

MiniMax

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What is the MiniMax algorithm?

MiniMax is an Artificial Intelligence algorithm implemented typically on two-player games such as chess and TicTacToe. The aim of the algorithm is to find the best move for the AI player to make, assuming that the opponent will also make the best move possible. The algorithm works by recursively evaluating the game tree of the current state of the game, and assigning a score to each possible move. The algorithm will then choose the move with the highest score, assuming that the opponent will also make the best move possible. The algorithm will then repeat this process until the game is over. This algorithm can be further optimized using alpha-beta pruning, which works by pruning the game tree to reduce the number of nodes that need to be evaluated. This is done by keeping track of the best possible score that the maximizing player can achieve, and the worst possible score that the minimizing player can achieve. If the worst possible score that the minimizing player can achieve is less than the best possible score that the maximizing player can achieve, then the algorithm will not evaluate the nodes below that node.

How does the algorithm work?

For the game of TicTacToe, it works as follows:

1. Initialize the game board and the evaluation function (1 for win, -1 for loss, 0 for draw)
2. If the game is over or the maximum depth has been reached, return the score of the game board
3. If the current player is the maximizing player:
 - (a) Initialize the best score to be -infinity
 - (b) For each possible move:
 - i. Make the move
 - ii. Recursively call the algorithm on the new game board
 - iii. Update the best score to be the maximum of the current best score and the score returned by the recursive call
 - iv. Update the alpha value to be the maximum of the current alpha value and the best score
 - v. Undo the move
 - vi. If the beta value is less than or equal to the alpha value, break out of the loop
 - (c) Return the best score
4. If the current player is the minimizing player:
 - (a) Initialize the best score to be infinity
 - (b) For each possible move:
 - i. Make the move
 - ii. Recursively call the algorithm on the new game board
 - iii. Update the best score to be the minimum of the current best score and the score returned by the recursive call
 - iv. Update the beta value to be the minimum of the current beta value and the best score
 - v. Undo the move
 - vi. If the beta value is less than or equal to the alpha value, break out of the loop
 - (c) Return the best score