OPTIMIZING ROAD SAFETY

Integrating Helmet Detection & Number Plate Recognition

Dawood Ali | C00302916@setu.ie
Supervisor: Dr. Oisin Cawley | Oisincawley@setu.ie
MSc. Data Science, SETU Carlow

Ollscoil Teicneolaíochta an Oirdheiscirt
South East Technological University

INTRODUCTION

Motorcycles are the predominant means of transportation in countries like India, Pakistan, Brazil, and Thailand, with India alone accounting for 210 million motorcycles as of August 2022 (HT, 2022). Legislation mandates helmet use in many of these regions, emphasizing a commitment to rider safety beyond legal requirements. The illuminating MAIDS (Motorcycle Accidents in Depth Study) report, covering five European countries, reveals a crucial statistic: helmets could have significantly reduced or prevented head injuries in 68.7% of documented motorcycle accidents (Kulkarni, 2018). These findings highlight the critical role helmets play in enhancing motorcycle commuter safety globally.

Aims & Objectives

The following aims encapsulate the core of our project, delineating the path toward creating a sophisticated Smart Transportation Safety system:

- To develop a Smart Transportation Safety system for enhanced road safety using YOLOv4 for accurate and real-time helmet detection.
- To integrate advanced technologies for comprehensive traffic monitoring, utilizing OCR techniques to enhance License Plate Recognition.
- To implement YOLOv4 and SSD algorithms for helmet detection and compare them, evaluating their performance under various traffic conditions.

LITERATURE REVIEW

Chiverton (2012) proposed an SVM-based system to detect helmetless motorcycle riders, focusing on head region features. However, it faces issues with misclassification and fails to identify motorcyclists initially.

Recent advancements like YOLO (Wu & Jin, 2019) and SSD (Sieberta et al., 2019) offer improved real-time detection by dividing images into grids or combining anchor boxes with bounding box regression. Deep learning, particularly YOLOv5, offers superior efficiency and accuracy compared to traditional methods, making it ideal for this study.

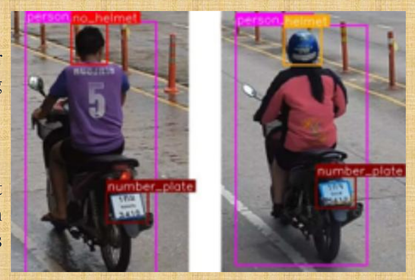
METHODOLOGY

Research Design:

This study combines applied research with controlled experiments to develop a road transportation safety system. YOLOv4 and SSD is used for helmet detection, and OCR is employed for license plate recognition. Data is sourced from open-source platforms and manually selected images. Traffic conditions serve as independent variables, while performance metrics of detection algorithms are dependent variables. Model architectures, training procedures, and system implementation details are provided, along with comprehensive validation and testing phases.

Data Preprocessing:

Images are resized to a standardized format and pixel values normalized for consistency. Data augmentation includes random rotations and variations in lighting conditions. Outliers and irrelevant images are addressed.



Integrating YOLOv4/SSD and OCR:

YOLOv4 is configured with predefined hyperparameters for real-time object detection. Training involves a preprocessed dataset sourced from online platforms, with fine-tuning for improved accuracy. OCR for license plate identification undergoes preprocessing steps and alignment with the Smart Transportation Safety system.

DATA COLLECTION

The dataset for this study includes data from both open-source platforms and manually selected internet images, focusing on motorcycles and riders. Open-source data offers diverse real-world traffic conditions, while manually selected images provide varied scenarios for model training and evaluation.

TECHNOLOGIES

CONCLUSION

The implementation of the Smart Transportation Safety system, integrating YOLOv4 for helmet detection and OCR for license plate identification, represents a significant advancement in road safety. YOLOv4's optimized settings enable rapid and accurate helmet detection in diverse traffic conditions, while meticulous OCR implementation ensures precise license plate recognition.

Limitations:

Challenges may arise in accurately detecting helmets under varying lighting conditions or when helmets exhibit diverse appearances. Similarly, recognizing obscured or unclear license plates may pose difficulties.

Next Steps:

The Smart Transportation Safety system lays the groundwork for smarter traffic monitoring. Next steps will include focusing on improving computer program accuracy and handling known challenges using deep learning and computer vision technologies.

References

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