Emotions specified Automatic Report Generator for Psychiatrists

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***Abstract*: Human emotions are mental states of feelings that arise spontaneously rather than through conscious effort and are accompanied by physiological changes in facial muscles which imply expressions on the face. Some of the different emotions are happy, sad, anger, disgust, fear, surprise, etc. Facial expressions play a role in non-verbal communication which appears due to the internal feelings of a person that reflects on the face. Humans are completely dependent on non-verbal communication and facial expression is the most important part of it. This paper gives an overview of Facial Emotion Recognition (FER) techniques, datasets [1], and how we create an automatic emotions analysis-based Report using FER. It has been recognized for decades and it is a vital topic in the fields of computer vision and machine learning. This paper is aim to understand the basic principles of FER and Data Visualization and help to understand how Emotions can be analyzed using the Machine learning Techniques specifically about the Open CV and Data Visualization process using matplotlib, the library of python.**

***Keywords*: Facial Expressions, Facial Emotion Recognition (FER), Data Visualization, Machine Learning, Emotion Analysis.**

1. INTRODUCTION

Emotion is the state of mind that is aligned with feelings, and thoughts usually directed toward a specific object. Emotion is a behaviour that reflects personal significance or opinion regarding the interaction with other human beings or related to a certain event. We can prevent suicides, and also it can be very helpful for medical organizations. More specifically, Psychiatrist and other medical staff of mental health need more meetings with patients tounderst and their medical mental history to analyze their emotions and stress level to reduce these types of problems and hopefully, this software helps the psychiatrists and medical staff to overcome the time needed during analysis and observation of the patient. Facial emotion recognition aims to help identify the state of human emotion (e.g., neutral, happy, sad, surprise, fear, anger and disgust) based on particular facial images that were present in the dataset. The challenge on facial emotion recognition is to automatically recognize facial emotion state and this should be overcome with the help dataset of images. The more the dataset is cleaned and specific, the higher is the accuracy of correct emotion prediction. The acronym for Facial Emotion Recognition (FER) is different in many papers, such as Facial Emotion Recognition and Facial Expression Recognition. In this paper, the acronym FER is refer to Facial Emotion Recognition. Generally, FER is split into three major stages as shown in Figure 1: (i) Face Detection, (ii) Feature Extraction, and (iii) Emotion Classification. At the initial stage, which is a preprocessing stage, a pictureof a face is detected and face components will be detected from the region. The facial components can be the eyes, brows, nose, and mouth. In the second stage, informative features will be extracted from different parts of the face. In the last stage, a classifier needs to be trained before being used to generate labels for the Emotions using the training data [1].

Fig.1: Facial Emotion Classification Stages

The emotion or expression recognition tools are proposed and developed before this research paper but no paper proposed the system that can help medical organizations for the treatment of patients and reduce the number of meetings h the patient with doctors. This Proposed system will help to analyze the emotion of the patient and calculate the level of stress and mind tiredness of the patient and at last, it will automatically generate the report according to the need of the doctor.

2. Literature / Background

Facial expressions is an important aspect in human communication and interactions. It is an important tool in behavioural studies and medical treatments. Facial emotion detection techniques provide a fast and practical. The purpose of the present study was to develop an intelligent system or we can say software for facial image-based expression /emotion classification using the OpenCV(library of Python) which has inbuilt Neural networks in itself. Emotion recognition has been broadly studied under the Computer Vision community. Mostly work focused on the analysis of facial expression to predict human emotions. Various techniques have

been developed in the research area of emotion recognition. To extract facial features Local binary pattern (LBP), LDP etc.. are different techniques. Some of them are described in this paper.

A) Linear Discriminant Analysis (LDA)

LDA is a supervised subspace learning technique. Paper [4] has applied a simple LDA-based classification scheme for FER as it can be trained quickly. Meanwhile, we analyzed LDA to recognize expressions by using LBP features. In paper , LDA is used to search for the projection of axes on which the data points of different classes are far from each other while requiring data points of the same class to be close to each other. Automatic Classification of Single Facial Images gives an approach that how we can discriminate or differentiate the face emotions using the different techniques/ methodology/ Algorithm [2].

