Research Review on
Riv87c, Game tree search by Min/Max Approximation(MMA).

Compare MMA with Minimax with Alpha-beta Pruning (MAP)

The MAP is based on Depth First Search, it gets the best move by iterating between min and max, that also means, it completely ignore the back up move, or the other potential good moves. and due the discrete essence of the min and max function, it reflects NO sensitivity of each leaf of each search of given depth against the root. but to get each best move of the given depth, it is less intensive in computation compared with MAP, and due its essence of map and reduce, it can be paralleled more easily than MMA.

The MMA is penalty-based iterative search, the penalty score is on each edge between child and ancestor, the lowest sum of penalty between root and leaf determine the leaf to be expanded. the generalized p-mean make the min/max function continuous and approximate the min/max result, we call this function Ve, the continuous Ve pave road to below mathematics procedure.
   1) we use the partial derivative of Ve(root) on Ve(leaf) to embody the change sensitivity from leaf to root, and this is an accumulative multiplication of the partial derivatives between each pair of vexes of each edge in the path from root to leaf.
   2) while the penalty is the accumulative sum of the weight of each edge.
   3) to achieve 1), the weight function in 2) need to be able to transform the plus operation to multiply, that means it should be a logarithm function on Ve. finally, the largest of change sensitivity root on leaf is the leaf with least sum of the penalty.

To avoid the expensive computation of partial derivative of min/max approximation, they use the alternative approximation named as 'reversed approximation'. min/max algorithm still used, the main point of the MMA is to assigned weight, the calculation of the partial derivative between each pair of each edge is replaced by certain numerical approximation method. consider the smaller p of p-mean means smaller confidence level of the result, they use some tricks to improve the accuracy.

They test the MMA and MAP on game of connect of four.
the result shows MAP outperform if the limitation solely on time. while MMA prevails when limitation solely on move count.