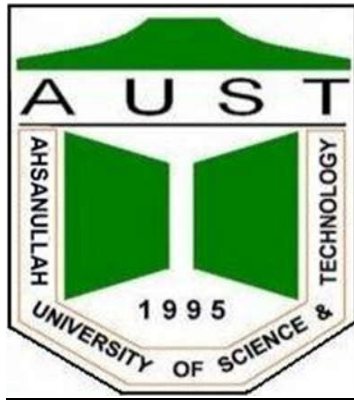


# **AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**



**Course No: CSE4238**

**Section: C      Lab Group: C1**

**Semester: Fall 2021**

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In the given dataset we have to perform two experiment. In the first experiment we have given some fixed hyper parameter. In second experiment we have to improve model performance by tuning the hyperparameters.

### **Experiment 1:**

<b>Hyper parameter</b>	<b>Values</b>
Number of hidden layer	6
Number of nodes in hidden layers	200(for all layers)
Epoch	4
Learning rate	0.01
Batch size	20
Activation function of hidden layers	4(Relu Activation Function)
Model	Neural Network

## Model Performance

```
Epoch 3: Batch-672: Accuracy: 0.856026828289032, Loss: 0.024977351918849828
Epoch 3: Batch-673: Accuracy: 0.8560921549797058, Loss: 0.024959808478151265
Epoch 3: Batch-674: Accuracy: 0.8560088872909546, Loss: 0.024959843182101715
Epoch 3: Batch-675: Accuracy: 0.8557037115097046, Loss: 0.02498587446163098
Epoch 3: Batch-676: Accuracy: 0.8557692170143127, Loss: 0.02496901660490803
Epoch 3: Batch-677: Accuracy: 0.8556868433952332, Loss: 0.025050431338896867
Epoch 3: Batch-678: Accuracy: 0.8554572463035583, Loss: 0.025098501773040117
Epoch 3: Batch-679: Accuracy: 0.8552283048629761, Loss: 0.025118767182357796
Epoch 3: Batch-680: Accuracy: 0.854999594688416, Loss: 0.025126309542478447
Epoch 3: Batch-681: Accuracy: 0.854992687702179, Loss: 0.02513359857151468
Epoch 3: Batch-682: Accuracy: 0.8549120426177979, Loss: 0.02512852830178708
Epoch 3: Batch-683: Accuracy: 0.8547584414482117, Loss: 0.02514712019069434
Epoch 3: Batch-684: Accuracy: 0.854751467704773, Loss: 0.025145856211266932
Epoch 3: Batch-685: Accuracy: 0.8547444939613342, Loss: 0.025172012007530154
Epoch 3: Batch-686: Accuracy: 0.8545917868614197, Loss: 0.025175603862265368
Epoch 3: Batch-687: Accuracy: 0.8545851707458496, Loss: 0.025176481599750042
Epoch 3: Batch-688: Accuracy: 0.854142427444458, Loss: 0.025247354955726498
Epoch 3: Batch-689: Accuracy: 0.8538461327552795, Loss: 0.025283377249664337
Epoch 3: Batch-690: Accuracy: 0.8532608151435852, Loss: 0.02529292966009698

Done with Epoch 3, Accuracy: 0.8538177072003481, Loss: 0.025309435813888646

Validation Accuracy: 0.6989847715736041

<-----Finished Training----->

Validation Accuracy: 0.7979695431472081
```

## Discussion:

After building model with 6<sup>th</sup> hidden layer, I have found train accuracy 85% with train loss 0.0253 value with validation accuracy 79.79%.



evaluate()



0.7084496320730779

Here, I have got 70.844% test accuracy.

Here, I have splitted my dataset into 70:30 ratio where 70% used for training and among 30%, 10% is for validation and 20% is for testing.

I tried to avoid sigmoid function because it is proved that sigmoid activation function gives bad result inside hidden layers and can cause vanishing gradient problem. For that reason, I used Relu activation function. I also applied normalization on the image for better image classification.

## Experiment 2:

Hyper parameter	Values
Number of hidden layer	6
Number of nodes in hidden layers	200(for all layers)
Epoch	7
Learning rate	0.01
Batch size	20
Activation function of hidden layers	4(Relu Activation Function)
Model	Neural Network

## Model Performance

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Epoch 6: Batch-772: Accuracy: 0.9692357778549194, Loss: 0.005004518696859749  
Epoch 6: Batch-773: Accuracy: 0.9692755341529846, Loss: 0.004998467424565162  
Epoch 6: Batch-774: Accuracy: 0.969315230846405, Loss: 0.004994365316905919  
Epoch 6: Batch-775: Accuracy: 0.9693548083305359, Loss: 0.004988344467575512  
Epoch 6: Batch-776: Accuracy: 0.9692655205726624, Loss: 0.004992231463691815  
Epoch 6: Batch-777: Accuracy: 0.9693050980567932, Loss: 0.00498600813098422  
Epoch 6: Batch-778: Accuracy: 0.9693444967269897, Loss: 0.004980849747885387  
Epoch 6: Batch-779: Accuracy: 0.9693838357925415, Loss: 0.004974922926726468  
Epoch 6: Batch-780: Accuracy: 0.9694230556488037, Loss: 0.004968624086304305  
Epoch 6: Batch-781: Accuracy: 0.9693982601165771, Loss: 0.004969262222940682  
Epoch 6: Batch-782: Accuracy: 0.9694373607635498, Loss: 0.004964487487777753  
Epoch 6: Batch-783: Accuracy: 0.9694764018058777, Loss: 0.004958301174245052  
Epoch 6: Batch-784: Accuracy: 0.9695152640342712, Loss: 0.004953560469421435  
Epoch 6: Batch-785: Accuracy: 0.96955406665802, Loss: 0.004947453957528564  
Epoch 6: Batch-786: Accuracy: 0.9695292711257935, Loss: 0.004947442701752902  
Epoch 6: Batch-787: Accuracy: 0.9695044755935669, Loss: 0.004951845995654036  
Epoch 6: Batch-788: Accuracy: 0.9695431590080261, Loss: 0.004946661632000421  
Epoch 6: Batch-789: Accuracy: 0.9683777093887329, Loss: 0.004940969244437115