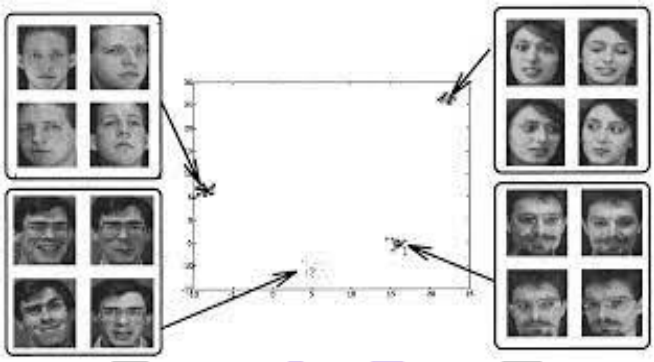

Fig.2: LDA-based classification scheme

B)Local Binary Pattern (LBP)

LBP is a visual descriptor used in classification for CV i.e., computer vision. It is the primary technique in face recognition. Most of the future approaches and techniquesfor face recognition are created based on LBP. Later, it has been applied in facial images analysis. Paper has made a comparison between several techniques to know and get about the performance of FER using LBP features. Their study determined that in a compact representation, LBP features can get discriminative facial information. The dataset used in this paper mostly contains the frontal face images that help the training model to understand and extract the features of the face that are present in the image [3].

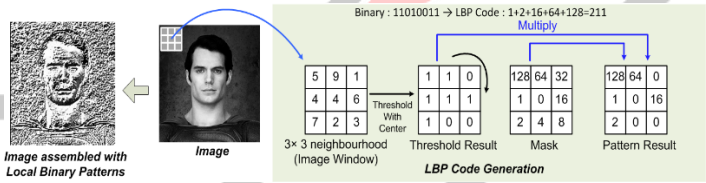

Fig.3: LBP features

3. Proposed system / Methodology

Extracting out the features is an important step in the analysis of emotion. It contributes to a quick and accurate recognition of expression, i.e., Neutral, happiness, surprise and disgust, sadness, anger and fear are expressions of the faces. Facial expressions are most regularly used to explicate human emotions[4]. We divide the emotions into two categories that contain a range of different emotions: positive emotions and non-positive emotions. This will help to interpret the exact level of emotion of stress or tiredness of mind. Face Detection, Extraction, Classification and Recognition [5] are major steps to be used in the proposed system. At the initial stage, the real-time video will be taken as input and then the video will be pre-processed and then the feature extraction will be done. After the feature extraction, the Emotion is to be detected parallelly during the real-time video.

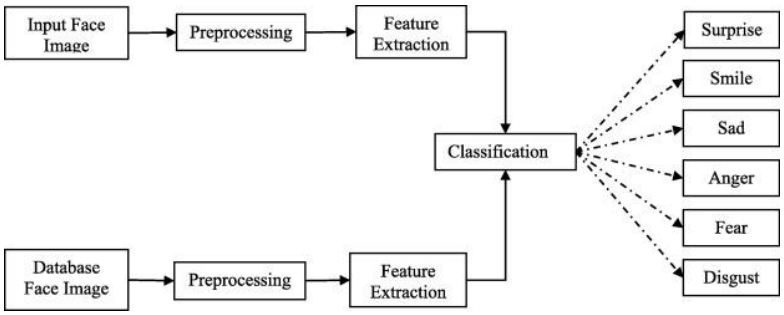

Fig.4: Process of extracting the features of emotion

This complete process will work under the time observation and during the observation of the patient, the time and emotion will be calculated thoroughly. In the end, these things will be displayed in the report under the observation time –

- how many times the emotion can be changed by the patient
- Average time of all Emotions
- Time Percentage of positive and negative emotions
-

The average time of Emotion will be calculated using the basic average formula:-

Time of one emotion during the observation / Total observation time

More things that will be related to time and emotion will also be calculated in the proposed system and further can be updated by the developers. Many different datasets can be used to train the model and test the system like Facial Emotion Recognition (FER) 2013 and Custom dataset. These are used to develop a working model to recognize facial emotions [6]. FER-2013 dataset has around 35,000 images with different emotion categories (happy, sad, contempt, disgust, surprise, neutral, anger). The custom dataset contains imagesof around 25,000 with five different emotions (happy, sad, surprise, anger, neutral. Pre-Processing is the first task to perform any task on the input or image. After the pre-processing, the faces are detected and features are extracted using a Haar filter. It is implemented using OpenCV and Python [7]. Face detection and feature extraction can be done by the Cascade_classifier function in OpenCV. At the final stage, the calculated number of things will be displayed in the report in the form of graphical representations. The Graphical representations should be like these figures, at the end of the report [8].

