

OBSERVATIONS:

1.Num_neuron_in_each_layer : [784,100,10]

Activation Function Used : sigmoid

Epochs : 800

Learning Rate :0.00001

Batch Size : 500

Validation accuracy: 85.875%

Iteration: 0

error: 2.2036163044016774

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.
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Iteration: 770

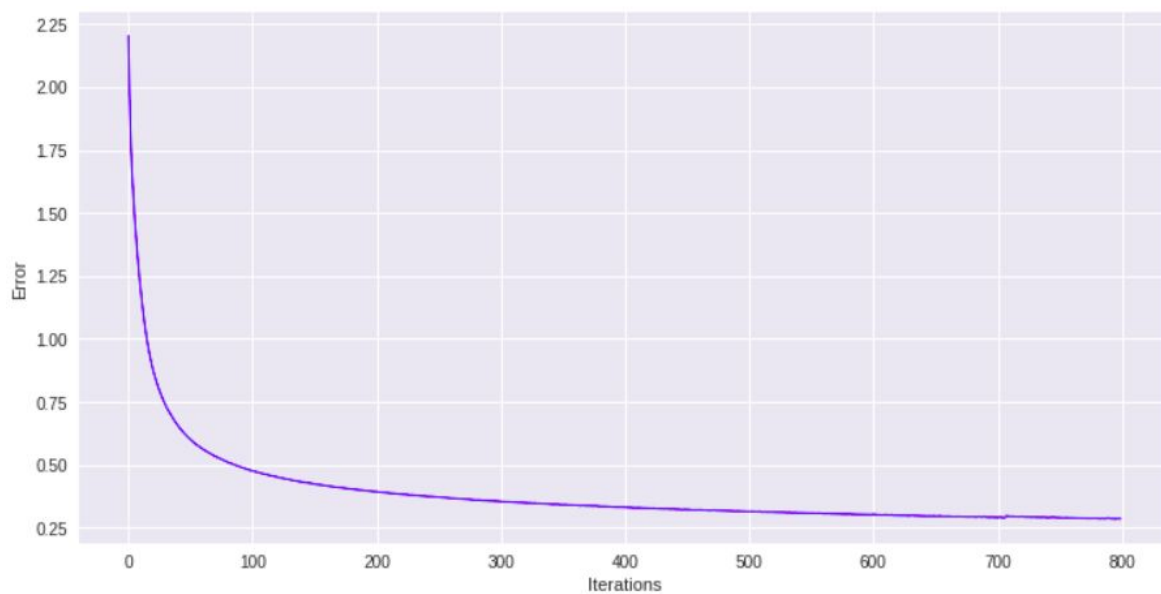
error: 0.28700020517938934

Iteration: 780

error: 0.28575543304231865

Iteration: 790

error: 0.28594103759499684



2.Num_neuron_in_each_layer : [784,100,10]

Activation Function Used : tanh

Epochs : 800

Learning Rate :0.00001

Batch Size : 500

Validation accuracy: 85.95833333333334%

Iteration: 0

error: 1.7576857402869848

Iteration: 10

error: 0.6756829769607707

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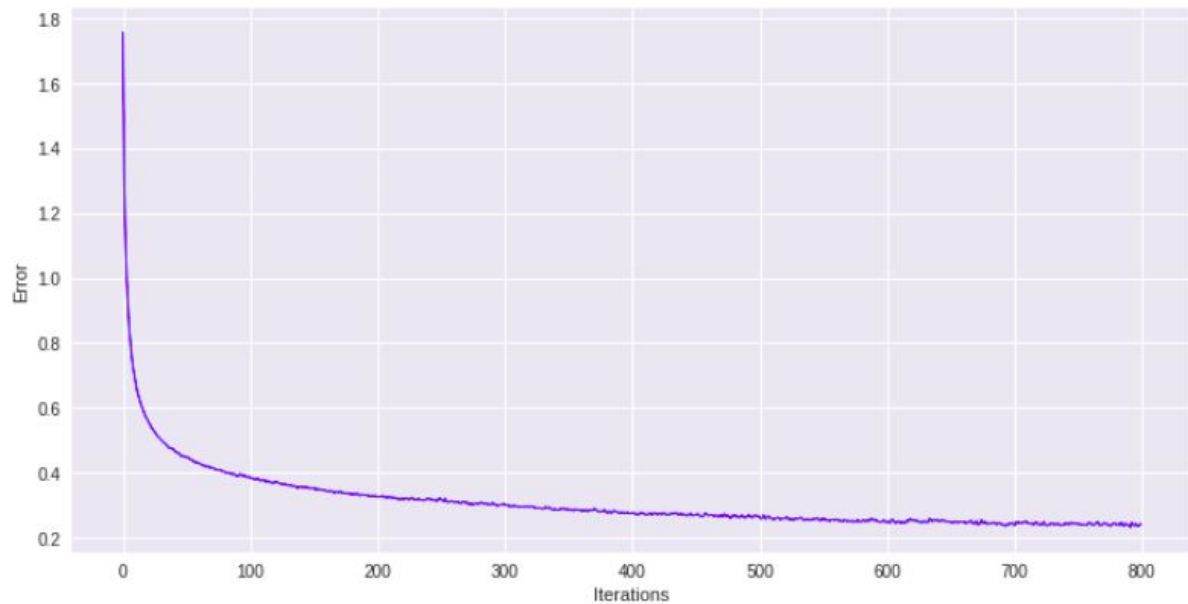
.

