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Driver Behaviour Detection Based on Convolution Neural System

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Abstract: Driving is a set of behaviours that need high concentration. Sometimes these behaviours are dominated by other acts such as smoking, eating, drinking, talking, phone calls, adjusting the radio, or drowsiness. These are also the main causes of current traffic accidents. Therefore, developing applications to warn drivers in advance is essential. This research introduces a light-weight convolutional neural network architecture to recognize driver behaviours, helping the warning system to provide accurate information and to minimize traffic collisions. This network is a combination of feature extraction and classifier modules.

The feature extraction module uses the advantages of the standard convolution layers, depth wise separable convolution layers, average pooling layers, and proposed adaptive connections to extract the feature maps. The benefit of the convolution block attention module is deployed in the feature extraction module that guides the network in learning the salient features. The classifier module is comprised of a global average pooling and soft max layer to calculate the probability of each class. The overall design optimizes the network parameters and maintains classification accuracy. The entire network is trained and evaluated on three benchmark datasets.

Keywords: Driver behaviour, CNN Model, Face Recognition, Data Augmentation

I. INTRODUCTION

Nowadays, road traffic systems have grown much in terms of quantity and complexity. Accordingly, the number of accidents also increased gradually. The statistics of the World Health Organization point out that about 1.35 billion people die and approximately 50 million road traffic collisions occur every year. If the drivers really focused when driving, it could reduce the accident rate by four times. According to a statistic from the National Highway Transportation and Safety Administration (NHTSA) in the United States (US), about 2,895 people were killed in distracted driving accidents in 2019, accounting for 8.7% of all traffic accident deaths in that year. Both driver inattention and driver distraction are huge challenges in road traffic, resulting in a high number of accidents and fatalities every year. For this reason, vehicle manufacturers, suppliers, start-ups, and researchers are devoting more and more resources to better understand and measure the causes of driver distraction and inattention. Thereby, they develop warning and prevention mechanisms for driver or increase the automation level of the vehicle to avoid dealing with driver distraction in the first place, e.g., with automated driving functionalities.

Some modern vehicles above a certain vehicle class and equipment level may already have simple systems that can detect certain types of driver inattention, such as driver fatigue, and warn the driver accordingly. Such systems are usually subsumed under the term driver assistance systems, which also include vehicle automation systems such as adaptive distance keeping or lane keeping. Driving a vehicle is an extremely complex task. Distraction and more generally driver inattention has been a major concern for road safety professionals and others take many years as both increases the risk of an accident considerably. According to NHTSA statistics, approximately 25% of police-reported crashes involve some form of driver inattention such as the driver is distracted, fatigued, or otherwise lost in thought. Abnormal driving behaviour (e.g., drowsy, aggressive, drunk, careless, and reckless driving) is defined by the driver behaviour, which increases the risk of the accidents. Most driver behaviour detection systems only identify one type of abnormal driver behaviour, whereas few papers attempt to distinguish among the different types of driver behaviour. Nevertheless, there is still no driver behaviour monitoring system that can efficiently distinguish between different abnormal driver behaviours. In order to clarify different styles of driver behaviour, we summarize the various characteristics of driving styles in the following. Aggressive driving behaviour includes unsafe lane change, quick change in car acceleration and speed, tailgating (drive too closely behind another vehicle). Distracted driving style is associated with inattention to necessary activities and task of driving toward other activities such as drinking, eating, and using smartphone or technologies in the car. Distracted driving usually followed by a quick driver reflex to rectify car situation.

Driver fatigue usually leads to the drowsy driving style that is accompanied by observable symptoms such as yawning, closing eyes, slower reactions and steering, rare use of brake, and lower revolutions per minute (RPM).
Using alcohol or drug affects the driver mental ability and leads to the drunk driving style that is accompanied by measurable symptoms such as lower use of brake, abrupt acceleration, and dangerous lane change.

