Driver Behaviour Detection

ABSTRACT

To reduce the risks of road accidents caused by driver drowsiness and distraction, effective solutions need to be developed. One such solution is the development of information systems that utilize advanced technologies to detect signs of driver fatigue and distraction. Other methods include improving road infrastructure, increasing awareness through education and training, and implementing laws and regulations that discourage dangerous driving behaviors. By utilizing these methods, the risks associated with driver distraction and drowsiness can be reduced, and roads can be made safer for everyone.

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INTRODUCTION

Road crashes cause 1.3 million deaths and 20 to 50 million non-fatal injuries annually, with a significant economic impact of $518 billion. Human error causes almost 80% of severe collisions, with distracted driving being responsible for over 60% of commercial fleet crashes. Alcohol-related crashes are responsible for over 30% of road traffic fatalities in major countries. Unsafe driving behavior such as impaired, aggressive, distracted, and speeding driving is a leading cause of road traffic fatalities and injuries worldwide.

METHODS AND MATERIALS

The methodology for identifying driver behavior involved manual data collection of about 8,000 samples of individuals wearing and not wearing seatbelts, and the downloading of distraction and drowsiness data from Kaggle with around 3,000 and 4,500 samples, respectively. The collected data was labeled, and frame extraction was performed on the video data to increase the amount of data and enable real-time processing for the model's predictions. This allowed the model to analyze each image individually and make predictions based on the extracted frames.

RESULTS

The effectiveness of the Driver Behavior Detection system was validated through multiple experiments, showing that it can operate successfully on a standard smartphone with lower computational cost than other comparable methods. The results of the experiments are presented, starting with the Drowsiness model, followed by the Seatbelt model, and concluding with the Distraction model.

Table 1. . Detection accuracy rates of Drowsiness Model.

feature	Pre-Trained Model	Training Accuracy	Testing Accuracy	Training images	Testing images	epochs	LR
Drowsiness	Vggl6	97.03%	88.66%	18012 Image 1126 (batch)	4600 Image 288 (batch)	8	0.001
	Vggl9	70.34%	60.55%			5	
	MobileNet	99.37%	96.63%			5	
	MobileNet V2	99.64%	93.75%			3	

Table 2. Detection accuracy rates of Seat belt Model.

feature	Pre-Trained Model	Training Accuracy	Testing Accuracy	Training images	Testing images	epochs	LR
Seat belt	Vggl6	99%	95.5%	7017 image 439 (Batch) 352 (batch for train) 87 (batch for validation)	1600 Image 100 (batch)	2	0.001
	Vggl9	99.4%	85.5%				
	MobileNet	98%	93%				
	ResNet 50	98%	83%				

Table 3. Detection accuracy rates of Distraction Model.

feature	Pre-Trained Model	Training Accuracy	Testing Accuracy	Training images	Testing images	epochs	LR
Distraction	Vggl6	98.7%	97.5%	30K	7K	2	0.0001
	Vggl9	96.5%	93%				0.001

