Cars Object Detection model (YOLOv8)

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The Dataset:

this stage, focus on preparing the dataset for the object detection task. The dataset source for this task is the "Car Object Detection" dataset obtained from Kaggle. This dataset contains images of cars for training an object detection model and labelling the data after this using Robowflow.

The Dataset details:

The Dataset images ---------> 1001 image
Images that contain cars ---------> 479 image
After this I used data Augmentation technique to produce mor images the technique I used (Horizontal flipping)
Images after Data Augmentation ---------->650 image
After this I divided the Dataset to three sets([training: 507 images], [validation: 95 images], [testing: 48 images]

Models:

This stage will show all the models I tried to train to get the best results using this data set

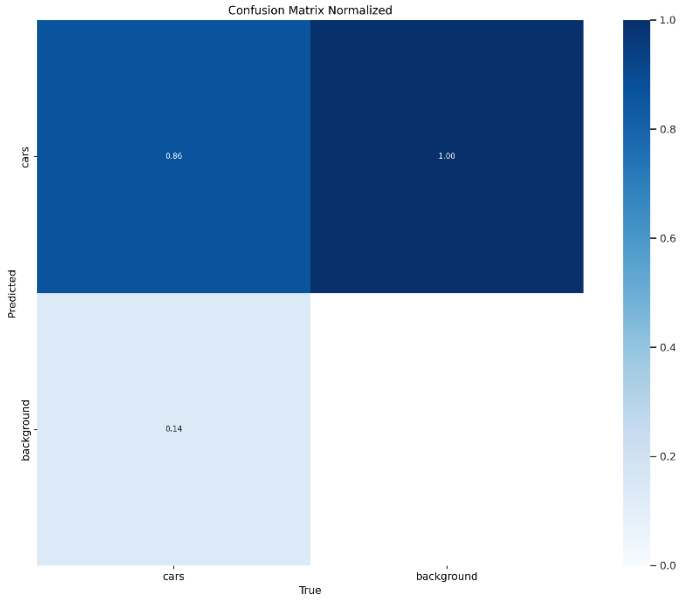
I trained three models

First model: (YOLOv8n with 50 epoch)

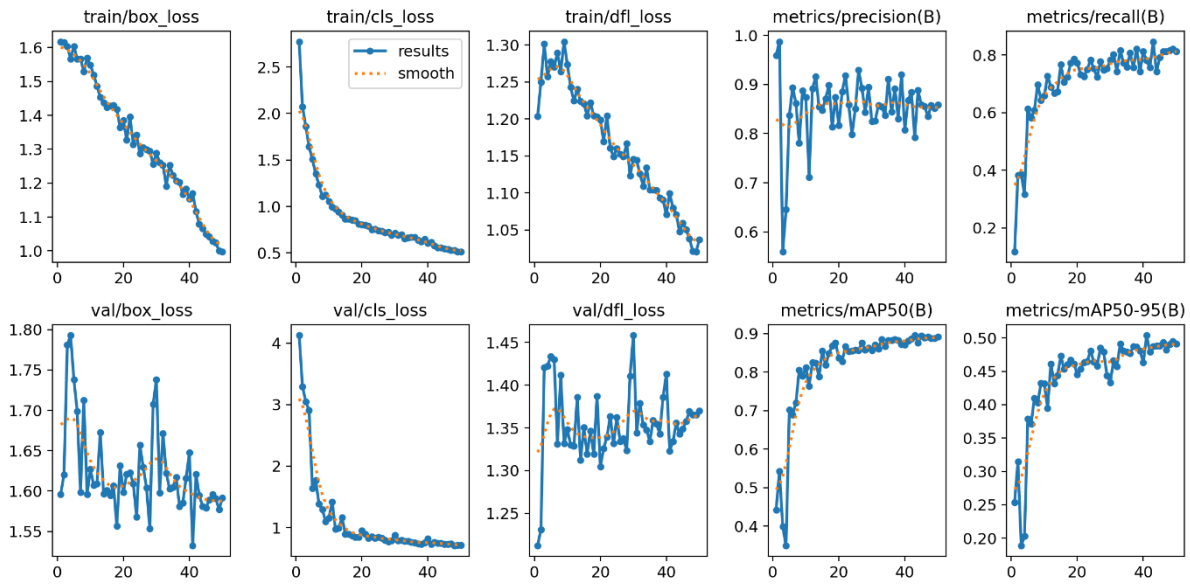
In this model, it excelled during testing on the test dataset which is sample from the same dataset, showingcasing near-perfect performance. However, when challenged with traffic videos, especially those presenting cars from a front-view angle, its accuracy dipped noticeably. The underlying cause can be linked to the dataset's limitation, primarily consisting of images capturing cars from a side-view angle. Evidently, a more diverse and comprehensive dataset is required to improve the model's ability to handle varying viewpoints and scenarios, especially within the context of traffic video analysis.

