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Udacity Artificial Intelligence Nanodegree - Research Review

Deep Blue Research Review

The Deep Blue research by Murray Campbell, A. Joseph Hoane Jr., and Feng-hsiung Hsu; describes the techniques and the rationale behind the decisions that Deep Blue supercomputer made in six-game match against Гарри Кимович Каспаров - the World Chess Champion. It has to be stated that complexity of chess movements is enormous - there are 10^{120} possibilities - the number proposed by Claude Shannon (in 1950) in his famous article "Programming a Computer for Playing Chess" in Philosophical Magazine.

The Deep Blue success was recognized in 1997 (after being beaten by Kasparov year earlier) - it is obvious that attempts to create super-human chess machine were made half of century before - yet with no avail.

What made Deep Blue outstanding were:

1. a single-chip chess search engine,
2. a massively parallel system with multiple levels of parallelism,
3. a strong emphasis on search extensions,
4. a complex evaluation function, and
5. effective use of a Grandmaster game database.

The Deep Blue II victory was possible because of its predecessor failure - the new chess chip had a completely redesigned evaluation function, going from 6400 features to over 8000 as a response to specific problems observed in the 1996 Kasparov games, as well as in test games against Grandmaster Joel Benjamin. Author of this review is keen on stating that this process is not only enhancement, and can be called supervised evolution of the machine.

Aforementioned piece of hardware also added hardware repetition detection, a number of specialized move generation modes and speed increase to up to 2.5 million positions per second. Another improvement was more chips in the system and parallel processing. Last, but not least - the newly created and redesigned evaluation function was refactored, thoroughly tested and tuned specifically to match Kasparov skills.

The research describes techniques of the system as a whole and goes into more details to describe the evaluation function of the search tree. Simply put - there were about 8000 features which values were summed to achieve the result. In following pages the research dives into details regarding heuristic, tree search and methods of scoring each and every state of game after player made his move.

The Deep Blue II game agent was based on previous inventions such as ChipTest, Deep Thought, NegaScout and Deep Blue I - its direct predecessor.

The Deep Blue research is a brilliant way to understand steps to consider while creating game agent as well as scale of complexity hardware and software wise. Here many software and hardware choices had to be made, yet now - in 2017 we have vast sea of either to choose from. During this course both - hardware and software is much more obvious - standard local computer (any post 2010 desktop/laptop is sufficient) and python skills. But that is not limiting at all - and that will be the subject of totally different story.