# Subtask 1: The No-Entry Sign Detector

## Training Performance

Figure : True Positive Rate and False Positive Rate for each stage

Training performance improved rapidly over the three stages. The initial stage had only 100% rate of true and false positives by evaluating every image to be positive. The two next stages quickly reduced the false positive rate to 1.65% and 0.05% respectively. The true positive rate remained at a constant 100% throughout, exposing the model’s bias towards positive images on the training data. This is because the positive images are very straightforward and are tested on the same data that it is trained on.

## Testing Performance

A picture containing text, tree, outdoor, sign

Description automatically generatedCompared to the training, the model performed considerably worse on testing data than training data. The true positive rate averaged 58.5% and an F1 score of 0.477. Due to the testing positives being partially obscured (Figure 2) while varying much in shape and proportion (Figure 3), there is a considerable drop of the true positive rate from the training performance.

The model is unable to spot signs without the high contrast borders that are present in the positive training images and is also unable to distinguish between brighter areas in images and the main white stripe on the stop sign. This is most likely due to the regularity and lack of variety of the positive training images or the model being underfitted.

Adjusting the model’s ‘minNeighbours’ attribute resulted in a worse true positive rate and overall F1 score, however much increased the model’s reliability (Figure 5). This could be argued to perform better depending on the context the model is used for.

Figure : Obscured signs

A picture containing text, sign

Description automatically generatedPerformance could be improved with a wider variety of training images, both positive and negative. A further stage in the model’s creation process could theoretically improve performance by reducing underfitting but experimentation with 3 stages resulted in a massively reduced true positive rate and therefore overfitting.

Figure 5: Min neighbours against various scores

Figure : Mistaken white stripes

Figure 3: Obscured and difficult orientations

# Subtask 2: Integration with Shape Detectors

A picture containing text, tree, outdoor, sign

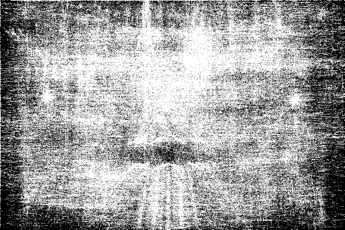
Description automatically generatedA picture containing text, building, altar

Description automatically generatedA picture containing text, street, sign

Description automatically generatedA picture containing text

Description automatically generated

A close-up of a person's chest

Description automatically generated with low confidence

A picture containing night sky

Description automatically generatedA picture containing tree, outdoor, night

Description automatically generated