CHESS ENGINES

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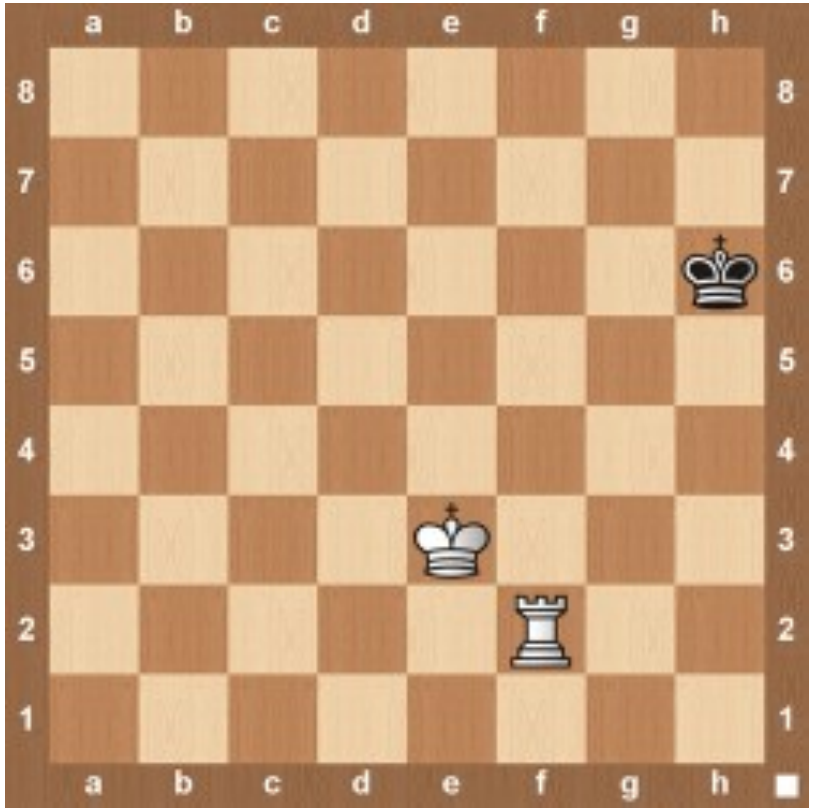
Explanation and Purpose

- Highly specialized calculators for chess
- Studying chess
- Back end program

Brief History

- 1914 – First Machine for Chess
- 1986 – The phrase “Chess Engine”
- 1989 - Deep Thought beats Bent Larson
  but loses to Gary Kasparov




the rematch
GARRY
KASPAROV
DEEP
BLUE

Brief History

- 1996 – IBM rematch - Deep Blue wins
- Chess Engines have surpassed humans for chess performance
- Engine tournaments

1		Carlsen		2873.5
2		Caruana		2818.4
3		Ding Liren		2804.3
4	↑1	Giri		2779.0
5	↓1	Vachier-Lagrave		2778.4
6	↑1	Nepomniachtchi		2775.0
7	↑1	Mamedyarov		2774.6
8	↓2	Grischuk		2774.4
9		Anand		2768.5
10		Artemiev		2761.0

1		Hou Yifan		2659.0
2		Ju Wenjun		2592.0
3	↑1	Koneru		2558.0
4	↑1	Lagno		2552.7
5	↑3	Goryachkina		2552.6
6	Live	Muzychuk M		2551.2
7		Cmilyte		2538.0
8	↓2	Muzychuk A		2528.5
9		Kosteniuk		2528.2
10		Dzagnidze		2522.5

1	Carlsen	2889.2	21 Apr 2014
2	Kasparov	2856.7	03 Mar 2000
3	Caruana	2851.3	08 Oct 2014
4	Aronian	2835.5	02 Feb 2014
5	Topalov	2826.5	24 Aug 2015
6	Mamedyarov	2826.2	30 Sep 2018
7	So	2824.5	01 Apr 2017
8	Anand	2820.7	26 Jan 2011
9	Vachier-Lagr	2819.3	28 Jul 2016
10	Nakamura	2819.0	23 Aug 2015

1	Stockfish 10 64-bit 4CPU	3546
2	Houdini 6 64-bit 4CPU	3520
3	Komodo 11.2 64-bit 4CPU	3503
4	Lc0 0.21.1 JH.T6.532 GPU	3486
5	Fire 7.1 64-bit 4CPU	3424
6	Komodo 12.3 MCTS 64-bit 4CPU	3409
7	Xiphos 0.5 64-bit 4CPU	3401
8	Ethereal 11.25 64-bit 4CPU	3389
9	Laser 1.7 64-bit 4CPU	3366
10	Fizbo 2 64-bit 4CPU	3341

How do they work

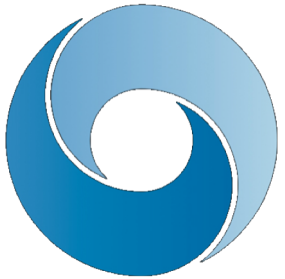
- Two different approaches – both are by machine learning
- First Principles
  - Zero Sum Game
  - Perfect Information
  - Alternating Moves
- Starting moves are given book moves
- Final Positions are Table Bases
- Everything in-between is the algorithm

Decision Trees

- Brute Force engines
- Alpha–Beta pruning

  a search algorithm that seeks to decrease the number of nodes that are evaluated by the minmax algorithm in its search tree.
- The current position is the root
- Children nodes represent the legal moves
- Each child has children nodes based on legal moves
- Converge similar positions
- Pieces and combinations are weighted and position reevaluated.

Neural Networks



- Still uses trees but stacks a neural network on top of it
- PUCT - Predictor + Upper Confidence Bound Tree Search
- Simulates the games many times and tries to predict the most promising move based on the simulation results.
- Probabilities of a best move is determined through back propagation until resources are exhausted.

Which is Better

- Both have won major tournaments
- Static position return different results
- Better than humans