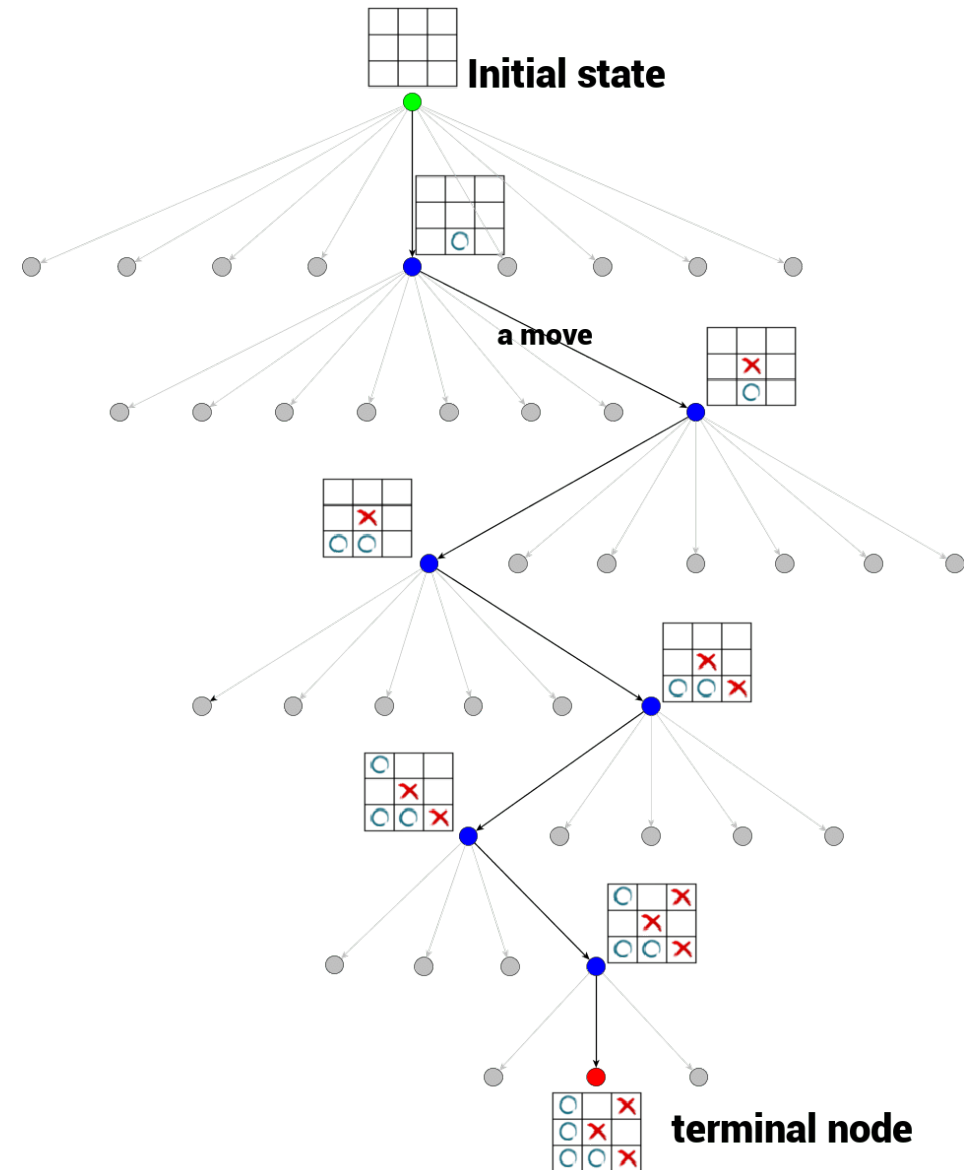
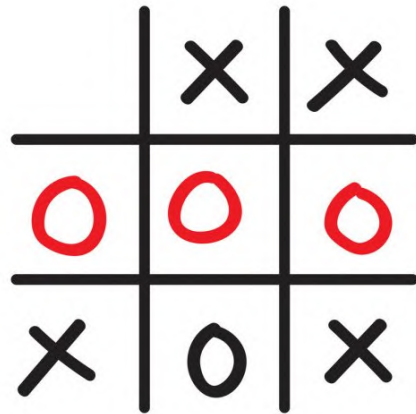




