Research Paper Overview

Game Tree Searching By Min/Max Approximation

Summary

This paper introduces a new technique for searching in game trees, based on the idea of approximating the min and max operators with generalized mean-value operators.It describes a method which will always expand the node that is expected to have the largest effect on the value. The method attempts to focus the computer's attention on the important lines of play. The key idea is to approximate the "min" and "max" operators with generalized mean-value operators.
The penalty based iterative search is a general method for choosing which leaf to expand in an iterative method.
The "penalty" P(c) of a tip c belonging to any tree -> T(E), as to be the sum of the penalties of all the edges between c and the root S of tree T.
The "min/max approximation" heuristic is special case of the penalty-based search method, where the penalties are defined in terms of the derivatives of the approximating functions

Results

Experimental results from almost 1,000 games of Connect-Four suggest that the scheme is superior to minimax search with alpha-beta pruning, for the same number of calls to the move routine. They also indicate that the scheme outplays alpha-beta with iterative deepening, when both schemes are restricted to the same number of calls to the move operator. However, the scheme has higher overhead, so that further work is needed before it becomes competitive when CPU time per turn is the limiting resource.
It is also observed through reading the paper that based on time usage alone, alpha-beta seems to be superior to our implementation of the min/max approximation approach.
In short the areas where it might fall short are:

- The tree has to be explicitly stored ~ This increases Memory Complexity.
- Penalty based-schemes always tend to evaluate all the tip’s successors
- They spend a lot of time traversing back-forth as compared to depth-first scheme