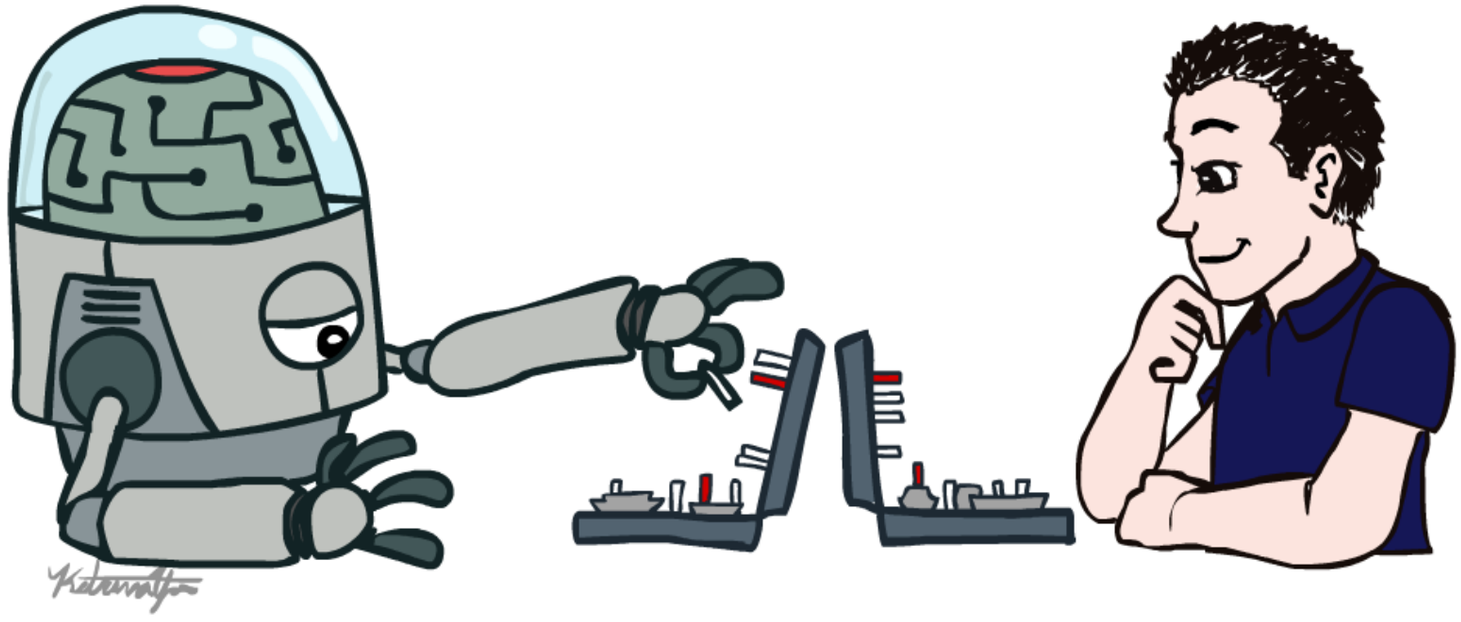
人工智能



附加章

CADE METZ BUSINESS 03.16.16 7:00 AM

IN TWO MOVES, ALPHAGO AND LEE SEDOL REDEFINED THE FUTURE

Lee Sedol. GEORDIE WOOD FOR WIRED

SEOUL, SOUTH KOREA — In Game Two, the Google machine made a move that no human ever would. And it was beautiful. As the world looked on, the move so perfectly demonstrated the enormously powerful and rather

