Project Synopsis

on

Facial Movements Identification for Vehicle Drivers using Machine Learning

Submitted as a part of course curriculum for

Bachelor of Technology

in

Computer Science

Submitted by

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DECLARATION

We hereby declare that this submission is our work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Signature of Students
Name: Utkarsh Mishra
Roll No.: 2000290120179
Date:

CERTIFICATE

This is to certify that Project Report entitled "**Facial Movements Identification for Vehicle Drivers using Machine Learning**" which is submitted by **Utkarsh Mishra** in partial fulfilment of the requirement for the award of degree B. Tech. in Department of Computer Science of Dr A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

Date:

Supervisor Signature
Prof. Vikas Kamra
CS Department

ACKNOWLEDGEMENT

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ABSTRACT:

The number of road accidents has constantly been increasing recently around the world. As per the national highway traffic safety administration's investigation, 45% of vehicle crashes are done by a distracted driver right around each. We endeavor to build a precise and robust framework for distinguishing diverted drivers. While driving the vehicle, drivers frequently perform secondary activities that distract driving. A decrease in driver distraction is a critical aspect of the smart transportation system. Different convolutional networks had been trained on images by eliminating the final layer to get their feature vectors. By using the stacking ensemble technique, we stack all the feature vectors to train it on a convolutional network. This stacking technique, which is used to detect the distracted driver posture, achieves 97% accuracy. The study shows how models predict the desired classes. Real-time driver distraction detection is the core to many distraction countermeasures and fundamental for constructing a driver-centered driver assistance system.

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Chapter-1: Introduction

1.1 Introduction:

Distracted driving is the act of driving while engaging in other activities which distract the driver's attention away from the road. Distractions are shown to compromise the safety of the driver, passengers, pedestrians, and people in other vehicles. Cellular device use while behind the wheel is one of the most common forms of distracted driving.[1] According to the United States Department of Transportation, "texting while driving creates a crash risk 23 times higher than driving while not distracted." Studies and polls regularly find that over 30% of United States drivers had recently texted and driven. Distracted driving is particularly common among, but not exclusive to, younger drivers. Distractions while driving can be separated into three distinct groups: visual, manual, and cognitive. Visual distractions involve taking one's eyes off the road. Manual distractions involve taking one's hands off the wheel. Cognitive distractions occur when an individual is not mentally focused on the act of driving.

1.2 **Problem Statement**:

A distracted driver is any activity that takes the driver's attention from the road. Sending a text message, talking on a cell phone, using a navigation system, and eating while driving are a few examples of distracted driving. Any of these distractions can endanger you, your passengers, and others on the road. Causes of distracted driving.

- Talking on the phone.
- Texting and other phone manipulation.
- Talking with another passenger.
- Moving objects/animals in the vehicle.
- Adjusting audio and/or climate controls.
- Manipulating car components and controls.
- Reaching for an object or device.

1.3 Objective:

The objective of this report is to focus on ways to minimize the chances of drivers getting distracted using CNN and Stacking Enumerable along with Eye detection, to prevent accidents and mishappening by detecting and improving warning systems.

1.4 Scope:

We will focus on building a highly efficient ML model to classify different driver distractions at runtime using computer vision. We would also analyze the overall speed and scalability of the model in order to be able to set it up on an edge device

Chapter 2: Literature Review

Paper 1: Distracted Driver Detection Based on a CNN With Decreasing Filter

Summary:

This research paper focuses on detection of distracted driving by the rapidly developing deep learning technology. The D-HCNN model achieves good driver posture classification accuracy. To satisfy the above contradictory requirements, the design of D-HCNN considers the following two points:
(1) Parameter quantity reduction and accuracy promotion. First, the original images contain considerable amounts of background noise, such as the color of clothing and light, and we are only interested in the driver's posture.
(2) High speed. Most of the parallelism of a convolutional network is reflected in the calculation of each layer, and there is generally no parallelism between layers.

Paper 2: Towards a Context-Dependent Multi-Buffer Driver Distraction Detection Algorithm

Summary:

Driver distraction detection systems are typically based on
(i) lateral and longitudinal driving performance measures,
(ii) electrophysiological recordings or
(iii) gaze information. In the presented case study, the combined AttenD2.0 output and AttenD follow rather similar patterns, indicating inattention when engaged in the NDRA and showing a rather high level of alertness otherwise. AttenD reacts slightly more to the drivers' looking for the confirmation button upon handing over and taking back control. This is connected to the fact that in AttenD2.0 the distraction classification for off-forward glances is slightly delayed, due to the shape of the decrement function, and because mostly the forward buffer is affected, while the mirror buffers only decrease slightly.

