Deep Blue paper one page summary

The key result was:

The goal is to build an AI program that can defeat chess masters, but we can also note that the machine specs were very high to be able to compute all the possible moves and there outcomes, which leads us to say it was just using its computational power in an enhanced brute force algorithm, it didn't have any learning formulas or AI.

Some of the techniques used, besides the mini-max, iterative deepening and alpha-beta pruning:

1. Using two evaluation functions for different situations:

The evaluation function implemented in the Deep Blue chip is composed of a "fast evaluation" and a "slow evaluation" , slow evaluation takes into account a lot more parameters such as square control, pins, X-rays, king safety, pawn structure, passed pawns, ray control, outposts, pawn majority, rook on the 7th, blockade, restraint, color complex, trapped pieces, development, and so on. It's used only when there is a critical situation, while fast evaluation is used at the start. The features recognized in both the slow and fast evaluation functions have programmable weights, allowing their relative importance to be easily adjusted.

2. Using variable limit on the maximum depth that should be searched as the game progresses:

As the iteration deepening proceeds, the number of minimum and maximum depths used increases as the end game is nearer and possibilities for moves becomes less, so we can have a variable limit on the depth searched in limited depth searches.

3. Pruning similar nodes that can be found at deeper levels:

No progress technique is if possible to reach a state earlier in the game "early depth" then we prune it if the same state is reached through a different path in a deeper level

4. Using well known openings to start the game:

Deep Blue operates much like a turbocharged "expert system," drawing on vast resources of stored information (For example, a database of opening games played by grandmasters over the last 100 years) and then calculating the most appropriate response to an opponent's move

Some more things to talk about:

1. **The differences between last version of Deep Blue and the one before last:**
   There are two main differences between the Deep Blue of last year and the current version. First of all, this year Deep Blue will be running on a faster system - the latest version of the SP - which uses 30 P2SC or Power Two Super Chip processors. As a result, it will run about twice as fast as last year's system

   Secondly, Deep Blue's "chess knowledge" has improved since last year, the development team has spent the past several months educating Deep Blue about some of the finer points of the game.

   Deep Blue averaged about 100 million chess positions per second. This means it examined and evaluated 100 million different chess positions every second. In the new version, the developers estimate that Deep Blue will work about twice as quickly - that is, 200 million chess positions per second

2. **Is deep blue actually intelligent?**

   "no." Earlier computer designs that tried to mimic human thinking weren't very good at it. No formula exists for intuition. So Deep Blue's designers have gone "back to the future." Deep Blue relies more on computational power and a simpler search and evaluation function.

   Deep Blue applies brute force aplenty, but the "intelligence" is the old-fashioned kind. Think about the 100 years of grandmaster games. Kasparov isn't playing a computer, he's playing the ghosts of grandmasters past. That Deep Blue can organize such a storehouse of knowledge -- and apply it on the fly to the ever-changing complexities on the chessboard -- is what makes this particular heap of silicon an arrow pointing to the future.

3. **Why is it hard for deep blue to win over Kasparov?**

   Although chess has a finite number of possible outcomes that the computer must analyze, there are subtleties that do not easily subject themselves to objective analysis. Material is easy to evaluate, but what happens when a human player offers a gambit? In evaluating whether material gain makes up for a possible loss of positional strength, the

computer is no longer comparing apples to apples. Sophisticated programs like Deep Blue must have ways of evaluating gambits, and declining them if necessary.