ISSN 2319 – 7595
Volume 12, No.3, May - June 2023
International Journal of Information Systems and Computer Sciences
Available Online at http://warse.org/IJISCS/static/pdf/file/ijiscs011232023.pdf
https://doi.org/10.30534/ijiscs/2023/011232023

AI-Powered Road Safety: Detecting Driver Fatigue through Visual Cues

Dr C. Padmaja[1], B. Nihalini Reddy[2], M. Chandana[3], T. Shreya[4]
[1] Assistant Professor, Dept. of ECE, G. Narayanamma Institute of Technology and Sciences (for women) Hyderabad, India, c.padmaja@gnits.ac.in
[2] Dept. of ECE G. Narayanamma Institute of Technology and Sciences (for women) Hyderabad, India, chandanaprincy9@gmail.com
[3] Dept. of ECE G. Narayanamma Institute of Technology and Sciences (for women) Hyderabad, India, nihalinibaddam@gmail.com
[4] Dept. of ECE G. Narayanamma Institute of Technology and Sciences (for women) Hyderabad, India, shreyathokala60@gmail.com

Received Date : April 03, 2023 Accepted Date : May 15, 2023 Published Date : June 07, 2023

ABSTRACT

Driving when fatigued is among the main causes of road deaths. Consequently, one ongoing research area is how to recognize driver fatigue and how to determine whether it is present. A large percentage of conventional methods are either based on machines, the behavior of people, or physiological processes. Some solutions need expensive sensors and data processing, while others are infiltrating and uncomfortable to the driver. As a consequence, this study creates an accurate, real-time method for identifying driver fatigue. The footage is captured by a camera, and image processing techniques are employed to recognize the driver's face in each frame. When facial landmarks on the detected face are pointed, the eye aspect ratio and mouth opening ratio are computed based on their values, and drowsiness is recognized utilizing generated adaptive thresholding. The following stage involves determining whether or not a discovered item is a face using SVM. It also checks the driver's eye aspect ratio (EAR) and mouth opening ratio (MOR) up to a predetermined number of times to look for signs of sleepiness and yawning. If sleepiness is identified, a warning email is sent to the registered email address.

Key words: Mouth Aspect Ratio (MAR), Eye Aspect Ratio (EAR), Histogram of Oriented Gradients (HOG), Support Vector Machine (SVM).

1. INTRODUCTION

One of the leading factors in fatal car accidents is driving when tired. Long-distance or overnight bus drivers, long-haul truck drivers, particularly at night, and bus drivers are more prone to encounter this problem. A sleep-deprived driver is the greatest nightmare of every passenger worldwide. Auto accidents associated with exhaustion result in an important percentage of collisions and fatalities every year. Due to its significant practical significance, the detection of driver fatigue and its indication are currently a focus of research. Due to its significant practical significance, the detection of driver fatigue and its indication are currently a focus of research**.** The mechanism for detecting tiredness on a basic level. is composed of the acquisition system, the processing system, and the warning system. The acquisition system takes a video of the driver's frontal face at this point and transmits it to the processing block for online analysis to detect tiredness.

If the warning system detects tiredness, it will issue the driver with a warning or alert. Physiological, behavioural, and vehicle-based tired driving detection methods make up the three primary categories. The vehicle-based system continuously monitors a wide range of variables, such as steering wheel movement, brake or accelerator use, vehicle speed, lateral acceleration, lane position deviations, etc. The identification of any abnormal change in these measures is what is meant by "driver drowsiness." This measurement does not interfere with the driver because he or she is not connected to the sensors. The behavioural-based approach looks at the driver's perceptual behaviour, such as eye blinking, eye closure, yawning, etc., in order to spot signs of intoxication. The vehicle-based technique continuously records a number of parameters, such as the throttle movement, braking system or stimulant pattern, pace of the car, longitudinal accelerated motions, zone irregularities, etc. Being that these traits are only detected by a basic camera, this measurement is also non-intrusive. This measurement is intrusive since the sensors are connected to the distracted motorist. As more sensors are used, the system will become more expensive and larger. the creation of a webcam-based system that can identify driver fatigue from a face image using the processing of images and machine learning methods.

