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DRIVER ACTIVITY RECOGNITION FOR INTELLIGENT VEHICLES: A DEEP LEARNING APPROACH

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ABSTRACT: Driver activity recognition plays a crucial role in enhancing the safety and intelligence of modern vehicles. This work presents a deep learning-based approach for recognizing driver activities in real time to prevent accidents caused by distraction, fatigue, or unsafe behavior. The proposed system utilizes advanced neural network architectures such as Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks to analyze visual and temporal data captured from in-vehicle sensors and cameras. The model is trained on a diverse dataset containing various driver actions, including safe driving, mobile phone usage, drowsiness, and inattentiveness. Feature extraction is performed automatically by deep learning models, eliminating the need for manual intervention and improving classification accuracy. The system continuously monitors driver behavior and generates alerts when unsafe activities are detected. Experimental results demonstrate that the proposed approach achieves high accuracy, robustness, and real-time performance compared to traditional machine learning techniques. The integration of this system into intelligent vehicles can significantly reduce road accidents, enhance driver awareness, and contribute to the development of advanced driver assistance systems (ADAS) and autonomous driving technologies.

Keywords: Driver Activity Recognition. Deep Learning, Intelligent Vehicles, Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), Driver Monitoring System (DMS), Computer Vision, Behavioral Analysis, Real-Time Detection, Drowsiness Detection, Distraction Detection, Advanced Driver Assistance Systems (ADAS), Human Activity Recognition (HAR), In-Vehicle Safety, Autonomous Driving Systems.

INTRODUCTION: Fatigue, drowsiness and sleepiness are often used synonymously in driving state description [1]. Involving multiple human factors, it is multidimensional in nature that researchers have found difficult to define over past decades [2]–[5]. Despite the ambiguity surrounding fatigue, it is a critical factor for driving safety. Studies have shown that fatigue is one of the leading contributing factors in traffic accidents worldwide It is particularly critical for occupational drivers, such as drivers of buses and heavy trucks, due to the fact that they may have to work over a prolonged duration of the driving task, during the peak drowsiness periods (i.e., 2:00 A.M. to 6:00 A.M. and 2:00 P.M. to 4:00 P.M.), and under monotonous or boredom working conditions.. The main idea behind this project is to a develop the system which can detect an drowsiness of the driver and issue a timely warning. Driver Fatigue is the main reason for a large number of a road accidents. The detection can be done in the many different ways and by using the different parameters. The parameters can be the drivers behavior while a driving, the physiological parameters and by checking a vehicle steering. Propose system uses the behavior of parameter. The behavior parameter include the eye blinking, the yawning, the eye openness, jaw position etc. The live video is captured by a camera that is fit in the bus. The video is divided into the frames and then select the images from the frames. By taking individual image, noise from the image is cleared. Then the image is converted into an grayscale image. The respective calculation of the image selection is displayed on the screen. After converting of the image to grayscale the face detection is done on the converted image. Compare an sample image with the image present in the database of the sample images. Then the detection of jaw position, eye openness and the angle of iris. Then, whether the driver is drowsy or not is checked by the calculation of before the mentioned parameters. If the driver is drowsy then the alarm is raised. By using this system the rate of the accidents can be reduced. Fatigue, somnolence and somnolence area unit typically used synonymously in driving state description [1]. Involving multiple human factors, it's two-dimensional in nature that researchers have found troublesome to outline over past decades [2]–[5]. Despite the anomaly encompassing fatigue, it's a crucial issue for driving safety. Studies have shown that fatigue is one amongst the leading conducive factors in traffic accidents worldwide [6]. it's notably crucial for activity drivers, like drivers of buses and serious trucks, thanks to the very fact that they will need to beat up a protracted length of the driving task, throughout the height somnolence periods (i.e., 2:00 A.M. to 6:00 A.M. and 2:00 P.M. to 4:00 P.M.), and below monotonous or dissatisfaction operating conditions [7], [8].

