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Driver Alert System Using Deep Learning and Machine Learning

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Abstract

The rising number of road injuries is one of the most pressing challenges facing the world today. One of the main causes of traffic accidents were unsafe and inattentive driving. Drowsiness or a loss of focus on the part of the driver is believed to be a significant factor in such incidents. Driver drowsiness tracking research can assist in the reduction of road accidents. This journal presents a good approach for applying a driver's sleepiness alarm system that uses Machine Learning and Deep Learning techniques to identify and track the driver's yawning and sleepiness. For face detection and recognition, the device utilises the Histogram Centred Gradient (HOG) function descriptor, which is widely used in image processing. The SVM is then used to determine if the image being identified is a face or not. It also checks the driver's Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR) up to a certain countable frames to see whether he or she is sleepy or yawning. Since the driver's drowsiness or fatigue is proportional to the number of hours spent behind the wheel, an extra element for changing the face and mouth reference frames have been added. This increases the sensitivity to detect drowsiness. This also necessitates the introduction of face recognition so that each driver can be tracked individually. This Project aims to provide a Driver Alert System consisting of three sections Face Recognition to unlock vehicle, traffic light detection and Drowsiness alert system.

Keywords: Driver Alert System, Histogram Oriented Gradient, Deep Learning, Face Recognition, traffic light detection, Drowsiness alert system, Image Processing.

1. Introduction

This Project aims to provide a Driver Alert System consisting of three sections Face Recognition to unlock vehicle, traffic light detection and Drowsiness alert system.

1.1 Face Recognition

A Facial Recognition is a software application to recognise a male or female with a video or a captured image. This shows a method of facial recognition in which a human face is recognized from a single picture and multiple human faces can also be detectable from a single picture. A face detector has to say whether or not there is a face in the picture.

1.2 Traffic Light Detection

Traffic light identification and interpretation are critical in the field of smart vehicles. Many that have colour blindness will make use of this initiative. Better identification and clearer interpretation can help avoid road collisions by some vehicles at busy intersections and thereby increases travel safety [1-6].
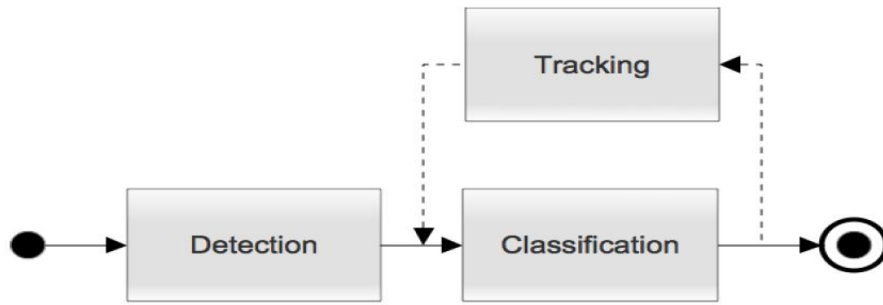
Chart.1. Traffic Light Detection Mechanism

1.3 Drowsiness Alert

Drowsiness and sleep are significant considerations related to car injuries caused by the driver when driving a car. This journal depicts spontaneous drowsiness identification through Computer Vision. This system is designed to diagnose sleepiness by a camera placed in the front position to the driver and warns the driver. The alertsystempredictsdrowsiness with the face and eyes from the specific part of the picture and the driver's eye blinks.

