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Progress Report – Connect Four AI

We have made good progress on our project so far. The UI for the project is, for the most part, complete. A user can select from human or various AI types for player one and from the various AI types for player two. It is now possible to have AI versus AI. We still need to come up with a way to perform multiple games of AI versus AI while recording the results in order to determine which AI versions perform the best.

At the moment, we have four different AI implementations:

1. The first uses a simple minimax procedure and only considers win or loss situations. We currently have this AI set to look four moves ahead.
2. The second also uses a minimax procedure, but a weight has been associated with a win or a loss (i.e., a win in two moves is weighted higher than a win in four moves).
3. The third also uses a minimax procedure, but makes use of a heuristic function to give values to states that are not a win or loss. The heuristic function considers the number of each player's open triples (i.e., the number of three-in-a-row pieces with an open slot available to complete a four-in-a-row sequence). Wins/losses are scored as 1000/-1000 and each open triple is scored as 50/-50 depending on the player.
4. The fourth uses a minimax procedure, but makes use of alpha-beta pruning to increase the look ahead value.

With consideration to the remaining time left to complete this project, we will most likely not consider any of the game variations that were described in the initial project proposal. For the same reason, we will not consider the genetic algorithm approach for constructing a heuristic function.

In regards to the remaining work for the project, we would like to create two or three more AI versions with the possibility of using some of the learning techniques we have recently learned to create an AI that can be trained to play. We would also like to collect data concerning the win/loss ratio for each AI versus the other AI in order to create some graphical representations of the performance of each AI. We believe that we should have enough time left to complete the work proposed in this progress report.

The following is a list a references that we have consulted during our research:

Connect Four Wiki
> http://en.wikipedia.org/wiki/Connect_Four

Connect Four AI: How it works
> http://roadtolarissa.com/connect-4-ai-how-it-works/

Connect Four AI: Minimax
> http://roadtolarissa.com/connect-4-ai-how-it-works/

JC-Tree
> https://code.google.com/p/jc-tree/

Algorithms: Minimax
> http://web.stanford.edu/~msirota/soco/minimax.html

Algorithms: Alpha-Beta Pruning
> http://web.stanford.edu/~msirota/soco/alphabeta.html

Alpha-Beta Example (video)
> https://www.youtube.com/watch?v=xBXHtz4Gbdo&spfreload=10

Iterative Deepening DFS Wiki
> http://en.wikipedia.org/wiki/Iterative_deepening_depth-first_search

Computing Strategies with Perfect Information
> http://artint.info/html/ArtInt_240.html

Reinforcement Learning
> http://artint.info/html/ArtInt_262.html