Heuristic Analysis

Andrew Cai

Synopsis

The goal of this project is to create an agent to play the game of "Isolation". The agent will use iterative deepening search base on mini-max search with alpha-beta pruning to search the best moves with given time limitation. With that I implemented three different heuristic functions to evaluate the moves.

1. custom_score

This heuristic function will penalize a player if he has more corner moves and reward a player with less corner moves. Since if a player move to a corner, then he will have less opportunity to get rid of isolation and then have less opportunity to win the game.

2. custom_score2

This heuristic function will reward a player if he has more central moves and penalize a player with less central moves. Since with a central position, a player has more legal moves and more opportunities to win the game.

3. custom_score3

This heuristic function just return the value of number of current player's legal moves minus number of opponent's legal moves. Normally a player has more legal moves win the isolation game.

Here is the result of the tournament with these heuristics.

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                    ************************
                         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     9  |  1     9  |  1     9  |  1
    2       MM_Open     8  |  2     6  |  4     6  |  4     5  |  5
    3      MM_Center    9  |  1    10  |  0     8  |  2     9  |  1
    4     MM_Improved   4  |  6     7  |  3     5  |  5     6  |  4
    5       AB_Open     6  |  4     7  |  3     4  |  6     6  |  4
    6      AB_Center    8  |  2     4  |  6     5  |  5     6  |  4
    7     AB_Improved   4  |  6     6  |  4     4  |  6     5  |  5
--------------------------------------------------------------------------
          Win Rate:      68.6%        70.0%        58.6%        65.7%

Your ID search forfeited 244.0 games while there were still legal moves available to play.
```

I chose custom_score method as the heuristic used in score evaluation with the following reasons:

1. It outperforms all other heuristics with win rate 70.0%, which is higher than other heuristics.
2. The logic is simple, easy to understand and implement.
3. It only check the current state and no need to track history states. So no additional space needed.