A REVIEW ON DRIVER'S DROWSINESS DETECTION USING FACIAL FEATURE

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Abstract:

Drowsiness of the driver is one of the big reasons for road accidents from the past few years. This turns out to be a big problem not only for the driver but also for the people who use that road. With the improvement in technology, various accident prevention technologies are evolving. The primary objective of avoidance of road accidents can be achieved through real-time drowsiness detection of a driver using video capturing with face detection. After capturing and detecting the drowsiness by using a camera, the alert sound will be triggered. The position of head and blinking of eyes are used as the features to detect whether the driver is drowsy or not. The camera captures the real-time drowsiness by using Local Binary Pattern to detect the face and haar cascade classifier to detect the eyes. A custom eye blinking file has been developed for eye blinking detection.

Keywords: *Alarm, convolutional neural network, drowsiness detection, eye detection, face detection, machine learning, supervised learning, unsupervised learning.*

Introduction:

Driver drowsiness is a significant variable in the majority of vehicle accidents. Driver's capacities of response, data handling, and judgment will be disabled when they are exhausted. It is exceptionally useful to help them to remember resting or further developing cautiousness when exhaustion comes. Driver's weakness discovery as a non-nosy technique is a promising yet testing work. It was exhibited that driving execution gets most horrendously terrible with tiredness which brings about crashes establishing over 20% of all vehicle accidents. Public Highway Traffic Safety Administration(NHTSA) analyzed information demonstrates that driving while languid is a contributing variable to 22% - 24% of fender benders and driving while lazy outcomes in a 4 to 6times higher close accident/crash risk comparative with ready drivers. Since numerous street mishap happens because of driver's faintness and languor, there is a requirement for growing such a technique which will stand tall against these accidents. A few signs that can be estimated for driver weariness are: yawning, feeling eager, feeling firm, responding gradually, weighty eyes. There have been many examination works done to recognize driver's sleepiness in light of above tokens of the body. The eyes' states might mirror the drivers are exhaustion or not. In any case, that aren't the main data which can mirror drivers' weariness. The yawning is one more significant hint to mirror drivers' exhaustion. The location framework will be more hearty assuming that yawning along with eye flickering or different hints is incorporated to settle on joint choice. Our

principle point in fostering this task is to forestall vehicle accidents because of driver tiredness and consequently save lives. A ton of vehicle fabricating organizations are as of now approaching this matter in a serious way and have fused security systems in the independent vehicles. Mercedes is the main organization to have its own driver sleepiness framework in its vehicles. On distinguishing driver sleepiness, their framework naturally vibrates the directing haggle future they have plans to foster programmed controlling that takes over on identifying driver laziness. Following its strides is one more organization Volvo.

Methodology:

For the detection of driver's drowsiness, there are some methodologies such as the percentage of eyelid closure over the pupil over time (PERCLOS), physiological measurements like electrocephalogram (EEG), electrocardiogram (ECG) [1], capturing eye closure, facial features [2] and driving performance (such as steering characteristics, lane departure, etc.) [3]. In the proposed system, we are focusing on capturing eye closure to detect drowsiness. The entire process can be divided into several modules such as capturing input, pre-processing (grayscale conversion & image resizing), face detection, eye detection, classification and drowsiness detection. The basic illustration of the modules of drowsiness detection is shown in the figure followed:
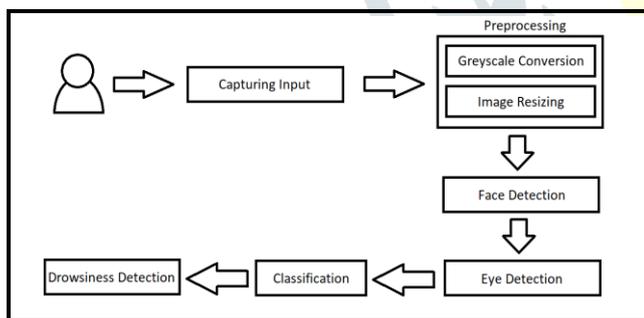

Fig. System Architecture

1. Capturing Input:

To begin with drowsiness detection, we first need to capture images live. So we make an infinite loop that can keep capturing frames infinite times. To capture frames, we can use OpenCV library. The cv2.VideoCapture(0) can be used to access the webcam and then capture frames with cap.read() method. That frame can be stored in variable to further process it.

