

Heuristics Analysis

Heuristics functions:

Below are the three evaluation functions for my game-playing agent:

1. The first function: The difference in legal moves

Description: The difference between all possible legal moves by the player with all possible legal moves by the opponent in the current state of the game.

$$\text{own_moves} - \text{opp_moves}$$

Rationale: the difference between the player's legal moves always shows the possibility of having more potential moves and probability to win the game.

2. The second function: the squared ratio in legal moves

Description: the ratio between the squared values of all possible legal moves by the player with all possible legal moves by the opponent in the current state of the game.

$$\text{own_moves}^{**2} / (1 + \text{opp_moves}^{**2})$$

Rationale: the squared ratio between player's legal moves shows that the high chances for the current player to win over the opponent.

3. The third function: the cubed ratio in legal moves

Description: the ratio between the cubed values of all possible legal moves by the player with all possible legal moves by the opponent in the current state of the game.

$$\text{own_moves}^{**3} / (1 + \text{opp_moves}^{**3})$$

Rationale: the cubed ratio between player's legal moves shows that the high chances for the current player to win over the opponent.

Heuristics Functions Results:

The results from utilizing these evaluation functions are as follows:

***** Playing Matches *****									
Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	10	0	10	0	10	0	10	0
2	MM_Open	8	2	7	3	7	3	10	0
3	MM_Center	9	1	10	0	9	1	8	2
4	MM_Improved	6	4	7	3	8	2	8	2
5	AB_Open	6	4	5	5	7	3	5	5
6	AB_Center	5	5	4	6	6	4	6	4
7	AB_Improved	6	4	4	6	7	3	5	5
Win Rate:		71.4%		67.1%		77.1%		74.3%	

Heuristics Function Analysis:

1. Random is not performing well with any of the AB versions.
2. Win rate results for AB Custom 2 and 3 are pretty close and so increasing polynomial order will not help much.
3. Win rate results for AB Custom 2 heuristic function is the better than other two and so suited for the tournament.

Heuristics Function Recommendation:

Based on the win rates shown above, the most recommended heuristics function is **the squared ratio function** between the current player and the opponent.

Following are the reasons:

1. The win rate is consistently much better than regular difference function.
2. The squared ratio makes much higher difference in value than regular ratio between the player's legal moves.
3. Since increasing the polynomial order does not help much here, the best polynomial order to go with is two.