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Driver Drowsiness Detection and Alert Systems

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Abstract: Drowsiness has significant contribution to the accidents on road. Accurate measurement is required to track the state of the driver. It has various shortcomings. Convolutional neural networks(CNN) developed using Keras were utilized to create the model that we employed. CNN is a branch of deep neural networks that is appropriate for image classification. It consists of many layers that include input, output and hidden layers. The drowsiness detection systems for drivers have the potential to greatly increase traffic safety by warning drivers to stop or take breaks when they are in danger of nodding off behind the wheel.
Keywords: CNN (Convolutional Neural Networks), Deep Neural Network, Drowsiness, LSTM-CNN, Haar Cascade Classifier

I. INTRODUCTION

A system called driver drowsiness detection can tell when a driver is getting fatigued or dozing off while operating a vehicle. Drowsy driving has been linked to fatal accidents and other traffic fatalities, thus this can be a serious safety risk. Driver drowsiness can be identified using a variety of methods, including:

1) *Eye Tracking:* Some systems track the driver's eyes using eye tracking technology. The driver can be nodding off if their eyes are closed or moving erratically.
2) *Face-Recognition Technology:* Some systems examine the driver's facial expressions to look for tiredness indicators like drooping eyelids or a slack jaw.
3) *Monitoring of The Driver's Heart Rate:* Some systems utilize sensors to track the driver's heart rate and alarm them if it drops below a predetermined level which could be a sign that they are nodding off.
4) *Vehicle Monitoring:* Some systems keep an eye on how the car is driving and search for indications that the driver may not be fully awake, such as lane wandering or abrupt changes in speed.

II. RELATED WORKS

A. *LSTM-CNN Architecture for Human Activity Recognition*

This paper proposes a model for the traditional pattern recognition techniques have advanced significantly in recent years. The use of deep learning technologies to understand human activities in mobile and wearable computing scenarios has drawn a lot of interest due to its growing acceptance and success. A deep neural network with Convolutional layers and long short-term memory (LSTM) was suggested in this research. With just a few model parameters, this model could automatically extract activity features and categorize them. In conclusion, the LSTM-CNN model consistently outperforms those suggested in other research and exhibits sound generalization.

B. *A Real-Time Driving DrowsinessDetection Algorithm with Individual Differences Consideration*

This paper proposes a development of a driving sleepiness detection algorithm is crucial for enhancing traffic safety. However, the majority of them are focused on developing an all-encompassing sleepiness detection technique while ignoring the variations among individual drivers. This study suggests a real-time sleepiness detection method for drivers that takes into account their unique driving styles. Finally ,to develop a offline training module and online monitoring module in the study, taking into account the individual variations of the drivers. A specific driver- specific classifier built on SVM is trained, and while driving, the per-trained classifier is used to assess the condition of the driver's eyes.

C. *Comprehensive Drowsiness Level Detection Model Combining Multi-modal Information*

This paper proposes a drowsiness detection model that can identify all levels of drowsiness, from weak to strong, is presented in this study. This method is predicated on the fundamental premise. First, it is assessed how sensitive the posture index and other indices were to different degrees of drowsiness. Then, to cover all stages of drowsiness, and develop a drowsiness detection model by combining a number of indices sensitive to both weak and strong drowsiness. After drowsiness detection, future research will concentrate on the creation of arousing and arousal-maintenance systems.

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The success in detecting drowsiness at a variety of degrees, even light drowsiness, will make it possible to design interfaces that let users choose stimuli that are best suited to their level of drowsiness and the settings in which they aredriving.

D. Real-Time Driver-Drowsiness DetectionSystem Using Facial Features

This paper proposes a system the DriCare uses video images to detect drivers' signs of tiredness without usage of any gadgets on human body. Additionally, based on 68 critical features. It creates a new detecting algorithm for face regions. Then, assessment on the drivers' condition using these facial areas. It takes the features from eyes and lips and generates a warning to driver. Based on facial key points, it defines the detection zones for the face. Due to its rapid operation, DriCare works in real-time.

E. Real Time Driver Fatigue DetectionSystem Based On Multi_Task CNN

This paper proposes a model for Multi-tasking Convolutional Neural Network (ConNN) which is suggested in this article to identify driver weariness and drowsiness. When modelling a driver's behaviour, the eyes and mouth are used. Driver weariness is tracked through changes to these traits. In contrast to studies in the literature, the suggested Multi-task ConNN model now simultaneously incorporates mouth and eye information. Calculations of the duration and percentage of closed eyes (PERCLOS) as well as the frequency and duration of mouth and yawning sneezes are used to assess driver fatigue (FOM). Three categories in are used in this study to categorize the driver's level of weariness. The study's ability to build a faster and more effective system with just one model rather than separately building models for two different ConNN architectures is one of its strongest points. Future work will add the head condition, which is just as crucial as the eye and mouth conditions, and integrate the system into an embedded system.

III. OBJECTIVES

The objective is that the driver drowsiness detection system's goal is to help reduce accidents involving both passengers and vehicles. The primary objective of driver drowsiness detection is to increase road safety by reducing accidents brought on by drowsy driving. Motor vehicle collisions involving drowsy drivers frequently result in severe injuries or fatalities. The objectives include identifying drowsiness states, popping up alerts,decreasing the crash risks and also enhancing the road safety.

IV. METHODOLOGY

In this model , we'll use OpenCV to collect webcam photos and feed the min to a Deep Learning model that will identify whether a person 's eyes are "Open" or "Closed" based on their position. For this Python project, the strategy we'll employ is as follows:
Let's now examine our algorithm's operation step by step.

1) Step1: Capture video stream

Capture the video stream from the camera or input video file and iterate through the frames using loop.

2) Step 2: Eye extraction

Load a detector, such as Haar Cascade Classifier , to detect the face and regions in the input images or video frames. Use the detectors to extract the eye regions from the face regions in the input images or video frames.

3) Step3: Eye State Detection

Feed the eye regions extracted in step 2 to the trained CNN model. Use the model to detect the state of the eyes, i.e., open or closed.

4) Step 4: Drowsiness score calculation

Generate a drowsiness score based on the eye state and any other relevant factors, such as the duration of eye closure or head posture.

5) Step 5: Alarm triggering

If the drowsiness score exceeds the threshold, trigger an alarm or warning to alert the driver. Use any suitable alarm or warning mechanism, such as playing an audible alert.

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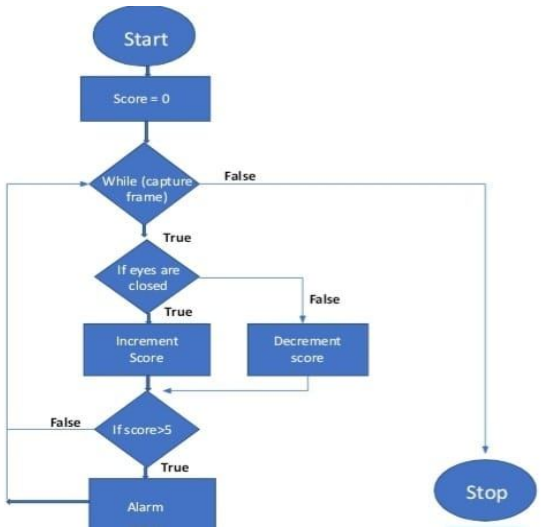


Fig. 1 : Block Diagram of Drowsiness detection

A. CNN Architecture

CNN: Convolution neural networks . These networks may sound like an odd amalgam of biology, math, and computer science with a dash of CS, but they have been some of the most important developments in the area of computer vision and image processing. The multi layer perceptron (MLP) is a regularized variant of the Convolutional neural networks . They were created based on how the neurons in the visual cortex ofanimals function.

1) Convolution Layers

The input layer, the hidden layer, and the output layer make up the convolution layers. While in neural networks every input neuron is linked to the hidden layer below it, in CNN only a small subset of input layer neurons are linked to those in the hidden layer. The features of an input image can be extracted with the aid of convolution layers. Additionally, it is capable of numerous tasks including edge detection.

2) Pooling Layers

The major objective of the pooling layer isto extract features; by doing so, it helps to reduce the size of the representation and the parameters, making this model more efficient. It also aids in minimizing over fitting. Pooling layers are new layers that are applied in convolution layers. The featuremaps' dimension is decreased using it.

3) Fully Connected Layers

A fully connected (FC) neural network can be used to classify the data into distinct classes after the features have been retrieved. SVM can also be used in place of fully connected layers, although doing so results in an additional layer of complexity. Completely interconnected layers to enable training of the model. This layer contains the data that is crucial to the input, and it produces a probability that the model is attempting toforecast.

V. APPLICATION REQUIREMENTS

A. TensorFlow

An open source library for AI&ML is called TensorFlow. Deep neural networks can make extensive use of it to concentrate on training and interference. It has a comprehensive set of tools and libraries, enables academics to include cutting- edge technology in machine learning, and makes it simple for developers to create and deploy applications that use machine learning.

B. Numpy

It is primarily intended for numerical computations. Additionally, the Python programming language has a package called Numpy. Multidimensional array metrics and a substantial number of high level mathematical operations are defined using Numpy.

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C. Keras

It is the TensorFlow library's interface. It is expandable, modular, and user-friendly. It supports other widely used features such as dropout, batch normalization, and pooling.

D. Jupyter Notebook

The basic objective of the open-source scientific computing programme Jupyter Notebook is to mix equations, visuals, and live code. It supports more than 40 programming languages. The terms Julia, Python, and R are combined to form the moniker Jupyter. While Anaconda comes preinstalled, Jupyter is primarily designed for data science and analytics applications. Data sets, such as visuals and charts, are produced by modules like Matplotlib, Plotly, or Bokeh in Anaconda.

E. Open CV

OpenCV is an open-source library used for processing image and computer vision. It has a significant part in real-time applications, which is much needed in modern world scenario. It is used to analyze images and films to find faces, objects, and handwriting. Python has a ability to handle the OpenCV when it is integrated with libraries like NumPy. This is used to identify visual patterns and features.

