Heuristic Analysis

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The heuristics used on this project are vital to its success as they provide the means to choose between the available actions. On the other hand, heuristics are not the only attribute that define the success of the algorithm, as other parameters such as CPU load, max_depth and timeout parameters also affect greatly the agent performance. As this analysis is only about the heuristics considered, max_depth and timeout were set to 3 and 12 respectively, to avoid the agent forfeiting or failing to complete matches but still maintaining good overall scores.

To assess the heuristics, some trials were performed, each with different heuristics. Initially, the results were not constant, what required the number of matches to be increase to 12, as with more matches the results tend to be less affected by issues such as are affected by CPU load and other non-controllable parameters. Also, to improve readability, the results were parametrized by assessing the performance for each heuristic based on the AB_Improved performance.

The following heuristics were considered:

1. Open move score or number of moves remaining to the agent: more legal moves should result on more flexibility and greater chance of escaping from tricky situations;
2. Improved Score or number of agent's move discounted the adversary's moves: improved version of number 1, this heuristic privileges minimizing the opponent's moves and maximizing the agent's;
3. Improved Adversary Score or number of agent's possible moves minus the square of the number of possible moves for the adversary: similar to heuristic number 2, this considers moves for both players but focus on reducing the number of possible moves for the adversary;
4. Improved Agent Score or number of agent's possible moves squared minus the number of possible moves for the adversary: like heuristic number 2, this considers moves for both players but focus on increasing the number of possible moves to the agent;
5. Distance from the center: in this heuristic, the score is calculated by considering the distance of the agent from the center of the board;
6. Heuristic 5 plus 3: This option focus on both approximating the agent to the center of the board and reducing the opponents moves;
7. Heuristic 5 plus 4: This option focus on both approximating the agent to the center of the board and increasing the agent's moves;
8. Heuristic 5 plus 2: This option focus on both approximating the agent to the center of the board, increasing the agent's moves and reduce the adversary's;

Figure 1 shows the results for the heuristics score considering the AB_Improved of each round to obtain the pondered score.

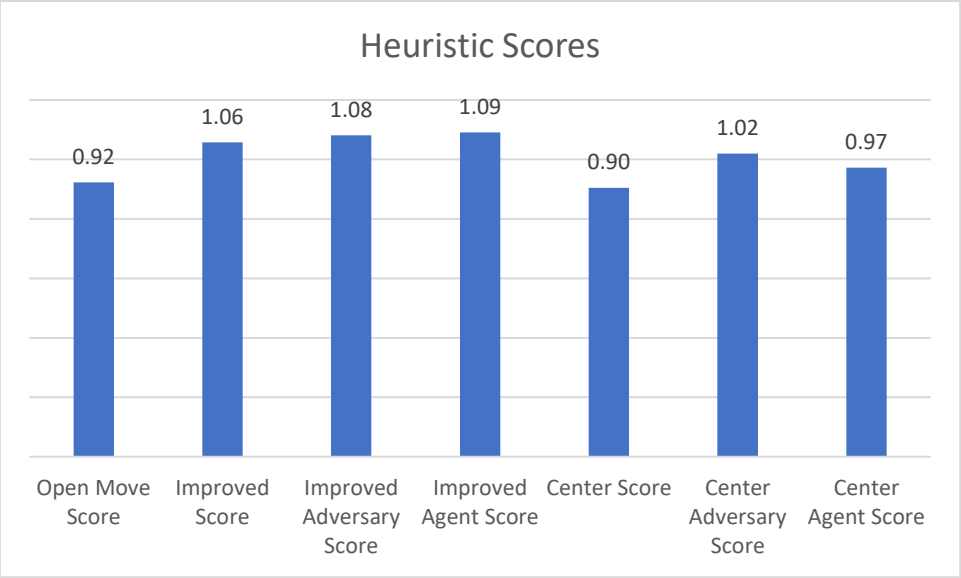

Figure 1 - Results for different heuristics

Therefore, the chosen heuristic was improved agent score, as it was the one with the best win rate, around 10% more than AB_Improved. In addition, this heuristic is quite simple and was capable of predicting well the final outcome of the game, which reflected on its improved performance. If a better performance was required, further trials with different depth values would probably yield better results.