

AlphaGo: using machine learning to master the ancient game of Go



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Founders of AlphaGo

- **Demis Hassabis and Shene Legg** are the co-founders of an Artificial Intelligence Company based in London called **DeepMind**.
- With the help of Lead Researcher of DeepMind **David Silver**, they developed the *The game of Go - AlphaGo*
- Their mission is to fundamentally understand intelligence, and recreate artificially.



What is GO?

- Go is the world's oldest continuously played board game.
- The game of **Go** originated in China more than 2,500 years ago, it is considered one of the ***four essential arts*(with music, poetry and painting)** required of any true Chinese scholar.



How to play and What is the goal of the game?

Fig - 1

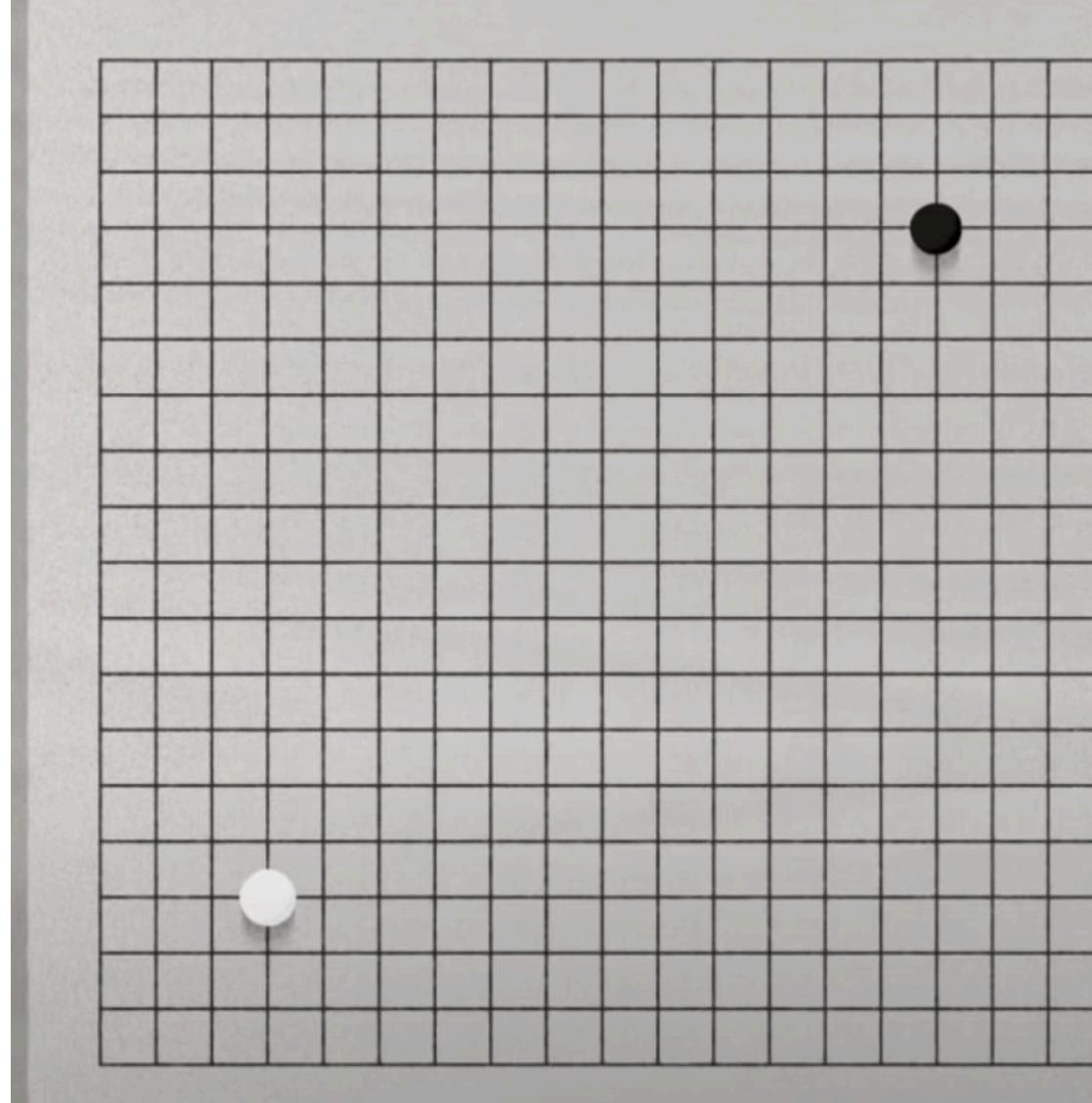


Fig - 2

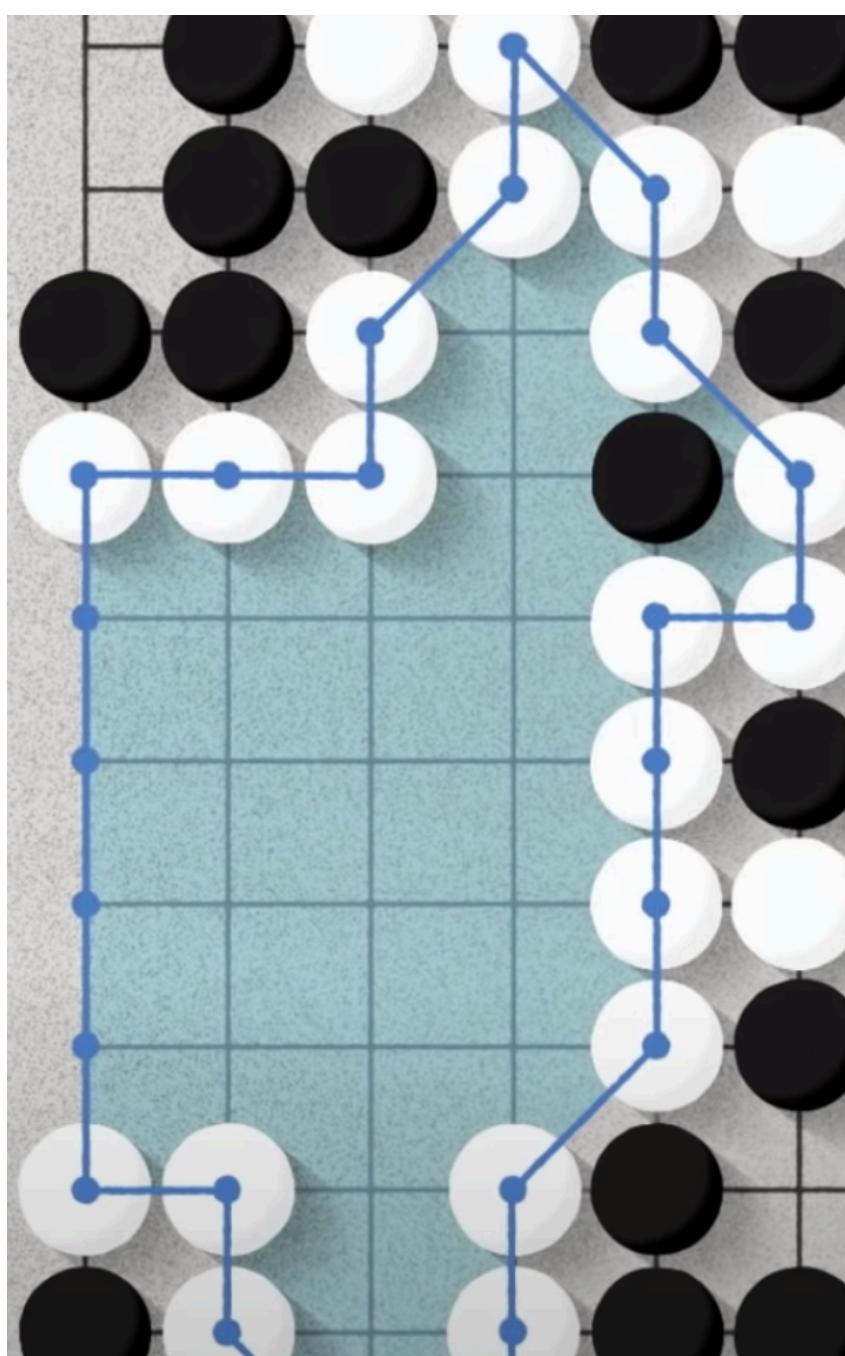


Fig - 3

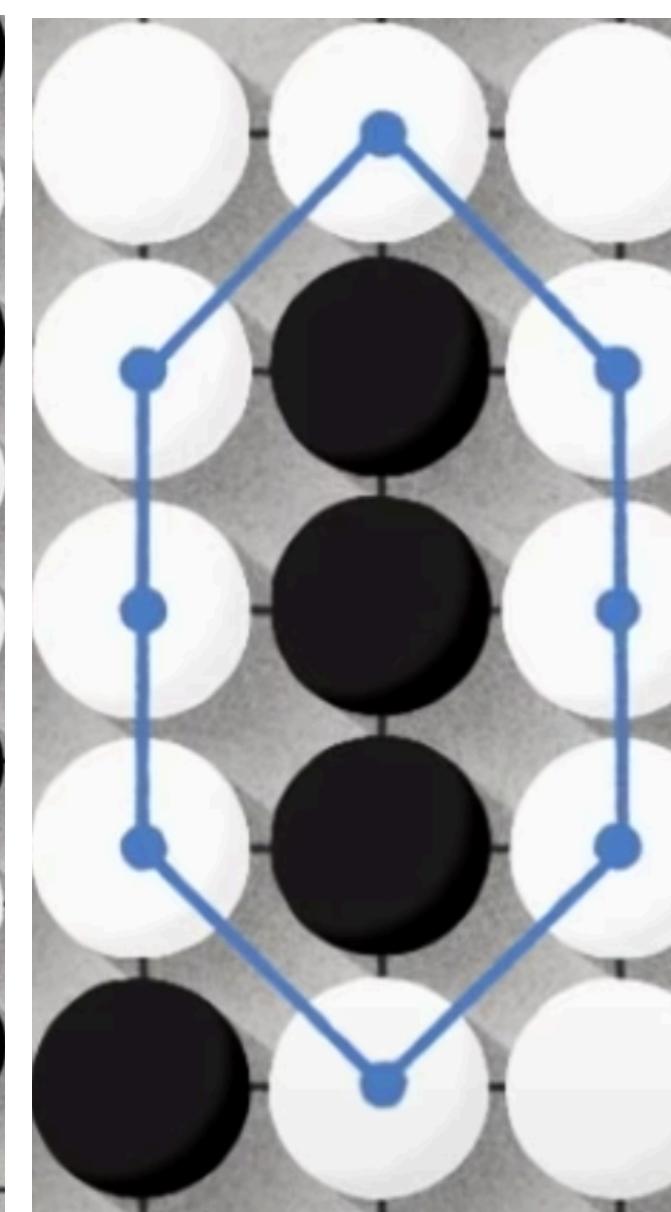


Fig - 4

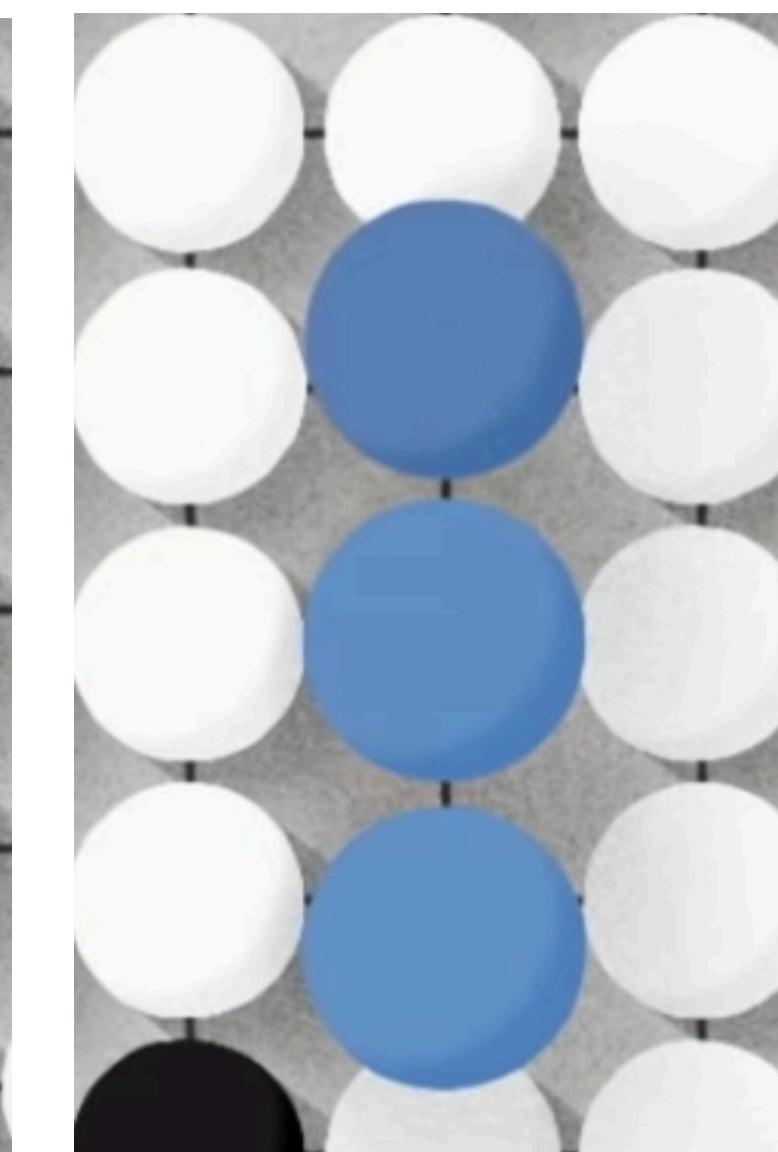


Fig - 5

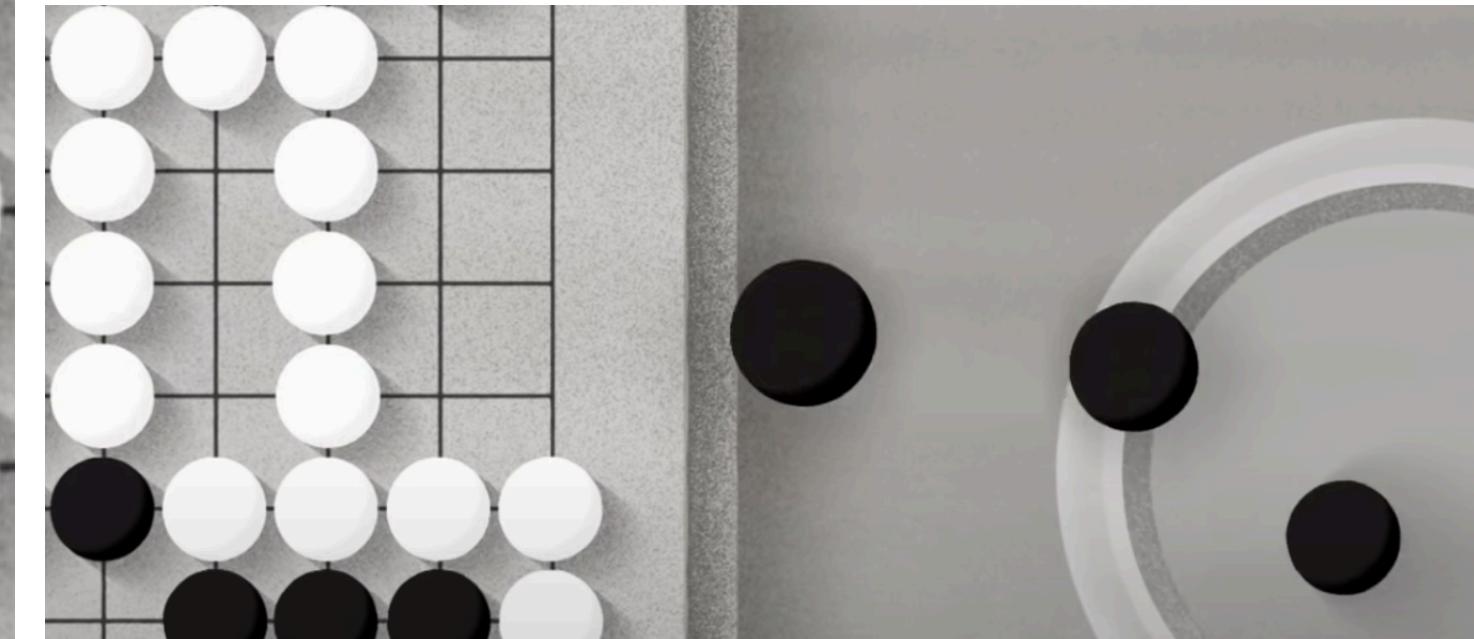
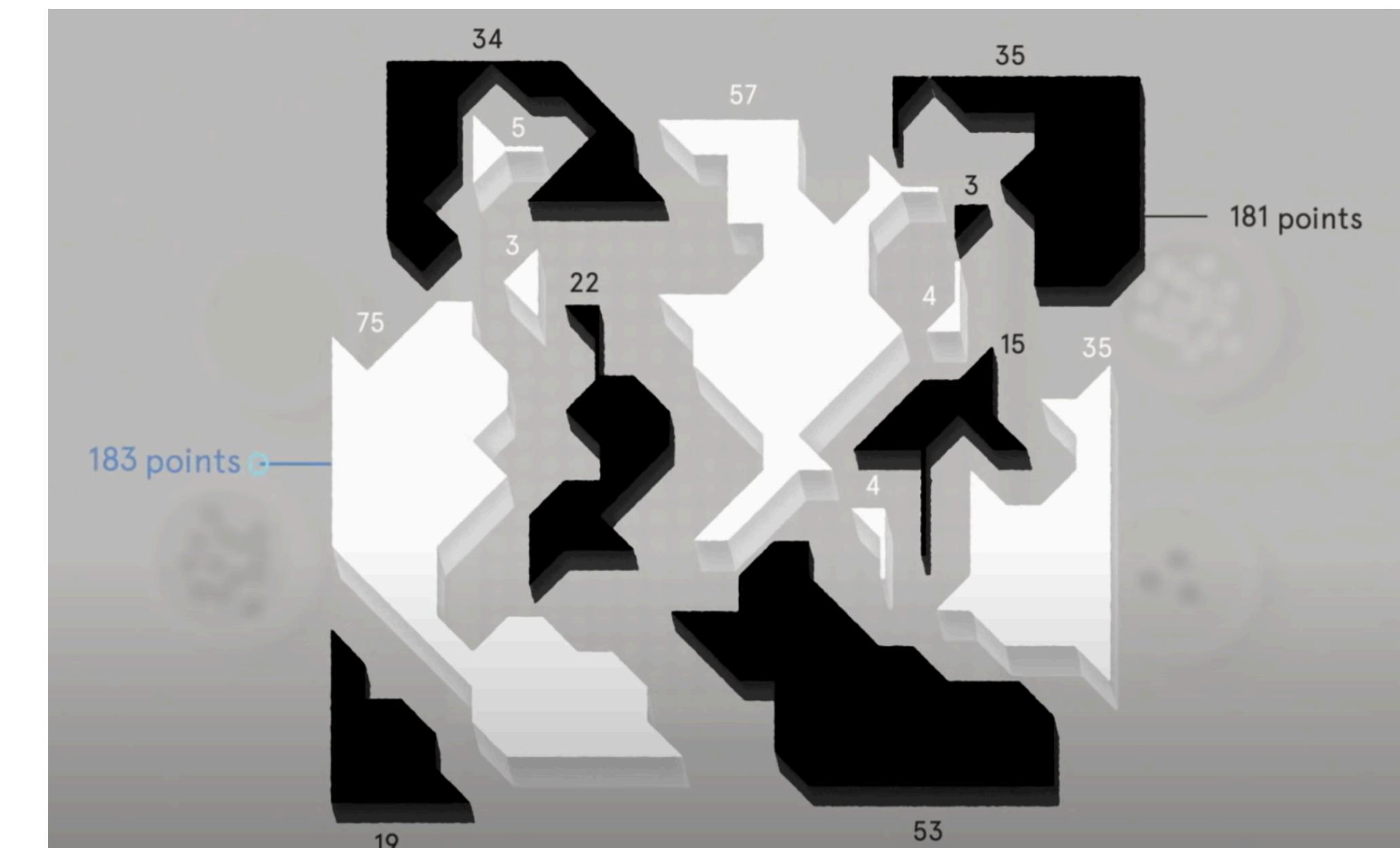


