



Monitoring Driver Behavior using Machine Learning Techniques – A Comprehensive approach

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Abstract: The main reason for motor vehicle accidents is the driver's drowsiness. In this project, the presence of drowsiness will detect and alert the driver. For the detection of drowsiness, the most relevant visual indications are the driver condition such as the behavior of the eyes. The Algorithm used in this project is opencv, HaarCascade with machine learning. This system works adequately under natural lighting conditions and no matter the use of driver accessories like glasses or a cap, etc. With the concept of machine learning and it's techniques the driver will be alerted and a consent message will be sent to a family member or a friend. Due to a large number of traffic accidents when driver has fallen asleep, this proposal was developed in order to prevent these kinds of accidents and without the necessity of purchasing any specialized devices.

IndexTerms - Haar-Cascade, Machine Learning, openCV.

I. INTRODUCTION

Now days, machine learning and artificial intelligence has become the most realistic technology that has been started to develop the world's extraordinary software and application to secure the world's safety. Driver drowsiness detection is a car safety technology which helps prevent accidents caused by the driver getting drowsy. Various studies have suggested that around 20% of all road accidents are fatigue-related, up to 50% on certain roads. In order to reduce such accidents and enhance the safety of the driver and the passengers, driver drowsiness detection systems have been worked on and developed by various researchers all across the world. In this project, machine learning technique is used to recognize the behavior of driver using the face detection and eye detection and send a consent message to a family member or a friend. This drowsiness detection system is behavioral based and it depends on the behavior of the driver. To be more specific eye closure is monitored through a camera to detect drowsiness in such systems. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars. Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image that store in database with the trained dataset.

II. RELATED WORK

Face recognition is a broad problem of identifying or verifying people in photographs and videos. Face recognition is a process comprised of detection, alignment, feature extraction, and a recognition task. Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video. Eye recognition is the process of measuring either the point of gaze (where one is looking) or the motion of an eye relative to the head. The system is capable of detecting facial landmarks, computes Eye Aspect Ratio (EAR) and Eye Closure Ratio roach. There are a number of methods for measuring eye movement. The most popular variant uses video images from which the eye position is extracted. After detecting the presence of drowsiness, it will set off the alarm system and alert the driver and a consent message will be sent to a family member or a friend. This system will help to prevent accidents caused by driver drowsiness. Drowsiness of the drivers is the main cause of accidents in the world. Due to lack of sleep and tiredness, drowsiness can occur while driving. The best way to avoid accidents caused by driver drowsiness is to detect drowsiness of the driver and warn him before fall into sleep. To detect drowsiness facial feature recognition has been used. Here, we propose a method of detecting driver drowsiness using opencv, HaarCascade with machine learning. This system works adequately under natural lighting conditions and no matter the use of driver accessories like glasses or a cap, etc. Upon the detection of drowsiness, the alarm will set off to warn the driver about the presence of drowsiness and send a consent message to a family member or a friend.

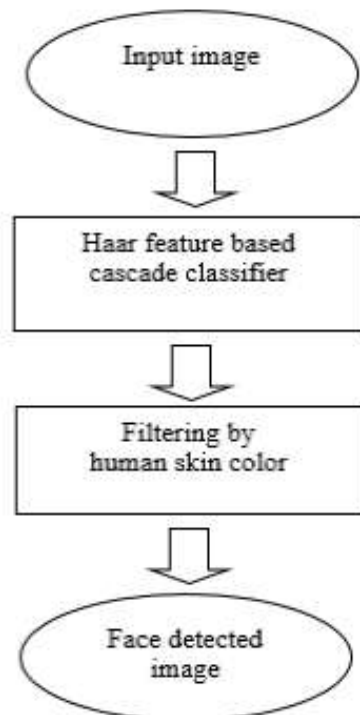


Figure 1. Haar Feature based Face Detection in openCV

III. LITERATURE SURVEY

In this section, some of the recent studies in the domain of ensemble learning and ML applications for driver behavior monitoring will be briefly reviewed. Then, the recent studies in the domain of driver behavior analysis using ML algorithms are presented.

A. ENSEMBLE APPLICATIONS

Ensemble classifiers have wide applications in different fields such as remote sensing, medical, transportation and so on. Studies in this area is not always easy since they need sufficient range of data to avoid complex model caused by oversampling and simple model caused by under sampling. Ensemble method is used in remote sensing because of several reasons: Firstly, a large amount of data from spaces is collected by satellite. Secondly, some data have poor label or do not have label. The level of consciousness and the concentration of drivers while driving play a vital role for reducing the number of accidents. In recent decade, invehicle infotainment (IVI) [or in-car entertainment (ICE)] is one of the main reasons that lead to degradation of driver's performance and losing awareness. However, the impacts of some other reasons, such as drowsiness and driving fatigue, are entirely important as well. Hence, early detection of such performance degradation using different methods is a very hot research domain. To this end, the data set is collected using two different simulated driving scenarios: normal and loaded drive (17 elderly and 51 young /35 male and 33 female). Therefore, concentrates on driving performance analysis using various machine learning techniques.

