Tesla Autonomous Vehicle Detection - YOLOv8 Project

Part 1

[the doc can be read in conjunction with ref:

https://github.com/Rimbik/assessments/blob/main/gen-ai/capstone1/autonomousCar/Code/capstoneReadmeVD.pdf

For Tesla autonomous vehicle detection, building a self-made CNN-based model from scratch is extremely challenging.

The **first challenge** is object identification—determining **whether an object is a vehicle or not** is itself a major hurdle.

Then comes the challenge of identifying the type and number of vehicles.

Given the objective and the annotation .csv provided with the assignment, the approach chosen was:

Use a pre-built (semi/full) model and customize it using the dataset, which aligns with the assignment's purpose.

Among many available models and technologies, we chose the **YOLOv8** model to train on our custom images and dataset.

Implementation Steps

Step 1: What We Have

- All the training images
- Their annotation CSV file

Step 2: Why We Didn't Use the Provided CSV

The existing .csv annotation was found to be **faulty**:

• Many entries in the CSV had **filenames without corresponding images**.

• For instance, the image 00000009.jpg should have an annotation entry labeled "00000009", but this consistency was not found.

Decision: Create a **fresh annotation CSV** and generate **YOLOv8-compatible YAML** for training data.

Step 3: Image Uploads

Due to GitHub's file size limits, images were uploaded in .rar format (~19MB each).

- All images were uploaded to GitHub in split .rar format
- Downloaded and extracted via code to recreate the complete image dataset locally

Step 4: Annotation Preparation

- Created a fresh annotation CSV
- Converted CSV to YOLOv8 YAML format for training
- Used manual tools to rectify annotation coordinates when required

Step 5: Model Training

- Trained the YOLOv8 model with:
 - 10 epochs
 - Early stopping
 - Saved model as .pt file for future inference

Step 6: Inference

Ran inference on the saved .pt model to achieve:

- Vehicle detection with bounding boxes
- Vehicle count on roads

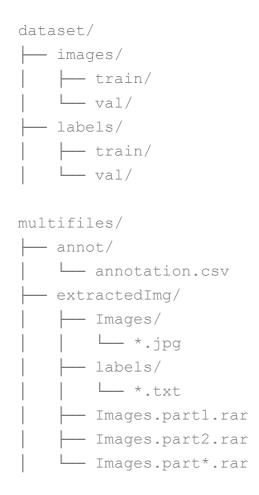
GitHub Repository

The entire codebase is available publicly on GitHub for:

- · Easier access
- Further learning and experimentation

Project Directory Structure

[all are autogenerated on code exucution in google colab]



public

Source code: https://github.com/Rimbik/assessments/tree/main/gen-ai/capstone1/autonomousCar/Code