CPSC371 Project Phase 2

Due Date 1: Monday, February 23rd 11:59 pm

Due Date 2: Friday, February 27th 11:59 pm

Neural Network to Solve XOR and Rubix Cube

Objective

1. Implement a Neural Network (NN)
    a. Must include constructors for NN of any topology
    b. Must implement a method for feed forward, as outlined in class
    c. Must include a method to save a given neural network to disk
    d. Must include a method to load a given neural network from disk
2. Implement Stochastic Back Propagation (SBP)
    a. Implement a static method for SBP as outlined in class
    b. This method must work for NN of any topology
    c. Must be able to successfully train a NN based on training data
3. Create an interface SBPImpl
    a. This interface must specify all of the required methods that the NN must implement so that SBP can train it
    b. We want to decouple SBP from NN
    c. SBP should only work on objects of type SBPImpl and not NN directly
4. Train the NN to a high degree of accuracy on the XOR problem
    a. Use a 2-2-1 /w bias NN

x0	x1	x0 xor x1
-1	-1	-1
-1	1	1
1	-1	1
1	1	-1

5. Train the NN to a high degree of accuracy on the Rubix Cube problem
    a. Use the training data from A* searching Rubix Cube to train a neural network

Experiments

1. Experimentally determine which size of hidden layer provides best results for Rubix Cube
    a. Search the space of hidden layer sizes methodically
    b. Provide accuracy results for all hidden layer sizes tested
2. Experimentally determine which learning rate provides best results for Rubix Cube
    a. Search the space of learning rates methodically
    b. Provide accuracy results for all learning rates tested
3. Experimentally determine which number of training iterations provides best results for Rubix Cube

    a. Search the space of training iterations methodically
    b. Provide accuracy results for all training iterations tested
4. To do this, you will want to try (hidden layer size, learning rate, training iteration) triples
    a. For each triple, run 10 trials
        i. For each set of 10 trials record the best accuracy achieved
5. Provide heat graphs for each 2D axis through your parameter space
    a. That is, provide a heat graph for (hidden layer size, learing rate), (learning rate, training iteration) and (hidden layer size, training iteration)
    b. So, for every (hidden layer size, learning rate, training iteration) triple that you test, you will need to generate 3 heat graphs
6. Once you have thoroughly searched your parameter space, determine your top 5 triples
    a. Include the 3 heat graphs for each of these 5 parameters in your write up
    b. Your write up should have 15 heat graphs for Rubix Cube

Documentation Requirements

1. Provide a .pdf with the following information in it
    a. A detailed analysis of how you mapped your Rubix Cube to the NN input layer
    b. An explanation of the various classes, data structures and algorithms in your solution
    c. A brief explanation on the results achieved for XOR problem
    d. 15 heat graphs for Rubix Cube
        i. An explanation of what each heat graph means

Things you must include

1. Provide a .zip file with the following in it
    - Full source code
    - Working JAR
        - Jar must run from command line with command <java –jar jarname.jar> on a Windows 7 system running JRE 8x
        - It is your responsibility to test and verify that your JAR works in the required environment
        - I will NOT do anything special to make your JAR run. If it fails to run, you get 0 for that section of the marks
    - Experimental results in a .txt or .csv file
    - Write up in a .pdf file
2. The .zip should be named as follows
    - <FirstName><LastName><StudentNumber>CPSC371Phase2.zip
    - For example, if I were to submit this assignment I would submit the following file
3. WarrenMarusiak123456789CPSC371Phase2.zip

Grading

1. Unit Testing – 10%
2. Engineering – 35%
3. Working Jar – 35%

4. Experimental Data – 10%
5. Documentation – 10%