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Driver Drowsiness detection using AI

Rohan Chopra[1], Ashish Lathkar[2], Souporno Ghosh[3], Anshul Bansod[4], Sonali Sanjay Kubde[5], Midde Rahil Rehan[6], Kosti Gowri Sai Madhurya[7]

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ABSTRACT

Driver fatigue is one of the primary reasons of accidents in the world. Detecting the drowsinessof the driver is one of the surest approaches of measuring driver fatigue. In this project we aim todevelop a drowsiness detection device. This device works through tracking the eyes of the driver and sounding an alarm while he/she is drowsy.

The system so designed is a non-intrusive real-time monitoring device. The priority is on improving the safety of the driver without disturbing him. Eye blink of the driver is detected in our project. If the driver eyes continue to be closed for more than a certain duration of time, the driver is said to be drowsy and an alarm is sounded. The programming for that is achieved in OpenCV using the Haarcascade library for the detection of facial features.

INTRODUCTION

Driver fatigue is a significant factor in a large range of vehicle accidents. Recent information estimate that yearly 1,200 deaths and 76,000 accidents may be attributed to fatigue related crashes.

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

The purpose of this project is to develop a drowsiness detection system. So we mainly focus on the designing a system that will accurately monitor status of driver's eyes in real-time.

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

To detect eye patterns initially we thought of using Matlab. However Matlab had some serious limitations and requires very high processing capacities. Also there were some issues with speed in real time processing. It was capable of processing only 4-5 frames per second. Though the eyeblink is detected by the Matlab program, the performance was found severely wanting.

This is where OpenCV is better compared to Matlab. OpenCV is an open source computer visionlibrary.

OBJECTIVES:

To build a drowsiness detection system that will detect whether a person is drowsy or not basedon eye blink patterns.

To alert the driver by sounding the alarm when he/she is drowsy, closes eyes for a certain periodof time.

LITERATURE SURVEY

1) Drowsiness Detection of a Driver using Conventional Computer Vision Application

METHODOLOGY

In the paper, pre-existing features for facial landmark detection is implemented to spot the stateof drowsiness and fatigue. 68- facial landmark predefined landmark allows in shape prediction toobviously identify the varied regions of the face like eye brows, eye, mouth region etc. Various change in parameters of those distinguished points reports various expression of

the person

2) Smartphone-based drowsiness detection system for drivers in real-time

METHODOLOGY

The versatility of mobile phones has been growing steadily over the years with the exponential growth in their demand and popularity. Statistics given on Smart insights indicate that there are 4-billion mobile phones in use of which 1.08 billion are smart phones . The behavior of the attention during the onset of a sleepy condition is dynamic and unpredictable. Thus any system monitoring the changes in eyeball positions must be quick in locating the eye and constantly track its position over time. The system must take under consideration, the chance of perspective distortion and be robust to any variation in eye shape caused by it. It must not be affectedby situations like lane switching when portions of the drivers face may temporarily move out of the domain being captured by the camera lens. Although pulse rate variability(HRV) is a critical indicator for fatigued or drowsy state of the user, most existing methods are intrusive in nature and need electrodes to be placed in contact with the drivers body . Our system makes use of a simple heart-beat sensor equipped with a Bluetooth module for measuring the physiological parameters. This sensor works works in conjunction with the camera-based behavioral module that tracks facial movements.

PRO'S

A hybrid system that incorporates both physical and behavioral parameters in building a drowsiness detection model could be very promising and play a very important role in real-time on-road drowsiness detection

CON'S

It suffers from limitations like an inability to capture coherent images in the absence of illumination.

3) Human Drowsiness Detection In Real Time, Using Computer Vision

METHODOLOGY

Here they used drowsiness detection algorithm, which they need called DDA (Drowsiness Detection Algorithm), obtains images of the driver's face, processes them and determines whether the person is drowsy or not. All this is often done in real time.

