**DROWSINESS DETECTION SYSTEM USING HAAR CASCADE CNN**

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**ABSTRACT**

Machine learning techniques have been used in order to predict the condition and emotion of a driver to provide information that will improve safety on the road. It is an application of artificial intelligence. Artificial Intelligence is a method by which systems can automatically learn as well as improve without being explicitly programmed. A driver’s condition can be estimated by bio-indicators, behavior while driving as well as the expressions on the face of a driver. In this paper we present an all-inclusive survey of recent works related to driver drowsiness detection and alert system. We also present the machine learning algorithm, HAAR based cascade classifier, OpenCV which are used in order to determine the drivers condition. Finally, we identify the challenges faced by the current systems and present the corresponding research opportunities.

**Keywords:** HAAR, OpenCV, Drowsiness

1. **INTRODUCTION**

Drowsiness is one of the significant reasons for road crashes that results in considerable damaging consequences to the individuals who suffer fatal or non-fatal injuries, property damage and economic losses to the nation. A survey conducted by the National Highway Traffic Safety Administration (NHTSA) estimated that 8.8% to 9.5% crashes resulted from road accidents in 2018 in the United States. Another study made by the American Automobile Association (AAA) Foundation for Traffic Safety identified that around 328,000 drowsy driving crashes occur yearly.

1. **METHODOLOGY**

Machine learning techniques have been used in order to predict the condition and emotion of a driver to provide information that will improve safety on the road. It is an application of artificial intelligence. Artificial Intelligence is a method by which systems can automatically learn as well as improve without being explicitly programmed. A driver’s condition can be estimated by bio-indicators, behavior while driving as well as the expressions on the face of a driver. In this paper we present an all-inclusive survey of recent works related to driver drowsiness detection and alert system. We also present the machine learning algorithm, HAAR based cascade classifier, OpenCV which are used in order to determine the drivers condition. Finally, we identify the challenges faced by the current systems and present the corresponding research opportunities.

* 1. **Eye Blink Detection**

The eyes of drivers can be continuously tracked by applying the mean-shift method to continue to track them even when they move. The mean-shift is a method used to find the peak or center of gravity of data distribution, which indicates the algorithm is moving to a data-dense area and the center of the distribution. When the data are distributed on a 2D plane, the process of finding the densest peak point of the data is constructed by the following methods

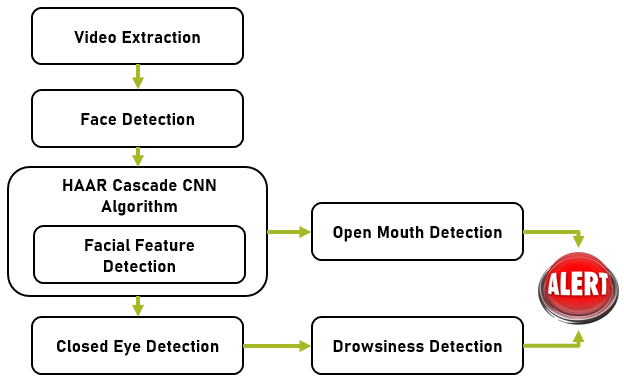
* Obtain data originating from the radius, r, from the current position.
* Move the current position to the coordinates of the center of gravity.
* Repeat step 1 and 2 until the position converges.

**2.2 Yawn Detection**

As a result of a questionnaire survey, it was found that the occurrence of many drowsy driving operations depend on the air quality in vehicles. Therefore, this study tried to prevent drowsy driving by detecting the concentration of carbon dioxide in vehicles. Represents a sensor for measuring the concentration of carbon dioxide of the NDIR (Non-Dispersive Infrared) system. If the concentration of carbon dioxide was over 1500 ppm, it was expected that drowsiness would appear. Further, when the concentration of carbon dioxide was high, this not only caused drowsiness and stiffness but also caused dizziness, headache and health problems. This sensor measures the concentration of carbon dioxide to the extent that refraction is caused by gas concentration using a non-distributed infrared emitting unit.

1. **MODELING AND ANALYSIS**

Face Detection a widely popular subject with a huge range of applications. Modern day Smartphones and Laptops come with in-built face detection software’s, which can authenticate the identity of the user.



