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Monitoring Driving Behavior Through Deep Learning Tools and Fuzzy Inferencing

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Abstract

Drivers are meant to concentrate on driving, but they pay more attention to their surroundings, and they are overconfident in their driving abilities and underestimate the impact of distraction activities on driving performance. The distracted activities include using cell phones in the car, fetching items in car, talking with passengers. In this experimental work the driver head posture is examined to know whether the driver is concentrating on his frontal view. The danger level is indicated using the fuzzy logic to determine the risk level in real time. Based on vehicle speed, it is an excellent method for detecting unsafe road conditions in a timely manner. The Convolutional neural network model is best suitable to detect driver distraction more reliable than training model that only collect data in simulation experiment. We additionally confirmed that our device can offer well timed signals when drivers are performing

Keywords – driving behavior, CNN, distracted activity

1. INTRODUCTION

Drivers are meant to concentrate on driving, but they pay more attention to their surroundings, and they are overconfident in their driving abilities and underestimate the impact of distraction activities on driving performance. The distracted activities are as follows using cell phones in the car, fetching items in car, talking with passengers. Among all the distracted activities the most common one is using call phones while driving. According to a research performed by the National Highway Traffic Safety Administration, nearly half of young drivers under the age of 21 confess to talking on the phone while driving and feel that doing so will have no impact on their driving. Accidents are primarily caused by distracted driving. Monitoring Driving Behavior Systems providing solution to this problem. We propose a model for monitoring driver behaviour using deep learning technologies and fuzzy logic theory in this research. In [1] they conducted two researches on the link between secondary task performance, such as cell phone use, and the probability of crashes and near-collisions. To allow objective assessment, accelerometers, cameras, global positioning systems, and other sensors were installed in the vehicles of 42 newly licensed drivers (16.3 to 17.0 years old) and 109 people with more driving experience. In [2] in this study, they created a low-cost method for identifying driver fatigue based on micro-sleep patterns. In contrast to typical approaches, they gathered images by placing a camera on the driver's extreme left side, and developed two algorithms that allow for accurate face and eye detection even when the driver is not facing the camera or when the driver's eyes are closed. In [3] driver distraction techniques that have been discovered so far are primarily intrusive or semi-intrusive in nature. Not only do the methods impair driving, but they are also constrained by various environmental conditions, resulting in a high false positive rate. This research only considers noninvasive vehicle kinematics indicators and proposes a deep learning-based recognition approach. Finally, to achieve distracted driving classification and recognition, the long short-term memory neural network (LSTM-NN) is applied, with the results compared to SVM and AdaBoost. In the next section literature survey is discussed.

2. RELATED WORK

In [4] In this paper we describe our SmartCar testbed: a real-time data acquisition system and a machine learning framework for modeling and recognizing driver maneuvers at a tactical level, with special emphasis on how the context affects the driver's performance. The perceptual input is multimodal: four video signals capture the contextual traffic, the driver's head and the driver's viewpoint; and a real-time data acquisition system records the car's brake, gear, steering wheel angle, speed and acceleration throttle signals. Over 70 drivers have driven the SmartCar for 1.25 hours in the greater Boston area. Graphical models, HMM and coupled HMM, have been trained using the experiment driving data to create models of seven different driver maneuvers: passing, changing lanes right and left, turning right and left, starting and stopping. We show that, on average, the predictive power of our models is of 1 second before the maneuver starts taking place. In [5] This paper discusses and provides a comprehensive insight into the well-established techniques for driver inattention monitoring and introduces the use of most recent and futuristic solutions exploiting mobile technologies such as smartphones and wearable devices. Then, a proposal is made for the active of such systems into car-to-car communication to support vehicular ad hoc network's (VANET's) primary aim of safe driving. We call this approach the dissemination of driver behavior via C2C communication. Throughout this paper, the most remarkable studies of the last five years were examined thoroughly in order to reveal the recent driver monitoring techniques and demonstrate the basic pros and cons. In addition, the studies were categorized into two groups: driver drowsiness and distraction. Then, research on the driver drowsiness was further divided into two main subgroups based on the exploitation of either visual features or nonvisual features. A comprehensive compilation, including used features, classification methods, accuracy rates, system parameters, and environmental details, was represented as tables to highlight the (dis)advantages and/or limitations of the aforementioned categories. A similar approach was also taken for the methods used for the detection of driver distraction. [6] This paper discusses the driver characteristics based on driver's operation behavior, or the driver behavior characteristics. Following the presentation of the fundamental of the driver behavior characteristics, the key technologies of the driver behavior characteristics are reviewed in detail, including classification and identification methods of the driver behavior characteristics, experimental design and data acquisition, and model adaptation. Moreover, this paper discusses applications of the identification of the driver behavior characteristics which has been applied to the intelligent driver advisory system, the driver safety warning system, and the vehicle dynamics control system. At last, some ideas about the future work are concluded.[7] This paper adopts a method for overcoming the problem of cascading errors inherent in prior approaches, resulting in realistic behavior that is robust to trajectory perturbations. We extend Generative Adversarial Imitation Learning to the training of recurrent policies, and we demonstrate that our model rivals rule-based controllers and maximum likelihood models in realistic highway simulations. Our model both reproduces emergent behavior of human drivers, such as lane change rate, while maintaining realistic control over long time horizons. In the next session methodology of the proposed system is discussed.