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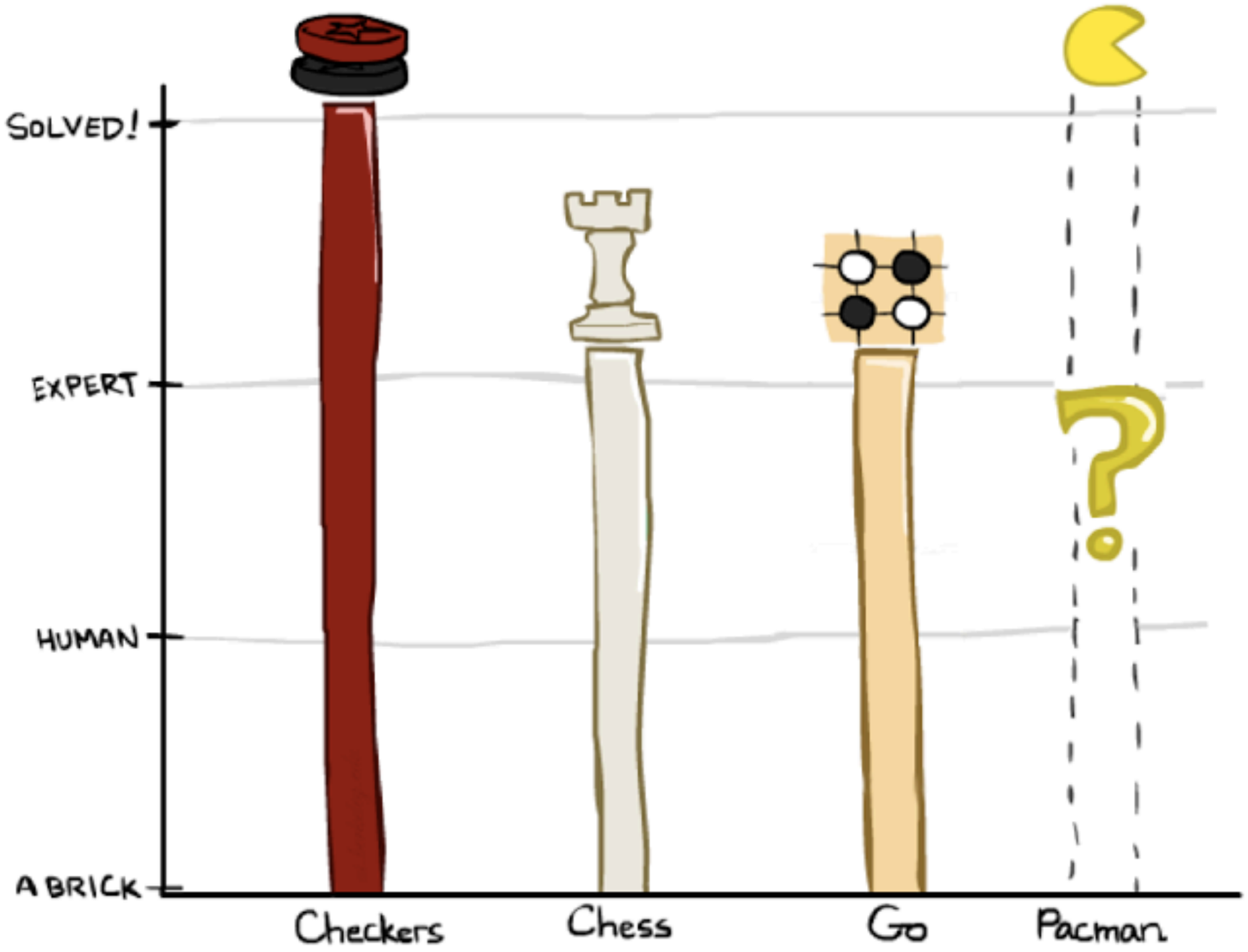
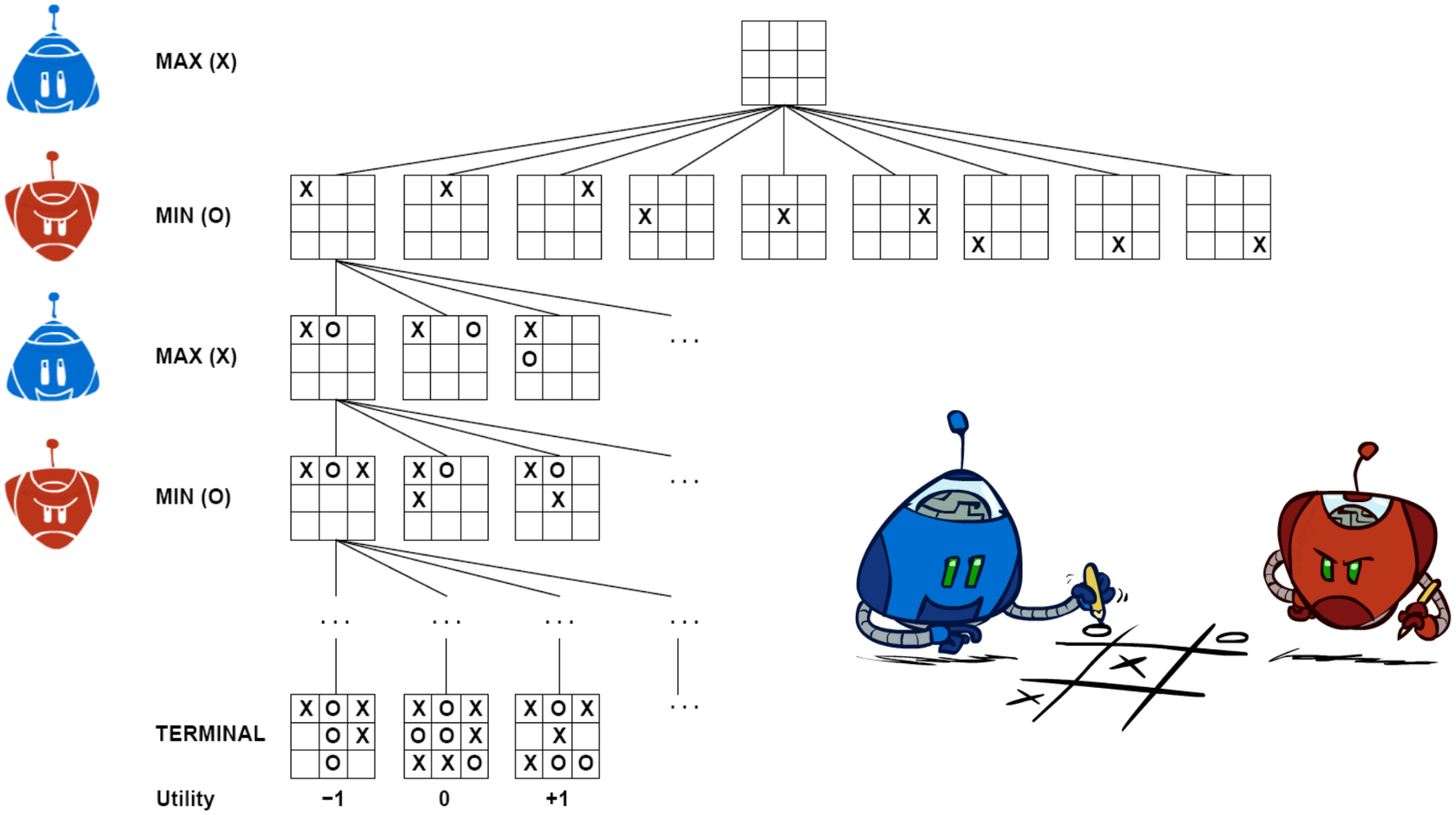
It's Official: The Smartphone Market Has Gone Flat
5 HOURS

