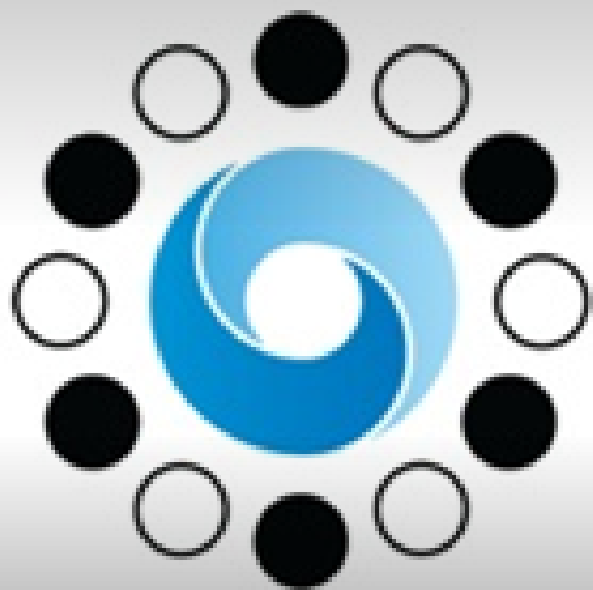


AlphaGo



AlphaGo

創新AI碩一

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Ho, Che-Ping

Outline

1. What is AlphaGo?

CLICK HERE



- AlphaGo's Competition Result with Human Being.

2. What Methodology does AlphaGo adopt?

CLICK HERE



- Previous Chess AI, Deep Blue.
- AlphaGo's Training Process, Neural NetWork & Monte-Carlo-Search

3. What aspect can we apply from AlphaGo?

CLICK HERE



- Next Generation of AlphaGo: Alpha Zero
- AlphaGo Teaching Tool
- AlphaGo on Game: Alpha Star & AI Bot

What is AlphaGo

- Astonishing Competition with Human

What is AlphaGo ?

- AlphaGo → Artificial Intelligence, Excellent at Go Chess.

- Competition Achievement:

1. Year : 2015

Competitor : Fan Hui, European Go Champion

Record : 5:0, AlphaGO Win

→ **Before, No computer has beaten human champion.**

2. Year : 2016

Competitor : Lee Se-Dol, Korean Go player, 9 dan rank.

Record : 4:1, AlphaGO Win

→ **AI's Milestone.**



What is AlphaGo ?

- Competition Achievement (Continued):

3. Year : 2017

Competitor : Ke Jie, Chinese Go player, 9 dan rank.

Record : 3:0, AlphaGO Master Win

→ **Became World Champion & the Topmost in the rank.**

AlphaGo Master:
As the World Number One



Rank	Name	♂♀	Flag	Elo
1	Google DeepMind AlphaGo			3612
2	Ke Jie	♂		3608
3	Park Junghwan	♂		3589
4	Lee Sedol	♂		3557
5	Iyama Yuta	♂		3532
6	Mi Yuting	♂		3529
7	Kim Jiseok	♂		3515
8	Lian Xiao	♂		3515
9	Shi Yue	♂		3509
10	Chen Yaoye	♂		3497

Official Trailer: AlphaGo



ALPHAGO

Methodology

- Secret of AlphaGo

Any Other Chess AI Before AlphaGo?



- **Deep Blue**

- Year: 1996
- Competition Achievement:
Beat Russian grandmaster, Kasparov.
First Time Human World Champion Lost.
- Methodology: Search Tree
 1. MIN-MAX
 2. Alpha-beta pruning



However

- **Aspect of Go**

- Grid: 19*19
→ Huge Search Space

- Complexity: $\sim 10^{170}$

Go → 200 possibilities / step

Chess → 20 possibilities / step

- Evaluate All Possibilities by Brute Force
→ Intractable & No Way !

- Neither MIN-MAX Nor Alpha-Beta Pruning.

→ Think: How AlphaGo works?



