Research Review
Deep Blue

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Abstract

The paper describes the Deep Blue system, the chess machine, and gives some of the rationale that went into the design decisions behind Deep Blue.

Key facts

The research to create a chess machine started in the 1980s. The predecessors of Deep Blue were ChipTest, Deep Thought (1988), and Deep Thought II (late 1990s). There were two distinct versions of Deep Blue, one which lost to Garry Kasparov with 2-4 score in 1996 and the one which defeated him with 3.5-2.5 score in 1997, Deep Blue I and Deep Blue II, respectively.

There were a number of factors that contributed to this success:

Massively parallel system with multiple level of parallelism
Deep Blue is a massively parallel system designed for carrying out chess game tree searches. The system is composed of a 30-node (30-processor) IBM RS/6000 SP computer and 480 single-chip chess search engines, with 16 chess chips per SP processor. The average system speed was 126 million positions per second with maximum speed up to 330 million.

Single-chip chess search engine
The chess chip divides into three parts: the move generator, the evaluation function, and the search control which may be extended with external Field-Programmable Gate Array.

Strong emphasis on search extensions
In Deep Blue several new search extensions were implemented like the Hybrid hardware/software search and the massively parallel search.

Complex evaluation function
There are 54 registers and 8096 tables for a total of 8150 parameters that can be set in the evaluation function which is essentially a sum of a feature values.

Effective use of a Grandmaster game database
Deep Blue used the Opening book (about 4000 positions), the Extended book (the summary of about 700000 game database) and the Endgame database which included all chess positions with five or fewer pieces on the board, as well as selected positions with six pieces.

The success of the project was not a result of any one factor. There were many design decisions that had to be made.
The Deep Blue project encouraged further development of computational methods applied to games.