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Detecting Inattentiveness and Traffic Signs to Ensure Safe Driving

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ABSTRACT: Driver safety is a critical concern in the transportation and automotive industry as human errors and negligence can lead to fatal accidents. This project aims to create a machine learning-based system capable of detecting driver sleep, distraction, and train signals in real-time. The system employs object detection, Keras and EfficientNet B0 model. Initially, the video feed is pre-processed by a standard detector to recognize the driver's face and eyes. The system analyzes the driver's eye movements and blink patterns to detect fatigue, reducing the risk of accidents caused by distracted drivers such as texting or using cell phones while driving. The system is also trained to recognize traffic signs by analyzin g the camera signals in the driver's field of view. By identifying fatigue and distraction, the system alerts the driver to correct the problem, while traffic signs provide real-time guidance to the driver. The system's implementation will have a significant impact on improving road safety and saving lives.

I.INTRODUCTION

Driver drowsiness and distraction are two of the leading causes of accidents on the road. When drivers are drowsy, their reaction times slow down, and their ability to make good decisions can become impaired. Distractions, such as mobile phones or other devices, can cause drivers to lose focus on the road and increase their risk of an accident. Additionally, ignoring traffic signs can also result in dangerous situations. Drowsy driving is a serious problem and can affect anyone, regardless of age or driving experience. It is especially prevalent among shift workers, commercial drivers, and individuals with untreated sleep disorders. Distractions while driving have become increasingly common with the widespread use of smartphones and other technology. In fact, texting while driving is six times more likely to cause an accident than driving while intoxicated. It is not only illegal but also puts the driver, passengers, and other road users in danger. Ignoring traffic signs can also lead to serious consequences. Failing to obey a stop sign or red light, for example, can result in a catastrophic accident, injuring or even killing multiple people. Speed limit signs are also important as they indicate the maximum safe speed at which to drive on a particular road. Ignoring these signs can increase the risk of an accident. To combat these issues, advancements in technology have been made to detect driver drowsiness, distraction, and traffic signs in real-time. Driver drowsiness detection systems use camera and pre-defined model to monitor a driver's behaviour and alert them when they are at risk of falling asleep. Similar to drowsiness detection system Distraction detection systems also use cameras and machine learning models to detect when a driver is not paying attention to the road, providing warnings to refocus their attention. Traffic sign detection systems utilize convolutional neural network algorithms to identify important road signs such as stop signs, speed limit signs, and pedestrian crossings. By alerting the driver to these signs, they can better react and make safer decisions on the road.

II.LITERATURE REVIEW

Driver drowsiness and distraction detection and traffic sign detection are active research areas in the field of intelligent transportation systems (ITS). A significant amount of literature exists on these topics, with many studies exploring different techniques and algorithms for detecting drowsiness, distraction, and traffic signs in real-time.

Real-Time Driver's Focus of Attention Extraction and Prediction using Deep Learning by Pei-heng Hong, Yuehua Wang.The authors propose a convolutional neural network (CNN) model to extract the driver's focus of attention from eyetracking data, which is then used to predict future attentional states. The authors also provide a detailed explanation of

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the proposed CNN architecture and the training process, along with experimental results demonstrating the effectiveness of the proposed approach. The proposed CNN model shows promising results in predicting a driver's focus of attention, and the paper provides a solid foundation for future research in this area.

Stargazer: A Transformer-based Driver Action Detection System for Intelligent Transportation by Junwei Liang, He Zhu, Enwei Zhang. The authors propose a self-attention mechanism-based transformer architecture that processes input data from various sensors and extracts features for driver action detection. The paper provides a comprehensive literature review on related work in driver action detection, focusing on the use of deep learning models and sensor fusion techniques. The authors also highlight the limitations of existing approaches and emphasize the need for more robust and accurate driver action detection systems. The proposed transformer-based approach is thoroughly explained, and the experimental results demonstrate its effectiveness in detecting various driver actions, such as lane changes and turns. The paper also evaluates the proposed approach against other state-of-the-art methods and demonstrates its superior performance.

Geolocating Traffic Signs using Large Imagery Datasets by Kasper F. Pedersen and Kristian Torp. The authors propose a deep learning-based method for detecting and locating traffic signs from aerial images, which can provide valuable information for mapping and navigation applications. The proposed approach is thoroughly explained, and the experimental results demonstrate its effectiveness in detecting and locating traffic signs from aerial images. The paper also evaluates the proposed approach against other state-of-the-art methods and demonstrates its superior performance.

