Driver Drowsiness Detection System with OpenCV and Keras

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Abstract—
Drowsiness and Fatigue of driver's square measure amongst the many causes of road accidents. Every year, the amounts of deaths increases and fatalities injuries globally.
During this paper, a module for Advanced Driver help System (ADAS) is given to cut back the quantity of accidents because of driver's fatigue and thus increase the transportation safety; this technique deals with automatic driver somnolence detection supported visual info and computing. we tend to propose associate degree algorithmic program to find, track, and analyze each the drivers face and eyes to live PERCLOS, a scientifically supported live of somnolence related to slow eye closure.
However, the development of such systems encounters many difficulties related to fast and proper recognition of a driver's fatigue symptoms.
One of the technical possibilities to implement driver drowsiness detection systems is to use the vision-based approach. This article presents the currently used driver drowsiness detection systems. The technical aspects of using the vision system to detect a driver drowsiness are also discussed.
The parameters of the eyes and mouth detection are created within the face image. The video were change into images frames per second. From there, locating the eyes and mouth can be performed. Once the eyes are located, measuring the intensity changes in the eye area determine the eyes are open or closed. If the eyes are found closed for 4 consecutive frames, it is confirm that the driver is in drowsiness condition.

Keywords *–Python, OpenCV, Keras, Tensorflow etc.*

I. INTRODUCTION

The attention position of driver degrades because of lower sleep, long nonstop driving or any other medical condition like brain diseases etc. Several checks on road accidents says that around 30 percent of accidents are caused by fatigue of the motorist.

When driver drives for further than normal period for mortal also inordinate fatigue is caused and also results in frazzle which drives the motorist to sleepy condition or loss of knowledge. Drowsiness is a complex miracle which states that there's a drop in cautions and conscious situations of the driver. Though there's no direct measure to descry the drowsiness but several other indirect approaches can be used for this purpose.

With this Python project, we will be making a drowsiness detection system. A countless number of people drive on the highway day and night. Taxi drivers, bus drivers, truck drivers and people traveling long-distance suffer from lack of sleep. Due to which it becomes very dangerous to drive when feeling sleepy.

The majority of accidents happen due to the drowsiness of the driver. So, to prevent these accidents we will build a system using Python, OpenCV, and Keras which will alert the driver when he feels sleepy.

II. LITERATURE SURVEY

In India, there's an increase in the number of cases of business accidents. Involving buses and heavy vehicles similar as motorcars, lorries, and exchanges each time. One of the primary causes contributing to business accidents is doziness and weariness.Driving in this situation can have disastrous consequences because it impairs the motorist's judgement and focus. Motorists can avoid falling asleep at the wheel if they make way similar as carrying enough sleep before driving, drinking coffee, or stopping for a break when drowsy. However, indeed when motorists are apprehensive that they are fatigued, they constantly refuse to take one of these conduct and continue driving.

Thus, detecting doziness is important as one of the way to help the road accidents. This design proposed that yawning and eyes discovery is the egregious signs of fatigue and doziness.

We used the following technologies in this process.

1. OpenCV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library. It has been designed to help developers build computer vision applications that can work in real-time. OpenCV provides a wide range of functions and algorithms that can be used for image processing, feature detection, object recognition, and machine learning. It is written in C++ and has interfaces for various programming languages, including Python, Java, and MATLAB. OpenCV is used in various fields, such as robotics, surveillance, automotive, and healthcare, to name a few. Its popularity lies in its ease of use, flexibility, and speed, making it a go-to tool for computer vision developers around the world.
2. Keras is a high-level open-source neural networks library written in Python. It was developed with the goal of making deep learning more accessible and user-friendly for developers and researchers alike. Keras provides a simple and intuitive interface to build and train complex neural networks, allowing developers to focus on the design and experimentation of their models rather than the underlying technical details. It is built on top of other popular deep

learning frameworks, such as TensorFlow and Theano, which provide efficient computation for training and testing neural networks. Keras supports various types of neural networks, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and multi-layer perceptrons (MLPs). Additionally, Keras allows for easy model customization, transfer learning, and model deployment. Its user-friendly interface and versatility have made Keras a popular choice for building deep learning applications across various industries, such as image recognition, natural language processing, and predictive analytics.

3. TensorFlow is an open-source software library for machine learning and artificial intelligence. It was developed by the Google Brain team and released in 2015. TensorFlow is designed to handle large-scale machine learning tasks and can be used to build and train various types of deep learning models. It provides a flexible and efficient programming interface that supports both high-level and low-level APIs, making it easy to customize models to meet specific requirements. TensorFlow's core functionality is based on the concept of data flow graphs, where mathematical computations are represented as nodes and data as edges. This allows for efficient distributed computing and the ability to train models on large datasets. TensorFlow has become one of the most widely used deep learning frameworks, with a vibrant community of developers contributing to its growth and development.
4. Pygame is a cross-platform set of Python modules designed for writing video games. It provides an easy-to-use interface for game development, with functions for handling graphics, sounds, user input, and game physics. Pygame is built on top of the SDL library, providing a high-level API for game development without sacrificing performance.

