



AlphaZero 1 - Chess 0

How Modern AI is Reshaping Thought

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March 29, 2018

A Brief History of Computer Chess

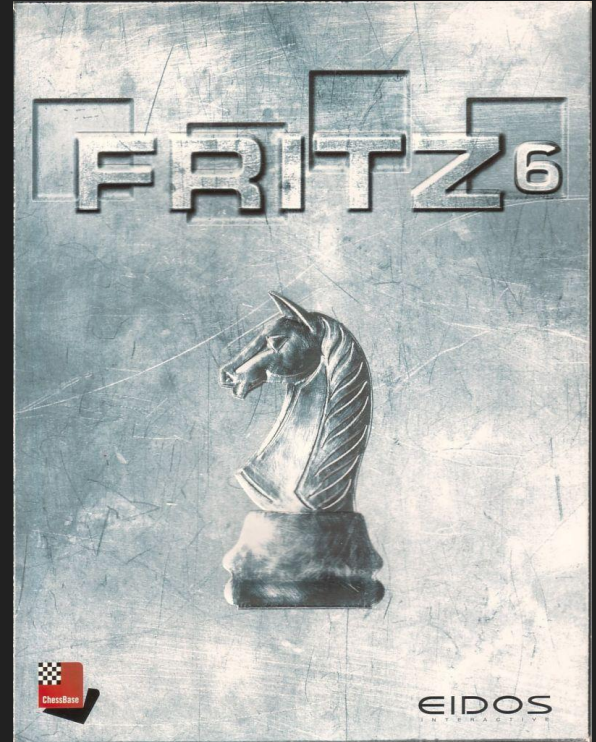
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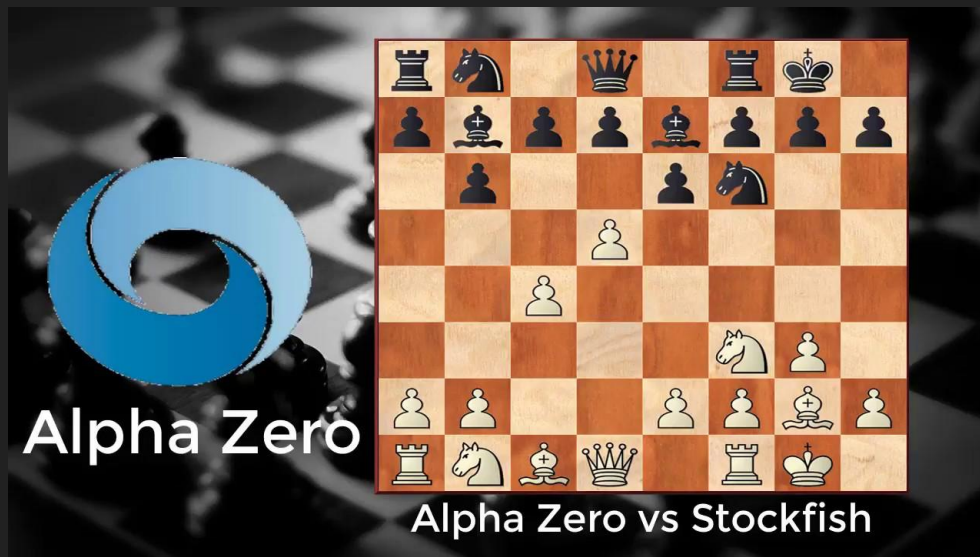
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- **Early 2000s** - Chess engines commercially available
- **Late 2000s** - Chess engines become consistently stronger than Grandmasters

Rank	Name	Rating		
		Elo	+	-
1	Stockfish 9 64-bit 4CPU	3450	+20	-19
2	Houdini 6 64-bit 4CPU	3413	+19	-19
3	Komodo 11.2 64-bit 4CPU	3405	+17	-17
4	Deep Shredder 13 64-bit 4CPU	3294	+15	-15
5	Fire 6.1 64-bit 4CPU	3292	+20	-20
6	Fizbo 2 64-bit 4CPU	3284	+22	-22
7	Andscacs 0.93 64-bit 4CPU	3256	+22	-22
8	Booot 6.2 64-bit 4CPU	3228	+16	-16
9	Fritz 16 64-bit 4CPU	3205	+14	-14
10	Chiron 4 64-bit 4CPU	3204	+16	-16

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- Crushed leading chess engine Stockfish with 28 wins and 72 draws from 100 games



