Driver Drowsiness Detection

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Abstract — As we all know that the progress within the industry has made life easier for us, and also risky because the traffic accidents have steadily increased. an outsized number of automobile accidents are caused and thanks to various reasons out of which the most cause is thanks to drowsiness of the driving force. Many drowsiness detection methods are made and tested for the security of the driving force and other people travelling with them. Several feature types are utilized in CNN-based drowsiness detection. during this study, we presented a test using CNN a man-made neural network which is essentially used for image processing, classification, segmentation and also for other auto correlated data. Drowsiness affects people lifestyle that results in inefficient work or car accidents thanks to insomnia resulting damage to life and property. Especially, it can go to pot when it happens to public transportation. because the author works in Department of Land Transport (DLT), drowsiness may be a one among the very best factors causing the car accidents. Therefore, thanks to this concern, effective detection of drowsiness system is performed. the aim of this paper is to develop algorithm to research face structure of the driving force by taking live video media and detecting drowsiness. Also, the system is conducted to look at Algorithm's efficiency. The result shows that using facial landmarks can help to get eyes component effectively, which may help to make equations to detect drowsiness correctly.

Keywords —Drowsiness, face detection, Computer Vision, Image Processing, CNN.

I. Introduction

Long distances and motorway driving are often tiring and monotonous. In recent years, drowsiness and fatigue became the supreme reasons for causing severe road accidents in India and worldwide also the many increment within the percentage of road accidents thanks to drowsiness and fatigue seized the researcher's attention. it's also been observed that driver's performance also deteriorates with increase in drowsiness. In NHAI's studied that in the midnight 90% accidents are due the driver's drowsiness and fatigue. With this view, the creation of smart vehicles has been highly increased. Autonomous cars can convince be an excellent thanks to affect drowsy driving. Drowsiness detection by considering various parameters of driver exhaustion be the integral a part of future Smart Vehicle System (SVS) which considers eye blinking rate, eye closure time, yawning, eye brows shape, drivers gesture aside from speed of the vehicle, movement of steering, break and accelerator pattern and continuous driving duration etc. Numbers of techniques are in use to detect drowsiness and fatigue. Other parameters for this will be medical parameters like pulse, pulse etc. In SVS, high vision cameras are embedded to capture run time images of the drivers and generate the alerts accordingly. Car accidents are a majority problem for society, and driver drowsiness is one among main reasons of accident. When the driving force is sleeping, the car will continue drive with speedy around four second and car will choose 100 meters without control, so it's very dangerous. Driver might be seriously injured or death immediately. Road statistic show around 12 p.m. to 8 a.m. is that the hottest duration to possess car accident explanation for driver drowsiness. the prevailing technologies are complex as they use equipment's like infrared camera and sensors. there's also another method which measures the EEG and EOG signals to work out the drowsiness. This method is extremely tedious because it requires tons of equipment's and that they need to be attached to the driver's body making him uncomfortable. during this project, we offer an easy solution to the matter by employing a normal camera and CNN method.

II. Literature Review

2019 – This paper was written by Wisaroot Tipprasert, Chamaporn Chianrabutra and Chamaiporn Sukjamsri titled as a way of Drivers Eyes Closure and Yawning Detection for Drowsiness Analysis by Infrared Camera. it's four steps namely eye detection, face detection, mouth detection, eye closure and yawning detection. It says that these four steps give more accurate results.

2020 – This paper was written by Venkata Phanikrishna B and Suchismitha Chinara titled as Time Domain Parameters as a feature for single-channel EEG-based drowsiness detection method. It stated the importance by specifying the rationale about how drowsiness results in fatal accidents and therefore the got to prevent them by creating a machine which will signify one when he/she is drowsy. It uses methodology of Hazroth parameters and EEG analysis. It did achieve goals by using Hazroth manuscript along side EEG that nobody has ever done.

2020 – This paper was written by Hamed Laouz, Soheyb Ayad, Labib Sadek Terrissa titled as Driver Drowsiness and

Fatigue Detection. It states the importance by highlighting the accidents caused on the road due the carelessness of the driving force thanks to insufficient sleep and drowsiness. It uses sensors like ECG, EEG, EMG and EOG. it's achieved results that they need accurate detection in good lighting instead of night but have good physiological signal measurements give stable end in most of the cases.

2020 – This paper was penned by Hitendra Garg titled as Drowsiness Detection of Driver using Conventional Computer Vision Application. It states that the alongside developments in technology in automobiles it's needed to form it more safe and secure to stop the road accidents caused by fatigue. They used RT-DDS i.e., Real-Time Drowsiness Detection System applicable on automobiles and cars with the assistance of conventional Computer Vision Applications. it's achieved goal by behavioral analysis, high end camera installation and traditional algorithm to detect the possible coordinate to spot eyes and mouth.