In this work, we look at the synchronisation of the dynamic behaviour, as a degree of complexity, of coronary heart rate (ECG) and brain (EEGs). EEG and ECG records have at some point been amassed in experiments in sleep-disadvantaged subjects exposed to real conditions. The diploma in which mind and heart complexity loses complexity in synchronous fashion shows that the two structures are likely to interact. The preliminary consequences from the examination of four subjects reveal the life of a weak to intermediate correlation between these organic oscillator pairs. Furthermore, both coronary heart price and mental alerts have been computed by evaluating energy spectrum and by investigating the association of synchronising styles with widespread frequencies within both systems. The national motorway site visitor’s protection administration estimates that from 1989 via 1993, driving force drowsiness/fatigue became a contributing element in crashes yearly on U.S. highways. A current study has tested the consequences of innovative sleep deprivation on using overall performance to assess the fee of crashes and the modifications in riding overall performance attributable to sleepiness. Because it might be dangerous to take a look at this below real driving conditions, the high-constancy highway using a simulator was used. a spread of measures, along with non-stop electroencephalogram (EEG) tracking, videotaping, and analyses of using overall performance data and questionnaire facts have been used to determine the consequences of sleep deprivation at the using performance of six men and six women aged 26-35. Motorway protection variables, which include range of crashes and number of lane tours, were unacceptably excessive on day 3 after 36 hours of no sleep and on day 4 after 60 hours without sleep. More subtle measures of motorway safety, together with velocity and lateral placement variance, had been also related to sleep deprivation. Even though some tendencies seemed,

none of the variables have been drastically suffering from partial sleep deprivation, possibly because individuals have been younger, very wholesome, and not medicated and because they had no sleep debt at the beginning of their life. An initial neural internet analysis using the facts gathered is underway. If styles of using overall performance can be recognized, it'll lend robust support for the improvement of a neural internet in vehicle-based totally device for detecting and caution drowsy drivers of ability risk. The effects of partial sleep and the driving time on next alertness and performance have been investigated by vehicle drivers. 20 healthy male topics, 25 and 55 years old without any problems of sleep, participated in simulated riding periods between 14 p.m. and four p.m. Subjects had been deprived of sleep before one consultation, as they had been allowed to sleep handiest between 3 a.m. and 7 a.m. in the previous night.

The subjects' performance, Electroencephalogram, and Karolinska Sleepiness Scale (KSS) score have been recorded throughout the driving mission. The results found that sleep deprivation affects KSS but does not affect (alpha theta) spectral strength while driving time affects these parameters. The use of sleep restriction also encouraged this effect. Time on my own had a huge impact on riding performance; the sleep restriction had the simplest effect on one of the performance indices examined: the diversity of right-hand edge crossings. These results are interpreted in sentences of the relationship between alertness and overall deterioration of performance. Template Matching is a method for searching and finding the region of a template photograph in a bigger picture. OpenCV comes with a function cv.matchTemplate() for this motive. It without a doubt slides the template photograph over the enter photograph (as in 2nd convolution) and compares the template and patch of enter picture below the template photo. Several evaluation methods are implemented in OpenCV. (You may take a look at medical doctors for extra information). It returns a gray scale photograph, in which each pixel denotes how a great deal the neighbourhood of that pixel is healthy with template does.

If the input image is long (WxH) and the template image is big (wxh), the output image can be big (W-w+1, H-h+1). You can use cv.minMaxLoc() to find the most/minimum cost as soon as the result is achieved. Take it as the left-top corner and take (w,h) as width and rectangle peak. This rectangle is your template region. With the population boom, the occurrence of automotive injuries has also increased visibly. A thorough analysis shows that about one and a half million accidents occur in India by myself in the course of one year. Likewise, approximately 60% of these accidents are precipitated because of motive fatigue. Driver fatigue affects driving ability in three areas: a) Coordination is impaired, and b) response time is longer, and c) judgement is affected. This paper offers the use of image processing, face/eye detection strategy for an actual time monitoring system. Similarly, haarcascade samples are used to distinguish between a watch blink and a dull/fatigue detection in order to perform certain realtime calculations. This mission is the extension of NATURAL FY 2008 and FY2009, which are called "Realtime Non-Intrusive Drowsiness Driver Detection" projects, which aim to expand an intrusive motive force drowsiness detection device in real time in an attempt to reduce drowsiness from injuries. In our previous research, non-intrusive sensors were developed for cardiac beat measurement on the vehicle steering wheel.

