DLCV, Lab2

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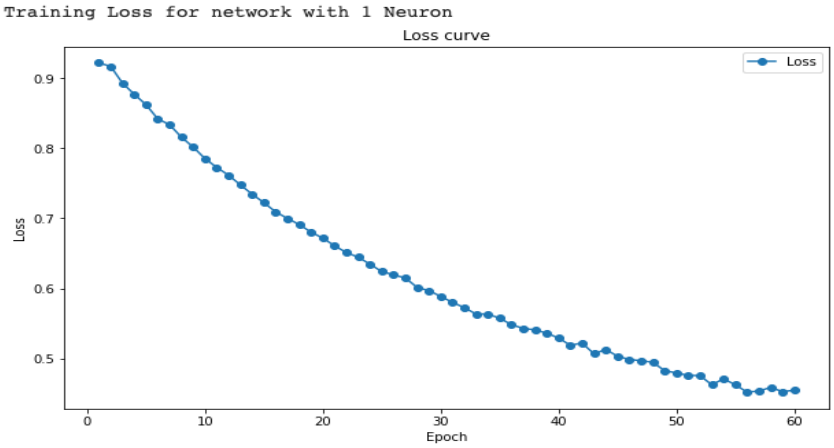
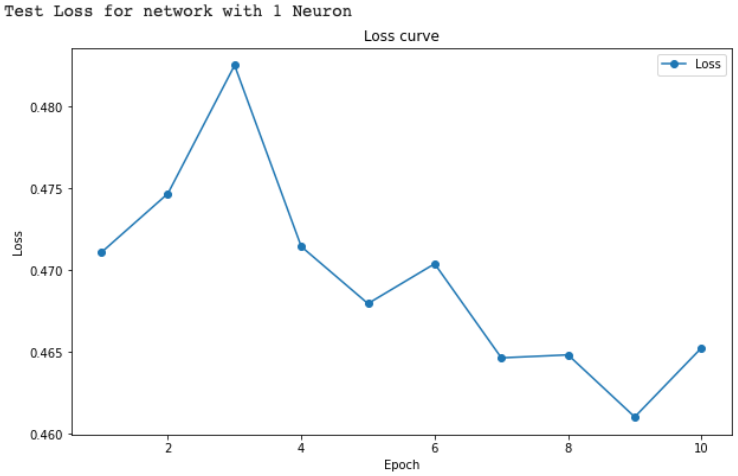
Single Neuron:

Batch_size=1000, learning rate= 0.1





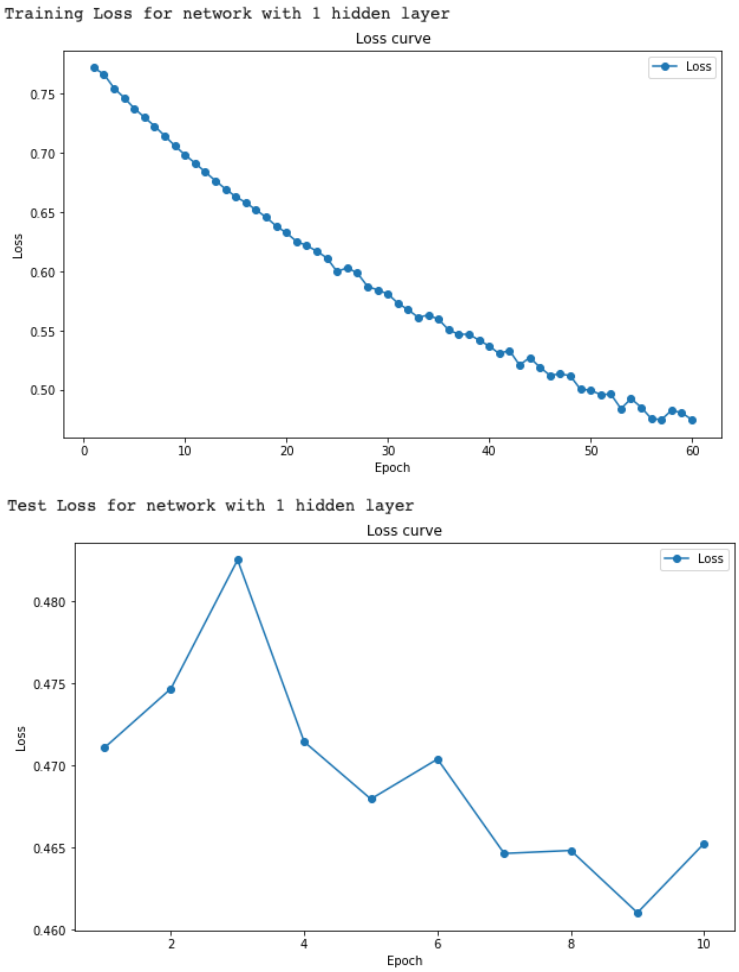
Accuracy: 91%

For the neural network with a single neuron, it's the simplest design of the neural network, where there's only one output for each input. The activation function was sigmoid and cross-entropy loss was calculated between the predicted and actual values. Regarding the training loss, we can see that the loss reduces as the model is trained and the loss finally reaches its lowest value in the final epoch. When testing the model, we can observe that for epoch 3rd the loss value gets hiked suddenly however,

after that it decreases. For a smaller value of the learning rate(< 0.1), the model learns very slowly and the loss decreases slowly. For a larger batch size, the loss decreases quickly when trained.

