

# Research Review Summary

## “Deep Blue”

### Goals

The paper starts with a brief history of from ChipTest and Deep Thought, the first chess machine to beat a Grandmaster in tournament play, to Deep Blue II, the system that defeated World Class Champion Garry Kasparov in 1997. Then the paper covers the system, overview of the chess chip, the software search, the hardware search, the parallel search, the evaluation function and miscellaneous techniques used in designing Deep Blue.

### Techniques

This paper gives descriptions on various techniques and design decisions used when building Deep Blue. In summary, Deep Blue II relies on ideas like quiescence search, iterative deepening, transposition tables and NegaScout. More specifically, Deep Blue II implements a hybrid hardware/software search and a massively parallel search. The hardware search takes place on the chess chips, specially designed for chess game, each of which carries out a fixed-depth null-window search and includes a quiescence search. The software search implements a depth-limited version of alpha-beta using the negamax formulation. While the hardware search is faster and simpler than the software search, the software search is more flexible and easier to extend. The evaluation function also consists of a hardware part and a software part. Some other techniques that Deep Blue II used include opening book, extended book and endgame databases.

### Results

The success of Deep Blue II over World Class Chess Champion Garry Kasparov was a result of the combination of all the techniques summarized above. The author also mentions areas for improvement which includes, increasing the parallel search efficiency, adding an external FPGA (Field Programmable Gate Array) to make the hardware search more efficient and flexible, adding pruning mechanism to improve the search, and further tuning the evaluation function both manually and automatically.