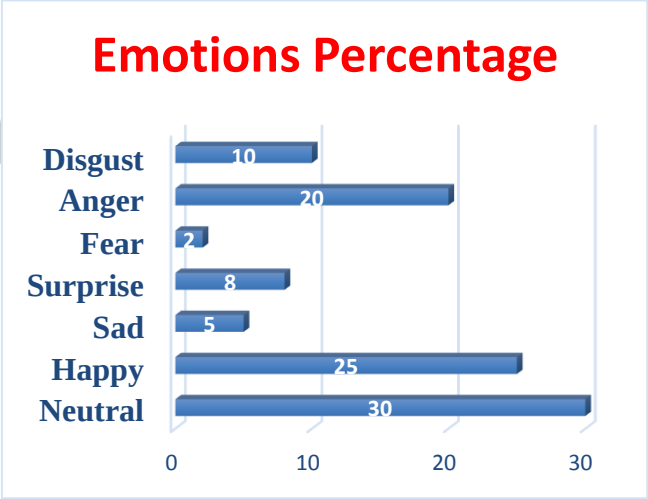

Fig.5: All Emotions Percentage Capturing Graph

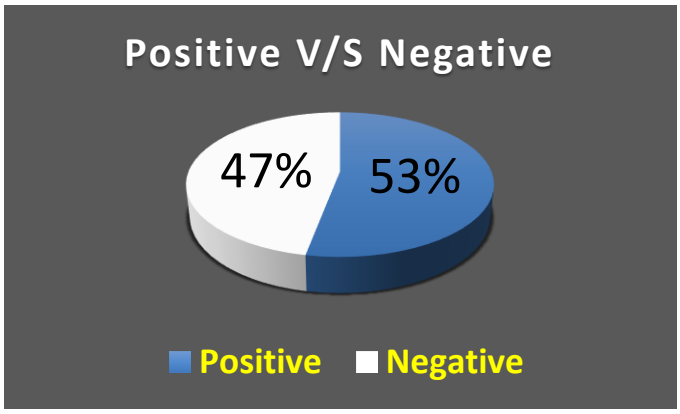

Fig.6: Positive v/s Negative Emotions Ratio

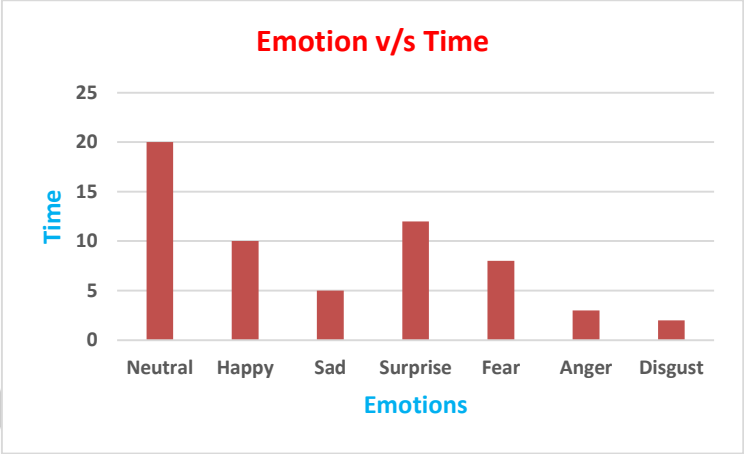

Fig.7: Positive v/s Negative Emotions Ratio

The above mentioned Graphical representations are just sample visualization. According to the need of the psychiatrist or medical organization, it can change and developed with the help of acquired after the observation of patient or person. All these depend on the occurring of emotions on the face of the patient or person. A system that could classify facial expressions atthe macro-level [8], consisting of seven basic human expressions discussed above also (Neutral, happiness, surprise and disgust, sadness, anger and fear).

6. Advantages of Proposed system

This proposed system will help the medical organizations and psychiatrists to find out the stress level, mental tiredness or emotional changeability of a patient concerning the time. It saves time as the whole process completely relies on the machine or system. As we all know, in today's time the physical meetings become dangerous due to the covid 19 as it spreads the infection very rapidly. If this proposed model or system is present at these times, it will be very helpful as It reduces the number of meetings of the patient with the doctor. If the doctor observes the patient then it takes a lot of time and plenty of meetings but if this was done by this system then all required things will be calculated very accurate and fast under the observation time and also the plenty meetings are also not required.

7. Conclusion& Future Scope

In this paper, the idea of a system or model is proposed that reduces the number of meetings of mental health patients with the doctors. The Idea proposed in this paper completely works on the Computer Vision and process the input that would be taken from a real-time video format and then identifies and calculates the emotions under the observing time. This will help the medical organizations to get the emotional level mind of patients without the plenty meetings. This work should be done using a CNN architecture/ algorithm on the FER-2013 dataset. This combination gives descent accuracy of 70-72 %. This completely depends on the dataset. The more Dataset is accurate the more will be the accuracy of the model trained. Further, in future, it can be more accurate as the dataset will be updated or the same will produce high accuracy. Therefore, to improve the accuracy of emotion recognition systems, facial expressions would work but body movements are also needed to consider. As body movements show kinetics and motion of body parts, which helps in detecting the emotions and sentiments of a person.

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