RESULTS VISUALIZATION

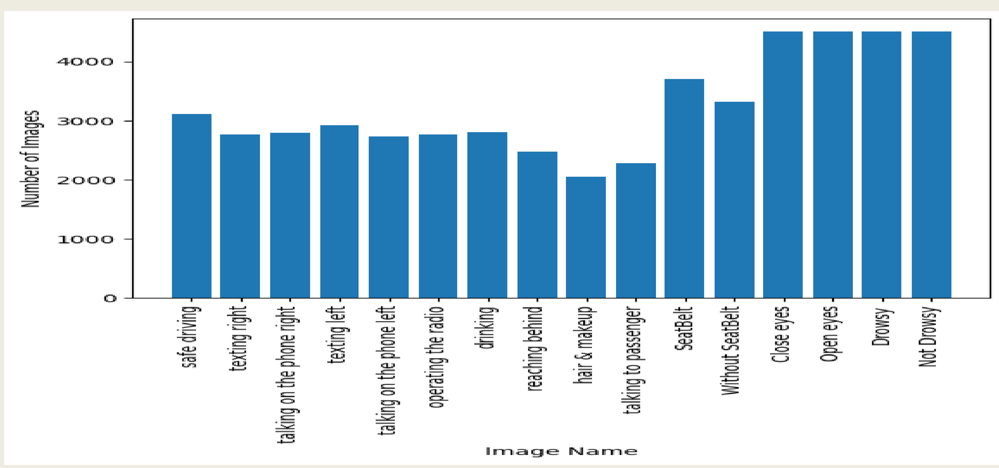


Figure 1: Train Data

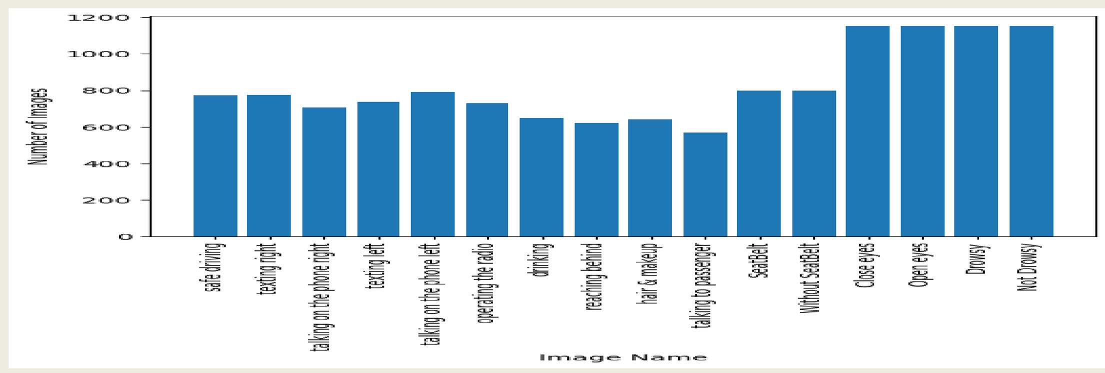
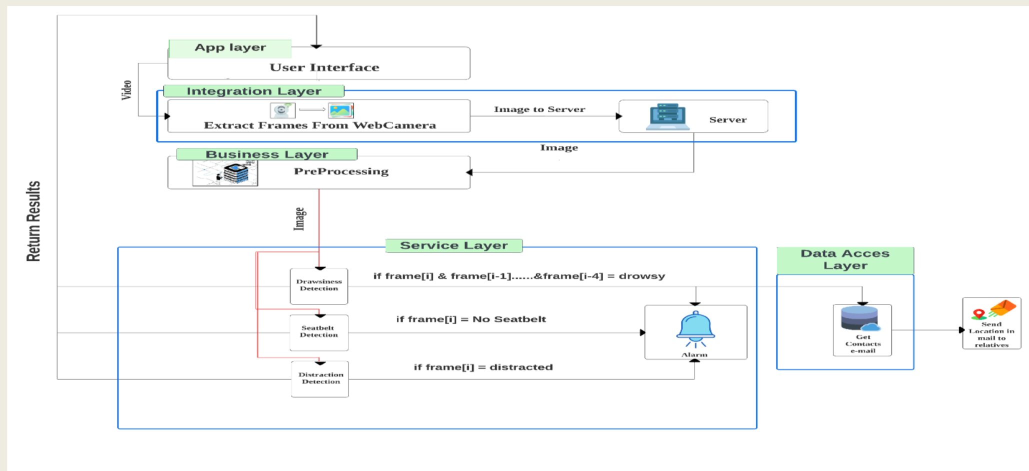


Figure 2: Tast Data

System Architecture



CONCLUSIONS

This poster proposes a CNN-based approach to identify different driving styles, including distraction styles, drowsiness styles, and seatbelt usage. The approach involves three stages: data gathering, pre-processing, and decision-making. Data is collected from various sources, preprocessed, and trained with separate models for seatbelt usage, distraction style, and drowsiness style. An application is developed that detects these styles in real-time and provides warnings to the driver's relatives via alarms or email notifications. The proposed approach is effective, straightforward, and applicable in real-time.

REFERENCES

1. A. Kashevnik, R. Shchedrin, C. Kaiser and A. Stocker, "Driver Distraction Detection Methods: A Literature Review and Framework,"
2. Azman, A. et al. (2019). Real Time Driver Anger Detection. In: Kim, K., Baek, N. (eds) Information Science and Applications 2018. ICISA