DESIGN
Neural Nets Got You

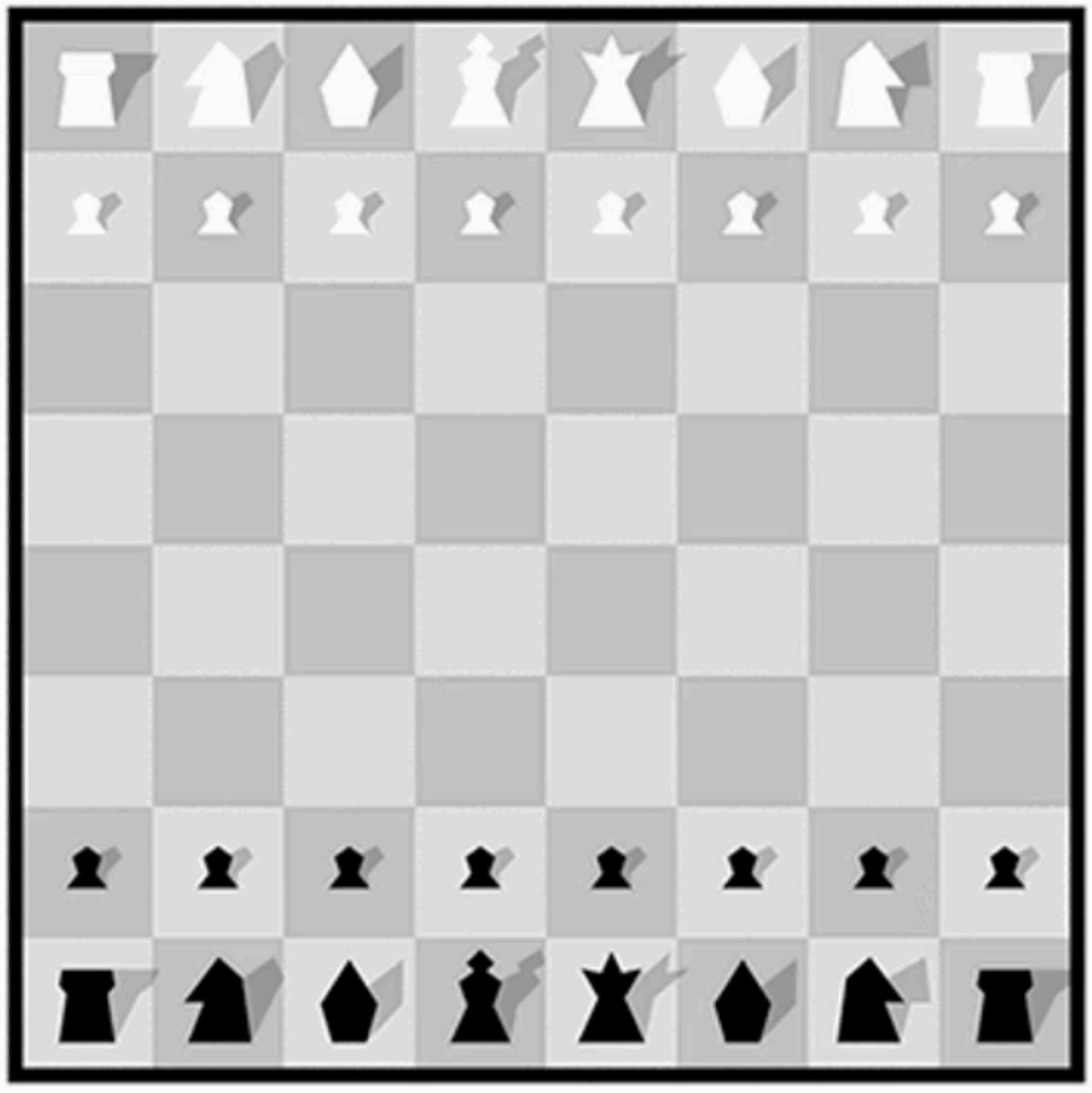

SOLVED!
EXPERT
HUMAN