Iteration: 780

error: 0.2399188154933641

Iteration: 790

error: 0.23585097059762858



VARIATION WITH BATCH SIZE:

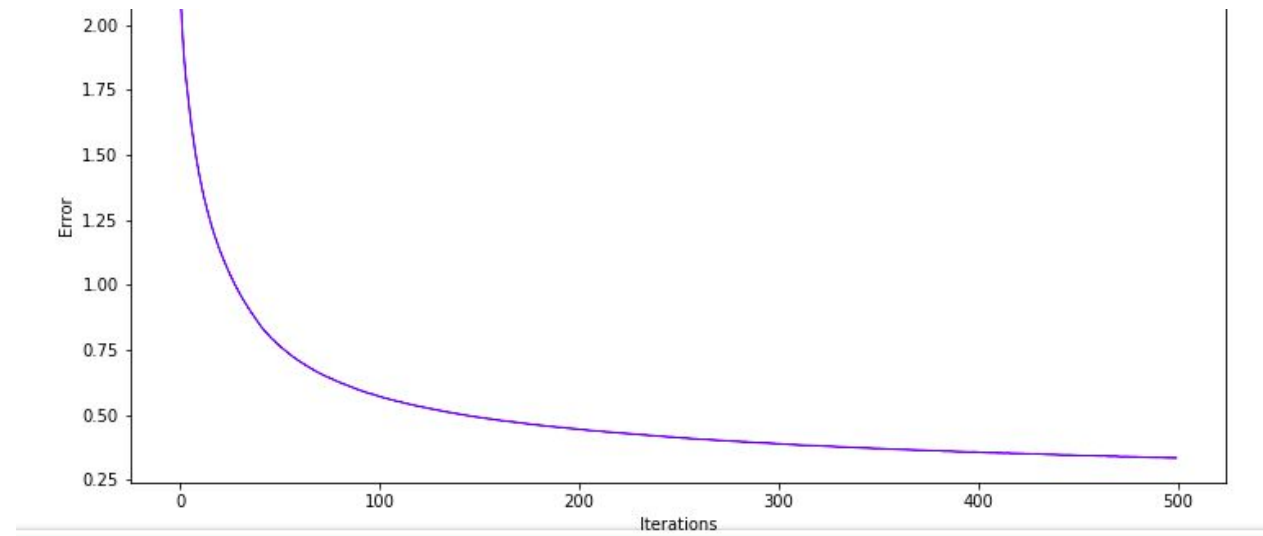
```
1.num_neuron_in_each_layer = [784,100,10]
```

```
Batch size:1000
```

```
neural_net_batch = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "sigmoid" )
```

```
neural_net_batch.model_fit_with_batches(500, 0.00001, train, 1000)
```

Validation accuracy: 84.73333333333333%



```
2.num_neuron_in_each_layer = [784,100,10]
```

```
neural_net_batch = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "tanh" )
```

```
neural_net_batch.model_fit_with_batches(500, 0.00001, train, 1000)
```