PRO'S

DDA does not need a perfect eye classification because it uses a sliding window of 30 frames, so a few errors every 30 frames will not affect the result

4) A novel approach for Drowsiness Detection using Local Binary Patterns and Histogram of Gradients

METHODOLOGY

In this paper, they developed a face detection system and employed feature extraction algorithms to analyze and detect the drowsiness of the driver by calculating the ratio. during this section, a short description on image quality assessment, preprocessing, face detection, feature extraction and evaluating drowsiness are included

PRO'S

The detection system is also validated with the standard database and found to be better than the baseline systems using the same database

5) Visual Analysis of Eye State and Head Pose for Driver Alertness Monitoring

METHODOLOGY

In this paper, Presented visual analysis of eye state and head pose for continuous monitoring of alertness of a vehicle driver. Most existing approaches to visual detection of non-alert driving patterns rely either on eye closure or head nodding angles to determine the driver drowsiness or distraction level. The proposed scheme uses visual features like HP, pupil activity,

and eye index to extract critical information on non-alertness of a vehicle driver. A support vector machine classifies a sequence of video segments into alert or non-alert driving events. Experimental results show that the proposed scheme offers high classification accuracy with acceptably low errors and false alarms for people of assorted ethnicity and gender in real road driving conditions.

PRO'S

Proposed scheme offers high classification accuracy with acceptably low errors

6) Advanced Driver Drowsiness Detection System using Machine Learning

METHODOLOGY

Here Their proposed approach of AD3S has been well demonstrated with the help of an algorithm and is implemented with the help of an Android application. The application can be installed on an Android device. Once the application gets installed on the device, it captures facial landmarks at the backend by utilizing Dlib library. A server has been implemented on Flask. When the application is running, the images of the driver are continuously sent over the server and are processed for capturing facial landmarks. A data set of 1200 participants is collected and trained using machine learning classifiers. To determine the drowsiness of driver, EAR, NLR and MOR values are used for training the models. The accuracy results have been further utilized when a driver starts a new ride. The important point that is taken into consideration by AD3S is that the driver can be drowsy as soon as he/she starts the ride. Therefore, to tackle this situation, AD3S captures facial images of the driver as soon as he/she starts the ride. For the first 10 seconds, the system checks whether the driver is fit to drive or not,by sending the values to the pre-trained model. The returned variable from the pre-trained-model determines if the driver is fit to drive or not. If the driver is fit to drive, then he/she can continue with the ride else system generates a message that the driver is drowsy and suggests the driver to take a break. The following sections describe various modules of AD3S system

PRO'S

The highlight of AD3S is that it determines drowsiness of drivers using non-intrusive methods. Hence, no external devices or sensors are required to be attached to the body of the driver

7) Mobile EEG Based Drowsiness Detection using KNearest Neighbor

METHODOLOGY

The system requirement is that the stage to set a minimum limit on the success of the system. This stage contains a role in completing the design of the sleep detection system using human brain waves. During this sleep detection system, there's one user, the driver. The driver will use this method against himself. Some of the requirements for brainwave-based sleep detection systems include:

- The system can perform a series of processes to detect drowsiness within the driver whouses an EEG device while driving his vehicle.
- The sleep detection system will take brain wave signals using an EEG device that doesn'tinterfere with driver activity.
- Driver drowsiness are analyzed using the application on the driver's smartphone to soundan alarm if sleepiness conditions are detected.
- The system is real-time that produces output within a certain period so it can preventaccidents directly.

PRO'S

Accuracy is high compared to other methods.

8) A Method of Driver's Eyes Closure and Yawning Detection for Drowsiness Analysis by Infrared Camera

METHODOLOGY

In this paper main concept is detecting the driver's face, and set it to region of interest (ROI). Next they used ROI to find

targets as eyes and mouth. This process starts from get input from infrared 2D camera and processing by MATLAB.

CON'S

Errors occurred when a face is occluded such as hand.

9) Bias Remediation in Driver Drowsiness Detection Systems Using Generative Adversarial Networks

METHODOLOGY

In this paper, a unique framework that enhances the performance of CNNs for driver drowsiness detection is presented. This is often accomplished by highlighting regions where the model is failing and passing similar GAN generated images to the model for retraining. This strategy relies on boosting, where a weak classifier is iteratively re-weighted to make it a strong classifier. Here, they explained related works on data augmentation and visualization strategies.

PRO'S

The proposed approach does not rely on any meta-data or assumptions about the race or ethnicity of individuals in the datasets, which is a commonly used approach to determine algorithmic fairness or bias.

10) Detection of Driver's Drowsiness Using New Features Extracted From HRV Signal

METHODOLOGY

A small electric pulse initiates a heartbeat and triggers a contraction of the heart muscle. These electrical signals will be detected using electrodes attached to the surface of the skin or within alittle distance of the skin using ECG devices. An ECG signal is a representation of the heart 's electrical activity at different stages of the blood flow within the heart. Each cardiac cycle produces ECG waves designated as P, Q, R, S and T to represent different phases of a heartbeat. The R-R interval refers to the interval from the peak of 1 QRS complex to the peak of the following in an electrocardiogram

PRO'S

The value of accuracy, sensitivity, and specificity of HRV and new signals is more than HRV signal.

