

Vehicle Detection using YOLOv8

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Abstract

We built a vehicle detection system using YOLOv8. Our model was trained on a custom dataset of cars, buses, trucks, motorcycles, and pickups. After training, the model was able to detect vehicles in video footage with high accuracy and speed. The results show that YOLOv8 can be a reliable tool for real-time traffic monitoring.

Introduction

Detecting vehicles is important for applications like traffic control, surveillance, and self-driving cars. Our team chose YOLOv8 because it is fast, accurate, and widely used in computer vision. The goal of this project was to train YOLOv8 on our dataset and test how well it can detect vehicles in real-world video.

Methodology

- Dataset: Custom-labeled images with five classes (Car, Bus, Truck, Motorcycle, Pickup).
- Preprocessing: Images resized and annotated in YOLO format.
- Training Setup:
 - * Model: YOLOv8s
 - * Epochs: 100
 - * Image Size: 640x640
 - * Configured using data.yaml
- Metrics Used: Precision, Recall, mAP (mean average precision).

Results

The model learned effectively: training loss decreased steadily while accuracy improved.

- Precision: 1.0
- Recall: 0.99
- F1 Score: 0.99
- mAP@0.5: 0.995
- Confusion matrix showed very few misclassifications.
- In video tests, the system detected vehicles clearly and in real time.

Discussion

The model performed very well, with high accuracy and reliable detections. It worked in real-time, which makes it suitable for traffic monitoring. Some challenges remain, like handling occlusions (vehicles blocking each other) and low-quality video. Improving the dataset and fine-tuning parameters could make the system even stronger.

Conclusion

Our team successfully trained YOLOv8 to detect vehicles. The model achieved high precision, recall, and mAP, and worked well on video tests. This project shows that YOLOv8 is a strong choice for real-time vehicle detection. Future work could expand the dataset and integrate the system into real-world applications.

References

- Ultralytics YOLOv8 Documentation: <https://docs.ultralytics.com>
- YOLOv8 GitHub Repository: <https://github.com/ultralytics/ultralytics>