2. Methodology

2.1 Face Recognition Using OpenCV

Face recognition and imageprocessing are the popular topics in the biometric research. For a certain reference the 1950s and the 1960's, older studies on facial recognition can be recollected back to the engineering history. Certain historical findings include the experiments of Darwin's

interest on facial detection.By using the Intel tool called Open CV which is an open source, facial recognition can be performed easily with more accuracy. The chosen facial characteristics are one direction from a mask and an image database. This is seen in comparison with biometrics, such as fingerprint, thumb and eye scanning systems, and is used frequently for authentication systems. The most important evaluation is carried out using various detection algorithms like Fisher face, Markov, multi-linear subspace using tensor representations and nervously controlled dynamic relation matching, etc,. The Intel open-source computer vision library makes coding simplistic to use. This includes sophisticated technologies such as face scanning, facial detection, image processing, and a number of instant tools for artificial intelligence [7-12].
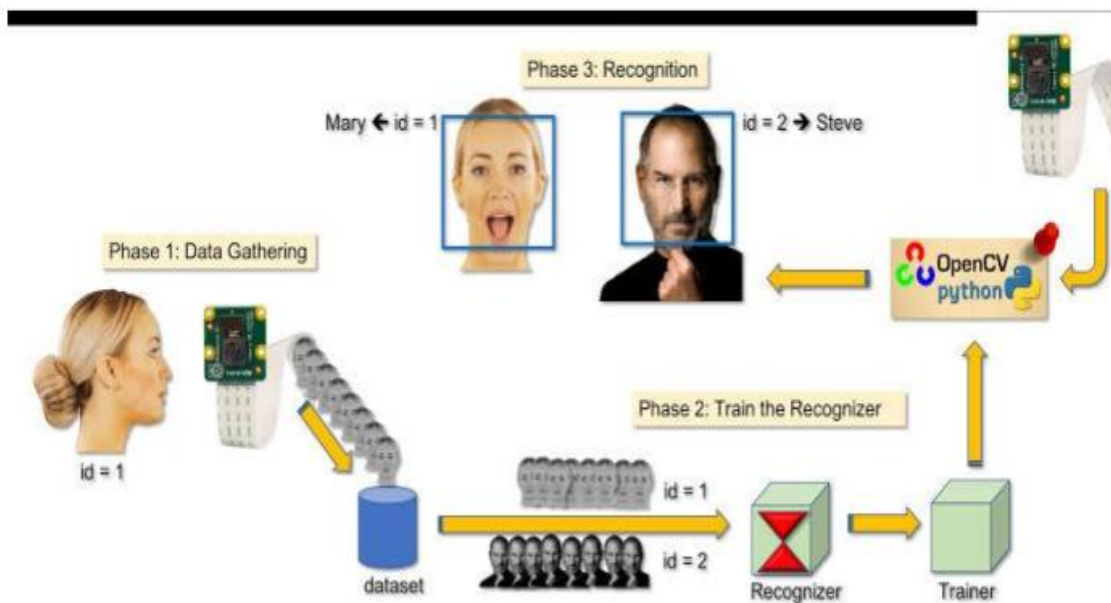

Fig.1. Face recognition system design using python and OpenCV

2.2 Traffic Light Detection Mechanism

Color and shape characteristics were commonly used in early work to recognize traffic lights. This system involves colour segmentation, HOG extraction features, SVM, ANN and RF training methods. For each of the candidate regions resulting from the previous phase, the features of the Histograms of Oriented Gradients (HOG) were extracted to help detect traffic light structures, removing much of the false positives. The utility of this function has been applied to pedestrian recognition, target detection and other computer vision issues. HOG characteristics are relatively invariant in size and rotation, which is critical for traffic lights. HOG characteristics are calculated by taking orientation histograms of edge strength in a local field. As shown above, colour is a significant feature of a traffic signal.
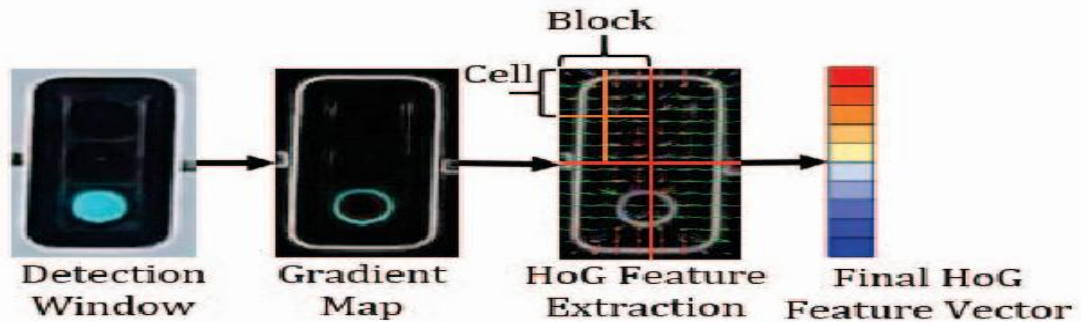
Fig.2. HOG Feature Extraction