ALLE KURS OG ARRANGEMENTER

AlphaZero – kunstig intelligens i ~~sjakk og go~~

Signe Riemer-Sørensen



Number of leaf nodes

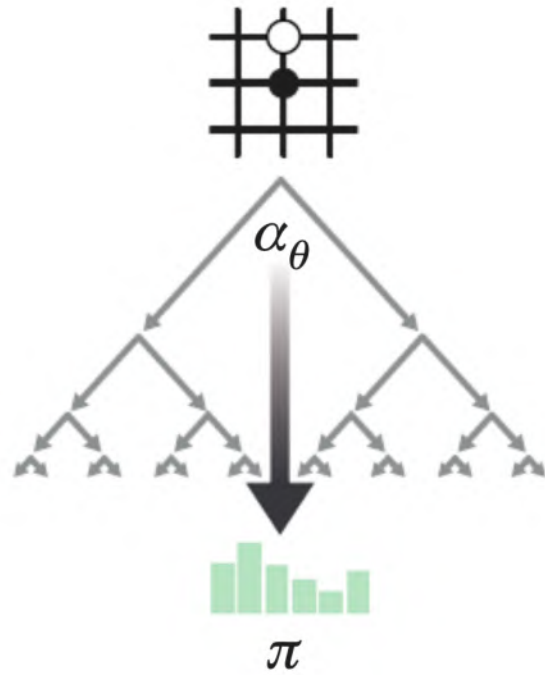
Tic-tac-toe 255,168

Chess 10^{123}

