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Machine Learning-based Real-time Driver Drowsiness System

T. Sri Vyshnavi[1], P. Jyothi[1], P. Uma Maheswarao[1]

[1]Assistant Professor, [1]Department of CSE

[1]Mother Teresa Institute of Science and Technology, Sanketika Nagar, Sathupally, Khammam, Telangana

ABSTRACT

In today's busy and hectic world, people are unable to get full rest and complete bedtime sleep. Due to this when they drive after a sleepless night, they end up dozing off while driving which can be very fatal. A lot of accidents are caused due to drowsy driving every year and it often goes undetected thereby leading to huge loss of lives and resources. We are presenting a system that detects drowsiness while driving and alerts the driver for the same. Such systems are available in high end cars only. Our system uses the front camera of the driver's mobile phone placed in front of the driver. The detection of eyes closed is efficient and works under different situations, it uses camera of any normal android phone. Hence, we provide users with a cheap technology. Driver drowsiness detection is a safety technology which prevents accidents when the driver is getting drowsy.

Keywords: Machine Learning, Driver drowsiness, Visual Behaviour.

1. INTRODUCTION

Driver drowsiness detection is a safety technology which prevents accidents when the driver is getting drowsy. According to statistics, globally around 20% of all road accidents are fatigue-related, up to 50% on certain roads. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. Driver distraction occurs when an object or event draws a person's attention away from the driving task. Unlike driver distraction due to driver drowsiness involves a major damage not only to driver but also to co- travelers. Detection of fatigue involves observation of a face, detection of eye position and the observation of eye status. The analysis of face images is a popular research area with applications such as face recognition, virtual tools and human identification security systems. In the project we will focus on the localization of the eyes and mouth, which involves looking at the entire image of the face and determining the position of the eyes and mouth, by a self-developed image processing algorithm. Once the position of the eyes and mouth is located, the system is designed to determine whether the eyes are opened or closed, mouth opened or closed and detect fatigue.

Video Recording: Using this module we will connect application to webcam using OPENCV built-in function called Video Capture. Frame Extraction: Using this module we will grab frames from webcam and then extract each picture frame by frame and convert image into 2-dimensional array. Face Detection & Facial Landmark Detection: Using SVM algorithm we will detect faces from images and then extract facial expression from the frames.

Detection: Using this module we will detect eyes and mouth from the face

Calculate: Using this module we will calculate distance with Euclidean Distance formula to check whether given face distance closer to eye blinks or yawning, if eyes blink for 20 frames continuously and mouth open as yawn then it will alert driver. OpenCV is an artificial intelligence API available in python to perform various operation on images such as image recognition, face detection, and convert images to gray or coloured images etc. This API written in C++ languages and then make C++ functions available to call from python using native language programming. Steps involved in face detection using OpenCV.

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1.1 Face Detection Using OpenCV

This seems complex at first, but it is very easy. Let me walk you through the entire process and you will feel the same.

- Step 1: Considering our prerequisites, we will require an image, to begin with. Later we need to create a cascade classifier which will eventually give us the features of the face.
- Step 2: This step involves making use of OpenCV which will read the image and the features file. So, at this point, there are NumPy arrays at the primary data points. All we need to do is to search for the row and column values of the face NumPy N dimensional array. This is the array with the face rectangle coordinates.
- Step 3: This final step involves displaying the image with the rectangular face box.

2. LITERATURE REVIEW

M. Omidyeganeh; A. Javadtalab; S. Shirmohammadi "Intelligent driver drowsiness detection through fusion of yawning and eye closure"

Driver drowsiness is a major factor in most driving accidents. In this paper we present a robust and intelligent scheme for driver drowsiness detection employing the fusion of eye closure and yawning detection methods. In this approach, the driver's facial appearance is captured via a camera installed in the car. In the first step, the face region is detected and tracked in the captured video sequence utilizing computer vision techniques. Next, the eye and mouth areas are extracted from the face; and they are studied to find signs of driver fatigue. Finally, in a fusion phase the driver state is determined, and a warning message is sent to the driver if the drowsiness is detected. Our experiments prove the high efficiency of the proposed idea

Menchie Miranda, Alonica Villanueva, Mark Jomar Buo, "Portable Prevention and Monitoring of Driver's Drowsiness Focuses to Eyelid Movement Using Internet of Things"

This paper includes a drowsiness prevention device since recently vehicular count of accidents increases yearly in the Philippines. Current safety measures are followed to increase the driver's awareness which includes the use of standard rumble strips on roads reference, installation of GPS, speed limiters, sensors and other studies uses signal processing embedded of an expensive vehicle. The technology uses internet of things so that the vehicle owner can monitor the driver's drowsiness everywhere during work hours. The study focuses at the eyelid movement that is not yet mentioned to the previous study. This proposed system continuously scans the eyelid movements of the driver and once drowsiness is detected the device automatically alerts him using a random-typed alarm. It automatically forwards the report to the vehicle owner from the web application through internet access. The project received consistent results through evaluation and testing as it is 95% successfully detects and alerts a drowsy driver.