Neural Network with one Hidden Layer:-

Batch_size=1000, learning rate= 0.1

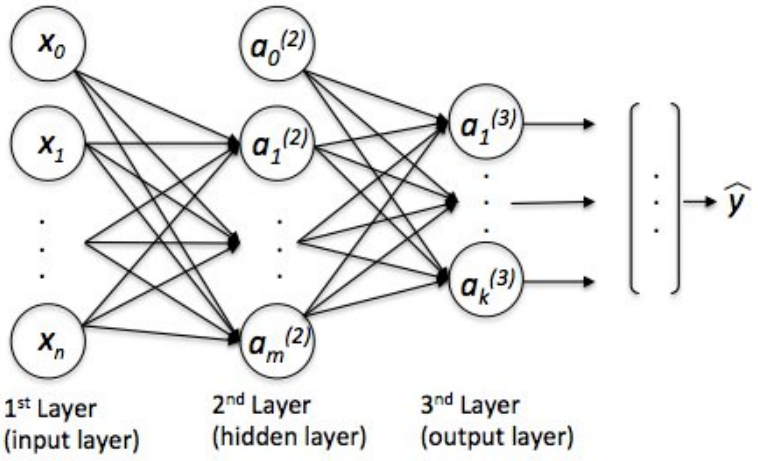


Accuracy:- 91.08%

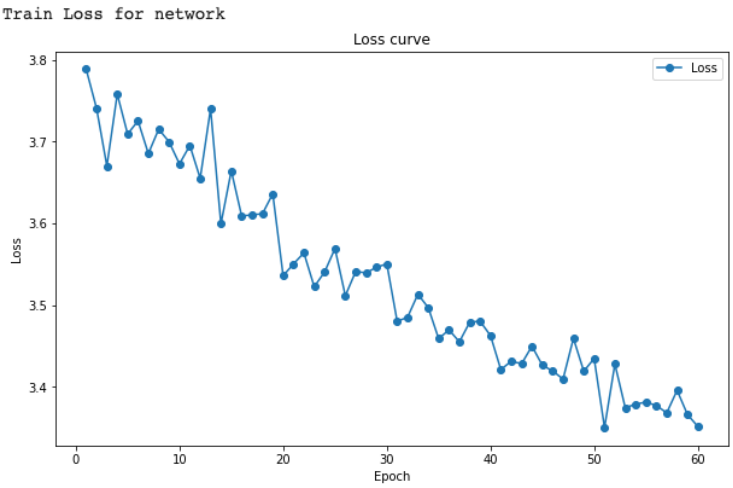
For the neural network with one hidden layer, having 64 neurons we can see that the training loss decreases when we train the model for 60 epochs. The test loss of the model hiked suddenly at the 3rd epoch, however, after that point it started to decrease and around the 9th epoch, it reaches the lowest value. After the 9th epoch, it starts to increase again. For the batch size of 5000, the training loss decreases more quickly.

Multi-class Neural Network:-

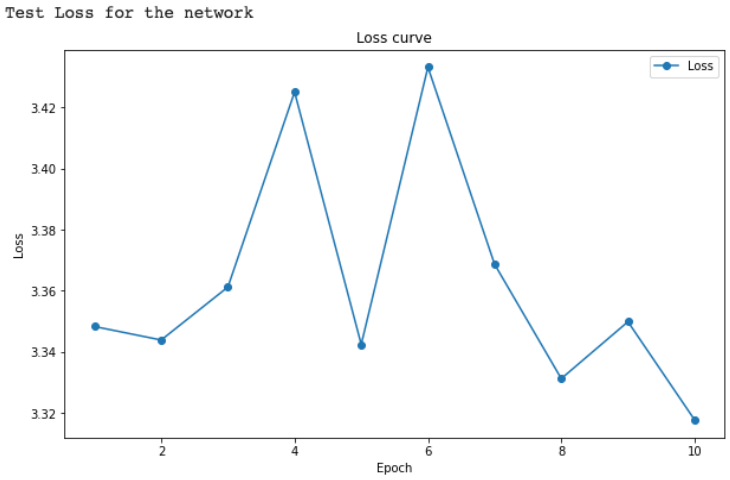
Below is the architecture for a Multi-class neural network having 1 hidden layer. The input layer is of size (784,1) and the size for the hidden layer has 64 neurons is (64,1). The size of the final output layer is (10,1). For an input batch of 1000, the input size will be (784,1000), w1 will be (784,64) and w2 will be (64,10). In order to classify the 10 digits in the output layer, we'll be using the softmax function instead of the sigmoid. The Batch_size used was 1000, and the learning rate was 0.5.



Training loss:



Test Loss:



Accuracy:- 15.15%

For the multiclass neural network, the training loss decreases finally however, there were a lot of peaks in between while training the model. Regarding testing of the model, there's a sudden hike in the test loss at epochs 4 & 6. However, the loss starts to decrease after 6. Also, the network's accuracy is not very good around 16%. As we change the learning rate to a higher value the model adapts quickly which results in a decrease in the loss values.