Cardiovascular (HRV) variability is analysed from the heartbeat pulse alerts to detect drowsiness of the driving force. Promising results were obtained. Yet the use by the most

manageable one parameter (low-frequency(LF)/HF ratio of HRV) in the entry right into the driving force's fame which has relative high variability and a sort of changing pattern for certain drivers is an important problem with the preceding machine. We advise to use in this project more than one drowsiness-detection parameter which includes the LF/HF ratio, the VLF (very low frequency) HRV signal, RRV (common moving coronary coronary heart rate c programme language duration), the change in pressure of the driver, and the variability in wheel movements. This integrated approach could be investigated in a driving simulator with an Electroencephalography (EEG) dimension and evaluation as EEG is the maximum correct indication of the levels of sleep and can be used as a preferred "gold" and to discover the occasions where the fall-in sleeves are off-line. The paper provides an set of rules for detection of the attention-blinks in photograph sequences.

Motive force's psychosomatic nation adaptive using guide safety device is surprisingly expected to lessen the wide variety of visitor's injuries. Drowsiness is ideal as a vital hazard component which may additionally bring about severer visitors accidents. Coronary heart fee was obtained from Electrocardiogram (ECG). Then coronary heart charge variability (HRV) became calculated from ECG waveform the use of the maximum entropy approach. CCD digital camera with infrared ray changed into added to capture gaze route and eyelid closure. Have a look at a speculation that simultaneous size of both coronary heart fee variability (HRV) and blinking duration may be beneficial means to come across onset of drowsiness in actual time. The technique to estimate onset of drowsiness was proposed, which feature can be included into driver's psychosomatic state adoptive use of a support protection system for the reduction of visitors injuries/

III. PROBLEM FORMULATION

Current doziness discovery systems, similar as Electroencephalography (EEG) and Electrocardiography (ECG), which descry brain frequency and measure heart meter, independently, bear complex calculation and precious outfit that's uncomfortable to wear while driving and isn't suitable for driving conditions.

A drowsiness detection system that uses a camera in front of the motorist is more ideal for use, but the physical signals that indicate doziness must first be linked in order to develop a dependable and accurate drowsiness detection algorithm.

During discovery of the eyes and mouth region, issues crop due to lighting intensity and while the motorist tilts their face left or right. As a result, the thing of this design is to review all once exploration and styles, and also present a system for detecting doziness using videotape or webcam.

IV. POSSIBLE SOLUTION

A drowsiness detection system which use a camera placed in front of the driver is more suitable to be use but the physical signs that will indicate drowsiness need to be located first in order to come up with a drowsiness detection algorithm that is reliable and accurate.

Lighting intensity and while the driver tilt their face left or right are the problems occur during detection of eyes and mouth region.

Therefore, this project aims to analyze all the previous research and method, hence propose a method to detect drowsiness by using video or webcam. It analyzes the video images that have been recorded and come up with a system that can analyze each frame of the video.

V. IMPLEMENTATION

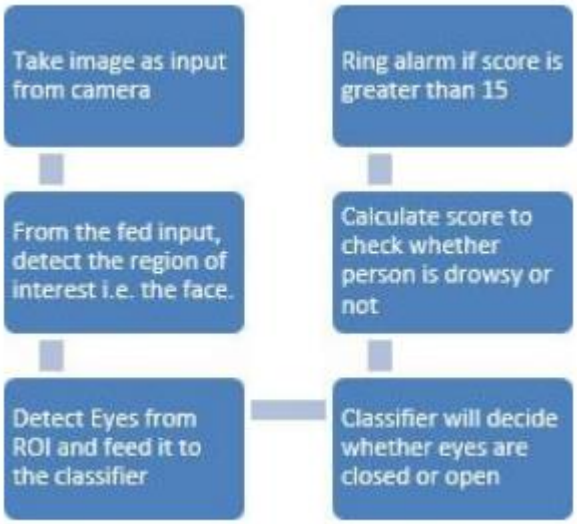

Fig. 1 - Systematic Flowchart of the algorithm

Fig. 2 – User Case Diagram of Designed System

- With the help of a camera, each frame is captured continuously, for this, it is ideal to create and infinite loop by the method provided by OpenCV i.e., cv2.VideoCapture(0), each frame is captured and stored in a variable named frame.

