

AIND Research Review: Deep Blue

Deep Blue is the computer chess system that beat the chess world champion Garry Kasparov in 1997.

Goal and Techniques used

The goal of the Deep Blue project was to create a world-class chess machine.

Previous efforts had proved that chess grandmasters could search way beyond what a uniform searcher could possibly achieve, so from a search perspective, the two most important goals were:

- Make the search highly non-uniform
- Avoid simple errors with a reasonable depth uniform search

There were several techniques used to this purpose.

Null Window Search

This search is like *alpha-beta*, but depends on a good ordering of the nodes to speed it up. Assuming the first node is the best option, it will run *alpha-beta* searches on the other nodes with *alpha* and *beta* equal. This basically means it can only know if another node would be better (or worse), but not their exact values. If the first node turns out to not be the best it will default to a normal *alpha-beta*.

Transposition Tables

Previously seen positions may be stored with their corresponding evaluation value so as to not search again if the position is reached through another path in the search.

Credit for Extensions on Search

Forcing moves, threats, new moves being enabled, among others, were said to generate *credit* for each player. If either player reaches a certain threshold, they both get discounted the amount and the search depth is extended further by said amount. This helps greatly to increase the non-uniformity of the search, as *boring* positions will not get an extension.

Evaluation Function

Custom hardware was built to evaluate states to speed up the search. Both hardware and software search had evaluation functions that could be approximated if there was no need to run the full evaluation, as it was very expensive time-wise. The features used for the evaluation function were hand-picked and tuned for better performance.

Opening Book and Grandmasters' Database

Deep blue stored several board configurations and the moves masters played on them. If a given move is widely preferred by masters, it could override the search and just play it.

Results

Deep Blue beat the Garry Kasparov in May 1997 in a six-game match, with two wins, three draws and a loss.