LITERATURE SURVEY: A Survey on Driver Fatigue-Drowsiness Detection System paper by Indu R. Nair, Nadiya Ebrahimkutty , Priyanka B.R , Sreeja M, Prof. Gopu Darsan ,this paper address to one of an major reasons for road accidents now a day is due to driver fatigue. Be it long distant travelling or drunk driving drowsy state leads to risky crashes which are hazardous to lives as well. To overcome such accidents some method has to be developed which is feasible to all the vehicle drivers. This paper is based on various methods for the preventing road accidents and designs on a drowsiness detection methods which were proposed and have advantages and disadvantages. A Review on the Driver Face Monitoring Systems for Fatigue and the Distraction Detection driver face monitoring systems is one of the main approaches for the driver fatigue or distraction detection and accident prevention. Paper by Mohamad-Hoseyn Sigari, Muhammad-Reza Pourshahabi Mohsen Soryani and Mahmood Fathy. Driver face monitoring systems capture the images from an driver face and extract the symptoms of fatigue and distraction from eyes, mouth and head. These symptoms are usually percentage of eyelid closure over time (PERCLOS), eyelid distance, eye blink rate, blink speed, gaze direction, the eye saccadic movement, yawning, head nodding and head orientation. The system estimates driver alertness based on extracted the symptoms and the alarms if needed. In this paper, after an introduction to a driver face monitoring systems, the general structure of these systems is then discussed. Then a comprehensive review on the driver face monitoring systems for fatigue and distraction detection is presented. Jennifer F. May , Carryl L. Baldwin present a paper on Driver fatigue: The importance of identifying causal factors of the fatigue when considering detection and the counter measure technologies this paper state that the technologies currently exist which enable detection of the driver fatigue and the interventions that have the potential to dramatically Research to detect driver drowsiness can be classified into three categories: 1) vehicle-based approaches, 2) behavior-based approaches, and 3) physiological-signal based approaches (see [7], [9] for a good review). In physiological approaches, the physiological signals from a body, such as electroencephalogram (EEG) for brain activity, electrooculogram (EOG) for eyemovement, and electrocardiogram (ECG) for heart rate, are evaluated to detect driver drowsiness [10]–[15]. Recent studies showthat themethods using physiological signals (specially the EEG signal) can achieve better reliability and accuracy of driver drowsiness detection compared to other methods[16].However, the intrusive nature of measuring physiological signals can hinderdriving, especially for prolonged driving periods. Vehiclebased approaches collect signal data from sensors in vehicles to evaluate driver's performance. These methods monitor the variations of steering wheel angle, lane position, speed, acceleration, and braking to predict the driver fatigue [1]–[2].

PROPOSED METHOD:

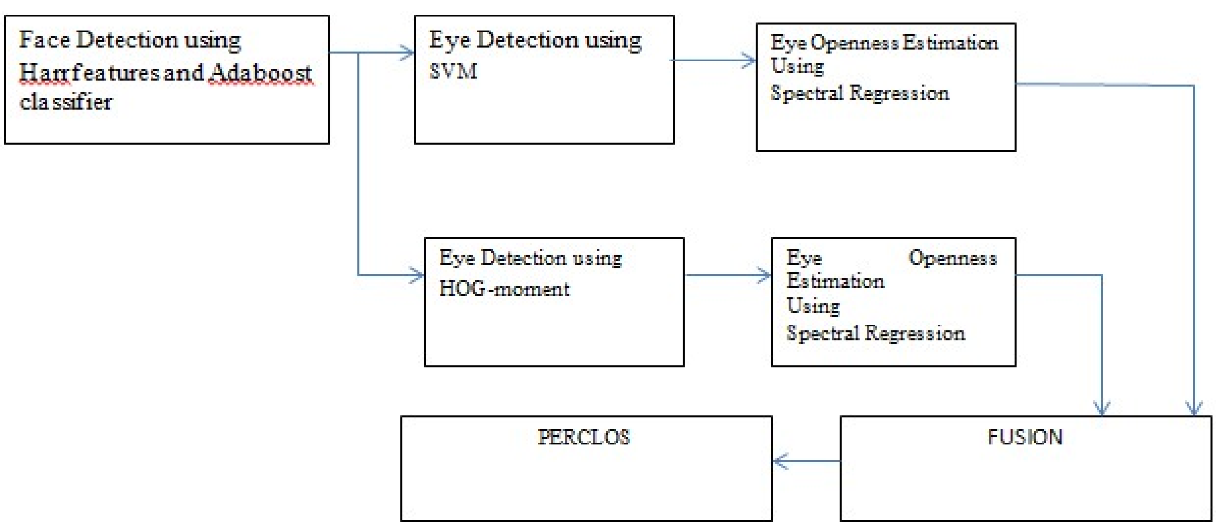


Fig:1 Proposed Block diagram

The main contribution of this project is a novel vision-based system for bus driver fatigue detection which is applicable to low-resolution face images captured from an oblique viewing angle to the driver's face, so that it can share a wide-view camera mounted for driver's full body behavior monitoring. The technological contributions can be summarized as follows:

• A novel framework for vision-based driver fatigue detection which integrates head-shoulder detection, multi-pose face detection, multi-model eye detection, eye openness estimation, fusion, and PERCLOS estimation for driver fatigue detection;

• A manifold learning algorithm to learn a mapping from a low-resolution eye image to a continuous level of eyepenness;

• A fusion algorithm to obtain an accurate and robust eye openness estimate based on adaptive integration on multimod eye detections on both eyes;
• A refined approach to compute PERCLOS measure based on the continuous levels of eye-openness.
The system framework is illustrated in above figure. There are six main steps in the process. First, a head-shoulder detector is applied to detect the presence of a driver and locate roughly the position of the driver's head. Then, two models of face detectors are used to detect a front-view face or an oblique-view face within the region of the head. Third, two eye detection methods are employed to locate the potential eye positions and scales in the image. In the fourth step, our proposed eye openness estimation method is applied to the located eyes by the two eye detectors. Next, a fusion operation is proposed to obtain an accurate and robust estimate of driver's eye openness based on adaptive integration on multi-model eye detections for both eyes. The score of driver's fatigue, i.e., PERCLOS, is computed on the recent records of eye openness over a specified period. Details are described in the following subsections.

Face Detection

Over the region of head, face detectors are applied to find a face looking towards the front of the bus. First, the Matlab face detector [54] is applied. It is very robust to find the front-view faces since it is trained with a huge number samples. However, it mostly fails to detect the oblique-view faces observed by the camera as shown in Fig. 1. In a ten-minute video recording of a bus driver on duty, the Matlab detector can only detect about 40% of the driver's faces in the normal driving poses. Therefore, we train an additional face detector specially for the oblique-view faces using the Matlab face detection algorithm, i.e., the algorithm based on Harr features and Adaboost classifier [54]. This face detector will be applied if the Matlab face detector fails to find a face in the head position. If both face detectors fail to find a face in the head position, it means that the bus driver may have turned his face away, which may indicate an abnormal driving state. Since the face detectors are only applied to the head regions, much less false positives are generated compared with the approach of scanning the whole image for face detection.