Validation accuracy: 85.02499999999999%

Iteration: 0

error: 2.070441552634819

Iteration: 10

error: 0.8898387679540262

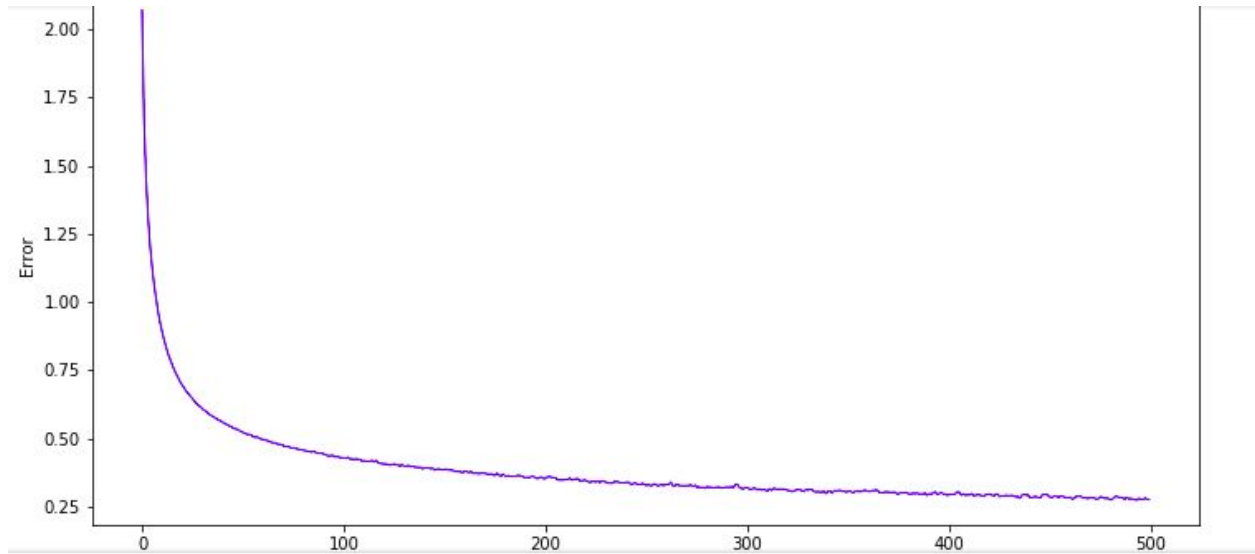
...

Iteration: 480

error: 0.27514505609657364

Iteration: 490

error: 0.2795709371540182



VARIATION WITH NUMBER OF HIDDEN LAYERS:(For number of layers vs prediction loss graph)

1. TWO HIDDEN LAYERS

```
1.num_neuron_in_each_layer = [784,100,100,10]
```

```
Batch size = 40000
```

```
neural_net = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "tanh" )
```

```
neural_net.model_fit(500,0.00001,train)
```

```
print(neural_net.error_list)
```

