UDACITY

PROJECT

Traffic Sign Classification

A part of the Self Driving Car Engineer Nanodegree Program

PROJECT REVIEW

CODE REVIEW

NOTES

SHARE YOUR ACCOMPLISHMENT!

Meets Specifications

Excellent work, you nailed it!
👏👏👏

I can see you put a lot of effort in your project and advanced a lot, you should be really proud!

You have shown a firm grasp of the concepts presented here and are good to go.

Keep going and good luck!
Paul

PS. If you have further questions remember you can find me on Slack as `@viadanna`

Files Submitted

The project submission includes all required files.

Good job submitting all required files.

Dataset Exploration

The submission includes a basic summary of the data set.

Good job completing the basic data summary.

This step is essential to build a general idea on the dataset.

The submission includes an exploratory visualization on the dataset.

Awesome

Excellent exploration of the dataset, I can see you put a lot of effort to understand what your model will be dealing with.

Suggestion

I recommend setting the number of bins for the histogram the same as the number of classes to get a better view of the class distribution.

To further explore the dataset visually, you could plot a couple examples from each class. Tip: check out numpy.where.

Design and Test a Model Architecture

The submission describes the preprocessing techniques used and why these techniques were chosen.

Nice implementation of normalization.

Suggestion

A good idea here is to normalize the image data into a range such as [-1, 1] to turn it into a well conditioned problem by having roughly zero mean and equal variance, making it easier for the optimizer to go and find a solution while also preventing the network weights from exploding. You can find more information about this on the course.

The submission provides details of the characteristics and qualities of the architecture, including the type of model used, the number of layers, and the size of each layer. Visualizations emphasizing particular qualities of the architecture are encouraged.

Nice description of the model architecture.

Suggestion

Just slightly confusing as the convolutions are reported `Convolution 1x1` and then a `1x1 stride` is reported, which seems redundant. A better alternative would be reporting the patch size which is `5x5` in this case.

Have your tried visualizing this architecture using TensorBoard?

The submission describes how the model was trained by discussing what optimizer was used, batch size, number of epochs and values for hyperparameters.

Good job reporting the training parameters.

Suggestion

Instead of a fixed number of **epochs**, one alternative is implementing early termination, as overtraining can lead to overfitting. This also frees you to experiment with other hyperparameters and architectures without having to worry about adjusting this.

You can do this easily by defining a max number of epochs, and on each epoch decide to continue or terminate based on the previous values for validation accuracy and/or loss. For instance, if there's no improvement for the last *n* epochs, stop training.

While at it, you could save your model whenever the validation score increases, to keep only the best model found during training.

The submission describes the approach to finding a solution. Accuracy on the validation set is 0.93 or greater.

Nice reasoning for using *LeNet* and good work exceeding the required 93% accuracy on validation.

Suggestion

To learn more about convolutional networks I recommend this book.

Another architecture with good results here is this example for CIFAR-10.

Test a Model on New Images

The submission includes five new German Traffic signs found on the web, and the images are visualized. Discussion is made as to particular qualities of the images or traffic signs in the images that are of interest, such as whether they would be difficult for the model to classify.

Nice evaluation of the new images.

Suggestion

Google Streetview is the perfect place to find more german traffic signs.

The submission documents the performance of the model when tested on the captured images. The performance on the new images is compared to the accuracy results of the test set.

Good job reporting the accuracies for the test set and new images.

Suggestion

For increased robustness, you can use the image augmentation technique to further rebalance the number of examples for each class and to expose your model to a wider variety of image qualities.

Check out this article for a great explanation with examples.

The top five softmax probabilities of the predictions on the captured images are outputted. The submission discusses how certain or uncertain the model is of its predictions.

Awesome

Excellent visualization of the softmax probabilities.

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