Behavioral Cloning Project

Rubric Points – Justification

Required Files

- Are all required files submitted?

  This submission includes a model.py, modified drive.py, model.h5, writeup report and video.mp4.

Qualify of Code

- Is the code functional?

  The model generated was used to successfully operate the simulation

- Is the code usable and readable?

  As per the lectures, the model was implemented using keras and the code is clearly organized and commented as required.

Model Architecture and Training Strategy

- Has an appropriate model architecture been employed for the task?

  The input is normalized using lambda layer followed by convolutional layers with kernel size 5 & 3 with 'relu' activation function. Finally four fully connected layers and compile using adam optimizer.

- Has an attempt been made to reduce overfitting of the model?

  Dataset was split into training/test sets & Data Augumentation techniques like flipping the images horizontally to prevent overfiiting. The model was tested with the simulator to ensure the vehicle drive in the lane.

- Have the model parameters been tuned appropriately?

  Use of adam optimizer eliminated the learning rate parameter.

- Is the training data chosen appropriately?

  The model was first trained with sample dataset provided by udacity. Then the dataset captured from training mode of simulator was used to train the model.

Architecture and Training Documentation

- Is the solution design documented?

  Tough part in the solution design was with the data augumentation. Instead of utilizing the power of transfer learning, I tried to implement a custom model with a lambda layer, 5 convolutional layer with filters (3 & 5) and relu activation function followed by 4 fully connected layer to understand the mechanism of the model.

- Is the model architecture documented?

Layer (type)	Output Shape	Param #
lambda_1 (Lambda)	(None, 70, 160, 3)	0
conv2d_1 (Conv2D)	(None, 33, 78, 24)	1824
conv2d_2 (Conv2D)	(None, 15, 37, 36)	21636
conv2d_3 (Conv2D)	(None, 6, 17, 48)	43248
conv2d_4 (Conv2D)	(None, 4, 15, 64)	27712
conv2d_5 (Conv2D)	(None, 2, 13, 64)	36928
flatten_1 (Flatten)	(None, 1664)	0
dense_1 (Dense)	(None, 100)	166500
dense_2 (Dense)	(None, 50)	5050
dense_3 (Dense)	(None, 10)	510
dense_4 (Dense)	(None, 1)	11

Total params: 303,419

Trainable params: 303,419

Non-trainable params: 0

- Is the creation of the training dataset and training process documented?

  To create the training data, I utilized the sample data provided by udacity. For each image, normalization would be applied before the image was fed into the network.

  Images in the training set:

  a. Center image
  b. Horizontally flipped center image
  c. Left image
  d. Right image

Simulation

- Is the car able to navigate correctly on test data?

  The model was able to guide the vehicle to stay on track with the training information and it would be safe if a human is placed inside. ☺