



Traffic Sign Classification Using Artificial Intelligence

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**Can self-driving cars learn the
difference(s) between objects?**

Overview

- ❖ Trained 3 different convolutional neural networks (CNNs) on ~4000 images of 5 different kinds of traffic signs:



Stop



Pedestrian
Crossing



Signal Ahead



Speed Limit
(25 MPH)



Speed Limit
(35 MPH)



Model Quality

- ❖ Best model achieved 86% accuracy in differentiating between sign types
- ❖ Used LIME Image Viewer to determine what parts of the pictures were used by the models to make their predictions



Pros and Cons of CNNs

- ❖ Can achieve very high (99%+) accuracy
- ❖ Relatively easy to create and implement thanks to Keras and Google Tensorflow
- ❖ High computational power requirements
- ❖ Need thousands to hundreds of thousands of examples on which to train
- ❖ “Black box” model -- we have no idea what the individual neurons are doing



Our model is ~90% confident that this is a stop sign...



...But it doesn't use the sign itself to guess "stop sign".



Medium/high level of confidence (>50%) that this is a stop sign...



...Based on the sky, road, and trees.



Why does this happen?

- ❖ There is more commonality between pictures than simply the signs themselves
 - E.g. pictures that contain stop signs also contain palm trees, blue skies, roads, and buildings
 - Increasing the diversity of training data will help differentiate traffic signs from the background
- ❖ The model, therefore, does not know where exactly it should be looking
 - Using bounding box data is a direct solution



Conclusions

- ❖ The most successful model achieved 86% accuracy, but it almost never looked at the correct thing in order to arrive at its predictions
- ❖ Amount of training data must be vastly increased in order to achieve further increases in accuracy
- ❖ Bounding boxes can also be used in training set



Recommendations

- ❖ Use images that do not share background features such as landscaping or other context.
- ❖ Create bounding box data, or use datasets that have bounding box features.
- ❖ Choose a model architecture that natively incorporates bounding boxes.



Future Work

- ❖ Use bounding boxes in training data to specify exactly where the model should look in order to make its predictions
- ❖

Thank You!

Data source: <http://cvrr.ucsd.edu/LISA/lisa-traffic-sign-dataset.html>