VI. CONCLUSIONS

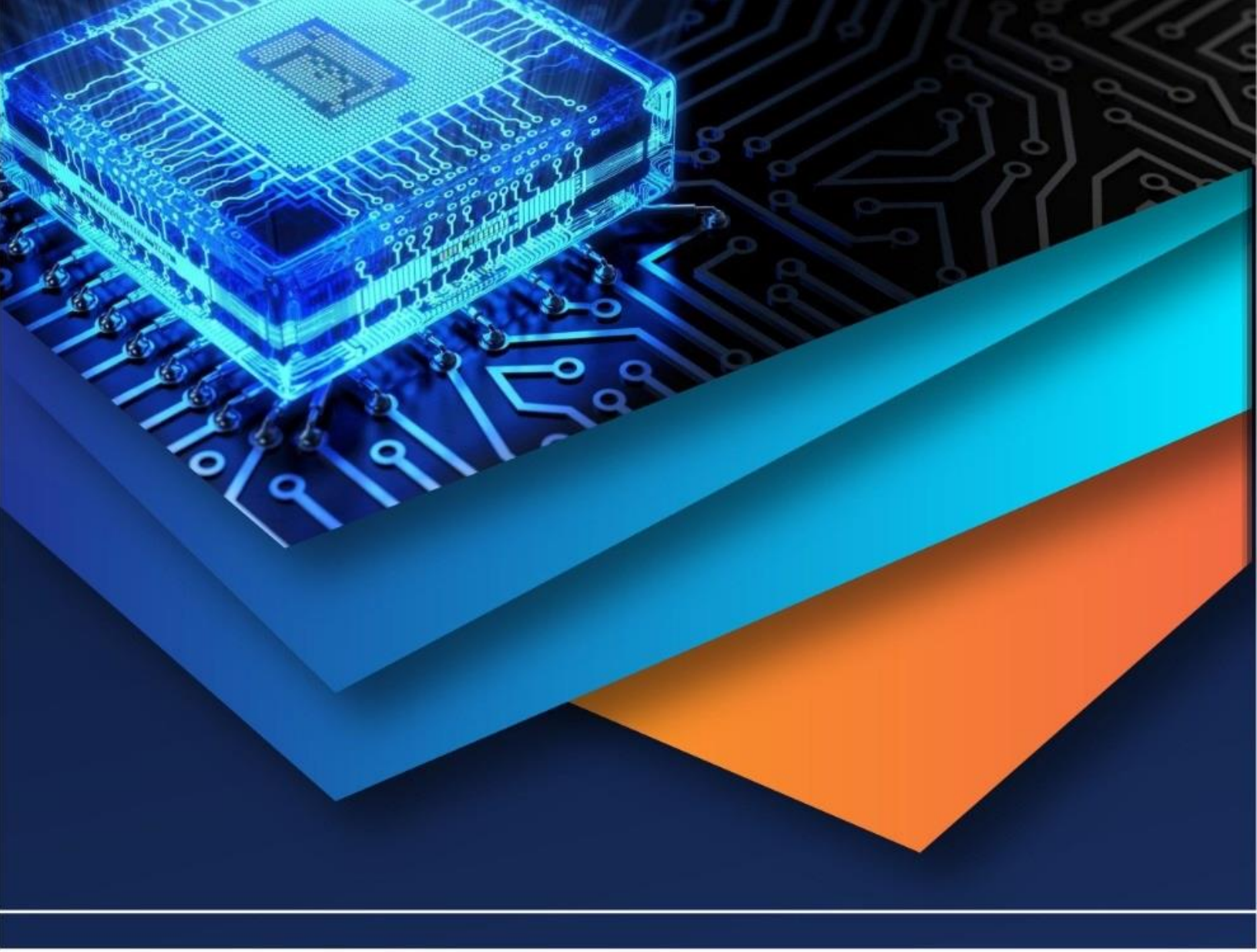
The paper states the advancement of technology over the last 50 years has given drivers a lot of support by ensuring high levels of comfort and safety in their automobiles. Driver weariness is one of the many possible causes of accidents, and it will be discussed and addressed issues in this paper. This work, will employ powerful artificial intelligence-based algorithms to identify driver exhaustion and the rate of drowsiness. It suggests a method to identify driver tiredness using artificial facial traits including eye closure, yawning, and vertical distances between the eyes and mouth. The method for driving drowsiness detection and driver rate of drowsiness is proposed in this research project. It infers from the data of 9 patients that decision tree and neural network classifiers have produced superior results than linear SVM and LDA for classifying the driver into sleepy and non- drowsy. As previously mentioned, we have defined an algorithm for the Rate of Drowsiness. Decisions could be made using previous methodologies based on characteristics like eye blinks and ocular closure. It has taken into account the subject's eyes and lips as features and employed contemporary classifiers to categorize the subject as drowsy or not .Although the presented classifiers are capable of producing results that are reasonable, there is still room for improvement in their efficiency. By examining numerous other classifiers, one can use a drowsiness detection classifier that is more reliable. The algorithm can still be enhanced by conducting research on additional datasets to increase the rate of drowsiness detection.

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