II. LITERATURE SURVEY

1) Sometimes these behaviours are dominated by other acts such as smoking, eating, drinking, talking, phone calls, adjusting the radio, or drowsiness. These are also the main causes of current traffic accidents. Therefore, developing applications to warn drivers in advance is essential. This research introduces a light-weight convolutional neural network architecture to recognize driver behaviours, helping the warning system to provide accurate information and to minimize traffic collisions. This network is a combination of feature extraction and classifier modules. The feature extraction module uses the advantages of the standard convolution layers, depth wise separable convolution layers, average pooling layers, and proposed adaptive connections to extract the feature maps. The benefit of the convolution block attention module is deployed in the feature extraction module that guides the network in learning the salient features. The classifier module is comprised of a global average pooling and SoftMax layer to calculate the probability of each class. The overall design optimizes the network parameters and maintains classification accuracy. The entire network is trained and evaluated on three benchmark datasets: the State Farm Distracted Driver Detection, the American University in Cairo version 1, and the American University in Cairo version 2. As a result, the accuracies on overall classes (ten classes) are 99.95%, 95.57%, and 99.61%, respectively.
2) It would develop a variety of complications like diabetes, chronic kidney disease, depression, cardiovascular diseases, or even sudden death. Early SA detection can help physicians to take interventions for SA patients to prevent malignant events. This paper proposes a lightweight SA detection method of multi-scaled fusion network named SE-MSCNN based on single-lead ECG signals. The proposed SE-MSCNN mainly includes multi-scaled Convolutional Neural Network (CNN) module and channel-wise attention module. In order to facilitate the SA detection performance, various scaled ECG information with different-length adjacent segments are extracted by three sub-neural networks. To overcome the problem of local concentration of feature fusion with concatenation, a channel-wise attention module with a squeeze-to-excitation block is employed to fuse the different scaled features adaptively. Furthermore, the ablation study and computational complexity analysis of the SE-MSCNN are conducted. Extensive experiment results show that the proposed SE-MSCNN has the performance superiority to the state-of-the-art methods for SA detection on the Apnea-ECG benchmark dataset. The SE-MSCNN with the merits of quick response and lightweight parameters can be potentially embedded into a wearable device to provide an SA detection service for individuals in home sleep test (HST).
3) As per the survey of National Highway Traffic Safety Administration (NHTSA), distracted driving is a leading factor in road accidents. In this paper, authors present a Convolutional Neural Network (CNN) based approach for detecting and classifying the driver distraction. In the development of safety features for Advanced Driver Assistance Systems, the algorithm not only has to be accurate but also efficient in terms of memory and speed. Hence, authors focused on developing computationally efficient CNN while maintaining good accuracy. Authors propose a new architecture named as mobileVGG based on depth wise separable convolutions. Authors evaluate results of the proposed network on the American University in Cairo (AUC) distracted driver detection dataset as well as State farm's dataset on Kaggle and compare the performance with state-of-the-art CNN architectures from literature. The proposed mobileVGG architecture with just 2.2M parameters outperforms earlier approaches while achieving 95.24% and 99.75% accuracy on AUC and State farm's dataset respectively with less computational complexity and memory requirement.

III. DATASETS

The research community has made several efforts to construct high-quality and diverse driving datasets, especially those focusing on road scenes.
Examples include the BDD100K corpus, Mapillary Vistas Dataset Waymo Open Dataset, and nuScenes dataset. However, the MDM dataset focuses on the drivers, not the road scenes.
While there has been interest in different aspects of driver monitoring such as visual attention emotions, and driving anomalies, we will review relevant datasets that have focused on head pose estimation, and gaze estimation. This section also reviews recent efforts to collect long-term driving datasets.

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IV. EXISTING SYSTEM

The research community has initiated various attempts to build high quality and varied driving datasets. The MDM dataset focuses on the drivers, but not in the highways. Despite the interest in various area of driver monitoring such as driving irregularities, visual attention, emotions. They examined pertinent datasets that was been used to estimate head posture. But the efficiency was severely lacking. Additional iterations are necessary which reduces system speed comparison. Less precision was achieved.

