CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Christina K. Llanes

Project Number
S1216

Project Title
Neurotic About Hidden Neurons

Abstract

Objectives/Goals
The purpose of this project is to determine whether adding more hidden units to a neural network increases its accuracy. It was hypothesized that if more hidden units are added, then the performance of the neural network will increase, but the time it takes for the network to learn will also increase.

Methods/Materials
First, six neural networks were designed on Excel Spreadsheets, each containing a different amount of hidden units (8, 16, 32, 48, 64, 96 hidden units). These networks will be performing pattern recognition to recognize decimal digits. Digits are inserted in the neural network through an array of 8 cells by 4 cells on the User Interface worksheet. A digit can be drawn into the array by putting color into the cells, making the pattern look like a digit. All the networks were trained using the back propagation algorithm, which was coded in Visual Basic. The neural network was trained with training data. Then experiment data was propagated through all six networks, and the results were recorded on the Experiment Data worksheet.

Results
All of the neural networks performed approximately the same, except the neural network with 8 hidden units which was about 40% less accurate. However, the time that the networks took to learn the training data does increase drastically as the number of hidden units increases, even if the pattern recognition performance only improves slightly.

Conclusions/Discussion
The results of the neural networks support the hypothesis. The neural network with 96 hidden units performed with the greatest accuracy, but it took the longest time to learn out of all the neural networks because of the additional computations it had to calculate. Therefore, if one wanted to create a neural network with high accuracy and the time to learn was not important, then the network should contain a large amount of hidden units. On the other hand, if one wanted to create a neural network that learned quickly and performed with lower accuracy, then a network with less hidden units should be used.

Summary Statement
I tested if the amount of hidden units in a neural network would effect its accuracy and its learning time.

Help Received
Mother and sister typed up experiment data. Professor Crowley gave me neural network advise. Mr. Wellman helped me with the topic. My father taught me basic calculus.