Research Review: Game Tree Searching by Min / Max Approximation

The goal

This paper describe a new technique for searching in game trees, based on the idea of approximating the min and max operators with generalized mean-value operators.
Also, it points out that there are still further works needed to improve the efficiency.

Previous works, such as Alpha-Beta pruning method does help on reducing the computational time needed in the game search tree. However, new techniques are still needed, the method in this paper illustrate that "A method is needed which will always expand the node that is expected to have the largest effect on the value."

The core idea of the "min/max approximation" method is that approximate the "min" and "max" operators with generalized mean-value operators.

A heuristic method is usually based on a "static evaluation function", for the proposed technique in this paper, a B-star algorithm which requires 2 static evaluation function is used.

The min/max approximation technique is a penalty based scheme. There are many situation that can gives a node some penalties. The idea then is to expand the node with the least penalty and add to the tree.

Result

In order to compare the min/max approximation method with the minimax with alpha-beta pruning method, the authors of the paper let these two methods compete with each other.

There are two resource bound type: time bound per turn and moves count bound in total.

In short, there are 490 games were played for each resource bound, 980 games were played in total.

With the time usage bound, the alpha-beta seems to work better that the min/max approximation. But under move-based resource limits, min/max approximation is definitely superior. Such a result gives us a sight that the min/max approximation is good at reducing the number of calls to the move operator, in different purposed cases, the min/max approach can work better. Overall, the results are encouraging.