3. PROPOSED METHODOLOGY

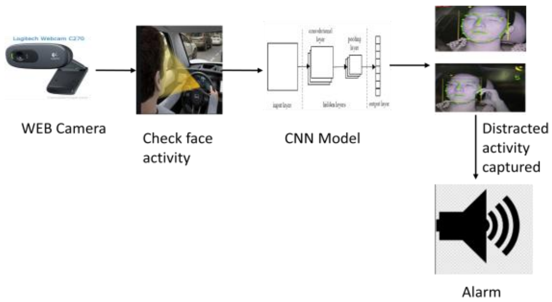
Abnormal driving detection it may be summarized primarily based totally on literatures of computerized unusual riding conduct detection that, there are regularly 3 normally used detection schemes. The first one is primarily based totally at the detection of human physiological signals using diverse kinds of sensors. The second one is primarily based totally on facial details. The third one is primarily based totally on movement traits of the guidance wheel that is successful to hit upon the driver's hand pressure, the guidance time, the brake behavior, etc. Furthermore, physiological alerts of people range substantially because of the physiological distinction in every man or woman individual and her / his environmental conditions.

A driver head pose estimation module is able to determine whether the driver is focusing on his frontal, while a deep learning based distraction recognition model would detect whether the driver is performing a distraction activity. A danger level inference module based on fuzzy logic combines information from the head pose estimation and the distraction recognition modules to infer the danger level in real time manner.

Convolutional neural network (CNN)

The LeNet-5, one of the earliest CNN models, was created with the goal of recognizing and classifying handwritten characters, and its accuracy is satisfactory. In general, the convolutional layer, the pooling layer, and the full connected layer make up CNN's main architecture. To extract latent features through a layer-by-layer model architecture, the convolutional layer and the pooling layer collaborate to produce numerous convolution groups. The classification task can then be accomplished using fully linked layers based on latent features.

ARCHITECTURE



First the image of the person is inputted in the system then the convolutional layers in which it checks the facial activities of the driver then the pooling process will begin.

The pooling layer is a new layer added after the convolutional layer specifically after an nonlinearity has been applied to the feature maps output by a convolutional layer. The most common approach used in pooling is max pooling.

Once again a convolution layer is present at the end the images are as sorted as normal driving, texting while driving, talking while driving. If it encounters the distracted behavior the alarm starts beeping.

You only look once (YOLO)

Object recognition is approached differently in the YOLO framework. It predicts the bounding box coordinates and class probabilities for these boxes using the full image as a single instance. The most significant benefit of YOLO is its incredible speed, which allows it to process 45 frames per second. In the next session results are discussed.

4. RESULTS AND DISCUSSION

This paper develops a methodology using CNN which is a deep learning method to monitor the driving behavior from distracted activities such as drowsiness, using mobile. Once the distracted behaviors are detected to indicate the danger level inference the alarm will activity and it gives a beep sound until driver gets activate.

In figure 1 the driver is using mobile after reaching a maximum score the alarm has been activated and the red line indicates the danger level inference and starts beeping.

In figure 2 the driver has closed his eyes while driving the car so as it is a distracted activity so alarm gets activated to indicate the danger level inference and starts beeping until the driver opens his eyes.

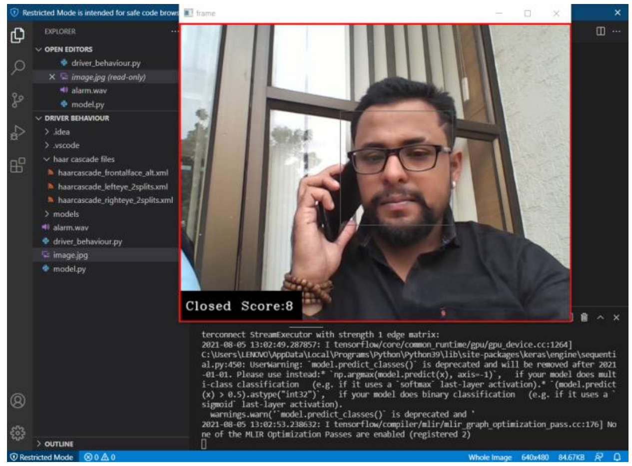


Fig1. While using mobile it encounters the distracted activity and starts beeping.

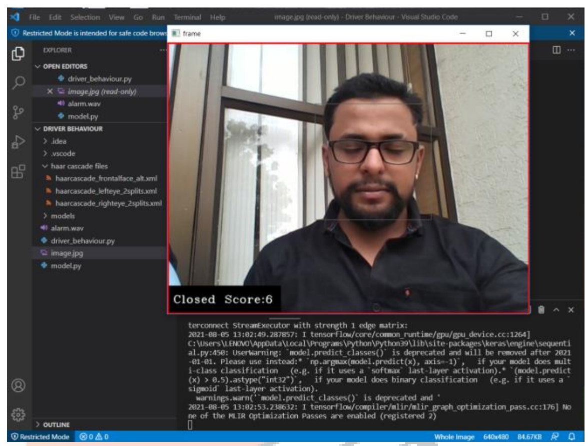


Fig2.The driver has closed his eyes so as it is a distracted activity so alarm starts beeping.

5. CONCLUSION

In this paper, we proposed a novel driving behavior monitoring system based on a risk degree inference using CNN and YOLO framework. While driving if the driver performs the distracted activities such as using mobile phones, feeling drowsiness the danger level is indicated using the fuzzy logic to determine the risk level in real time manner. The CNN model is best suitable to monitor the driving behavior and it is more reliable than training model that only collect data in simulation experiments. We additionally confirmed that our device can offer timed signals while the driving force turned into distracted. Only three distracted activities were examined in our suggested system. We'll integrate some more distracted action in future enhancement. We also take into account the driver's alcoholic behaviour while driving. We will create a multivendor IOS mobile application.

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