11) Driver Monitoring Based on Low-Cost 3-D Sensors

METHODOLOGY

Proposed a solution for driver monitoring and event detection based on 3-D information from a range camera is presented. The system combines 2-D and 3-D techniques to produce head pose estimation and regions-of-interest identification. based on the captured cloud of 3-D points from the sensor and analyzing the 2-D projection, the points corresponding to the head are determined and extracted for further analysis. Later, head pose estimation with three degrees of freedom (Euler angles) is estimated based on the iterative closest points algorithm. Finally, relevant regions of the face are identified and used for further analysis, e.g., event detection and behavior analysis. The resulting application could be a 3-D driver monitoring system based on low-cost sensors.

12) Driver drowsiness detection system under infrared illumination for an intelligent vehicle

METHODOLOGY

Proposed that to reduce the number of such fatalities, a module for an advanced driver assistance system, which caters for automatic driver drowsiness detection and also driver distraction, is presented. artificial intelligence algorithms are used to process the visual information so as to locate, track and analyze both the driver's face and eyes to compute the drowsiness and distraction indexes. This realtime system works during nocturnal conditions asa results of a near-infrared lighting system.

PRO'S

Works during nocturnal conditions as a results of a near-infrared lighting system

13) A Partial Least Squares Regression-Based Fusion Model for Predicting the Trend inDrowsiness

METHODOLOGY

Here they Proposed a brand new technique of modeling driver drowsiness with multiple eyelid movement features supported an information fusion technique—partial method of least squares regression with which to deal with the problem of strong collinear relations among eyelid movement features and, thus, predicting the tendency of the drowsiness. The predictive precisionand robustness of the model thus established are validated, which show that it provides a unique way of fusing multi-features together for enhancing our capability of detecting and predicting thestate of drowsiness.

PRO'S

Provides a unique way of fusing multi-features together for enhancing our capability of detecting and predicting the state of drowsiness.

14) Camera based Drowsiness Reference for Driver State Classification under Real Driving Conditions.

METHODOLOGY

In this paper, they proposed that measures of the driver's eyes are capable to detect drowsiness under simulator or experiment conditions. The performance of the foremost recent eye tracking based in-vehicle fatigue prediction measures are evaluated. These measures are assessed statistically and by a classification method based on a large dataset of 90 hours of real road drives. The results show that eye-tracking drowsiness detection works well for a few drivers as long as the blinks detection works properly. Even with some proposed improvements, however, there are still problems with bad light conditions and for persons wearing glasses. As a summary, the camera based sleepiness measures provide a valuable contribution for a drowsiness reference,but don't seem to be reliable enough to be the sole real reference.

PRO'S

Proposed a noble method to detect driver drowsiness based on detecting eyelid closing and opening using artificial neural networks as classification algorithm

15) A Mobile Application for Real-time Driver Drowsiness Detection

METHODOLOGY

In this paper the general procedure of Drowsy Detection comprises the subsequent steps. Firstly, the facial region and landmarks are extracted with the face detection model and landmark model. Secondly, three CNN models (face model, eye model and mouth model) are built to classify facial drowsiness state, eyes state, and mouth state respectively.

PRO'S

Proposed driver drowsiness detection framework is an accurate, practical, real time and low-cost method, and every one required could be a mobile without the web

PROPOSED METHODOLOGY

To detect driver drowsiness following steps need to be followed

Step-1 Take input from a user.

- With a help of webcam, we will take live video as input. we made an infinite loop toaccess web cam that will capture each frame

Step-2 Detect the face in the live video and create a Region of Interest (ROI).

- First we will be converting our input into gray scale image.
- To detect the face from the image we will be using haar cascade classifier