EYE DETECTION: Two eye detectors are applied to the rectangular region of the detected face. The Matlab eye detector [4] performs well to locate the eyes in the front-view faces, even with closed eyes. But it often fails to locate the pair of eyes in the oblique-view faces. Since the driver's left eye is too close to the face boundary in the image, the Matlab eye detectormaymiss it, or locate the driver's left eye on the right eye or mouth, as shown in the first 3 examples in Fig. The results of Matlab eye detection in this application situation can be summarized as:
(a) no output, i.e., both eyes are missed;
(b) one output, i.e., only the left eye is detected and the right eye closing to the face boundary is missed; (c) two outputs, i.e., two eyes are correctly detected orright eye is wrongly located on the left eye or mouth. We have developed an eye detector for human-robot interaction [5]. It combines both sketch and graph patterns of eye for eye detection with a trained SVM, and employs a Maximum-Likelihood algorithm to locate a pair of eyes on the multiple detections of eyes on face. It was refined for detecting eyes in obliqueview faces. It performs better to detect and locate a pair of open eyes in oblique-view faces than the Matlab eye detector. But it might fail to find the correct locations of closed eyes, as shown in the last example in Fig. 3. The outputs of our eye detector can be summarized as: (a) no output, i.e., both eyes are missed; (b) a pair of outputs, i.e., two eyes are correctly detected or located at wrong positions due to closed eyes. The Driver basic cognitive process may well be the results of a scarcity of alertness once driving attributable to driver temporary state and distraction. Driver distraction happens once associate in nursing object or event attracts a person's attention far away from the driving task. Not like driver distraction, driver temporary state involves no triggering event however, instead, is characterised by a progressive withdrawal of attention from the road and traffic demands. each driver temporary state and distraction, however, may need an equivalent effects, i.e., minimized driving performance, longer latency, Associate in Nursingd an multiplied risk of crash involvement[11]. Driving may be a complicated task wherever the driving force is accountable of observance the road, taking the proper call on time and at last responding to alternative driver's actions and totally different road conditions. "Fig.1.2", shows the diagram of overall system. supported Acquisition of video from the camera that's ahead of driver perform real-time operation of Associate in Nursing incoming video stream so as to infer the driver's level of fatigue if the temporary state is calculable then the output is send to the warning device and alarm is activated. There are units several strategies for police work the driving force temporary state. The signs of the driving force temporary state are [12].

- Driver is also yawn oftentimes.
- Driver is unable to stay eyes open.
- The driving force cannot bear in mind driving the previous few miles.
- Drift into the opposite lane or onto the shoulder of the road

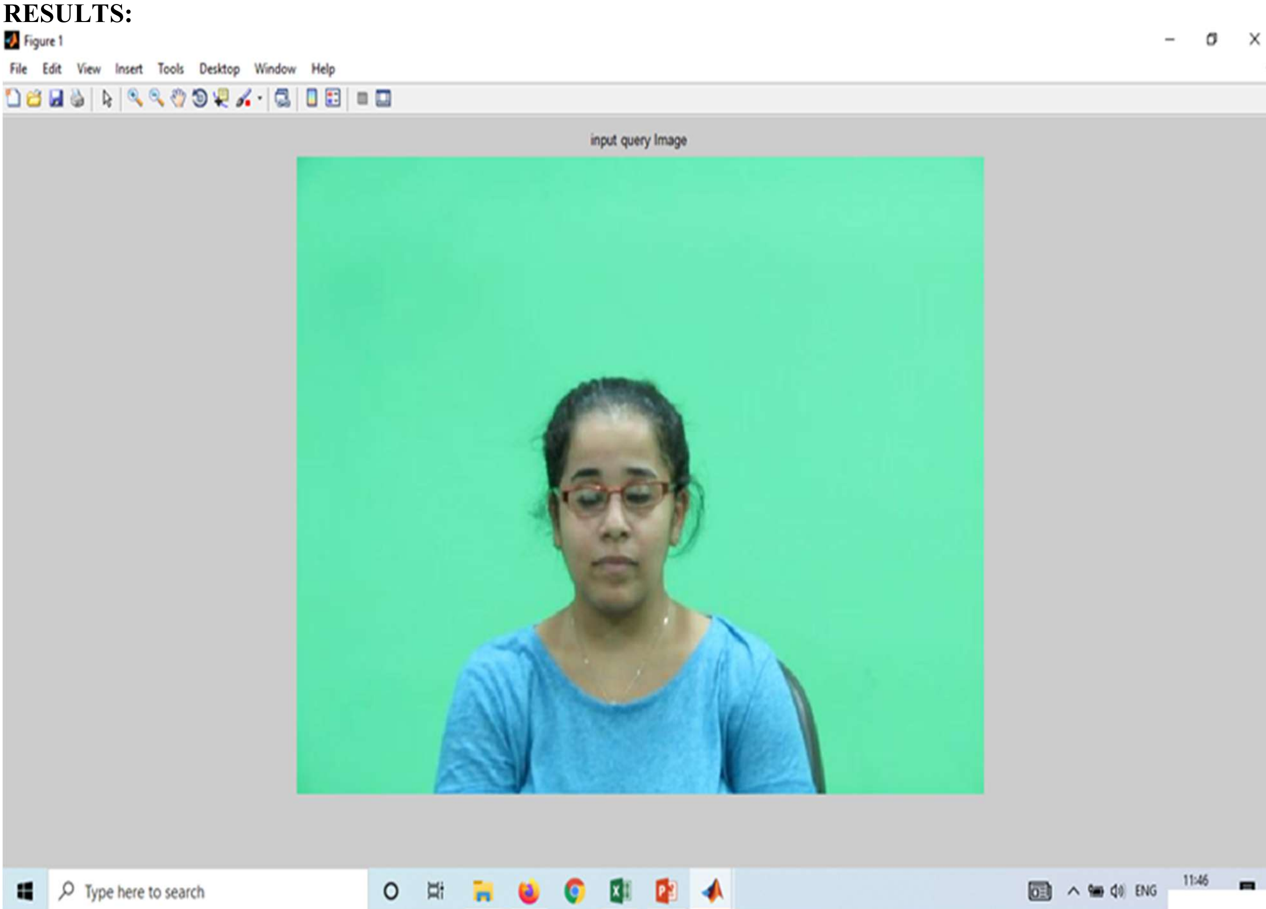
SPECTRAL REGRESSION: First, a head-shoulder detector is applied to detect the presence of a driver and locate roughly the position of the driver's head. Then, two models of face detectors are used to detect a front-view face or an oblique-view face within the region of the head. Third, two eye detection methods are employed to locate the potential eye positions and scales in the image. In the fourth step, our proposed eye openness estimation method is applied to the located eyes by the two eye detectors. Next, a fusion operation is proposed to obtain an accurate and robust estimate of driver's eye openness based on adaptive integration on multi-model eye detections for both eyes. The score of driver's fatigue, i.e., PERCLOS, is computed on the recent records of eye openness over a specified period.

