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Deep learning-based traffic sign recognition and auditory alert system for Sri Lankan drivers

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Traffic signs play a crucial role in keeping the roads safe and providing efficient awareness to drivers. They play a vital role in helping drivers, navigate and understand the rules of the road. Road accidents occur when drivers fail to follow traffic signs or disregard traffic rules, resulting in injuries, property damage, and even deaths. It's important to always pay attention to traffic signs, follow the provided instructions, and drive responsibly. Sri Lanka stands out with its distinct traffic signs, differing significantly from those seen in other countries. This study aims to develop a deep learning-based traffic sign alert system with good accuracy and efficiency in traffic sign recognition and enhance driver awareness through the integration of an auditory alert system. This alert system was implemented under two main divisions: object detection system and auditory alert system. The traffic signs dataset images were labeled and preprocessed using the Roboflow software tool. The system was trained using the YOLOv5 model, allowing it to learn complex patterns and features associated with 15 different sign classes. To further enhance driver awareness, an auditory alert system was developed using the PyDub library to generate real-time alerts in the form of voice messages. These alerts are triggered whenever a traffic sign is detected, providing an additional layer of information to the driver. The integrated and fine-tuned YOLOv5 model achieved the F1 score of 90.09% and mean average precision (mAP) of 87.55% on the test dataset resulting in good evaluation metrics values for detection. This YOLOv5 model-based traffic sign auditory alert system was highly effective and efficient in enhancing driver awareness.

Keywords: Traffic signs; Recognition; Auditory alert; YOLOv5; Roboflow