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Enhancing Automative Safety System for Driver Fatigue Detection by Using Mediapipe's Framework

[1]*Induja V.*, [2]*Dr.Tharani S.*
[1]M.Sc., PG Student in Computer Science, Auxilium College (Autonomous), Vellore - 06
[2]*Assistant Professor,Department of Computer Science and Applications, Auxilium College (Auotonomous), vellore -06*

ABSTRACT

Traffic accidents caused by tiredness, exhaustion, and distracted driving are a big concern on a global scale. As per global Road Safety reports drowsy driving was reason for 91,000 road accidents in Tamil Nadu in the year 2023. In this study, I suggest a collective deep learning architecture for automatic driver sleepiness detection while some earlier works are suggested extracting the lips and eyes movements to identify sleepiness, more contemporary computer vision-based systems have performed only somewhat well. This is because they either use extremely large deep learning models with still-poor performance or they use hand-crafted features with traditional methods like K-NN Algotithm and openCV. To overcome such issues in this project I am planing to create a Driver Drowsiness Detection and Alerting System using Mediapipe's Face Mesh solution in Python. These systems assess the driver's alertness and warn the driver if needed. Continuous driving can be tedious and exhausting. A motorist may get droopy and perhaps nod off due to inactivity. we will create a drowsy driver detection system to address such an issue. For this, we will use Mediapipe's Face Mesh solution in python and the Eye Aspect ratio formula using by Navie Bayes Algorithm. My goal is to create a robust and easy-to-use application that detects and alerts users if their eyes are closed for a long time.

Keyword: Navie Baye's, Mediapipe Framework.

1.INTRODUCTION

Drowsiness is identified when a person is tired enough to be transitioning between 'asleep' and 'awake' cognitive states owing to a variety of spontaneous and long-term health or mental conditions. A driver may be well-aware of rules and safety measures, but it is the eventual fatigue that triggers laxity in the nervous system of the body leading to crashes and mishaps. Some of the known underlying causes of a distracted driver behind the wheels are lifestyle factors,sleep disorders among other mental and health conditions. Substantial evidence pinpoints drowsiness to be a causing factor for road accidents. A survey in the US by the National Highway Traffic Safety Association (2019) reported that road accidents due to driver drowsiness, from the year 2013 to 2017, claimed about 4,111 lives, and about 91000 car crashes and 795 deaths (in the year 2017).In a similar report by CDC (2014) , it was obvious that the fatalities curve has increased over the last decade. Studies also reveal that a significant fraction of these crashes can be prevented by appropriate measures including, but not limited to, measurement of the problem, public awareness, policy development, and improving vehicular technology. There are many time-series-based anatomical and physiological features that could be incorporated in drowsiness detection and alarm systems. It is, but, essential to employ methods for feature extraction that are practically possible, fast to process, and are reliable. These EEG and ECG-based features tend to work well as they accurately capture the physiological patterns in the body but these are not an ideal choice due to their partial invasive nature and difficulty in deployment. Many leading automobile industries incorporate vehicle-based sensors for detecting driving patterns in the vehicles but these vehicles were targeted for higher prices in the market. In this scenario,

research is essential in cost efficient methods that use non-invasive sensors and can be used by a large-scale population.

2. LITERATURE SURVEY

Title: " Intelligent Driver Drowsiness Detection for Traffic Safety Based on Multi CNN Deep Model and Facial Sub sampling"

Author: Muneeb Ahmed, Sarfaraz Masood, Musheer Ahmad and Ahmed A

Year: Published in October 2022

Description: we propose an ensemble deep learning architecture that operates over incorporated features of eyes and mouth subsamples along with a decision structure to determine the fitness of the driver. The proposed ensemble model consists of only two InceptionV3 modules that help in containing the parameter space of the networking drowsiness of driver, it can be done in different ways like detecting facial expression of the driver and measuring Eye Aspect Ratio (EAR). Blinking pattern is different for each and every individual. The pattern gets varied in terms of squeezing degree of eye, blink duration and speed of closing and opening the eye [16]. The proposed method involved with the following methodologies such as Haar Cascade Classifiers, Shape Predictor_68_facial landmark detection, Eye Aspect Ratio (EAR), Ubidots cloud service and Twilio API.