A BRICK
Checkers
Chess
Go
Pacman

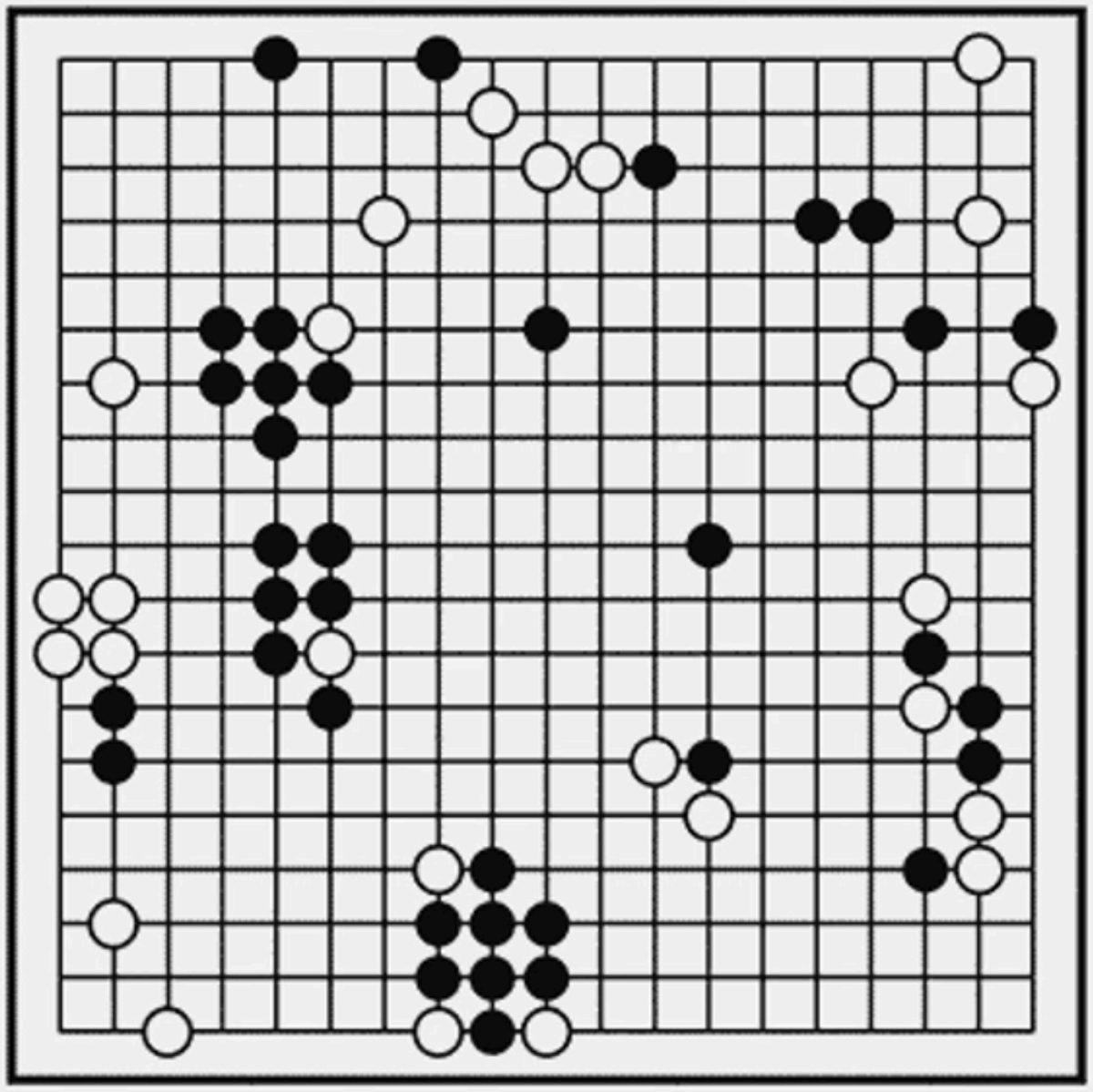
如何设计一个针对围棋的AI?