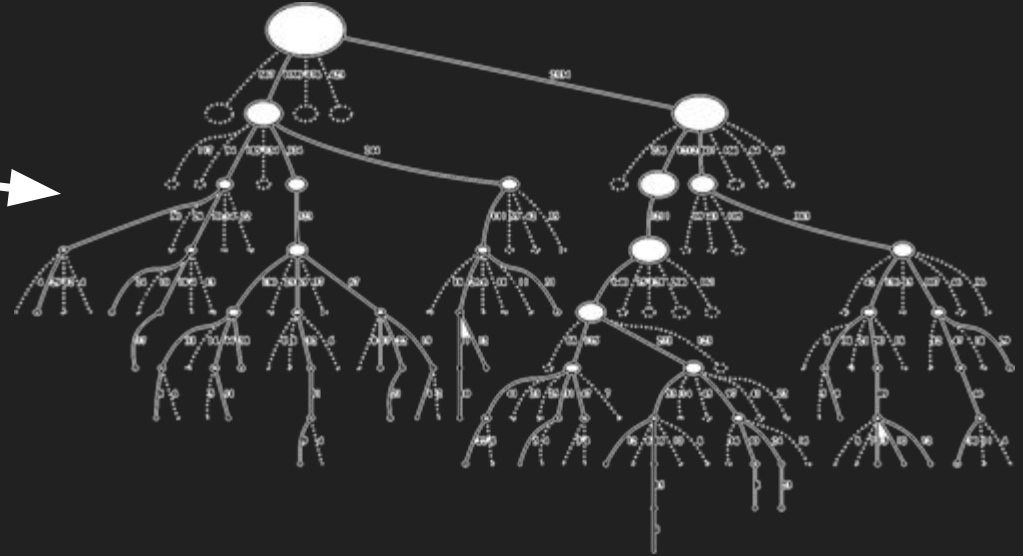
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- Previous chess engines relied on **alpha-beta pruning** and **heuristic evaluation**

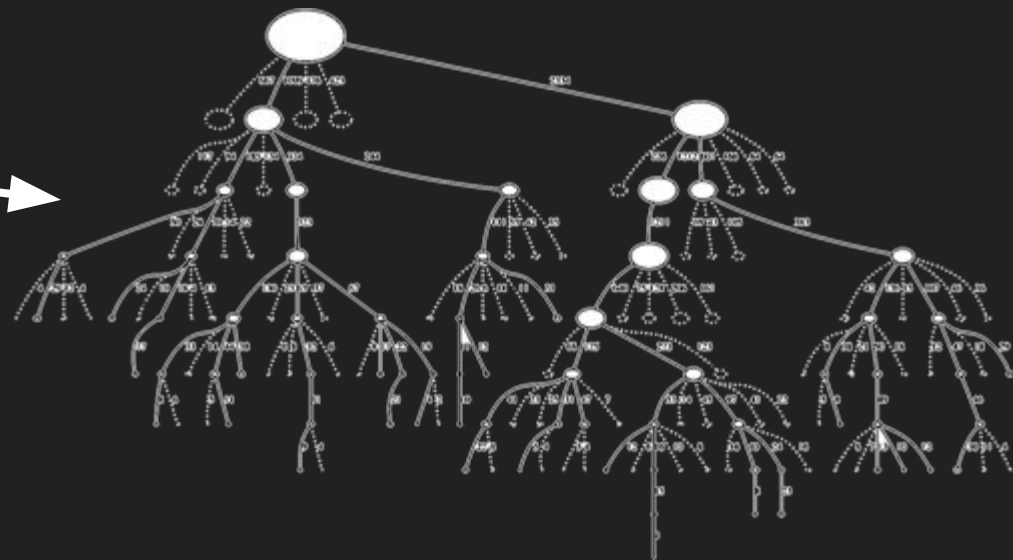
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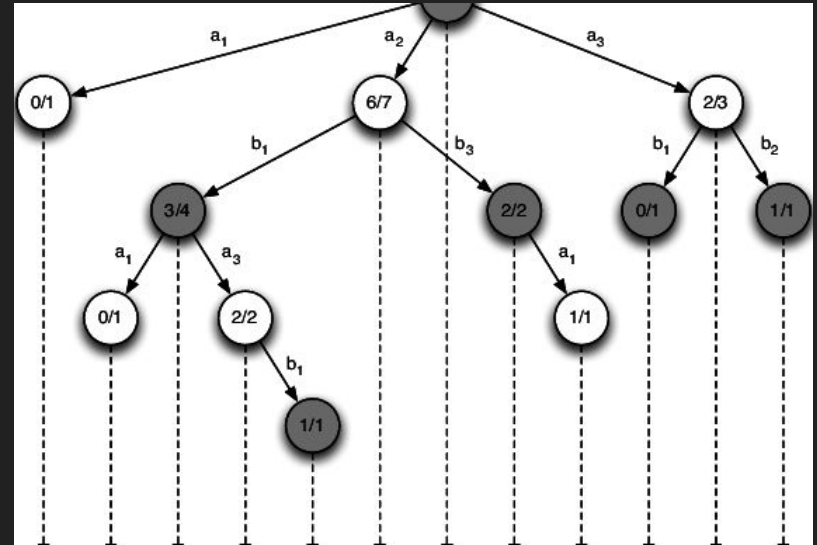


