DRIVER DROWSINESS DETECTION SYSTEM

Problem Definition:

This project is to develop a driver drowsiness detection system by using histogram analysis. It is known that a driver is under drowsiness influences by looking at the eyelid. Based on the previous research, there is none used histogram for analysis. The result can be not accurate because histogram analysis analyzed the whole image. Therefore, if the analysis area is not specified, the result will be not accurate and efficient.

Aims and Objectives:

i. To develop a system that able to detect drowsiness of a driver based on eyelid detection in digital image.
ii. To make analysis of the eyelid by using Euclidian distance between eyes.

Benefits:

1. Using this we can detect symptoms of driver fatigue early to avoid accidents.
2. System can be developed at low cost.
3. Sensors are sensitive enough to detect minor movements.
4. Area required for installation is less, can be fitted to small places in car.
5. No manual attention is needed.
6. Automatically controlled and easy to use.

Methodology :-

The project is divided into the following major parts:-

- **Collecting Data:-**

  A Python script will be responsible for getting the real time video from the installed camera and detecting the eye region from the image .

- **Designing the Algorithm :-**

  Designing the algorithm for calculating the distance between fixed points on the eyes and extracting the eye aspect ratio for individual eyes .

- **Alert generation:-**

  Using the values of the eye aspect ratio alert is generated depending on the amount of time for which the eyes were shut .

Technology:

- Image Processing
- Python
- Machine Learning

Working:

A program was developed to identify the driver's drowsiness based on real-time camera image and image processing techniques**,** and this program makes warning alarms go off when it detects drowsiness driving.

Based on real-time video and image processing technology, we have created a program that determines the driver's drowsiness status and alerts the user according to a certain level if they are drowsy driving. The driver's face and eye detection method and the drowsiness step determination method using the supervised learning algorithm are implemented in the real-time vision system.

The Histogram of Oriented Gradients technology and the learned Face Landmark estimation techniques were used to detect faces and eyes.
Furthermore the concept of Eye Aspect Ratio was used to detect drivers' drowsiness.
Finally, the KNN algorithm was used to divide the drivers' level of drowsiness into three stages, and differential alarms go off for each stages.

Extracting face and eye region:
Using the HOG face pattern, to find the face from the Grayscaled-HOG-input-image.
Use the Face Landmark Estimation algorithm to locate the landmarks on the face.

Drowsiness detection method:
Each eye is represented by 6 (x, y)-coordinates
The EAR is calculated using six (x, y) coordinates for the detected eye.
The EAR equation

$$\mathrm{EAR} = \frac{||p_2 - p_6|| + ||p_3 - p_5||}{2||p_1 - p_4||}$$

- Calculated EAR
- The calculated EAR will have a value more than zero when the eyes are open, and a value close to zero when the eyes are closed.
- This program has set a 50% value from the average EAR value to the threshold value.
  1) measures the average EAR value when the eyes are open.
  2) measures the average EAR value when the driver is closing his eyes
  3) sets the threshold using the above two results.
- The computed EAR has a nonzero value when you open your eyes and a value close to zero when you close your eyes. If you set a certain threshold to the threshold (the threshold used to determine drowsy operation), you can detect that the driver is drowsy by checking whether the EAR value is smaller than that value.
- In addition, since it is not necessary to examine both eyes separately to determine drowsy driving, the average of EAR values of each eye was used.
- Threshold value is set to 50% of EAR value when eyes are opened. If it's smaller (when the eye size is smaller), the driver thinks you're sleepy and cares about whether you're sleepy, so the alarm sounds even if you're not in full sleep.
- To apply this algorithm, we applied three steps:

  1) Determine average EAR value when driver opens eyes

  2) Determine average EAR value when driver closes eyes

  3) EAR value that is 50% of eyes open using the above two values.

  if EAR < threshold for 27 frame then going alarm off.

The drowsiness phase is divided according to the time when the eyes are closed and the time the eyes were opened before the drowsiness operation.To distinguish drowsiness level, we used K-Nearest Neighbor(KNN) supervised learning algorithm.

Deliverables:

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