Research Review – Deep Blue

Goals

This paper discusses the evolution of chess machines built from late 1980s to till the Deep Blue II that beat the grandmaster Garry Kasparov in 1997. The paper takes the reader through with improvements made on Software, Hardware, Storage methods for moves, heuristics, end games., Hybrid approaches, Training the machine with expert dictionary, etc., and invites researchers with pointers to lead in to further improvements.

Techniques

Few of the techniques introduced in this paper

- *Software Algorithms*: Deep Blue Evaluation Function - A parallel approach of evaluating the board at column level to identify predetermined features that are either threats / advantages. Null window Alpha-Beta search and Repetition Detector; Credit Generation Mechanisms – requiring auxiliary computation powers; Time control – a distinguished time mode between normal and panic time to meet the constraint of the game to meet specified number of moves in stipulated time; Deep Blue selective search with FFPs; and cut-off techniques such as Expectation Dependency restrictions, Fractional Extensions, Delayed Extensions, Dual Credit, Preserving Search Envelope.

- *Hybrid Software Hardware Search:* Hardcoded endgame databases for faster search during the final stages of the game while fewer pieces on board; Dictionary based improvements to game strategy, based on moves played by Grandmasters & scores based on how recent the moves were played and using a summary of moves (open book & extended book); Move Generator: Chess chip with a hardwired finite state machine to generate a 'move'

- *Massively Parallel Search:* Hardware Search and Parallel Searching with insights in to the parallelism architecture, performance tuning and load balancing

Results

The Deep Blue II game machine has been improved massively by means of improving the Software Algorithm, improving Hardware performance through parallelism and storing large clever approaches in hardwired finite state machines or in ROMs & CDs. Multiple factors influenced improving the game machine to a substantial level to beat a Grandmaster.