Neutral Emotion

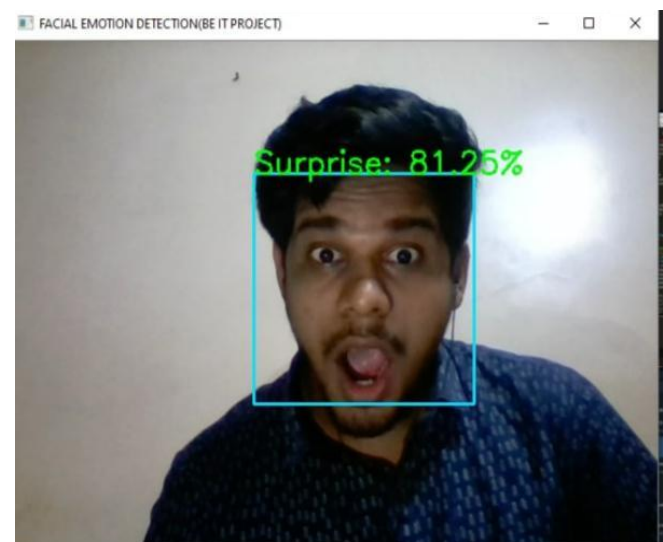


Fig 9: Surprise Emotion

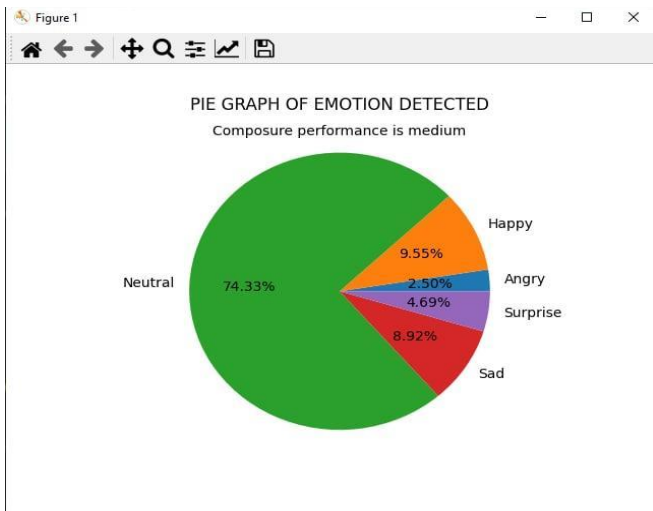


Fig 10: Pie Graph of Emotion Recognition

Once the camera window is closed when we click on the "PIE GRAPH" button, the pie graph of different emotions is displayed, the composure performance is also given according to the overall output.

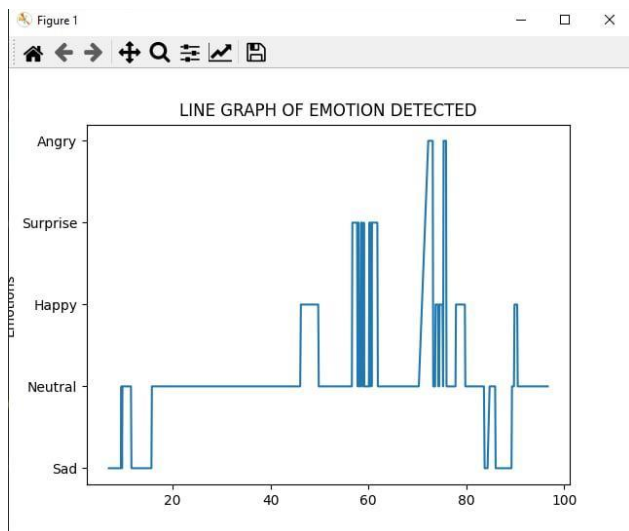


Fig 11: Line graph of Emotion Recognition

When we click the "LINE GRAPH" button, a line graph of different emotions is displayed.

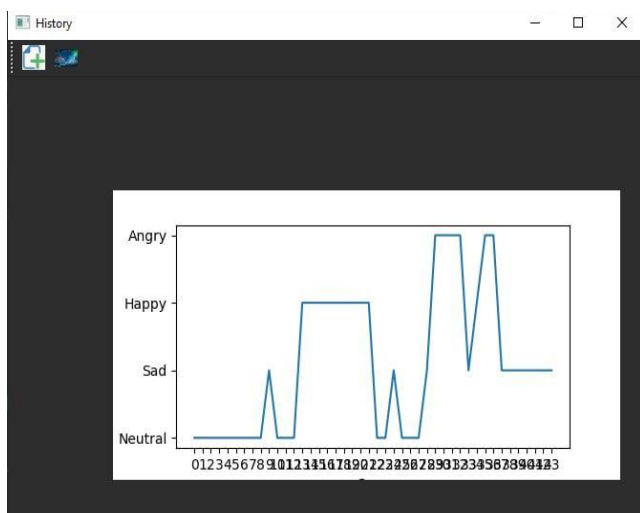


Fig 12: History output Line Graph

The additional feature added as the line graph can be viewed from the previous file saved. As we click on the "HISTORY" button the above page will be open. First, we need to select the file from which we want to see the graph of the emotions and, then it will display the graph.

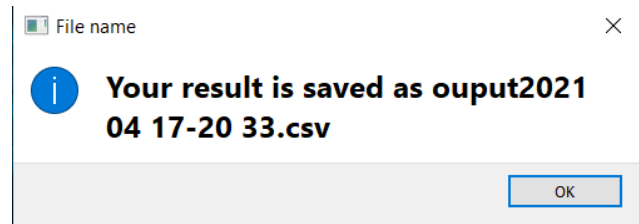


Fig 13: Name of the File Save

When we click on the "FILENAME" button, it will tell the filename in which the result has been stored.

5. Advantages and Disadvantages

5.1 Advantages

1. With facial expression recognition systems, the computer will be able to assess human expressions depending on their effective state in the same way that human senses do.
2. The system can be used for online interview purposes and can analyze the composure performance of the candidate in the interview.
3. The system can learn and improve in real-time. It can increase its accuracy with time.

5.2 Disadvantages

1. Emotion recognition is not possible whenever a mask or sunglasses is worn on the face.
2. The faulty rate of emotion recognition is about 4-5%.

6. CONCLUSION

Human emotion recognition plays a crucial role within an interpersonal relationship. The automatic recognition of emotions has been a lively research topic from early eras. Therefore, we decided to make a system that can detect the emotions of the user. The system takes input directly through a webcam and preprocesses the images it receives as input. And through comparative study identifies the emotion of the user. This system can be used to analyze the composure performance of a candidate during an interview. It can analyze the composure of a candidate based on the percentage of emotions shown into three different categories, which are low, medium, and high. This system can further be applied in fields like business, medical, education, advertisement, and much more.

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