

Summary of Deep blue research paper:

Deep Blue is a chess machine that beat Gary Kasparov in a six match game in 1997.

There were number of factors contributing to Deep blue success starting from

Single chip chess search engine, massive parallel system, emphasis on search extensions, complex evaluation function to effective grandmaster game database. Series of machines like chiptest, deep thought 2, deep blue 1 and deep blue 2 had led to the overall success of deep blue.

About the system:

Deep blue is a parallel system designed to carry out chess game tree searches. It has massive search capacity and each chess chips is capable of searching 2.5 million chess positions per second. Deep blue would average around 100 million chess positions per second for tactical positions and double that for quieter positions.

The four main deep blue system characteristics are

- Large searching capacity

- Search would provide insurance against simple errors

- Hardware evaluation

- Hybrid and software approach

The system chip can generate moves, evaluate moves and does search control.

Move generator is 8*8 array of combinatorial logic and the move generation include evasive as well as attacking moves and also permits quiescence searching. The move generations are controlled by hardware finite state machines and computes all possible moves.

Based on earlier experiences a selective search was built for deep thought 2 this will later be the basis for deep blue selective search. The principles behind selective search are extended forcing, dual credit and delayed extending.

There is also a mechanism for credit which identifies nodes that will receive credit. Another point worth noting is that deep blue implements pruning mechanism "no progress" which means if a move is worth playing then it is best to play earlier rather than later.

Hardware search is a fixed width single window search which uses quiescence search involves depth of search and find offsets, once hardware search is triggered the system is free to work other tasks.

Deep blue parallel search characteristics include processor hierarchy, control distribution, parallelism and synchronization

The system evaluation function is very powerful and involves a complex The chess chip recognizes.

8000 different patterns and each is assigned a value.

Each feature value is static or dynamic. The evaluation function is run only at the root level

In addition to this Deep blue has 54 registers, 8096 table entries and 8190 parameters

Deep blue has an opening book comprising various first moves and an extended book.

It also has an endgame database fewer than 5 pieces

Deep blue has a straight forward time control mechanisms. Adequate time buffer is included for sudden death scenarios and system issues.

Conclusion:

There is no one factor that led to the success of Deep blue the combination of all the above factors have led to the success of Deep blue.

The large searching capacity, non uniform search and complex evaluation functions

were all instrumental in deep blues success.

The areas of improvement were parallel and hardware search efficiency which could have been made better. The paper attempts highlights the areas of improvement for further exploration.