Fig - 6

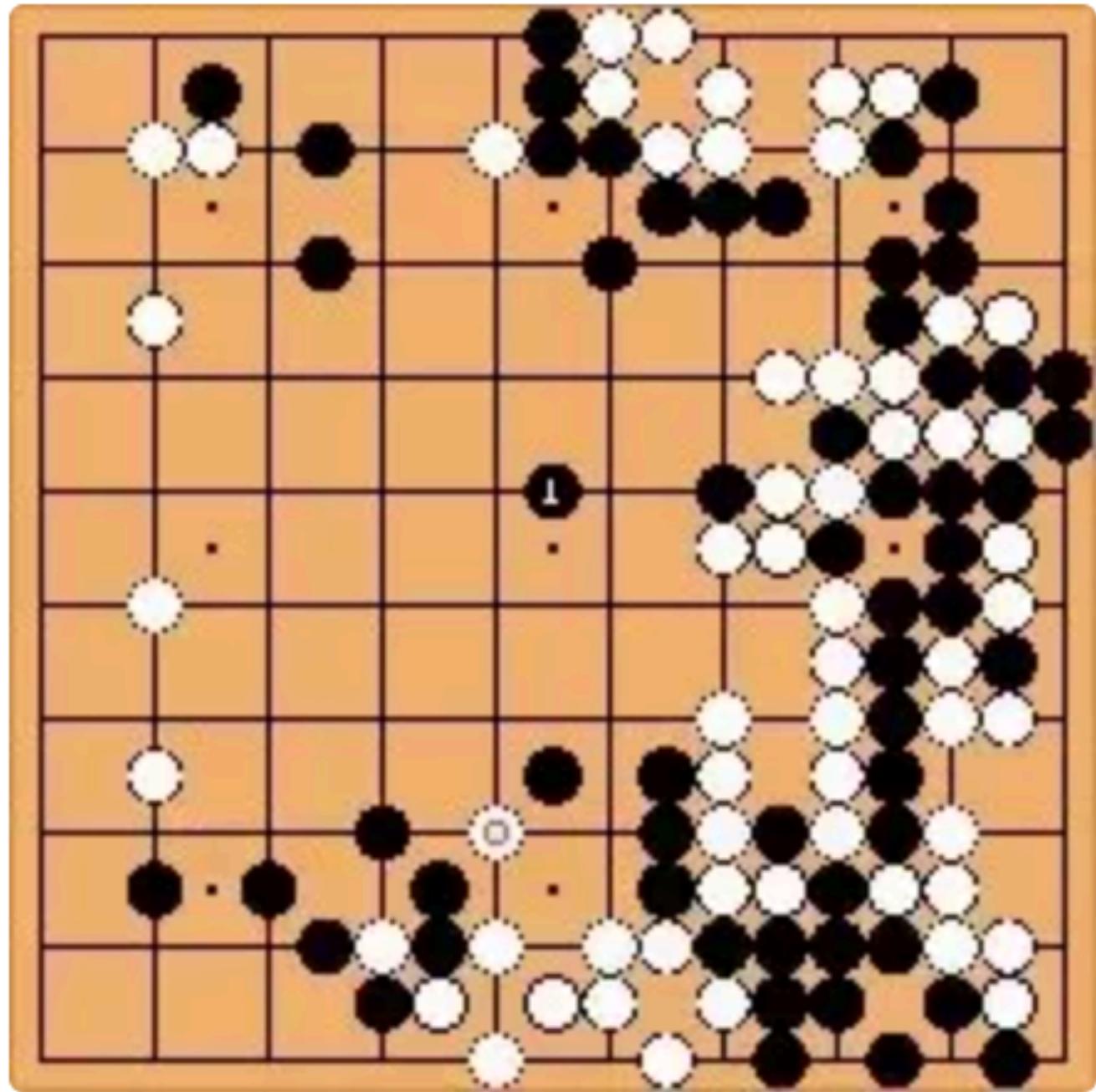


Fig - 7



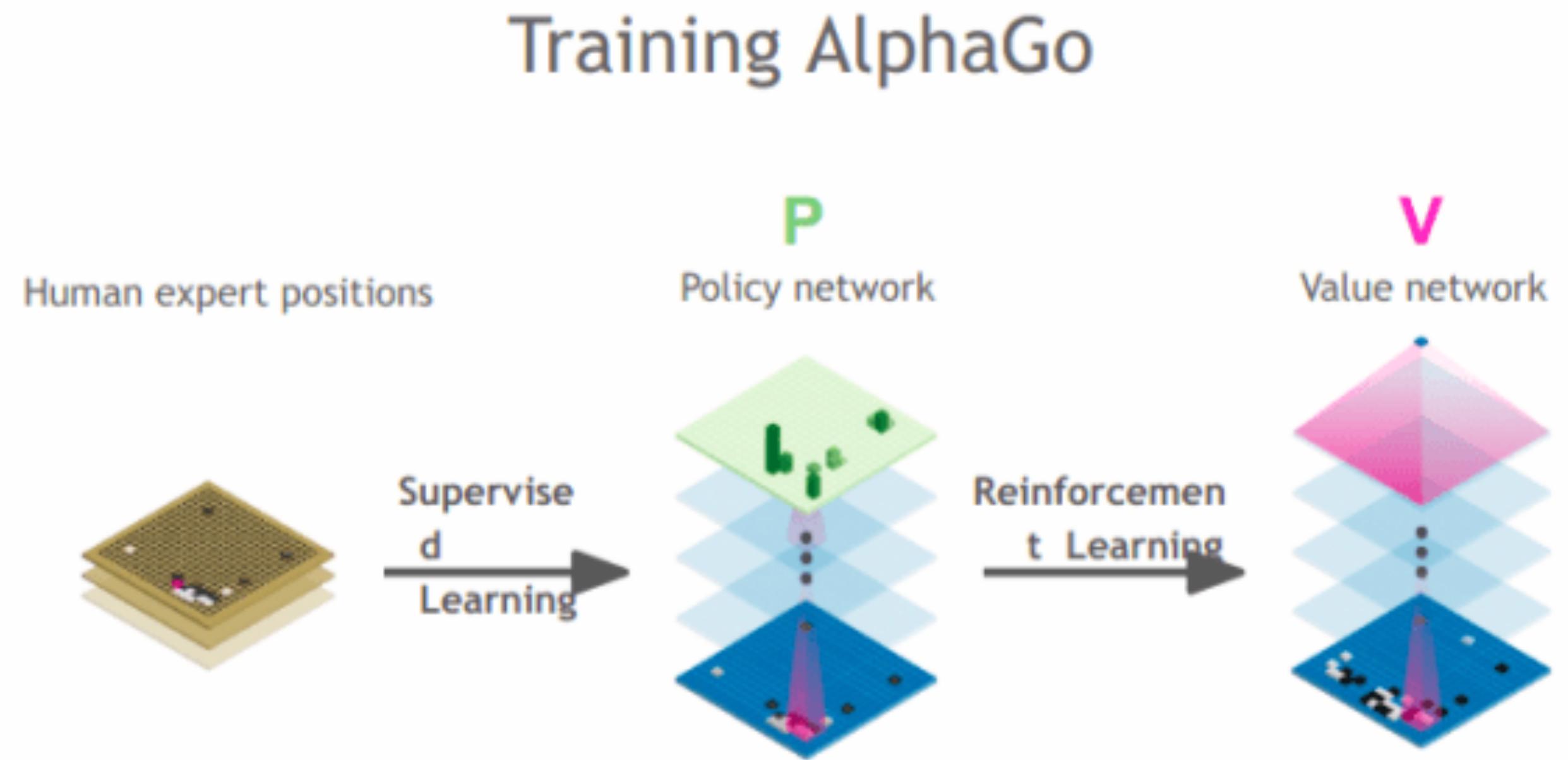
AlphaGo Challenge

- Go is known as the most challenging classical game for artificial intelligence because of its complexity.
- After the first two moves of a Chess game, there are 400 possible next moves. In Go, there are close to 130,000. In this manner if we go on, then the **total number of possible moves is more than the number of atoms present in the entire universe**
- **AI researchers can't use traditional brute-force AI,**