B. EVOLUTIONARY APPLICATIONS

The study of the visual behaviors of observers in subjective image quality assessment is helpful in understanding of human visual system. It can also be used to improve the reliability of assessment results. It can also be used to improve the reliability of assessment results. Drowsiness or fatigue is a major cause of road accidents and has significant implications for road safety. Several deadly accidents can be prevented if the drowsy drivers are warned in time. A variety of drowsiness detection methods exist that monitor the driver's drowsiness state while driving and alarm the drivers if they are not concentrating on driving. Deep learning methods have got fantastic performance on lots of largescale datasets for machine learning tasks, such as visual recognition and neural language processing. Most of the progress on deep learning in recent years lied on supervised learning, for which the whole dataset with respect to a specific task should be well-prepared before training. However, in the real-world scenario, the labeled data associated with the assigned classes are always gathered incrementally over time, since it is cumbersome work to collect and annotate the training data manually.

IV. SYSTEM MODULES AND IMPLEMENTATION

Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop a conventional algorithm for effectively performing the task. Machine learning is closely related to computational statistics, which focuses on making predictions using computers. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a field of study within machine learning, and focuses on exploratory data analysis

through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics.

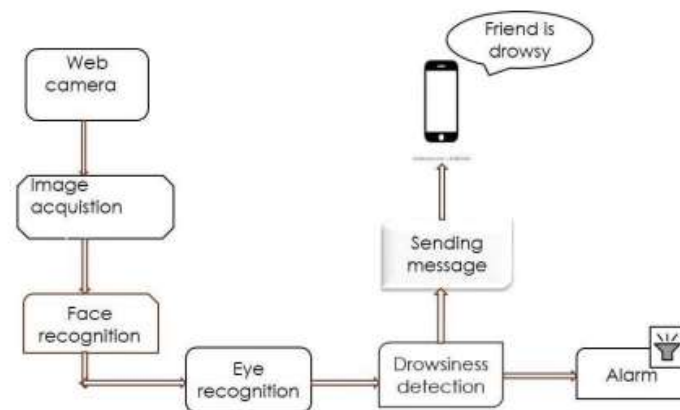


Figure 2. System Architecture

4.1 Face Recognition and Eye Recognition

Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Face-detection algorithms focus on the detection of frontal human faces. Eye recognition is the process of measuring either the point of gaze (where one is looking) or the motion of an eye relative to the head.

4.2 Drowsiness Detection

It will implement the drowsiness detection algorithm using OpenCV, dlib, and Python. With the SciPy package, can compute the Euclidean distance between facial landmarks points in the eye aspect ratio calculation. It will also need the imutils package, as a series of computer vision and image processing functions to make working with OpenCV easier. In order to actually play WAV/MP3 alarm, we need the play sound library, a pure Python, cross-platform implementation for playing simple sounds. Using pip install play sound. The function which is used to compute the ratio of distances between the vertical eye landmarks and the distances between the horizontal eye landmarks. The return value of the eye aspect ratio will be approximately constant when the eye is open. The value will then rapid decrease towards zero during a blink. If the eye is closed, the eye aspect ratio will again remain approximately constant, but will be much smaller than the ratio when the eye is open.

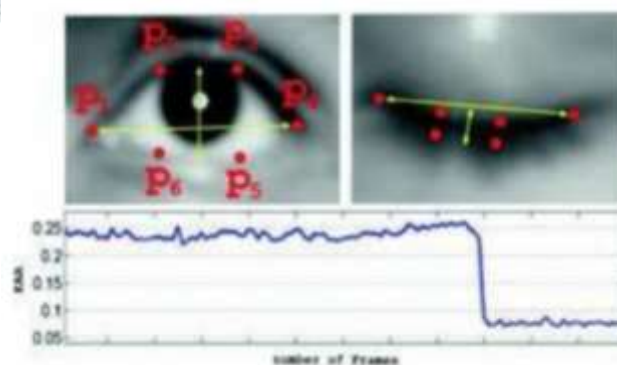


Figure 3. Eye facial landmark

4.3 Sending Alarm Message

Twilio is a cloud communications platform as a service company. Twilio allows software developers to programmatically make and receive phone calls, send and receive text messages, and perform other communication functions using its web service APIs. Register to twilio communication website after that they will provide us auth_token key and auth id key. With the help of two key are auth_token, authid, and mobile number, a message will send to family member once the driver is drowsy. This will be working in the process of sending a message to a client with the help of using message API.

V. CONCLUSION

The aim of this project is to address a solution to one of the major causes for road accidents, the driver drowsiness; the proposed solution does track the driver's eyes and then notify him when the presence of drowsiness is detected in order to avoid losing control of the car and causing accident. The proposed method based mainly on two main phases, the first phase is to detect and pre-process the eye images using Haar cascade algorithm and the second phase is to build a classification model that will be able

to classify whether the eye is opened or closed and then set off the alarm accordingly. The result shows that this method is flexible for developing and ready to use as drowsiness detection application for comprehensive solution.

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