AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Course No: CSE 4238

Course Name: Soft Computing Lab

Section: C

Semester: Fall 2020

Submitted to:

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Experiment 1 VS Experiment 2 using Dataset A:

Hyperparameters:

In Experiment 1:

```
#Batch Parameters
batch_size = 20
num_iters = 20000
input_dim = 28*28
num_hidden = 200
output_dim = 10

learning_rate = 0.01
```

In Experiment 2:

```
#Batch Parameters
batch_size = 142
num_iters = 20000
input_dim = 28*28
num_hidden = 220
output_dim = 10

learning_rate = 0.001
```

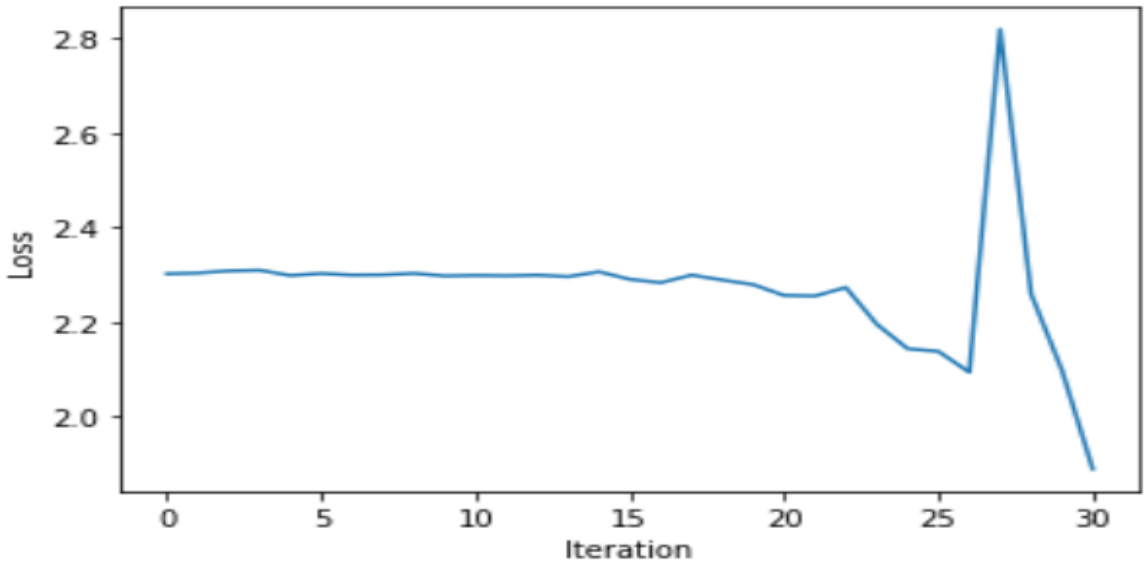
Hidden Layers:

We used six hidden layers in Experiment 1 and four hidden layers in Experiment 2.

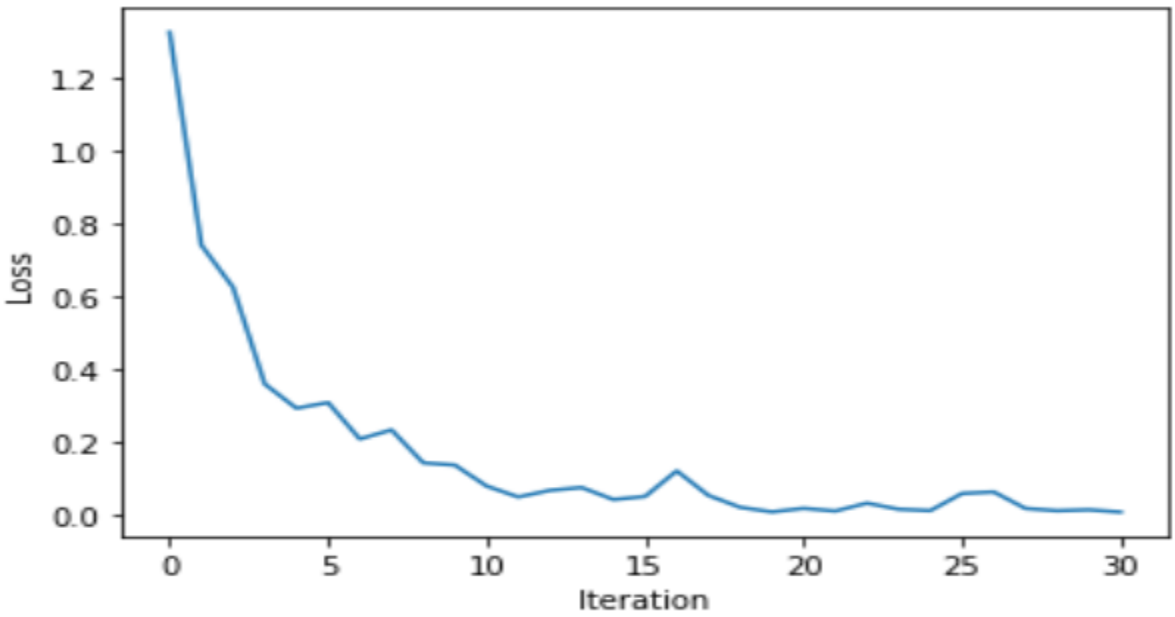
Loss VS Iteration Graph:

Here we showed the Loss VS Iteration Graph comparison between Experiment 1 and Experiment 2.

Experiment 1:



Experiment 2:



Iteration Steps:

Here we showed the accuracy comparison between Experiment 1 and Experiment 2.

Experiment 1:

```
Epoch:  14
Iteration: 10500. Loss: 2.256779432296753. Accuracy: 10.812182741116752
Iteration: 11000. Loss: 2.255619764328003. Accuracy: 19.263959390862944
Epoch:  15
Iteration: 11500. Loss: 2.273759365081787. Accuracy: 19.67005076142132
Epoch:  16
Iteration: 12000. Loss: 2.1960830688476562. Accuracy: 19.01015228426396
Iteration: 12500. Loss: 2.1441211700439453. Accuracy: 21.700507614213198
Epoch:  17
Iteration: 13000. Loss: 2.1384050846099854. Accuracy: 20.685279187817258
Epoch:  18
Iteration: 13500. Loss: 2.0944061279296875. Accuracy: 22.20812182741117
Iteration: 14000. Loss: 2.819862127304077. Accuracy: 11.49746192893401
Epoch:  19
Iteration: 14500. Loss: 2.260526180267334. Accuracy: 17.614213197969544
Epoch:  20
Iteration: 15000. Loss: 2.09901762008667. Accuracy: 22.893401015228427
Iteration: 15500. Loss: 1.889609932899475. Accuracy: 22.715736040609137
```

Experiment 2:

```
Iteration: 14000. Loss: 0.01586131751537323. Accuracy: 90.60913705583756
Epoch:  128
Epoch:  129
Epoch:  130
Epoch:  131
Iteration: 14500. Loss: 0.009729638695716858. Accuracy: 90.40609137055837
Epoch:  132
Epoch:  133
Epoch:  134
Epoch:  135
Epoch:  136
Iteration: 15000. Loss: 0.012226930819451809. Accuracy: 91.11675126903553
Epoch:  137
Epoch:  138
Epoch:  139
Epoch:  140
Iteration: 15500. Loss: 0.006012659054249525. Accuracy: 90.96446700507614
Epoch:  141
Epoch:  142
Epoch:  143
Epoch:  144
```

Here we can see a huge difference in Experiment 1 and Experiment 2. When we applied six hidden layers and above shown hyperparameters, we did not get expected accuracy in Experiment 1. We got 22.715% highest accuracy. But after

Changing the hyperparamters, reducing the hidden layers, using Adam optimizer and also using Softmax activation in one of the hidden layers, we got highest accuracy as 91.116% in Experiment 2.

We applied these Experiments on dataset A.

Comparison Between Dataset A and Dataset 2:

Hyperparameters:

Dataset A and Dataset 2:

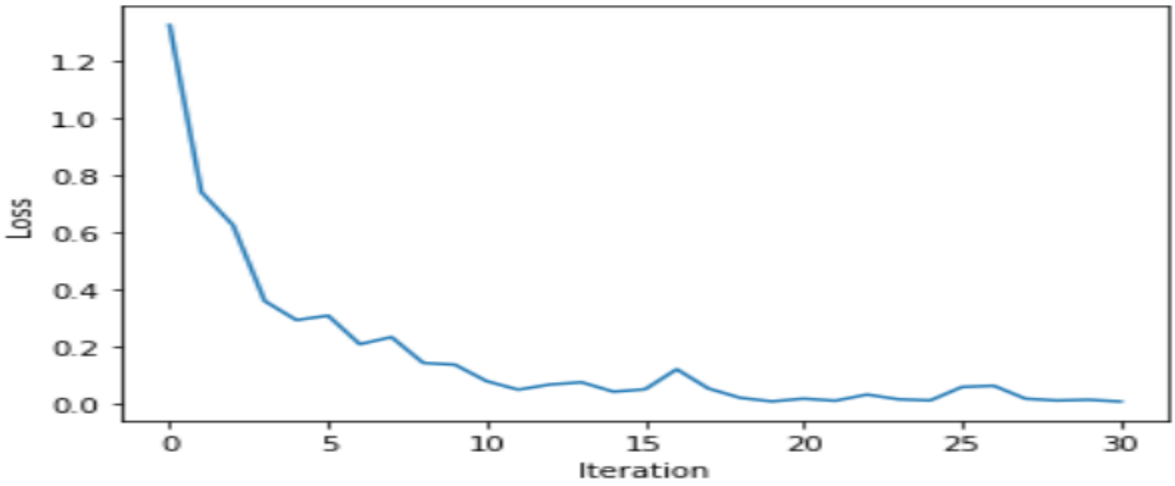
```
#Batch Parameters
batch_size = 20
num_iters = 20000
input_dim = 28*28
num_hidden = 200
output_dim = 10

learning_rate = 0.01
```