Physical and Physiological Drowsiness Detection Methods K. Singh and R. Kaur

Driver drowsiness detection technologies have the ability to avoid a catastrophic accident by warning the driver of his drowsiness. A number of methods have been proposed to detect drowsiness in the past few years. These method saris categorized into two major categories. One focuses on detecting physical changes during drowsiness by image processing techniques, such as percentage of eye-closure over time, average of eye-closure speed, eye tracking as quantization of drowsiness level. Second methods focused on measuring driver's physiological changes, Electro ocular graphic (EOG), or particularly, electroencephalogram (EEG), as a means of detecting the drowsiness states To study some of the drowsiness detection methodologies proposed in the recent years is the subject of this paper.

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Real-Time Detection of Drowsiness Related Lane Departures Using Steering Wheel Angle A. D. McDonald, C. Schwarz, J. D. Lee and T. L. Brown

Drowsy driving is a significant factor in many motors' vehicle crashes in the United States and across the world. Efforts to reduce these crashes have developed numerous algorithms to detect both acute and chronic drowsiness. These algorithms employ behavioral and physiological data and have used different machine learning techniques. This work proposes a new approach for detecting drowsiness related lane departures, which uses unfiltered steering wheel angle data and a random forest algorithm. Using a data set from the National Advanced Driving Simulator the algorithm was compared with a commonly used algorithm, PERCLOS and a simpler algorithm constructed from distribution parameters. The random forest algorithm had higher accuracy and Area Under the receiver operating characteristic Curve (AUC) than PERCLOS and had comparable positive predictive value. The results show that steering-angle can be used to predict drowsiness related lane-departures six seconds before they occur, and suggest that the random forest algorithm, when paired with an alert system, could significantly reduce vehicle crashes

3. PROBLEM ANALYSIS

3.1 EXISTING SYSTEM

It is very dangerous to drive while being tired or after not sleeping for long hours. It is estimated that drowsy driving caused approximately 70,000 crashes, 50,000 injuries, and around 1000 deaths. Today a large number of these accidents caused are not recognized because the driver do not inform that had fallen asleep as it would make them responsible for the accident and in worst cases it may also lead to loss of life. Hence it is important to track drowsiness detection and alert the driver at the same time to prevent such fatal accidents and loss of life.

In the present working system, it detects the drowsiness and alert the driver with a beep sound. But if he does not alert by this sound this may cause loss of life.

3.1.1 Disadvantages

- In This system, when drowsiness detects the buzzer will sound. But sometimes it's not prevented the accident occurrence.

3.2 PROPOSED SYSTEM

Almost everyone has experienced this drowsiness problem while driving. The people worst affected by drowsy driving are teenagers, professional truck drivers who have to drive on long routes for a long period of time without breaks, cab drivers who also drive for a long period, sometimes to complete their targets to get bonus profit and shift workers who work at night or for late hours also get affected due to tiredness. Drowsy driving can be due to driving on highways for long time without any breaks particularly at night.

To overcome the above problem, the drowsiness detection and prevention system is implemented. This paper describes the solution to this drowsiness problem.

Our system uses the camera to monitors the driver. It is placed in front to the driver to analyze the behavior of the driver i.e., whether the driver's eyes are closed or not. The front camera constantly captures the image of the driver and with the help of this checks whether the eyes of the driver are closed or not.

3.2.1 Advantages

- This system provides Drowsiness detection and accident prevention.

