Game Tree Searching by Min/Max Approximation

In this paper the author introduce a new technique of expanding a game search tree, he first examine the most famous techniques like min/max with alpha-beta pruning with iterative deepening and penalty-based iterative search methods, his method is derived from the penalty-based search.

In Iterative search heuristic method., each node has an estimate that get backed-up with every sibling visit as following.

Step 1: initialize the tree with the root and set the penalty of the root according to the static function of the game

Step 2: while the tree has unvisited nodes and time permits do:

    a) Pick an expandable tip c
    b) Expand c
    c) Update penalty of c and it's ancestors up to the root

In Penalty-based, a non-negative weight is assigned to each edge and the penalty of the node is the sum of weight from root to the node, the node with least penalty is picked for expansion .

The summary of Min/Max Approximation technique is that we replace Min / Max approach of evaluating the non-terminal nodes by a large generalized mean value of children node, since we are interested in expanding the node that have the maximum sensitivity on the root node [largest derivative with respect to other node] this is achieved by expanding the node with least penalty.

The author has done experiment on his approach and deduced that in a timely constricted per turn game, the Alpha beta pruning have higher winning rate, but when it comes to restricted the number of moves to be examined, his approach has superior winning rate over AB pruning.

At last, he discusses the limitations of his approach and compare them to the limitation of AB pruning and B* algorithm.