Isolation Heuristics Report

I implemented three different heuristics to try to beat the computer players in the tournament. The first heuristic, implemented in custom_score(), is what I would term “conservative”. The strategy I chose was to compute the state of the board based on three items of consideration:

- len(own_moves) - len(opp_moves): improved score
- num_blocking_moves: the number of moves that the player has that overlaps with the opponent’s moves
- num_blocked_moves: the number of moves that the player has that are blocked

The evaluation metric is:
- len(own_moves) - len(opp_moves) - num_blocking_moves - num_blocked_moves

The thought process behind this metric was that the improved score is a good way to block the opponent’s moves while balancing against making moves that reduce the player’s own moves, e.g. moving to the corners of the board unnecessarily. Computing the number of moves that the opponent could block if the player moved here provides a means to avoid making a move that would cut off the board for the player. Finally computing the number of blocked moves that the player has avoids moving to areas where players have been previously. Note that the last metric is not independent of len(own_moves), since this metric also captures moves which are blocked. Therefore it represents an extra penalty for making a move which results in causing the player to have fewer moves.

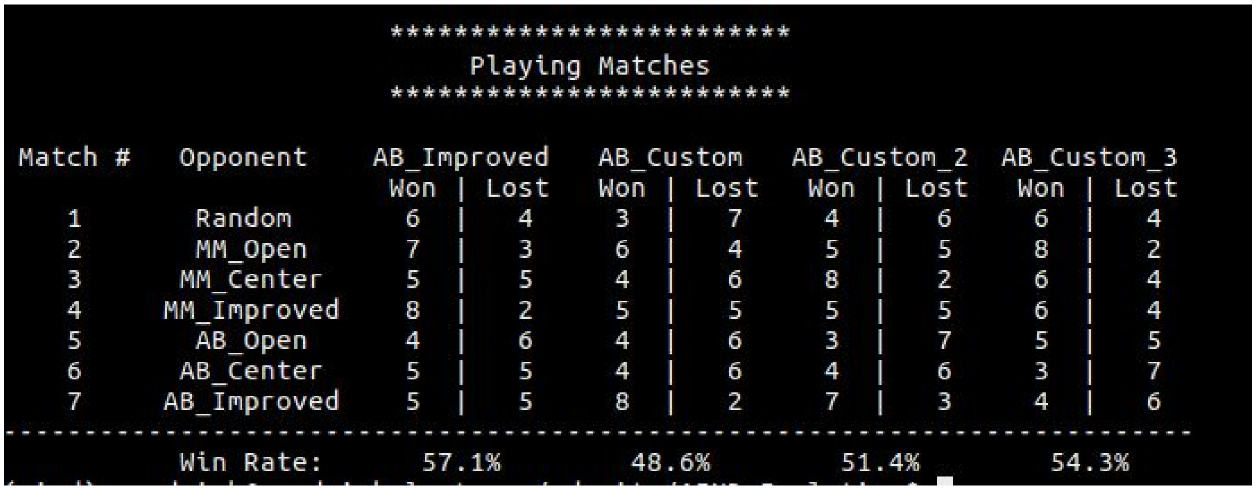
In custom_score_2() I implemented a strategy which I call “self-preserving”. The self-preserving strategy computes two metrics:
- opponent_distance: the distance from the player to the opponent
- len(own_moves): the # of moves the player has from this position

The heuristic is implemented as opponent_distance - len(own_moves). The idea is that the player should try to get away from the opponent to the greatest extent possible, while keeping the player’s options open.

In custom_score_3() I implemented a strategy called “smart improved score”, which computes the number of moves that the opponent could block and subtracts that from the improved score as follows:
- improved_score() - num_blocking_moves

The idea behind this metric is that the player should balance keeping their options open versus blocking the opponent’s moves, while trying not to make a move which allows the opponent to block the player.

The end result of these metrics was pretty interesting.



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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       6  |   4     3  |   7     4  |   6     6  |   4
    2       MM_Open      7  |   3     6  |   4     5  |   5     8  |   2
    3      MM_Center     5  |   5     4  |   6     8  |   2     6  |   4
    4     MM_Improved    8  |   2     5  |   5     5  |   5     6  |   4
    5       AB_Open      4  |   6     4  |   6     3  |   7     5  |   5
    6      AB_Center     5  |   5     4  |   6     4  |   6     3  |   7
    7     AB_Improved    5  |   5     8  |   2     7  |   3     4  |   6
--------------------------------------------------------------------------
           Win Rate:      57.1%        48.6%        51.4%        54.3%
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The best metric appeared to be custom_score_3(), however, it did not beat the AB_Improved player in the tournament metric. The second best performing metric was the custom_score_2() metric (“self-preserving”). This metric seemed to do well in head to head battles against AB_Improved, but played pretty poorly against the Random player. The worst performing metric was the custom_score() metric (“conservative”). What I found very interesting though is that the conservative and the self-preserving metric beats the AB_Improved player handily but plays poorly against the Random Player. It seems the metric seems too smart for its own good - it plays well against a sophisticated opponent, but not well against an unsophisticated opponent.

I found this exercise to be challenging, and was disappointed that I could not beat the AB_Improved player in the tournament.