V. PROPOSED SYSTEM

The system captures the live video of a person and converts it as an image. By using data augmentation, it creates many images and increases the size of the dataset. ImageDataGenerator is used to produce new images. For face recognition Haar cascade algorithm is applied. Once face recognition is done Convolution Neural Network algorithm is used to classify the behaviour of a person. This network consists of feature extraction and classifier modules. The design applies basic components in a CNN, with the proposed adaptive connections, and a convolution block attention module to learn important information of feature maps. It predicts whether the driver is drowsy, yawning, looking left or looking right and warns him by a buzzer sound.

VI. BLOCK DIAGRAM

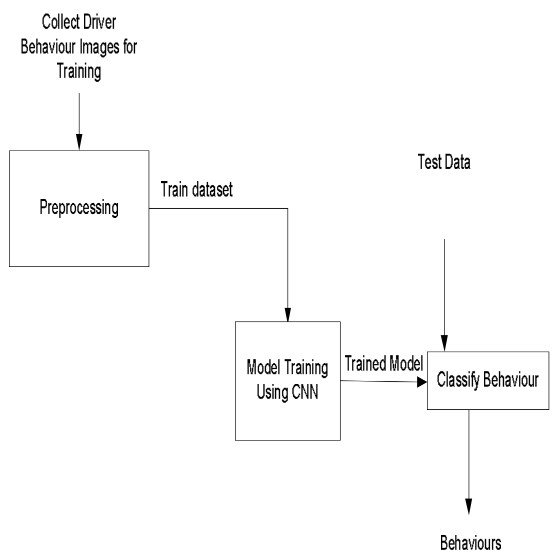


Fig.1: System Architecture

Fig.1 shows how the model collects the driver images, processes it classify the behaviours and gives the output.

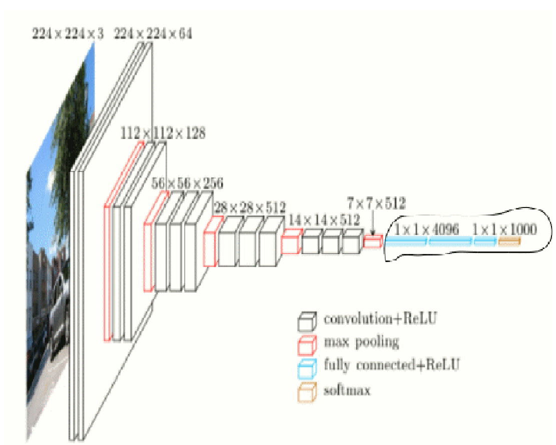


Fig.2: Basic CNN Architecture

Fig.2 shows a fully connected layer that predicts the class of the image based on the features extracted.

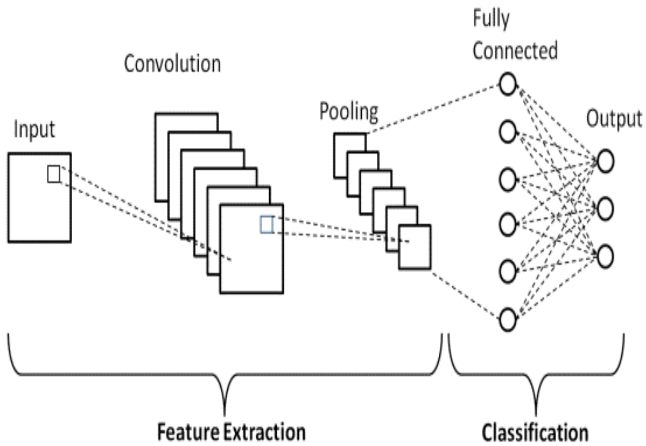


Fig.3: Feature Extraction

Fig.3 shows how the features are extracted from the given input.

