Synopsis
on
Driver Drowsiness detection using Machine Learning

CSE (AI-ML)

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Table of content

INTRODUCTION

Driver drowsiness is a leading cause of road accidents worldwide. To address this issue, the Driver Drowsiness Detection System using Machine learning project has been developed. The project employs deep learning techniques using the Machine learning algorithm to detect driver drowsiness accurately.

In addition to the Machine learning algorithm, the project also utilizes OpenCV (Open Source Computer Vision Library), an open-source computer vision and machine learning software library, and Python Django web framework, a high-level Python web framework that enables rapid development of secure and maintainable websites.

Overall, the project aims to improve road safety by providing an effective solution for driver drowsiness detection. With the use of state-of-the-art deep learning techniques and the integration of other technologies, the Driver Drowsiness Detection System is an innovative and effective solution to address the critical issue of driver drowsiness.

Tools/Environment Used :-

Python
OpenCV (Open Source Computer Vision Library)
Dlib
Imutils
Numpy
CMake
Alarm or Sound Module

Literature Review :-

Methodology :-

Step 1: Video Stream Acquisition

- A webcam is used to capture a continuous video stream of the driver's face. OpenCV’s VideoCapture class is used to initialize and control the video stream.

Step 2: Facial Landmark Detection

- The driver’s face is detected using dlib's frontal face detector, which uses a Histogram of Oriented Gradients (HOG)-based method.
- Once the face is detected, 68 facial landmarks are predicted using dlib's pre-trained shape predictor model (shape_predictor_68_face_landmarks.dat).

Step 3: Eye Detection and EAR Calculation

- From the detected landmarks, the points corresponding to the left and right eyes are extracted.
- The Eye Aspect Ratio (EAR) is calculated using the vertical and horizontal distances between the eye landmarks. The formula used is:

$$EAR = \frac{\| P2 - P6 \| + \| P3 - P5 \|}{2 \| P1 - P4 \|}$$

- EAR is computed separately for both eyes, and the average value is taken as the final EAR.

Step 4: Drowsiness Detection

- A threshold EAR value (typically 0.25) is established. If the EAR falls below this threshold, the eyes are considered closed.
- The system continuously checks how long the eyes have remained closed. If the eyes remain closed for more than 4 seconds, the system classifies the driver as drowsy.

Step 5: Alarm Triggering

- If the driver's eyes are closed for more than the 4-second threshold, an alarm sound is triggered using the Pygame library.
- The alarm continues to play until the driver's eyes are detected to be open again.

Step 6: Real-Time Display and Logging

- The current state of the driver's eyes (open/closed) and the EAR values are displayed on the video feed using OpenCV's putText function.
- Logs of the detected EAR values and the duration for which the eyes were closed aremaintained for further analysis and debugging.

Conclusion

The driver drowsiness detection system using eye blinking operates by monitoring and analyzing blink patterns in real-time. By utilizing visual data from a camera, processing it to extract meaningful features, and applying threshold-based classifications, the system effectively detects drowsiness and alerts the driver, ultimately aiming to enhance road safety.

References:-

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