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Driver Drowsiness and Distraction Detection using Machine Learning

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Abstract. Nowadays, a countless number of people tend to use different types of transportation for travelling from one place to another either through land, air or water. It is very dangerous to drive when you feel asleep. Long-distance drivers suffer from insomnia. The drivers should be very cautious while driving and even he/she have to be very careful while driving at night time. Driver's drowsiness is the real cause of many road accidents. Therefore, there is a necessity for developing a machine learning model that will detect and notify a driver's bad psychophysical condition and unnecessary distraction which could significantly reduce the number of road accidents. These factors lead to the innovation of this project in order to support the drivers for their drowsiness condition and prevent their distraction. This project uses the technology of OpenCV (Computer Vision) powered by Machine Learning in order to detect the eyes, head and mouth movements while driving. However, the development of such systems encounters many difficulties associated with the fast and accurate recognition of the driver's drowsiness symptoms. One of the best ways to detect a drowsy driver is to use a vision-based approach.

Keywords: Convolutional Neural Network, Region of Interest, Drowsiness, Eye movements, Head Movements, Computer-Vision.

1. Introduction:

1.1 Overview:

One of the simplest projects to start with was classification of images. So, now start from the bottom with detecting the driver's drowsiness and distraction which includes the detection of eyes, head and mouth for distraction and drowsiness.

1.2 Machine learning:

Machine learning is a sub-domain of artificial intelligence (AI). The goal of machine learning is usually to understand the structure of the data and to match that data to models that can be understood and used by humans. Machine learning is a field that continues to evolve. For this reason, there is something else to keep in mind as you work with machine learning methods, or analyse the impact of machine learning processes. Two widely accepted methods of machine learning are supervised learning trains algorithms based on input by human and output model data, and unsupervised learning algorithm provides a non-labelled data to allow it to detect input and produce output. Image classification is done using supervised machine learning. [1].

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1.3 Supervised learning:

In Supervised Learning, the model uses the labelled data for learning. After the thorough analysis of the data, the algorithm determines which label should be assigned to new data based on pattern and associates the patterns to the unlabelled new data. Supervised Learning can be divided into 2 types. They are Classification & Regression. Image classifier is under the category of Classification [2].

1.4 Convolutional Neural Network:

Convolutional Neural Network [3] is a type of Artificial Neural Network algorithm. It is a powerful image processing algorithm used for image detection and separation of frames from video clippings. CNN performs both generative and descriptive tasks which includes image and video recommendations along with Natural Language Processing. Basically, the neural network resembles the neuron system of the human brain. Other neural networks are not good for image processing as it takes longer time to extract the features and must be given with a less resolution pictures. CNN uses multiple layers for processing the images and the processing time gets reduced. There are three main layers in CNN. They are input layer, output layer and a hidden layer. The hidden layer performs all the processing related to images or languages.

2. LITERATURE REVIEW:

2.1 A Dedicated System for Monitoring the Driver's Fatigue by K.SubhashiniSpurjeon , et al.

The creation of an invisible computer watch system for real-time driver monitoring. Computer and imagery platforms such as image detection system, detection algorithm and eye tracking algorithm are simultaneously produced to produce multiple visual indicators that depict a person's level of fatigue [4]. Next, a framework is developed to simulate fatigue, which systematically combines different visual indicators and relevant content details to produce a dynamic indicator of fatigue.

2.2 The Drowsiness Warning System Using Artificial Intelligence by Nidhi Sharma, et al.

This review paper describes the various ways in which a driver can fall asleep by analyzing facial images taken by a camera mounted on a dashboard. The program involves two steps, eye recognition and instant drowsiness. Eye recognition is done through image processing. In the second stage, various implantation techniques such as the opposite mind, neural network, various body movements etc. Lack of proper light after sunset can cause problems in image reading. It can also be difficult for the system to detect the driver's eye wearing glasses [5]. In the future launch of an infrared light source may be the best solution for light deficiency after sunset.