**Figure 1:** System Architecture

There are numerous apps that can capture, detect and process a face in real time, can identify the age and the gender of the user, and also can apply some really cool filters. The list is not limited to these mobile apps, as Face Detection also has a wide range of applications in Surveillance, Security and Biometrics as well. But the origin of its Success stories dates back to 2001, when Viola and Jones proposed the first ever Object Detection Framework for Real Time Face Detection in Video Footage.

It taking about a gentle look on the Viola-Jones Face Detection Technique, popularly known as HAAR Cascades, and exploring some of the interesting concepts proposed by them. This piece of work was done long before the Deep Learning Era had even started. But it’s an excellent work in comparison to the powerful models that can be built with the modern day Deep Learning Techniques.

The block diagram of the proposed system has been shown. The camera captures the image and sends to the raspberry pi which is a 64 bit single board computer and acts as a mini pc.

This is connected to the monitor and it consists of 32 bit memory card installed with open CV which helps in image Processing. The encoder encodes the data. The encoded signal is decoded back in the Decoder. If the decoded signal crosses threshold of 2-3 sec, it will automatically makes the alarm beep and the parking light will be on in order to alert the driver, otherwise that signal is rejected and next signal is processed.

1. **RESULTS AND DISCUSSION**

**4.1 Camera**

The camera module is a product used to take photos and videos from mobile devices, such as smartphones, automobile, and smart home appliances. In all areas, a high level of technology is needed that requires high resolution, miniaturization, slimming, low-power, and high stiffness.

**4.2 Behavioral Measure**

A drowsy person displays a number of characteristic facial movements, including rapid and constant blinking, nodding or swinging their head, and frequent yawning. Computerized, non-intrusive, behavioral approaches are widely used for determining the drowsiness level of drivers by measuring their abnormal behaviors. HAAR (which is the percentage of eyelid closure over the pupil over time, reflecting slow eyelid closures, or “droops”, rather than blinks) has been analyzed in many studies. This measurement has been found to be a reliable measure to predict drowsiness and has been used in commercial products such as Seeing Machines and Lexus.

**4.3 Speaker**

An amplifier module is a component of active speakers. It is used to help drive the speaker, and produce the music that you wish to listen to. When music is processed by any device, it produces a signal that is sent to some form of speaker. This could be headphones or typical speakers that you see in a home.

**4.4 Subjective Measure**

Subjective measures that evaluate the level of drowsiness are based on the driver’s personal estimation and many tools have been used to translate this rating to a measure of driver drowsiness. The most commonly used drowsiness scale is the Karolinska Sleepiness Scale (KSS), a nine-point scale that has verbal anchors for each step, Hu *et al.* measured the KSS ratings of drivers every 5 min and used it as a reference to the EoG signal collected. The evaluated EEG data by confirming driver drowsiness through both a questionnaire and a licensed medical practitioner.

**4.5 Drowsy Eyes and Face Detection**

Recognize and manipulate faces from Python or from the command line with the world’s simplest face recognition library. Built using [dlib](http://dlib.net/)‘s state-of-the-art face recognition built with deep learning. The model has an accuracy of 99.38% on the [Labeled Faces in the Wild](http://vis-www.cs.umass.edu/lfw/) benchmark. This also provides a simple face recognition command line tool that lets you do face recognition on a folder of images from the command line.

1. **CONCLUSION**

Driver's drowsiness and fatigue nature can be detected by using Drowsy care system. The system comprises of a camera attached with an alarm which is placed in front of driver and fixed inside the car. The camera records the video of the driver's facial expressions for observing the drowsiness. The continuous video frames captured by the camera will be compared with the trained data sets. The trained data sets consists of collection of various images with open and closed right and left eyes along with mouth during yawning. If the continuous video frames that are captured by the camera matches with the images in the trained data sets then an alarm will be blown. We propose a new system for finding the driver's fatigueless based on the eyes and yawn deduction by using the datasets. We design and propose the new algorithm called Drowsy Care System to track the driver's eyes and mouth using the HAAR cascade CNN algorithm. The CNN algorithm can produce the success rate of 95% in reducing the accidents happening because of drowsiness. If the motive force is found drowsy then alert is given to the motive force through alarm. This system reduces the quantity accidents while driving a vehicle and helps to stay ourselves safe. The alarm indicates that the driver is in fatigue state or he is about to sleep it indicates the drowsiness. This alerts the driver and other co-passengers in the vehicle and the alarm will stop only when driver facial expressions comes to normal. Thus Drowsy care system prevents accidents and ensures safe driving by detecting driver's drowsiness.

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