2020 - This paper was written by Petchara Inthanon and Surasak Mungsing titled as Detection of Drowsiness from Facial Images in Real-Time Video Media using Nividia Jetson Nano. It states cons of Drowsiness both in work and on road that perhaps fatal. because the name suggests they use Nividia Jetson Nano. it's a tool that accurately evaluates the image by tracking closing eye motion and yawning or opening mouth motion. The results from this examination shows the system and therefore the equations that are developed by Nividia Jetson Nano with IoT equipment that's suitable for evaluating image. Moreover, webcam also can be wont to detect drowsiness.

2020 – This was written by K. Satish, A. Lalitesh, K. Bhargavi, M. Sishir Prem and Anjali T titled as Driver Drowsiness Detection. It states the importance by highlighting the increasing amount of road accidents caused by fatigue and drowsiness which always seems fatal. they need used two methods, first detect the face of driver and capture images of retina and calculated blinking threshold value and therefore the refore the second method by using Audrino module integrate the elastomeric sensors for Real -Time calculation of driver hand pressure on the car wheel and the threshold value is about. Hence, they conclude that the primary part does capturing and detection while the second is employed to integrate the information.

Methodology/Experimental

A. Synthesis/Algorithm/Design/Method

REQUIREMENTS-

- Os – windows 7 or higher.
- Ram – 4 gb or higher.
- Python 3.0 or higher.
- Tensorflow.
- Keras.
- Open cv.
- 720p hd camera.

ALGORITHM-

- Take image as input from a camera using OpenCV. It takes the input and converts it into grayscale.
- Detect the face within the image and make a neighborhood of Interest (ROI) using the Haar Cascade files. The ROI during this case is that the face and therefore the eyes.
- Detect the eyes from ROI and gives it to the classifier.
- CNN Classifier will differentiate whether eyes are open or closed.
- We can calculate score to see whether the person is drowsy. If the person is drowsy the score will increase and when the score exceeds ‘15’ the alarm will start ringing alerting the driving force.

METHOD-

The model we used is made with Keras using Convolutional Neural Networks (CNN). A convolutional neural network may be a special sort of deep neural network which performs extremely well for image classification purposes. A CNN basically consists of an input layer, an output layer and a hidden layer which may have multiple numbers of layers. A convolution operation is performed on these layers employing a filter that performs 2D matrix operation on the layer and filter. The CNN model architecture consists of the subsequent layers:

- Convolutional layer; kernel size 3, 32 nodes
- Convolutional layer; kernel size 3, 32 nodes
- Convolutional layer; kernel size 3, 64 nodes
- Fully connected layer; 128 nodes

At first, we take the input i.e., capture the image of the driving force through camera using OpenCV and convert it into gray’s scale. The OpenCV stands for Open-Source Computer Vision Library and is employed for face and eye detection. It's a library of computing functions mainly focused toward real-time computer vision. Then we basset the undesired region from the image using Haar Cascade files. The Haar Cascade files helps to consider ROI (region of interest) then we feed it to the classifier i.e., to CNN.

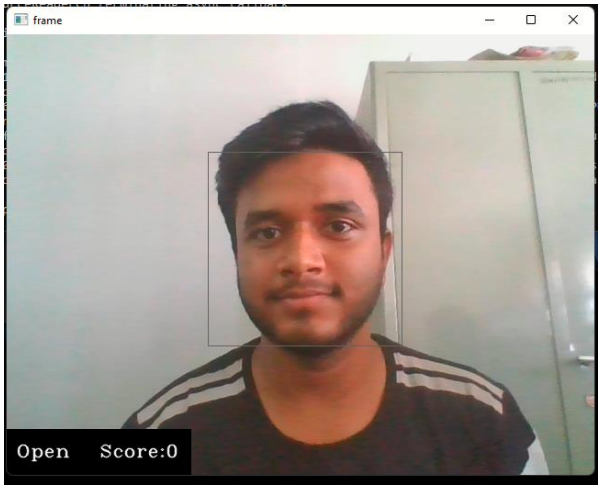
The interfareace to the present artificial neural network is provided by Keras which is an open-source software library in python.