2.3 Development of a Drowsiness Warning System Using Neural Networks, Itenderpalsingh, et al.

A non-invasive eye-tracking system and fatigue monitoring are developed. Details about that level. The closure is achieved by using various image processing algorithms that he has created for himself. During monitoring, the system be able to determine if the eyes are open, drowsy or

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closed. When the eyes are drowsy or closed, a warning is issued. The Neural network offers a completely different, unconventional way of finding a control problem, this technology is not hard to use and the results are very amazing [6].

3. Drowsiness Detection Techniques:

As shown in fig. 2, the following techniques are being used by machine learning scientists to detect driver's drowsiness [7]. They are I) EEG (electroencephalograph) based techniques II) Vehicular method III) Vocal measures IV) Images Processing based techniques V) Artificial neural network-based techniques. Out of these Image processing-based technique is used in this project.

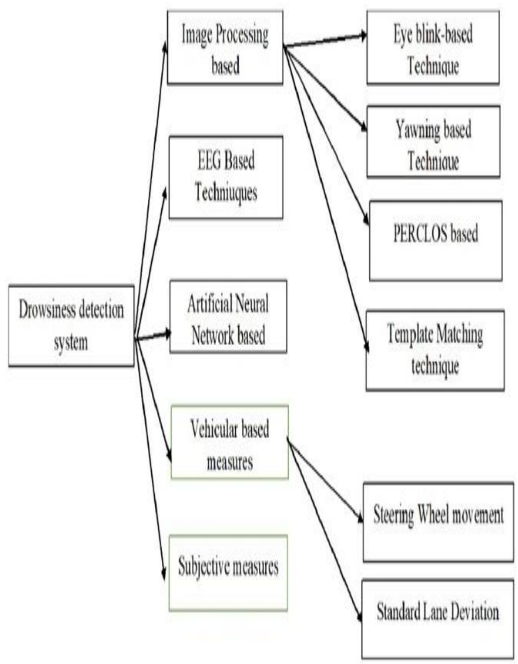

Fig. 1. Drowsiness detection techniques

4. **Implementation Details:**

4.1 MODULE DESCRIPTION:

4.1.1 Module 1: Detecting face and extracting eye part

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In this module, the face is detected and extracting the eyes part as region of interest. After this, it is compared with the trained Machine Learning model and determines the eyes are closed are opened. If the eye is closed for a certain threshold period, an alarm starts to beep.

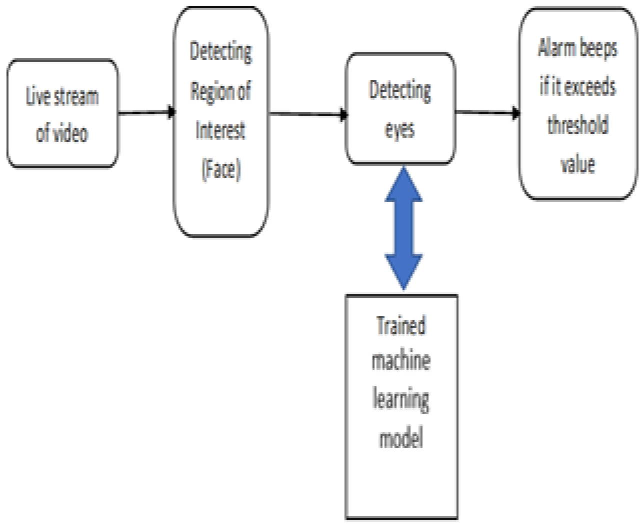

Fig. 2. Detecting eyes for drowsiness

4.1.2 Module 2: Detecting head for distraction

In this module, the head is detected for any distraction of driver by the head rotation and it is compared with the trained machine learning model as the head is tilted to the extreme left/right/seeing the rear mirror for long time. If the rotation is continued for a threshold value, it alarms and notices the driver.

