

Real Time Detection of Driver Drowsiness Using Deep Learning Techniques

Chirag Sharma (Assistant Professor)

Computer Science and Engineering
Lovely Professional University
Jalandhar, India
chiragsharma1510@gmail.com

Shashank Kumar Agrahari

Computer Science and Engineering
Lovely Professional University
Jalandhar, India
shashankagrahari17@gmail.com

Abstract—Driver Drowsiness issue is considered as one of the most significant reason that increases the number of road accidents. The given paper presents a novel methodology towards constant drowsiness recognition. The implementation of face detection methods under which Viola-Jones face finder has shown best results in the given work, while the strategy for finding the eye detected by the method for gradient has been demonstrated to be generally fitting on account of eyes identification. The fundamental focus of this work is to create a light weight model so as to reduce computational complexity.

Keywords—Face detection, Eye detection, Behavioral parameters, Drowsiness detection, and computer vision.

I. INTRODUCTION

The primary number of accidents occurs due to drowsiness or the fatigue caused to the driver as per NHTSA more than 10,000 crashes every year. This is a conservative estimation, as a result of the drowsy driving is underreported as a reason for accident. Additionally the accidents were caused by driver's basic cognitive process don't seem to be accounted. Depending on some French records for 2003 [2], more accidents occur due to sleep deprivation, fatigue than by using alcohol or drug intoxication. Therefore, large amount of efforts had been made to propose and develop effective security systems in order to decrease the number of accidents, furthermore to improve existing system in order to improve more results.

The vision of computer is primarily based on techniques from the second class that are very effective, as a result of the drowsiness can be detected by checking the visual bio behavior and facial features for example gaze, head-position, saccadic and eye openness. This type of classification encompasses a large vary of strategies and method with regard to information acquisition, image-processing and feature extraction and classification eg:- neural networks, etc. PERCLOS is an accepted parameter which is measured by most of strategies and is used to measure eye closure.

II. RELATED WORK

For eye detection, we have a tendency to usually would like face detection. In fact, it's important that despite the vital progress that has been created, detecting head pose and eye blinking with a high accuracy remains tough part due to the complexity of facial expressions. The literature on face expression recognition in static pictures is rather sparse in comparison with that of face recognition. The massive part of the contemporary references comprise algorithms to extract points from an image and to scale back the dimensionality of the problem. So the most issue are in specifically the wide range of faces from one person to different and the vast range of possible facial expressions, variable timing and appearance look each by age, gender, orientation, hair look, and therefore the presence of various accessories (glasses, locks). Added to this, we refer the challenges of shooting, for instance changes in head position, fractional lighting, and impediments. Finally, the technical constraints imposed to limit the specified memory space and computing time to allow the execution in real time.

III. PROPOSED APPROACH

In our framework, a shrewd camera has been connected on the dashboard of vehicle. It takes pictures of various conditions of driver's tiredness discovery. The framework comprises of three stages: face location, eye recognition and head pose estimation.

A. *Face and Eye detection*

The technique of Viola-Jones is recognize of face and eyes. This technique allow the detection of objects that learning was performed. It was planned mainly for the goal of face detection, but could likewise be utilized for other kinds of objects. As a supervised learning methodology, the technique of Viola-Jones needs a whole bunch to thousands of samples of the detected object to organize a classifier.

The proposed work presents the strategy of being affective and fast. The Viola Jones technique uses artificial representations of element values : The pseudo Haar-features. These qualities are examined by the distinction of sum of pixels of a minimum of 2 adjacent rectangular regions. The most effective features are then picked by a strategy for boosting, which provides a "strong" classifier additional by coefficient classifiers "weak". The Viola-Jones strategy utilized by the Ada-boost algorithm program.

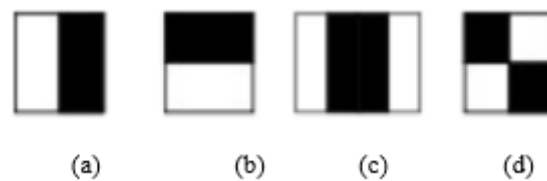


Fig1. Examples of neighborhoods used[8].