VII. RESULTS

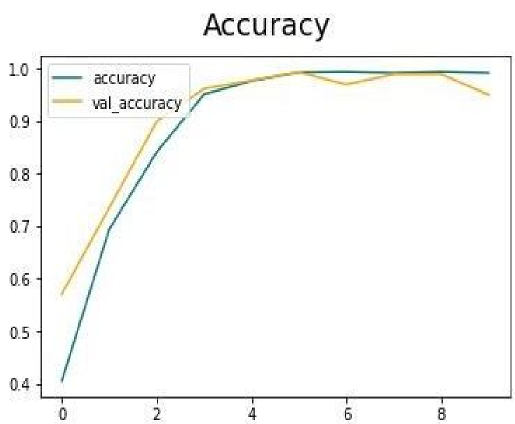


Fig.4: Training Accuracy

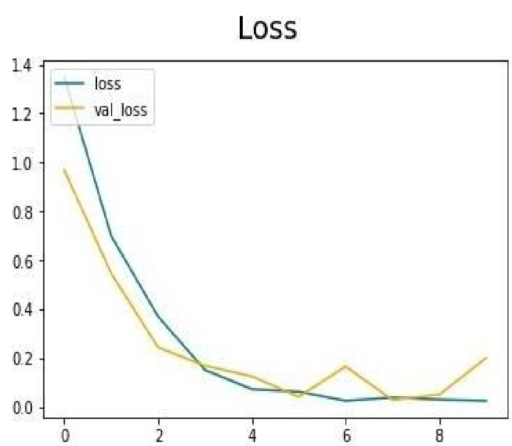


Fig.5: Training Loss

VIII. CONCLUSION

This architecture explains the advantages of standard convolution, depth wise separable convolution operation, and proposed adaptive connections to extract feature maps. Finally, the classifier is applied to recognize ten driver behaviours. This work applied several techniques for reducing the number of network parameters and increasing the accuracy. On the other hand, it was also tested on different resolution videos with good processing speeds.

REFERENCES

[1] Duy-linh nguyen , muhamad dwisnanto putro, and kang-hyun jo "Driver Behaviors Recognizer Based on Light-Weight Convolutional Neural Network Architecture and Attention Mechanism", IEEE, Digital Object Identifier 10.1109/ACCESS.2022.3187185, July 2022.

[2] Xianhui Chen, Ying Chen, Wenjun Ma, Xiaomao Fan, Ye Li, "Toward sleep apnea detection with lightweight multi-scaled fusion network", Elsevier, 8 April 2022.

[3] B. Baheti, S. Talbar, and S. Gajre, ''Towards computationally efficient and realtime distracted driver detection with MobileVGG network,'' IEEE Trans. Intell. Vehicles, vol. 5, no. 4, pp. 565–574, Dec. 2020.

