Project Proposal Final Version 1st Quarter 2008

Computer Systems Project Proposal - September 2008

1. Title (or subject area) of the project and NAME and PERIOD

   Machine Learning of Bridge Bidding, Dan Emmons, Period 3

2. Purpose and scope of the research project
   * goal and scope (extent)

The purpose of the project is to develop a method by which a computer can teach itself to bid effectively in the card game bridge. Success will be measured based on the ability of the machine to improve through training, not the overall playing ability. The project will not deal at all with the playing phase of the game beyond what is needed to evaluate the performance of bidding agents.

3. Background and review of current literature/research in this area.
   * List any preliminary background reading you've done so far, including other research projects that have been done before in this area.

I have done background reading on the minimax algorithm, alpha-beta pruning, and the killer heuristic, as well as reading the following two research papers:
Building a Fast Double-Dummy Bridge Solver, Chang. This paper discussed techniques and optimizations for creating a fast double-dummy bridge solver, which is the best tool to evaluate the performance of bidding agents.
Learning to Bid in Bridge, Amit and Markovitch. This paper suggests a novel method of storing a bidding system for machine partnerships to use as well as describing how co-training of the partnership can occur with this storage framework.

4. Procedure and Methodology.
   * What language(s) will you use?
   * What kinds of testing can be done for verification of your project's performance?

I will use Java exclusively for this project simply because there is no good reason to use anything else. To test the performance of my machine-learning method a co-trained partnership of computers will play against humans at each of two tables, the co-trained partnerships playing opposite hands at each. The results will be scored using the IMP method of bridge scoring. The average net IMPs gained per hand will be plotted against the amount of training done by the computer partnership. This will serve as a quantitative measure of how well the machine is learning.

5. Expected Results & Applications, value to others
   * What results do you expect to obtain from your project, and how can

these results and analysis be presented? What sorts of visuals can you use? If the project were completed, how do you imagine it will perform?

In the realm of computer science I expect to be able to demonstrate whether or not a certain approach to machine-learning of bridge bidding is feasible. In the realm of bridge playing I expect to be able to observe new bidding conventions based on the ideas adopted by machine partnerships in training. These results can be presented using a plot of a co-training partnership's skill as a function of time spent training. Hand printouts with double-dummy solutions and sample bidding sequences can be shown to demonstrate the actions a trained partnership is taking, as well as a subset of their decision tree that helps them to make these decisions. I imagine that a completed project would be able to outbid many human partnerships from a beginner to intermediate level.