From Valery Nguyen
Project: Behavior Cloning Project

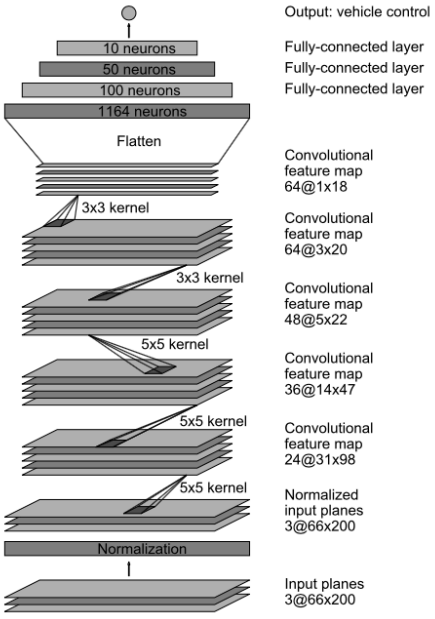
Data Collection:

I started by collecting my own data, doing 3 runs. The first run, I drove in the center of the road for 2 laps. Then I drove on the left side of the road for 2 laps. Finally I drove on the right side of the road for 2 laps. I then combined the images into one folder, and combined the CSV files into one.

Model Architecture:

A. An appropriate model arcthiecture has been employed

1. I started using the VGG19 net, and I left the images size to 160x320. It was however using too many parameters and my computer did not have the resources to run with ti.
2. Then after talking with my peers, I read an article on the nvidia blog, referring to a research paper on self driving car. I have structured my network based on the nvidia paper here: https://arxiv.org/pdf/1604.07316v1.pdf.



3. Instead of using input 160x320 or 66x200 as presented on the paper, I have resized my images to 64x64 so that it is less demanding in computing resources.
4. I used RELU layers as activation for each layer.

B. Normalization of input images

1. I started my model by adding a Keras Lambda layer to normalize my input.

C. Preventing overfitting

1. And I added several dropout layers to reduce overfitting.

D. Model parameter tuning

1. The model used an Adam optimizer with learning was of 0.001 at first (by default). Then I reduced it to 0.0001.
2. I started training my model with batch size of 128. Then I decreased it to 64, to lower the error.

E. Training

1. I have shuffle the input/labels before loading each batch.
2. I used 80% of data set for training, and 20% for validation.
2. And I changed the RGB images to YUV.
3. After each epoch, I saved my weights and tested my model/weights on the test track.

F. Data Augmentation

1. In order to increase my dataset, I used data augmentation methods to increase the variety of input images and I made the angle adjustments necessary for the new images.
2. I have added random horizontal flipping of the images
3. I added random vertical shifts, up to 30% of the height could be shifted.
4. I added random horizontal shifts, up to 30% of the width could be shifted.
5. I added random image rotation, up 15 degrees clockwise or counter-clockwise.

In the end, the car is able to drive autonomously around the track without leaving the road.