Summary of the Game Tree Searching by Min /Max Approximation*

Abstract

This research paper discussed the penalty-based approaches using min/max approximation functions and their derivatives to decide optimally which child will be explored based on the static evaluation function.

Explaination

Tree searching by min/max approximation is an example of a penalty-based iterative search method,which assign a penalty to the edge between each parent and child node. The lowest sum of penaltiesbetween the root of a tree and the tip nodes determines which node is to be expanded. Min/max approximation replace the minimum/maximum calculation with the generalized p-mean (which computationally expensive) function. The derivative of the p-mean function can be used to calculate the ‘sensitivity’ between twonodes, while the derivative of the exact min/max function provides no additional information.

Implementation

Implementing generalized p-means is computationally expensive. The implementation described in the paper use a “reverse approximation” approach. The traditional min and max calculations are used. The main point of using generalized means was for using the derivatives to assign sensitivity weights between each parent node and child node. They achieved this effect with a weight equation which provides a weight to every configuration based on the configuration value and the most favorable descendent value. The function provides a variable for penalizing depth and another for adjusting based on confidence in evaluation function accuracy. Using this implementation, they were able to test the performance of a penalty-based scheme against minimax with alpha-beta pruning.

Conclusion

Min/max approximation and other penalty-based approaches can outperform minimax with alpha-beta pruning if limited to the same number of moves. If the constraint is on time and not on moves, alpha-beta can explore more configurations and outperform the penalty based approach.