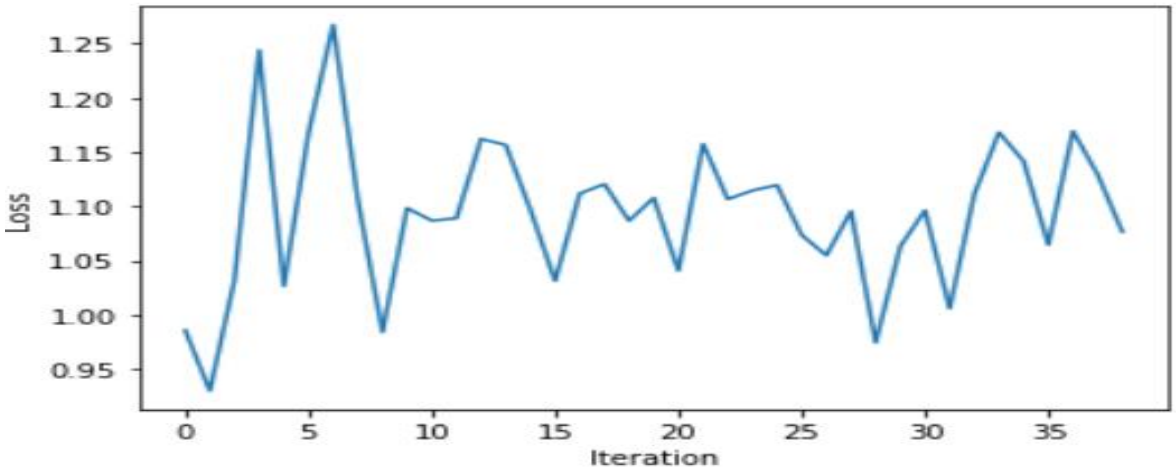
Loss VS Iteration Graph:

Here we showed the Loss VS Iteration Graph comparison between Dataset A and Dataset 2.

Dataset A:



Dataset 2:



Iteration Steps:

Here we showed the accuracy comparison between Dataset A and Dataset 2.

Dataset A:

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Iteration: 14000. Loss: 0.01586131751537323. Accuracy: 90.60913705583756
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Epoch:  137
Epoch:  138
Epoch:  139
Epoch:  140
Iteration: 15500. Loss: 0.006012659054249525. Accuracy: 90.96446700507614
Epoch:  141
Epoch:  142
Epoch:  143
Epoch:  144
```

Dataset 2:

```
Epoch:  40
Iteration: 16500. Loss: 1.111196517944336. Accuracy: 58.93
Epoch:  41
Iteration: 17000. Loss: 1.1681008338928223. Accuracy: 58.37
Epoch:  42
Iteration: 17500. Loss: 1.1415832042694092. Accuracy: 58.11
Epoch:  43
Iteration: 18000. Loss: 1.0644867420196533. Accuracy: 57.7
Epoch:  44
Iteration: 18500. Loss: 1.169246792793274. Accuracy: 58.49
Epoch:  45
Iteration: 19000. Loss: 1.1293905973434448. Accuracy: 58.81
Epoch:  46
Epoch:  47
Iteration: 19500. Loss: 1.0766397714614868. Accuracy: 59.81
```

Here, we can see that, we get better accuracy using Dataset A than Dataset 2.

Github code links:

Experiment 1 and 2 using dataset A:

https://github.com/Rakesh6430/Softcom-Lab- Codes/blob/main/Assignment%202/170104130_exp1and2.ipynb

Experiment 2 using dataset 2:

https://github.com/Rakesh6430/Softcom-Lab-Codes/blob/main/Assignment%202/170104130_exp2_dataset2.ipynb