Validation accuracy: 84.88333333333333%

Iteration: 0

error: 2.3518810124529246

Iteration: 10

error: 1.7506450521453398

Iteration: 20

error: 1.254110479415711

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Iteration: 470

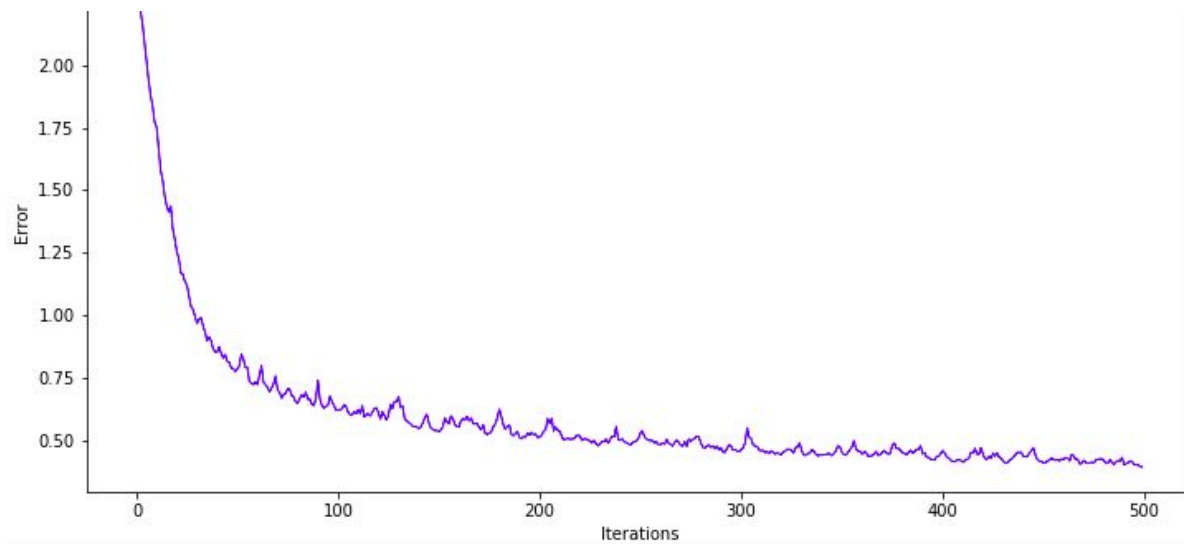
error: 0.4190943576849436

Iteration: 480

error: 0.4185590530151963

Iteration: 490

error: 0.40128287931238926



1.2.num_neuron_in_each_layer = [784,100,100,10]

```
neural_net_batch = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "sigmoid" )  
neural_net_batch.model_fit_with_batches(500, 0.00001, train, 500)
```

Iteration: 0

error: 2.3749455088714804

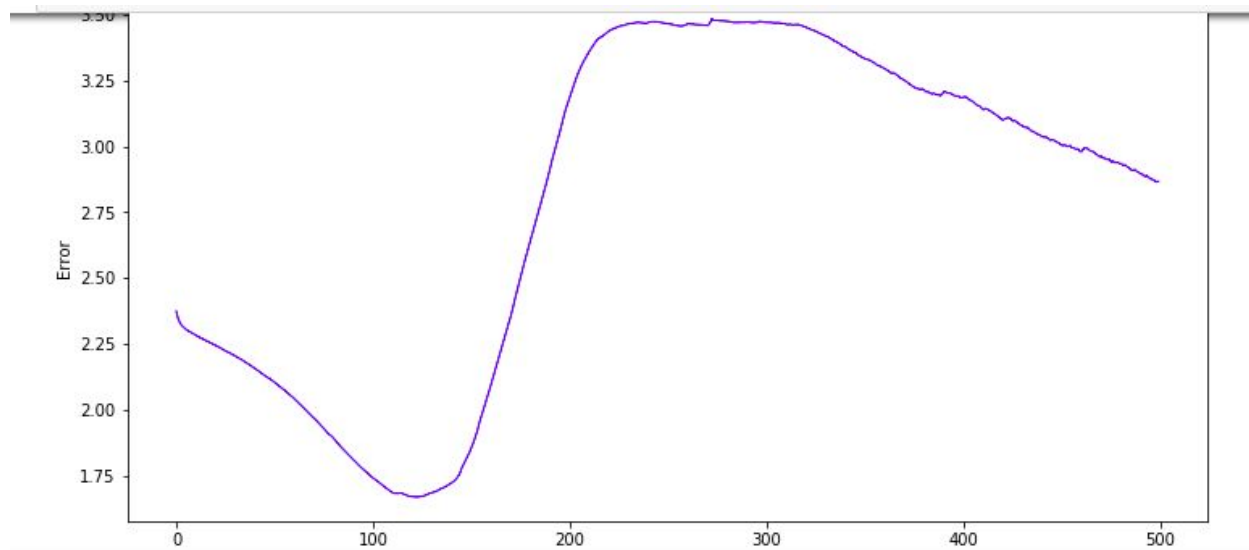
Iteration: 10

error: 2.2831999422421054

.
.
.

Iteration: 480
error: 2.9342775085966246

Iteration: 490
error: 2.8948809077111353
Validation accuracy: 42.20833333333333%



2.WITH THREE HIDDEN LAYERS:

```
num_neuron_in_each_layer = [784,100,100,100,10]  
neural_net_batch = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "sigmoid" )  
neural_net_batch.model_fit_with_batches(500, 0.00001, train, 500)
```