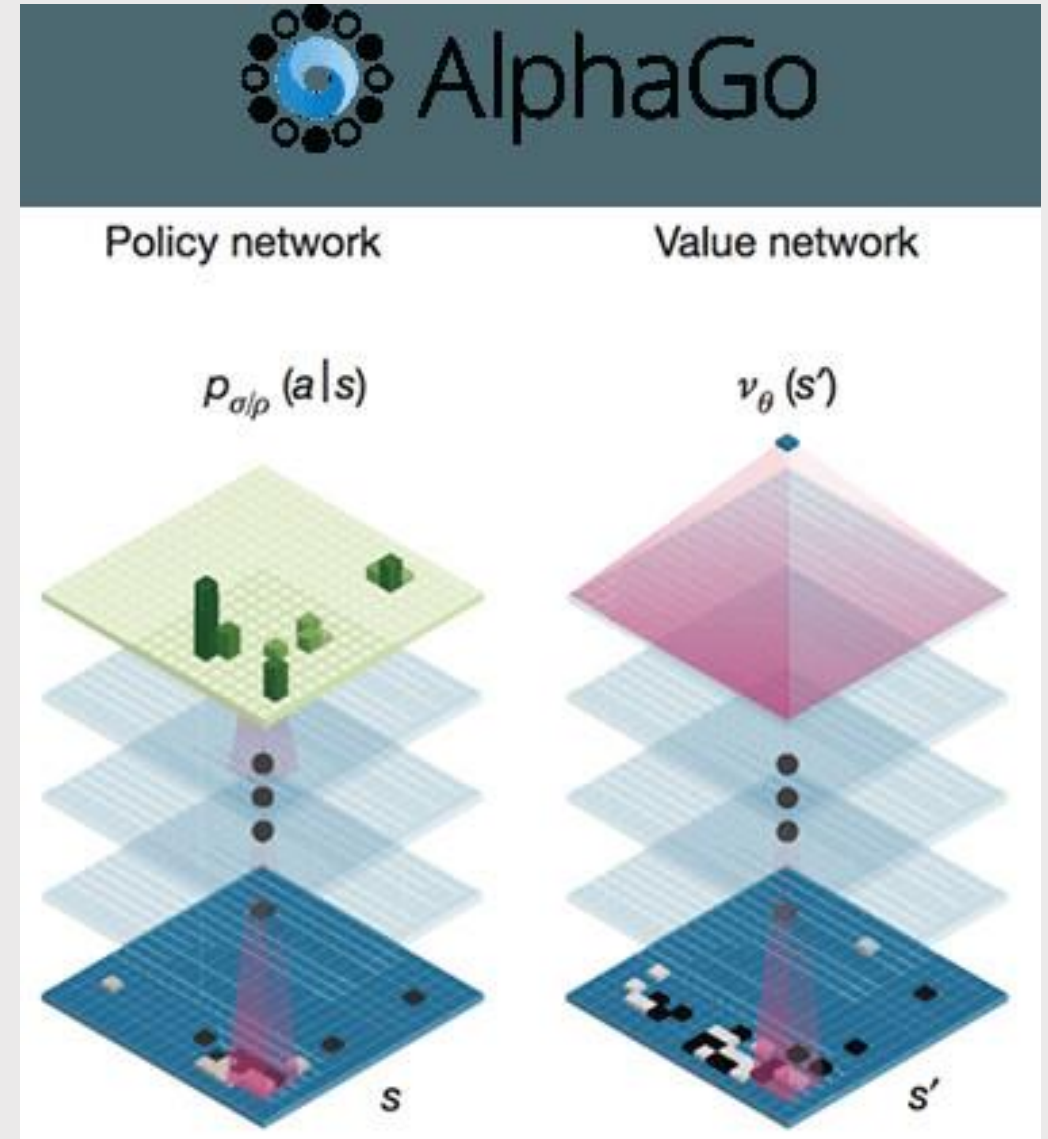
AlphaGo – 3 Steps

- Main Steps of AlphaGo can be divided into Three:
 1. Scanning the board to identify viable moves
 2. Constructing a tree-like structure to predict potential moves from each viable position.
 3. Calculating win rates for each branch of the tree and identifying the move with the highest winning probability.

AlphaGo

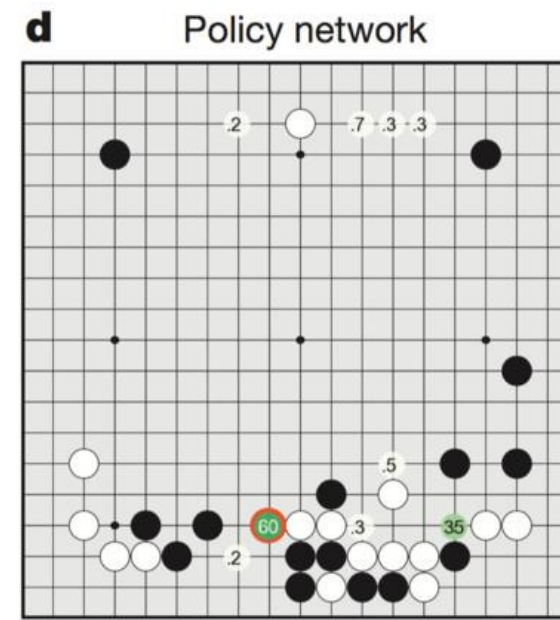
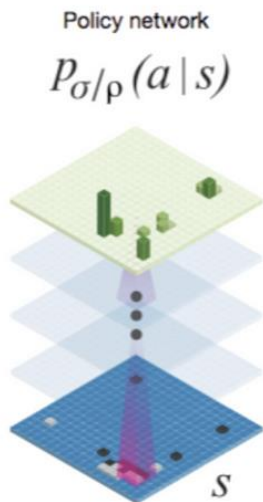
2 NetWorks

1. Policy NetWork
2. Value NetWork



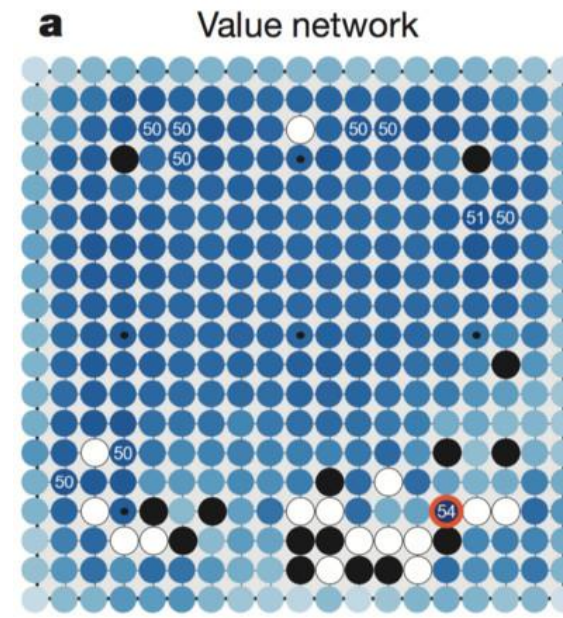
AlphaGo

Policy NetWork



1. Policy NetWork:
decide next best move
 - ① Supervised Learning
via many human players data.
 - ② Reinforcement Learning
→ play with itself

