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Udacity AI Nanodegree Isolation Agent

Heuristic Analysis

In this project, I created an AI agent that played the board game **Isolation**. Isolation is a 7x7 board game in which 2 players move their pawns from one box to another in either horizontal, vertical or diagonal direction. The challenge is that the player cannot move their pawn through another pawn and the last player that is unable to move loses.

To make an agent that wins the majority of the time, there were many algorithms used such as Minimax, Alpha beta pruning with minimax and iterative deepening so that the agent picks the position with most probability of winning in a reasonable amount of time. There were three custom scoring systems were implemented and below is the heuristic analysis of the games played.

Playing Matches									

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	8	2	6	4	6	4	9	1
2	MM_Open	4	6	6	4	3	7	7	3
3	MM_Center	8	2	9	1	8	2	9	1
4	MM_Improved	6	4	5	5	5	5	5	5
5	AB_Open	5	5	5	5	6	4	5	5
6	AB_Center	6	4	7	3	4	6	7	3
7	AB_Improved	4	6	5	5	6	4	6	4

Win Rate:		58.6%		61.4%		54.3%		68.6%	

There was a total of 7 games played between my AI agent and a baseline agent. The baseline agent used Iterative Deepening (ID) and AlphaBeta pruning with MiniMax (AB). My agent used both ID and AB and used my three custom scoring evaluations functions as well.

The results show that the overall Win rate for the baseline agent was 58.6% and for the three custom agents, the win rates are 61.4%, 54.3%, and 68.6% respectively.

It can be determined that the custom scoring evaluation functions 1 and 3 outperformed the baseline agent while the 2nd scoring function did not perform as well. The custom scoring function 2 only relied on the active player's available legal moves and simply returned that floating point value as the score. On the other hand, custom scoring functions 1 and 3 relied on opponent's available legal moves as well and performed calculations on while taking into consideration a few other attributes such as the total number of empty places on the board. This simply explains why the win ratio for function 2 is lower than the rest.

It can be concluded that considering more attributes into the scoring mechanism leads to a better scoring heuristic which leads to a better win rate. To improve this, what can be done is consider the current position of the player and the opponent and then after performing some geometrical analysis, scores can be calculated based on the position of the player on the board.