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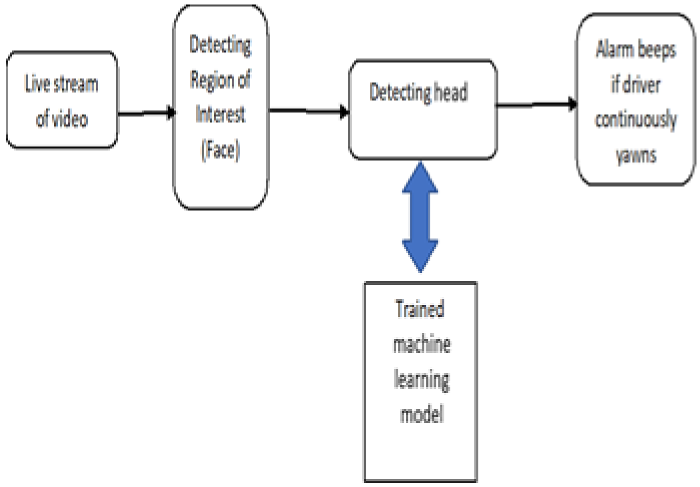

Fig. 3. Detecting head for distraction

4.1.3 Module 3: Detecting mouth for yawning

In this module, the mouth is detected for yawning as it indicates the pre-condition for fatigue and it is compared with the machine learning model as the mouth is extremely opened or not. This is implemented because of the precautionary condition before sleep and alerts the driver not to sleep.

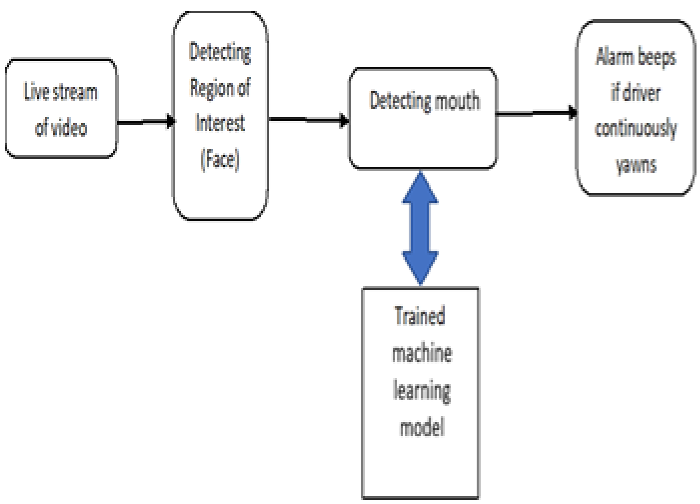

Fig. 4. Detecting yawning as a precautionary measure

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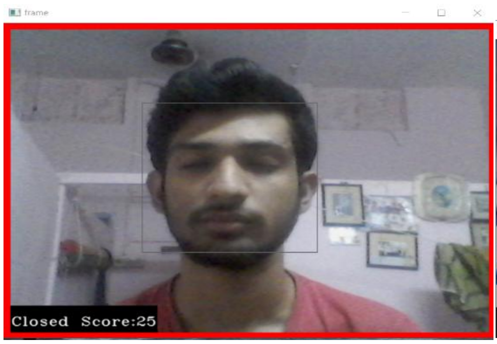
5. Results

