Road Object Detection using YOLOv8 on IDD Dataset

Meriel Rebecca Koshy
Navami Nair
Saintgits College of Engineering
15th July 2023

CONTENTS

I	**Abstract**	1
II	**Introduction**	1
III	**Motivation**	1
IV	**Prior Work**	1
V	**Our Approach**	1
VI	**Results**	2
VII	**References**	2

LIST OF FIGURES

1	**Confusion Matrix**	2
2	**Key Metrics tracked by YOLOv8**	2
3	**Person detected with an accuracy of 85%**	2
4	**YOLOv8 Inference on a Validation Batch**	2

Road Object Detection using YOLOv8 on IDD Dataset

I. ABSTRACT

Road safety is a critical concern, and detecting pedestrians walking on the wrong side of the road is crucial for preventing accidents and ensuring safe traffic flow. This project focuses on developing a road object detection system using the YOLOv8 framework to specifically identify pedestrians walking on the wrong side of the road. The report provides an overview of the dataset, training process, model architecture, and the steps involved in performing inference with the trained model. Evaluation results and performance analysis on the selected classes of people walking on the wrong side are discussed, highlighting the system's capabilities and potential applications in real-world scenarios.

II. INTRODUCTION

Road object detection plays a crucial role in ensuring road safety and efficient traffic management. With the advancement of deep learning and computer vision techniques, the task of detecting objects in real-time has become more accurate and efficient. In this project, we will be using the YOLOv8 framework to develop a road object detection system specifically focused on identifying people walking on the wrong side of the road.

III. MOTIVATION

The motivation behind this project stems from the pressing need to address pedestrian safety concerns, particularly instances where individuals walk on the wrong side of the road. This behavior not only puts the pedestrians themselves at risk but also poses a potential hazard to drivers and other road users. By developing a robust road object detection system that specifically targets this problem, we aim to contribute towards enhancing road safety measures and reducing accidents caused by pedestrian negligence.

IV. PRIOR WORK

Research and prior work on road object detection for detecting people walking on the wrong side of the road include the following approaches and techniques:
YOLOv4: YOLOv4 is an advanced version of the YOLO algorithm that incorporates several improvements, including architecture modifications, feature fusion techniques, and optimization strategies. YOLOv4 has been applied to road object detection projects, including the specific task of detecting pedestrians walking on the wrong side of the road. The model has been trained and fine-tuned on labeled datasets to achieve better accuracy and performance.
Deep Learning-based Approaches: Deep learning techniques have shown significant advancements in road object detection tasks, including pedestrian detection.These models can be fine-tuned or trained from scratch to specifically detect pedestrians walking on the wrong side of the road.
Data Augmentation and Balancing: To improve the detection performance, researchers have employed data augmentation techniques such as random cropping, rotation, scaling, and flipping. Data balancing techniques, such as hard negative mining or online hard example mining, have also been used to handle imbalanced datasets and improve detection accuracy.

V. OUR APPROACH

Dataset Collection:

- Utilize the IDD dataset, which consists of a large collection of road images captured in diverse locations across India.
- Identify and extract road images from the dataset that contain instances of pedestrians walking on both sides of the road.

Dataset Preparation:

- Split the IDD dataset into training, validation, and testing sets.
- Annotate the dataset by labeling the pedestrians and marking whether they are walking on the correct or wrong side of the road.

YOLOv8 Architecture:

- Implement the YOLOv8 architecture as the backbone for the object detection model.
- Customize the YOLOv8 output layer to include the specific class or attribute for pedestrians walking on the wrong side of the road.

Model Training:

- Initialize the YOLOv8 model with pre-trained weights, such as those from the COCO dataset or other large-scale datasets.
- Fine-tune the model on the annotated IDD dataset, focusing on detecting pedestrians and distinguishing between those on the correct and wrong sides of the road.
- Utilize data augmentation techniques, such as random cropping, scaling, and flipping, to increase the model's robustness and generalize its performance.