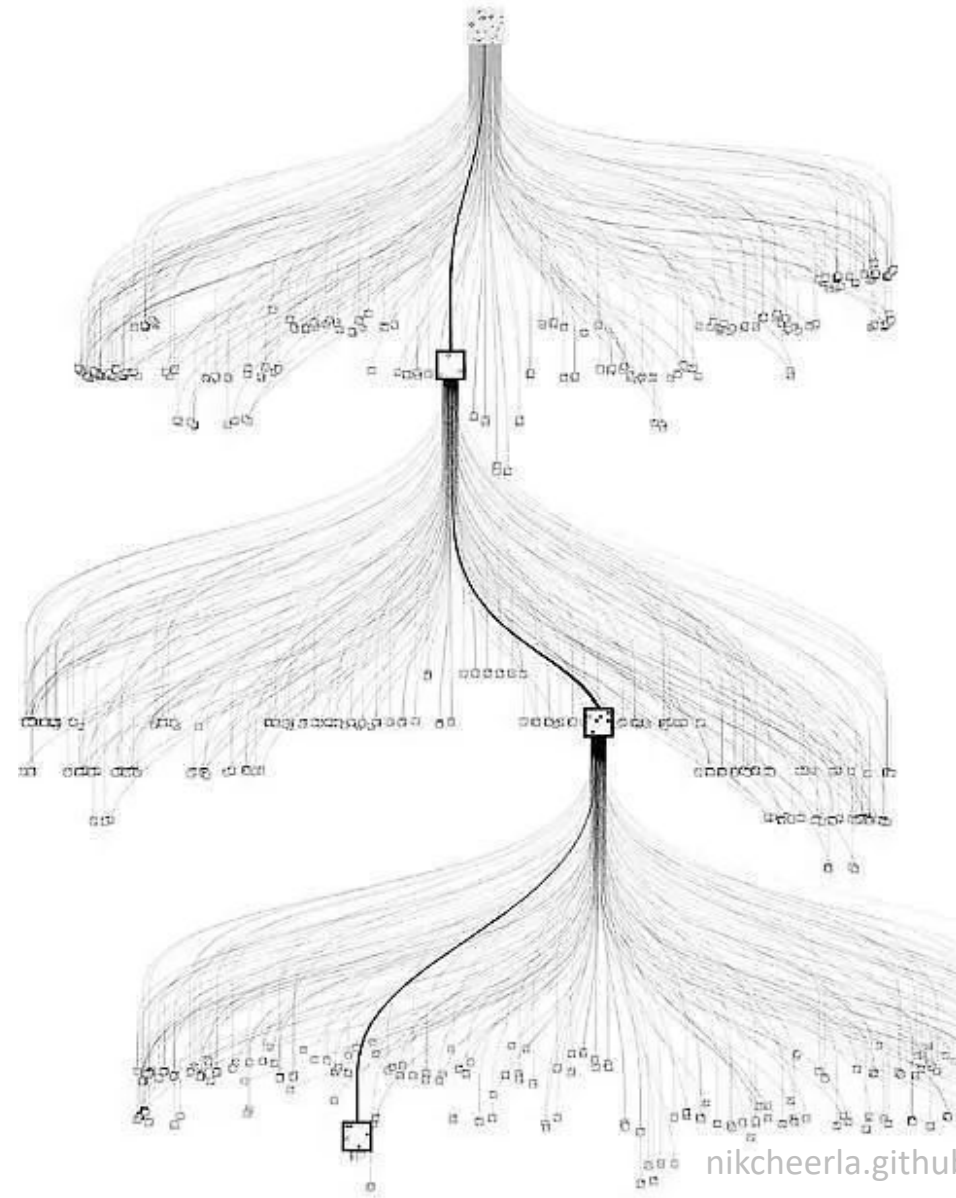
Go 10^{170}



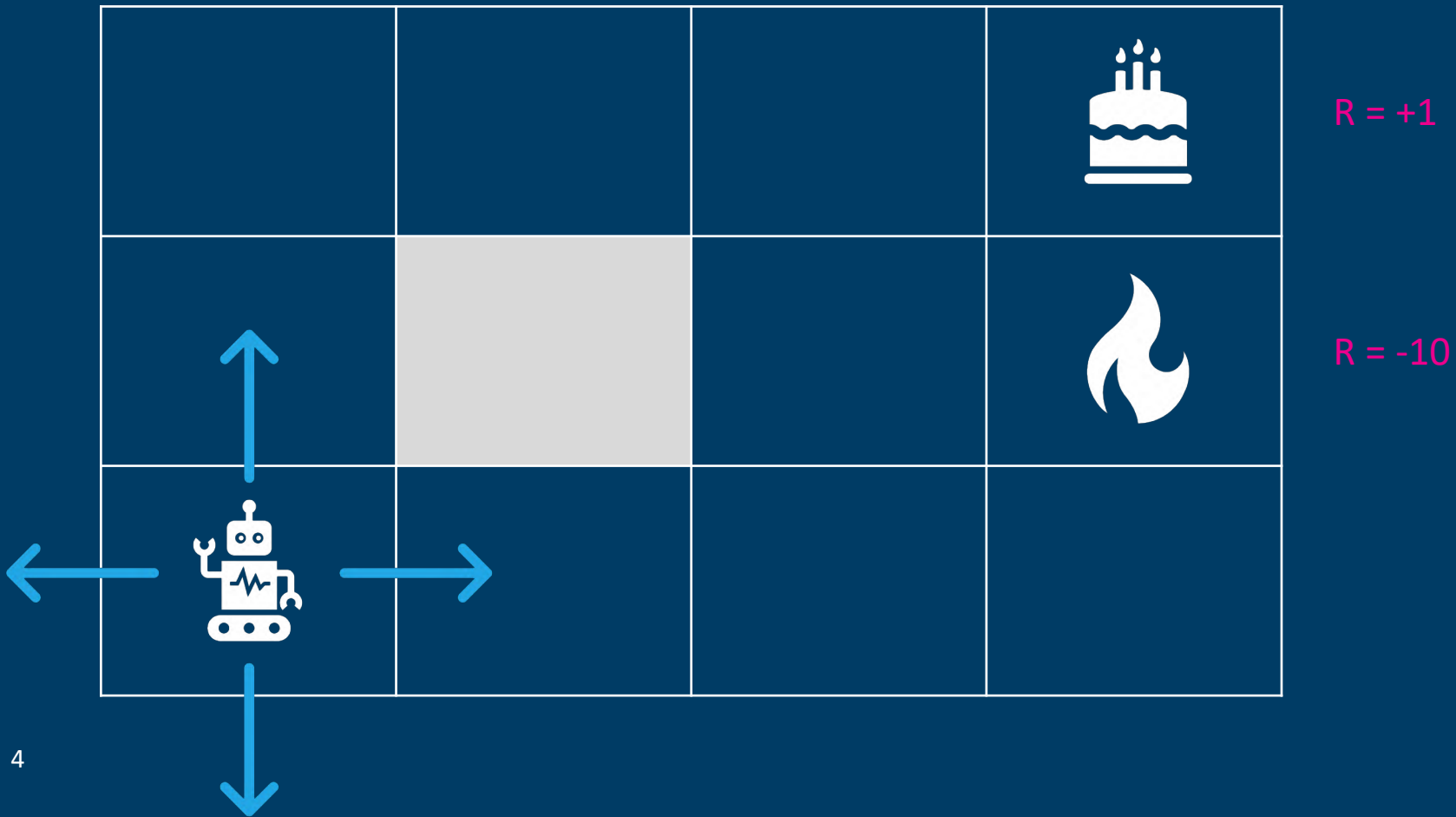
AlphaGo






Silver et al. 2017



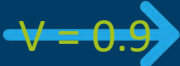



[nikcheerla.github.io](https://github.com/nikcheerla)



