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AIND Project 2: Build a Game-Playing Agent

Heuristic Analysis

Three different heuristics were implemented in order to evaluate the performance of each of them against the heuristic thought in class: the difference between the legal moves of player v.s. the opponent. This heuristic is referred to as 'ID_Improved' throughout this analysis, where 'ID' means iterative deepening.

This paper describes the results achieved by comparing the custom heuristics described below against the 'ID_Improved' heuristic.

Heuristic 1: The first heuristic implemented elaborates the idea of running away, rewarding the player based the distance between the player and the opponent. This is done because the distance increases the number of available moves and increase the winning opportunity. If the distance between the player and the opponent is maximum, the score will have a bonus of 2 moves. Thus is addition to calculating the difference in legals moves of the player v.s. the opponent, the player is rewarded for the distance between it and the opponent.

Heuristic 2: The second heuristic implemented elaborates the idea of running away toward the center, rewarding the player based the distance between the player and the opponent and the distance between the player and the center. Thus is addition to calculating the difference in legals moves of the player v.s. the opponent, the player is rewarded with the maximum of 4 moves for the distance between it and the opponent and the distance between it and the center.

Heuristic 3: The third heuristic implemented elaborates the idea of running away toward the center while pushing the opponent away from the center. The player is rewarded based on the distance between the player and the opponent, the distance between the player and the center, the distance between the opponent and the center. Thus is addition to calculating the difference in legals moves of the player v.s. the opponent, the player is rewarded with the maximum of 4 moves for the distance between player and the opponent, the distance between the player and the center, the distance between the opponent and the center.

	ID_Improved Evaluation	Heuristic 1 (running away)	Heuristic 2 (running away toward the center)	Heuristic 3 (running away toward the center while pushing the enemy away from the center)
Random	18 to 2	20 to 0	19 to 1	20 to 0
MM_Open	13 to 7	16 to 4	16 to 4	18 to 2
MM_Center	18 to 2	17 to 3	19 to 1	20 to 0
MM_Improved	13 to 7	17 to 3	17 to 3	17 to 3
AB_Open	12 to 8	12 to 8	12 to 8	12 to 8
AB_Center	11 to 9	10 to 10	10 to 10	15 to 5
AB_Improved	9 to 11	8 to 12	12 to 8	12 to 8
Win Rate	67.15%	71.45%	75.0%	81.4%

From the table, we can see that the performance increases from:
ID_Improved Evaluation -> Heuristic 1 Evaluation -> Heuristic 2 Evaluation -> Heuristic 3 Evaluation

One of the reason why Heuristic 3 performs better than the rest is:

- It inherits from good heuristics like Heuristic 1 and Heuristic 2.
- It is rewarded for doing the right things, not penalized for doing the wrong things. For some reason, the heuristics seem to perform better when they are rewarded instead of penalized. However, too much rewards or penalizations will reduce the performance of all heuristics.