Heuristic Analysis

For my heuristics I tried to be creative and come up with something completely different than just altering the coefficients of the already given function (my_moves-opponent_moves). I implemented two new heuristics:

- A very cowardly one, that tries to run as far away from the opponent as possible.
- An excessively brave one that tries to stay as close to the opponent as possible.

The third one (hybrid) is the sum between the heuristic that tries to maximise the distance to the opponent and the heuristic given in the lectures (my_moves-opponent_moves). In my testing this hybrid seemed to perform best consistently.

Won/Lost	AB_Improved	Dist_Max	Dist_Min	Hybrid
Random	90|10	89|11	92|8	94|6
MM_Open	68|32	62|38	76|24	82|18
MM_Center	92|8	90|10	90|10	87|13
MM_Improved	79|21	64|36	66|34	69|31
AB_Open	48|52	53|47	54|46	56|44
AB_Center	55|45	57|43	50|50	62|38
AB_Improved	49|51	48|52	48|52	47|53
Win Rate	68.7 %	66.1 %	68.0 %	71.0 %

The first two functions I implemented (dist_max and dist_min) consistently underperform the AB_Improved function by a bit. If I think of what would constitute a valid strategy for playing isolation, I would not pick any of these two over the original function. Maximising the difference between your moves and the opponent's moves seems like a better strategy. However, as we can see from the results of the hybrid heuristic, trying to maximise this difference **and** stay as far away as possible from the opponent seems to perform best. I think this is true because in general when taking multiple good heuristics into account you tend to get better accuracy compared to using just one. Good chess computers use thousands of heuristics to evaluate what the best next move is.

Above are the results of testing each heuristic with 100 games per adversary in order to get good accuracy. As can be seen from the results, the best heuristic seems to be the hybrid one. This seems to be consistent across all of my tests. If you were to pick just one heuristic out of these I would recommend picking the hybrid because:

1. In my tests it consistently outperformed the others even if by a slight margin.
2. Every single heuristic is bound to fail in certain situations. That is why the really big game computers use lots and lots of heuristics. By combining two good heuristics you have a situation where you get the best of both worlds.
3. This hybrid heuristic is harder to decipher by a human opponent. If using only a single simple function a human might be able to easily figure out the strategy and counteract it.