Research Review of Deep Blue by the IBM Watson Team

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Goal:

The goal of this research is to build a world-class chess machine.

There was a series of machines that led up to Deep Blue; ChipTest and Deep Thought, Deep Thought 2, Deep Blue I. Deep Blue is a massively parallel system designed for carrying out chess game tree searches. The system is composed of 30 processors and 480 single-chip chess search engines. The chess chips in Deep Blue are each capable of searching 2 to 2.5 million chess positions per second. Deep Blue relies on many of the ideas developed in earlier chess programs, including quiescence search, iterative deepening, transposition tables, and NagaScout.

There are some characteristics for Deep Blue to win the game.

* it has a large searching capacity. Strong human players are able to calculate well beyond the depth reachable by a uniform searcher of any conceivable speed. A minute of search in Deep Blue would reach a full-width depth of 12.2 on average.
* it has an evaluation function in Hardware to perform faster because a “better” evaluation function takes too long time to execute in Software.
* its search combines a software search with hardware search. The very fact that the two searches are different can lead to horizon effects.
* it is composed of 500 processors which are available to participate in the game tree search.

The chess chip divides into three parts: the move generator, the search control, and evaluation function. The move generator is implemented as an 8 x 8 array of combinational logic, which is effectively a silicon chessboard. And the search function is implemented in both hardware and software. The evaluation function is essentially a sum of values. The chess chip recognizes roughly 8000 different patterns, and each is assigned a value. There are 54 registers and 8096 table entries for a total of 8150 parameters that can be set in the evaluation function.

Results:

Deep Blue became the first chess machine that defeated World Chess Champion Garry Kasparov in a six-game in 1997. Deep Blue Team explains there were many factors that contributed the success of the Deep Blue. The large searching capability, non-uniform search, and complex evaluation function were critical.

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Campbell, Murray, A.joseph Hoane, and Feng-Hsiung Hsu. "Deep Blue." *Artificial Intelligence* 134.1-2 (2002): 57-83. Web.