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

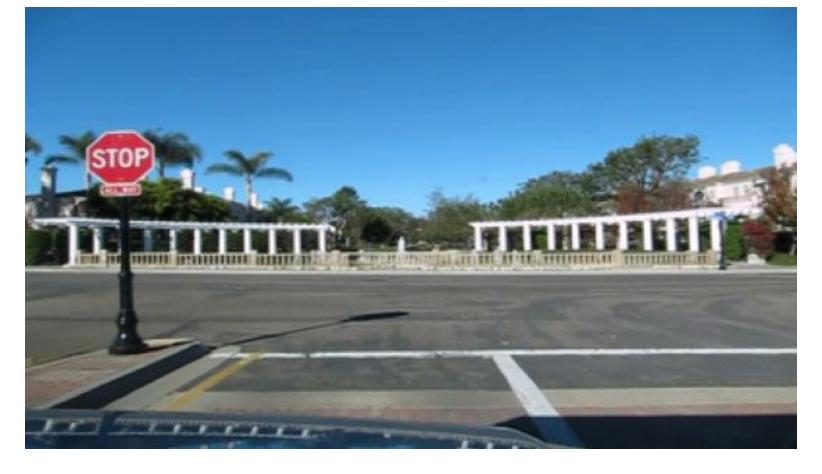
- High computational power requirements
- Need thousands to hundreds of thousands of examples on which to train
- * "Black box" model -- we have no idea what the individual neurons are doing



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!