Driver Drowsiness Detection and Alert System using Python and OpenCV

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Abstract

Driver Drowsiness is the one of the reasons for increase in accident rates. Various facial recognition methods have been proposed to detect and alert the driver in-order to avoid accidents. Hence, this system is proposed to reduce the number of accidents due to drivers fatigue and hence increase the transportation safety. This system deals with automatic driver drowsiness detection based on visual information captured by the system.

The driver is lively captured after which the images are further processed, and the fatigue is checked for. It creates an alarm for the driver immediately in case of fatigue detection, also an implementation to alert the vehicles owner and others concerned about the safety are alerted as well. The system enhances the safety measures by which accidents due to drivers drowsiness can be minimized.

I. Introduction

Driver exhaustion can be a significant variable in an expensive number of vehicle accidents. Road Accidents in India cause financial losses around Rs.9.34 billion every year. It can be seen there are around 2,700 road accidents consistently which is one death per every four hours. It has been figured around 25% of car crashes with driver fatalities are due to driver’s drowsiness.

It was uncovered that driving execution quickly drop with expanded tiredness which result in making more than 20% of all vehicle accidents. Less attention and focus while driving, heads the driver to being distracted and the likelihood of street accident goes high. Drowsiness related accidents have all the earmarks of being more serious as the driver isn’t capable of taking any preventive measures at that moment. Because of the danger that the drowsiness presents on the road, strategies need to be created for checking in its influences. Different strategies for driver drowsiness identification can be partitioned into two general classifications. The techniques in the first gathering recognizes the level of the tiredness focused around the physiological changes of the body. Eye status, speech properties, and the time interval between the eye being closed, head position, sitting carriage, heart rate, and brain signals are simply a couple of illustrations of the strategies in the first classification.

Techniques in the second category estimate that the driver's drowsiness level by following these progressions. Steering angle and the distance from the following vehicle, lateral position of the vehicle, longitudinal speed, longitudinal speeding up, and lane departure are utilized as a part of the technique of the second classification.

I I. Related Works

1]. QiangJi, Xiaojie Yang, "Real-time eye, gaze, and face pose tracking for monitoring driver vigilance", Journal of Real-Time Imaging.

This paper proposes a real-time prototype computer vision system for monitoring driver vigilance. The main component include a remotely located video CCD camera, a specially designed hardware system for real-time image acquisition and for controlling the illuminator and the alarm system, and various computer vision algorithms for simultaneously, real-time and non-intrusively monitoring various visual bio-behaviors that typically characterize a driver's level of vigilance. The visual behaviors include eyelid movement, face orientation, and gaze movement (pupil movement). The system was implemented in an environment with subjecting to different ethnic backgrounds, different genders, ages, with/without glasses, and under different illumination conditions, and it was found very robust, reliable and accurate.

2]. Guang-Yuan Zhang, Bo Cheng, Rui-JiaFeng, Jia-Wen Li "Real-time driver eye detection method using Support Vector Machine with Hu invariant moments", International Conference on Machine Learning and Cybernetics.

In the making of advanced vehicle safety systems, monitoring the driver vigilance level and issuing an alert when he is not paying adequate attention to the road is a promising way to prevent or avoid the road accidents. In such a system, developing a reliable real-time driver eye detection method is a crucial part. A real-time eye detection method using support vector machine (SVM) with Hu invariant moments is proposed here. The test sets from the experiment were used to validate the classification results. The validation results and conclusions about the performance of the method were presented in this paper.

3]. Fabian Friedrichs and Bin Yang, "Camera based Drowsiness Reference for Driver State Classification under Real Driving Conditions", 2010 IEEE Intelligent Vehicles Symposium.

To develop warning systems that detect reduced vigilance based on the behavior of driving, a reliable and accurate drowsiness reference is necessary. Studies show that measures of the driver's eyes are capable of detecting drowsiness under simulator or experimentational conditions. Here, the performance of the latest eye tracking based invehicle fatigue prediction measures are evaluated. These measures are assessed statistically and by a classification method based on a large dataset of 90 hours of real road drives. The results show that eye-tracking based drowsiness detection works well for some drivers as long as the blinks detection works properly.

4]. M. Wang, H. P. Chou, C. F. Hsu, S. W. Chen, and C. S. Fuh, "Extracting Driver's Facial Features During Driving ", 2011

14th International IEEE Conference on Intelligent Transportation Systems Washington, DC, USA.

A vision system for monitoring driver's facial features is discussed here. To begin with, the driver's face is located in the input video sequence. Then it is tracked over the subsequent images. The facial features of eyes, mouth and head are kept detecting in the course of face tracking. Feature detection and tracking are performed in parallel, so that the precise can be improved.

5]. Momin and Parag P. Abhyankar “Current Status and Future Research Directions in Monitoring Vigilance of Individual or Mass Audience in Monotonous Working Environment” International Journal on Soft Computing (IJSC) Vol.3, No.2, May 2012

Working in monotonous environment often causes lack of concentration or fatigue in an operator and many times such non-vigilance leads to accidents. That is why, early detection of fatigued state has become crucial in monotonous working environments like driving vehicle, operating machines etc. Such fatigued state often gets developed gradually and can be identified by certain symptoms. Different types of symptoms help in measuring non-vigilance in different ways.

I I I. Proposed Sysytem

The proposed system is a driver face monitoring system that can detect driver fatigue and distraction by processing of eye and face regions. After image acquisition, face detection is the first stage of processing. Then, the regions of eye and mouth are detected using the DLIB library and the symptoms of fatigue are extracted from those regions.

In the proposed system, the main focus and concentration is on the eye status of the individual driving the car. It consists of a parameter called the Eye Aspect Ratio also known as EAR which is an important parameter as it’s value plays a key role in the drowsiness detection process. A threshold value is also assigned at the beginning for the Eye Aspect Ratio. It compares the frequency of the eye to the assigned threshold value. If the value is above, an alarm is generated. Similar to the EAR, when the mouth region is detected, a threshold value is set and if the value is above the threshold frequency, again an alarm is generated to alert the driver. Lastly, an alert is sent using an email to the concerned person.

In the EAR graph as shown above, the EAR becomes zero when the eye is closed and remains constant when it is open. The EAR Ratio will have some certain variance among, the population depending on the individuals. It fully varies on the uniform scale of the image and in rotation of the face. The EAR is averaged as both the eyes can blink synchronously.

I V. Experimental Analysis

The Threshold value is set to 0.25,

Case I :

If the EAR = 0.37, which is clearly above the EAR Threshold value (0.25) set for the system. This means that driver is safe and there is clearly no symptoms of drowsiness.

Case II :

If the EAR= 0.20, which is clearly below the EAR Threshold of the Drowsiness Detection system. Hence, it creates an alarm as the driver is in half drowsy stage.

Case III :

If the EAR= 0.15, which is clearly a lot below the EAR Threshold (0.25) of the system. Unlike the previous case, here a “DROWSINESS ALERT!” warning is displayed along with a loud alarm sound.

Declarations

1. Funding :

Not Applicable

2. Conflicts of interest/Competing interests :

Not Applicable

3. Availability of data and material :

Not Applicable

4. Code availability :

Not Applicable

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