Done with Epoch 6, Accuracy: 0.9695450796269273, Loss: 0.004946925618756277

Validation Accuracy: 0.8984771573604061

<-----Finished Training----->

Validation Accuracy: 0.9

---

## Discussion

For improving the performance of my model I built my model with just 6 hidden layer just like before but this time I changed the momentum of SGD and train-val-test split, and I got better result from previous model. I got highest 96% train accuracy and loss value 0.004 with 89% validation accuracy.

```
[ ] evaluate()
```

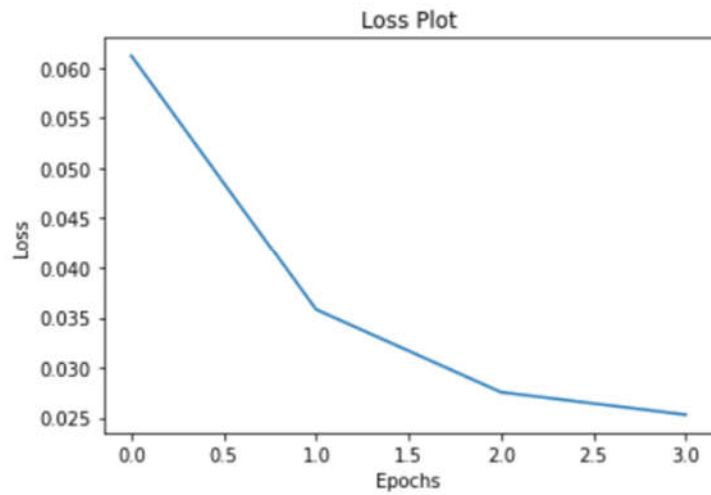
```
0.8863521055301877
```

Here, I have got 88.635% test accuracy on my test data.

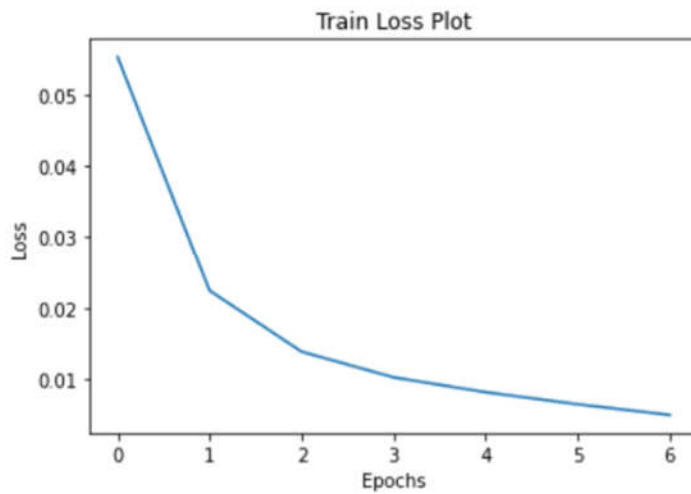
Here, this time I have splitted my dataset into 80:20 ratio where 80% used for training and among 20%, 10% is for validation and 10% is for testing.

# Loss vs Epoch Graph

## Experiment 1

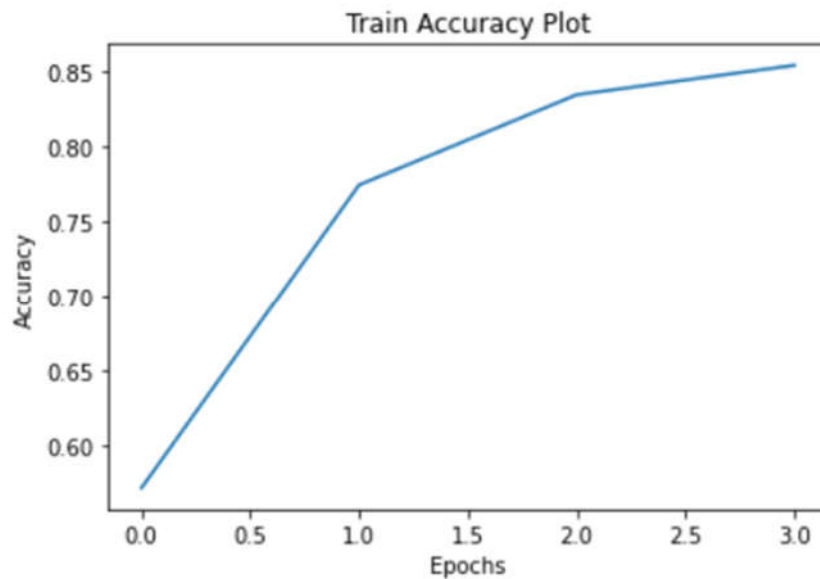


## Experiment 2



## Accuracy vs Epoch Graph:

### Experiment-1:



### Experiment-2:

