CS298 Proposal

Improving Chess Program Encoding Schemes

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Abstract:

Computer chess is a classic AI problem. In psychology chess has also been used to study human thinking. Many successful chess programs can beat chess experts, yet their style of play is incomparable to chess grandmasters. Unlike the computer logic that examines every possible position for a fixed number of moves, the grandmasters get their right moves from constructing the whole board based upon few pieces of information on the board and from recollections of salient aspects of past games. In this project my goal is to try to modify an existing computer chess program, GNU chess, so that it plays more like a human player. To do this first I am going to create a special game database that has all the moves played in some historical games by a player. In order to increase search efficiency I will modify the game database with my own clustering solution to cluster game boards based upon distance between them. Finally GNU chess' minimax algorithm will be modified such that next moves are generated according to the way moves distance from clusters in the new game database. Thus my chess program' will act as if moves were derived only from previously seen game boards.

CS297 Results

- Researched and understood how external chess game databases can be used with GNU chess program.
- Implemented Principal Variation Search (PVS) algorithm and compared it with Alpha-Beta pruning algorithm.
- Extension to PVS algorithm such that game database is consulted at every depth of the search.
- Computer Chess Program Autoplay setup such that two chess programs can play against each other.
- Implemented an efficient way to lookup game database for the next best move.

Proposed Schedule

Week 1: Jan.23-29	Research on finding the distance between two board games.
Week 2: Jan.30-Feb.5	Write up an algorithm to find the distance between two board games.
Week 3-4: Feb.6-19	Implement the above algorithm.
Week 5: Feb.20-26	Research on Clustering Algorithm.
Week 6: Feb.27-Mar.5	Write up an algorithm to cluster board games.
Week 7-8: Mar.6-19	Implement the above algorithm.
Week 9: Mar.20-26	Implement the logic to use the clustered board games to find the next best move.
Week 10: Mar.27-Apr.1	Work on above logic.
Week 11-13: Apr.3-Apr.17	Run tests and create statistical reports using Autoplay.
Week 14-18: Apr.17-May17	Project demo, fix errors and prepare for defense.

Key Deliverables:

- Software
  - Design and develop a function to convert one game board to a stored game board. This will be done by applying N number of moves on the current game board; where N is the maximum number of moves that will be applied. If the game board is convertible then the number of moves needed for conversion is the distance between the two game boards. This function will be used while creating the game database where the game boards found in some historical games will be compared against each other for clustering purpose. This function will also be used during the chess play in the search for the next best move the computer will play where the current board will be compared with the clustered game boards.
  - Design and develop a game database such that it has clusters of board games based upon distance between them. Distance between board games will depend upon the number of moves needed to convert one game board into another game board.
  - Modify the GNU chess program such that next moves are generated according to the way moves distance from clusters in the new game database.
  - Statistically compare the new chess program with GNU chess program.
- Report

Innovations and Challenges

- In order to modify GNU chess program the author had to thoroughly understand the GNU Chess program. Being an open source project, it was challenging for the author to understand the GNU Chess program because of poor documentation and varied authors.
- GNU chess program provides a special function to convert online games that are in PGN format into binary format written in network byte order. It was challenging for the author to modify this function to store game data with different information in network byte order. Further changes to this function will be innovative where the author will have to store clustering information in the binary format.
- Learning and enhancing the Principal Variation Search Algorithm on the game tree had been innovative. This knowledge will help the author modify GNU chess program such that next moves are generated according from the new game database.
- Setting up the Autoplay program such that the author's chess program is played against GNU Chess program had been challenging. This setup will help develop statistical reports on author's chess program when played against the GNU chess program.
- Comparing two game boards and finding the distance between them will be innovative as this will involve a complicated algorithm designed and developed by the author. The algorithm will have to properly handle many different cases leading to different board positions while converting one board game to another.
- Clustering of game boards based upon distance between them and using them to find the next best move will be challenging.

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