Hyperparameter Tuning:

- Experiment with different hyperparameters, including learning rate, batch size, and optimizer settings, to optimize the model's performance.
- Consider techniques like learning rate schedules and early stopping to prevent overfitting and enhance convergence.

Model Evaluation:

- Evaluate the trained model on the validation set, using metrics like precision, recall, and average precision to assess its accuracy and robustness.
- Fine-tune the model based on the evaluation results, adjusting hyperparameters or model architecture as necessary.

Testing and Deployment:

- Assess the final model's performance on the testing set to obtain accurate performance metrics.
- Deploy the trained model on new road images or real-time video streams to detect pedestrians walking on the wrong side of the road

VI. RESULTS

A. The confusion matrix, shown in Figure 1, helps assess the accuracy of the model by showing the number of true positives, true negatives, false positives, and false negatives for each class. The confusion matrix allows for a detailed analysis of the model's performance and the identification of any patterns or areas of misclassification.

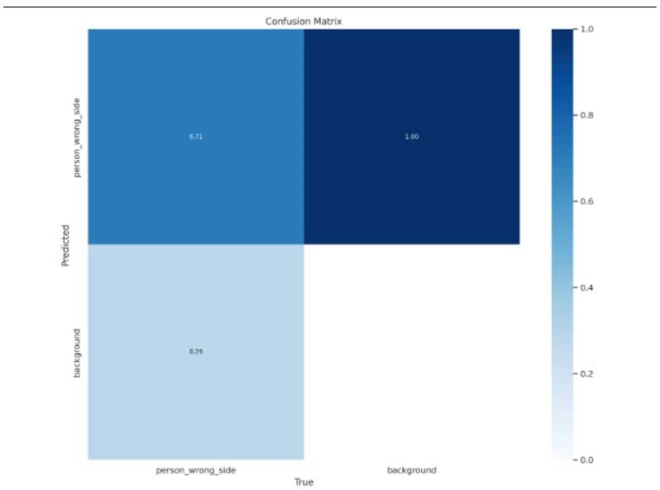

Fig. 1. Confusion Matrix

B. Figure 2 shows the graph generated as the output of the model's predictions. This graph provides an overview of the model's performance in terms of precision, recall, and other relevant evaluation metrics. It visualizes the model's predictions and their confidence scores for different traffic sign classes.

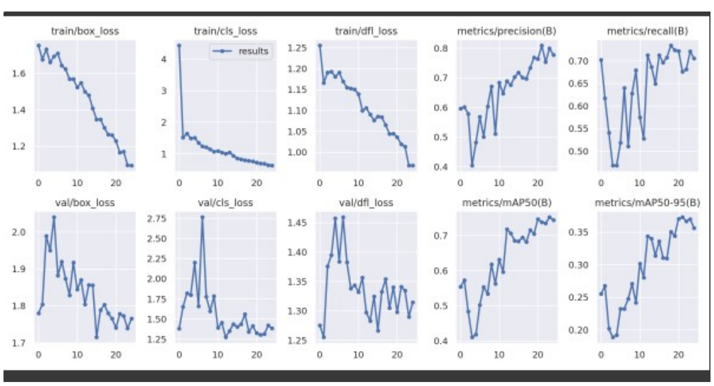

Fig. 2. Key Metrics tracked by YOLOv8

C. Figures 3 and 4 show the output of the model we trained. The people on the wrong side of the road was detected with an average of 75.2% precision, and 70.8% recall.

Fig. 3 Person detected with an accuracy of 85%

Fig. 4. YOLOv8 inference on a validation batch

VII. REFERENCES

[1] Indian Driving Dataseet (IDD) : https://idd.insaan.iiit.ac.in/

[2] Bochkovskiy, A., et al. "YOLOv4: Optimal Speed and Accuracy of Object Detection." arXiv preprint arXiv:2004.10934 (2020)

[3] https://blog.roboflow.com/how-to-train-yolov8-on-a-custom-dataset/