

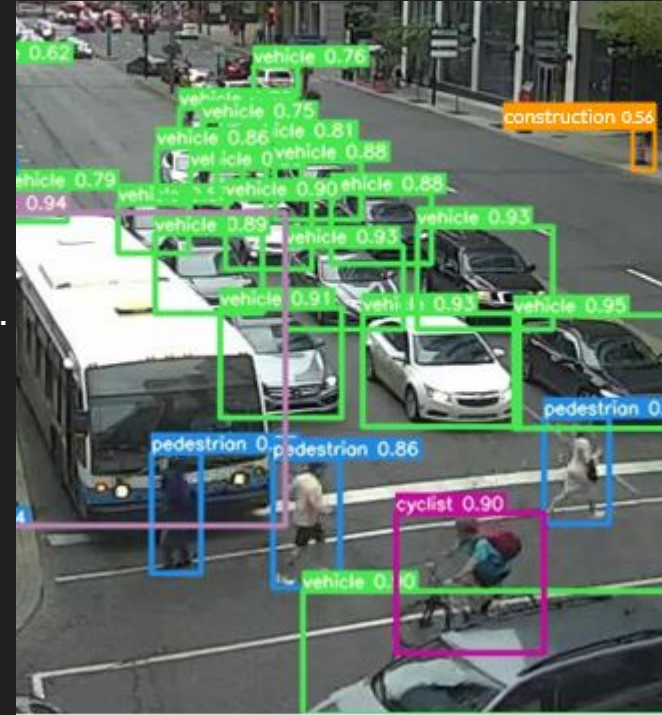
Final Report



Problems Statement

Use existing model to focus on detection of green street signs.

- Use YOLOv5 object detection model.
- Retrain YOLO model to only detect green street signs.
- Success: Identify at least 90% of the green street signs.



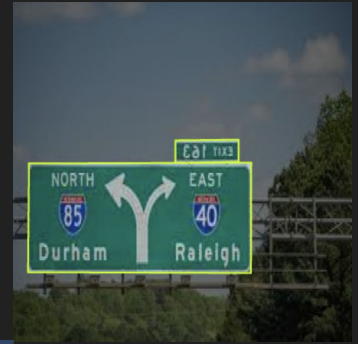
Data Wrangling

- YOLO version 5 model can be found at this Git repository.
 - <https://github.com/ultralytics/yolov5>
- Images for train were obtained two ways:
 - Internet searches
 - Frames pulled from driving video



Exploratory Data Analysis

- Uploaded 120 images to Roboflow.
- Annotate green signs in each of the images.
- Splits the images into train, test, and validation set.
- Exported all the data to use for training and testing.



Attempted Model Training with Tensorflow



- Used transfer learning on an already existing YOLO model.

Training of the object detection model proved to be a rather difficult process.

- Difficulty with python libraries and their dependencies.
 - Virtual environments, not successful getting Tensorflow to successfully run.
 - Discovered Mac OS required a special installation of Tensorflow.
 - Successfully installed Tensorflow.
 - Tensorflow kept killing my notebook kernel.

Attempted Model Training with Pytorch

- Tried using Pytorch instead of Tensorflow
 - Training the model, ran into problems.
 - Pytorch tried to incorporate Tensorboard.
 - The process again failed.



TensorBoard

Attempted Model Training with Colab

Try to train model using a cloud platform rather than locally.

- Used tutorial on how to train a custom model in Google Colab.
- Customize the process for green street signs.
- This process was successful.



Finally train and tested model:

- Training (84% of pictures), validation (12% of pictures), testing (4% of pictures)
- 500 epochs
- Batches of 80 images

Results

- Here are a few pictures that have been run through the model.
- Successful in detecting green street signs near and far with high levels of confidence.
- Bounding box accuracy could be increased.



Results

Here is the model run on a video.

- Model detected all signs.
- Confidence levels as high as 0.97.
- A few frames that had incorrect detections.
- Raising confidence threshold eliminated misdetections.