The results on validation set

- Precision: 0.868
- Recall: 0.78
- MAP50: 0.881
- mAP50-95: 0.505



the conf for all predections is 0.2



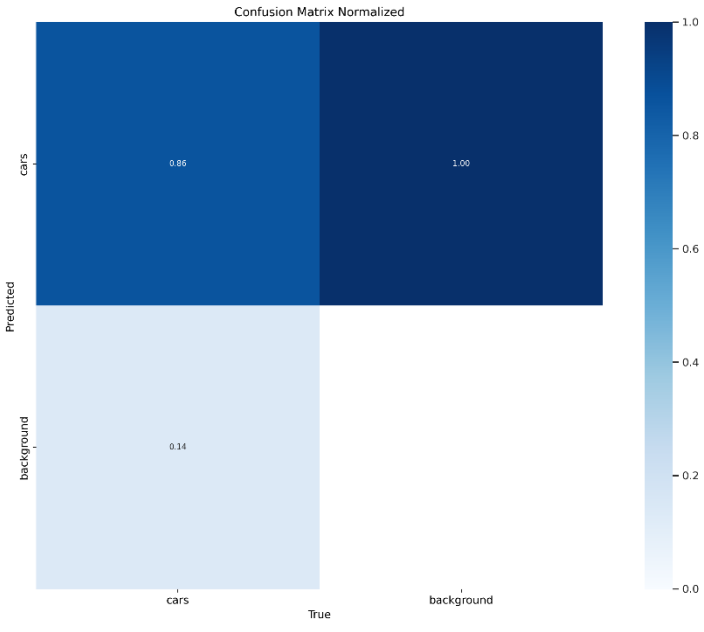
Second model: (YOLOv8n with 80 epoch)

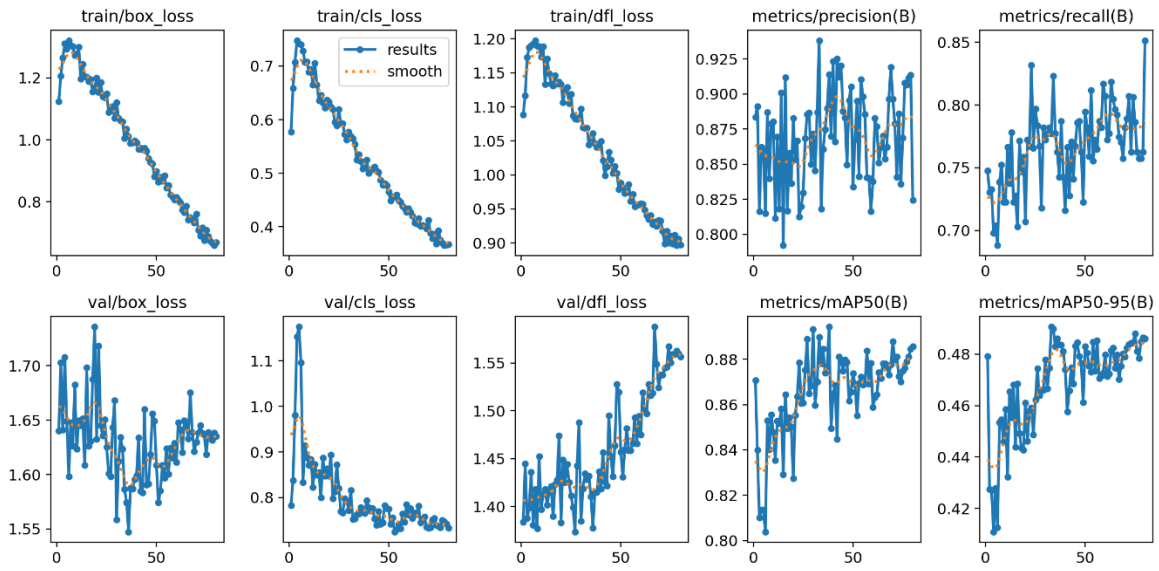
At the second model I tried to increase the number epochs to enhance the results but it was the same results

The results on validation set.

