



Object Detector for Road Signs

By Ka Hung Lee

A blurred, high-speed photograph of a train track receding into the distance. The tracks are dark and run parallel, leading the eye towards a vanishing point. Above the tracks, a large, dark, curved bridge structure dominates the upper half of the frame. The background is heavily blurred, showing hints of greenery and other tracks, suggesting rapid movement. The overall color palette is muted, with greys, blues, and greens.



- Roads and motorways are essential infrastructure that physically connects places together
- They also provide ease of access for vehicles to travel
- Road signs or traffic signs are constructed to guide or provide instructions for road users

Where is that sign?

- However, there could be times when user wish to:
 - Locate/Identify specific road signs
 - Be made aware of upcoming road signs
- To solve this problem, we could create a program that could detect specific road signs









Data



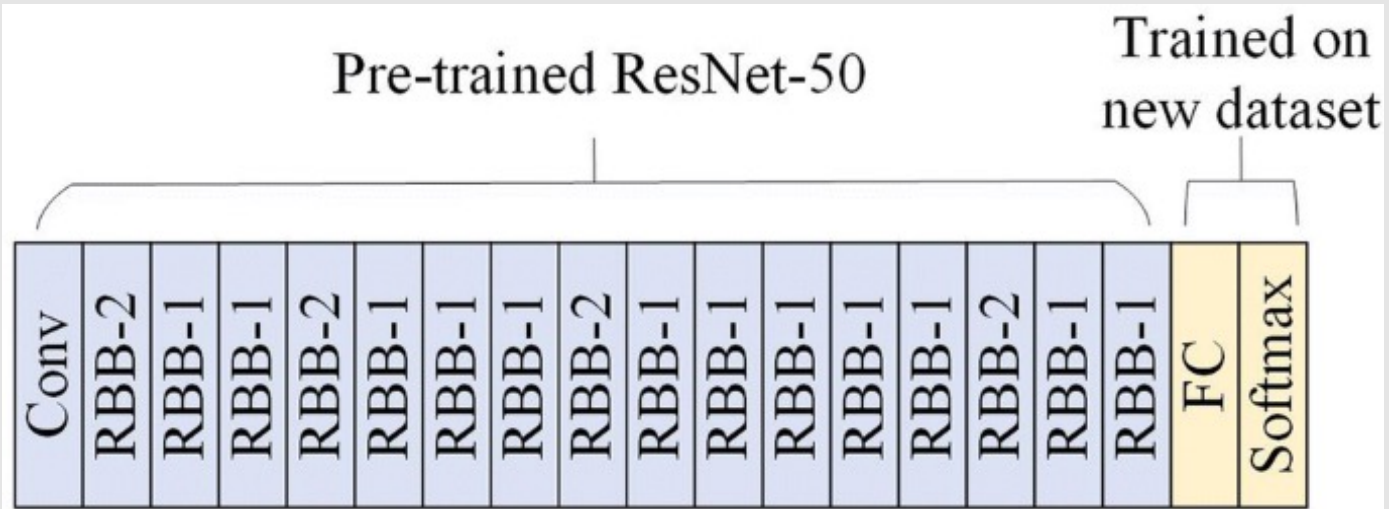
- Source:
<https://www.kaggle.com/andrewmvd/road-sign-detection>
- 877 images with 4 classes (trafficlight, stop, speedlimit, crosswalk)
- Existing labels were modified with 2 additional classes using Labelling (nostop, yield)
- 100 images were added through image augmentation to increase the sample size of yield

Number of Labels

- The dataset was partitioned roughly 9:1 (training/validation split)

|  |  |  |  |  |  |
|---|---|--|---|---|---|
| Label Name | | | | | |
| trafficlight | stop | speedlimit | crosswalk | nostop | yield |
| Total | | | | | |
| 176 labels | 93 labels | 862 labels | 298 labels | 107 labels | 111 labels |
| Training Size | | | | | |
| 162 labels | 77 labels | 780 labels | 263 labels | 97 labels | 94 labels |
| Validation Size | | | | | |
| 14 labels | 16 labels | 82 labels | 35 labels | 10 labels | 17 labels |

