

Knight Isolation Heuristic Analyses

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Heuristic 1: Legal Player Move Counts with distance-to-center checking and distance-to-opponent checking

This evaluation function builds on the basic algorithm of rewarding moves which have a higher number of available moves for our player, and punishes for moves which have a high number of moves available to our opponent. If moves have the same utility based on legal moves, then a preference is leaned towards positions in the center of the board, and positions which are closer to our opponent. Using the visualization tools, I determined most losses take place at the edges of the map. This makes sense - positions at the edge have naturally fewer valid moves. By occupying squares in the center of the grid, nearest to the opponent, we can force the opponent against the wall for a victory condition. This algorithm performed well winning roughly 72% of the time.

Heuristic 2: Legal Player Move Count - Legal Opponent Move Count

This evaluation function was discussed in the lectures and was naturally my first attempt at an heuristic. This algorithm performed well winning roughly XX% of the time. Additional checks were added to guarantee winning states and losing states are not undervalued.

Heuristic 3: Legal Player Move Count alone

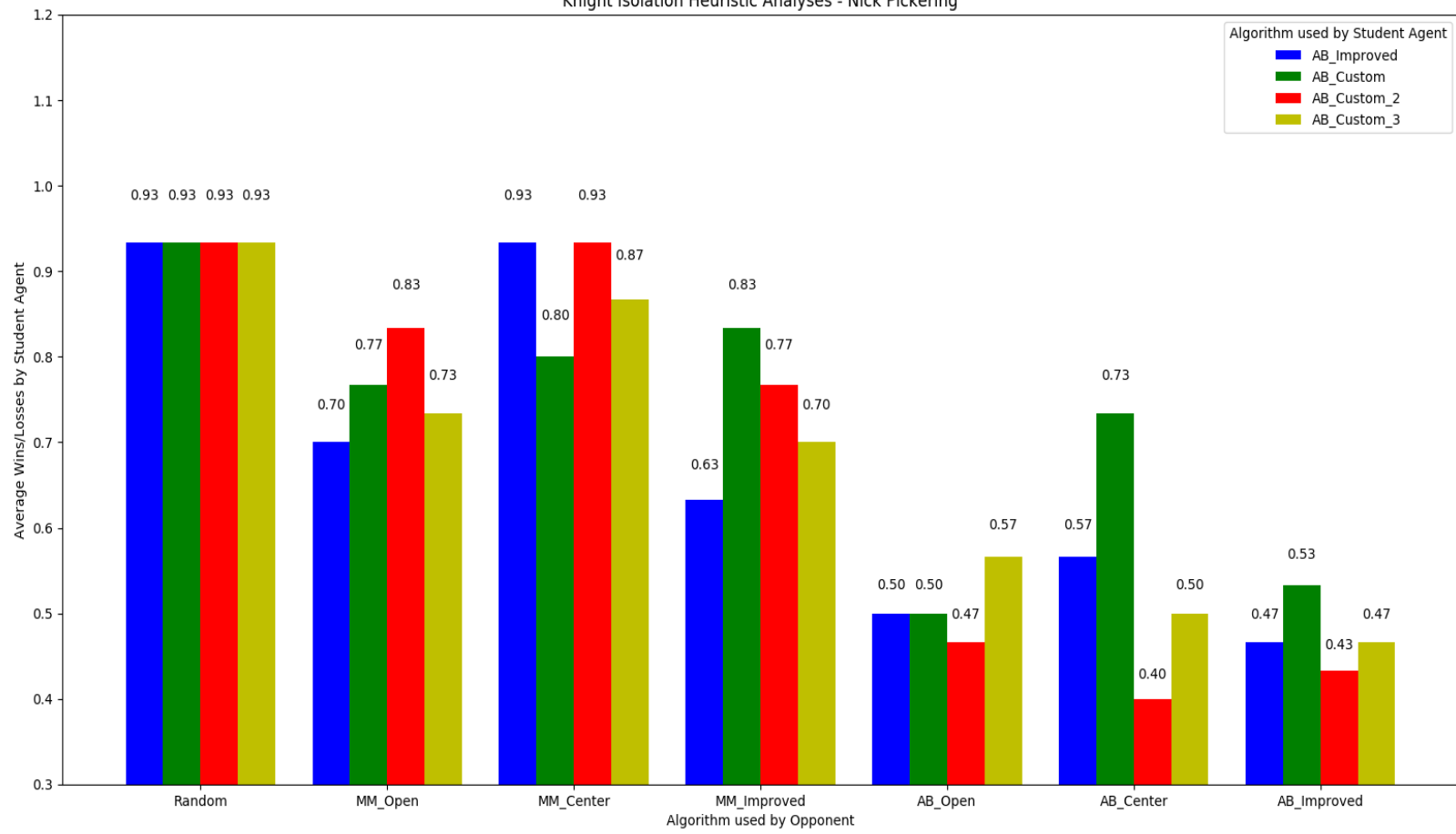
This evaluation function does not take into account the number of moves the opponent has left after our move. Surprisingly, this algorithm only slightly under-performs Heuristic 2. The nature of the piece's movements makes it difficult to trap an opponent. You have to nearly exhaust the board of options to get your opponent trapped. This heuristic has a winning rate of around XX%.

Recommended Heuristic

I recommend Heuristic 1 for evaluating Knight Isolation states.

This heuristic outperforms the other custom heuristics against more opponents and outperforms the AB_Improved agent against nearly every opponent agent. Heuristic 1 is outperformed only by Heuristic 2 against two opponents. In an odd case, Heuristic 3 performs extremely well against all Alpha-Beta agents. Heuristic 3 is a very aggressive algorithm, concerned with reducing opponents' options at all costs. I theorize that this boosted viability is caused by the heuristic's simplicity – by only counting the legal moves of the opponent, the evaluation function's run-time is much shorter and thus more branches can be searched.

Knight Isolation Heuristic Analyses - Nick Pickering



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*****
      Playing Matches
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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	8	2	10	0	7	3
3	MM_Center	9	1	9	1	10	0	9	1
4	MM_Improved	7	3	8	2	8	2	7	3
5	AB_Open	5	5	5	5	4	6	5	5
6	AB_Center	6	4	7	3	4	6	5	5
7	AB_Improved	4	6	5	5	4	6	5	5
Win Rate:		70.0%		74.3%		71.4%		68.6%	

Playing Matches									

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	9	1	8	2	9	1	10	0
2	MM_Open	7	3	7	3	7	3	7	3
3	MM_Center	9	1	8	2	8	2	7	3
4	MM_Improved	6	4	9	1	8	2	6	4
5	AB_Open	5	5	5	5	5	5	6	4
6	AB_Center	6	4	7	3	4	6	4	6
7	AB_Improved	5	5	6	4	4	6	4	6

Win Rate:		67.1%		71.4%		64.3%		62.9%	

Playing Matches									

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	9	1	10	0	9	1	8	2
2	MM_Open	6	4	8	2	8	2	8	2
3	MM_Center	10	0	7	3	10	0	10	0
4	MM_Improved	6	4	8	2	7	3	8	2
5	AB_Open	5	5	5	5	5	5	6	4
6	AB_Center	5	5	8	2	4	6	6	4
7	AB_Improved	5	5	5	5	5	5	5	5

Win Rate:		65.7%		72.9%		68.6%		72.9%	