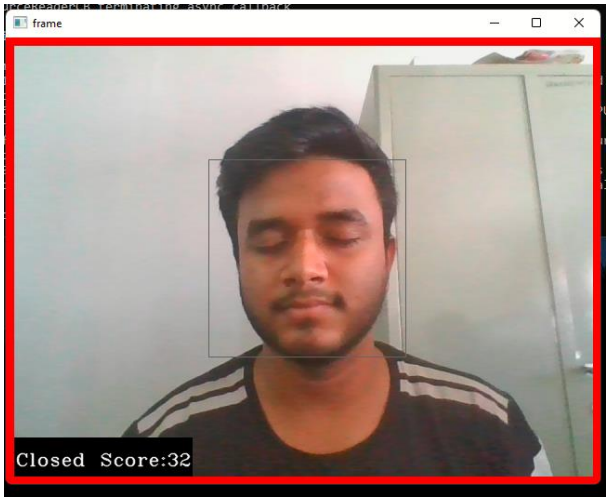
Role of Keras is acting as an interface for the TensorFlow library. Then the CNN categorizes whether the eyes are open or closed. we will also get the score to what extend the eyes are closed. We use plotting library for exact detection of coordinates in order that we will make the calculations properly this library is named Matplotlib and its numerical mathematics extension is NumPy. It constructs an object-oriented API for embedding of plots into apps using general-purpose GUI tools like Tkinter, wxPython, Qt, or GTK. there's also a prosecutorial "pylab" interface supported a state machine (like OpenGL), designed to closely resemble that of MATLAB, though its use is discouraged. SciPy makes use of Matplotlib. If the score is exceeding ‘15’ the alarm rings. We use Pygame to produce

the sound of beep. Pygame may be a cross-platform set of Python modules designed for writing video games. It includes special effects and sound libraries designed to be used with the Python programing language. during this way the whole machine works.

III. RESULTS AND DISCUSSIONS

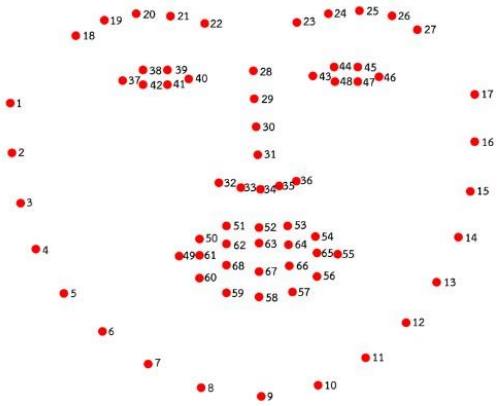
The proposed Driver Drowsiness Detection is embedded in an automobile to test the real driving cases. In this proposed system images are captured by high resolution camera in real time on different people. In this system as we know an algorithm is implemented in Open CV environment with the only aim of detecting the level of drowsiness and fatigue of the driver with the help of eye blinking rate. Our results show whether the eyes are open or close and the scores are displayed on the basis of to what extend the eyes are closed. The alarm makes a beep sound when the score of closed eyes exceeds '15' and the screen also shows red border. Our model gives almost 100% accuracy.

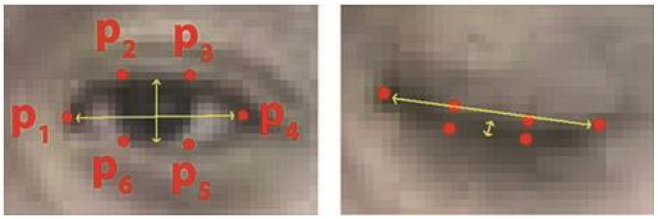




IV. HELPFUL HINTS

A. Figures and Tables





B. References

High vision cameras are embedded to monitor and capture to extract frames one by one and generate the alerts accordingly. Each extracted frame is analyzed at time to study the pattern of facial features; using Haar Cascade Classifiers and determined Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) for each frame [12]. With respect to the aforementioned concern, various researchers have proposed distinct ways to automate the system of measuring the drowsiness of a driver. Based on vision, Malla et al. [4] put-forward a light-insensitive system employing Haar algorithms [5] [6] to detect objects as well as face. The amount of eye closure was considered as a measure to detect the drowsiness of the driver. Later, Vitabile et al. [7] showed a drowsiness detection system which recognized the symptoms of a drowsy driver with the help of an infrared camera. The researchers used the concept of bright pupils to formulate an algorithm for eye detection and tracking. The system used to alert the driver upon detecting the drowsiness using an alarm. On the similar grounds, Bhowmick et al. [8] used the traditional Otsu threshold method [9]. Analysis report shows that if a person's awake for 18 hours leads drowsiness [2]. P.Davidson et al. designed a simple system that uses the Haar Algorithmic program to detect objects and facial features [11] using OpenCV libraries.

C. Abbreviations and Acronyms

CNN- Convolutional Neural Network.
DLT- Department of Land Transport
ROI- Region of Interest

V. Some Common Mistakes

The common mistakes that could happen are like the machine may not detect the eye conditions accurately, if we don't convert input into gray's scale it may not give accurate result and if the alarm isn't connected properly, it will not ring resulting to failure of entire machine.

