Traffic Sign Classification

Files Submitted

CRITERIA	MEETS SPECIFICATIONS	STUDENT COMMENTS
Submission Files	The project submission includes all required files. • Ipython notebook with code • HTML output of the code • A writeup report (either pdf or markdown)	The following files are submitted as part of the zip files. 1. Ipython notebook (Traffic_Sign_Classifier.ipynb) 2. Writeup: Writeup_Traffic_Sign_Classifier.pdf 3. HTML and PDF files of the notebook: Traffic_Sign_Classifier.html Traffic_Sign_Classifier.pdf

Dataset Exploration

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Dataset Summary	The submission includes a basic summary of the data set.	The dataset is a collection of traffic sign images of size 32x32x3
Exploratory Visualization	The submission includes an exploratory visualization on the dataset.	A sample of images are explored and displayed them. The preprocessing steps are initially tested as part of the exploration and later applied the same methods for preprocessing the data set

Design and Test a Model Architecture

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Preprocessing	The submission describes the preprocessing techniques used and why these techniques were chosen.	The preprocessing is done in 4 steps. 1. Convert the image to grayscale 2. Normalize the images 3. Affine transformation, and 4. Perspective transformation.
Model Architecture	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.	**My model has the following architecture** 1.5x5 convolution (32x32x1 in, 28x28x32 out) with 5, 5, 1, 32 filter and stride [1, 1, 1, 1] 2.ReLU 3.2x2 max pool (28x28x32 in, 14x14x32 out) with stride strides=[1, 2, 2, 1] 4.5x5 convolution (14x14x32 in, 10x10x64 out) with filter (5, 5, 32, 64) and strides [1, 1, 1, 1] 5.ReLU 6.2x2 max pool (10x10x64 in, 5x5x64 out) 7.Flatten layers from numbers (5x5x64 -> 1600) and 6 (5x5x16 -> 400) 8.Dropout layer 9.Fully connected layer (1600 in, 120 out) 10.ReLU 11.Dropout layer

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		12.Fully connected layer (120 in, 84 out) 13.ReLU 14.Dropout layer 15.Fully connected layer (84 in, 43 out)
Model Training	The submission describes how the model was trained by discussing what optimizer was used, batch size, number of epochs and values for hyper parameters.	The model used adam optimizer and trained with varying values for learning rate, match size and keep_prob. At rate = 0.00025 keep_probability = 0.8 epochs = 30, and batch_size = 64 the model reached the validation accuracy of over 96% and then I decided to stop the training .
Solution Approach	The submission describes the approach to finding a solution. Accuracy on the validation set is 0.93 or greater.	I started the solution with standard imagenet. In order to reduce the overfitting, I have added drop out regularization. Though not captured here, I have trained the model 3-4 days to finalize the final hyper paramters to achieve over 96% of validation accuracy and over 95% of the test accuracy.

Test a Model on New Images

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Acquiring 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.	I have acruired the new images from
		
		https://mutcd.fhwa.dot.gov/services/publications/fhwaop02084/
		
		and hand crafted the new some images from here to see if the model performs better.
		
		Since the model is tested with german signs and im using the US signs, most of the results came wrong, as expected.
		
		I would like to highlight a couple of images here.
		
		`bl_w_straight_or_right1.jpg`
		
		`ss1.jpg`
		
		These two images I have modified by hand from the standard Us signs and the model performs correctly when I removed the rectangle that surroungs the US signs.

Performance on	The submission documents the performance of the model when tested on the captured images. The	The performance of the model is at 4/12 which is 33.33%

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New Images	performance on the new images is compared to the accuracy results of the test set.	The low performance here is expected as I added more images on top of the minimum 5. Also the standard test set performance is 96.5% which i’m very happy with.
Model Certainty - Softmax Probabilities	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.	These are presented in the notebook or html or PDF in cell 694