

Research Review

Deep Blue is a chess AI developed at IBM that defeated World Champion Garry Kasparov in 1997. Deep Blue has had different versions but the paper focuses on the 1997 version with comparisons to the 1996 version. Deep Blue is a “massively parallel” system composed of 30 processors, each with a dedicated GB of RAM and 4 GB of disk space. Hardware aside, Deep Blue was very impressive from a software perspective. Deep Blue utilized null-window alpha-beta search, allowing it to eliminate the need for a value stack, thereby simplifying the hardware design. Unfortunately, this means in some cases multiple searches are needed. The search needs a move stack to keep track of explored moves at each depth of the search tree.

Deep Blue’s hardware search used a fixed-depth null-window search, which included a quiescence search. This featured many different search extension heuristics, it was fast, and yet relatively simple. The actual evaluation function is a sum of feature values. Deep Blue’s chess chip recognizes 8000 different patterns and assigns them all a value, all of varying complexities. The initial values are created by the “evaluation function generator.” The Deep Blue evaluation function generator is run only at the root node of the search tree. Besides adjusting feature values based on the context of the root position, the evaluation function generator creates abstractions for the values of the features in order to simplify the task tracking to a manageable level; dictating relationships between groups of related features instead of setting them all fully independently.

The result of Deep Blue was significant. The combination of its massive searching capability, non-uniform search, and complex evaluations were all imperative to the final machine capable of defeating a world class chess champion. This doesn’t mean however there

wasn't room for improvement, which there was much of. Parallel search efficiency and hardware search and evaluation efficiency and flexibility all had room for improvement, and future more powerful chess machines were created in following years.