Research Review

Deep Blue

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The paper describes the Deep Blue chess-playing system, which defeated Garry Kasparov in 1997. Although the paper dates from 2002, it is still relevant as it covers the game-playing system based on tree searches.

One interesting section of the article is where the considered hardware is described as at the time, computers were much less powerful, creating the necessity for custom processors for the task. For instance, the researchers created a move generator Integrated Circuit, task which is unthinkable nowadays as the computers are much faster. Additionally, many difficulties of implementing better algorithms are described and attributed to the hardware limitations, as once the IC is created, the cost to make any modification was exorbitant.

Another interesting aspect is that the evaluation function implemented is composed of both a fast and a slow evaluator, with the fast being responsible for computing the score for a given chess position and the slow carrying out more advanced heuristics. After the calculations are done, the results are compared considering programmable weights, so that the importance of each one can be adjusted. On the software search section of the paper, the calculations are explained and justified, including a section regarding different mechanisms to generate scores.

The search algorithms are also implemented on hardware and use a null-window alpha-beta search. This is justified by the fact that the null-window search eliminates the need for a value stack, which was very important considering the hardware implementation and limited memory size available at the time. Additionally, this search is performed in parallel by a 30-node computer and 480 chess chips, which demanded advanced coordination described on the document.

Additionally, the evaluation function considered was implemented on a chip and could recognize around 8000 different patterns, each with a different value. The document also describes in detail how the features are initialized and stored, noting that most of the features and weights were designed by hand, although a limited set was designed using a tool specifically created for this task. Also, the authors provide some examples for evaluation functions implemented.

This paper clearly demonstrates (and states) that the creation of a machine capable of winning the 1997 Kasparov game was a result of multiple factors, as it is expected on a multidisciplinary task such as this one. Also, this research makes one realize the enormous influence and power that our current computational power provides for the Artificial Intelligence field, as implementing a system similar to the presented one would probably require only a good computer nowadays. Finally, the paper demonstrates how some techniques already covered on the AIND, like alpha-beta pruning, can be applied and generate incredible results.