



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

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Project Title Choice Based on Past Knowledge using Multi-Layered Neural Networks in Tic-Tac-Toe	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the experiment was to test the learning capabilities of a neural network by teaching it how to play Tic-Tac-Toe. According to the research, neural networks learn by the assigning of a set of weights attached to valid choices. The weight of that choice signifies how much that move is valued. So if it was an effective move, then its weight is assigned a greater value from knowledge gained through past experiences.</p> <p>Methods/Materials The materials required for the experiment were: a computer that supports the Java Virtual Machine as well as the Java Run Time Environment. In order to perform the experiment, the Java Run Time Environment was installed. Once all of the required software was accessible, a program of the network was written. Several revisions were completed in order to debug all of the features of the system. This required creating graphical user interfaces to display data as well as to show the steps that the program was executing at that time.</p> <p>After completion of the application, the experiment was executed. A total of seventy-four trials were performed with each trial consisting of one-hundred games that the network played against a pre-written artificial intelligence. The data was taken directly from the output and input into graphs.</p> <p>Results Generally, the network had a net win percent change and a net tie percent change that were both greater than 0 and a net loss percent change of less than 0. It was not until trial thirty that any of the results passed the mean. It was observed that the average deviation showed slight differences between ties and its mean and wins and its mean. The average for wins was close to the result of evaluating the function of the power regression line for wins. (6.24% obtained by input 74 for $f(x) = 5.73x^{0.02}$ and 6.59%).</p> <p>Conclusions/Discussion Although the results showed that learning had occurred through the course of the experiment, they did not support the hypothesis because the program was never able to win against a human player. It instead learned how to tie with the computer player due to a flaw within the programming that overvalued the weight of a tie. This exaggerated value had the potential to increase the weight of a tie favorably by 166% more than the weight of an actual win.</p>	
Summary Statement The game of Tic-Tac-Toe was used in order to test the learning capabilities of a Neural Network.	
Help Received none	