VI. Limitations

Limitation of DDD is that it is purely dependent on facial expressions. In summary, many studies have determined that vehicle-based measures are a poor predictor of performance error risk due to drowsiness. Moreover, vehicular-based metrics are not specific to drowsiness. It can also be caused by any type of impaired driving, including driving under the influence of alcohol or other drugs, especially depressants

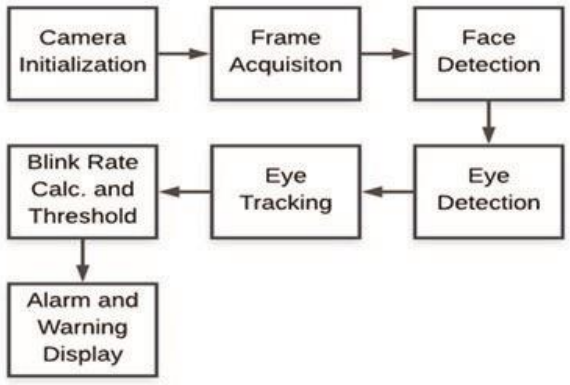
VII. Future Scope

The future works may aim on the utilization of exterior factors such as vehicle states, weather conditions, sleeping hours, mechanical data, etc., for fatigue measurement. Driver drowsiness stands a major threat to road safety, and the concern is especially severe for commercial vehicle operators. Twenty-four-hour operations, exposure to challenging environmental conditions, high annual mileage, and demanding work schedules all contribute to this serious safety issue. Monitoring the driver's state of drowsiness and attentiveness and providing feedback on their condition so that they can take appropriate action is one crucial step in a series of preventive measures necessary to address this problem. At the moment there is no adjustment in zoom or indentation of the camera during operation. Future work may be to automate zoom in on the eyes once they are distinguished.

VIII. Conclusion

In the proposed work, Driver Drowsiness Detection is implemented to detect the drowsiness and fatigue of a driver in real-time based on the image captured. The work is based on high end camera installation, behavior analysis and conventional algorithm to detect the possible coordinate to identify eyes. The methods suggested earlier are very complex as compared to our proposed method. Based on real time data capturing and analysis eye blinking detection are considered important parameters to detect drowsiness and fatigue of the drive and ring the alarm accordingly.

Appendix



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References

[1] T. Nichamon, and T. Pornpimol, (2019, Feb.) Motorbike's key to solving road deaths. [Online]. Available: https://tdri.or.th/2019/02/motorbikes-key-to-solving-road-deaths/

[2] Transport Statistics Group, Planning Division, Department of Land Transport, (2019, Oct.) Public Transportation Summary Report 2019". [Online]. From: https://web.dlt.go.th/statistics/

[3] L. Jakrin (2019, Dec.). "Drowsiness Syndrome Life Without Risk". [Online]. From: https:// bangkokhospital.com/th/disease-treatment/becareful-microsleep

[4] T. Soukupová, and J. Cech, "Eye blink detection using facial landmarks," 21st computer vision winter workshop, Rimske Toplice, Slovenia, 2016.

[5] J. Y. Wong, and Y. L. Phooi, "Real-Time Driver Alert System Using Raspberry Pi," ECTI Transactions on Electrical Engineering, Electronics, and Communications, vol. 17.2, pp.193-203, 2019.

[6] R. Manoharan, and S. Chandrakala, "Android OpenCV based effective driver fatigue and distraction monitoring system," 2015 International Conference on Computing and Communications Technologies (ICCCT), pp. 262-266, 2015.

[7] J. W. Baek, B. G. Han, K. J. Kim, Y. S. Chung, and S. I. Lee, "Realtime drowsiness detection algorithm for driver state systems". 2018 Tenth International Conference on Ubiquitous and Future Networks (ICUFN), pp. 73-75, July 2018

[8] J. A. Horne and L. A. Reyner, "Sleepiness detection for vehicle driver or machine operator," Nov. 6 2001, uS Patent 6,313,749.

[9] D. Dinges and M. Mallis, "Managing fatigue by drowsiness detection: Can technological promises be realized?" in INTERNATIONAL CONFERENCE ON FATIGUE AND TRANSPORTATION, 3RD, 1998, FREMANTLE, WESTERN AUSTRALIA, 1998.

[10] M. V. Yeo, X. Li, K. Shen, and E. P. Wilder-Smith, "Can svm be used for automatic eeg detection of drowsiness during car driving?" Safety Science, vol. 47, no. 1, pp. 115–124, 2009.

[11] A. M. Malla, P. R. Davidson, P. J. Bones, R. Green, and R. D. Jones, "Automated video-based measurement of eye closure for detecting behavioral microsleep," in 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology. IEEE, 2010, pp. 6741–6744.

[12] P. Viola, M. Jones et al., "Rapid object detection using a boosted cascade of simple features," CVPR (1), vol. 1, no. 511-518, p. 3, 2001.