Our Model



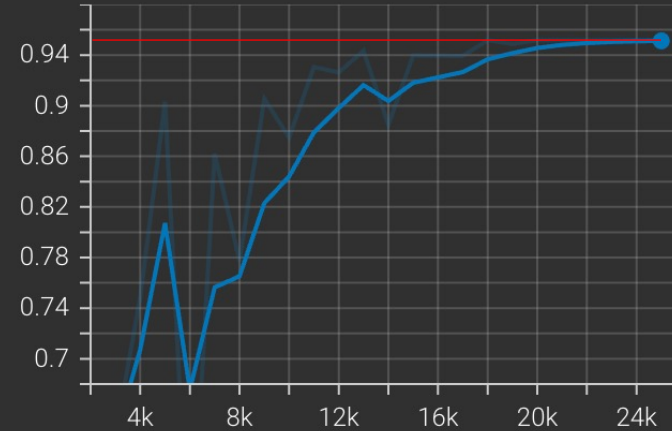
- Our model utilizes the saved weights of a pre-trained Retinanet Object Detection model (SSD with Resnet 50 v1) to train our customized model
- The model was trained for 25000 steps (2000 warm-up steps)

Model Performance (Validation Set)

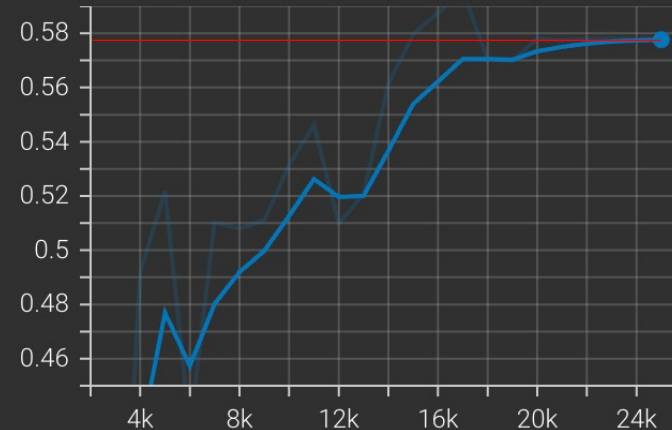
For static images, the model perform well for large objects, and less so for small objects

Precision

DetectionBoxes_Precision/mAP (large)
tag: DetectionBoxes_Precision/mAP (large)

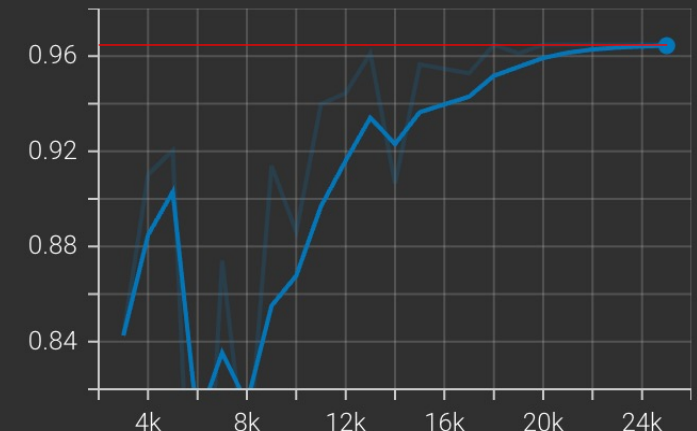


DetectionBoxes_Precision/mAP (small)
tag: DetectionBoxes_Precision/mAP (small)



Recall

DetectionBoxes_Recall/AR@100 (large)
tag: DetectionBoxes_Recall/AR@100 (large)



DetectionBoxes_Recall/AR@100 (small)
tag: DetectionBoxes_Recall/AR@100 (small)



Validation Set



Video Test and Conclusions



- The model was able to detect objects on video
- Apparent issues:
 - Detection for yield is spotty
 - Cars are mistaken for trafficlights
 - Certain road signs can only be detected close up

Potential Improvements

- Include more size variation for labels
- Include images of labels in traffic settings
- Increased sample size