AIND PROJECT 2 Research review: Multi-player Alpha-Beta Pruning, Richard E, Korf.

1. Goal

Generalization of minimax search with alpha-beta pruning to non-cooperative, perfect-information games with more than two players.

2. Techniques

This paper deals with the minimax algorithm, alpha-beta pruning technique for perfect-information, non-cooperative game learned in week 2 & week 3.

Luckhardt and Irani extended minimax to multi-player games. Each player tries to maximize his or her perceived return, and is indifferent to the returns of the remaining players.

If there is an upper bound on the sum of each players heuristic value, and there is a lower bound on the values of each player, then actual tree pruning is possible.

When player *i* is to move, and the *i*-th component of one of its children equals the upper bound on the sum of all components, all remaining children can be pruned, since no child's *i*-th component can exceed the upper bound on the sum. This process is referred as **immediate pruning**. This is equivalent to situations in the two-player case when a child of a Max node has a value of ***inf***, or a child of a Min node has a value of ***-inf***.

When sum of all players value is fixed in every level of the game, if upper bound of *i*-th component one of its children is less than or equal to the lower bound in previously evaluated node, then remaining children can be pruned. This procedure is called **Shallow pruning**.

Deep pruning refers to pruning a node based on a bound inherited from its great-grandparent, or any more distant ancestor. In a two-player game tree, it can only occur in trees of height four or greater. But it is not generalized to more than two players since the child node could affect the value of the ancestor.

3. Results

When there are three or more players, **immediate and shallow pruning are possible** under certain conditions, but **deep pruning is generally impossible** because the child node can affect the value of ancestor node.