

Game Tree Searching by Min / Max Approximation

1. Summary of the paper's goals or techniques:

(1) **Goals:** This paper introduced an iterative method for searching min/max game trees based on the idea of approximating the “min” and “max” operators by generalized mean-valued operators. This approximation is used to guide the selection of the next leaf node to expand, since the approximations allow one to select efficiently that leaf node upon whose value the (approximate) value at the root most highly depends. It is well known that the possibilities in the game explode in a combinatorial way, so it is not practical to search all the game tree, and techniques are needed to reduce the computational burden of exploring the game tree. Although there are some methods such as alpha-beta pruning, a method is needed which will always expand the node that is expected to have the largest effect on the value.

(2) **Techniques:** The paper used the "min/max approximation" heuristic which is a special case of the penalty-based search method, where the penalties are defined in terms of the derivatives of the approximating functions. This method will choose which leaf to expand in an iterative method.

2. Summary of the paper's results

This paper used 1,000 games of Connect-Four to the performance of the "min/max approximation" heuristic. The experiments show that alpha-beta method seems to be superior to the min/max approximation approach based on time usage alone. However, if it is based on move-based resource limits, the min/max approximation is superior.