The complete search for an object within an image that can be costly in the computing time, the method detection organizes a cascade of classifiers, applied sequentially. Each classifier determines the presence or absence of the object in the image. The simplest and fastest classifiers are placed at the beginning that quickly eliminates many drawbacks.

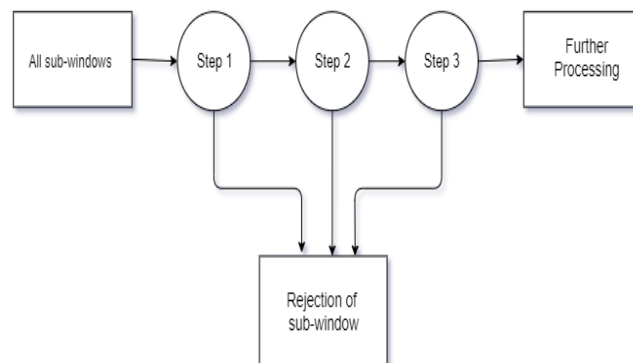


Fig2. Classifiers [8].

Normally, Viola Jones technique is used to provide best results in the human (animal also) Face Detection or different objects, with some false positives for a calculation time quite slow, allow real time operations.

B. Eye Blinking

The detection of eye blinking in real time is very important to estimate driver-drowsiness state. In writing, the PERCLOS [3] esteem has been used as temporary static metric that shows the level of conclusion in express time (e.g. in a moment, eyes are eighty percent closed). Utilizing these eyes nearer and blinking ration, one can recognize drowsiness of driver. At the point, we move to the following frame until obtaining close eyes. The eye closure is calculated the duration by us; if it exceeds a predened Time T (for instance 2 seconds), we are able to say that the driver enters in a sleeping state, consequently, our system launch's warning to wake the driver.

C. Facial Landmark Marking

In this step to extract facial landmarks of human face. In our project was being imported and deployed by Dlib library. In this library the pertained facedetector, whose is based on a modification to thehistogram of oriented slop and uses linear supportvector machine method for object detection. This is used to calculate distance between points. And these distance used for compute EAR value. EAR value is defined as the ratio of width and height of the eye and was determined using this equation.

$$EAR = (|p_2 - p_6| + |p_3 - p_5|) / 2 * |p_1 - p_4|$$

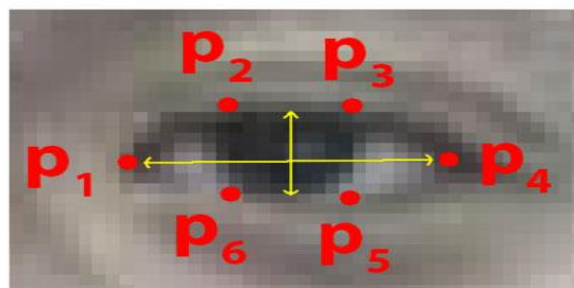


Fig3. Facial Landmark Marking

D. System Overview

The system design flowchart is shown in Fig3.

