Behavior Cloning

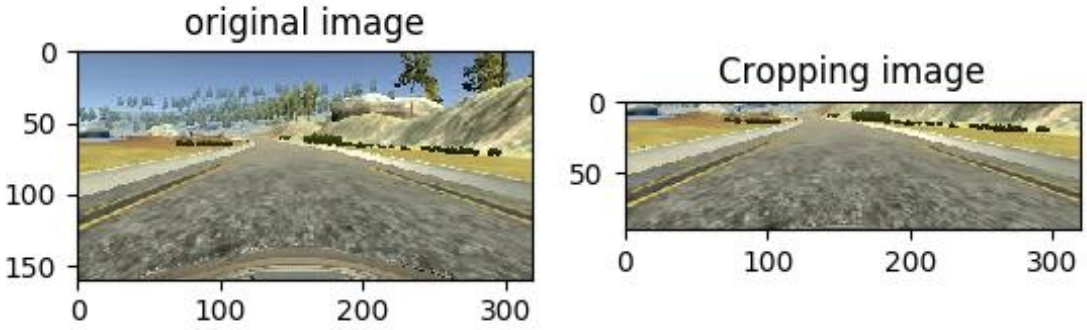
The goals / steps of this project are the following:

- Use the simulator to collect data of good driving behavior
- Build, a convolution neural network in Keras that predicts steering angles from images
- Train and validate the model with a training and validation set
- Test that the model successfully drives around track one without leaving the road
- Summarize the results with a written report

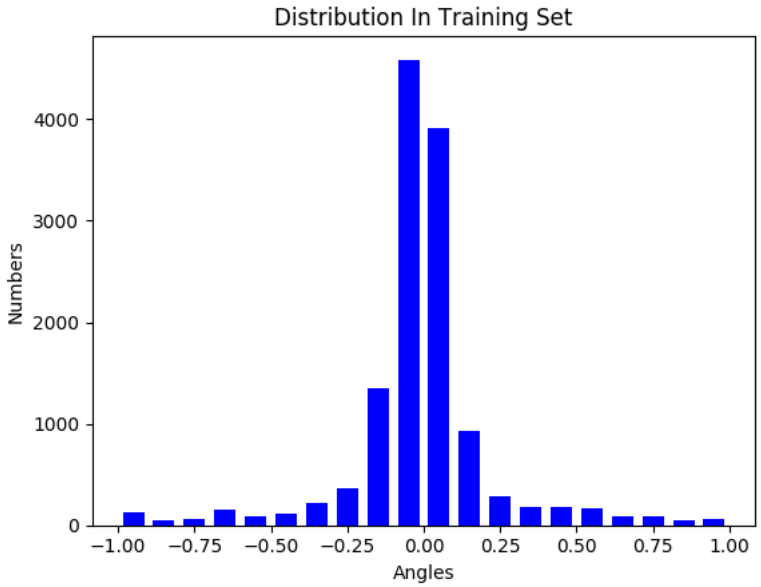
Data Collection and Visualization

I use the simulator to collect data of good driving behavior. First, I collect the data of five laps' correct driving. Then I collect the data of one lap's reverse driving the generalize the data. Finally, I collect one lap's data of sine driving so that the car can learn to go back to the center when it is off the road.

I do cropping on the image and here is the result:



Here is the distribution of data:



Model for training

I first tried Lenet for training a model. However, after times of trying, I found that the performance was not good. So, finding on the Internet, I use the NVIDIA's model structure. Since it has five convolutional layers, it can capture many details, and since NVIDIA uses this model to train real car, I think it definitely has the ability to train my car. Based on that, I changed it a little bit by adding **Dropout** layers to prevent the overfitting. Here is the visualization of my model structure. By the way, I use the **Adam optimizer**.

Layer	Output
/	160 * 320 * 3
Cropping2D	90 * 320 * 3
Convolutional2D, 'relu', Dropout	43 * 158 * 24
Convolutional2D, 'relu', Dropout	20 * 77 * 36
Convolutional2D, 'relu', Dropout	8 * 37 * 48
Convolutional2D, 'relu', Dropout	3 * 18 * 64
Convolutional2D, 'relu', Dropout	1 * 16 * 64
Flatten	1046
Dense	100

Dense	50
Dense	10
Dense	1

Training Set and Validation Set

I use the generator function provided on Udacity's course. I also do a little change on it to augment data. I randomly choose the camera image. If it is the right camera, the angel will minus -0.25, if it is the left camera, the angle will add 0.25. Also, I flip the image horizontally to generalize the data.

Here is the loss:

Test Video

See "Behavior Cloning.mp4"