

EXPERIMENTING WITH MINIMAX AND ALPHA-BETA PRUNING

Introduction :

The objective of this experiment was to explore and analyze the performance of Minimax and Alpha-Beta Pruning algorithms in tic-tac-toe.

Minimax Algorithm :

The minimax rule backs up values from the children of a node. For a MAX node, it backs up the maximum of the values of the children. For a MIN node, the minimum.

Evaluation Function

$e(p)$ = number of directions open for Max – number of directions open for Min

$e(p)$ = + inf if win for Max

$e(p)$ = - inf if win for Min

Average time : b^d

Alpha-Beta Pruning :

o Alpha-beta pruning is not actually a new algorithm, rather an optimization technique for minimax algorithm.

o It reduces the computation time by a huge factor. This allows us to search much faster and even go into deeper levels in the game tree.

o It cuts off branches in the game tree which need not be searched because there already exists a better move available.

$\alpha(n)$: The best value that MAX currently can guarantee; maximum value found so far.

$\beta(n)$: The best value that MIN currently can guarantee; minimum value found so far.

Worst case: b^d

Best case: $(2b)^{(d/2)}$

Conclusion :

In conclusion, the experiment highlighted the effectiveness of Alpha-Beta Pruning as an optimization technique for the Minimax algorithm. The combination of these two algorithms is crucial for enhancing the performance of decision-making processes in game theory. This study contributes to the understanding of algorithmic strategies in game-playing scenarios, providing valuable insights for future research in artificial intelligence and decision-making systems.