CS 380 – Neural Networks

Project 1 – Perceptron Neural Networks

Assigned Date: 2/13/2017

Due Date/Time: Monday 2/27/2017 (midnight or 11:59:59 PM) - executable code

Tuesday 2/28/2017 (2:30 PM) – printout

(70 points)

Implement a computer program to classify letters from different fonts using perceptron learning (see page 74 of the textbook). The program uses the input and output data dimensions specified in its network training set (see the attached sample training set and also see page 72 of your textbook for detail). However, the program can be applied to pattern classification problems with any data dimensions (as long as the dimensions of its training and testing sets are consistent). Test you program through appropriate dimension-matched testing sets (see the attached sample testing set and also see page 75 of the textbook for detail) and save the testing results into a file with the following format:  
   
 Actual Output:

A

1 -1 -1 -1 -1 -1 -1

Classified Output:

A

1 -1 -1 -1 -1 -1 -1  
  
Perform the following experiments and report them in detail in your printout:

* Train your net by a training data set (for instance, the attached sample training set) and then use the same set as a testing set. Does the net classify the training samples correctly?
* For a fixed testing set, test your net (in terms of its convergence speed, or the numbers of epochs required to converge) by selecting several values for the learning rate alpha (0.25, 0.50, 0.75 and 1.00) and by selecting several values for the threshold theta (0.00, 0.25, 0.50, 1.00, 5.00, 10.00, and 50.00). Present your results in a table and draw your conclusions.
* After training your net with the *attached* training set, test the ability of the net (in terms of its classification accuracy, or percentage of correctly classified letters) to classify noisy versions of the training patterns. Create three testing sets in this experiment:
  + LNITest, which has low noise-interference (LNI) input patterns (see the set on page 75 of the textbook),
  + MNITest, which has medium noise-interference (MNI) input patterns (by adding 3 additional wrong pixels wisely for each letter in LNITest), and
  + HNITest, which has high noise-interference (HNI) input patterns (by adding 6 additional wrong pixels wisely for each letter in LNITest).

Set alpha = 0.25 but try different values of the threshold theta (see the settings in the previous step). Present your results in a table and draw your conclusion if there is one.

Your program, along with various training/testing sets must be located in the subdirectory CS380/*proj1* right under the home directory in your account. The program should provide the user with a friendly interface for training and testing. The following are some sample runs:

[Training through training data]

Welcome to my first neural network – A Perceptron Net!

Enter 1 to train using a training data file, enter 2 to train using a trained weight settings data file:

1

Enter the training data file name:

sampleTraining

Enter 0 to initialize weights to 0, enter 1 to initialize weights to random values between -0.5 and 0.5:

1

Enter the maximum number of training epochs:

100

Enter a file name to save the trained weight settings:

sampleWeights

Enter the learning rate alpha from 0 to 1 but not including 0:  
0.5

Enter the threshold theta:  
1.0

Training converged after 4 epochs.

Enter 1 to test/deploy using a testing/deploying data file, enter 2 to quit:

1

Enter the testing/deploying data file name:

sampleTesting

Enter a file name to save the testing/deploying results:

sampleResults

[Training through trained weights files]

Welcome to my first neural network – A Perceptron Net!

Enter 1 to train using a training data file, enter 2 to train using a trained weights file:

2

Enter the trained weight settings input data file name:

sampleWeights

Enter 1 to test/deploy using a testing/deploying data file, enter 2 to quit:

2

Enter the testing/deploying data file name:

sampleTesting

Enter a file name to save the testing/deploying results:

sampleResults

Printout to be submitted in a folder:

1. Cover page (course name, term, project info, your name, date, etc.)
2. Assertion statement about the project completeness, correctness and punctuality
3. A detailed description of your implementation
4. A detailed report on the experiments
5. Compilation/Execution instructions
6. Sample runs
7. Source code (must be readable and well documented)

Enjoy your project!

A sample training set

63 (dimension of input pattern)

7 (dimension of output pattern)

21 (number of training or testing pairs)

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A1

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A sample testing set

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