2. LITERATURE SURVEY

Intelligent Video-Based Drowsy Driver Detection System under Various Illuminations and Embedded Software Implementation, 2015 International Conf. on Consumer Electronics - Taiwan, W. L. O et al [1]. This research produced a sophisticated, video-based fatigued recognition system that is immune to many lighting conditions, according to W.L.Ou et al.'s analysis [3]. Even when a driver is wearing glasses, the recommended method effectively detects drowsy conditions. The suggested system is divided into two multilevel computing processes: operator eyes detection and tired driver identification using a camera. Driver Drowsiness Detection System, IEEE International Workshop on Systems, Signal Processing and their Applications, 2013, B. Alshaqaq et al [4].

When using the 640x480 format video on the FPGA-based embedded platform, processing performance may increase its frame pace to as much as 16 following algorithms optimization. According to W.B. Horng et al., [2] driver fatigue surveillance using an instantaneous form vision monitoring system is advised for safe driving. Using the idiosyncrasies of complexions, the visage of a driver can be recognized in colour interior images. The ocular areas are then located using a technique called edge detection. Images of the gathered eyes are also utilized to identify weariness in order to offer some warnings for driving effectively addition to serving as dynamic templates for gaze tracking in the following frame. The system is put to the test using a Pentium III 550 CPU and 128 MB RAM.

The experiment's results seem to be highly encouraging and promising. The system can monitor the eyes at a pace of 20 frames per second, and on four test videos, the accuracy rate for both tracking and placing the eyes was 99.1% on average. The mean precise rate on the evaluation recordings is 88.9, whereas the accurate rate for identifying exhaustion is 100%. When they work, S. Singh et al. [5] disclosed a non-intrusive vision-based technique for the detection of driver fatigue. The system employs a colour video camera that confronts the driver directly and keeps an eye on his or her pupils to spot micro sleep or small periods of sleep. The algorithm searches the input space for the face using information on skin tone. After segmenting the pixels with a colour similar to skin, we use blob processing to pinpoint the face's precise location. We are able to focus our search by looking at the horizontal gradient map of the face and taking into consideration how the horizontal intensity gradient varies greatly around the eyes. For pupil tracking and localization, we use grayscale model matching. To determine if a pupil is shut or open, we employ an identical pattern recognition method. If the eyelids are closed for an unusually long time (5–6 seconds), the system assumes that the user is likely to fall asleep, and an alert is then activated.

According to C.Y. Chen et al. [6], drowsiness detection has a number of advantages, including a decrease in the incidence of car accidents. Utilizing image processing methods is one of the most cutting-edge and successful ways to treat a tired face. Examining sleepiness and providing information on information retrieval were the two objectives of the current pilot research. The RFID reader can only work when it is connected to a PC, hence this solution is problematic once more in that it is not portable. Second, the data collected on attendance is incorrect since the RFID tag does not contain guanine information, which may be utilized to uniquely identify a kid. Capture drivers' faces using an online driving simulator. Information on 25 drivers was gathered to determine the amount of weariness based on the signal at a 10fps picture rate. Additionally, each driver's data was analyzed across an average of 3000 frames. The frames were examined using the Cascade and Viola & Jones procedures to translate them into greyscale space, and after that, the picture's attributes were extracted using binary and histogram techniques. For data analysis, the Multipurpose Learning neural network was employed. The network received 15% of each driver's data for testing purposes and 15% for validation purposes. In the last phase, 93% of the results were verified for correctness. The new study has advantages over earlier studies, such as the intelligent identification and long-term usage of several criteria. This assists in the early detection of fatigue and, through warning, avoids irreparable losses.