Paper 3: A Triple-Wise Multi-Task Learning Framework for Distracted Driver Recognition

Summary:

Distracted driving has become a huge threat to human society. TML generates triplets composed of a raw image, a positive sample, and a negative sample. The positive sample maintains the same global spatial structure. as the raw input but smoothens the local texture of the human body region. The negative sample is generated by keeping the same local information as the raw input but destroying the global spatial structure. Thereafter, TML reduces CNN's local bias by exploring information among the triplets with a multi-task learning strategy.

Paper 4: A Hybrid CNN Framework for Behavior Detection of Distracted Drivers

Summary:

Gesture patterns are less distinguishable in vehicles due to in-vehicle physical constraints and body occlusions from the drivers. However, by capitalizing on modern camera technology, convolutional neural network (CNN) can be used for visual analysis. In this paper, we present a hybrid CNN framework (HCF) to detect the behaviors of distracted drivers by using deep learning to process image features. Features are extracted at different scales by three cooperative pretrained CNN models; then, the features are concatenated to obtain the feature maps. Subsequently, we train the fully connected layer to classify each distracted driving behavior. During the training procedure, we apply dropout technology to prevent the training model from overfitting to the training data. We apply CAM to highlight the detection area results. The results show that the proposed HCF achieves good performance for recognizing distracted driver behaviors, reaching a classification accuracy of 96.74%,

Paper 5: Distracted Driver Detection using Stacking Ensemble

Summary:

While driving the vehicle, drivers frequently perform secondary activities that distract driving. A decrease in driver distraction is a critical aspect of the smart transportation system. To decrease accidents and improve safety. This study represents a distracted driver detection, which is based on different CNN architectures, which include VGG19, InceptionV3, Xception, and ResNet50. The proposed model performs better than pre-trained models and takes less computational time also. Thus, stacked ensemble approach achieves better performance than other models presented in earlier research. This system has the potential to be implemented in real cars to prevent road accidents.

Paper Title	Author	Year of Publication	Technology Used
Distracted Driver Detection Based on a CNN With Decreasing Filter Size	Qin, B., Qian, J., Xin, Y., Liu, B., & Dong, Y.	**2022**	**CNN**
Towards a Context-Dependent Multi-Buffer Driver Distraction Detection Algorithm	Ahlstrom, C., Georgoulas, G., & Kircher, K	**2022**	**ML**
TML: A Triple-Wise Multi-Task Learning Framework for Distracted Driver Recognition	Liu, Di., Yamasaki, T., Wang, Y., Mase, K., & Kato, J	**2021**	**ML**
Machine Learning and End-to-End Deep Learning for Monitoring Driver Distractions from Physiological and Visual Signals	Gjoreski, M., Gams, M. Z., Luštrek, M., Genc, P., Garbas, J. U., & Hassan, T	**2020**	**ML**
HCF: A Hybrid CNN Framework for Behavior Detection of Distracted Drivers	Huang, C., Huang, C., Wang, X., Cao, J., Wang, S., Wang, S., Zhang, Y., & Zhang, Y	**2020**	**CNN**
Assessment of secondary tasks based on drivers' eye-movement features	Yao, Y., Zhao, X., Feng, X., & Rong, J	**2020**	**ML**
Leveraging Smartphone Sensors to Detect Distracted Driving Activities	Ahmed, K. ben, Goel, B., Bharti, P., Chellappan, S., & Bouhorma, M.	**2019**	**Smart Sensors**
Driver Internal State Estimative Model for Distracted State Detection.	Sawataishi, M., Ito, M., Sato, K., Madokoro, H., & Kadowaki, S.	**2017**	**ML**
Driver Distraction Detection Using Semi-Supervised Machine Learning	Liu, T., Yang, Y., Huang, G. bin, Yeo, Y. K., & Lin, Z	**2016**	**ML**
Driver Gaze Tracking and Eyes off the Road Detection System. *IEEE Transactions on Intelligent Transportation Systems*	Vicente, F., Huang, Z., Xiong, X., de La Torre, F., Zhang, W., & Levi, D	2015	ML

Chapter 3: Proposed Methodology

3.1 Algorithm Proposed:

Step 1: Installation of system on vehicles.