AlphaGo Value NetWork



2. Value NetWork:
evaluate chances of winning
→ training from self-play data.

AlphaGo Training Process

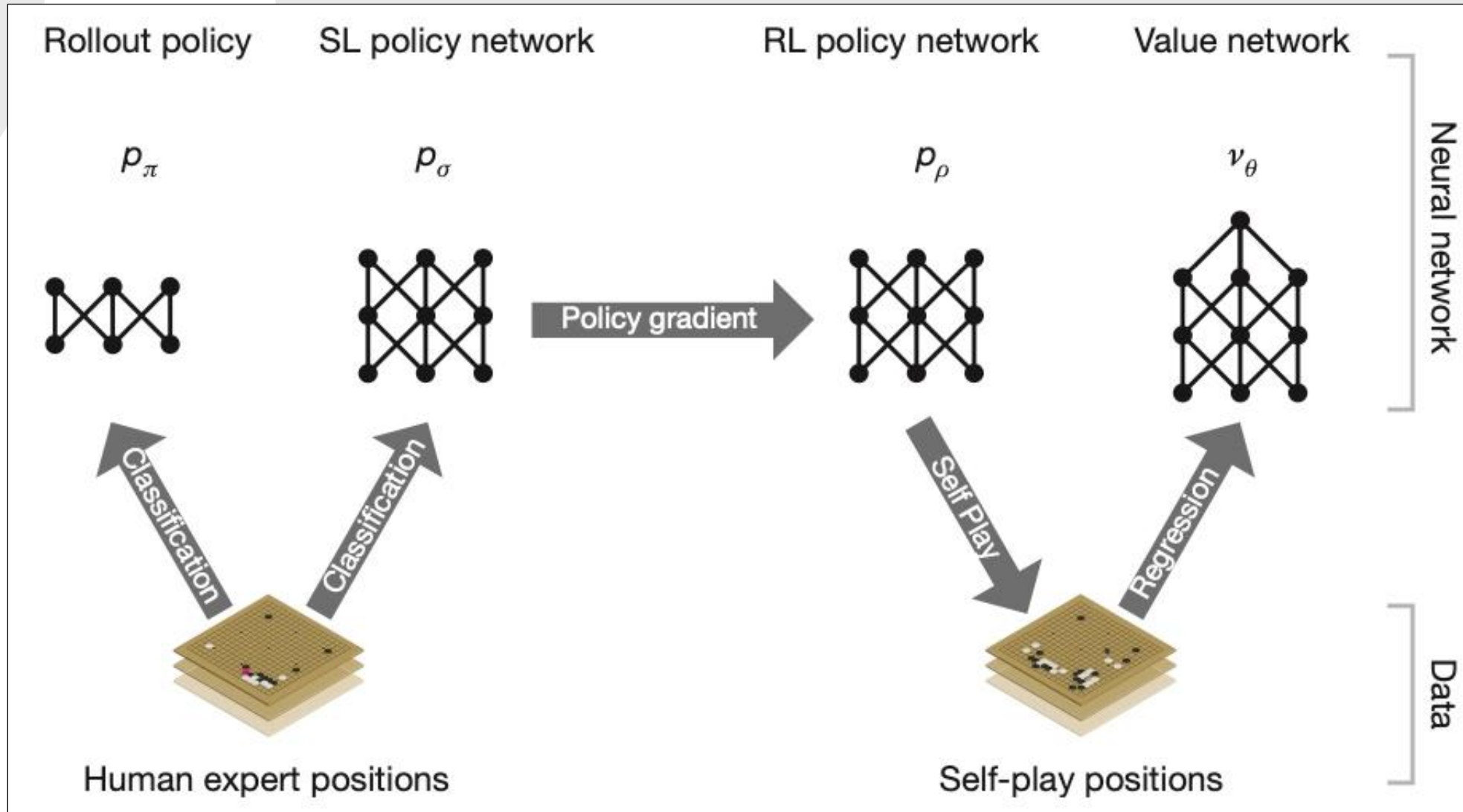


Illustration Training Process

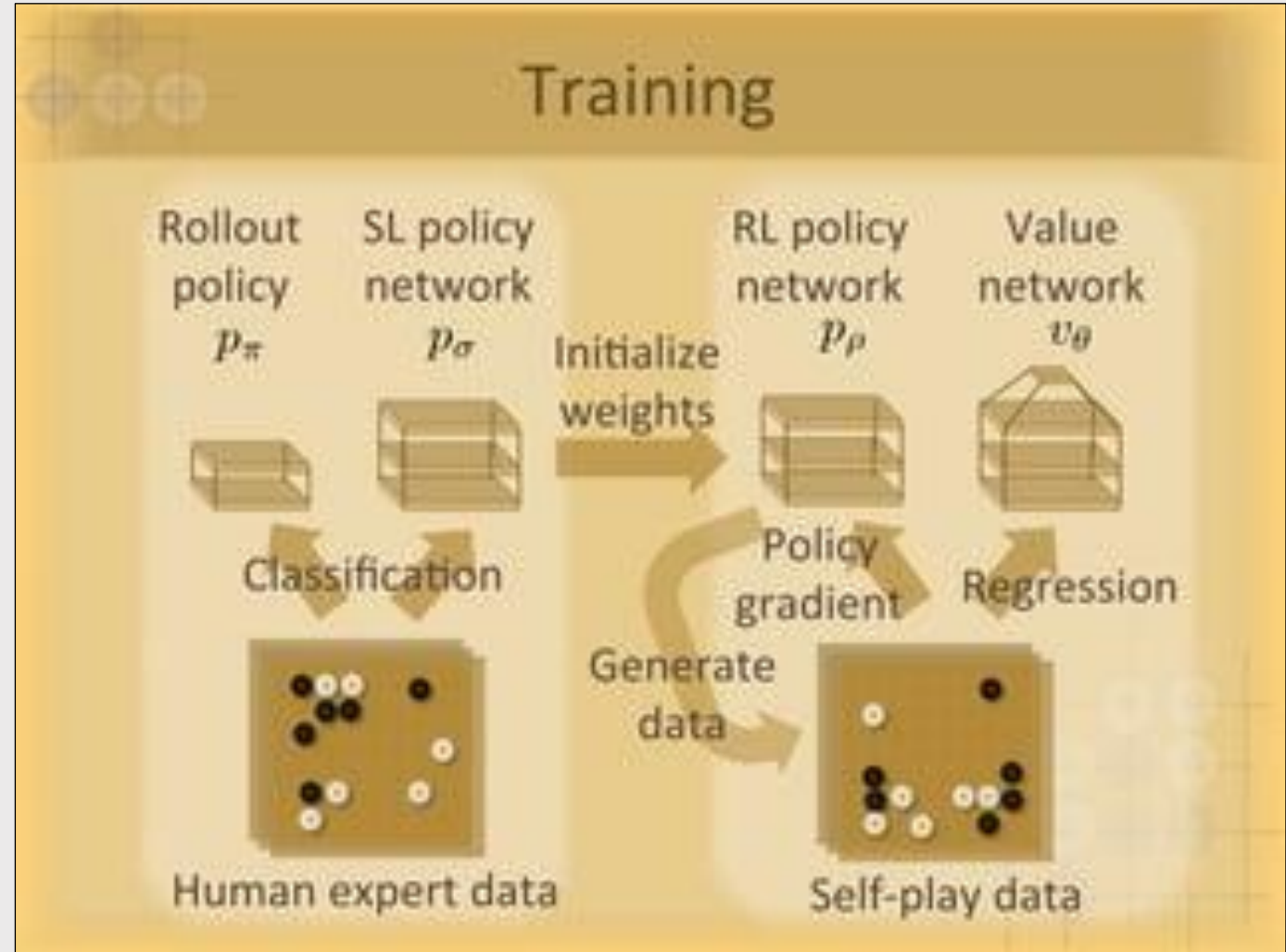


Illustration Supervised Learning

