Traffic Sign Recognition

Writeup

Build a Traffic Sign Recognition Project

The goals / steps of this project are the following:

- Load the data set (see below for links to the project data set)
- Explore, summarize and visualize the data set
- Design, train and test a model architecture
- Use the model to make predictions on new images
- Analyze the SoftMax probabilities of the new images
- Summarize the results with a written report

Rubric Points

Writeup / README

1. *Provide a Writeup / README that includes all the rubric points and how you addressed each one. You can submit your writeup as markdown or pdf. You can use this template as a guide for writing the report. The submission includes the project code.*

You're reading it! and here is a link to my project code

Data Set Summary & Exploration

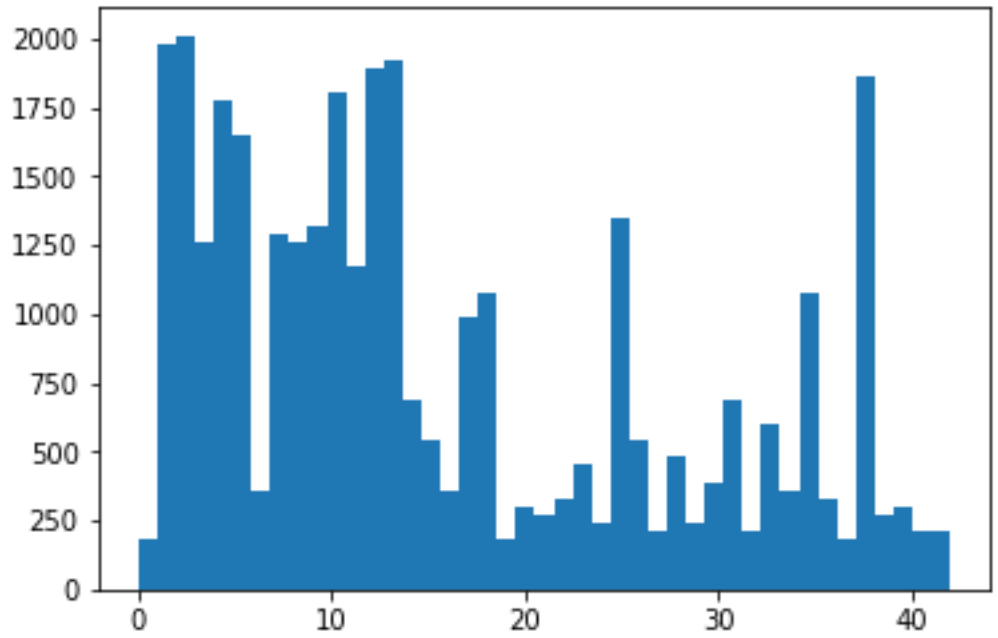
1. *Provide a basic summary of the data set. In the code, the analysis should be done using python, numpy and/or pandas methods rather than hardcoding results manually.*

Inbuilt pandas and numpy libraries were used to initially load and visualize the data.

- The size of training set is 34799
- The size of the validation set is 4410
- The size of test set is 12630
- The shape of a traffic sign image is 32 x32 x3
- The number of unique classes/labels in the data set is 43

2. Include an exploratory visualization of the dataset.

- A histogram was plotted to see the distribution of the labelled class in the data. From the observations we can see, data is skewed as all class labels are not present proportionally.

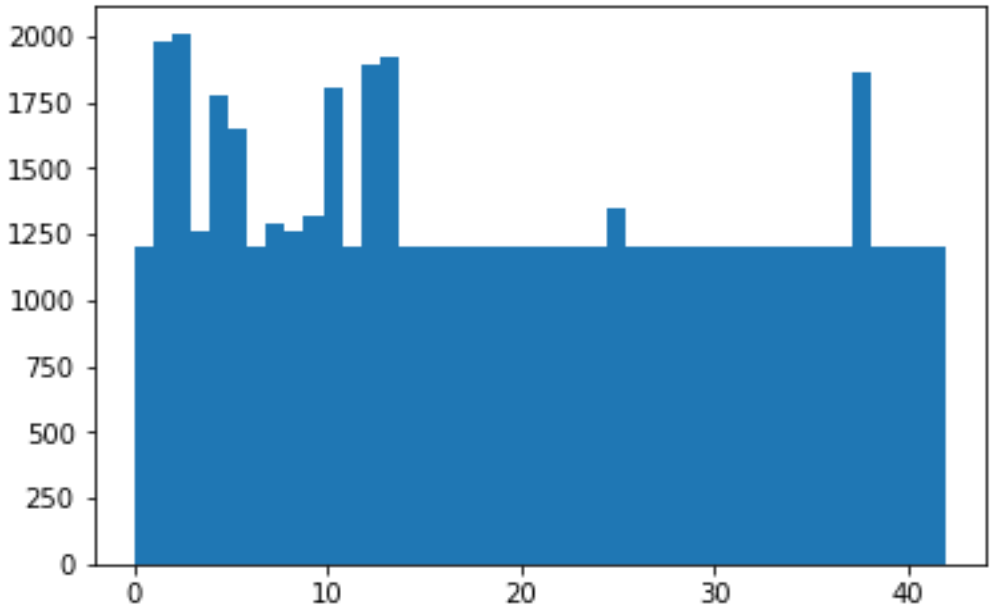


- All 43 unique classes were plotted to see all the different signs and the output is present in the python notebook

Design and Test a Model Architecture

1. Describe how you preprocessed the image data. What techniques were chosen and why did you choose these techniques? Consider including images showing the output of each preprocessing technique. Pre-processing refers to techniques such as converting to grayscale, normalization, etc. (OPTIONAL: As described in the "Stand Out Suggestions" part of the rubric, if you generated additional data for training, describe why you decided to generate additional data, how you generated the data, and provide example images of the additional data. Then describe the characteristics of the augmented training set like number of images in the set, number of images for each class, etc.)