- Next, the image is converted into greyscale, as the OpenCV algorithm takes only grey images for processing. The colour information is irrelevant anyway. Haar Cascade classifier is user to detect faces in the images captured. The classifier returns an array of detections with x, y coordinates height and width of the boundary of the box of the object. Each frame is iterated and boundary box for each face is detected.
- Now, the same procedure as above is applied to extract eyes from the face. Cascade Classifier is used to first detect left eye and then the right eye. The data of left eye is fed to l_eye variable and the data of right eye is fed to r_eye variable. The data of l_eye is fed to CNN classifier which will protect whether the eye is closed or not, similar process is applied to r_eye.
- Before feeding out data to CNN classifier, certain changes to be made due to its need of accurate measurements in the beginning. First, image is converted to greyscale and then resized to 24*24 because this is the size that the model is trained to handle. Then the data is normalized for better convergence. Now, the image is ready to be fed to the CNN classifier, after feeding the image to the classifier, predictions are made for both left and right eye.
- A score criterion is set to determine the threshold for detection. In this proposed model, the score is set to 15. Once the eyes are closed, the score will start increasing, after it attains the threshold value, the alarm goes off. The python library pyplay is used along with the function sound.play() for the alarm to ring.

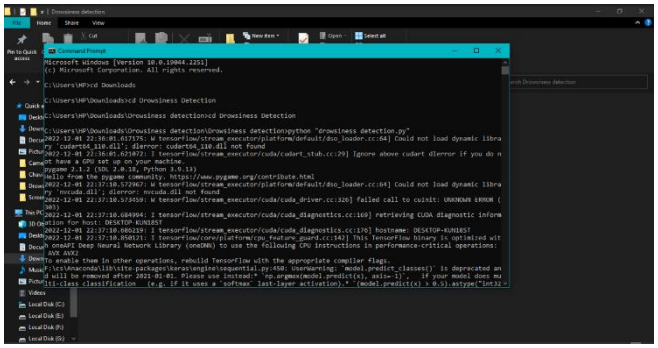

Fig. 3 – Starting the python file

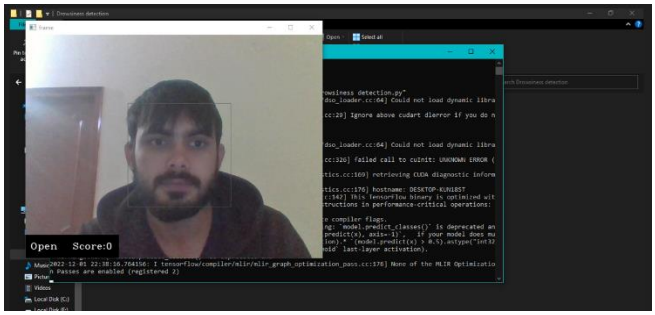

Fig. 4 – Camera opened to capture eyes movements

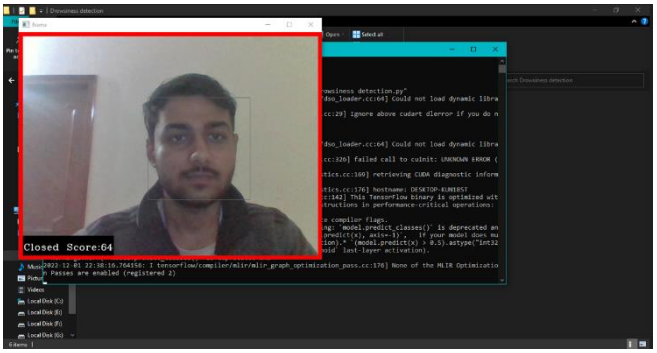

Fig. 5 – Scored increased after eyes got closed for few seconds

VI. CONCLUSION

The proposed model was tested under different conditions was lighting and was found to be fairly successful. This paper proposes an innovative approach for the detection of drowsiness of a driver in a new way by judging the movements of his/her eyes. The previous proposed models detected the same with the help of line of sight, frequency of yawning and several other physical traits. The proposed model is fairly efficient as it will ring an alarm once the eyes of the driver remain closed more than the predetermined amount of time. Before arriving at the final proposed model, trial and error method was employed to determine the best possible optimiser function. Deep learning methods are well known for image processing and this was explored during the course of this model.

Below are the key points that were found during the experimentation phase:

- 32x32x64x128x2(adam)(3conc 2 dense)
- 32x32x64x64x2(adam)(3conv 2 dense)
- 32x32x64x2(adam)(2conv 2 dense)
- 64x64x64x2(adam)(2conv 2dense)

These combinations of convolutional and dense were tried and the first layer was found to be the most suitable

- Adagrad (Orange)
- Adam(Blue)
- Nadam (Red)
- Adamax(Light Blue) These optimisers were tried and Adamax performed better.

The model achieves highest accuracy (without over-fitting) with three hidden layers.

VII. REFERENCES

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