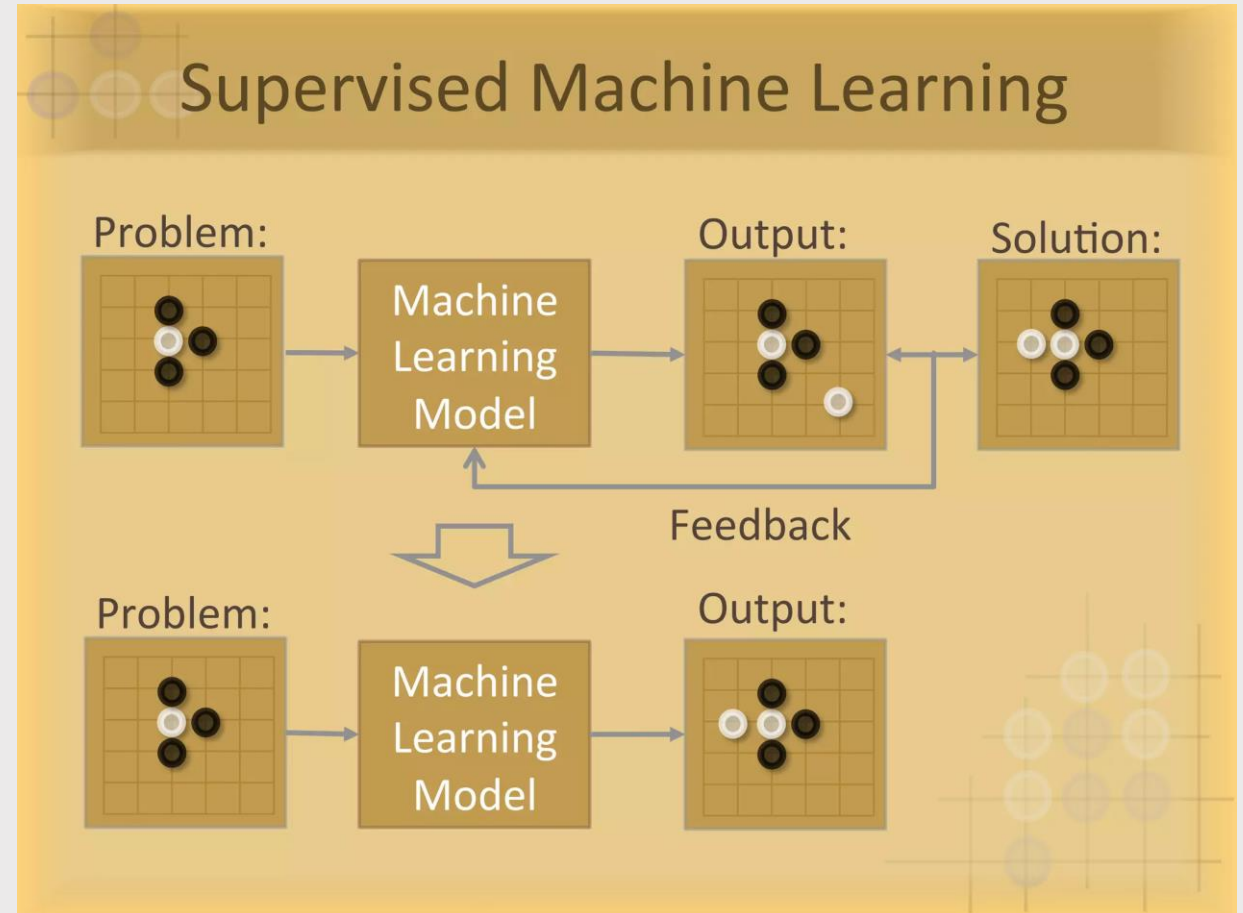


Illustration Neural NetWork

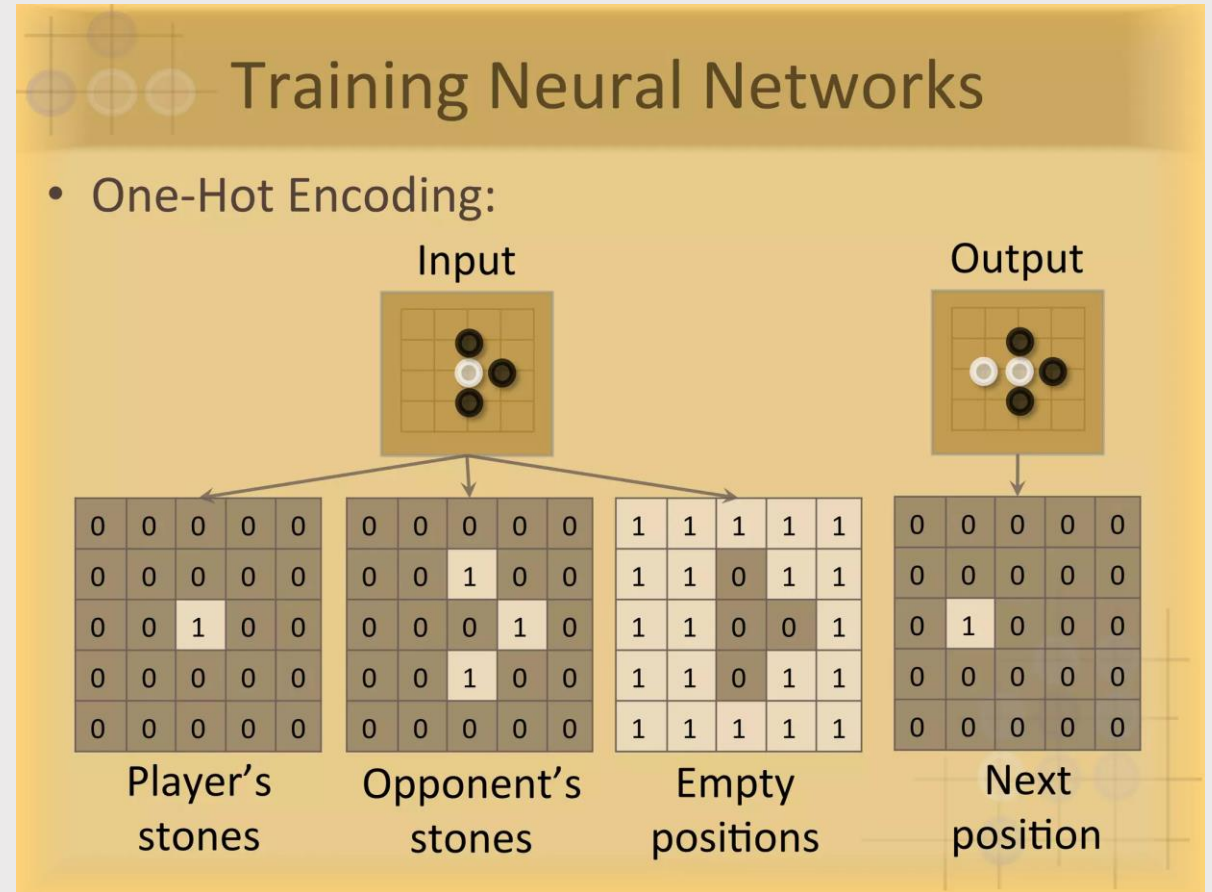
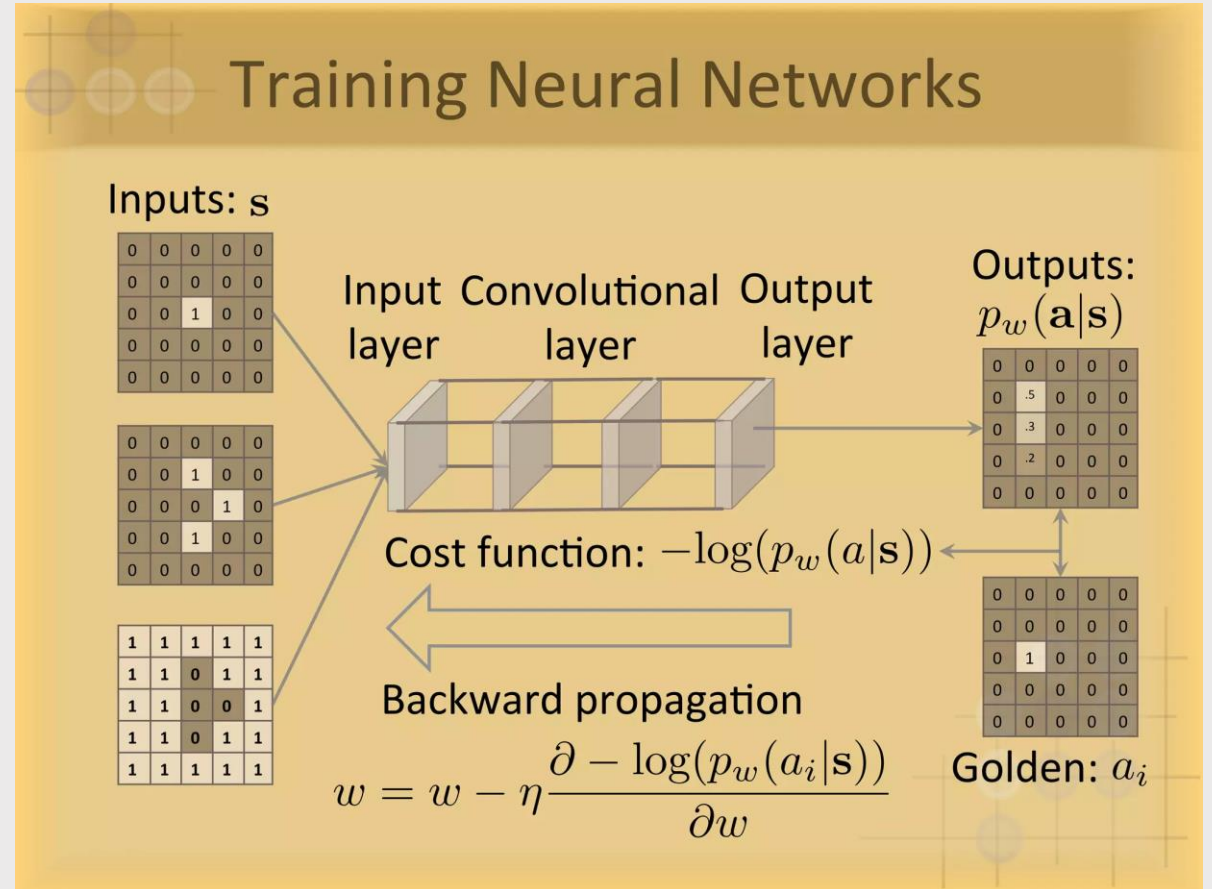