V = 1	V = 1	V = 1	
V = 1			
			

R = +1

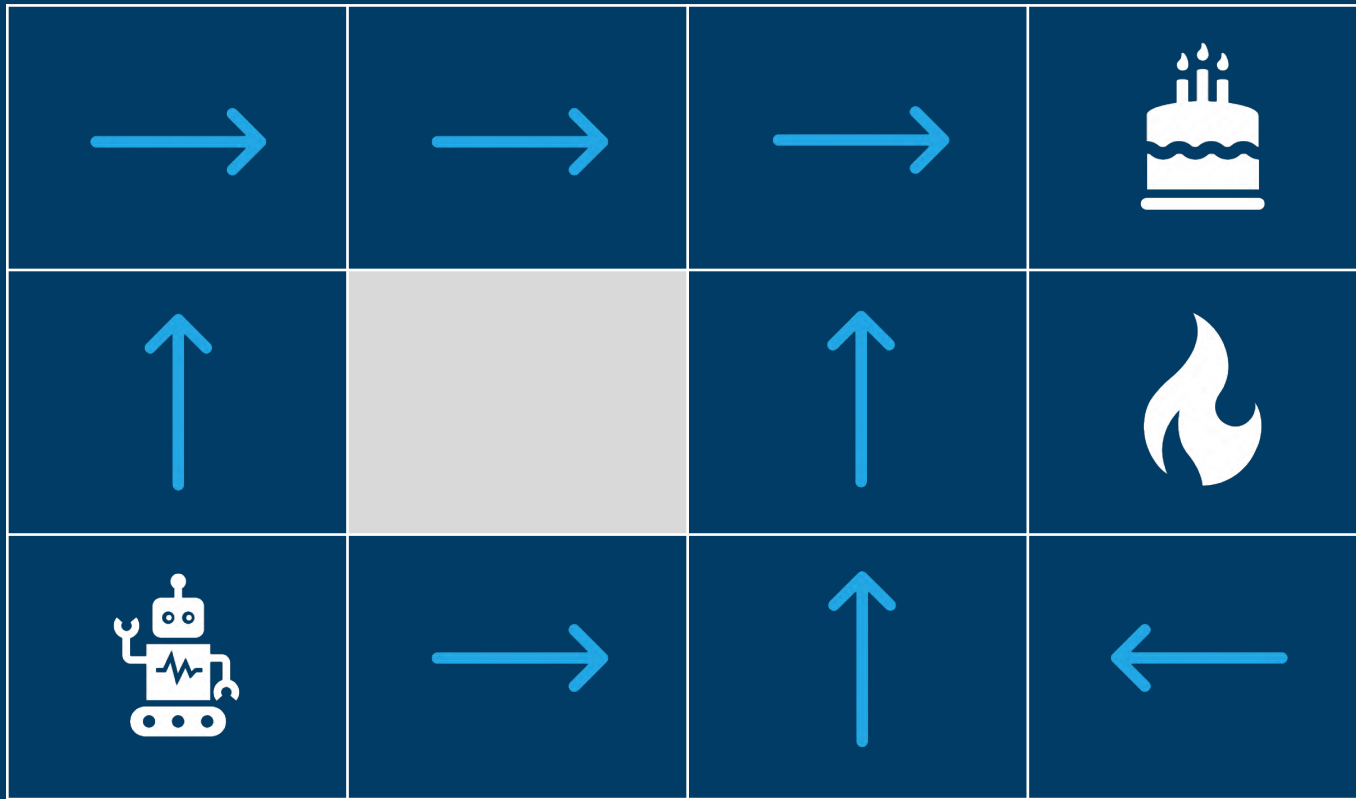
R = -10

V = 0.81	V = 0.9 	V = 1	
V = 0.73		V = 0.9	
 V = 0.66	V = 0.73	V = 0.81	V = 0.73