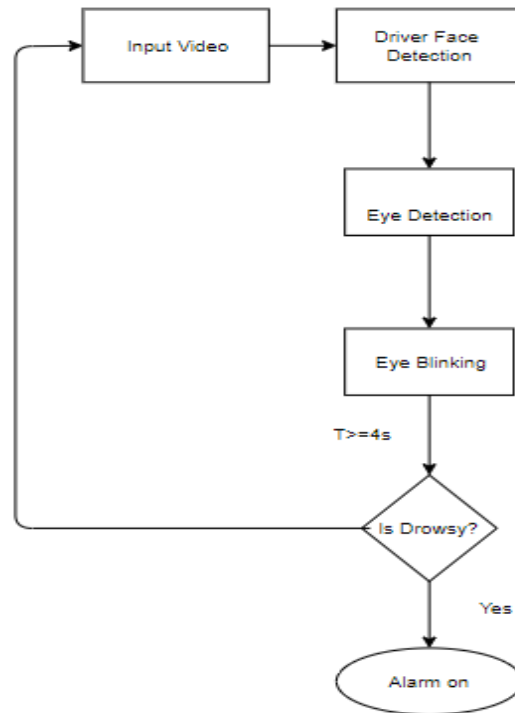


Fig 4. Proposed approach for recognizing driver drowsiness

We define three rules, to observe drowsiness state: □

- Rule-1 : if ($T > 2\text{sec}$),
Drowsiness=2. => Red .
- Rule-2: if ($(T < 2\text{ sec })$ and $(\text{pitch} = 1)$),
Drowsiness=1 => Yellow.
- Rule-3: if ($(T < 3\text{ sec})$ and $(\text{pitch}=0)$),
Drowsiness =0 => Green.

If Rule-1, the system alerts driver by a bip message “wake up”. If Rule-2, a yellow LED lights up. And, if Rule-3, we still in normal mode, there is no risks.

E. **EXPERIMENTAL RESULTS**

We are going to explain different experiment results as well as approaches developed in this work.

- Test-1: Eye detection by Haar-classifiers



Fig5: Eye Detection Using Haar-Classifier

We have implemented experiments on Fig-4: Eye detection using haar-classifier. The estimation of this method is made by the calculation of the rate of good detection eye blink (GDR1) using the fooling formula.

$$\text{GDR1} = \text{Number of detected eye} / \text{Total eye number}$$

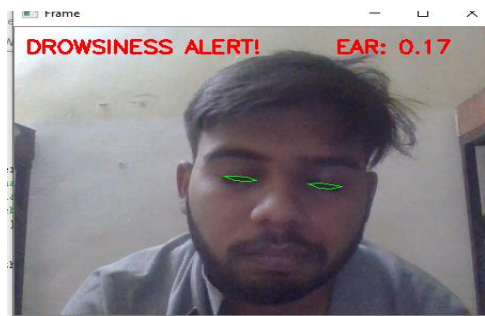


Fig6: Drowsiness Alert

With this algorithm we achieved to detect with a 90% as GDR1.

TABLE-1 Types of Approach followed

Approach	Eye Blink	Eye with Head Pose
Number of Tested Images	15	30
Number of detected images	15	27
GDR(%)	100	90

Fig7: Eyes Detection Algorithm Performance

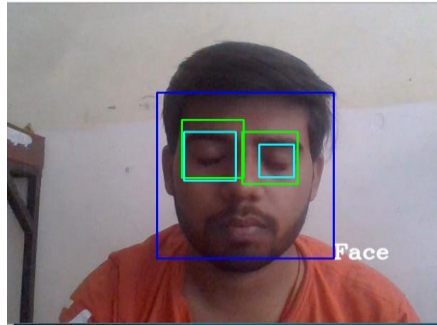


Fig8: Eye with Head (face) Pose

F. GUI Part

Python offers different choices for developing Graphical User Interface. But tkinter is most typically used methodology. Python with tkinter outputs the quickest and easiest method to make the GUI application.



Fig9: Main Window of GUI

In this window, there are five buttons. The first one is for the open cam and checks your camera is working properly or not. The second button is for the record, the third one is for the open cam and detects your object using a haar cascade classifier. And the last one is for the main button when clicking the last button than open a new window with cam and detect your eyes and give an alert signal with an alarm sound.

IV. CONCLUSION

This paper presents a brand new approach for dominant driver drowsiness state in real time supported eye blinking. The main focus of the presented work is to allow use of computer vision techniques, and its robustness against illumination variations, so as to solve real time scenarios. Thus drowsiness detection system has been designed by the

use of OpenCV and DLib package and Haar Classifiers. It has been fully tested and limitations has been addressed in future work.

V. FUTURE WORK

The areas to be addressed in the proposed work is the Dependence on ambient light, Hardware Requirements, Delay in sounding alarm, Poor detection with spectacles, Problem with multiple faces. The requirement for real time drowsiness detection is to slow to down the vehicle when it crosses certain level. The monitoring of level of drowsiness without any gaps and interruption is done and as soon as the level is crossed, the generation of signal is done to control the hydraulic braking system of the vehicle. Future work is enlightened to solve the real time problem of vehicle.

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