Driver Drowsiness detection system

Final Project Proposal
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Problem Overview

Globally, road accidents caused by driver fatigue pose a significant concern. Annually, the National Highway Traffic Safety Administration (NHTSA) reports approximately 100,000 accidents attributed to driver fatigue in the US. Drowsy driving is a leading cause of accidents, resulting in fatalities and injuries. The lack of effective systems to detect and prevent driver drowsiness poses a serious risk to road safety. For our CS 570 final project, we propose a driver drowsiness detection system with the assistance of literature[2]. This system alerts the driver about drowsiness by calculating the driver's eye blink rate through a camera. Such systems offer various benefits, primarily the integration into vehicle safety systems to alert drivers showing signs of drowsiness, thereby preventing accidents. Additionally, developers of in-car entertainment or assistance systems could incorporate this model to deactivate distractions when the driver begins to drowse, reducing accident risks. Gathering data on driver behavior for research purposes and educating new drivers about the symptoms of drowsiness are other noteworthy aspects.

Dataset Description

We use two main data sets in this project.
Dataset 1:https://www.kaggle.com/datasets/prasadvpatil/mrl-dataset -4 th version
This dataset comprises 4,000 gray images , with 2,000 closed eye images and 2,000 open eye images. The images were captured under diverse conditions, including varying lighting conditions, distances, resolutions, face angles, and eye angles.
Dataset 2: CIFAR 10
The CIFAR-10 dataset is renowned and consists of 60,000 32x32 color images across 10 classes, with 6,000 images per class. The dataset comprises 50,000 training images and 10,000 test images.

Method

To detect the drowsiness of the driver we use three different machine learning models

1. Literature proposed convolutional neural network classification model to detect if the eye is open or closed. To train the system we use dataset 1.
2. MobileNetV2 as a pre-trained model to classify a given image is that of an eye or not. To train this system, we use both dataset1 and dataset2 in equal amounts.
3. Face haar cascade classifier , Eye haar cascade classifier to detect Region of Interest (face and eyes)

In summary, the proposed system captures real-time video feed frames of drivers' faces at a rate of 25 frames per second. Each frame undergoes continuous analysis for drowsiness detection. Initially, resized grayscale frames are processed through a face Haar cascade to identify the Face Region Of Interest. Subsequently, the outputs from the face cascade are input into an eye Haar cascade to identify the Eye Region Of Interest. The detected eye ROIs are resized to 24x24x1 and pass through a pre-trained MobileNetV2 classification CNN model to determine whether the region represents an eye. If an eye region is detected, it is then fed into a second CNN classification model to classify whether the eye is open or closed. In the event of fewer than 10 blinks per minute, an alert message is printed.

Reference

[1] Pasaribu, Novie Theresia Br, et al. "Drowsiness detection according to the number of blinking eyes specified from eye aspect ratio value modification." *1st International Conference on Life, Innovation, Change and Knowledge (ICLICK 2018)*. Atlantis Press, 2019.

[2] Verma, Harshit & Kumar, Amit & Gouri, Shankar & Mishra, Gouri & Deep, Ujjwal & Mishra, Pradeep & Nand, Parma. (2023). DRIVER DROWSINESS DETECTION. Shu Ju Cai Ji Yu Chu Li/Journal of Data Acquisition and Processing. 38. 1527. 10.5281/zenodo.776772.