3. PROPOSED SYSTEM

To address the aforementioned problems, we offer a technique to identify weary drivers. Physiological, behavioural, and vehicle-based strategies are the three primary divisions of tired driving detection methods. A number of characteristics, such as lane orientation shift car pace, transverse acceleration, steering wheel movement, suspension or stimulant sequence, etc.. are persistently monitored by the vehicle-based approach. Any unusual variation in these numbers is interpreted as a sign of driver weariness. this evaluation doesn't interfere with the driver because the sensors aren't attached to them. A behavioural-based technique can detect tiredness by examining The operator's eye movements, such as blinking, closing, and yawning, etc.

4. METHODOLOGY

The design flow of the proposed system is shown in Figure 1.

Step 1: Collect a recording that was recorded for 30 minutes, and then use processing algorithms on these 2D images to extract the segments.

Step 2: Implement the facial detection using an AI-based histogram of oriented gradients (HOG) and linear SVM algorithms.

Step 3: The prominent positions on the face are computed from a restricted collection of pixel intensities using device image standardization and an ensemble of regression trees.

Step 4: The EAR value can be calculated by entering six coordinates surrounding the eyes by keeping the EAR threshold as 0.3.

Step 5: Calculate the Mouth aspect ratio (MAR) to detect whether a person is yawning or not.

Data collection: The frames from the video that was recorded using a camera are downloaded to a laptop. Once the frames have been recovered, picture processing techniques are applied to this 2D image. In addition to looking into the webcam, the participants are asked to yawn, blink, and occasionally close their eyes. Following the extraction of the frames, the first phase is face detection which can be done by the linear SVM methodology is used.

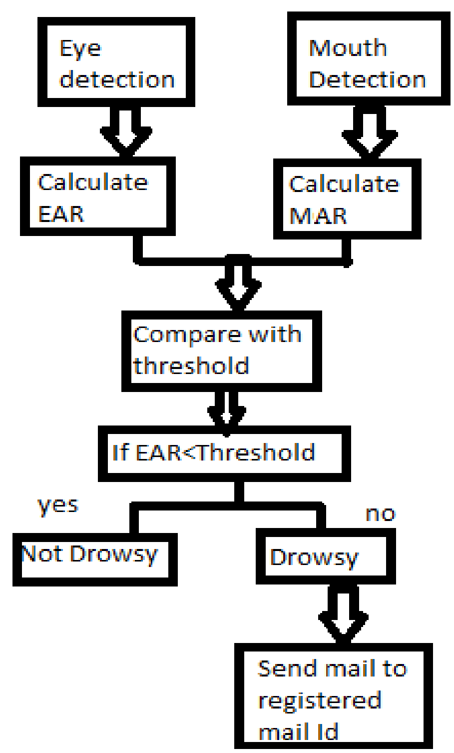

Figure 1: Block Diagram of Proposed System

This method calculates HOG descriptors on positive samples from images with a predetermined window size. The majority of the time, there are considerably more negative than positive samples. Once the traits for both classes have been determined, an SVM with linear properties is trained for the classification task. Once a face has been identified, Finding the positions of various facial features, such as the creases of the mouth and eyes, and so on, is the next step. If sleepiness has been noted, an e-mail reply will be sent to it.

Looking at the mouth aspect ratio (MAR) can help determine the possibility that someone is yawning. If the MAR value (from the driving procedure) surpasses the threshold several times in parallel, the algorithm will deem the driver as tired.

.5. RESULTS AND DISCUSSION

After installing the required software as mentioned above and choosing the path. Then write the code in Python and click on run.

Figure 2: Proposed application Window

Now click on Start Behaviour Monitoring Using Webcam and the webcam is accessed and hence it is turned on as shown in figure 2.