Illustration Neural NetWork



Another Search Tree

- Monte Carlo tree search

1. Selection
2. Expansion
3. Simulation/Evaluation
4. Back Propagation

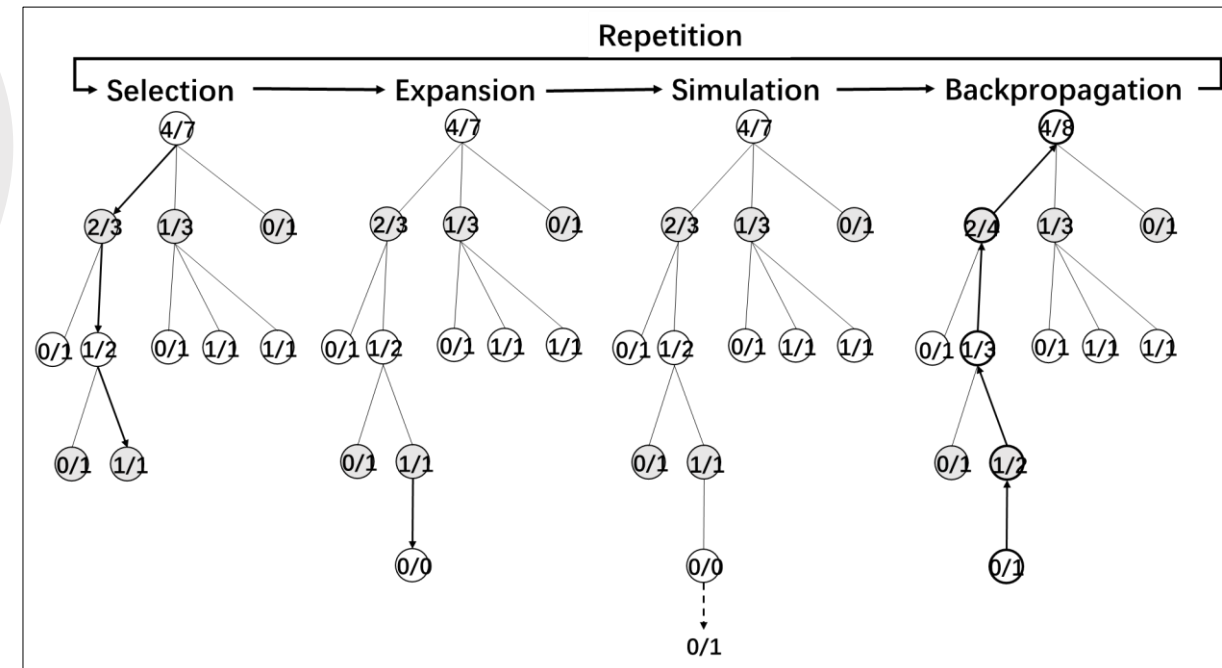
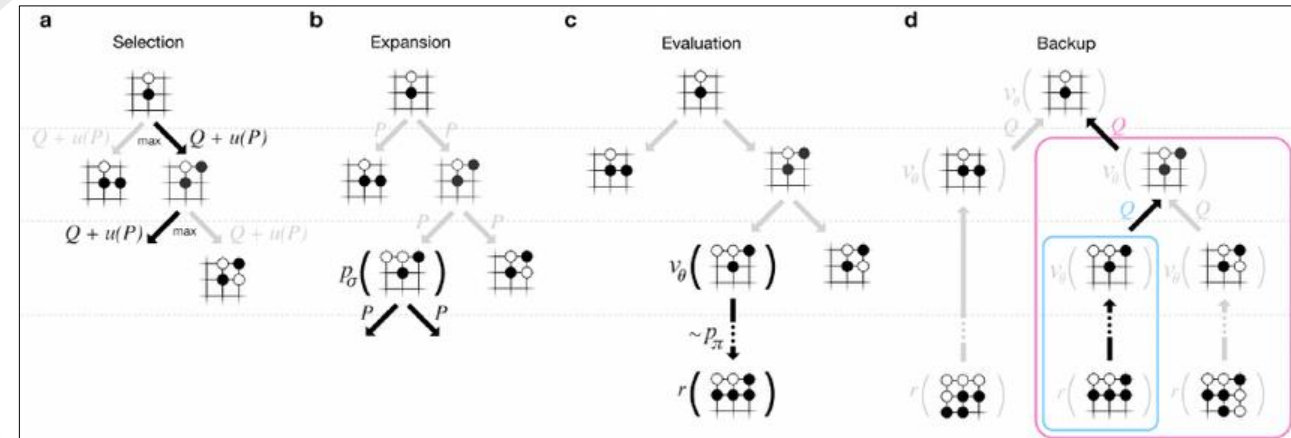
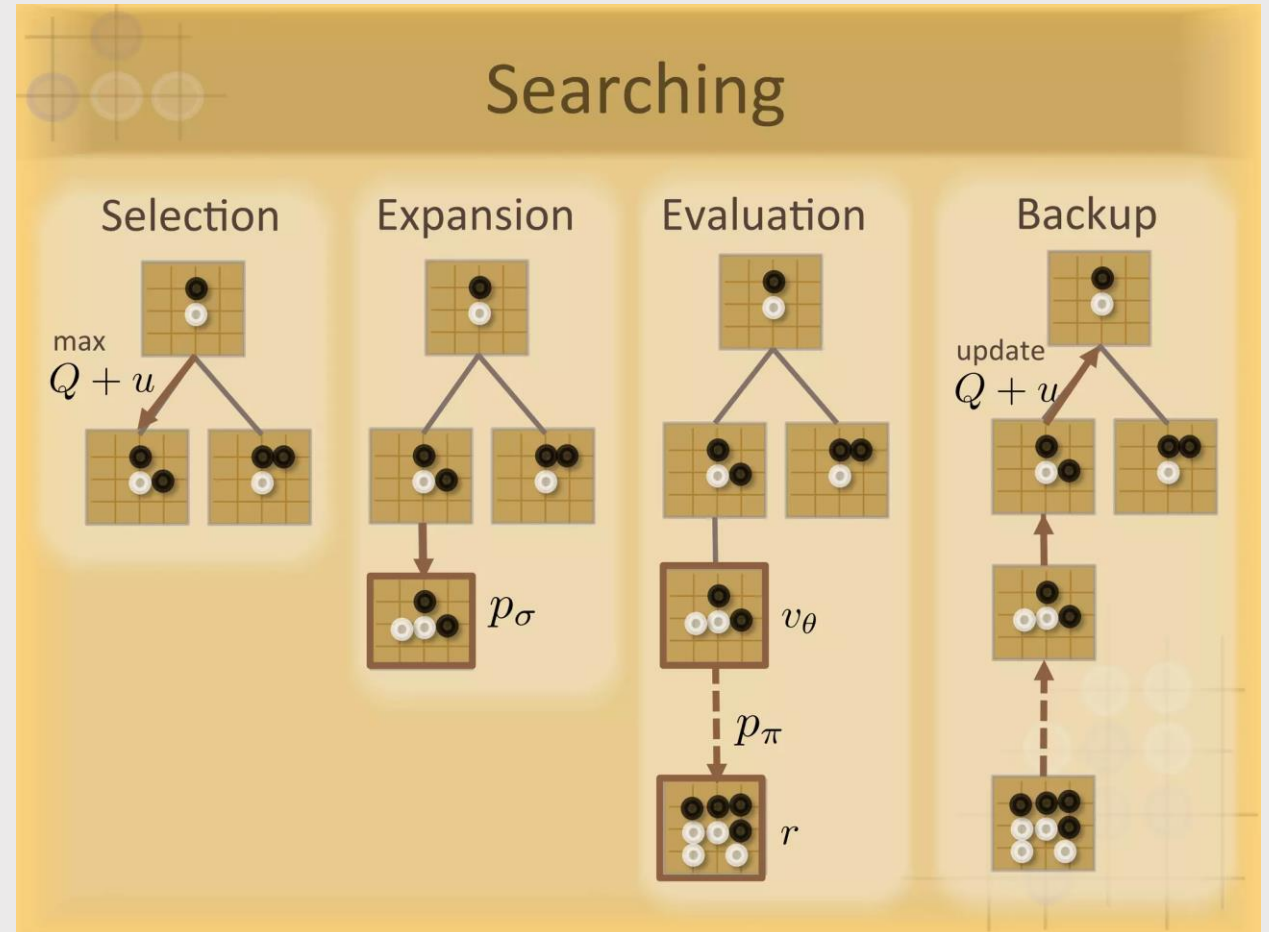


