

Machine Learning Assignment 1

Multi-layered Neural Network

Umair Ahmad 21i-2081

1. Architecture and Hyper Parameters Used:

Architecture for final model is with 1 input layer of 8 features and 5 hidden layer of 20 x 20 and 1 output layer without activation.

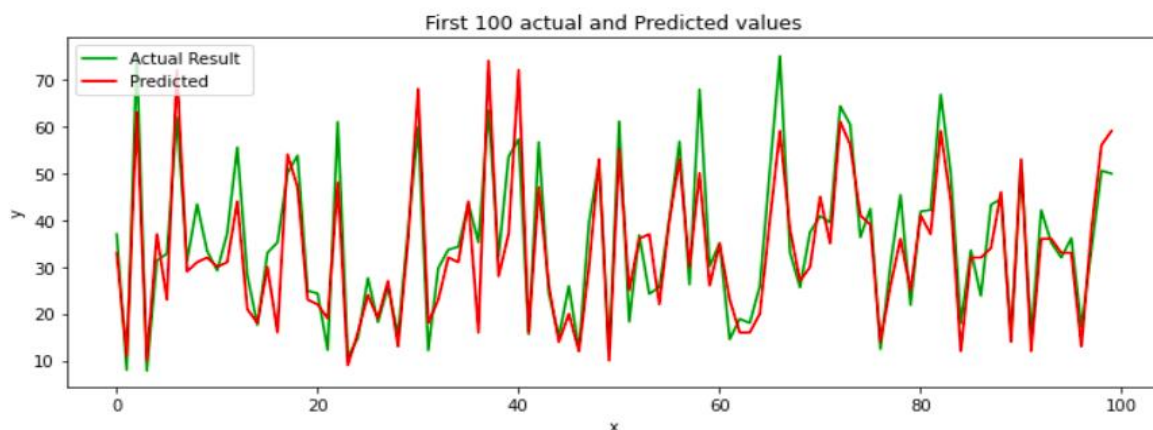
- Input Layer = nn.Linear(8, 20)
- Layer 2 = nn.Linear(20, 20) # Relu
- Layer 3 = nn.Linear(20, 20) # Relu
- Layer 4 = nn.Linear(20, 20) # Relu
- Layer 5= nn.Linear(20, 20) # Relu
- Output Layer = nn.Linear(20, 1) #No Activation

With this architecture of neural networks, it provides RMSE between 5-8 with optimized hyper parameters.

Hyper Parameters used and optimized in this neural network training is learning rate and no of epochs, no of features is already optimized. After 5 cross validations the best and minimum learning parameter this network provides is 0.00455 and no of epochs is 500. Also applied ADAM and SGD both optimizers from which ADAM provides significant good results.

After tasting this model with 70%-30% Split

[6.087293902780079]



Another architecture that I have used to get the lower RMSE is mentioned below

- Input Layer = nn.Linear(8, 20)
- Layer 2 = nn.Linear(20, 20) # Relu
- Layer 3 = nn.Linear(20, 20) # Relu
- Output Layer = nn.Linear(20, 1) #No Activation

2. RMSE of 5 folds

First Run

```
print(models_result)
```

```
[6.1639224033029, 5.255876941504854, 6.443225241690028, 6.00403904455033, 6.531350288061868]
```

Second Run

```
print(models_result)
```

```
[6.916821831045255, 5.917616227686771, 6.700520106452163, 5.826272783302764, 6.499530939923618]
```

Third Run

```
print(models_result)
```

```
[7.234178138070235, 5.936533015357048, 6.092717958449424, 5.605192397962965, 6.561621602072195]
```

Fourth Run

```
print(models_result)
```

```
[6.818424238114631, 5.946223655192912, 6.21142642086487, 5.809605421327265, 6.654816704151487]
```

Fifth Run

```
print(models_result)
```

```
[6.496152707564686, 6.254210702810669, 6.09868341479859, 6.104643041707408, 5.895947347284507]
```

3. Test RMSE Expectations

After analyzing the trained models multiple times and on different folds the observations and statistics of expected RMSE on the test data is most probably between **5.0-9.0**