ENPM 808A

Final Project by Soumosir Dutta

Overview

Training a Robot to navigate moving obstacles

Command directions are angular and linear velocity

A neural network is divised to solve this.

Data Analysis

Based on the fields and feature set

1080 sensor data normalized to 6 directional sensor viewing 270 degree angel

The positional coordinated are kept as is x,y,qr,qk for final goal, local goal and position of the robot

Output is considered to be [v,w] the linear and angular velocity

Model selection and comparison of the errors

mse in training data -LR: 0.08469151131341271

mse in testing date -LR : 0.08275897426599729

mse in training data -Ridge: 0.08469151131345751

mse in testing date -Ridge : 0.08275897544343264

mse in training data -SDGRegressor: 0.08484172256219111

mse in testing date -SDGRegressor : 0.08305160480836499

mse in training data -model_lasso: 0.08971326567345395

mse in testing date -model_lasso : 0.08305160480836499

Training data with neural networks mse: 0.0394

Test Data with neural networks : mse: 0.0397

Lowest error

We see the neural network provided with the lowest

Ein of 0.0394

Eout of 0.0397

Now let is decipher how we optimized our model based on

- hyper parameter tuning
- regularization

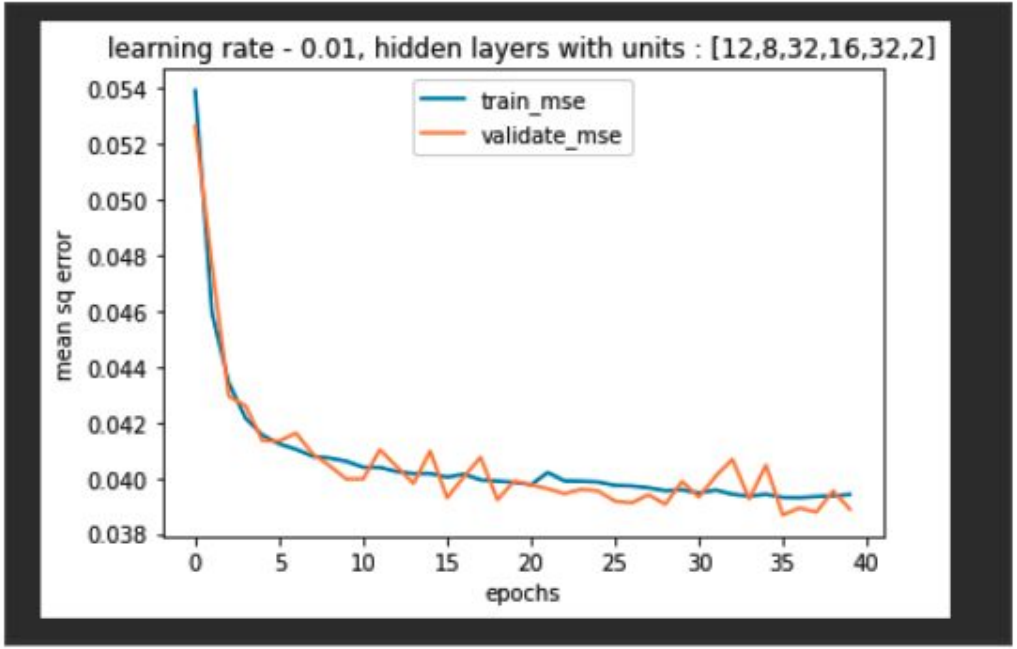
Hyperparameter tuning

1. Number of layers varied
2. Weight in each layes(desnsity of layer)
3. Learning Rate [0.1,0.01,0.001]
4. Regularization
    a. L1 regularizaers
    b. L2 regulariers
    c. Dropout

Final Model and performance

mse: 0.0394 - accuracy: 0.7967 val_mse: 0.0389 - val_accuracy: 0.9234

Layers with units - [12,8,32,16,32,2]



Generalization Error bound

In the present case,
Number of samples in test dataset =389817
And for δ = 0.05, the confidence level of 95% is given by :
And substituting the vaues
0.0397 <=0.0394 + 0.00217521263
The statement hold true.
Hence, if sample outside the current dataset is given for model prediction, the error in that prediction will be within E of predicted value with 95% confidence