Fig. 5(a) Eye opened and no beep Fig. 5(b) Eye is blinking so no beep



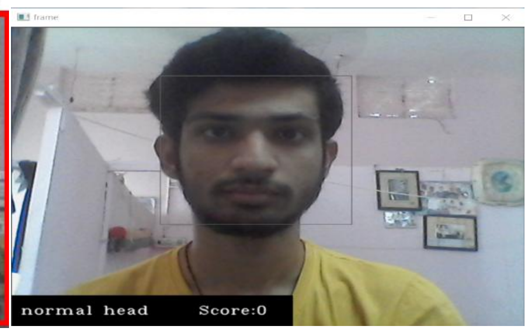
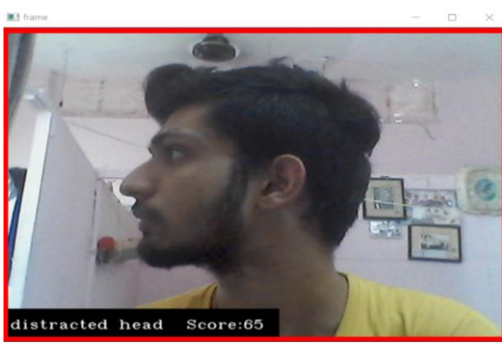


Fig. 6(a) Eye is closed and the alarm beeps Fig. 6(b) Normal head without distraction and no beep



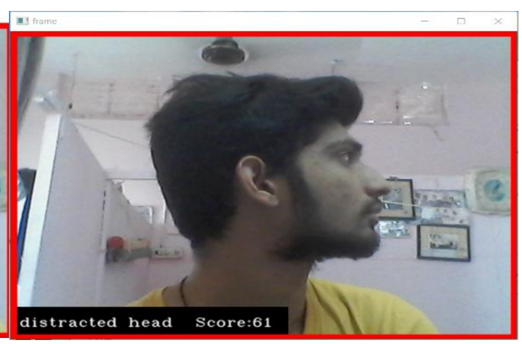


Fig. 7(a) Head is distracted to left and the alarm beeps Fig. 7(b) Head is distracted to right and the alarm beeps

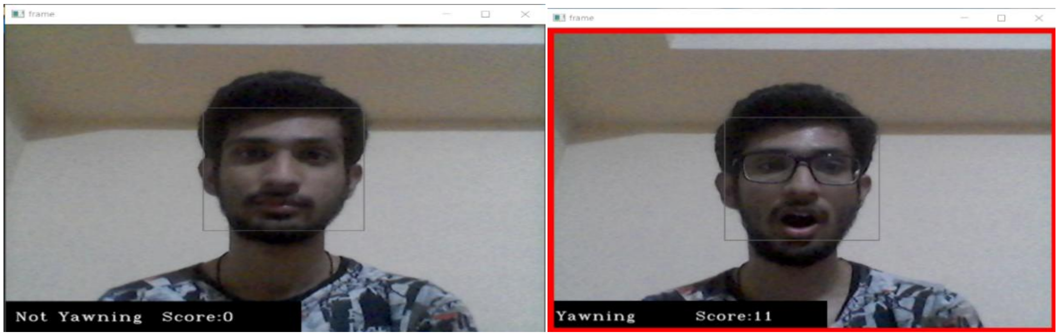


Fig. 8(a) The person is not yawning so no beepFig. 8(b) The person is yawning so the alarm beep

Appendix b. Accuracy graph

Various algorithms of machine learning and deep learning algorithm have been implemented and the accuracy was calculated. The accuracy graph is as follows.

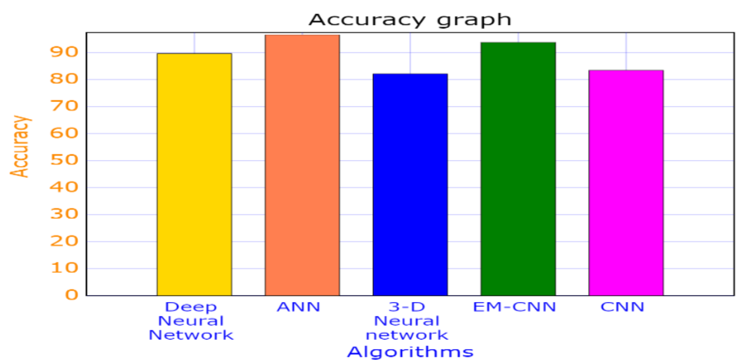


Fig. 9. Accuracy Graph

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