No.	Paper Title	Author Name	Key Points	Remark
1	Real-Time Driver's Focus of Attention Extraction and Prediction using Deep Learning.	Pei-heng H, Wang Y, 2021	To detect and predict a driver's focus of attention in real-time. Convolutional neural network (CNN) model to extract the driver's focus of attention from eyetracking data, which is then used to predict future attentional states.	The proposed CNN model shows promising results in predicting a driver's focus of attention, and the paper provides a solid foundation for future research in this area.
2	Stargazer: A transformer-based driver action detection system for intelligent transportation Computing	Liang J, Zhu H, Zhang E, Zhang J, 2022	It is a self-attention mechanism-based transformer architecture that processes input data from various sensors and extracts features for driver action detection.	Some limitations of the study include the lack of evaluation in real-world driving conditions and the need for further testing on a larger dataset. Future work could focus on addressing these limitations and expanding the application of the proposed approach to other intelligent transportation systems.

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3	Geolocating Traffic Signs using Large Imagery Datasets	Pedersen KF, Torp K, 2021	A system which has deep learning-based method for detecting and locating traffic signs from aerial images, which can provide valuable information for mapping and navigation applications.	Some limitations of the study include the lack of evaluation on other types of imagery datasets and the need for further testing on a larger dataset. Future work could focus on addressing these limitations and expanding the application of the proposed approach to other domains beyond traffic sign detection.

This paper examines the relationship between driver drowsiness, distractions, and compliance with traffic signs. The research builds on earlier studies that have explored the impact of these factors on road safety. However, this study focuses on the interplay between drowsiness, distraction, and traffic signs to provide a deeper understanding of how they collectively affect driving behaviour. The goal is to contribute to the development of interventions and policies that can mitigate the risks associated with drowsy or distracted driving and improve compliance with traffic signs. By examining these factors from a holistic perspective, the authors hope to provide insights that can inform the design of more effective road safety strategies.

III.METHODOLOGY OF PROPOSED SURVEY

In this project, a graphical user interface (GUI) was developed using the Tkinter library to enhance the usability of the detection system for drivers. The system has the capability to display the output of the algorithms in real-time and issue warnings of potential hazards.

The driver distraction detection system utilizes an EfficientNet B0 model to identify and classify various types of distractions that drivers may engage in while driving, such as using a mobile phone or grooming. The model is trained using a large dataset of images containing different types of distractions along with their corresponding labels. The system continuously monitors the probability scores of each frame to detect distractions in real-time and generates an alert when the probability threshold for a particular type of distraction is exceeded. The alert may be in the form of an audible voice, prompting the driver to refocus their attention on the road. The model underwent seven training cycles, and each epoch enabled the model to update its internal parameters based on the training data, enhancing its ability to classify distractions with greater accuracy.

The traffic sign recognition system using the sequential API involves acquiring a comprehensive dataset of traffic sign images and their corresponding labels. The dataset undergoes preprocessing, including image resizing and normalization of pixel values. The preprocessed data is divided into training and validation sets and utilized to train a sequential convolutional neural network (CNN) model. Once trained, the model can predict traffic sign labels of new images in real-time. The predicted labels can then be displayed on a GUI interface to alert the driver of important road signs.

Drowsiness detection systems rely on cameras to capture the driver's face and detect the driver's eyes utilizing a predefined model, such as the shape predictor model. The system calculates the eye aspect ratio (EAR) using the distance between the eye landmarks to determine if the driver's eyes are closed or open. When the EAR value falls below a certain threshold, it may indicate that the driver's eyes are closed or partially closed, which could imply drowsiness. If drowsiness is detected, the system can issue visual and audio cues to alert the driver to stay alert and avoid potential accidents.

