Assignment 2

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Introduction

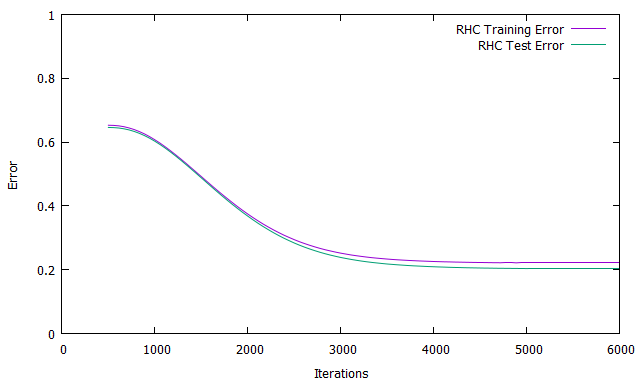
This assignment was done using Pushkar’s ABAGAIL code.

Training a Neural Net

For the neural net 27 input nodes were used at the input layer, 7 nodes at the hidden layer, and 1 node at the output layer. Seven nodes were used at the hidden layer because that is the number at which the original neural net performed best. The neural net was trained using Random Hill Climbing (RHC), Simulated Annealing (SA)(parameters used?), and a Genetic Algorithm (GA)(which one, parameters?) instead of BackPropagation. The training error is used as a fitness function (how to word this, since we are trying to optimize fitness not minimize cost).

Random Hill Climbing

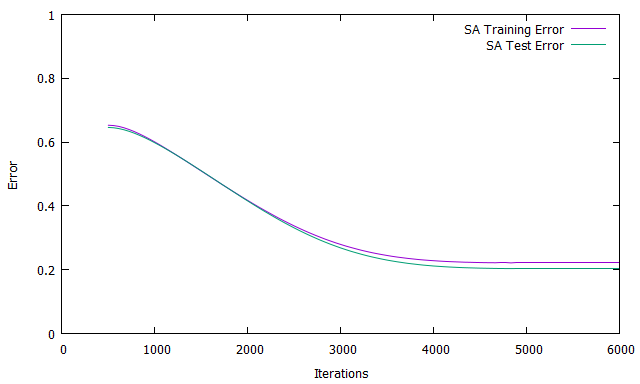
The GA, SA, and RHC is most likely not doing well because it is getting stuck in a local optima. The error stays at .221 even after 1,000,000 iterations for both SA and RHC. Does this mean this is the global optimum or are they both getting stuck in a local optima? Perhaps the global optima is very narrow and hard to reach, large basin of attraction. Strange part of the graph. The training error is lower than the testing error. However, this is not a major deal since they are very close together that means they are within the range of variance for each other. The training and testing error closely matches in all 3 graphs.



*Figure 1: Error vs Iterations for RHC*

Simulated Annealing

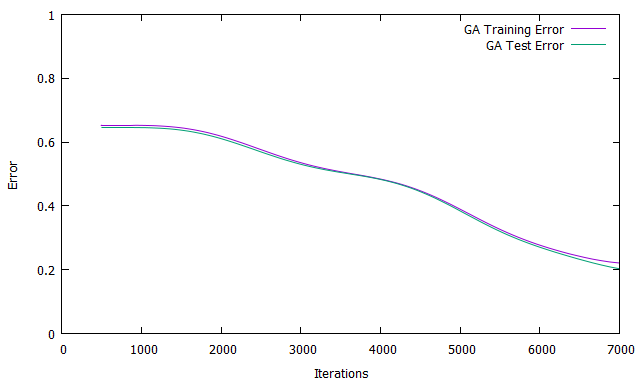
The temperature starts at 10^11 and steps down 5% every iteration.



*Figure 2: Error vs Iterations for SA*

Genetic Algorithm

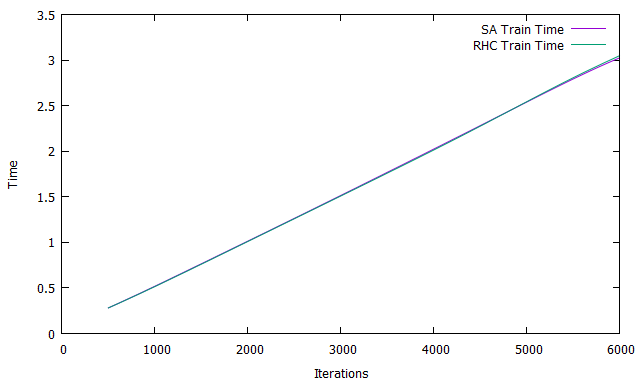
The Genetic Algorithm takes many more iterations to converge to the minimum of 0.221.



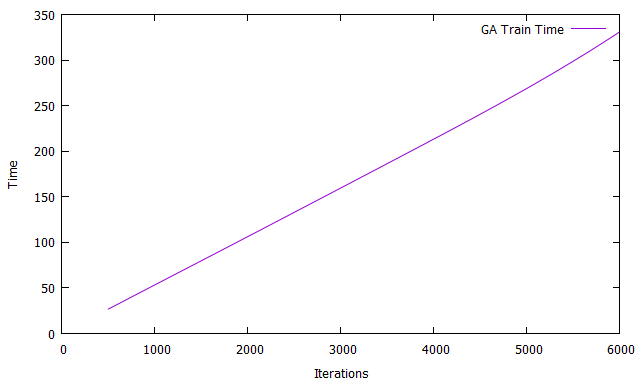
*Figure 3: Error vs Iterations for GA*

**Performance Comparison**

There are two figures showing the training time versus the number of iterations used for each algorithm. Figure 4 shows the training times for SA and RHC. Figure 5 shows the training times for the GA. As the figures show there is significant difference in training times between the GA and the other algorithms. The RHC and SA take only about 3 seconds at 6000 iterations. The GA takes about 325 seconds at 6000 iterations, an increase by a factor of 10. Both graphs show a linear increase in training times.



*Figure 4: Training time for SA and RHC in seconds*



*Figure 5: Training Time for GA in seconds*