2.3 Drowsiness Alert

Drowsiness and sleep causes road collisions, resulting in people's deaths and injury. In this approach, in order to detect the face, as the camera is oriented on the driver of the car, we can stop processing the image at the corners, thereby reducing the amount of processing needed. If the region of interest has been identified, the face has been detected; the region of interest is now the face, since the next stage includes eye detection. In order to detect the eyes, instead of processing the whole face area, we have identified a region of importance within the face region that further helps to achieve the primary purpose of the proposed method. Next, we make use of the Haar Cascade Xml file designed for eye identification, and we detect the eyes by processing only the area of interest. If the eyes have been identified, the next step is to decide if the eyes are in an open/closed state that is accomplished by obtaining and evaluating pixel values from the eye area. If the eyes are shown to be open, no measures are taken. But if the eyes are found to be closed constantly for two seconds, that is to say, a certain number of frames based on the frame rate, it ensures that the car driver feels drowsy and a loud alarm is stimulated. However, if the closed condition of the eyes is not constant, it is declared as a blink.
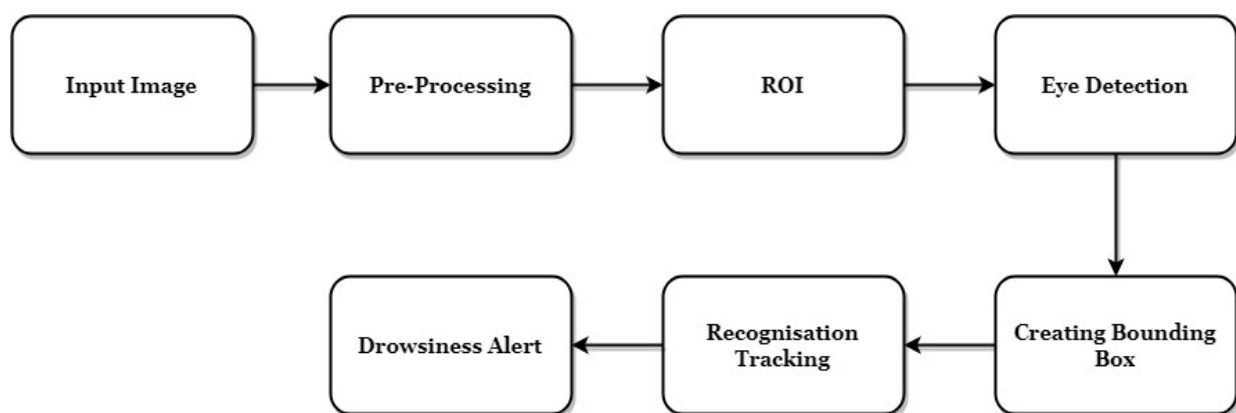
Chart.2. Drowsiness Detection Mechanism

Conclusions

This paper presents the methodologies of face recognition using OpenCV which involves the implementation of various machine learning algorithms. The traffic light detection which helps the driver overcomes the colour blindness using the HOG feature extraction with SVM, HSV algorithms. Then, the drowsiness alert helps in alerting while feeling drowsy with the blink rate and the state of eyes using Haar cascade mechanism. In our view, the machine built using these strategies will help the driver when driving.

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