CSI 873/MATH 689 Midterm research project. Due October 25, 2017.

1) Design an artificial neural network with 1 hidden layer, 3 hidden units for handwritten digit recognition.

2) Train your ANN on data below. Find parameters w_{ij} using the backpropagation algorithm. Implement the backpropagation algorithm yourself using your choice of language. Please comment your code.

a) Use part of the training data for validation and a stopping criteria.
b) What is the accuracy of the detection of the tested digits with the obtained w_{ij}? Estimate the confidence interval for the true error based on the testing data.

3) Repeat (1) and (2) for 2 and 4 hidden units.

4) Prepare a report on the results of your project. Share your observations. Include the code in the report together with instructions how to run it.

Comments on the data.

In the file data.zip:

math.gmu.edu/~igriva/data.zip

you will find 20 files:
10 for training: train0.txt, train1.txt,…,train9.txt
10 for testing: test0.txt, test1.txt,…,test9.txt

Each training file has more than 5000 digits. Select an appropriate number of training examples. Each testing file has at least 1000 digits. Make sure that you use at least 100 from each class for testing classification.

Each line from the files corresponds to each hand written digit. The first entry on each line is the digit it represents: 0, 1, 2 etc... 9 followed by 28*28 = 784 dimensional grayscale intensity vectors with the entries from 0 to 255. Scale each intensity vector with dividing it by the largest entry. All the entries will be between 0 and 1.