Driver Drowsiness Detection System

Submitted by

Ankit Gupta(181IT107)
Ayush Rahangdale(181IT109)
Kumsetty Nikhil Venkat(181IT224)

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Dr. G. Ram Mohana Reddy
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Table of contents

Aim

The aim of this project is to develop a prototype drowsiness detection system. The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver's eyes in real-time.

By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns in a sequence of images of a face.

Problem Statement

Driver fatigue is a significant factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes.

Safe driving is a major concern of societies all over the world. Thousands of people are killed, or seriously injured due to drivers falling asleep at the wheels each year. Recent studies show those drivers' drowsiness accounts for up to 20% of serious or fatal accidents on motorways and monotonous roads, which impair the drivers' judgment and their ability of controlling vehicles. Therefore, it is essential to develop a real-time safety system for drowsiness-related road accident prevention.

The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its affects.

Many methods have been developed and some of them are currently being used for detecting the driver's drowsiness, including the measurements of physiological features like EEG, heart rate and pulse rate, eyelid movement, gaze, head movement and behaviours of the vehicle, such as lane deviations and steering movements. Among those different technologies, ocular measures, such as eye-blinking and eyelid closure, are considered as promising ways for monitoring alertness.

Problem solution

We will use OpenCV for this project. OpenCV is an open source computer vision library. It is designed for computational efficiency and with a strong focus on real time applications. It helps to build sophisticated vision applications quickly and easily. OpenCV satisfies the low processing power and high speed requirements of our application.

We will use the Haartraining applications in OpenCV to detect the face and eyes. This will create a classifier given a set of positive and negative samples. The steps are as follows:-

- Gather a data set of face and eye. These should be stored in one or more directories indexed by a text file. A lot of high quality data is required for the classifier to work well.

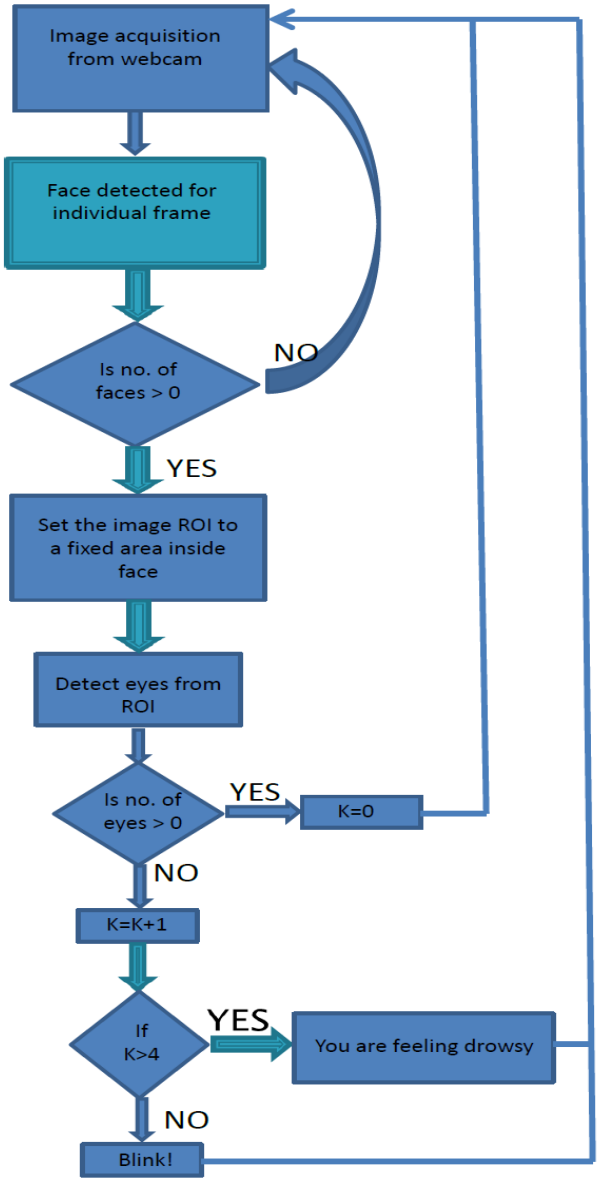
- The utility application create_samples () is used to build a vector output file. Using this file we can repeat the training procedure. It extracts the positive samples from images before normalizing and resizing to specified width and height.
- The Viola Jones cascade decides whether or not the object in an image is similar to the training set. Any image that doesn't contain the object of interest can be turned into negative sample. So in order to learn any object it is required to take a sample of negative background image. All these negative images are put in one file and then it's indexed.

- Training of the image will be done using boosting. In training we will learn the group of classifiers one at a time. Each classifier in the group is a weak classifier. These weak classifiers are typically composed of a single variable decision tree called stumps. In training the decision stump learns its classification decisions from its data and also learns a weight for its vote from its accuracy on the data. Between training each classifier one by one, the data points are reweighted so that more attention is paid to the data points where errors were made. This process continues until the total error over the dataset arising from the combined weighted vote of the decision trees falls below a certain threshold.

This algorithm is effective when a large number of training data are available. For our project face and eye classifiers are required. So we will use the learning objects method to create our own haarclassifier .xml files.

Around 200 positive and 300 negative samples will be taken. Training them is a time intensive process. Finally face.xml and haarcascade-eye.xml files will be created. These xml files are directly used for object detection. It detects a sequence of objects (in our case face and eyes). Haarcascade-eye.xml is designed only for open eyes. So when eyes are closed the system doesn't detect anything. This is a blink. When a blink lasts for more than 5 frames, the driver is judged to be drowsy and an alarm is sounded.

BLOCK DIAGRAM



Modules

Module 1:

No. of Labs: 1

Develop program for face detection

Module 2:

No. of Labs: 2

Develop program for Eye Detection

Module 3:

No. of Labs: 2

Training the dataset

Module 4:

No. of Labs: 1

Implement of Voila Jones Cascade

Module 5:

No. of Labs: 1

Implementation of System(Input videos using Webcam)

Performance metric

Model will be trained on training data available from dataset. Large dataset will be required. And the accuracy will be calculated based on test data from dataset. The program must detect the eyes and ring the alarm when the eye blink for a long period.