

## Research Review – Gary Yang

### Deep Blue

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Deep blue is an AI developed by IBM to play chess. Specifically they wanted to develop an AI that could defeat the World Champion Garry Kasparov in a six game chess match. The article covers both the 1997 version of Deep Blue, Deep Blue II, and the 1996 version, Deep Blue I. Deep Blue was a system made of 30 processors, with 1 GB of RAM and 4 GB of disk. It ran on the AIX 4.2 operating system.

Deep Blue II had a complete redesigned evaluation function, compare to Deep Blue I where it had 6400 features and Deep Blue II had over 8000. The new chip added hardware repetition detection, number of specialized move generation modes, and efficiency improvements that increased the per chip search speed to 2.5 million positions per second.

Deep Blue had a large searching capacity that were based on two main principles. The search should be highly non-uniform. The search should provide insurance against simple errors. Deep blue also used pruning algorithms, null move pruning. Deep Blue was using a highly selective search that satisfy IBM's insurance need. Deep Blue has its evaluation functions implemented in hardware. This allow Deep Blue to not need to constantly reevaluate its evaluation function against time. The hardware search is also parameterized but the search is fixed. It's also a massively parallel system, using over 500 processors to help with the game tree search.

The Deep Blue chip also had addition functions to help deal with evasion moves and generating attack moves, which in terms helps with quiescence search. It also had search control

to implement null-window alpha-beta search. Which in terms helps eliminate the need for a value stack. On top of that it also use the support of Field Programmable Gate Array to give access to more complicated search control.

To sum it up, Deep Blue's development was a significant impact with its massive search capability, highly non-uniform search, and its multiple highly complex evaluations to defeating Garry Kasparov. At the time it may have been all that we were capable of doing and it having been 20 years since Deep Blue II defeated Garry Kasparov, I can see that we could definitely improve the AI to be even more efficient and flexible.