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Eye Drowsiness Detection

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Abstract: *The major reason of the accidents is drowsiness caused by both sleep and alcohol. Due to driving for long time or intoxication, drivers might feel sleepy which is the biggest distraction for them while driving. This distraction might cost death of driver and other passengers in the vehicle and at the same time it also causes death of people in the other vehicles and pedestrians too. To prevent such accidents we, propose a system which alerts the driver if he/she feels drowsy. To accomplish this, we implement the solution using computer-vision based machine learning model. The driver's face is detected by face recognition algorithm continuously using a camera and the face of the driver is captured. The face of the driver is given as input to a classification algorithm which is trained with a data set of images of drowsy and non-drowsy faces. The algorithm uses landmark detection to classify the face as drowsy or not drowsy. If the driver's face is drowsy, a voice alert is generated by the system. This alert can make the driver aware that he/she is feeling drowsy and the necessary actions can then be taken by the driver.*

Keywords: Computer Vision, Machine Learning, Convolutional Neural Networks, Face Detection, Drowsiness

I. INTRODUCTION

Car accident is the major cause of death in which around 1.3 million people die every year. Majority of these accidents are caused because of distraction or the drowsiness of driver. Drowsiness appears in situations of stress,fatigue and boredom situations, for example, driving for a long time. In this way, drowsiness produces danger situations and increases the probability that an accident occurs.To prevent such accidents, our team has come up with a solution for this. In this system, a camera is used to record user's visual characteristics. We use face detection and CNN techniques and try to detect the drowsiness of driver, if he/she is drowsy then alarm will be generated. So that the driver will get cautious and take preventive measures.

II. LITERATURE SURVEY

Trupti K. Dange, T. S.Yengatiwar."Drowsiness Detection System Utilizing Physiological Signals."[2019]
The Physiological parameters-based techniques detect drowsiness based on drivers' physical conditions such as heart rate, pulse rate, breathing rate, respiratory rate and body temperature, etc. These biological parameters are more reliable and accurate in drowsiness detection as they are concerned with what is happening with driver physically. Fatigue or drowsiness, change the physiological parameters such as a decrease in blood pressure, heart rate and body temperature, etc. Physiological parameters-based drowsiness detection systems detect these changes and alert the driver when he is in the state, near to sleep.A list of physiological condition-based drowsiness detection system. These measures are invasive, so require electrodes to be directly placed on the driver's body.

Adrian Rosebrock."Drowsiness Detection with OpenCV (Using Eye Aspect Ratio)."[2017]
A real-time algorithm to detect eye blinks in a video sequence from a standard camera is proposed.A real-time eye blink detection algorithm was presented. We quantitatively demonstrated that regression-based facial landmark detectors are precise enough to reliably estimate a level of eye openness. While they are robust to low image quality (low image resolution in a large extent) and in-the-wild phenomena as non-frontality, bad illumination, facial expressions, etc.The proposed SVM method that uses a temporal window of the eye aspect ratio (EAR), outperforms the EAR thresholding.

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

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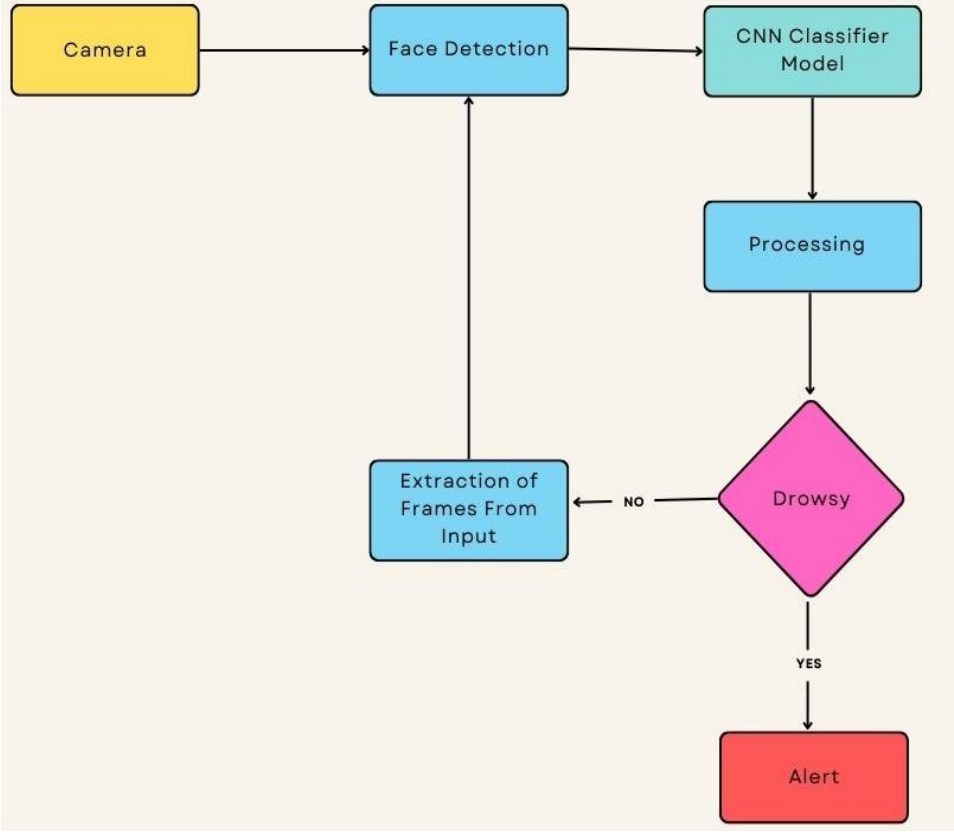
Burcu Kir Savas, Yasar Becerkli. "Real Time Driver Fatigue Detection Based on SVM Algorithm."[2018] :
In this study, SVM based driver fatigue prediction system is proposed to increase driver safety. The proposed system has five stages: PERCLOS, count of yawn, internal zone of the mouth opening, count of eye blinking and head detection to extract attributes from video recordings. The classification stage is done with Support Vector Machine (SVM). While the YawDD dataset is used during the training phase of the classification, real-time video recordings are used during the test phase.