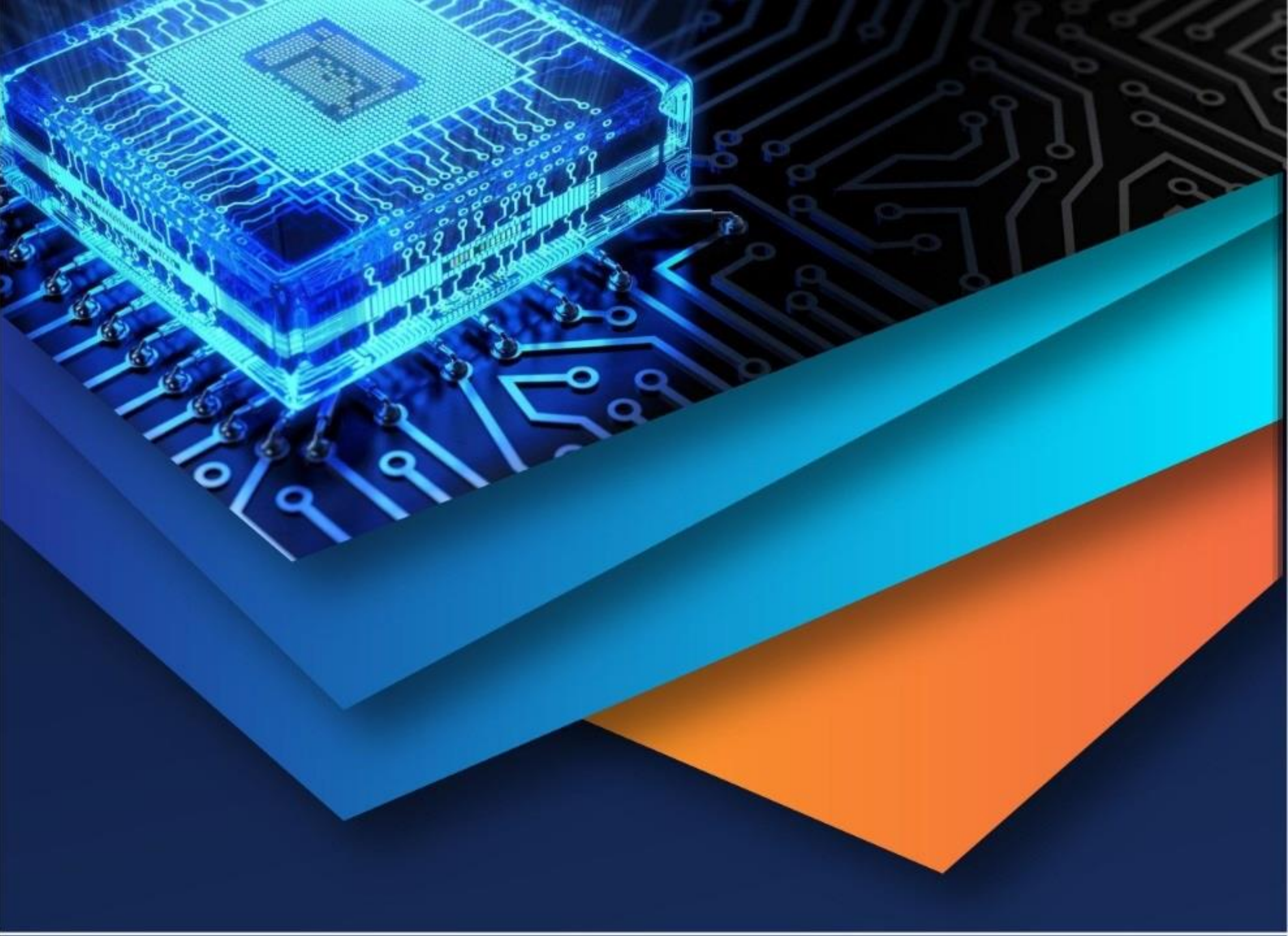
[4] B. Baheti, S. Gajre, and S. Talbar, ''Detection of distracted driver using convolutional neural network,'' in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. Workshops (CVPRW), Jun. 2018, pp. 1145–11456.

[5] H. M. Eraqi, Y. Abouelnaga, M. H. Saad, and M. N. Moustafa, ''Driver distraction identification with an ensemble of convolutional neural networks,'' J. Adv. Transp., vol. 2019, 2019.

[6] Y. Abouelnaga, H. M. Eraqi, and M. N. Moustafa, ''Real-time distracted driver posture classification,'' CoRR, vol. abs/1706.09498, Dec. 2018, doi: 10.48550/arXiv.1706.09498.

[7] A. Behera and A. H. Keidel, ''Latent body-pose guided DenseNet for recognizing driver's fine-grained secondary activities,'' in Proc. 15th IEEE Int. Conf. Adv. Video Signal Based Surveill. (AVSS), Nov. 2018, pp. 1–6.

[8] D. Tran, H. Manh Do, W. Sheng, H. Bai, and G. Chowdhary, ''Real-time detection of distracted driving based on deep learning,'' IET Intell. Transp. Syst., vol. 12, no. 10, pp. 1210–1219, Dec. 2018



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