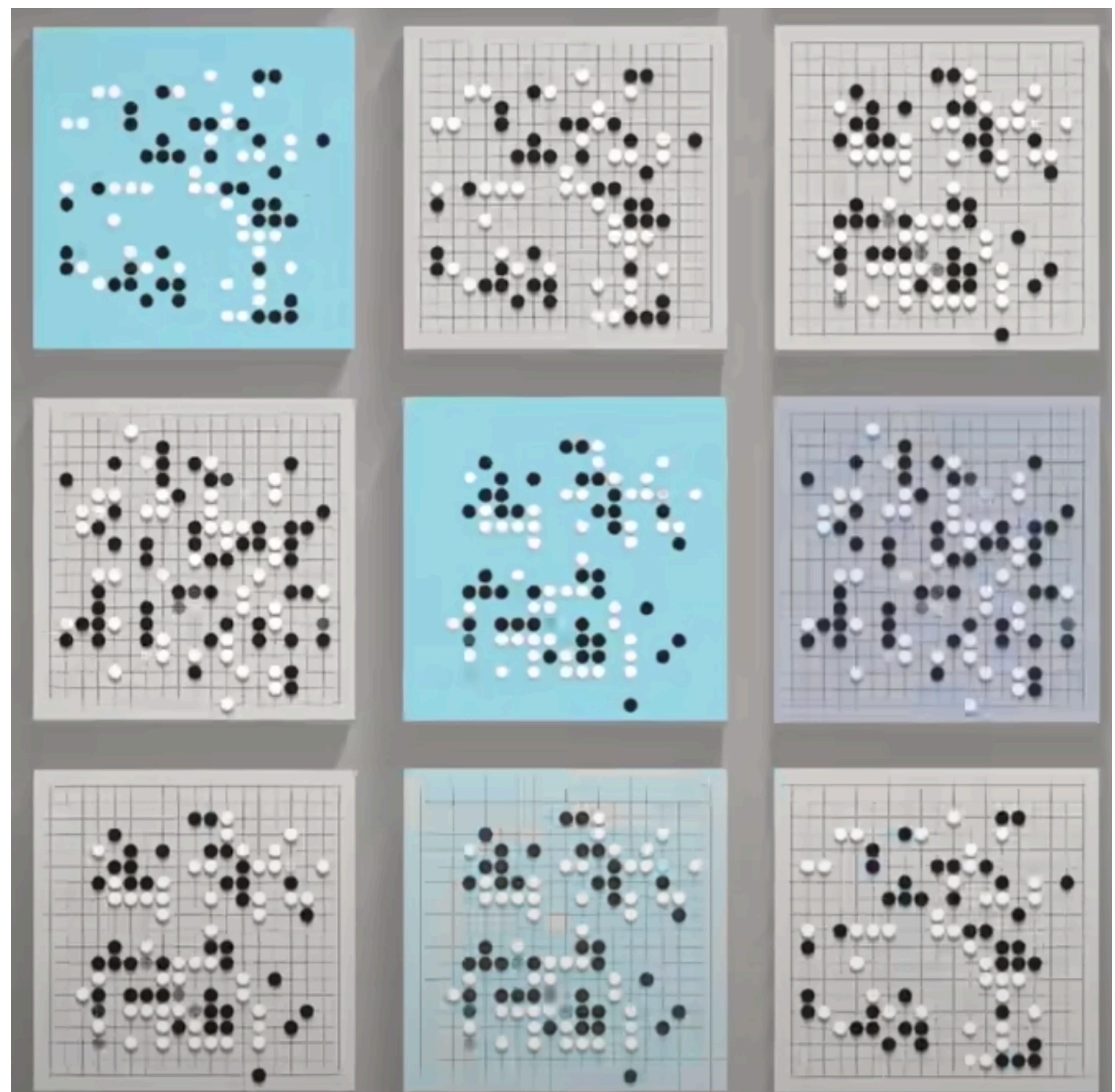


How they trained AlphaGo

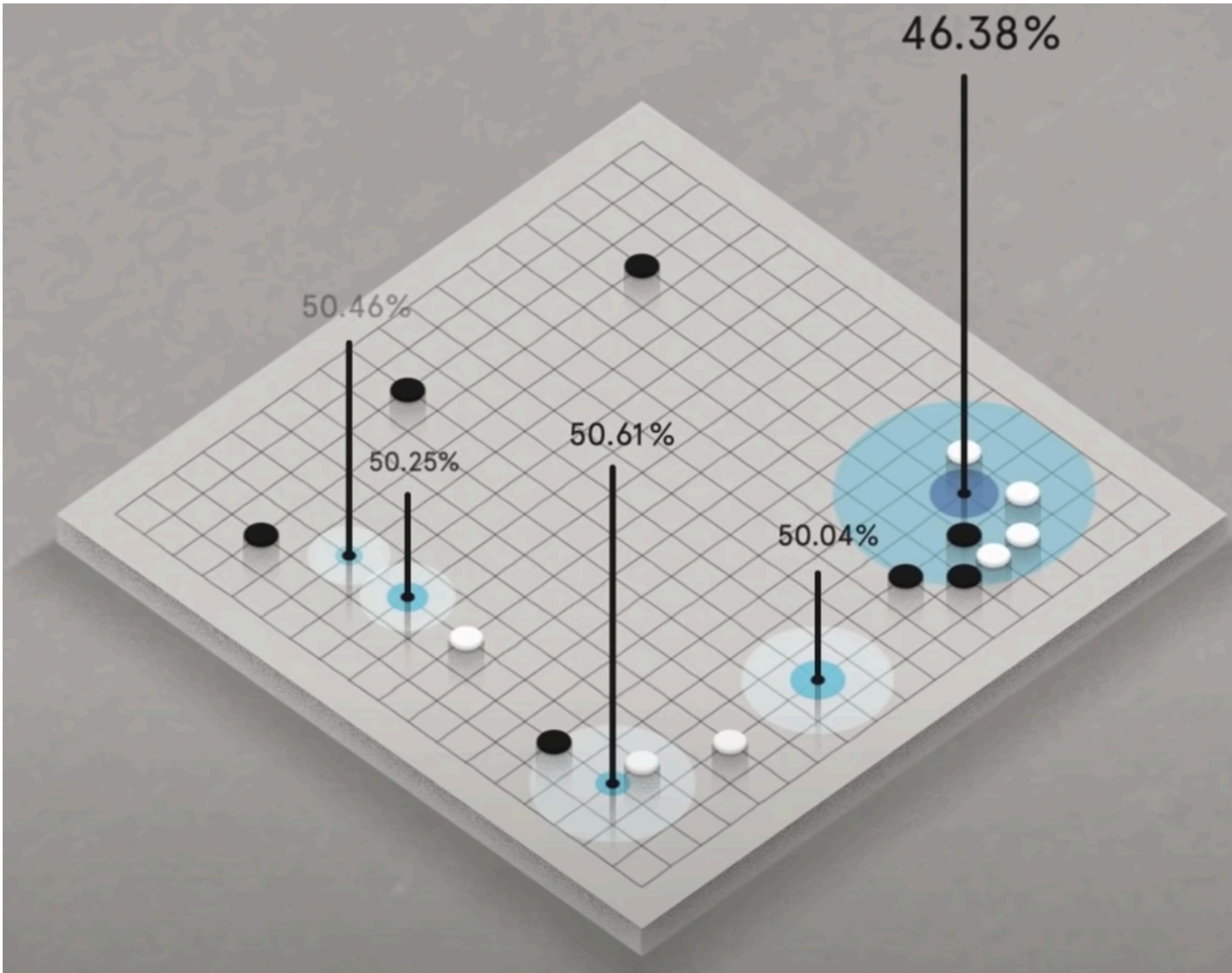
- The way they started off training AlphaGo is by showing it 100,000 games played by strong amateurs that downloaded from the internet.
- Then they had it play against different versions of itself thousands of times, each time learning from its mistakes.
- Over time, AlphaGo improved and became increasingly stronger and better at learning and decision-making. This process is known as **reinforcement learning**.
- AlphaGo has 3 main components: Policy Network, Value Network and Tree Search.