MiniMax

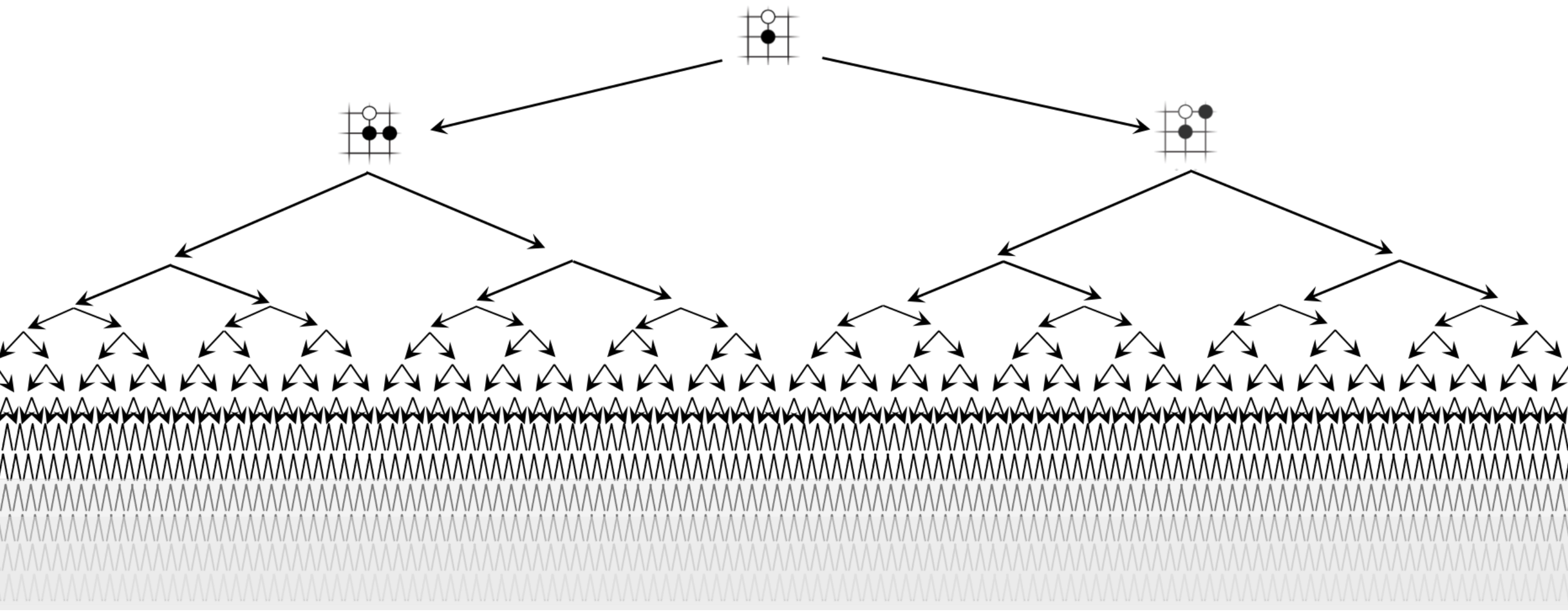


与国际象棋相比，为何设计一个下围棋的AI如此困难?

