Traffic Sign Recognition

Link to project code:

https://github.com/sethbunke/CarND-Traffic-Sign-Classifier-Project/blob/master/Traffic_Sign_Classifier.ipynb

https://github.com/sethbunke/CarND-Traffic-Sign-Classifier-Project/blob/master/Traffic_Sign_Classifier.html

Summary of training and testing data:

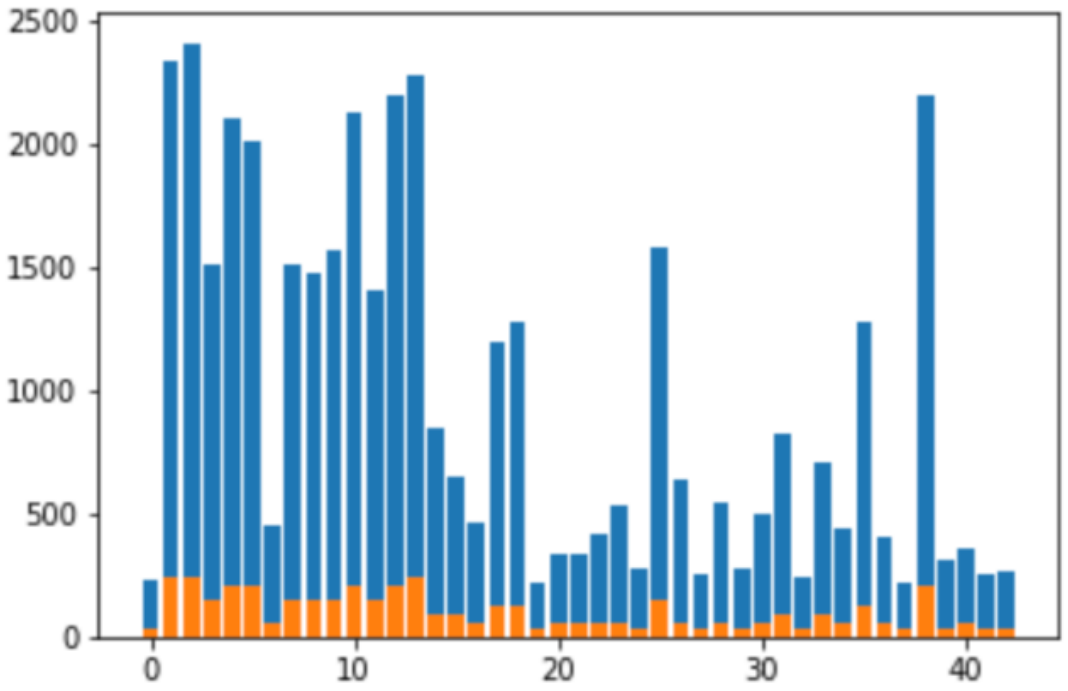
Number of training examples = 34799

Number of testing examples = 12630

Image data shape = (32, 32, 3)

Number of classes = 43

Exploratory visualization of dataset. Initial research of the data sets that were provided indicated very imbalanced data. To attempt to address this I concatenated the training, testing, and validation sets, shuffled that data and split that data between training and validation sets; 80% and 20%, respectively. Please see the notebook for percentages.



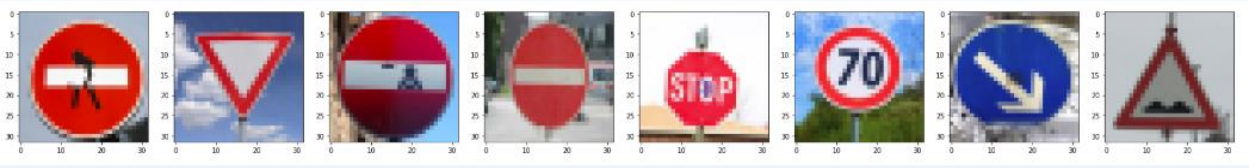
Preprocessing of image data. The preprocessing of the data was limited to min-max normalizing of the data. While I did explore converting the images to grayscale as well as augmenting the images (scale and position/translate – see submitted notebook), I did not apply the techniques to the dataset as I was ultimately able to get ~98% accuracy through a combination of tweaking hyper-parameters and changes to the network architecture. The most significant changes that I made to the architecture (which was based on LeNet), was to increase the depth of the filter on the second convolutional layer to 48 instead is 16 – meaning it would be able pick up more details in every convolution. Also, adding two drop-out layers with 80% keep probabilities.

Model Architecture:

Layer	Description
Input	**32x32x3 RGB**
Conv 5x5	**28x28x6**
Relu	
MaxPool	**2x2**
Conv 5x5	**10x10x48**
MaxPool	**5x5x48**
Flatten	**1200**
Fully Connected	**120**
Relu	
Drop-out	**Keep 80%**
Fully Connected	**84**
Relu	
Drop-out	**Keep 80%**
Fully Connected	**43**

Training the Model. Much of what was provided by LeNet was used. The main was around the number of epochs which was changed to 15 and resulted in an ~98% accuracy rate.

Testing on New Images. The 8 images included below were obtained from the internet and used to test the model.



Test Results on New Images. The model was 75% accurate on the 8 images.

image1.png:

Vehicles over 3.5 metric tons prohibited: 100.00%

SignName: 0.00%

Speed limit (100km/h): 0.00%

Wild animals crossing: 0.00%

Yield: 0.00%

image2.png:

Priority road: 100.00%

No passing: 0.00%

Speed limit (20km/h): 0.00%

Keep right: 0.00%

Yield: 0.00%

image3.png:

Vehicles over 3.5 metric tons prohibited: 100.00%

Wild animals crossing: 0.00%

SignName: 0.00%

Speed limit (100km/h): 0.00%

No entry: 0.00%

image4.jpg:

Vehicles over 3.5 metric tons prohibited: 51.66%

Bicycles crossing: 46.99%

Pedestrians: 0.95%

Dangerous curve to the left: 0.38%

Turn right ahead: 0.01%

image5.png:

Yield: 100.00%

Vehicles over 3.5 metric tons prohibited: 0.00%

Speed limit (70km/h): 0.00%

Speed limit (20km/h): 0.00%

Speed limit (100km/h): 0.00%

image6.png:

Priority road: 100.00%

Speed limit (50km/h): 0.00%

Speed limit (120km/h): 0.00%

Road narrows on the right: 0.00%

Children crossing: 0.00%

image7.png:

Go straight or left: 100.00%

Keep left: 0.00%

Road narrows on the right: 0.00%

Turn right ahead: 0.00%

Double curve: 0.00%

image8.jpg:

No entry: 99.37%

Road narrows on the right: 0.31%

Beware of ice/snow: 0.17%

Traffic signals: 0.12%

No passing for vehicles over 3.5 metric tons: 0.02%

Visualizing the Neural Network. Unfortunately I was not able to get the visualization to work. Any feedback on what I am doing incorrectly will be appreciated.