- Precision: 0.938
- Recall: 0.777
- MAP50: 0.89
- mAP50-95: 0.49

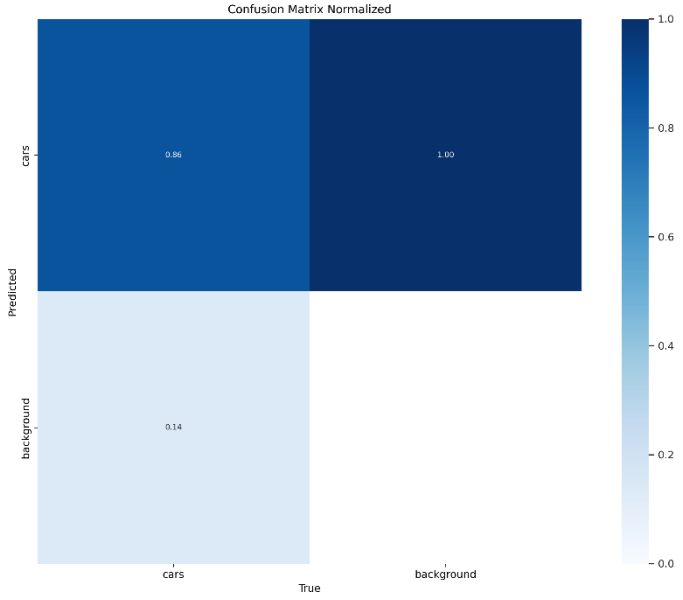
the conf threshold for all predections set 0.2





Third model: (YOLOv8m with 50 epoch)

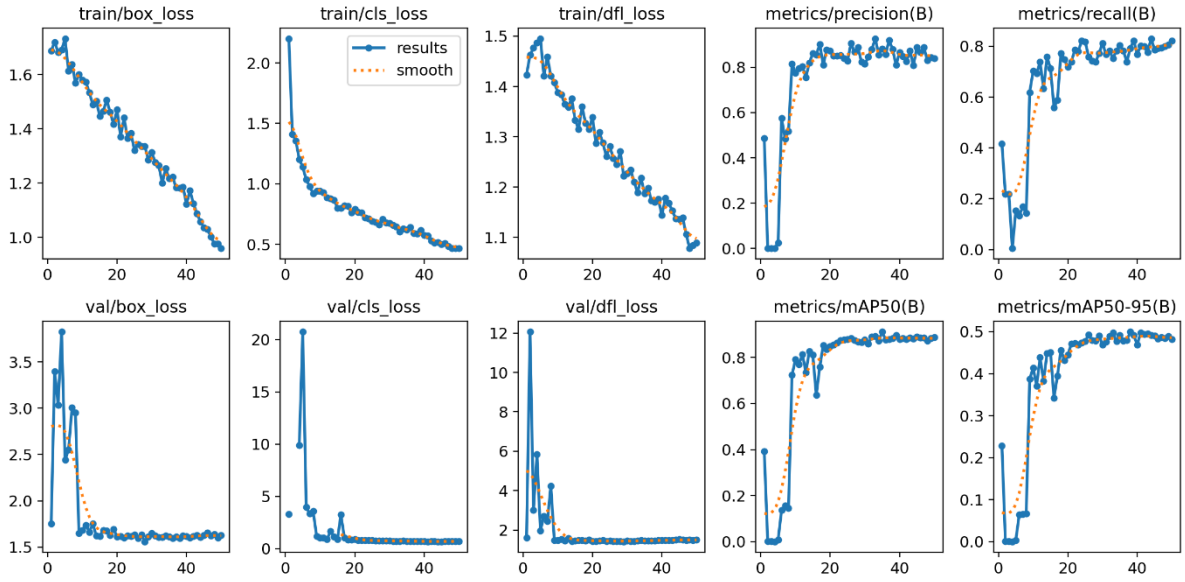
After the terrible results from the first and second models which because the dataset not good for the model so I decided to use more powerful model so used YOLOv8m which gives me the best result I can get from this dataset.