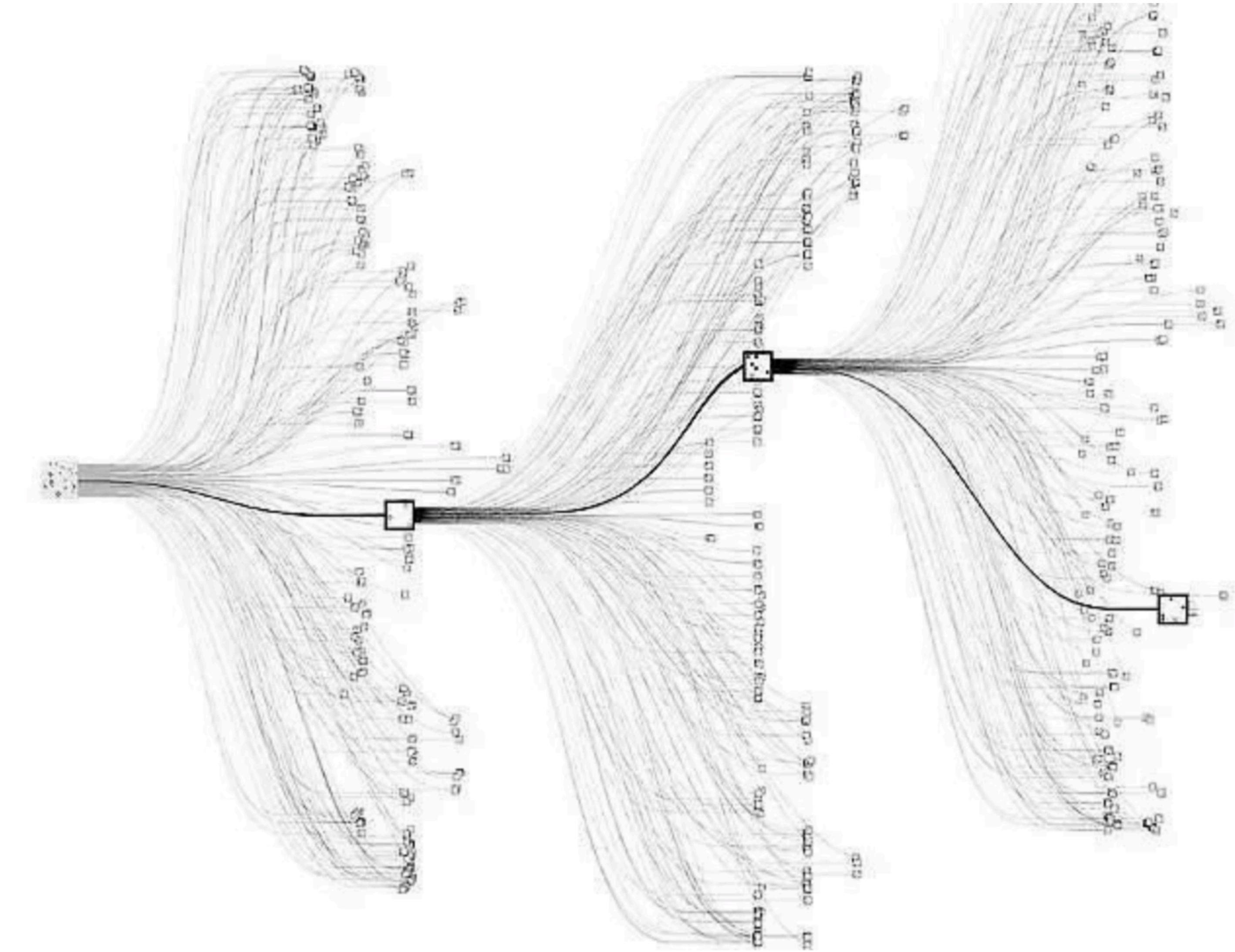
Policy Network



Value Network

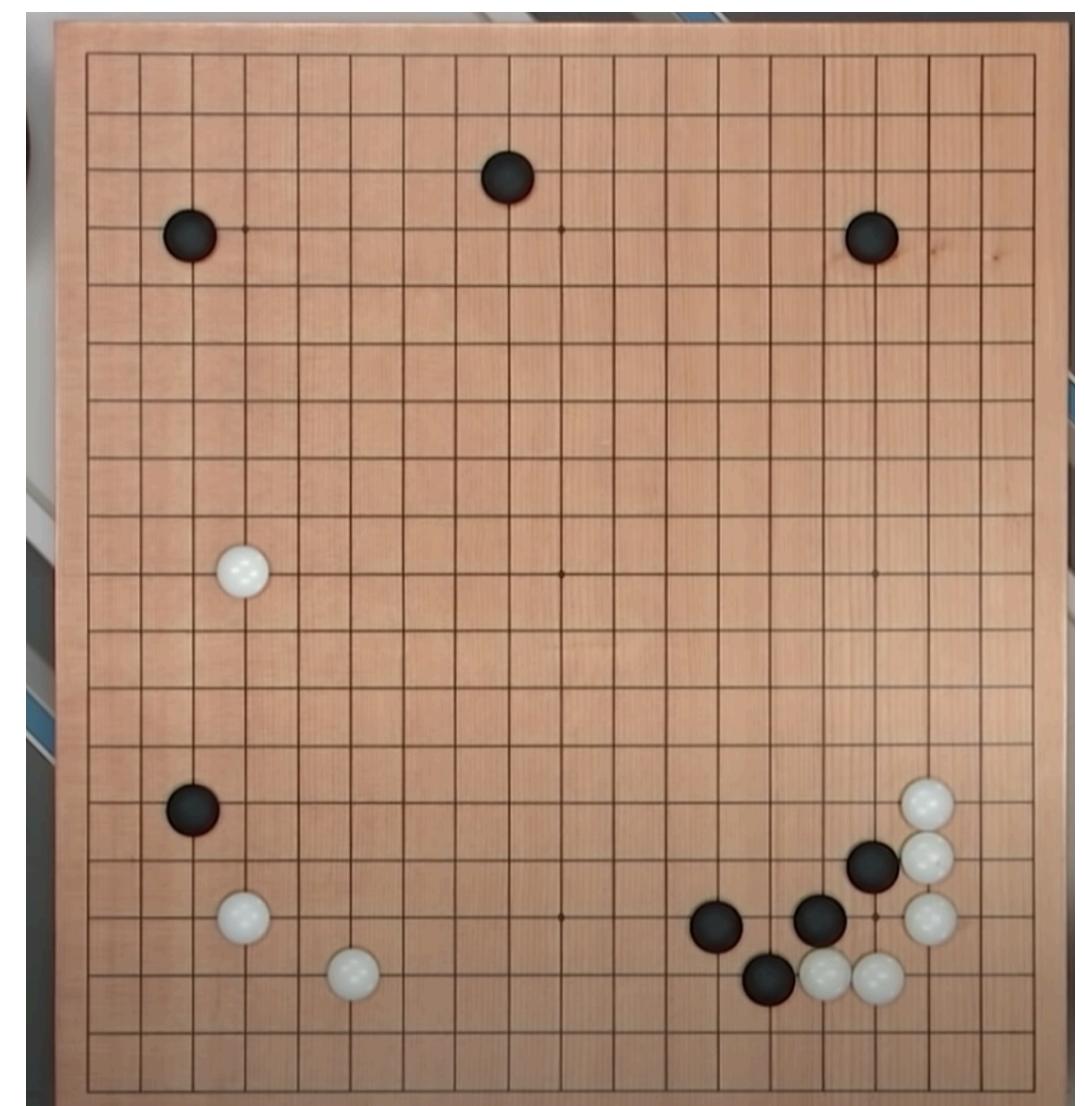


Tree Search

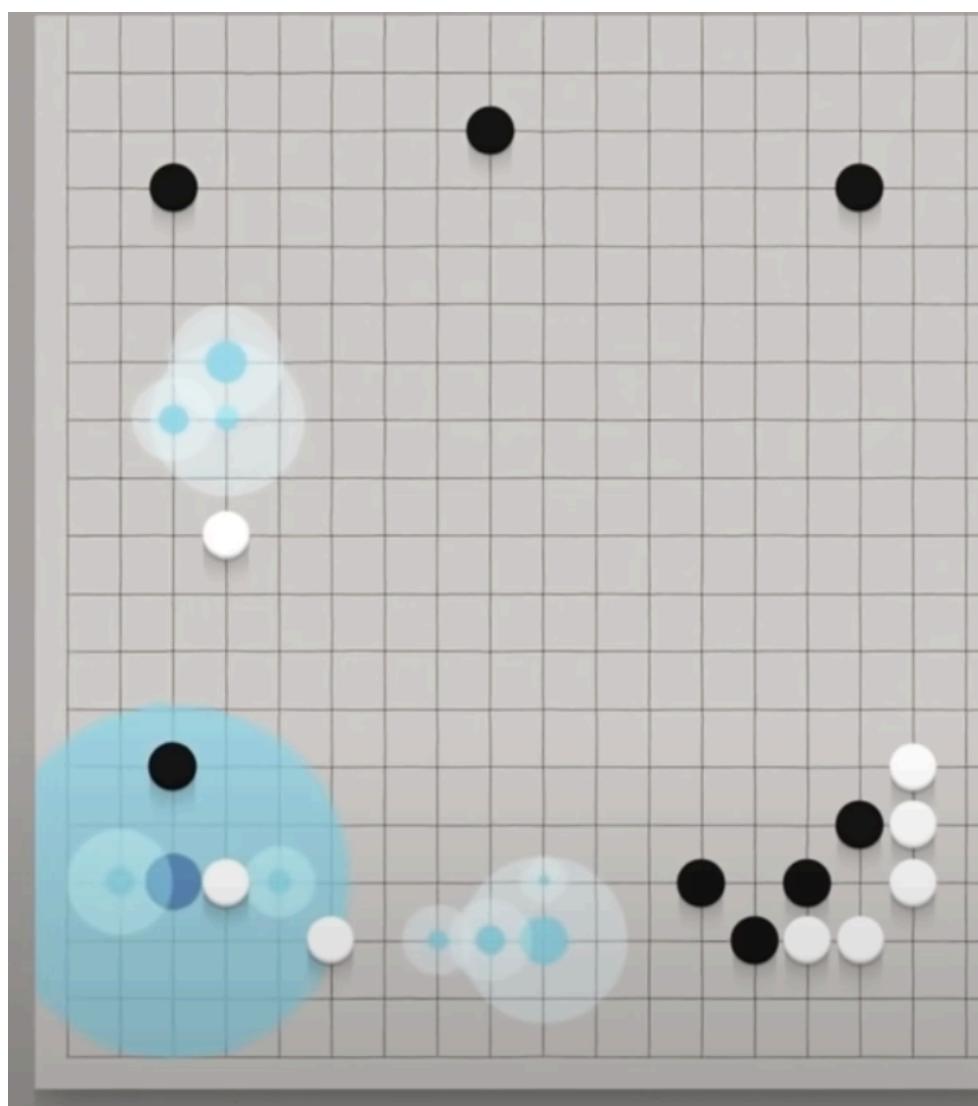


The search tree after testing 1600 possible moves.