2. Pre-processing:

The pre-processing is done to improve the image data and to remove unwanted distortions. Which increases performance and efficiency of the task. The system needs to capture and process images live, so to improve performance we apply pre-processing as followed:

i. Grey Scale Conversion: Grey Scale Conversion is used to remove the coloured data that is not useful for further operations. Therefore, decreasing the time to process the image and also improves performance of the system.

ii. Image Resizing: Resizing images is a crucial pre-processing step in computer vision. Our machine learning models train faster on smaller images. Since neural networks receive inputs of the same size, all images need to be resized before feeding them to the CNN. In our model we will have to resize the images to 24x24 pixel as the model was trained on 24x24 pixel images.

3. Face Detection:

Face detection is widely used for biometrics, face recognition [4], emotion recognition, fatigue detection [5], and in many mobile/desktop applications. To detect the faces in image, we need to pre-process the image first. After pre-processing the image, we will apply a haar cascade classifier to detect face inside the image.

4. Eye Detection:

Locating the position of eye is difficult task due to many factors such as lighting conditions, expression, facial shadowing, etc. Using the eye features, different measures can be calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of eye, opening velocity of the eye, closing velocity of the eye and an effective drowsiness detection model can be created. After the face is detected, locating position of eye can be done with better accuracy. If the eye could not be detected, we can assume that the driver is not looking at front.

5. Classification:

In our proposed system, classification will be done using a Convolutional Neural Network (CNN) Classifier. This CNN classifier will classify or predict the status of eye. Before feeding input to the classifier, we will pre-process the image and extract eye.

A Convolutional Neural Network (CNN) is a type of artificial neural network used in image recognition and object detection. The basic structure of CNN has multiple layers including convolutional layer, pooling layer and fully-connected layer [6]. The basic structure of CNN is illustrated in the diagram below:
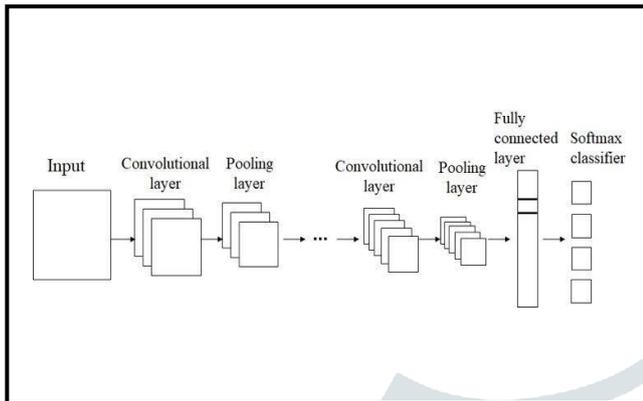

Fig. Convolutional Neural Network

i. *Convolutional Layer:* A convolutional layer is the main building block of a Convolutional Neural Network (CNN). It is the first layer of convolutional Neural network. Convolutional layer preserves the relationship between pixels by learning image features using matrix of input data. Convolution of an image with different filters can perform operations such as edge detection, Gaussian blur filter, sharpen, etc.
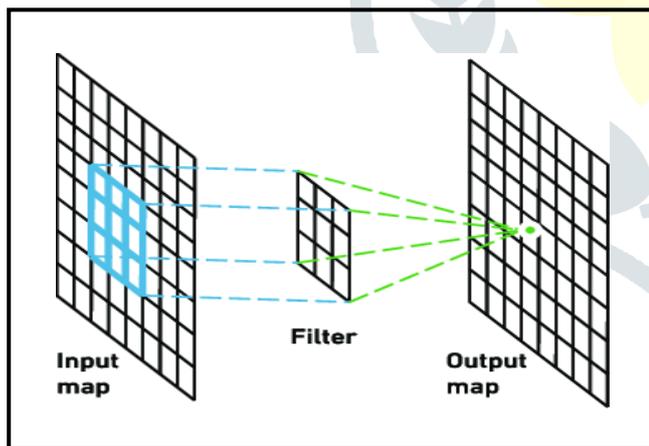

