COSC 3P71

INTRODUCTION TO ARTIFICAL INTELLIGENCE

FINAL PROJECT: CHESS

INSTRUCTOR:

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Aim of the project:

Implementing a Chess program, with a game tree-based AI

Theory of chess:

Chess is a board game played between 2 players. The chess that we play today was made in the 15th century. Chess is played on a square chessboard with 64 squares in a eight-eight grid. There is total 32 pieces where each player controls 16 pieces the pieces are of 2 colors black and white. The pieces on each side include one king, one queen, two rooks, two knights, two bishops and eight pawn. The main objective of the game is to checkmate the opponent's king in such a way that the king has no place to escape. There are also many variations to the game.

The movements of the chess:

The king can move one square in any direction. The king and the rook can also perform a special move called castling. King is also the most valuable piece in the game.

The rook can move any no of squares in the rank or file but doesn't have the ability to move over pieces.

The bishop can move any of number of squares diagonally but can’t jump over other pieces

A queen can move any no of squares in the rank, file or diagonally but can’t jump over pieces.

A knight moves to any of the closest squares that is not in the same rank, file, or diagonal. The knight is the only piece that can leap over other pieces. (The knight moves in L shape)

A pawn can only move forward in the same file for either one square or two squares. A pawn can kill other opponent’s piece when it is diagonally one square away from the pawn.

End of the game:

The game either finishes on a draw or the victory of one of the players.

Here are some of the ways a game can be won by:

- Checkmate: This is when the king is in check and the player cann’t move to a square where the king is safe or the move is legal.
- Resignation: A player can quit the game whenever they want when they feel like they are going to lose the game.

- Win on time: chess can be also played where the games are timed, so the player that runs out of time loses.
- Forfeits: when one player cheats or doesn't follow the rules of the game the match can be forfeited.

Ways in which a match can be draw:

- Stalemate: If the person doesn't have any legal move left but the player is also not in a check position, then the game is considered draw.
- Dead position: In case both the players are not able to checkmate their opponent then the game is drawn.
- Draw by agreement: Many times, in professional tournaments both the players agree to making the game a draw.
- Threefold repetition: when both the players are not able to play the game without repeating moves then the game is drawn.
- Fifty move rule: In case in the last 50 moves no pawn is moved or no capture has been done then the player can call it a draw.
- Draw on time: In a match which is timed if a player runs out of time or no moves can checkmate the opponent then the game is draw.

One of the first computer-based chess game started in 1960s. In the later years with the help of internet there come other ways to play this game online with people around the globe in real time. The first Internet chess server was called Internet chess server in 1995 made by the university of Utah. Nowadays, with the help of technology we are able to create more stronger and better programs which are better than many human players, which just shows how strong our machines have become due to the new development of Artificial intelligence.

Guidelines for the project:

To run the project main.py should be run. The board.py was used to make the board, AIEngine implements the minimax algorithm using alpha-beta pruning. The ChessforAI is a class that simulates a game in between a player and the artificial intelligence. Chessforplayers is a class that simulated a game between two players. Helpers is a group of functions and variables containing the information about the chess game and the pieces involved in the game. Piece is a base class of piece containing all the basic information about a piece. King, queen, bishop, rook, Knight, pawn all contain available positions and weight about each piece.

The algorithm in use here is the minimax algorithm with alpha-beta pruning. The project involves two player modes the first one being player to player and the second one being AI Vs Player. The program is written in python language.

Alpha-Beta pruning:

The algorithm implemented in this project is the minimax algorithm with alpha-beta pruning. At that level or higher, alpha is the best value that the maximizer can currently guarantee. At that level or higher, beta is the best value that the minimizer can currently guarantee. The alpha-beta pruning helps reduce the time involved in computation. It removes branches from the game tree that do not need to be searched because a better move is already available. The algorithm is written in the AIEngine class from where the algorithm is then implemented on the game.

In this game, you can also choose the depth search of the AI with whom you want to play chess, and the higher the depth search, the slower the AI will play.

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