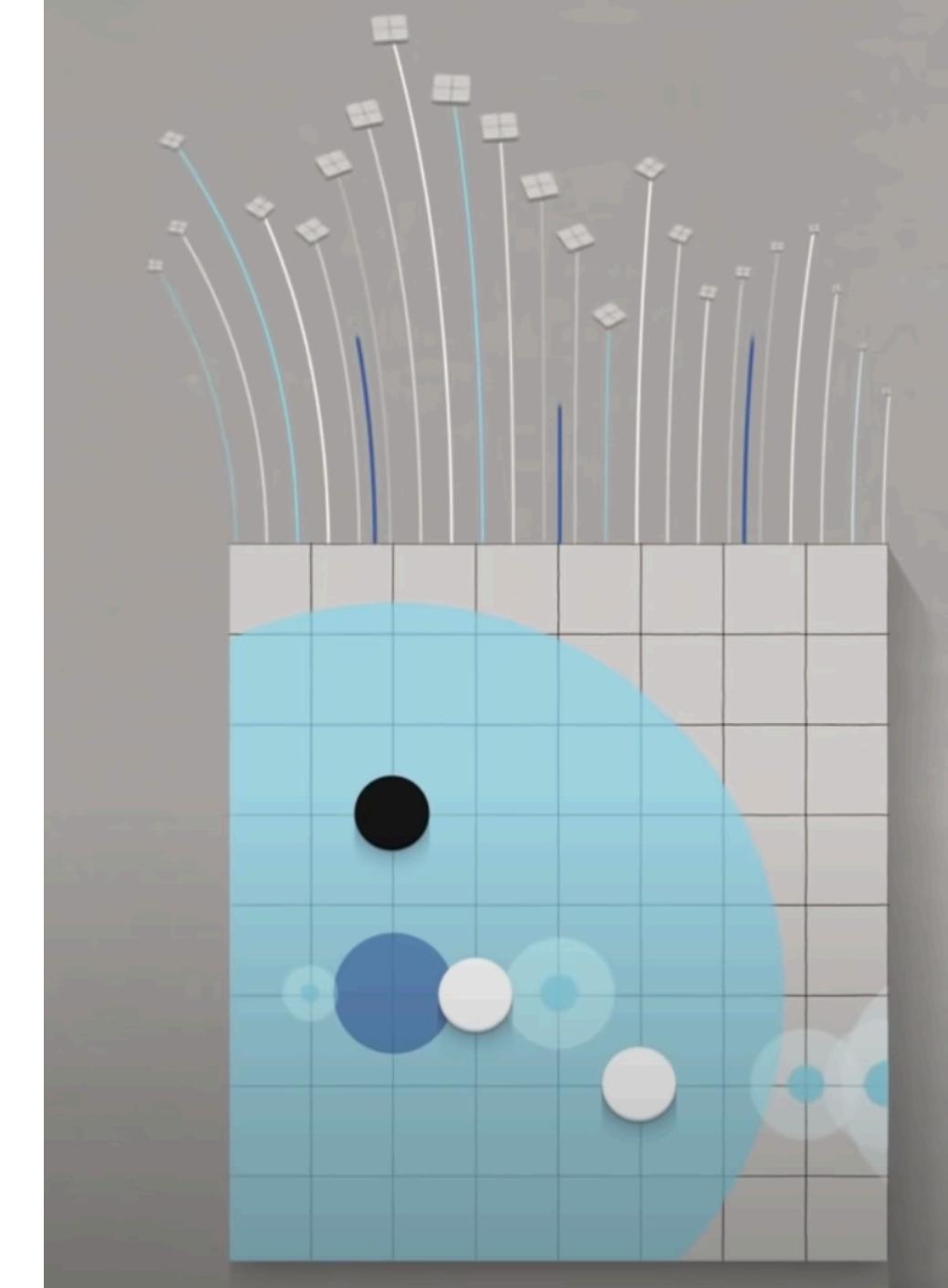
Step - 1



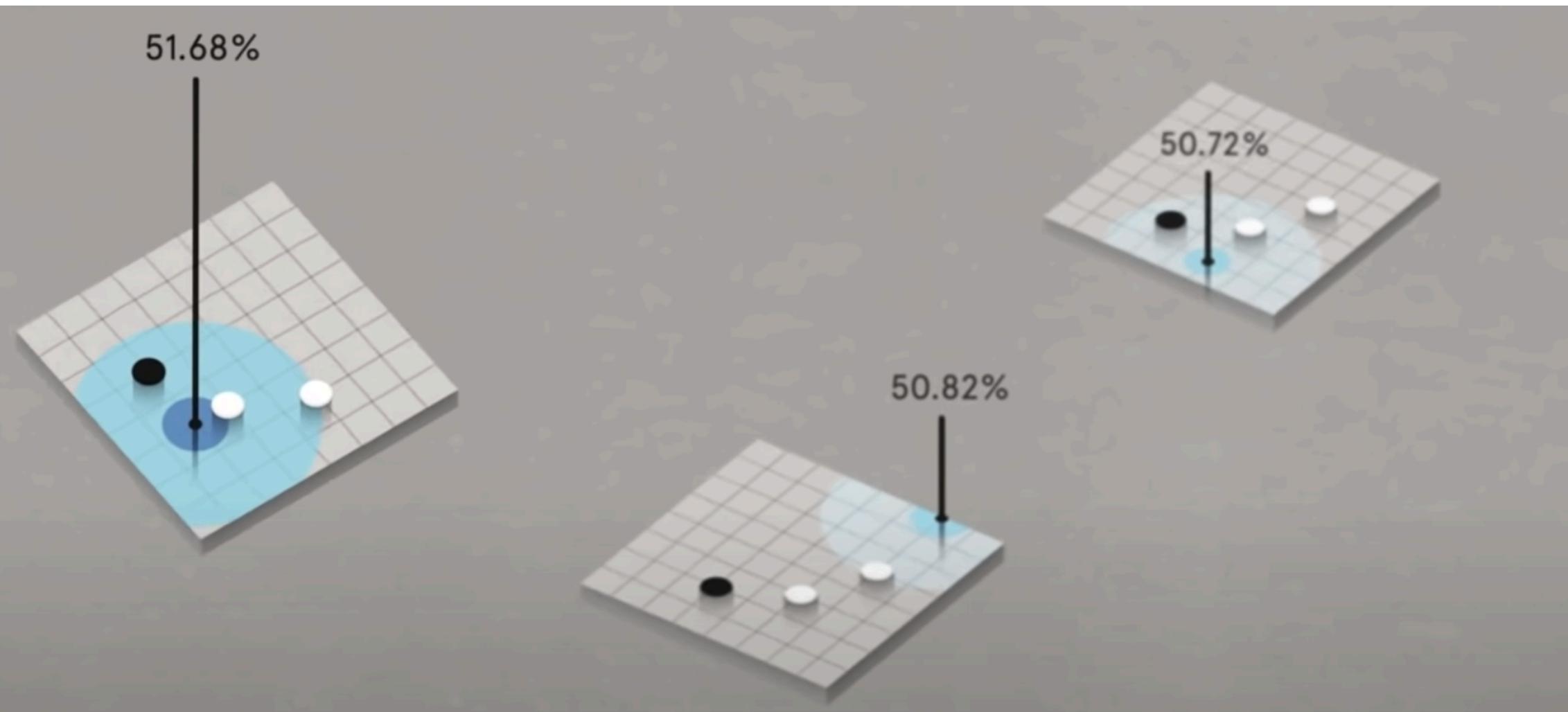
Step - 2



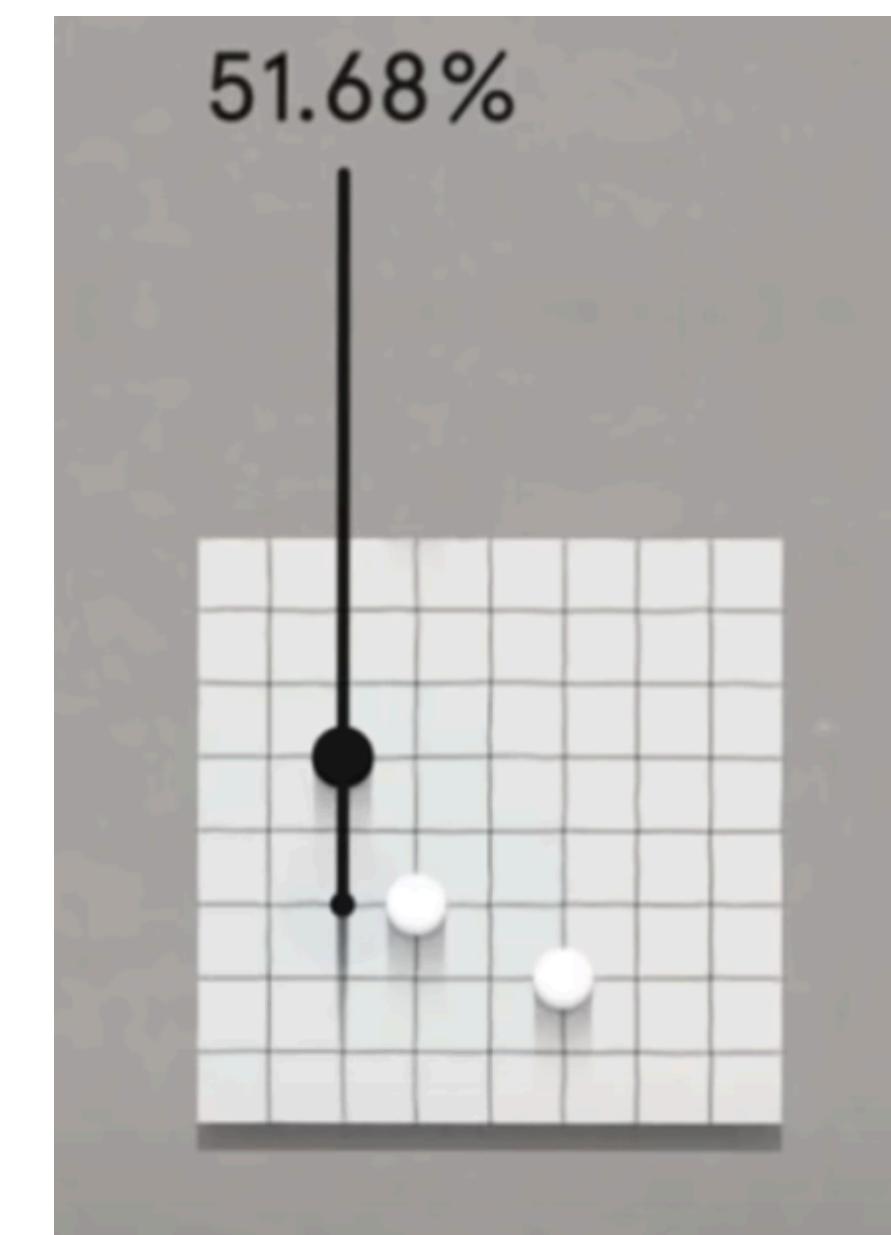
Step - 3



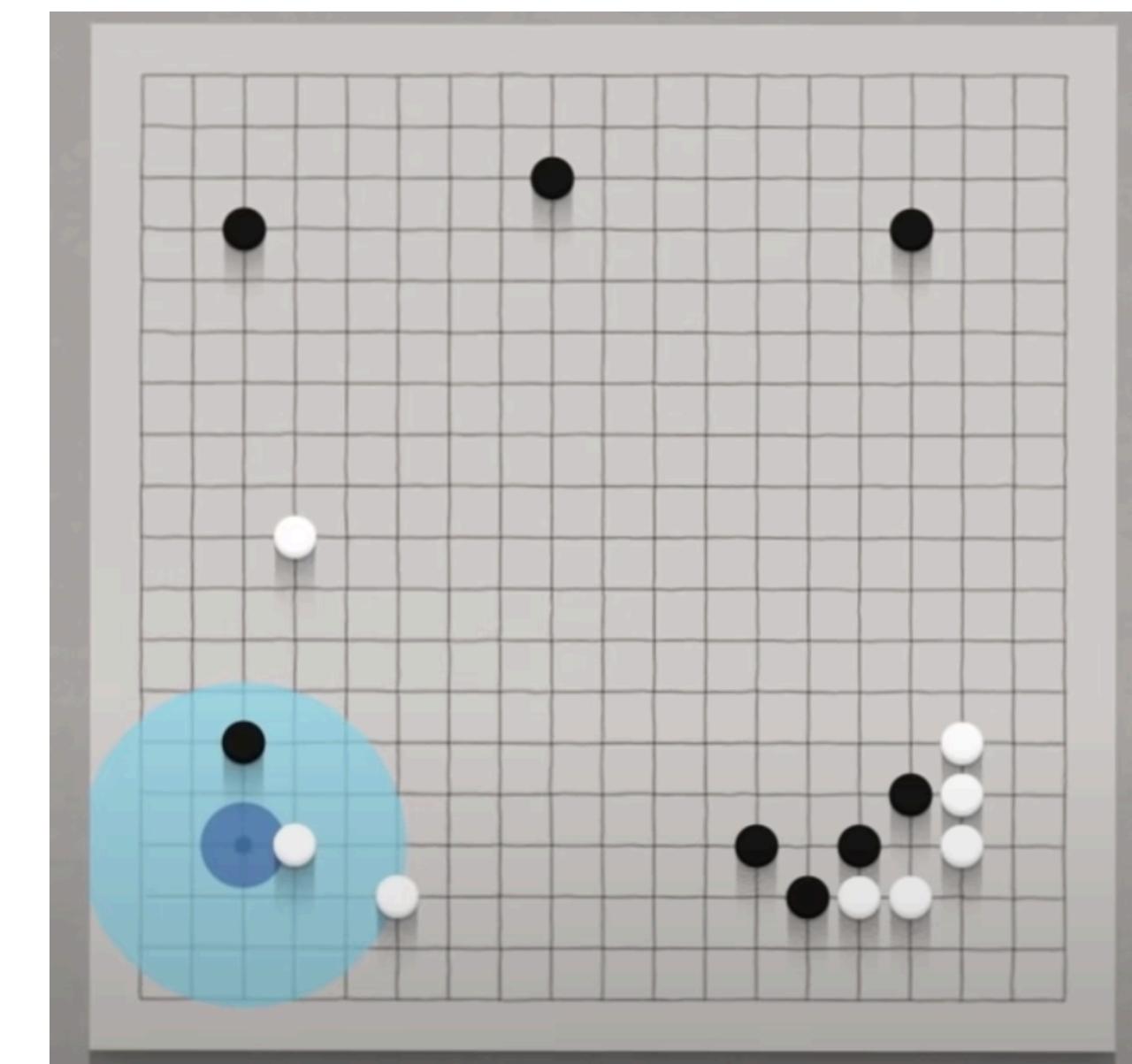
Step - 4



Step - 5



Step - 6



AlphaGo Matches

- Tournament between AlphaGo and the other top programs at the forefront of computer Go. AlphaGo won all but one of its 500 games against these programs.
- In October 2015, AlphaGo played its first match against the reigning three-time European Champion, Mr Fan Hui. AlphaGo won the first ever game against a Go professional with a score of 5-0.
- AlphaGo then competed against legendary Go player Mr Lee Sedol, the winner of 18 world titles, who is widely considered the greatest player of the past decade. AlphaGo's 4-1 victory in Seoul, South Korea, on March 2016 was watched by over 200 million people worldwide.



AlphaGo Versions

- AlphaGo Fan
- AlphaGo Lee
- AlphaGo Master
- AlphaGo Zero
- AlphaZero

Configuration and strength

Versions	Hardware	Elo rating	Date	Results
AlphaGo Fan	176 GPUs, ^[51] distributed	3,144 ^[50]	Oct 2015	5:0 against Fan Hui
AlphaGo Lee	48 TPUs, ^[51] distributed	3,739 ^[50]	Mar 2016	4:1 against Lee Sedol
AlphaGo Master	4 TPUs, ^[51] single machine	4,858 ^[50]	May 2017	60:0 against professional players; Future of Go Summit
AlphaGo Zero (40 block)	4 TPUs, ^[51] single machine	5,185 ^[50]	Oct 2017	100:0 against AlphaGo Lee 89:11 against AlphaGo Master
AlphaZero (20 block)	4 TPUs, single machine	5,018 ^[61]	Dec 2017	60:40 against AlphaGo Zero (20 block)

Thank You