Fig. Convolutional Layer [7]

ii. *Pooling Layer:* Pooling layer is also known as down-sampling. This layer reduces the number of parameters in the input. Similar to the convolutional layer, the pooling operation applies filter across the entire input. There are two main types of pooling as follows:
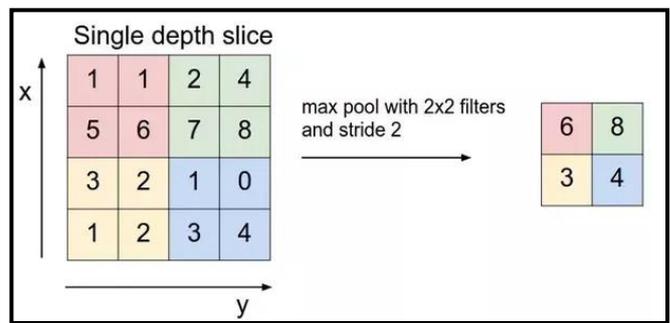
Fig. Pooling Layer [8]

a. *Max Pooling:* As the filter moves across input, it selects the pixel with maximum value to send to the output array.

b. *Average Pooling:* As the filter moves across the input, it calculates the average value to send to the output array.

iii. *Fully-connected Layer:* This layer performs the task of classification based on the features extracted through the previous layers. The CNN process begins with convolution and pooling, breaking down images into features and analyzing them.

The result of this process is then fed into a fully-connected neural network structure that drives the final classification decision [9]. Fully-connected layers usually leverage a soft-max activation function to classify inputs and produce a probability from 0 to 1.

Fig. Fully Connected Layer [8]

6. *Drowsiness Detection:*
Finally, based on the classification results we will calculate the score of drowsiness. Score is basically a value that we will use to determine for how long the person has closed his eyes. We keep increasing the score if the eyes are closed and if the eyes are open we decrease the score. If the score passes the threshold value, we can assume that the

person has closed his eyes for longer duration and alert the person by turning the alarm on.

Conclusion:

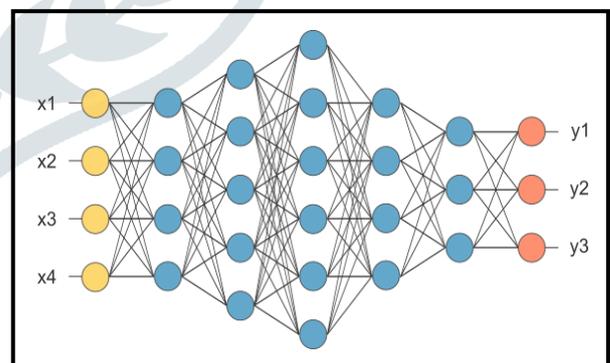The drowsiness detection and correction system we are developing is capable of detecting drowsiness in a rapid manner. Our proposed system can differentiate normal eye blink and drowsiness, which can prevent the driver from entering the state of sleepiness while driving.
During the monitoring, it decides if the eyes are opened or closed. When the eyes have been closed for too long, a warning signal is issued. Processing judges the driver's alertness level on the basis of continuous eye closures. This system can be used to reduce the amount of road accidents that happens to great extent. This can save a lot of lives, which is a main motive of this system.

This system does not need any complex system to work effectively. Taking the facts into consideration "Driver Drowsiness Detection System" is the future of road safety.

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