

Research Review – Deep Blue

Deep Blue is a chess program developed by IBM that defeated the then-reigning world chess champion Garry Kasparov. There were 2 versions of deep blue, one that lost in 1996 and the other discussed here that won in 1997.

Several factors including advancements in software and hardware contributed to Deep Blue's success:

- a single-chip chess search engine,
- a massively parallel system with multiple levels of parallelism,
- a strong emphasis on search extensions,
- a complex evaluation function, and
- effective use of a Grandmaster game database.

New Techniques Introduced

Chess Chip: The chip used in Deep Blue had a number of new functions including the generation of checking and check evasion moves. It also generated certain attack moves that permitted improved quiescence searching.

Search Function: Deep blue uses a hybrid software and hardware search function using over 500 processors in the game tree search speeding up the search process. The search function is built on the alpha-beta search algorithm that helped prune unnecessary moves saving computational power and used a repetition detector to identify moves that could result in repetitions.

Evaluation Function: The evaluation function is composed of fast and slow evaluation, which is a standard technique to skip computing an expensive full evaluation when an approximation is good enough. The slow evaluation scanned the chess board one column at a time, computing values for chess concepts such as square control, king safety, pawn structure and so on. The features in both the slow and fast evaluation functions were assigned programmable weights, allowing their relative importance to be easily adjusted as required during each stage of the match.

Results

The above-mentioned techniques along with several others helped Deep Blue defeat Gary Kasparov in 1997. But Deep Blue isn't just about playing chess. It proved that with intelligent search and evaluation techniques, an artificial intelligent system can help solve many complex human problems.