R = +1

$$V(s) = \max_a (R(s, a) + \gamma V(s'))$$

R = -10

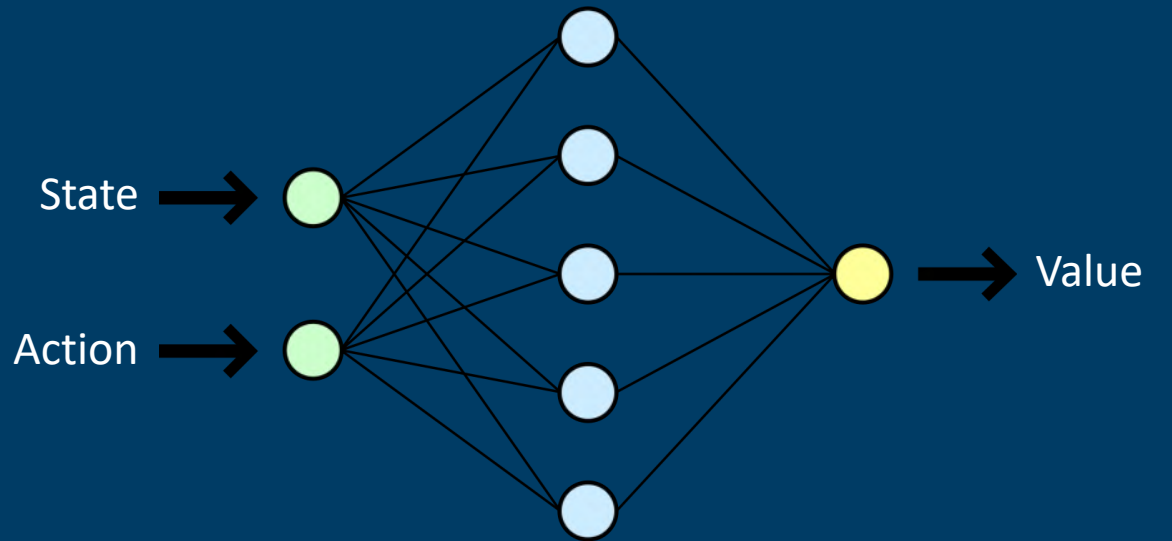


R = +1

$$V(s) = \max_a (R(s, a) + \gamma V(s'))$$

