**20100004**

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**Assignment Report:**

**Task:**

The task of this assignment is to build a neural network for classification to classify the handwritten digits data ranging from number 0 to number 9.

**Learning Rates:**

Learning rates of 0.01,0.001 and 0.0001 are tried. The best learning rate turned out to be 0.0001.

**Training Part:**

For training the network, images are read using open cv library and then turned into grayscale images of size (28,28) which are then resized into size of (1,784) to be feed into the neural network. The neural network contains 784,50,10 neurons in the 1st,2nd and the 3rd layer respectively. Training labels which are numbers simply are converted into one hot encoding array of size 10 having 1 in the ith position for the ith number. Images are first normalized and then batch normalization is applied which raises the training accuracy from 17% to 70%.For feedforward step, all images are passed into the neural network and final predictions are calculated. In back-propagation step, gradients are calculated using the back-propagation algorithm and then weights are updated based on that.

**Testing Part:**

For testing part, testing images are fed into the neural network and accuracy of 69% is obtained. The accuracy can be increased further by using relu or tanh as activation function or using some other activation function. In predictions, weights are not updated, simple feed-forward is done to get predictions. Loss and Accuracy functions are implemented to get loss and accuracy on the testing data.