IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DRIVERS SAFETY USING EMOTION DETECTION

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Abstract:- The emotional and mental state of a driver is very important for driving. There are many factors that affect the driving state of the driver such as fatigue , depression , sadness, nervousness , anger etc. which can cause many accidents. This paper presents an approach which is based on Convolution Neural Network (CNN) which helps in detecting the emotional and mental state of the driver. Due to which we can avoid many motor vehicle accidents. Afterwards, we noticed that the real-time emotion detection could be more effective, which continuously detects the emotional and mental state of the driver and send the alert message if driver is stressed, depressed, angry, fatigue etc.(negative emotions) which is dangerous and can cause accidents.

Keywords

Road Safety, Emotion Detection, Mental Health Detection, Accidents, Convolution Neural Network.

I. INTRODUCTION

The automatic emotion detection could be used in wide range of fields such as feedback system for e-learning programs, road safety, monitoring of workers performance in a critical task etc. As covid-19(pandemic) is a tough time for all of us, all the schools and colleges are closed and the students have to take there lectures in online mode, if we implement this emotion and mental state detection approach with the e-learning system so we can get the feedback from the students.

This system can reduce the number of accidents caused due to the drivers negligence. As we can see our cars are getting many safety features these days like airbags, predict rear-end collisions and braking assist , pedestrian detection etc. but one of the loophole of this is that they do not include the driver and his mental state in the decision making, so if we include this system it can make our driving more safe for us and others out in the roads.

Drivers know the dangers of over speeding while distracted and the collision risk associated with it but the cars should consist of a system that keeps on alarming them that in this mental state you can't drive the vehicle, you need to take a break and then continue driving or it would reduce the road safety and lead to many accidents. Approximately 1.3 million people die each year as a result of road traffic crashes due to the drivers distracted or stressed mental state, a single persons mistake can bring many peoples life to threat. Distracting driving can be defined as an activity that diverts the drivers attention. Drivers distraction can majorly be categorized into four main areas:-

- Visual Distraction
- Manual Distraction
- Cognitive Distraction
- Mental Distraction

This paper focuses on the mental distraction and its prevention which leads to the enhancement in the road safety.

II. SYSTEM OVERVIEW

In this section , we will briefly describe the hardware and the software components that are required to set up the system.

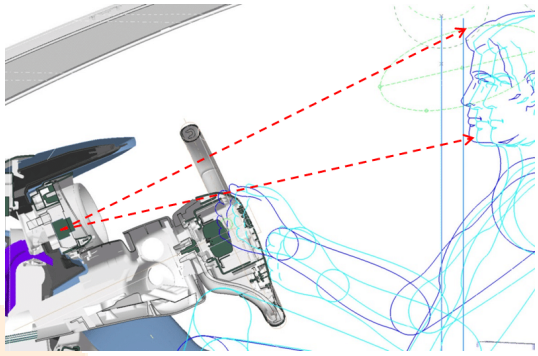

Fig. 1: An NIR- camera is mounted inside the dashboard And directed towards the drivers face

An NIR- camera is mounted inside the dashboard and directed towards the drivers face which continuously detects the emotions and the mental state of the driver.

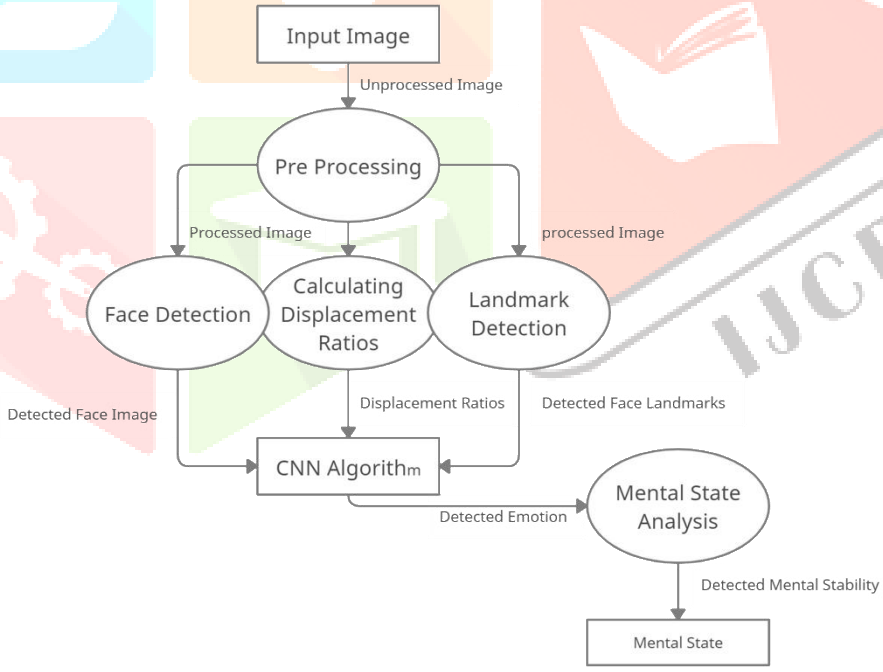

Fig. 2: Software modules in the detection system

The output of the NIR- camera is used as an input for the mental health detection system.
The images or videos are first pre-processed and then with the help of facial landmarks we detect the emotion of a person by using Convolution Neural Network(CNN) Algorithm then the mental state of the driver is detected.

III. EMOTION DETECTION

1. **Pre-Processing:-**
   Pre-processing involves the following techniques:-
   - **a) Read Image :-** An image is a 2D array of pixels ranging between 0and 255.
     An image can be defined by f(x,y) , where x and y are the horizontal and vertical coordinates.
     In this step we store the path to the image into variable then a function is created to load folder which contain images into array.
   - **b) Resize image:-** Some of the images which are captured by the camera vary in size, therefore we need to set a base size(48*48pixel) for all our images which are fed into the machine learning algorithm.
   - c) **Remove noise:-** One method to **remove noise** is by convolving the original **image** with a mask that represents a low-pass **filter** or smoothing operation. For example, the Gaussian mask comprises elements determined by a Gaussian function. This convolution brings the value of each pixel into closer harmony with the values of its neighbours.
   - **d) Segmentation:-** Image Segmentation is a process of partitioning the image into multiple segments. It is used to simplify or to change the representation of the image into something which is more meaningful , defined and easier to analyze.

2. **Image Augmentation:-**
   It is a technique which expands the data set artificially. This is helpful when the given dataset consists of very few number of data samples.
   Some of the image augmentation parameters which are generally used are to increase the data sample are rotation, shear, zoom, preprocessing function and so on.

3. **Feature Extraction:-**
   Feature extraction is a part of dimensionality reduction process, in which we divide the initial set of raw data and reduce it to more manageable group. So when the data needs to be process it will be easier. The large data set consists of large number of variables which requires a lot of computer resources to process them. Feature extraction helps in extracting the best features from those big data sets by selecting and combining variables into features, which effectively leads to the reduction of data. These features can be processed easily, and still they can describe the data set accurately.
   There are total of 68 facial landmark detectors in Dlib library which detects the 68 facial landmarks. By the use of the Dlib library we can extract the coordinates(x,y)
   of each facial point. There 68 landmark point are divided in specific areas like right eye, left eye, mouth , nose, left eyebrow, right eyebrow and jaw, as shown in the fig. 3. The feature extraction techniques used for the feature extraction are ensemble of regression tree and displacement ratios.

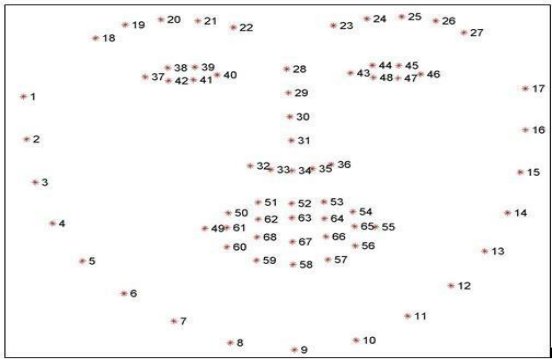

Fig. 3 : Facial Landmarks

4. Classification:-

By using Convolution Neural Network(CNN) we detect the emotion of the driver.
The input images image array is mapped with the values of the other image in the dataset and the algorithm gives the value of each emotion for the given input. But the most prominent emotion is taken into consideration.

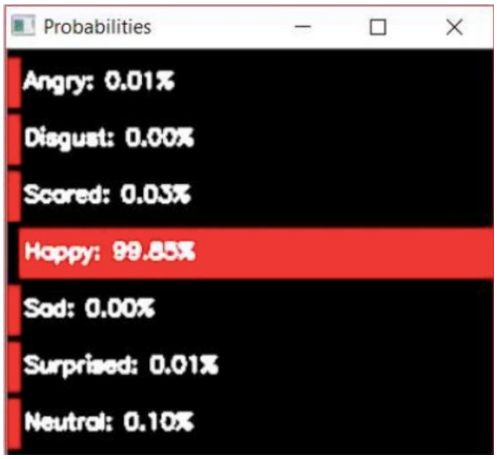

Fig. 4 : Emotion detection output

In figure 4 we can see that the most prominent emotion is happy, and based on these values the mental health of the driver is detected.

5. Mental Health detection:-

a) **Knowledge Base :-**
It contains certified images which we will use for comparisons for the sake of emotion recognition. These images are highly qualified and these are stored in given database. Whenever any input is given to system, system will find the relevant picture from knowledge base by comparing input to certified images and gives a output (emotion).

b) **Pre-processing and Resize:-**
The main goal of this step is to enhance input image and also remove various type of noises. After applying these techniques we need to resize the image that is consider only human face this is done by using eye selection method.

c) **Difference Measurements:-**
It will find the difference between the input image and the certified images (stored in knowledge base) and give result to emotion recognition step.

d) **Emotion Recognition:-**
It will get output from Difference measurement and compare the result and give output depend on minimum difference.

e) **Mental Health Prediction:-**
The prediction consist probabilities of all the 7 classes of human emotion based on these probabilities the system predict the mental stability of the image that is provided by the user.

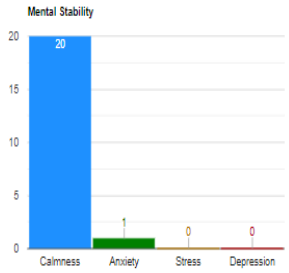

Fig. 5 : Mental state in the form of bar graph.

IV. CONCLUSION AND FUTURE WORK

Driver safety using emotion detection system is proposed and developed to send warning to the driver based on recognized face, so that we can prevent accidents. . The driver safety system proposed extracts the facial expressions through efficient texture Local Octal Pattern (LOP) and recognizes the facial expressions based on Deep Neural Networks, i.e., CNN. It can detect both natural and spontaneous emotions of a person. The proposed system can be further extended to include different manoeuvres to ultimately make the driving system capable of dealing with all types of vehicles, under varying driving environments and scenarios. Further enhancements are to be considered as part of future work to be able to withstand failure and retain robustness for extreme poses and heavy illumination as well as occlusions at certain point.

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