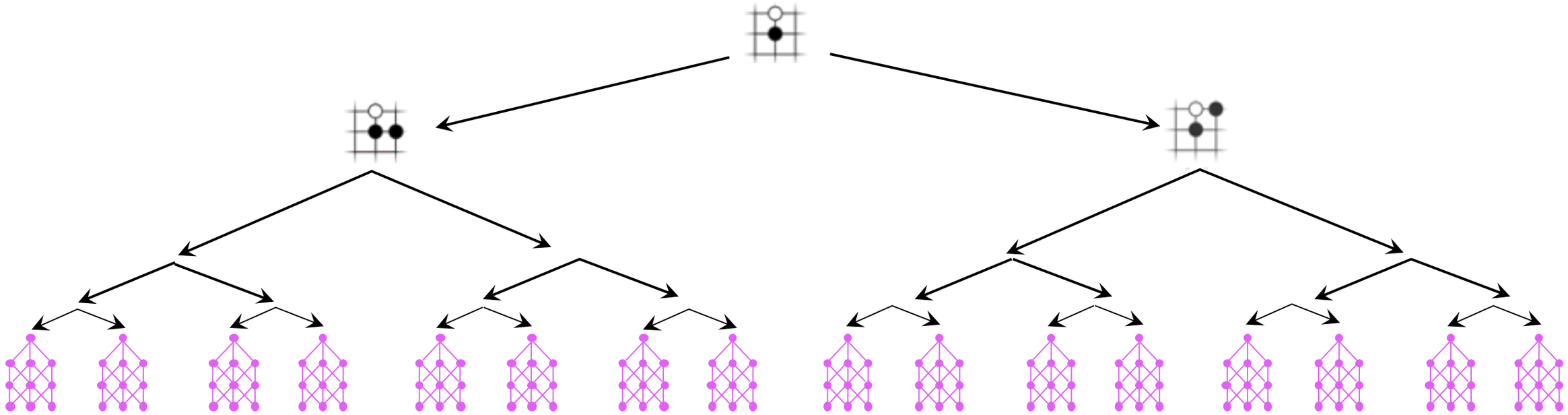




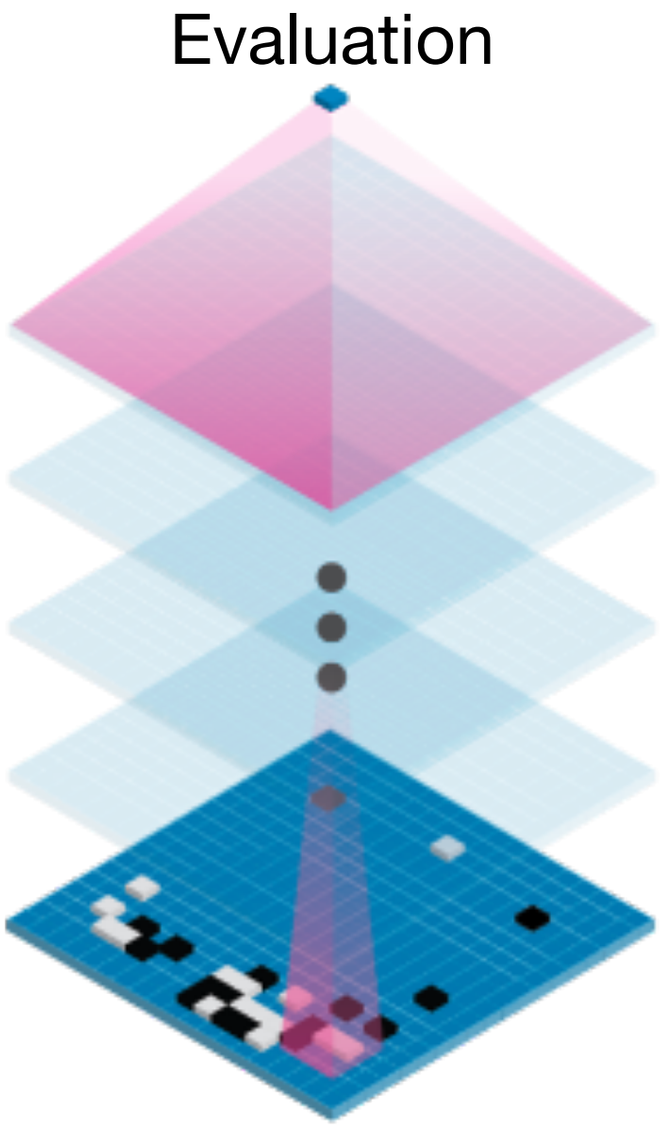
穷尽搜索

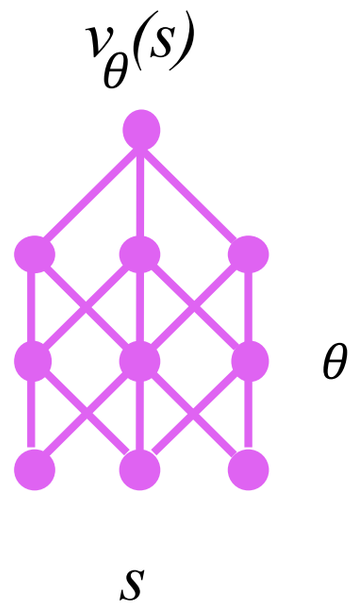