- Parameters of heuristic evaluation adjusted by hand - trial and error ([Demo](#))

What's so special about AlphaZero?

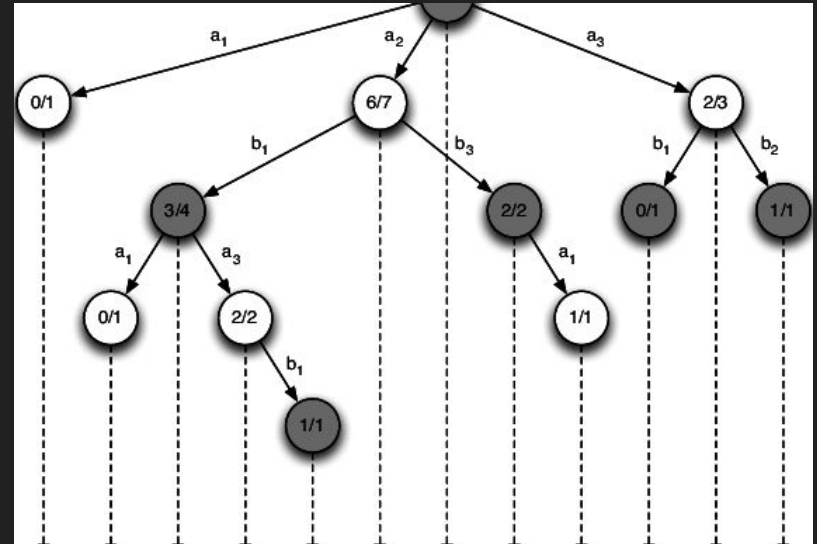
What's so special about AlphaZero?

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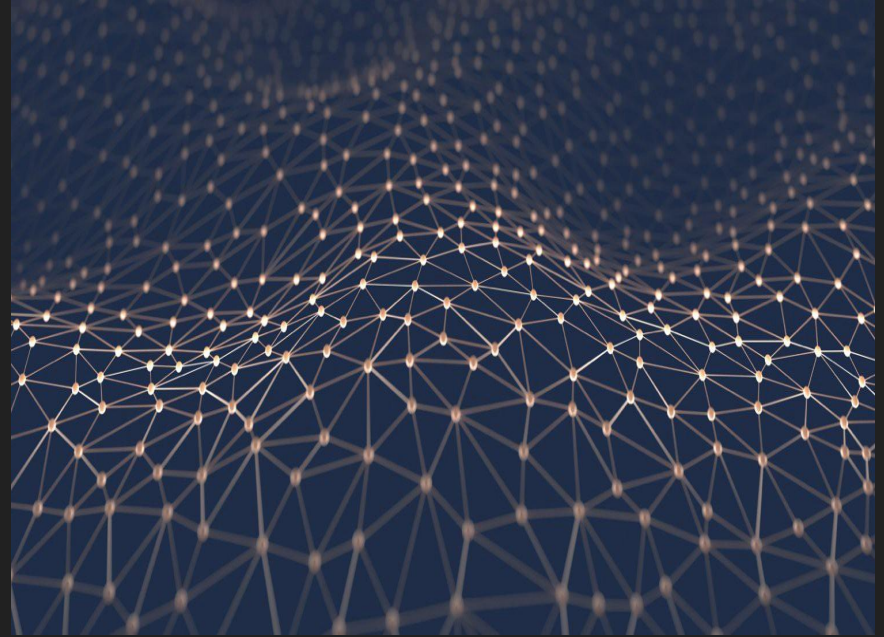
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- AlphaZero uses **Monte Carlo Tree Search (MCTS)**
- Simulates games and determines probability of winning with a certain move - fundamentally different approach to chess AI



