

15 October 2017

# Behaviour Cloning



In this project we aim to train a car on how to drive on the road autonomously. We train the model to predict the car steering angle using the dashboard camera output. To do so we use behaviour cloning. We collect the training data by driving the car using audacity's simulator. Once we have the required training data, we train the model using keras and then we test our model using the autonomous mode of the simulator.

## Collecting Training Data

We collect data by driving the car on the audacity simulator using the main track. In this project, collecting the data is the tricky part. To make sure our model learn well we followed those steps:

- Two rounds driving in the center of the road in both directions

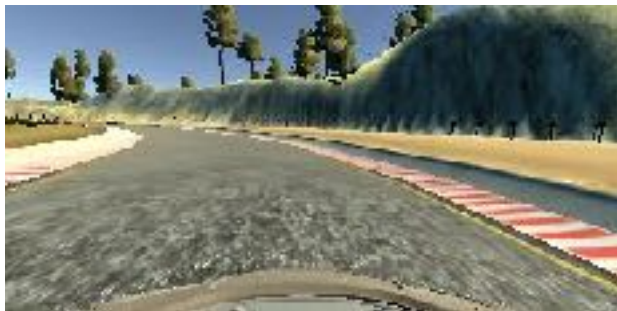
- Focusing only on the turns and recovering
- Cleaning the data



Training the model in different direction helps our model generalise more and learns better on how to drive on different directions.

## Pre-Processing Images

We process the training data by normalising and mean centering the data using keras as a first step. We also crop the main road region as it's the part that contain the features we care for. To help the model generalise more and get more data we use the left and camera output by using a correction parameter to get the right steering angle. We cleanup the data manually specially the recovery run as our model shouldn't include leaning to the edges of the road.

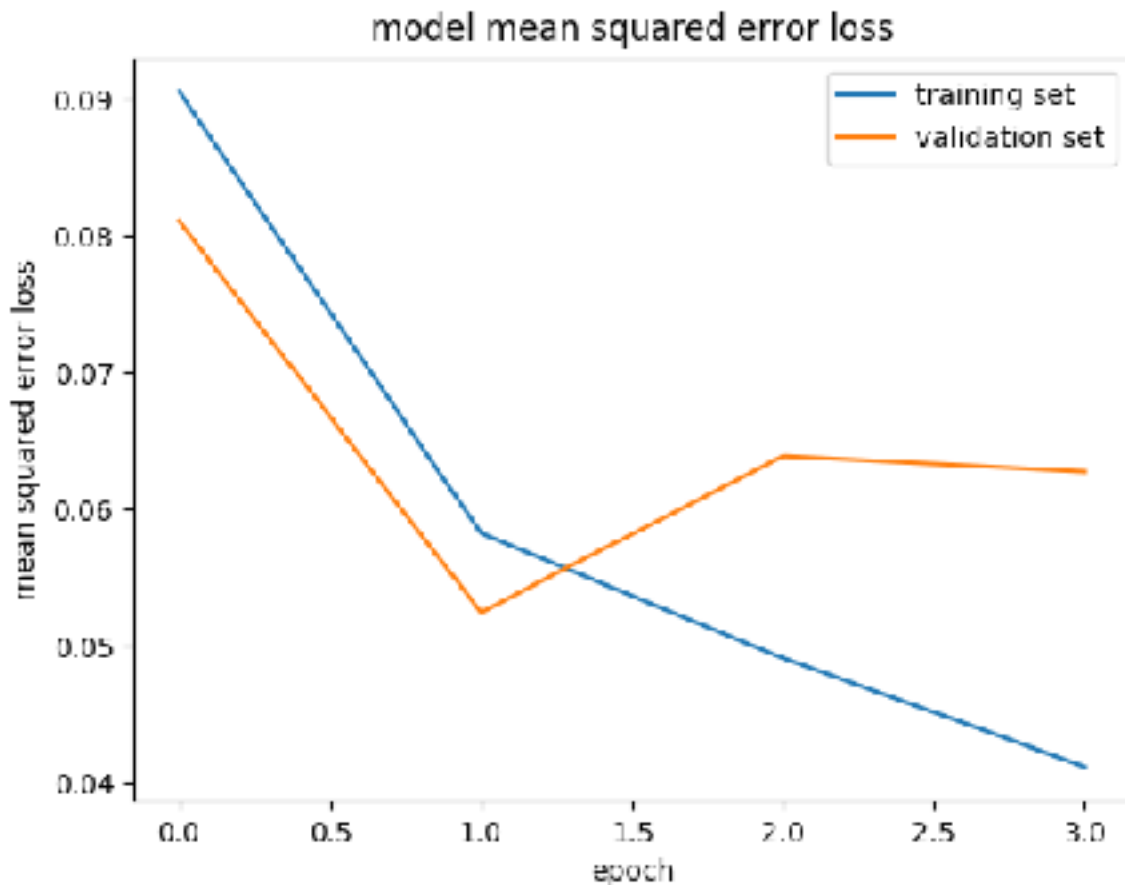


## Training Model

Once the data has been pre-processed we start training our model. We take the images as inout and the steering angle and the throttle as outputs. We experiment training our model using LENet and Nvidia architectures.

```
7915/7915 [=====] - 181s - loss: 0.0706 - val_loss: 0.0811
Epoch 2/4
7915/7915 [=====] - 99s - loss: 0.0582 - val_loss: 0.0524
Epoch 3/4
7915/7915 [=====] - 111s - loss: 0.0491 - val_loss: 0.0639
Epoch 4/4
7915/7915 [=====] - 122s - loss: 0.0411 - val_loss: 0.0627
*** End of the training process. ***
```

## Generating Diagram



## Testing on Main Track

We succeed to run the car through the main track. Our car can successfully predict the steering angle and the throttle parameters and move smoothly through the track.

## Conclusion

In this project we've been able to train a car by cloning the behaviour of human driving. We used Keras as a Framework over Tensorflow to train our model and the Nvidia architecture for driving cars as our neural network architecture. We can improve our model by generating more data that represent different scenarios like changing the light parameters or the lane colours in the images which will help our model generalise more and perform better on different roads.