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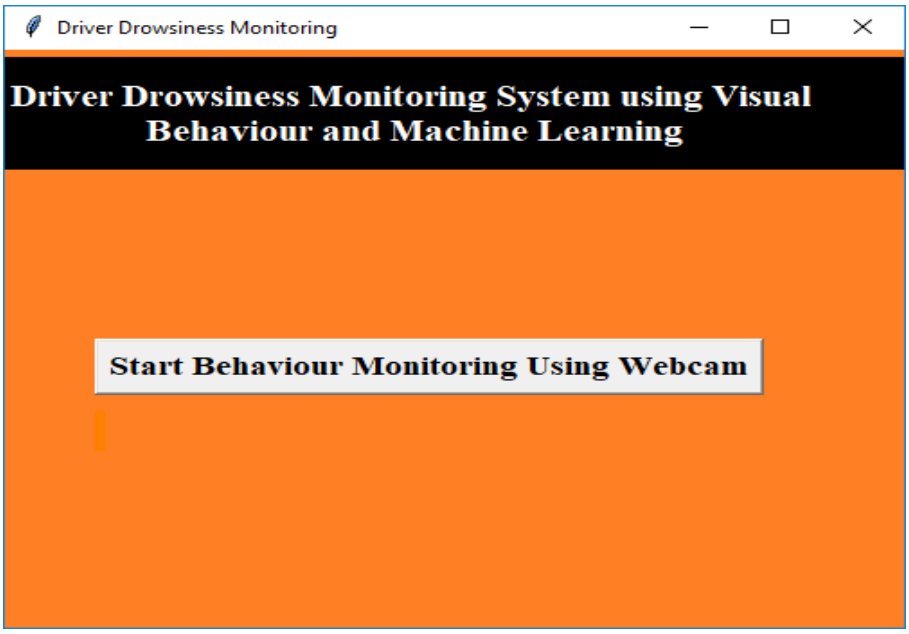
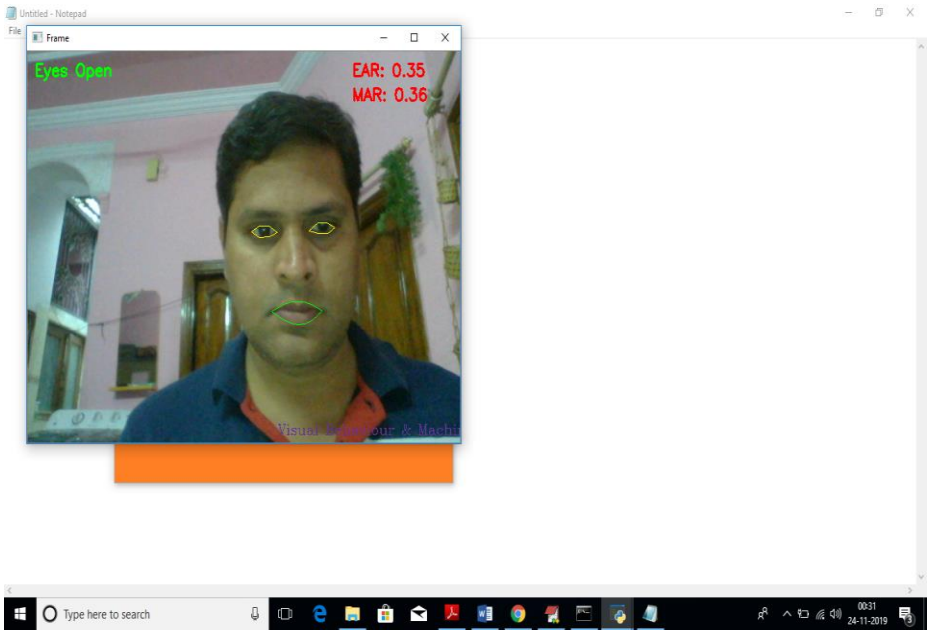
- It detects the Driver Continuously.

4. RESULTS



In above screen click on 'Start Behaviour Monitoring Using Webcam' button to connect application with webcam, after clicking button will get below screen with webcam streaming



In above screen we can see web cam stream then application monitor all frames to see person eyes are open or not, if closed then will get below message

