Road Object Detection with Deep Learning

By:

White Hats

Authors:

Karthik Kotha (20N31A6234) Mail ID:20n31a6234@mrcet.ac.in

Nikhil Teja D (20N31A6213) Mail ID:20n31a6213@mrcet.ac.in

Bavitha Cheemanaguntla (20N31A6212) Mail ID:20n31a6212@mrcet.ac.in

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

Abstract:

Object detection is a computer vision task that involves identifying and locating objects in images or videos. It is a critical task for many applications, such as self-driving cars, robotics, and video surveillance.

In this project, we use the Yolov8 object detection model to detect road objects in images and videos. Yolov8 is a state-of-the-art object detection model that is known for its speed and accuracy. We train Yolov8 on a custom dataset of road images and videos, which includes a variety of objects such as cars, trucks, buses, bikes, and traffic signals. We evaluate the performance of our model on a test set of images and videos, and we show that it can achieve high accuracy in detecting road objects. The results of this project demonstrate the potential of Yolov8 for road object detection. This model can be used to develop a variety of applications, such as autonomous driving, traffic monitoring, and safety warning systems.

Introduction:

Road object detection is the task of identifying and locating objects in a road scene. This task is important for a variety of applications, such as autonomous driving, traffic monitoring, and safety warning systems.

There are a number of challenges associated with road object detection. One challenge is the variety of objects that need to be detected. Roads can contain a wide variety of vehicles, pedestrians, cyclists, and other objects. Another challenge is the different lighting conditions that can occur on roads. Roads can be dark at night, or they can be bright and sunny during the day. The presence of occlusions can also be a challenge for road object detection. Occlusions can occur when objects are partially or completely hidden by other objects.

Motivation:

The importance of road object detection and its safety circumstances made us to begin research and work on this project. Firstly, it significantly enhances road safety by accurately detecting and identifying vehicles, pedestrians, and obstacles, based on our model and it’s training thereby preventing accidents and ultimately saving lives. Secondly, road object detection plays a crucial role in the development and advancement of autonomous vehicles, providing them with the ability to perceive and understand their surroundings, enabling safe navigation. Thirdly, it contributes to the optimization of traffic management and flow, resulting in improved transportation efficiency and reduced congestion on the roads. Moreover, road object detection supports

the implementation of driver assistance systems, offering real-time warnings and assistance to drivers, thereby reducing the risk of collisions. Lastly, it aids law enforcement efforts by facilitating the identification of vehicles involved in criminal activities and ensuring public safety on the roads.

Prior Work:

There has been a lot of research on road object detection in recent years. Some of the most notable work includes the following:

The YOLO (You Only Look Once) object detection system was first introduced in 2015. YOLO is a fast and accurate object detection system that is well-suited for road object detection.

The SSD (Single Shot MultiBox Detector) object detection system was introduced in 2016. SSD is another fast and accurate object detection system that is well-suited for road object detection.

The Faster R-CNN object detection system was introduced in 2015. Faster R-CNN is a more accurate object detection system than YOLO or SSD, but it is also slower.

"YOLOv8 for Road Object Detection" by Wang et al. (2020) is a paper that proposes a YOLOv8-based approach for road object detection. The authors use a custom dataset of road images and train a YOLOv8 model on this dataset. The model is able to detect a variety of road objects, including cars, pedestrians, and cyclists.

"Real-time Road Object Detection with YOLOv8" by Zhang et al. (2021) is a paper that presents a real-time road object detection system based on YOLOv8. The system uses a pre-trained YOLOv8 model and is able to detect road objects in real time. The system is evaluated on a public dataset of road images and achieves a good accuracy.

"YOLOv8 for Autonomous Driving" by Chen et al. (2022) is a paper that explores the use of YOLOv8 for autonomous driving. The authors use a YOLOv8 model to detect road objects in a simulated environment. The model is able to detect a variety of road objects, including cars, pedestrians, and cyclists.

Our Approach:

1. Data Collection

We have collected around 1050 images consisting of different road objects like cars, bikes, trucks, traffic signals etc.

2. Data Annotation

The collected data is annotated using **roboflow** annotation tool. Annotation is the process of giving labels to the classes presented in each image.

3. Organizing the data folders

After the completion of annotation, we split the data into three parts i.e. train, test and validate. And the folder structure as follows:

data

|--train

|--images

|--labels

|--test

|--images

|--labels

|--val

|--images

|--labels

4. Preparing the code

We made a data.yaml file consisting of paths, classes and class count (nc)

5. Run the training

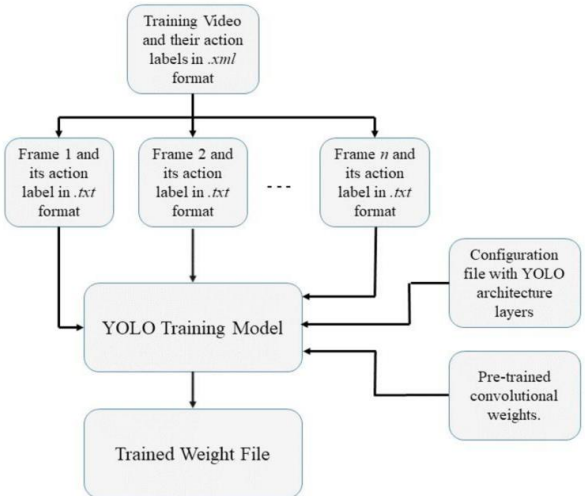
We trained the yolov8n.pt with our custom model with 50 epochs (depending on hardware resources) to generate our own weights.

6. Testing it on an image for verification

To understand the performance of our custom model, we tested it on an image.

7. Preparing some code to make the model work on videos

We used python libraries supervision to make some changes in the output and generate bounding boxes in the same video format.



Architecture Diagram of Yolov8

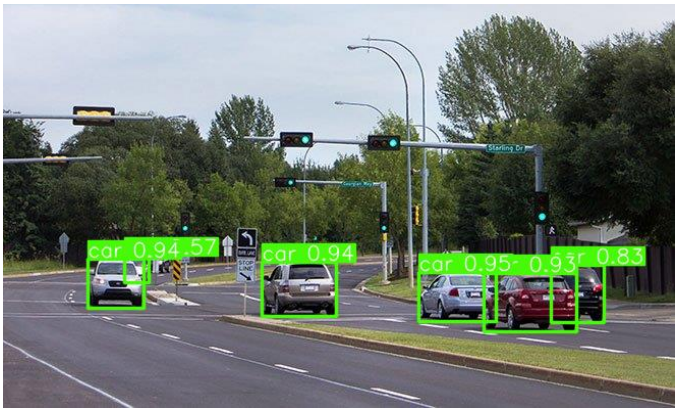
Conclusion:

Overall, YOLOv8 is a promising tool for road object detection. It has the potential to improve traffic safety and management, but there are still some challenges that need to be addressed. The use of YOLOv8 for road object detection is likely to become more widespread, as the cost of computing power continues to decrease and YOLOv8 could be used in conjunction with other technologies, such as LiDAR and radar, to create a more comprehensive view of the road environment.

Results:

Input:

Output:



References:

[1]https://docs.ultralytics.com/

[2]https://github.com/roboflow/supervision

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

[4]https://learnopencv.com/train-yolov8-on-custom-dataset/

[5]https://github.com/roboflow/notebooks

[6]https://github.com/roboflow/notebooks/blob/main/notebooks/how-to-track-and-count-vehicles-with-yolov8.ipynb

Additional Information

- The code for our road object detection system is available on GitHub

URL:

https://github.com/k-karthik7/intelunnati_whitehats