利用值估计降低深度

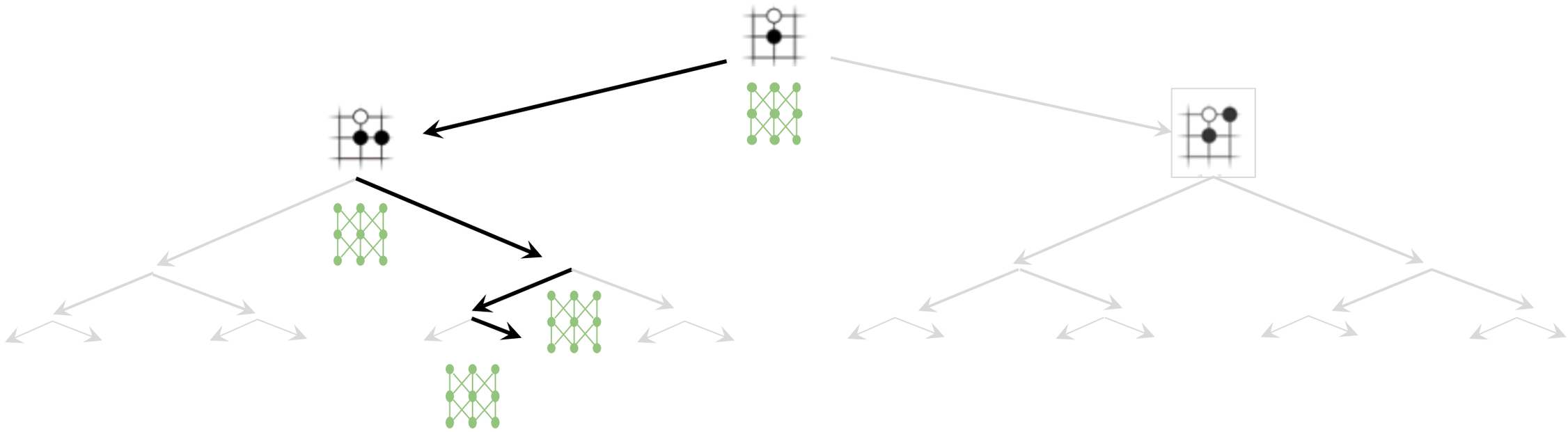


神经网络进行值估计



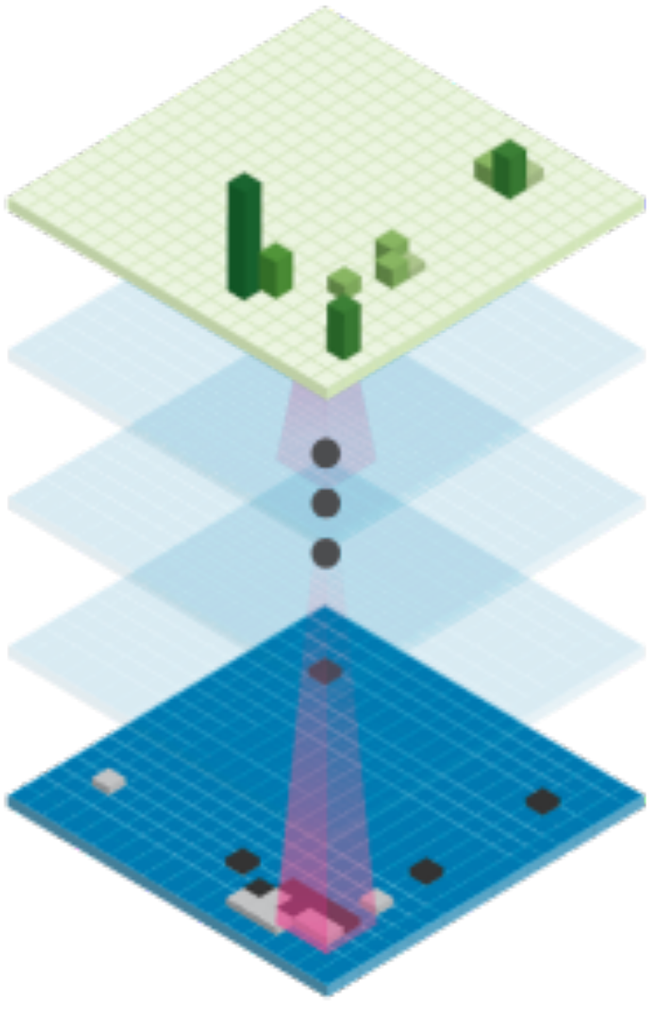


利用策略估计降低搜索宽度