Illustration Monte Carlo



Application

- Future Utilization of AlphaGo

AlphaGo Zero *by 2017*

- uses no Human Knowledge & learn only by Self-Play

① 0 days

→ only basic rules as input,
no prior knowledge of the game.

② 3 days

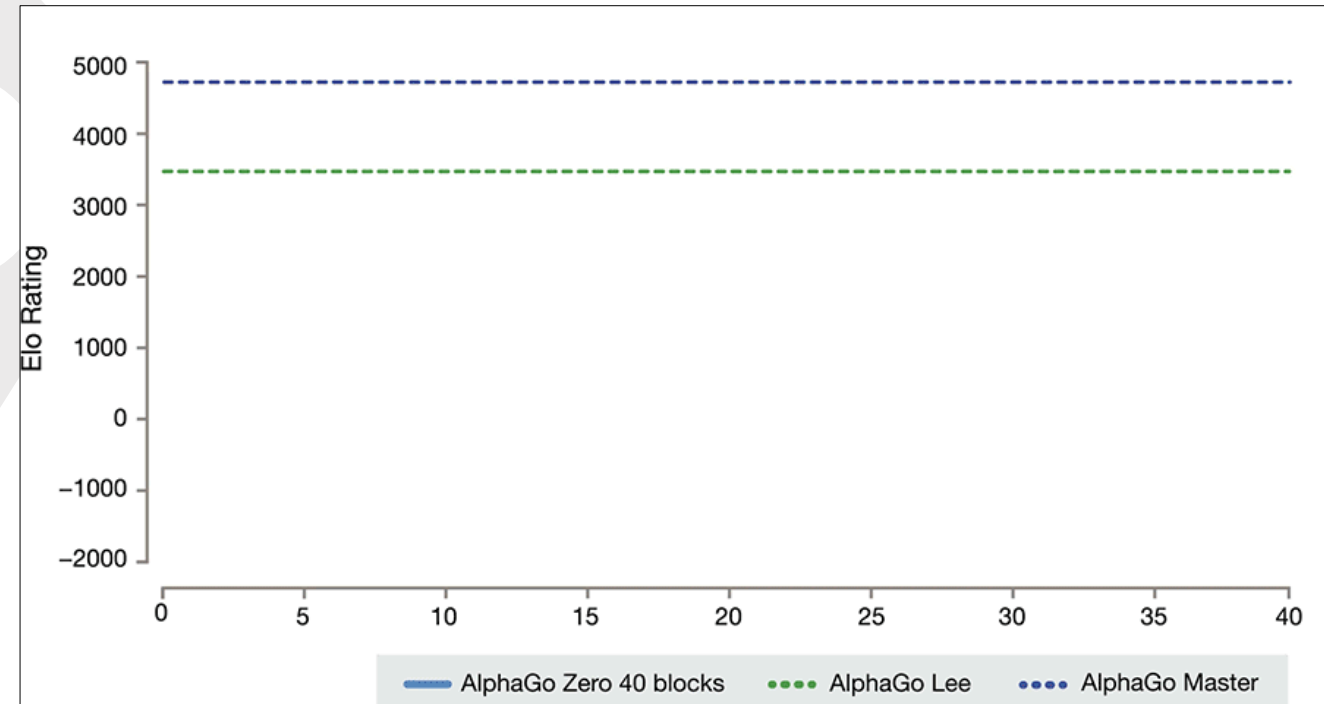
→ AlphaGo Zero surpasses AlphaGo.

② 21 days

→ AlphaGo Zero reaches Master.

③ 40 days

→ Surpasses all other versions.



Move Over AlphaGo - **Alpha Zero**

Alpha Zero taught itself to play **three different games**

① Trained 9 hours

→ Surpasses Stockfish in *Chess*.

② Trained 12 hours

→ Surpasses Elmo in *Shogi*.

② Trained 13 days

→ Surpasses Alpha in *Go*.





AlphaGo Teach

Let the AlphaGo Teaching Tool help you find new and creative ways of playing Go.

Application: Teaching Tool

- be used to explore the opening moves of a game of Go.
- try out alternative moves and show the probabilities of a win.



AlphaGo on StarCraft II – **Apha Star**

Difficulty to AI in past:

1. Unlike Chess or Go, you won't know opponent's action unless observation.
2. Not turn-based game, both Apha Star and opponent must make decisions ASAP.