SPECTRAL REGRESSION: Spectral methods have recently emerged as a powerful tool for dimensionality reduction and manifold learning. These methods use information contained in the eigenvectors of a data affinity (i.e., item-item similarity) matrix to reveal low dimensional structure in high dimensional data. The most popular manifold learning algorithms include Locally Linear Embedding, Isomap, and Laplacian Eigenmap. However, these algorithms only provide the embedding results of training samples. There are many extensions of these approaches which try to solve the out-of-sample extension problem by seeking an embedding function in reproducing kernel Hilbert space. A disadvantage of all these approaches is that their computations usually involve eigen-decomposition of dense matrices which is expensive in both time and memory.

CONCLUSION:

The increasing number of traffic accidents due to a diminished driver's vigilance level has become a serious problem for society. Statistics show that 20% of all the traffic accidents are due to drivers with a diminished vigilance level. Furthermore, accidents related to driver hypo-vigilance are more serious than other types of accidents, since sleepy drivers often do not take correct action prior to a collision. For this reason, developing systems for monitoring driver's level of vigilance and alerting the driver, when he is drowsy and not paying adequate attention to the road, is essential to prevent accidents. The prevention of such accidents is a major focus of effort in the field of active safety research. People in fatigue show some visual behaviors easily observable from changes in their facial features like eyes, head, mouth and face. Computer vision can be a natural and non-intrusive technique to monitor driver's vigilance. Faces as the primary part of human communication have been a research target in computer vision for a long time. The driver fatigue detection is considered as one of the most prospective commercial applications of automatic facial expression recognition. Automatic recognition (or analysis) of facial expression consists of three levels of tasks: face detection, facial expression information extraction, and expression classification. In these tasks, the information extraction is the main issue for the feature based facial expression recognition from an image sequence. It involves detection, identification and tracking facial feature points under different illuminations, face orientations and facial expressions. In this research work SVM Classifier is applied to detect the fatigue problem and getting the different results. Here the accuracy of the work is 70%.