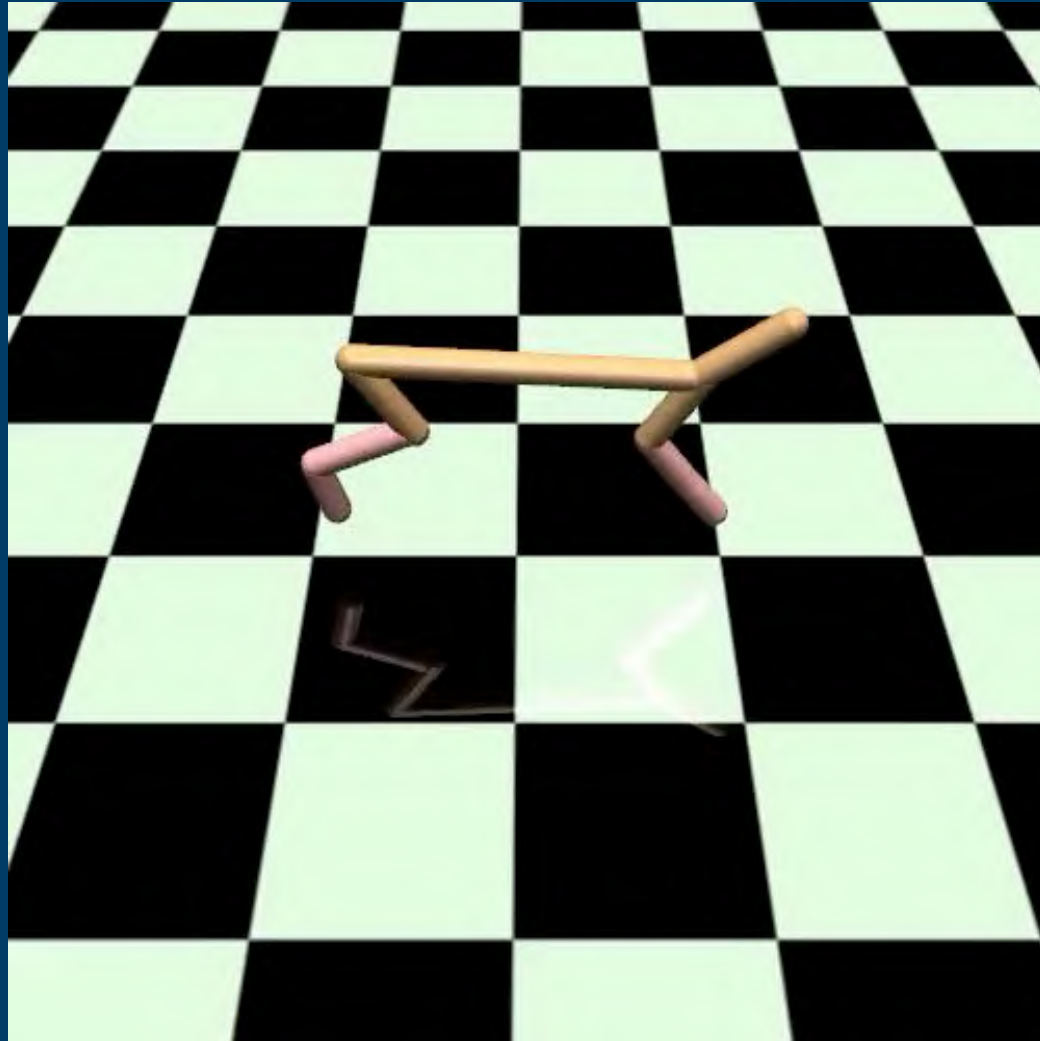
R = -10

		Actions			
		↓	→	↑	←
States	(1,1)	V			
	(1,2)				
	(1,3)				
	(1,4)				
	(2,1)				
	...				