Validation accuracy: 19.8%

Iteration: 0
error: 2.313153539569811

Iteration: 10
error: 2.3023527798180785

Iteration: 20
error: 2.3013075087576924

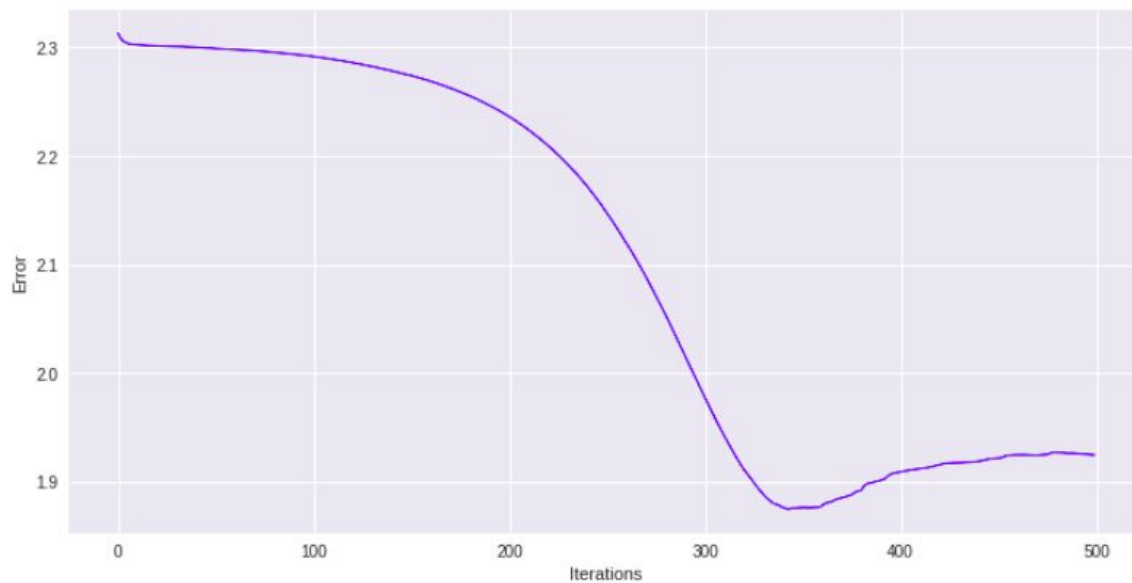
.
.
.
.

Iteration: 460
error: 1.9248747170519647

Iteration: 470
error: 1.9243928711827547

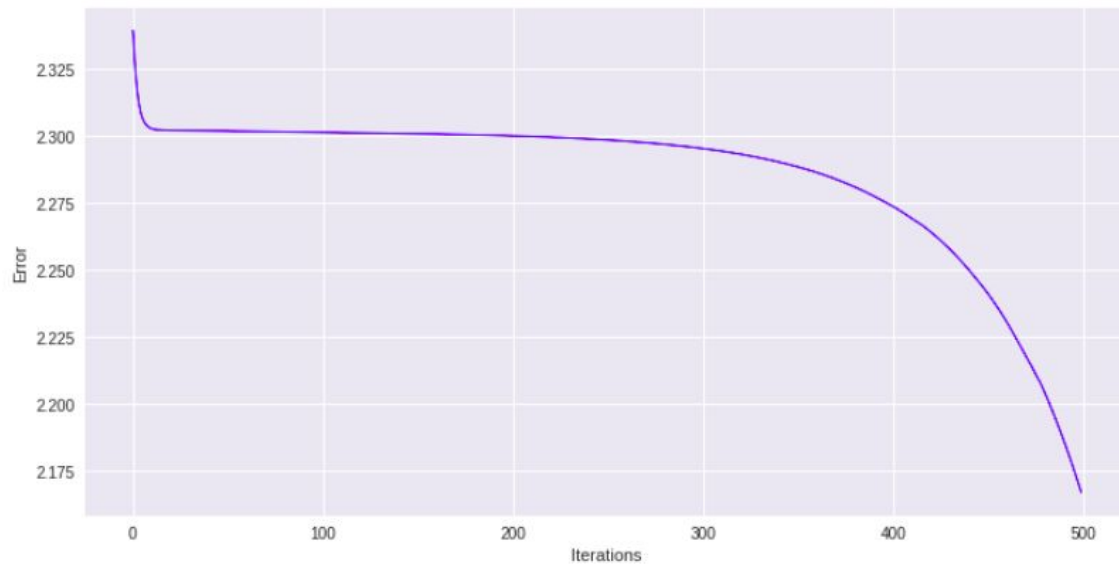
Iteration: 480
error: 1.9268736022884843

Iteration: 490
error: 1.926089844679696



3.WITH FOUR HIDDEN LAYERS:

```
num_neuron_in_each_layer = [784,100,100,100,100,10]
neural_net_batch = NeuralNetwork(784 , 10 , num_neuron_in_each_layer, "sigmoid" )
neural_net_batch.model_fit_with_batches(500, 0.00001, train, 500)
Validation accuracy: 20.283333333333335%
```



BEST ARCHITECTURE: