



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

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Project Title Neurotic About Neurons	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals A neural network was designed and coded to identify decimal digits using Visual Basic and Excel. It was hypothesized that the neural network would have a 75% accuracy in recognizing the digits.</p> <p>Methods/Materials The neural network was composed of three layers: the input layer, the hidden layer, and the output layer. The neural network was trained with twenty examples of each digit, for a total number of 200 trials. The input pattern for each digit was inserted into the neural network in the form of an eight by four array of data, and the neural network generated an answer. The back propagation algorithm was used to train the neural network, iterating 30,000 times and achieving a 0.01 mean square error.</p> <p>Results The neural network was able to identify the training set of digits with a 90% accuracy. The results of the training data showed that the network learned properly and identified the digits with a high accuracy. Next, experimental data was created by people who had not seen the original training data. After all the experimental data was propagated through the neural network, the results showed that it identified the experimental data with an 83% accuracy. The experiment data results showed that the network could identify new patterns of digits that had not been propagated through the network in the training data. The network adapted to the new information and identified the digits with a high accuracy. To achieve those results, 30,000 iterations of the training data were executed in order to reduce the mean square error as much as possible so that the network could identify new patterns properly. The learning rate was also lowered so that the weights were adjusted by smaller increments. Although this lengthened the convergence time, it was necessary to prevent false minimum errors in the network.</p> <p>Conclusions/Discussion The neural network was successfully created and identified the decimal digits from the training and experiment data. The hypothesis stated that if a neural network was trained to identify decimal digits, then it would be able to identify the digits with a 75% accuracy. The results prove that the hypothesis is valid because the neural network correctly identified the experiment data with an 83% accuracy.</p>	
Summary Statement A neural network was designed and coded to identify decimal digits using Visual Basic and Excel.	
Help Received My father helped me to understand the back propagation math, and he bought me a new computer to finish the project. My mother and sister helped to create the experiment data. Professor Michael Crowley, from USC, gave me some suggestions for my project.	