RESULTS:



Figa: Input image

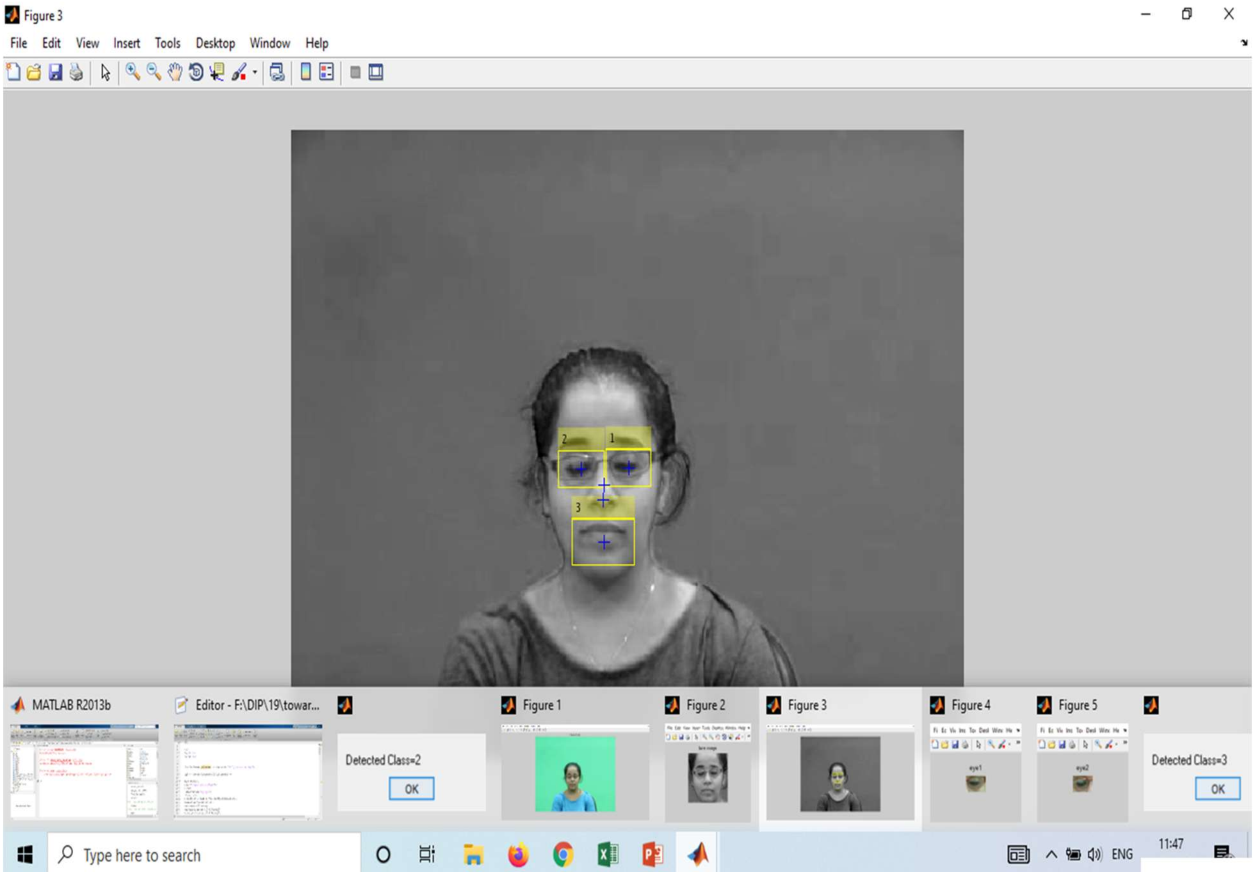


Fig b: result captured in matlab

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FUTURE SCOPE : The driver fatigue is the major problem in today's world, because due to the downiness problem day by day accidents are increased. In the future work it further implemented with the help of Neural Network and other real time sensor devices. So that more accuracy is achieved.

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