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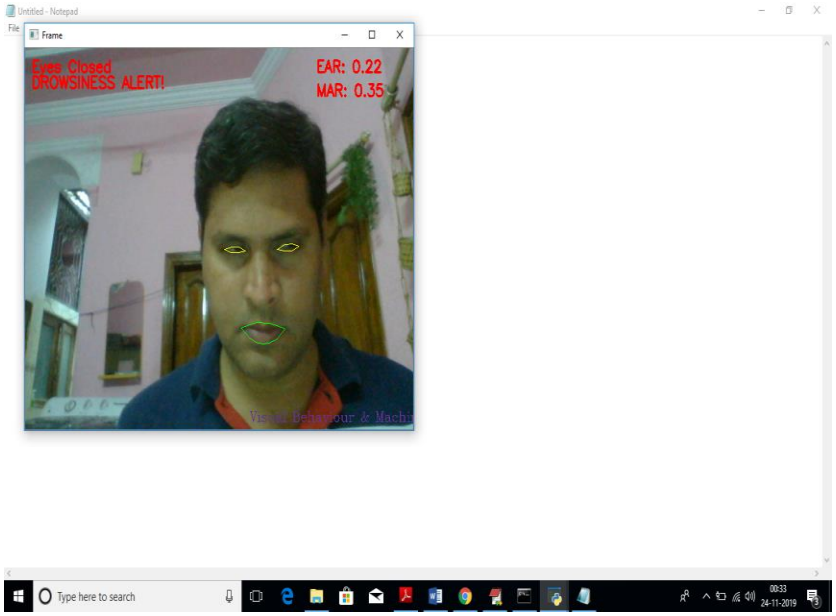
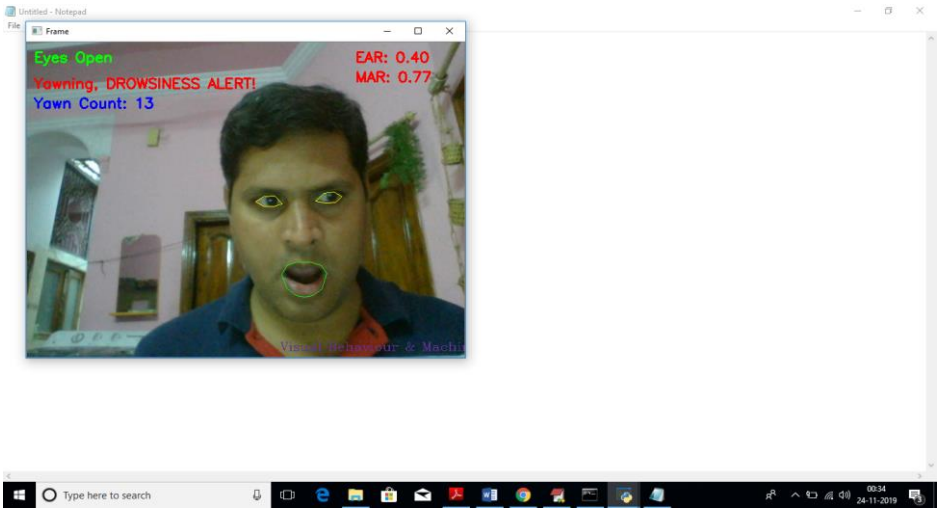
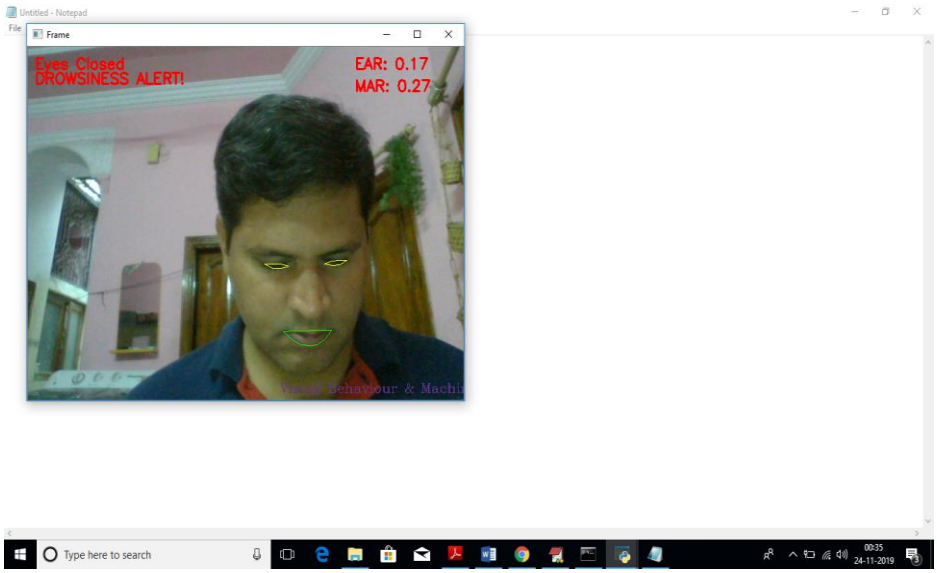


Similarly, if mouth starts yawn then also will get alert message





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5. CONCLUSION

A real-time implementation of a driver fatigue monitoring system was presented in this paper. A number of techniques were used in the development process, including histogram equalization and median filtering for image pre-processing. The Viola-Jones object detection framework was then used to detect the face, eyes and mouth in successive frames, together with correlation coefficient template matching to determine feature states. Support Vector Machine classification based on a combination of three fatigue features was then used to detect the overall fatigue level of the driver being captured by the camera in real-time at 15 frames per second with a 640×480 resolution. In general, as demonstrated in the previous section, the computer vision approach adopted was very successful in classifying the visual appearance of the driver, achieving an average recognition rate of 95.2%. The results further demonstrate the feasibility of deploying non-intrusive fatigue monitoring systems for commercial applications.

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