Venkata Rami Reddy Chirra, Srinivasulu Reddy Uyyala and Venkata Krishna Kishore Kolli."Driver drowsiness detection using ANN image processing" [2019] :
For the classification of the driver's drowsy or alert state, artificial neural networks were used. Artificial neural networks are extensively used for the image classification.Deep learning is a subset of machine learning in artificial intelligence that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Deep Belief Networks, Restricted Boltzmann Machines and Deep Autoencoders are all methods belonging to the Deep Learning. These methods are used in a wide range of applications, the image classification being one of the fields in which these are employed with success.

III. SYSTEM ARCHITECTURE



IV. METHODOLOGY

1. Data Collection: The system captures images or video of the driver's face using a camera mounted inside the car.
2. Face Detection: The system uses computer vision algorithms, such as the the Convolutional Neural Networks (CNN), to detect the facial landmarks, such as the corners of the eyes and mouth, and the bridge of the nose.

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3. EAR and MAR Calculation: The system then calculates the EAR and MAR based on the positions of the detected facial landmarks.
4. Drowsiness Detection: The EAR and MAR values are compared to predetermined thresholds. If the EAR or MAR falls below the threshold, the system determines that the driver may be drowsy or sleepy and alerts the driver with an audible or visual alarm, to prevent accidents.

EAR Equation = EAR (A+B)/ (2.0 * c)
Where,
A = dist.euclidean (eye [1], eye[5])
B= dist.euclidean (eye[2], eye[4])
C = dist.euclidean (eye[0], eye[3])
MAR Equation = MAR (A+B+C) / 3.0
Where,
A = dist.euclidean (mouth [13], mouth [19])
B = dist.euclidean (mouth[14], mouth [18])
C = dist.euclidean (mouth [15], mouth[17])

Algorithm: Convolutional Neural Network

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other

CNNs can be used in eye drowsiness detection systems to automatically extract features from eye images or videos and classify them as open, closed, or partially closed, indicating whether the person is drowsy or not.

In addition, CNNs can also handle variations in lighting, orientation, and other factors that may affect the accuracy of traditional computer vision algorithms. Overall, the use of CNNs in eye drowsiness detection systems can help improve the accuracy and robustness of the system

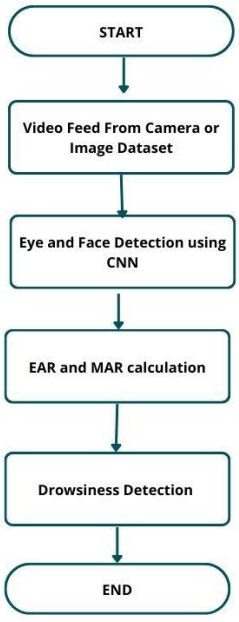

Figure 2 Flow Chart

V. CONCLUSION

The paper described an Eye Drowsiness Detection system based on CNN-based Machine Learning. We used OpenCV to detect faces and eyes using a haar cascade classifier and then we used a CNN model to predict the status. The system

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was able to detect facial landmarks from images and pass it to a CNN-based trained Deep Learning model to detect drowsiness. There are limitations to this technology, such as obstructing the view of facial features by wearing sunglasses and bad lighting conditions. However, given the current state, there is still room for performance improvement and better facial feature detection even in bad lighting conditions. Thus we have successfully designed a prototype drowsiness detection system using OpenCV software and Haar Classifiers. The system so developed was successfully tested, its limitations identified and a future plan of action developed

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