Artificial Intelligence Nanodegree

Build a Game-Playing Agent - Heuristic Analysis

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1. **Offensive Strategy**

   Idea: maximize my choices of moves

   score = len(game.get_legal_moves(player)) * 1.0

   Result: (ID_Improved: 87.14%, My_Agent: 85.00%)

2. **Defensive Strategy**

   Idea: minimize opponent's choices of moves

   score = len(game.get_legal_moves(game.get_opponent(player))) * -1.0

   Result: (ID_Improved: 90%, My_Agent: 67.86%)

3. **Hybrid Strategy**

   Idea: maximize my choices of moves and, at the same time, minimize opponent's choices of moves

   score = ((0.1 + (len(game.get_legal_moves(player))) * 1.0) /

   ((0.1 + len(game.get_legal_moves(game.get_opponent(player)))) * 1.0))

   (I added 0.1 to prevent Division by Zero error)

   Result: (ID_Improved: 88.57%, My_Agent: 91.43%)

4. **Conclusion**

   The Hybrid Strategy is chosen because it provides highest winning rate among 3 strategies.

   The Offensive or Defensive Strategy only considers a part of the problem, whether a move will provide My_Agent with as many future moves as possible or a move made by My_Agent will reduce opponent's future moves as many as possible. These 2 strategies are quite simple in term of calculation, so the execution time should be fast, which means the Minmax Tree Search or AlphaBeta Pruning algorithm can run deeper than more complex evaluation function.

   The Hybrid Strategy is the most comprehensive among 3 strategies as it considers both My_Agent future's moves and opponent's future moves. For this strategy, the evaluation score will be highest when My_Agent has the most future moves available and my opponent has the fewest future moves available. Comparing to other 2 strategies, this strategy is heavier in term of calculation and may lead to shallower depth of the search tree. However, as the evaluation function is comprehensive, the winning rate is higher comparing to 2 other strategies.

Game	Offensive Strategy		Defensive Strategy		Hybrid Strategy	
	ID_Improved	My_Agent	ID_Improved	My_Agent	ID_Improved	My_Agent
1	85.71%	85.00%	87.14%	72.86%	87.14%	89.29%
2	87.86%	85.00%	93.05%	65.00%	85.71%	91.43%
3	89.29%	82.14%	84.29%	66.43%	87.86%	88.57%
4	90.71%	85.71%	92.14%	72.14%	87.14%	88.57%
5	85.71%	79.29%	90.00%	71.43%	84.29%	87.14%