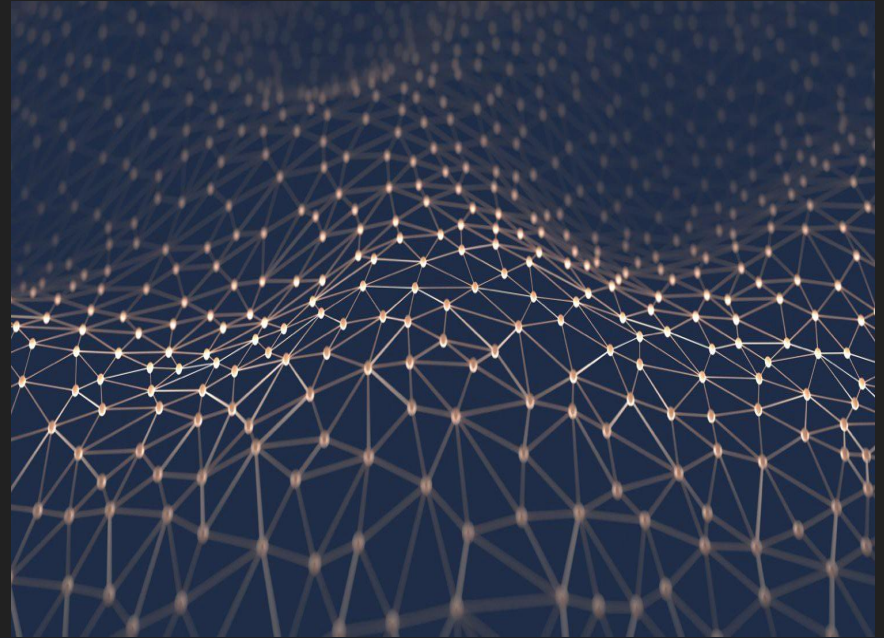
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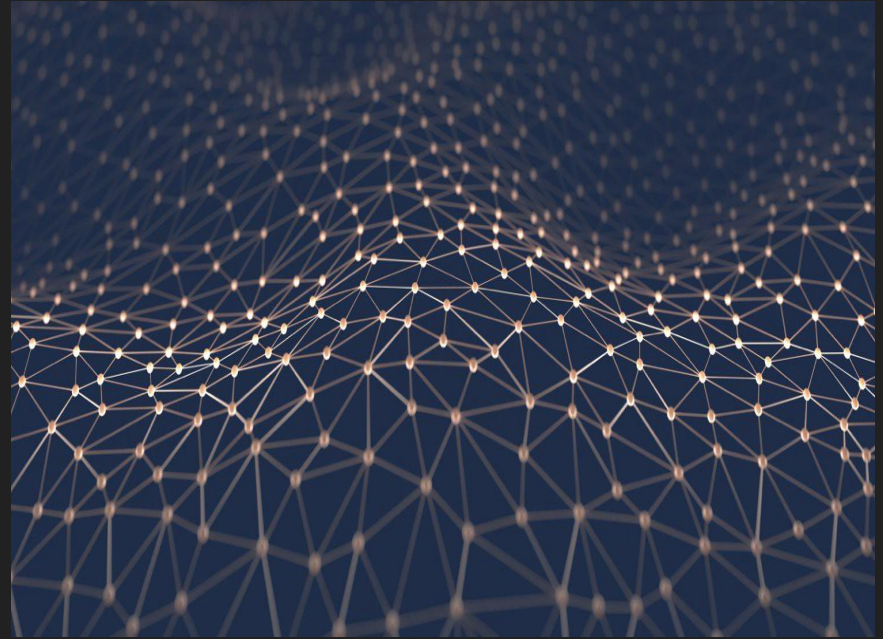
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- **Self-reinforcement learning**



