Deep Blue Research Review

For AI Nanodegree Project 2

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The key to Deep Blue's chess prowess was its ability to search through chess positions in parallel, while passing them through a powerful vetting system driven by its evaluation functions. This search capability was further powered by its extensive database, meaning it did not always have to search through theoretical positional outcomes and could rely on existing knowledge of optimal play.

The core of Deep Blue was a specially designed chess chip. This is a silicon representation of a chessboard that can be used to perform hardware-based searching as well as heuristic application; since the evaluation function for Deep Blue was implemented in hardware. This form of searching is more focused around exploring the tree near the leaves and while it cannot perform a lot of recursive extensions, or be particularly extensible and flexible when compared to software searching, it does allow for some very complex quiescent search.

Deep Blue was also equipped with a software search, where it could make up for the shortcomings of the hardware system. The software system was designed to use the hardware system as a version of dynamic evaluation function as well as work in tandem (using a predetermined switching algorithm) to create a non-uniform search engine. This, coupled with the high degree of parallelization designed around offloading long term computation to the software developed into a thinking machine that the designers and developers understood to be closer to how human chess grandmasters thought about the game.

When it came to specific tactical play, the team did spend time on coming up with a specific database to combat Kasparov. However, this was hardly used, and most of the theoretical knowledge that the AI relied on was its opening book and extended book. The concept of an opening book is well understood and applied across the field, but the extended book was an expansion upon the theory. Using machine learning heuristics like frequency analysis of moves as well as a study of annotated games created a series of good chess practices and guidelines that Deep Blue could rely on without having to resort to the more rote learning approach of an opening database.

The evaluation functions, both static and dynamic, were very complex, but could have been tuned further, according to the afterwords of the developers. The system relied on pattern recognition databases that, when combined, generated a score that offered the cumulative tactical advantage/disadvantage of the particular position it was studying. The actual valuation of said tactical advantages was "far from complete" in their words, and was one of the things they wished they could have improved. Another oddity was the lack of a pruning method in the searching algorithm, which would have both made the search much more powerful as well as added to the non-uniformity of chess strategic planning that the developers were hoping to achieve.

Deep Blue's success is well documented as a foundation for the future of game-playing artificial intelligences and it is my hope, and it appears to be reflected in the writing of the team at IBM, that the future will lead to even better silicon-borne competition.