Step-3 Eyes will be detected from ROI and feed to classifier

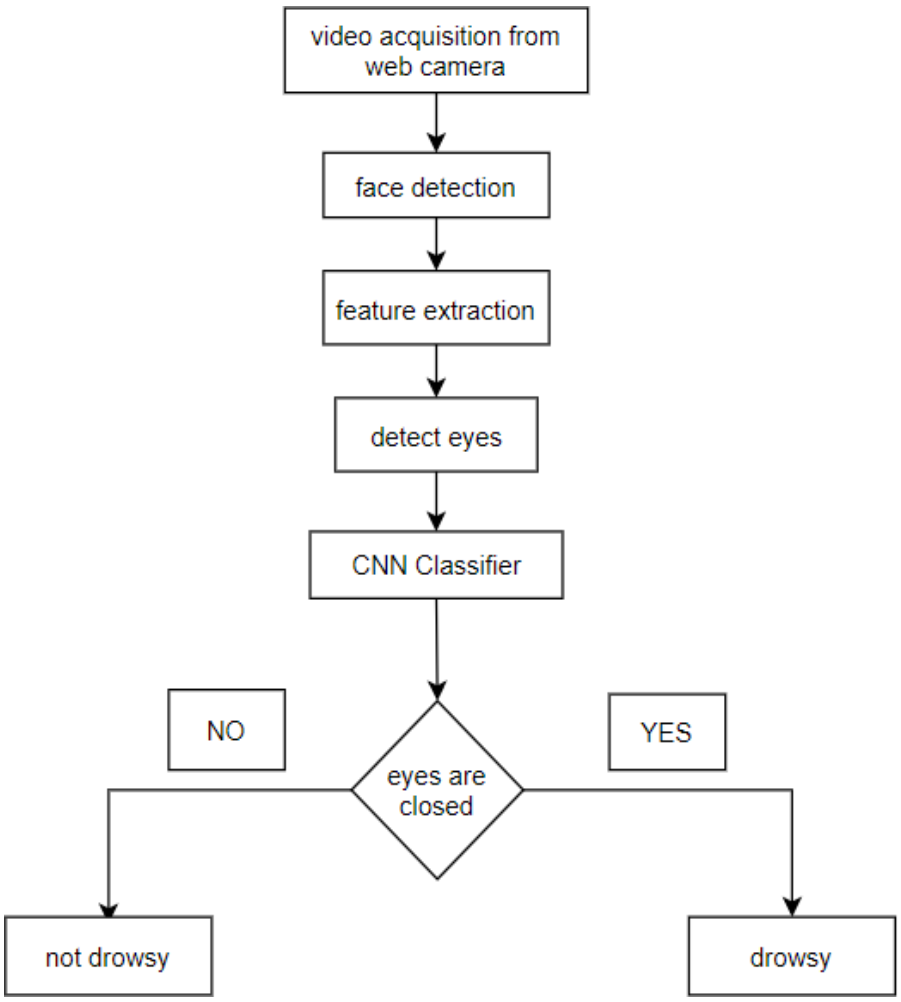
- The method we used for face detection will be used for eye detection.

Step-4 Status of the eye will be known with the help of classifier

- For predicting the status of the eye we will be using CNN classifier

Step-5 Check whether the person is drowsy or not based on the score

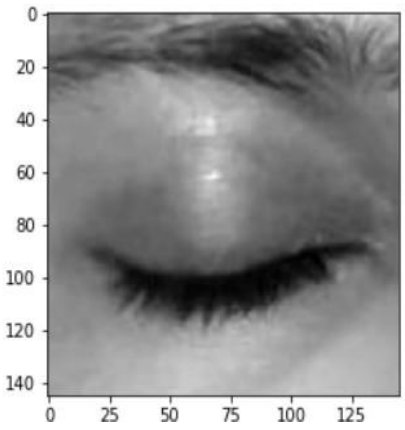
- Score will be calculated based on how long a person closed his eyes.
- Score will keep on increasing if both eyes of the person are closed and score will keep ondecreasing if both eyes of the person are opened.
- Based on the score, the alarm is sounded here we set threshold value to 15 so, when person score is greater than 15 alarm is sounded and when person score is less than 15 alarm stops sounding.



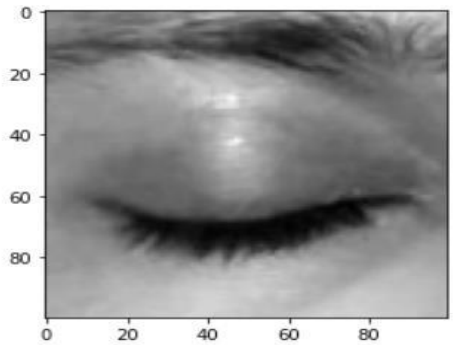
RESULTS AND DISCUSSION

Preprocessing the data:

In [4]:
```
import numpy as np
import matplotlib.pyplot as plt
import os
import cv2
from tqdm import tqdm

DATADIR = "C:\\Users\\SHIVA SUPRITH\\Desktop\\trial"

CATEGORIES = ["Closed", "Open"]

for category in CATEGORIES:
    path = os.path.join(DATADIR,category)
    for img in os.listdir(path):
        img_array = cv2.imread(os.path.join(path,img) ,cv2.IMREAD_GRAYSCALE)
        plt.imshow(img_array, cmap='gray')
        plt.show()
        break
    break
```



In [3]:
```
IMG_SIZE = 50

new_array = cv2.resize(img_array, (IMG_SIZE, IMG_SIZE))
plt.imshow(new_array, cmap='gray')
plt.show()
```



```
In [6]: training_data = []

def create_training_data():
    for category in CATEGORIES:

        path = os.path.join(DATADIR,category)
        class_num = CATEGORIES.index(category)

        for img in tqdm(os.listdir(path)):
            try:
                img_array = cv2.imread(os.path.join(path,img) ,cv2.IMREAD_GRAYSCALE)  # convert to array
                new_array = cv2.resize(img_array, (IMG_SIZE, IMG_SIZE))  # resize to normalize data size
                training_data.append([new_array, class_num])  # add this to our training_data
            except Exception as e:  # in the interest in keeping the output clean...
                pass
            #except OSError as e:
            #    print("OSErrroBad img most likely", e, os.path.join(path,img))
            #except Exception as e:
            #    print("general exception", e, os.path.join(path,img))

create_training_data()

print(len(training_data))
```

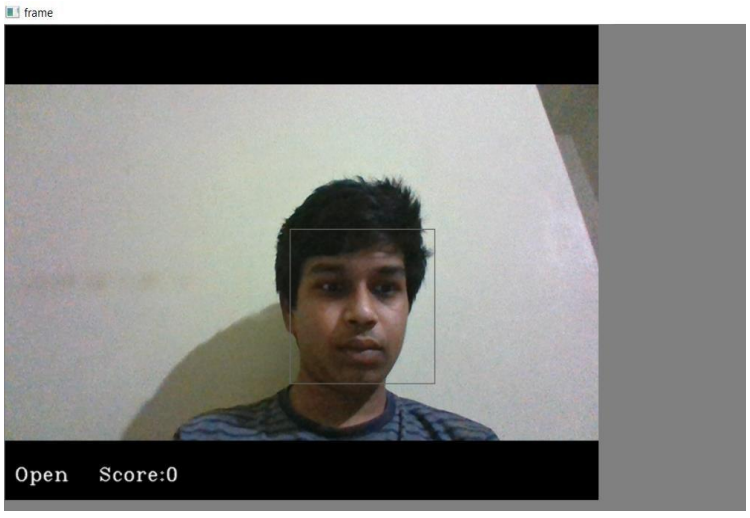
```
100%|██████████| 617/617 [00:00<00:00, 642.68it/s]
100%|██████████| 617/617 [00:00<00:00, 625.13it/s]
1234
```

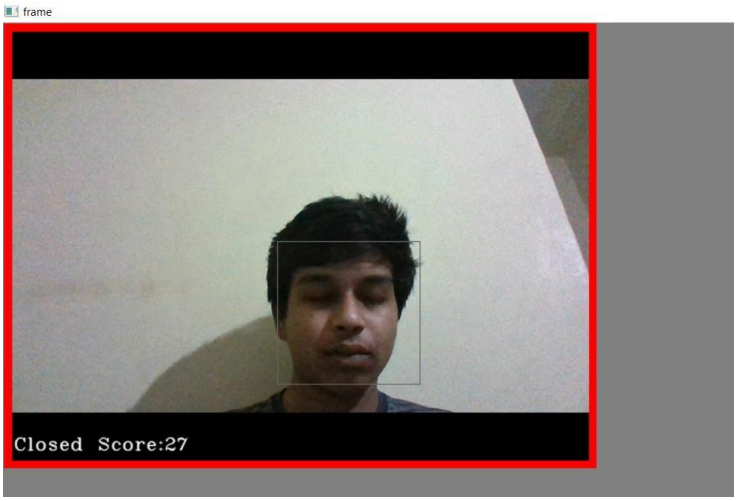
```
In [7]: import random

        random.shuffle(training_data)
```

```
In [8]: for sample in training_data[:10]:
            print(sample[1])
```

```
1
0
0
0
0
0
1
0
0
0
```

OUTPUT:





CONCLUSION

Thus we developed a driver drowsiness detection system which detects the drowsiness of driverbased on the status of eyes and sounds the alarm when eyes are closed for a certain period of time

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