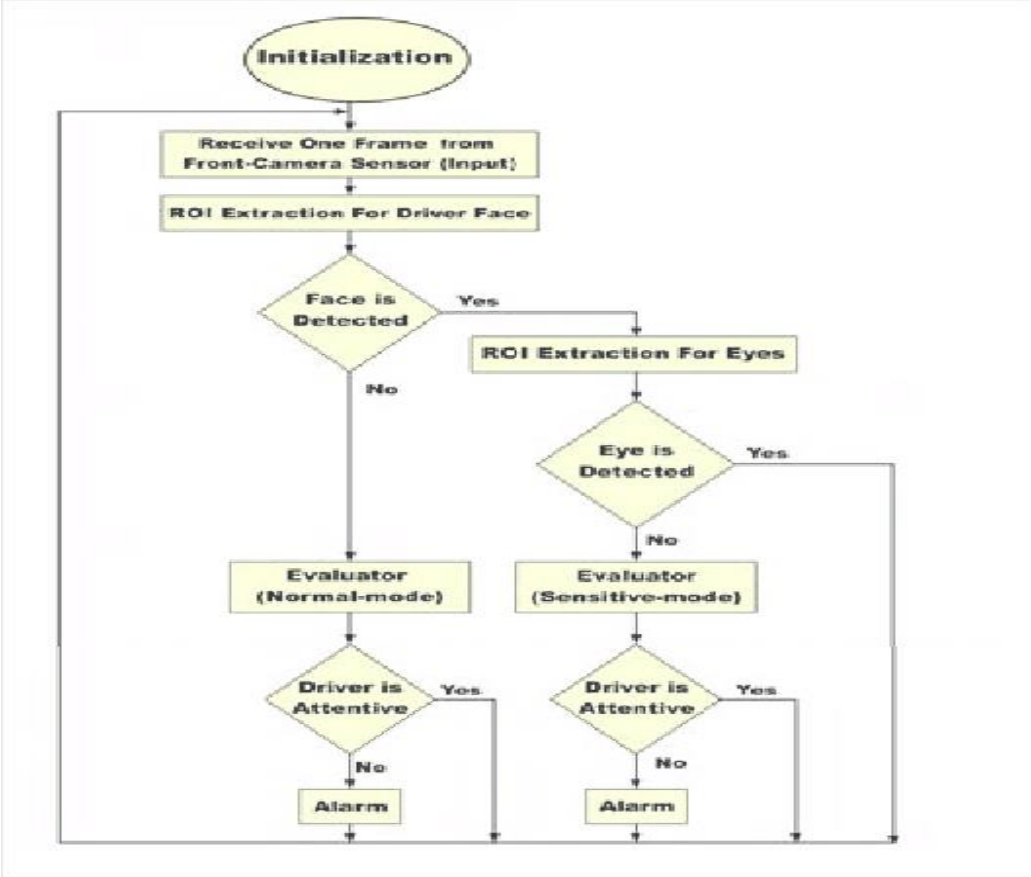
Step 2: Use of Camera and Sensors to detect distracted driver while driving

Step 3: Warn the driver about distraction and record the data.

Step 4: Use of data to analyze and improve the system.

Step 5: Prevention of further accidents by giving early warning.

3.2 Flowcharts:



Chapter 4: Technology used

- Windows operating system
- Python Programing Language
- NumPy and Panda Libraries
- Cameras and Sensors

Chapter 5: Diagrams

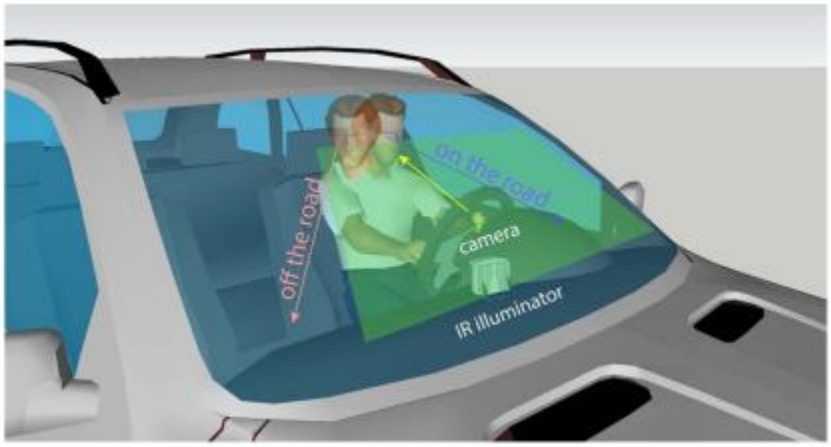


Fig. 1. Eyes off the road (EOR) detection system.

Fig 2: Camera and IR illuminator position

Fig3: Different Input Data

Conclusions:

Distracted driving behaviors are a primary cause of traffic accidents. Hence, it is necessary to find methods to effectively identify distracted driving behavior. Different methods are:

(1) A hybrid CNN framework (HCF) to recognize distracted driver behaviors.
(2) To classify instances of distracted driving during phone usage via processing data collected from in-built accelerometer and gyroscope in the phones.
(3) Classifying drivers based on experience and age when assessing the level of distraction is necessary.
(4) A triple-wise multi-task learning framework to improve the accuracy of distracted driver recognition tasks.
(5) A real-time EOR system using the video from a monocular camera installed on steering wheel column can help in prevention.
(6) Stacked ensemble approach achieves better performance than other models.

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