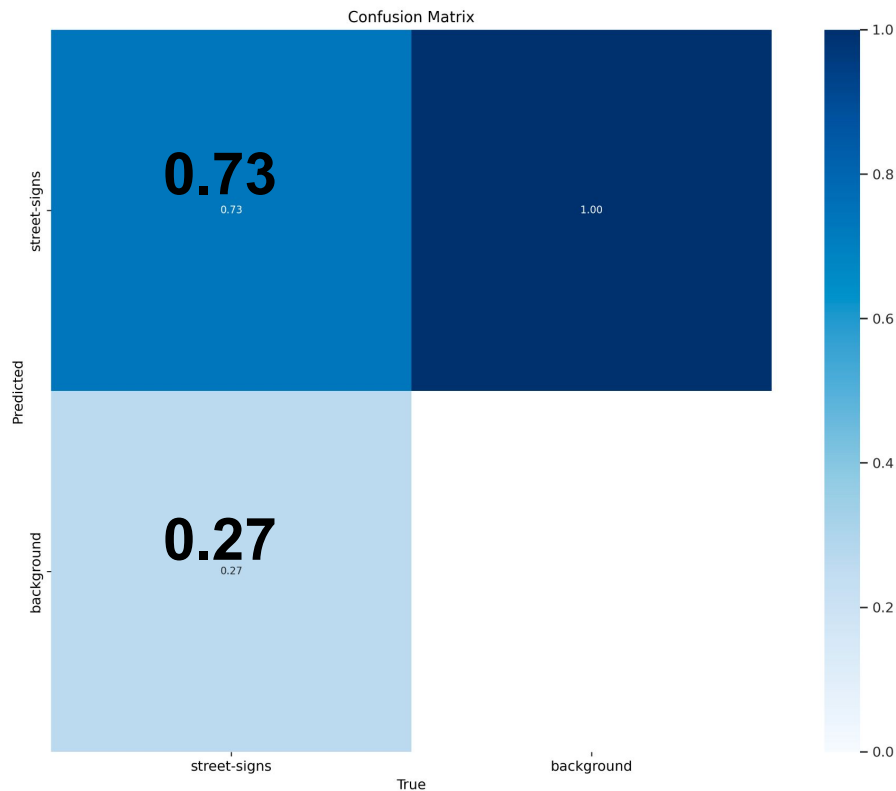


Results

Confusion matrix:

Green Street Sign Detection

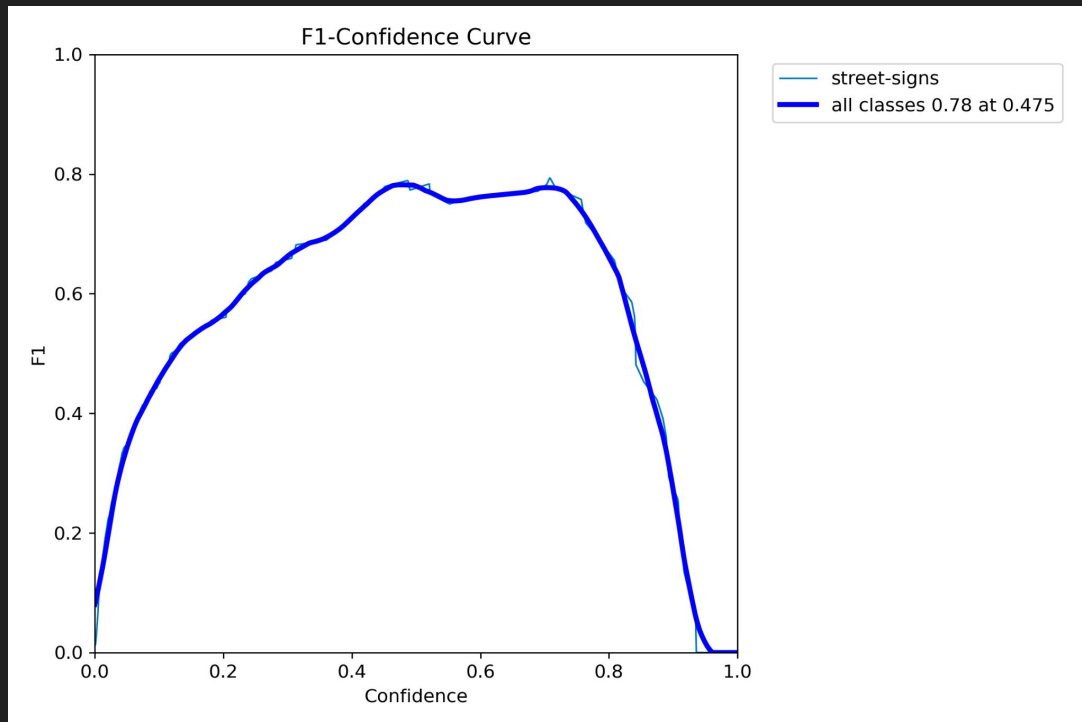
- 73% success rate
- 27% predicting background when it was actually street sign



Results

F1-Confidence Curve

- Confidence value of 0.475
- F1 score maximum of 0.78
- This F1 score is a good value
- Can be improved with further training.



Future Research

- Improve the detection accuracy of the green street signs.
 - Eliminate the incorrect detections.
 - Increase bounding box accuracy.
- The sign detection is the first step in a multi-step project:
 - Detect sign.
 - Detect letters on sign.
 - Recreate street sign with green background and white letters.
 - Display the recreated sign for users to more easily read.
- Apply project process to another object for detection.