Title: "A robust and efficient EEGbased drowsiness detectio system using different machine learning algorithms"

Author: Islam A

Year: Published in July 2022

Description: The driver will be notified to interrupt his/her travel if an accurate and robust fatigue detection system is available. Dealing with this approach will help the driver avoid accidents and make the right decisions. This paper aims to detect drivers' sleepiness using a powerful software tool. It was initially developed by capturing electroencephalography (EEG) signals and processing them. In this research, different machine learning algorithms were applied to the EEG signals of twelve subjects to measure their performance. In the first step, all recorded data for all subjects were segmented into second epochs. Brain signals were labeled alert or drowsy for each epoch. Before applying the machine learning algorithms to the epoched signal, a preprocessing step is introduced to extract the relevant features. The applied algorithms are Naive Bayes (Diagonal Linear Discriminant Analysis), Support Vector Machines (Linear and Radial Basis Functions), K-Nearest Neighbor (KNN), and Random Forest Analysis (RFA). In general, this developed EEG-based system detects drowsiness and loss of focus of drivers in real-time with high accuracy, making it a practicable and reliable option for real-time applications.

Title: "CNN Based Driver Drowsiness Detection System Using Emotion Analysis"

Author: Chand, H. Varun, and J. Karthikeyan

Year: (2021).

Description: The drowsiness of the driver and rash driving are the major causes of road accidents, which result in loss of valuable life, and deteriorate the safety in the road traffic. Reliable and precise driver drowsiness systems

are required to prevent road accidents and to improve road traffic safety. Various driver drowsiness detection systems have been designed with different technologies which have an affinity towards the unique parameter of detecting the drowsiness of the driver. This paper proposes a novel model of multi-level distribution of detecting the driver drowsiness using the Convolution Neural Networks (CNN) followed by the emotion analysis. The emotion analysis, in this proposed model, analyzes the driver's frame of mind which identifies the motivating factors for different driving patterns. These driving patterns were analyzed based on the acceleration system, speed of the vehicle, Revolutions per Minute (RPM), facial recognition of the driver. The facial pattern of the driver is treated with 2D Convolution Neural Network (CNN) to detect the behavior and driver's emotion. The proposed model is implemented using OpenCV and the experimental results prove that the proposed model detects the driver's emotion and drowsiness more effectively than the existing technologies.

Title: "Drowsiness detection system for drivers using image processing technique"

Author: Jose, Jithina, et al

Year: Published January 2021

Description: These days, drowsy driving plays a significant role in a lot of road incidents. Car accidents can be avoided by implementing a system with alarm to alert drowsy drivers in order to focus on the road and help them to stay focused. This paper has developed to detect driver drowsiness and trigger them with an alarm to alert drivers in order to prevent accidents, and reduce loss of lives and sufferings. Several techniques have been studied and analyzed to conclude the best technique with highest accuracy to detect the driver drowsiness. The proposed method utilizes Python, dlib, and OpenCV to build a real-time framework that uses a computerized camera to monitor and process the driver's eye and yawn. A camera will be utilized so that it concentrates towards monitoring the driver's eye and yawn. A trigger is issued to alert the driver. The proposed system acknowledges whether the driver is sleepy and it gives a caution alert, when his eyes and yawn are discovered close together for a particular measure of casing.

Title: "Challenges in detecting drowsiness based on driver's behavior"

Author: V. Triyanti and H. Iridiastadi

Year: 2019

Description: This paper will also address challenges in capturing aspects of natural expression, driver responses, behaviour and task environment associated with sleepiness.The mechanisms in detecting fatigue and sleepiness while driving has been categorized into three broad approaches, including vehicle-based, physiological-based, and behavior-based approaches. This paper will discuss recent studies in recognizing drowsy drivers based on their behaviors, particularly changes in eyes and facial characteristics. A technical aspects should be seriously considered, including correctly capturing face and eye characteristics from unwanted movements, unsuitable task environments, technological limitations, and individual differences. A number of approaches to be reduce the risk of drowsy drivers.