Important components

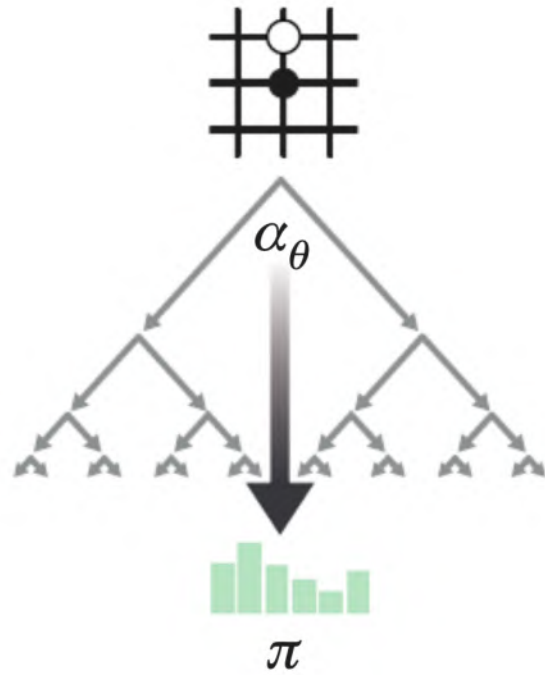
- The reward
 - What is the goal?
 - Sparse vs shaped
- The environment
 - The behaviour of the system
 - Stochastic and systematic feedback
- The agent
 - How to interpret the environment
 - How to learn? Balance exploration versus exploitation



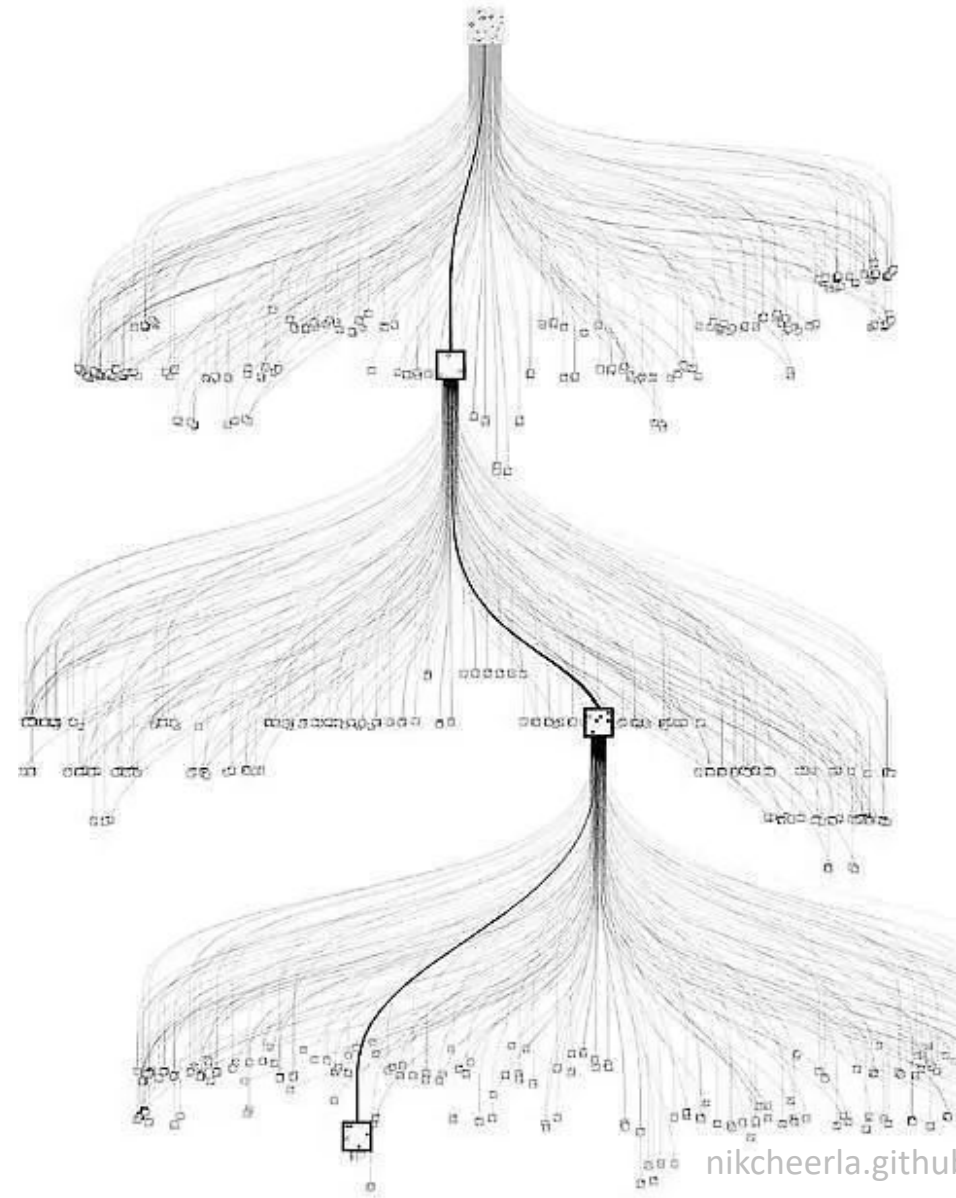
Alex Irpan, implementation of Gu et al. 2016