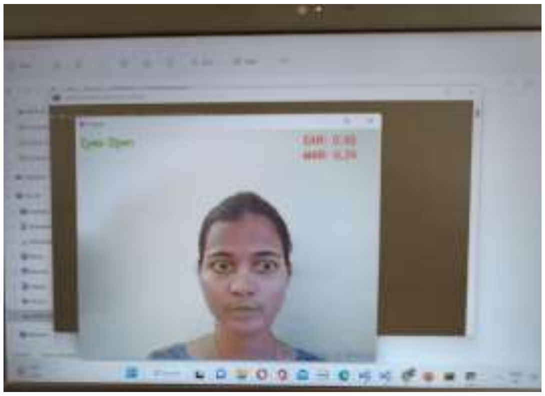

Figure 3: Output window when eyes are open

We can observe from Figure 3 that the EAR and MAR values are 0.39 and 0.34 respectively whose threshold values are 0.25 and 0.75. As we can observe that EAR is greater than the EAR threshold and MAR is less than MAR Threshold hence the description shows eyes open.

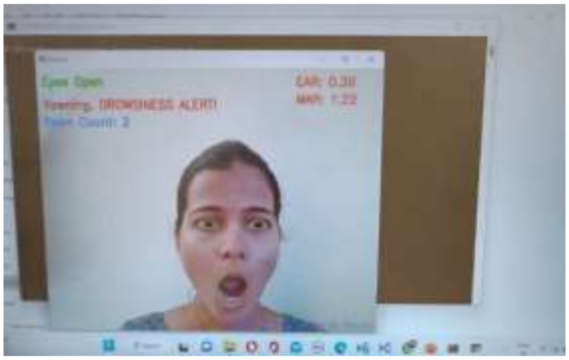

Figure 4: Output window when yawning

The measured EAR and MAR values are 0.36 and 1.22 where EAR is greater than the threshold hence eyes Open message is displayed as shown in figure 4. Whereas the MAR value is greater than the threshold and hence yawning Drowsiness Alert message is displayed as also the yawn count.

6. CONCLUSION

Using machine learning and visual behaviour, a low-cost real-time driver sleepiness monitoring system has been developed. Here, streaming video from a webcam is used to calculate visual behavioural characteristics including eye aspect ratio, mouth opening ratio, and nose length ratio. Real-time driver sleepiness detection has been created using an adaptive thresholding method. With the generated synthetic data, the built system performs precisely. the values of the features next.

The accuracy of the EAR and MAR threshold values examined in this study, which are 0.25 and 0.75, respectively, can be improved by gathering additional data from individuals with various attributes.

A variety of sophisticated algorithms can greatly enhance frame extractions. The non-linear SVM method may also be used to mark features in the frame.

Overall, this is the most straightforward and economical project that may be improved by using various hardware components in accordance with our various demands.

REFERENCES

[1] W. L. Ou, M. H. Shih, C. W. Chang, X. H. Yu, C. P. Fan, **Intelligent Video-Based Drowsy Driver Detection System under Various Illuminations and Embedded Software Implementation**, 2015 International Conf. on Consumer Electronics - Taiwan, 2015.

[2] W. B. Hong, C. Y. Chen, Y. Chang, C. H. Fan**, Driver Fatigue Detection based on Eye Tracking and Dynamic Template Matching**, IEEE International Conference on Networking, Sensing and Control, Taipei, Taiwan, March 21-23, 2004.

[3] S. Singh, N. P. Papanikolopoulos, **Monitoring Driver Fatigue using Facial Analysis Techniques**, IEEE Conference on Intelligent Transportation System, pp 314-318.

[4] B. Alshaqaqi, A. S. Baquhaizel, M. E. A. Ouis, M. Bouumehed, A. Ouamri, M. Keche, **Driver Drowsiness Detection System**, IEEE International Workshop on Systems, Signal Processing and their Applications, 2013.

[5] M. Karchani, A. Mazloumi, G. N. Saraji, A. Nahvi, K. S. Haghighi, B. M. Abadi, A. R. Foroshani, A. Niknezhad, **The Steps of Proposed Drowsiness Detection System Design based on Image Processing in Simulator Driving**, International Research Journal of Applied and Basic Sciences, vol. 9(6), pp 878-887, 2015.

[6] R. Ahmad, and J. N. Borole**, Drowsy Driver Identification Using Eye Blink Detection**, IJISET - International Journal of Computer Science and Information Technologies, vol. 6, no. 1, pp. 270-274, Jan. 2015.