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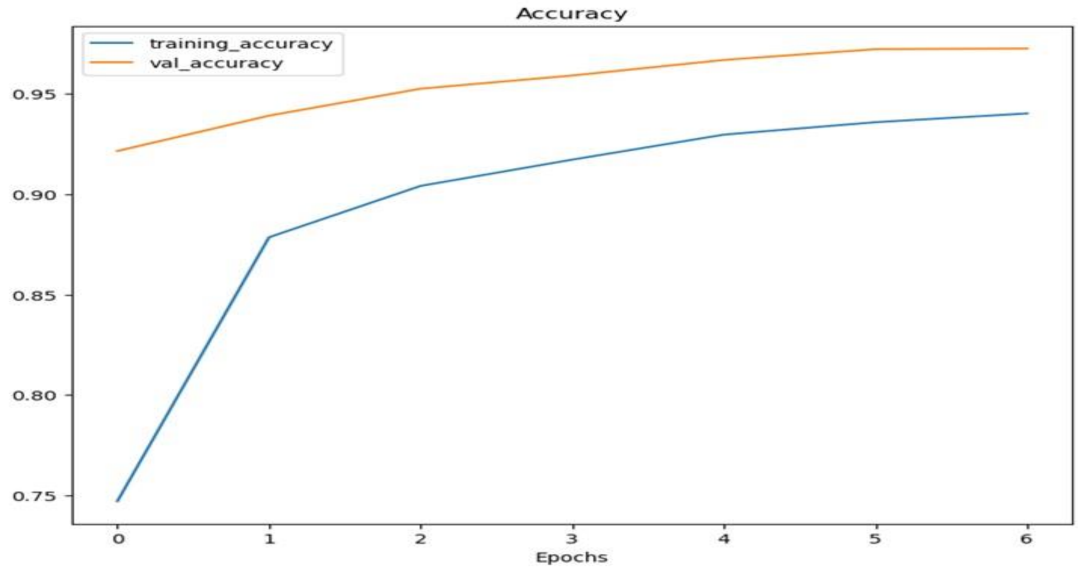

Figure 1: Accuracy graph of Distraction Detection

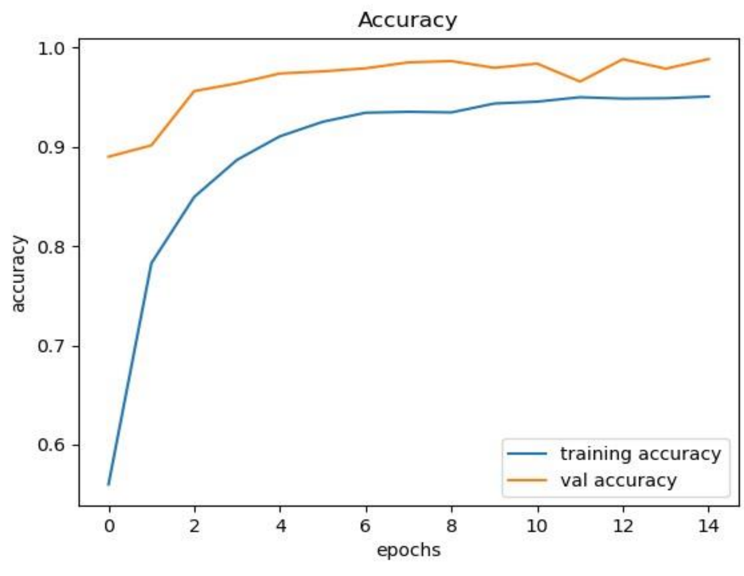

Figure 2: Accuracy graph of Traffic signs detection

IV.CONCLUSION AND FUTURE WORK

In this paper we have proposed an approach to detection drowsiness and distraction of drivers as well as traffic sign recognition which are important technologies for ensuring safe driving. These technologies utilize various CNN model to monitor and analyze the driver's behavior and the surrounding environment. By identifying signs of drowsiness or distraction, these technologies can alert the driver to take action or even take control of the vehicle to prevent accidents. Traffic sign recognition systems can also help by providing real-time alerts and warnings, these systems can help drivers make better decisions and avoid accidents. The development and integration of these technologies into vehicles can greatly improve the safety of driving and reduce the number of accidents on the road. Future work in this area could focus on the

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development of more advanced technology for detecting drowsiness and distractions, such as wearable sensors and vehicle-based systems. Additionally, further research could explore the impact of other environmental factors, such as weather conditions and road design, on driver behavior. Finally, the study highlights the need for policy interventions that promote safe driving behaviors, such as public awareness campaigns, enforcement of traffic laws, and incentives for safe driving. By continuing to study these factors, we can work towards creating safer roads for everyone.

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