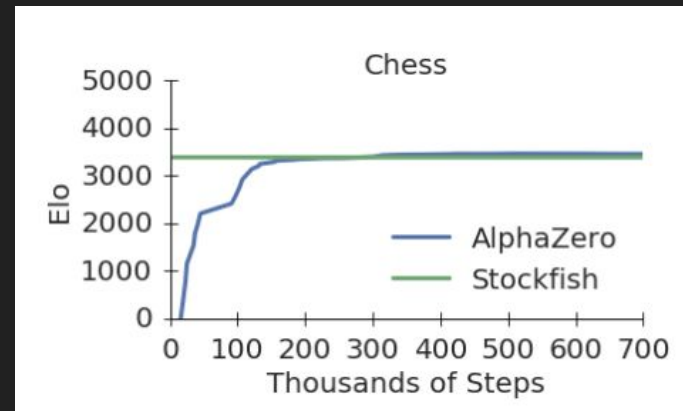
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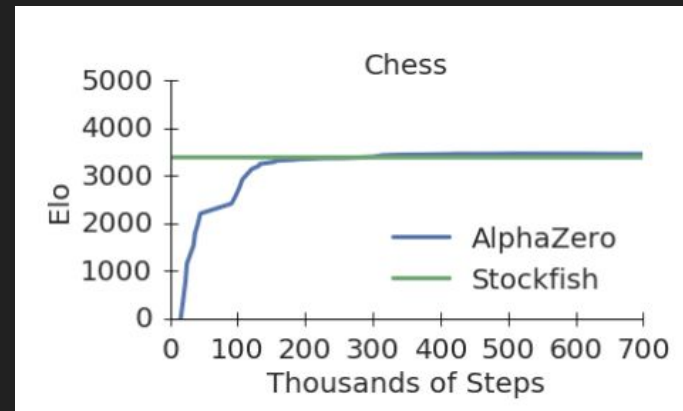
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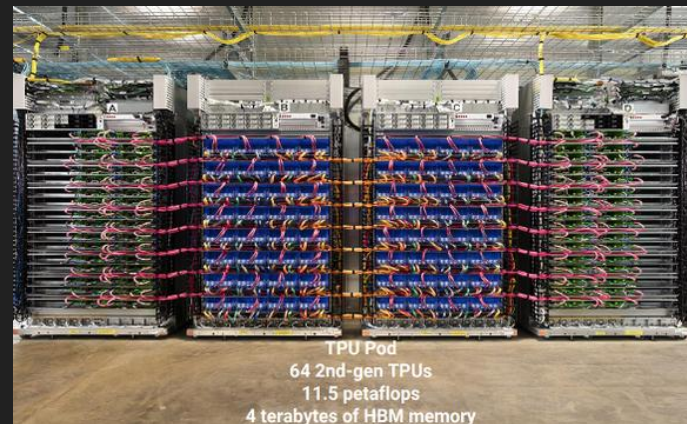
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- **Scalable to other complete information two-player games**



What's Next for AlphaZero?

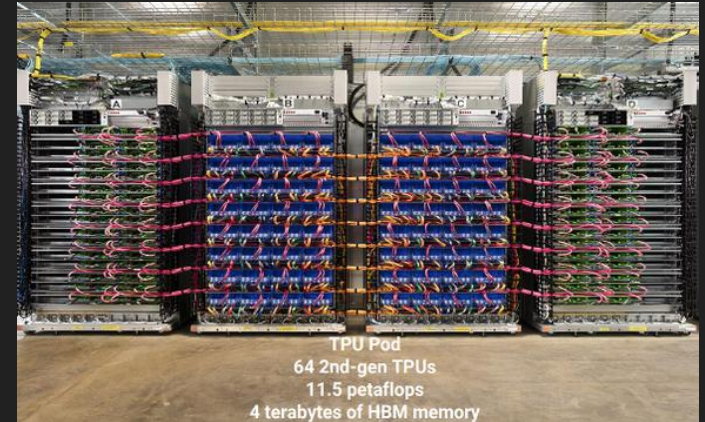
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- Neural network computations done on **Tensor Processing Unit (TPU)** - not commercially available



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- AlphaZero not feasible on ordinary computers



Reactions from Top Chess Grandmasters

Fabiano Caruana: "I was amazed. I don't think any other engine has shown dominance like that. I think it was four hours of learning so who knows what it can do with even more."

Sergey Karjakin: "I will pay very much to get access to this program. Maybe \$100,000, today!"

Wesley So: "Chess isn't yet dead; it's pretty inexhaustible. The main problem is that most of the games are the same for the first 12, 15 moves."

Implications for the Future of AI



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- Moving away from blind search
- Neural networks - very close parallel to how humans learn chess
- Ever-increasing computational power



Conclusion

- AlphaZero revolutionary for both chess and AI
- A result of big changes we have already begun to see with machine learning and neural networks - more closely simulating human thought
- Could have a great impact in the future - next step could be applying this to incomplete information games like poker

Thank you!

Citations

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