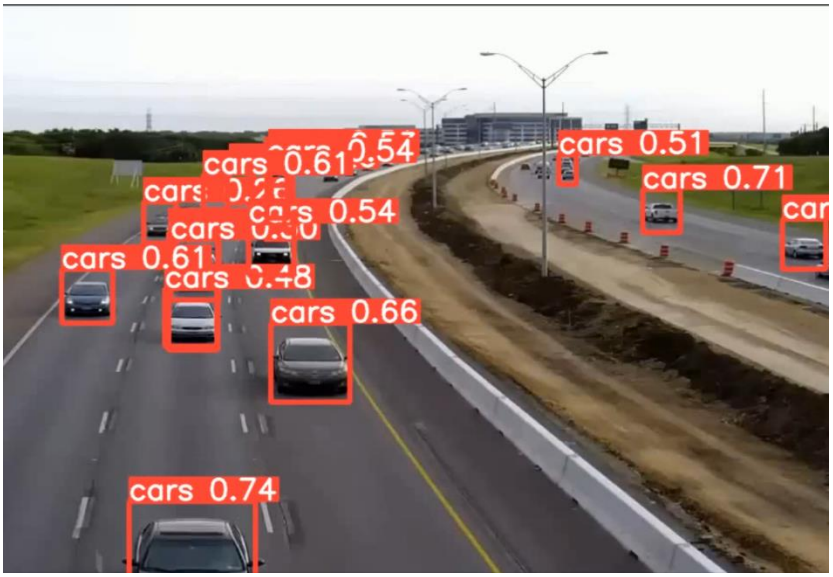


The results on validation set

- Precision: 0.879
- Recall: 0.792
- MAP50: 0.883
- mAP50-95: 0.5

the conf threshold for all predections set 0.2



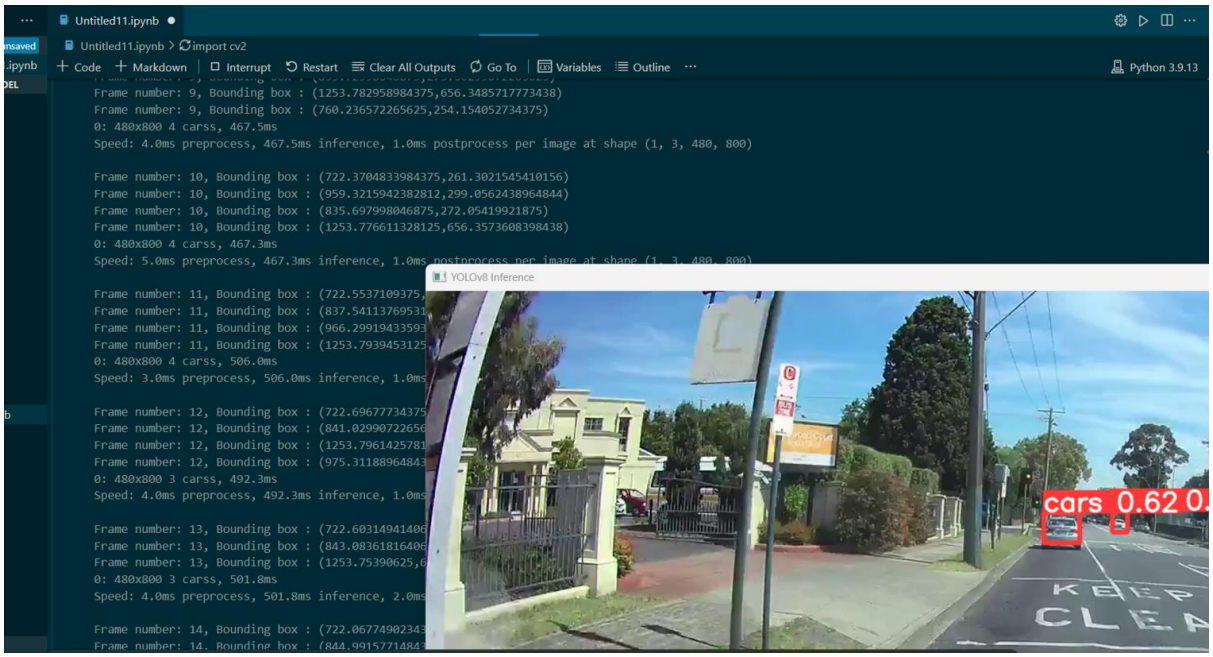


The problem at the model that we can notice the recall at it when we try it on the traffic videos there's some of garbage with the detected cars. In my opinion in this type of models which it will be use for real time detections the recall will be problem because I don't want any false detections but at the other hand the precision will not be that problem because there is a lot of frames to detect the objects if the model didn't detected the object in the first or second frame it will detect it at the third frame . I can handle this problem using the "confidence threshold".

confidence threshold: It determines the minimum confidence or certainty level required for an object detection prediction to be considered valid or reliable.

Bounding Boxes per Frame:

At this Stage I started to make code that take path of my video and start annotating the objects at each frame by drawing bounding boxes around the detected Cars using my trained model and print the centroid of my bounding boxes at each frame



The references int the project :

- Roboflow projects
- Ultralytics YOLOv8 documentation