HEURISTIC_ANALYSIS

Project 2: Adversarial Search Agent

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SUBMITED BY: MOHAMED AYMAN NAGUIB

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Heuristic 1 (custom_score)

Firstly, for this heuristic the number of legal moves is first calculated for both the player and his opponent, furthermore the difference between them is calculated, if the difference is not 0 then it is returned, else we calculate the Manhattan distance to the centre of the board. If the returned value is “inf” then the player has won, if the returned value is “-inf” then he has lost the game.

Results:

As shown below in Figure 1 is our game-playing agent performance with comparison with the AB_Improved provided by Udacity.

Match #	Opponent	AB_Improved		AB_Custom	
		Won	Lost	Won	Lost
1	Random	19	1	19	1
2	MM_Open	16	4	16	4
3	MM_Center	18	2	16	4
4	MM_Improved	16	4	16	4
5	AB_Open	8	12	10	10
6	AB_Center	11	9	9	11
7	AB_Improved	11	9	16	4
	Win Rate:	70.7%		72.9%	

Figure 1: Heuristic 1 Performance

Analysis:

This heuristic showed great results, given the fact that if the number of legal moves are equal for both players, it tries to move closer to the centre as the chance of having more moves is increased then.

Heuristic 2 (custom_score_2)

For this heuristic we also check if the difference between the legal moves between both players and return it if it is not 0. But, if the difference is zero then we check something different, and that is the blank spaces for the active player, given the fact that we do not calculate any spaces but we calculate the spaces in the rays (knight movement) until we find an obstacle or we reach the end of the board.

Results:

As shown below in Figure 2 is our game-playing agent performance with comparison with the AB_Improved provided by Udacity.

Match #	Opponent	AB_Improved		AB_Custom_2	
		Won	Lost	Won	Lost
1	Random	19	1	18	2
2	MM_Open	13	7	14	6
3	MM_Center	19	1	18	2
4	MM_Improved	13	7	16	4
5	AB_Open	9	11	6	14
6	AB_Center	12	8	11	9
7	AB_Improved	12	8	7	13
	Win Rate:	69.3%		64.3%	

Figure 2: Heuristic 2 Performance

Analysis:

The heuristic showed good results given the fact that it finds blank spaces and not just any blank spaces but blank spaces in its rays. Unfortunately, it showed results not as good as the first heuristic, but I tried it against a friend's game-agent and amazingly it did even better than the first heuristic.

Heuristic 3 (custom_score_2)

For the last heuristic I thought of doing the same for heuristic 2 but with a small modification, rather than just calculating the blank spaces for the active player, why not calculate for both players and return that difference.

Results:

As shown below in Figure 3 is our game-playing agent performance with comparison with the AB_Improved provided by Udacity.

Match #	Opponent	AB_Improved		AB_Custom_3	
		Won	Lost	Won	Lost
1	Random	17	3	18	2
2	MM_Open	16	4	17	3
3	MM_Center	17	3	17	3
4	MM_Improved	14	6	13	7
5	AB_Open	11	9	13	7
6	AB_Center	10	10	11	9
7	AB_Improved	10	10	9	11
	Win Rate:	67.9%		70.0%	

Figure 3: Heuristic 3 Performance

Analysis:

After checking the empty spaces for both players, this heuristic performed better than the previous one indeed.

Recommendation:

I recommend using the first heuristic (custom_score) as it checks for the legal moves and if it is the same for both players, then it checks positional advantage as it evaluates movements closer to the middle better than other movements. Using the Manhattan distance was used as it is a more adequate distance measuring than Euclidean distance.