CS 4342 - Machine Learning
Homework - 6
Three Layered Artificial Neural Network
By Revant Mahajan and Suryansh Goyal

Hyperparameter Tuning

We initially experimented with 24 different hyperparameter settings.

- Units in hidden layer = [40,50]
- Epochs = [50, 60]
- Epsilons = [0.01, 0.05, 0.1]
- Mini batch sizes = [32, 64]
- Alpha = [0.01]

The results are shown in the last 5 lines. Please note that "**accuracy**" here refers to **validation accuracy**.

```
hiddenUnits: 50, epsilon: 0.01, batchSize: 32, epochs: 50, alpha: 0.01, accuracy: 0.8763333333333333
hiddenUnits: 50, epsilon: 0.01, batchSize: 32, epochs: 60, alpha: 0.01, accuracy: 0.8761666666666666
hiddenUnits: 50, epsilon: 0.01, batchSize: 64, epochs: 50, alpha: 0.01, accuracy: 0.8704166666666666
hiddenUnits: 50, epsilon: 0.01, batchSize: 64, epochs: 60, alpha: 0.01, accuracy: 0.8673333333333333
hiddenUnits: 50, epsilon: 0.05, batchSize: 32, epochs: 50, alpha: 0.01, accuracy: 0.8755
hiddenUnits: 50, epsilon: 0.05, batchSize: 32, epochs: 60, alpha: 0.01, accuracy: 0.8725833333333334
hiddenUnits: 50, epsilon: 0.05, batchSize: 64, epochs: 50, alpha: 0.01, accuracy: 0.88025
hiddenUnits: 50, epsilon: 0.05, batchSize: 64, epochs: 60, alpha: 0.01, accuracy: 0.8813333333333333
hiddenUnits: 50, epsilon: 0.1, batchSize: 32, epochs: 50, alpha: 0.01, accuracy: 0.877
hiddenUnits: 50, epsilon: 0.1, batchSize: 32, epochs: 60, alpha: 0.01, accuracy: 0.87575
hiddenUnits: 50, epsilon: 0.1, batchSize: 64, epochs: 50, alpha: 0.01, accuracy: 0.8745833333333334
hiddenUnits: 50, epsilon: 0.1, batchSize: 64, epochs: 60, alpha: 0.01, accuracy: 0.868
bestNumUnitsInHiddenLayer 50
bestEpsilon 0.05
bestMiniBatchSize 64
bestNumEpochs 60
alpha 0.01
```

Output of the Last 20 Epochs on the Test Set

```
Epoch: 40, Test Accuracy: 87.4, Test Cross Entropy Loss: 0.37007920108093456
Epoch: 41, Test Accuracy: 87.3, Test Cross Entropy Loss: 0.37174486075884383
Epoch: 42, Test Accuracy: 87.45, Test Cross Entropy Loss: 0.37157396695478445
Epoch: 43, Test Accuracy: 87.42, Test Cross Entropy Loss: 0.37224087035407494
Epoch: 44, Test Accuracy: 87.46000000000001, Test Cross Entropy Loss: 0.37015050469768923
Epoch: 45, Test Accuracy: 87.62, Test Cross Entropy Loss: 0.36961049161518233
Epoch: 46, Test Accuracy: 87.6, Test Cross Entropy Loss: 0.36992578363711753
Epoch: 47, Test Accuracy: 87.6, Test Cross Entropy Loss: 0.3707135727409263
Epoch: 48, Test Accuracy: 87.56, Test Cross Entropy Loss: 0.3700731845486216
Epoch: 49, Test Accuracy: 87.51, Test Cross Entropy Loss: 0.370584117044195
Epoch: 50, Test Accuracy: 87.45, Test Cross Entropy Loss: 0.37086016879652084
Epoch: 51, Test Accuracy: 87.53, Test Cross Entropy Loss: 0.3730159442892162
Epoch: 52, Test Accuracy: 87.46000000000001, Test Cross Entropy Loss: 0.3741643611467243
Epoch: 53, Test Accuracy: 87.41, Test Cross Entropy Loss: 0.3755636786036867
Epoch: 54, Test Accuracy: 87.4, Test Cross Entropy Loss: 0.3759105085345628
Epoch: 55, Test Accuracy: 87.37, Test Cross Entropy Loss: 0.3753887303113274
Epoch: 56, Test Accuracy: 87.42, Test Cross Entropy Loss: 0.37578194444183916
Epoch: 57, Test Accuracy: 87.4, Test Cross Entropy Loss: 0.37545673161675736
Epoch: 58, Test Accuracy: 87.33, Test Cross Entropy Loss: 0.3756119703353519
Epoch: 59, Test Accuracy: 87.52, Test Cross Entropy Loss: 0.37678943912133916
Epoch: 60, Test Accuracy: 87.46000000000001, Test Cross Entropy Loss: 0.37523224304326513
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Test Accuracy: 87.46000000000001
Test Cross Entropy Loss: 0.37523224304326513
```