Alpha Star Competition with Human

However, AI through **Deep Reinforcement Learning**, in the year 2018:

- *First Round*

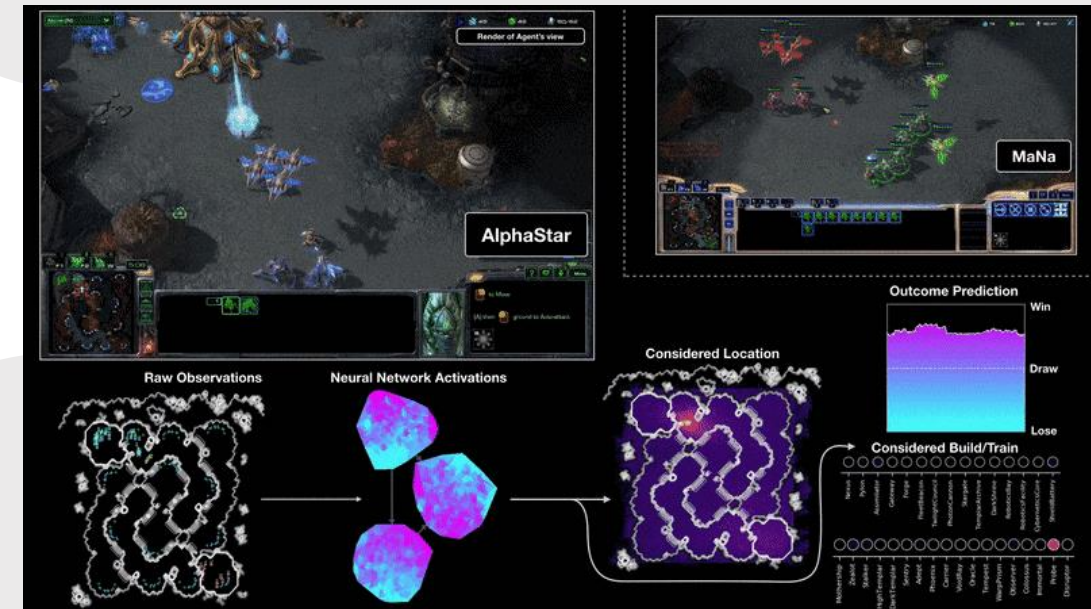
Competitor : TLO, German professional player.

Record : 5:0 → Alpha Star Win

- *Second Round*

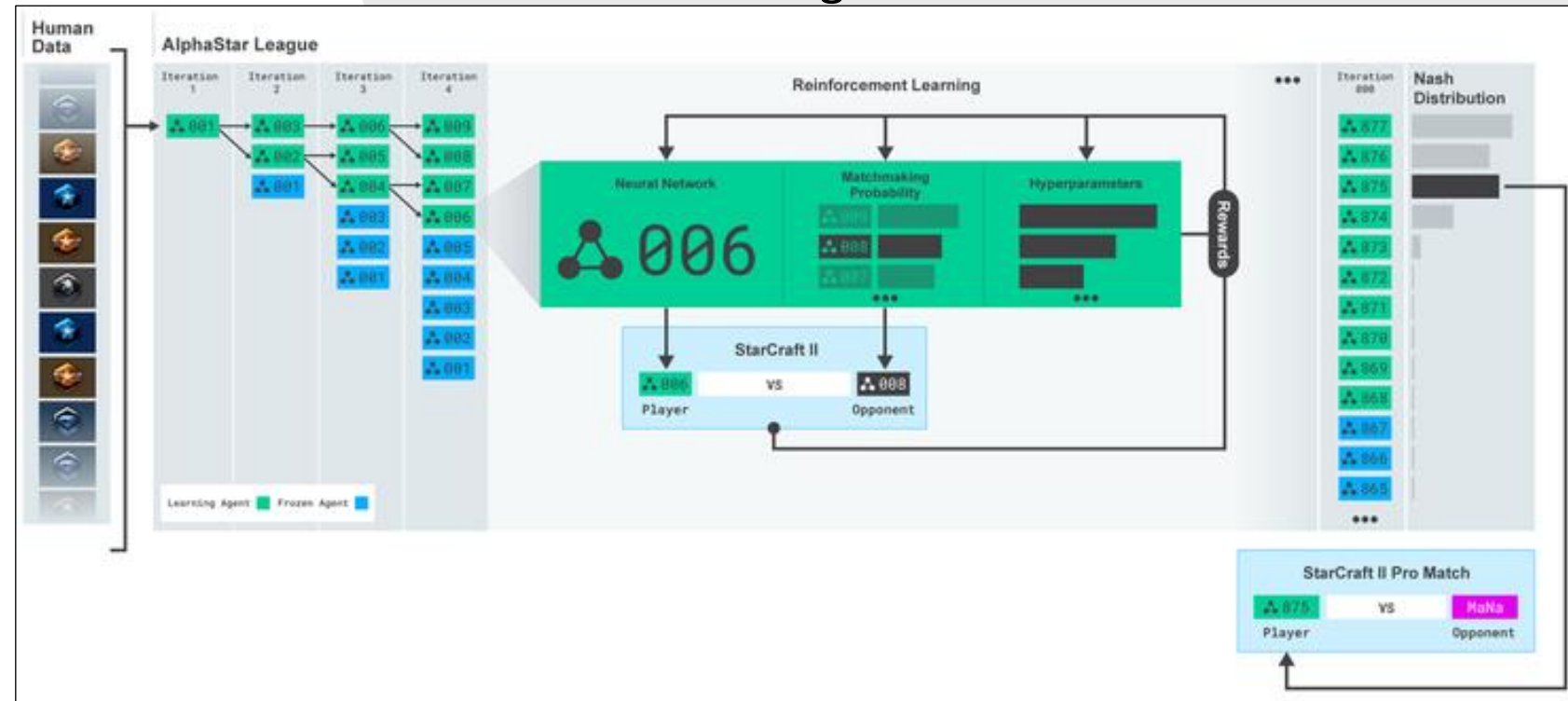
Competitor : MaNa, the world's top ten player .

Record : 5:0 → Alpha Star Win



Alpha Star Training Process

- Initially, trained from human game replays.
- Then, trained against other competitors in the league.
- The parameters are updated by RL from the game outcomes against competitors.
- The final agent is sampled from the Nash distribution of the league.





AI Bot

(AI on Video Games)

- TORCS:
The Open Racing Car Simulator
- Techniques: DRL
- Benefits:
 1. Player's Partner
Train noob or Challenge Player.
 2. Help run the games. / Detect any weaknesses of a game after design.
- This program is developed by Taiwan, National Yang Ming Chiao Tung University.

Conclusion

- Will AI replace Human Being?
AlphaGo → Weak AI, not Strong AI.
AI does not have a mind.
 - However,
we can utilize AI on many aspects,
such as Game or teaching tool.
 - Still Go or Chess is human's pleasure.
AI only evaluate the next movement,
but no feeling.
 - In order to achieve the perfection,
we have lots of effort to do.
- **Think how to create value for ourself.**





The End, Thank You

Glory to the Spirit, AMEN !