Driver Drowsiness Detection
Final Project Report

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Problem Statement:

To detect the face of a person and identify his/her eyes in that 'Region of interest' and detect their state whether they are closed or opened.
A statistical data of cause of accidents has shown that 43% of accidents are due to drivers' tiredness and they are unable to detect that, which is making a huge loss of life. This detection is very helpful to raise alarm if a person at driving feels drowsy.

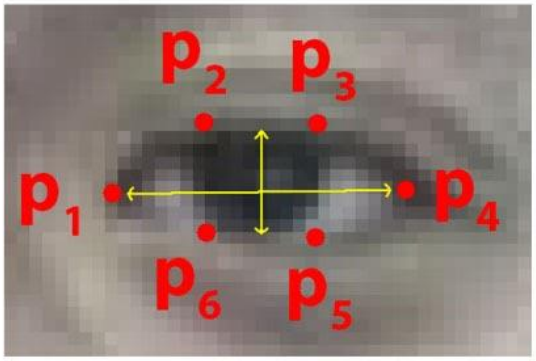
My motivation is that it can save many lives and nothing is more than life. And this is very important for people who work hard all day and return home driving themselves with tiredness.

Implementation details:

This project can be done in different ways, popularly used way is importing large data sets of closed and open eyes of different people and making a machine learning classification model, which further detects whether it is a closed or open eye and raises alarm based on the output.
I primarily tried this model and the difficulty I faced is finding such a huge amount of data set and even though I got that through thorough research, the accuracy of that model is about 80% which is quite low. And in the case of saving lives, it is not at all usable.

So, I came up with an algorithm that detects the eye of a person. Each eye is represented by 6 coordinates, starting at the left corner of the eye and moving clockwise around the eye. It checks 20 consecutive frames and if the eye aspect ratio is less than 0.25, an alert is generated.

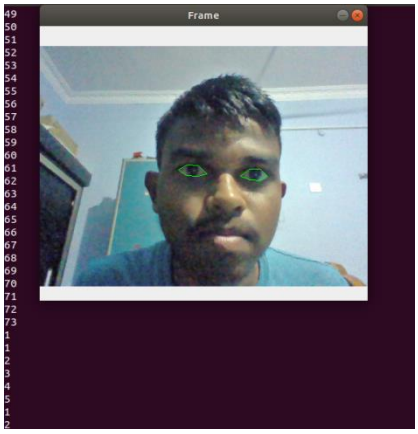
OpenCV (cv2) is a cross-platform library using which we can develop real-time computer vision applications. This library is used to detect the eyes. Facial landmarks is a prominent data file obtained on internet which identifies 68 points in a human face. An important library is imported from imutils is face_utils.Imutils are a series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images easier with OpenCV. Face_utils library is an opensource wrapper library for the most common face detection models. It also provides multiple such as face-cropping.
Using face_utils,separated the points that are particularly present on left eye and right eye. Scipy library is used to calculate distance.



And dlib library is used for prediction. It is used in implementing various machine learning algorithms including regression, classificaton which are used in this project.

Eye aspect ratio is given by = $\frac{||p_2-p_6|| + ||p_3-p_5||}{2||p_1-p_4||}$.

Glimpse of the project :



Detecting eyes for more than

Giving alert as eyes are closed

10 seconds

Conclusion: Successfully implemented the code to detect the state of eyes. Tried implementing it using "haarcascade" library and machine learning technique classification but found that it is less accurate and implemented algorithm which uses mathematical shape and calculates the aspect ratio to find the state of eyes.

References :

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