

Research Review: Deep Blue

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This review describes briefly the findings of the paper on Deep Blue system by Campbell et al. published in 2002. This paper describes the second version of Deep Blue which was used to beat Garry Kasparov in 1997, who was the world champion at the time. In 1996 the previous version of Deep Blue lost to Kasparov, and this served as a learning ground to overcome the deficiencies in the algorithm and the system. Several changes were made to Deep Blue after the first version lost in 1996. Most importantly, the second version facilitated a large searching capacity. This was possible through a number of improvements, through a hybrid hardware and software search, and by having a massive parallel processing ability (about 500 processors were available for game search).

Deep Blue I also had the hardware search and evaluation on silicon (called chess chips). Each chess chip can recognize about 8000 different patterns. In the improved version, the amount of these chips were doubled, and a more powerful newer generation computer was used to support the higher processing demands. The hardware search simplified the task of programming on the software side, however, the search was still rigid, as it can only handle certain functional forms. The searching process also included something called a non-uniform approach, which mimics how human chess players think beyond the given depth. This algorithm also made improvements to provide insurance against simple errors, which can be crucial to win against a strategic player.

The chess chip or the hardware side of the Deep Blue consists of three parts: move generator, evaluation function and search control. We already saw that the hardware search complements the software side. The evaluation function in the chip can perform both fast evaluation and slow evaluation. These two have programmable weights, and were used depending on how

computationally expensive the potential move is and how sophisticated the evaluation function is.

The new Deep Blue system also had credit generation mechanisms that identifies nodes which receives credit than the normal ones, such as, threat, mate threat move or a move that influences a potential change in the game. The system also maintained databases of opening and end-game moves, which were obtained from simulations of playing with itself and other chess champions.

Although most of the evaluation functions in Deep Blue were tuned by hand, these were a couple that were automated, specifically for choosing the weights, based on existing data. These also led to significant improvements in the system.

Deep Blue II defeated the world champion Garry Kasparov by a score of 3.5-2.5 in 1997. The success of the improved system was a combination of several factors mentioned above. Although, the authors note that they have identified many improvements that could be made to the system, and many alternatives were left unexplored at the time.