Research Review: Deep Blue by IBM Watson

Markus Buchholz

The paper Deep Blue discusses about chess computer system developed by IBM, which in 1997 won with Garry Kasparov. Authors presents design approach (reminding previous computer concepts) to final chess machine functionality. By emphasizing the developed final architecture, authors pointed the main weakness of previous architecture (which in 1996 lost the game with G.K) and described (main goal of this paper) implemented series of system changes to success in chess game.

The successful chess machine was achieved mainly by integration the maximally possible amount of software-modifiable chess knowledge onto the chess chip (completely redesigned evaluation function, repetition detection), which influenced the speed performance. The second major improvement was adding more chess chips in the computer architecture. Finally, development system software and debugging tools made the system more reliable and robust. Giving the main overview of IBM Deep Blue II chess system which was based on IBM RS/6000 Supercomputer (average about 100 million positions per second) and earlier know ideas, like: quiescence search, iterative deepening, transposition tables and NegaScout, authors approached to detailed system design of chess system.

The search function occurs in parallel on two levels. First search is distributed around the supercomputer nodes (hardware). Secondly the other search level is performed in software. Authors described the software architecture to support search capability (null-window alpha-beta search algorithm.) . Using the best experiences from previous chess machine design (Deep Blue I) authors described concisely Deep Thought 2 selective search and presented main design principles: e.g: Extend forcing/forced pairs of moves, Forced moves are expectation dependent fractional and delayed extensions

Further, the readers can familiarize with chess chip overview, where the chess program was deployed. Hardware based algorithm output exceeded the software-based design. Here the authors described main part of the chip. They focused first on **move generator**, which main function is to generates the chess moves and allows the search to go forward in time. Secondly the **evaluation function** that computes the values of future positions, and finally the **search control** that goes backward in time and backs up the future values to the present position. The hardware search is supported by parallel search algorithm (parallelism) demonstrated in on of paper paragraph.

The paper does not discuss about results directly or give one common clear evidence factor. “ The success of Deep Blue in the 1997 match was not the result of any one factor”. The final success was the combination of presented in regarding paper factors (techniques).The authors (team) understood that several areas of improvement in presented solution could have been implemented: parallel search, increase usage of FPGA.