RESEARCH REVIEW

DEEP BLUE

Deep Blue is the IBM's chess machine that defeated World Chess Champion Garry Kasparov in a six-game match in 1997.

Techniques Introduced:

Hardware Search:

The hardware search takes place on the chess chip that carries out a fixed-depth null-window search, which includes a quiescence search. Hardware search is fast and simple whereas software search is efficient and complex. Both the Hardware and software search runs parallelly controlled by a host processor on chip. The host can abort hardware search if its taking too much time. Chip has 3 main parts

- Move Generator
- Search Control
- Evaluation Function

Software Search:

The software search forms the basis for Deep Blue's selective search which is knowns as 'Dual Credit with delayed extensions'. This search comes into immediate effect whenever the machine faces serious problems such as Principle Variation(PV) i.e. current best play for both sides. Credits are assigned to either player based on the type of move generated. The credit assigned for various conditions is depth dependent, with positions near the root of the tree generally receiving more credit than positions far from the root. This choice allowed quicker resolution of moderately deep forcing lines without allowing the search to explode.

Parallel Search:

Deep Blue uses a static processor tree with one master node controlling 29 nodes, which in turn control 16 chess chips each. Deep Blue uses centralised control of the parallel search conducted on the master node. It executes offset depth searches as well as null move searches in parallel because both the searches cannot be done on hardware. When a depth search leads to a load balancing problem, it aborts hardware search and push to software search.

Evaluation Function:

Evaluation function is sum of features values that are either very easy or very complex. A feature value can be static (which are set once at beginning of the search) or dynamic (which are scaled during evaluation time). This function makes abstractions on the feature values in order to dictate relationships between related values.

Opening Book & Extended Book:

The opening book in Deep Blue was created by hand, primarily by Grandmaster Joel Benjamin, with assistance from Grandmasters Nick De Firmian, John Fedorowicz, and Miguel Illescas. The book consisted of about 4000 positions, 19 and every position had been checked by Deep Blue in overnight runs. The openings were chosen to emphasize positions that Deep Blue played well.

The extended book is a mechanism that allows a large database to influence and direct Deep Blue's play in the absence of opening book information. It summarizes the database which uses to nudge the machine in the direction of chess opening theory.