AlphaGo



Silver et al. 2017



[nikcheerla.github.io](https://github.com/nikcheerla)



AlphaZero – no human knowledge



Train on TPU

3 hours: Play like human

19 hours: Play with advanced strategies

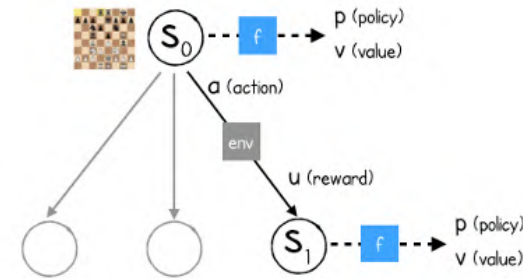
70 hours: Super human play



muZero – no rules



AlphaZero

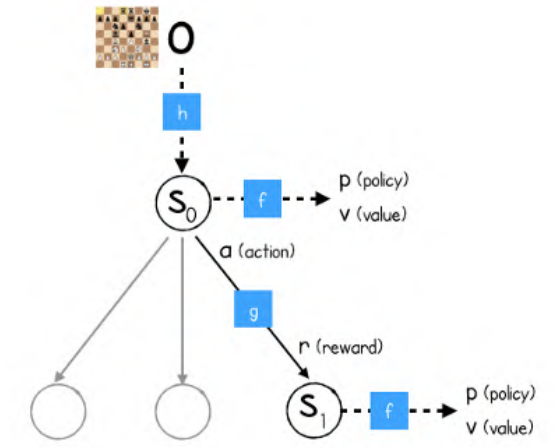


AlphaZero has 1 network

	from	to
prediction f :	s	p, v

David Foster

MuZero



MuZero has 3 networks

	from	to
prediction f :	s	p, v
dynamics g :	s, a	r, s
representation h :	o	s



Summary

- Deepmind blogpost about muZero with links to AlphaGo and AlphaZero
<https://deepmind.com/blog/article/muzero-mastering-go-chess-shogi-and-atari-without-rules>
- More details about muZero with pseudo code
<https://medium.com/applied-data-science/how-to-build-your-own-muzero-in-python-f77d5718061a>
- Why is it difficult to use in real life?
<https://www.quantamagazine.org/why-alphazeros-artificial-intelligence-has-trouble-with-the-real-world-20180221/>