Title: “Physiological signal-based drowsiness detection using machine learning: Singular and hybrid signal approaches ”

Author: Md Mahmudul Hasanab, Christopher N.Watlingab and Grégoire S.Larue’s

Year: 2021

Description: Drowsiness is one of the main contributors to road-related crashes and fatalities world wide. To address this pressing global issues, researchers are continueing to develop driver drowsiness detection system that use a variety of measures. This approach considered many metrics from three physiological signals like electroencephalography (EEG), electrooculography (EOG), electrocardiography and (ECG) as ground truth. The methodology consisted of signal recording with a psychomotor vigilance test (PVT) pre-processing, extracting, and determining the important features from the phsycological signals for drowsiness detecion.

Title: Visual-based Real Time Driver Drowsiness Detection System Using CNN

Author: Vishal.k,varun.A

Year: 2021

Description: The traffic accident is one of the most frequent cause of death in the world; and an important cause of the traffic accident is the fatigue of the driver, who falls asleep during driving. To overcome this problem in this paper, we propose a real-time driver drowsiness detection system, in which the driver's face region is extracted and introduced into a specific designed shallow convolutional neural network (SS-CNN). The SS-CNN detects the state of driver drowsiness using “eye closure” or “eye open” state. To distinguish between the “eye closed” state caused by normal eye blinking and that caused by drowsiness, the proposed system analyzes consecutive results of the SS-CNN. If the system determines that driver falls asleep, an alarm rings to awake the driver in order to avoid a possible accident. The proposed SS-CNN provides an accuracy of 98.95%, which outperforms the previous works. In the experimental section, we provide several links in which real-time operations of the proposed system can be observed.

Title: ”Driver Drowsiness Detection using Hybrid Deep Neural Network"

Author: S. Zhang, Y. Cai, and J.Cheng

Year: 2019

Description: In today’s world driver drowsiness is a major reason for fatal accidents of on road vehicles. Developing an automated, real-time drowsiness detection system is essential to provide accurate and timely alerts to the driver. In the proposed system, hybrid approach of CNN (Convolutional Neural Network) and BiLSTM (Bidirectional Long Term Dependencies) is used to detect the driver’s drowsiness. Video camera is used to track the facial image and eye blinks of the driver. The proposed system works in three main phases: In the First phase, driver's face image is Identified and observed using a web camera. In the Second phase, the eye image features are extracted using the Euclidean algorithm. During the third phase, the eye blinks are continually monitored. The final stage decides whether the measure in eye square is closed state or open state. When a driver falls asleep, there will be a warning message to alert the driver to prevent road accidents.

Title: "Advanced Driver Assistance System for the drowsiness detection using facial landmarks"

Author: Cueva, Luis Darío Sinche, and Jorge Cordero

Year: 2020

Description: Several factors often contribute to car accidents, most of them caused by human error, and the most notable are drowsiness, fatigue, distracted driving, and alcohol. Although self-driving cars are the best solution to save human lives and avoid car accidents, they are expensive. The roads in many countries are not prepared for the movement of this type of car. Scare new technologies included in modern cars, such as backup cameras and sensors, contributed to keeping drivers safer in this paper. A driver monitoring system is based on determining the driver's face's main points, which provide the required vital information for face analysis. The Efficient Net convolutional neural network (ConvNet) model is used for facial landmarks prediction, which is employed to detect face drowsiness and fatigue in real-time. The system is trained to detect multiple traits, including facial expressions, yawning and head poses. The results show that employing facial landmarks will assist in efficiently producing eyes and mouth features, which can assist in appropriately creating models to analyze drowsiness. Due to this, the proposed safety features are applicable and available in future vehicles.

3.CONCLUSION

A stacking-based ensemble architecture that integrates the weighted contributions of EAR(eye aspect ratio) which learn the features of the eyes separately in the samples collected from the dataset—has been 66 proposed in this project. Unlike earlier research, this work is credible because it detects tiredness using a dashboard camera's simple feed rather than by monitoring the driver's EEG, ECG, or any other physiological signs. To extract the coordinates of the regions of interest (eyes), the Fast MTCNN has been used in the proposed model. We have shown that the EAR detection architecture performs better than individual models when trained on eye sub samples. Results indicated a greater rate of extraction of frames after employing Fast MTCNN, indicating that this end-to-end model is also resistant to changes in pose and lighting circumstances. The suggested model outperformed other recently proposed non-invasive solutions on this dataset, according to the results, which showed very detection accurate capacity over a large valuation dataset.

4.REFERENCES

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