- **Augmentation Of Data**
  As a first step, since the distribution of the classes is not same, I decided to augment the data. This will help in making distribution of classes even. Two concepts were used to generate new images from the current data set:
  - Rotate the image, through the center randomly between 1 to 90 degrees
  - Translate the image by a random shift
  - All the classes having samples less than 1200, were augmented. So finally, the minimum number of samples for each class were 1200. This is as shown in the image below.



- Normalization and Gray Scaling:
  Finally, the complete data was gray scaled and normalized

2. *Describe what your final model architecture looks like including model type, layers, layer sizes, connectivity, etc.) Consider including a diagram and/or table describing the final model.*

My final model consisted of the following layers:

Layer	Description
Layer 1: Convolutional.	Input = 32x32x3. Output = 28x28x6
Pooling	Input = 28x28x16. Output = 14x14x16.
Layer 2: Convolutional.	Output = 10x10x16
Pooling	Input = 10x10x16. Output = 5x5x16.
Fully Connected	Input=400, Output =120
Fully Connected	Input=120, Output=84

Fully Connected	Input =84, Output =10

3. *Describe how you trained your model. The discussion can include the type of optimizer, the batch size, number of epochs and any hyperparameters such as learning rate.*

To train the model, I used below parameters. It was mainly by trial method, I tried to find the parameters.

Batch size=128

Epochs=40

Learning Rate =0.001.

Adam Optimizer was used to update the weights of the model.

4. Describe the approach taken for finding a solution and getting the validation set accuracy to be at least 0.93. Include in the discussion the results on the training, validation and test sets and where in the code these were calculated. Your approach may have been an iterative process, in which case, outline the steps you took to get to the final solution and why you chose those steps. Perhaps your solution involved an already well known implementation or architecture. In this case, discuss why you think the architecture is suitable for the current problem.

The approach, I took to get the 93 % data accuracy, was to Augment the data. On generating the histogram, of original data set it was observed, the data is highly skewed. Hence, I generated more samples for each class an made sure that each class had a minimum of 1200 samples. This will help in a better model and hence better accuracy.

For augmenting the data set, I used two approaches:

- First was mainly to rotate the images randomly.
- Second was to translate the images randomly.

I used OpenCV and wrote two functions to achieve the rotation and translation of images. This augmented data was added to the original data set and the final data was gray scaled and normalized

Test a Model on New Images

Choose five German traffic signs found on the web and provide them in the report. For each image, discuss what quality or qualities might be difficult to classify.

Here are the five images I took from the web:

I took 60, 70 and 30- three speed limit signs, because the images resemble each other, and I wanted to observe how the model behaves in classifying these images.

Further I took the bicycle and the STOP sign.


60
gettyimages
rolfo


70


STOP
gettyimages
Rolfo Rolf Brenner

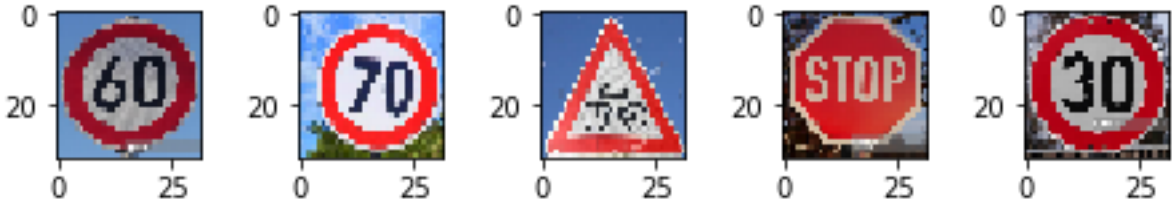

alamy


30
gettyimages
rolfo

2. Discuss the model's predictions on these new traffic signs and compare the results to predicting on the test set. At a minimum, discuss what the predictions were, the accuracy on these new predictions, and compare the accuracy to the accuracy on the test set (OPTIONAL: Discuss the results in more detail as described in the "Stand Out Suggestions" part of the rubric).

The model was able to predict these images with 20 % accuracy. I think the main problem was because the images I took from web were 700 *700 approximately, and when I resized these images, lot of information was lost probably and hence the model could predict these with only accuracy of 20 % .

From were the resized figures obtained. We can observe in these images, resolution is badly effected as compared to original images.



Describe how certain the model is when predicting on each of the five new images by looking at the softmax probabilities for each prediction. Provide the top 5 softmax probabilities for each image along with the sign type of each probability. (OPTIONAL: as described in the "Stand Out Suggestions" part of the rubric, visualizations can also be provided such as bar charts)

Below were the labels marked by the classifier in order of their probabilities.:

1. For image 30 (label 1)
   `[32 1 6 0 38]`

2. For image 60 (label 3)

   `[ 2 3 1 32 0]`

3. For image 70 (label 4)
   `[5 7 3 4 9]`

4. For image bicycle (label 29)
   `[35 25 28 29 23]`

5. For image STOP (label 14)
   `[14 36 21 5 17]`