Udacity – Artificial Intelligence Nanodegree Program

Project: Build a Game Playing Agent
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For this project, a game player agent was developed to play knights isolation. The purpose was to explore adversarial search techniques and implement one of three options:

- **Option 1: Develop a custom heuristic (must not be one of the heuristics from lectures, and cannot only be a combination of the number of liberties available to each agent)**
- **Option 2: Develop an opening book (must span at least depth 4 of the search tree)**
- **Option 3: Build an agent using advanced search techniques (for example: killer heuristic, principle variation search (not in lecture), or monte carlo tree search (not in lecture))**

The following sections of this report are organized first by outlining the option implemented for the project by presenting the performance of the agent against a baseline.

Section 1. Implementation of an Advanced Search Technique

Through research, **MTD(f)** (Memory-enhanced Test Driver using first guess) was the algorithms chosen as an advanced search technique. The baseline agent was an alpha-beta pruning search as developed in class with minor performance improvements.

For performance analysis, 100 matches were run with the baseline and the advanced search agent. Fair matches **were not enabled** as they would not have a significant impact given the agent always selects a random move at first.

Section 2. Performance of MTD(f) vs. Baseline

The performance analysis was performed at a depth level of 9 for both MTDF(f) and the baseline. Overall, MTD(f) underperforms by a wide margin averaging 25%.

The decrease effectiveness against the minimax agent is likely attributed to the depth of search and the time limitations. Considering MTD(f) stores previously visited nodes, the logic for retrieval could also contribute to a lower performance.

Time	Baseline	MTD(f)
10ms	66%	68%
50ms	59%	26%
100ms	52%	29%
150ms	49%	27%
200ms	55%	21%
250 ms	49%	27%

Figure A. Performance Comparison