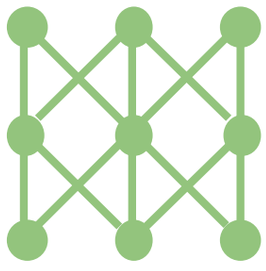
神经网络进行策略估计

Move probabilities



Position

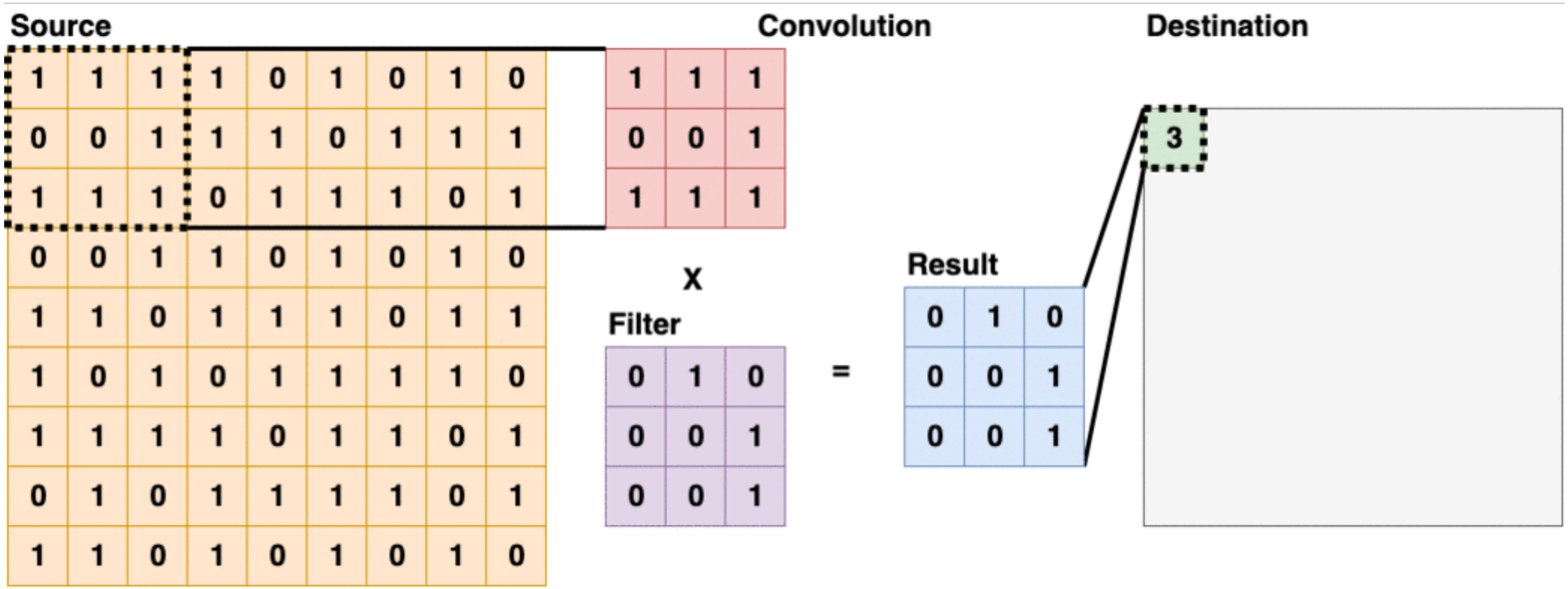
$p\sigma(a|s)$



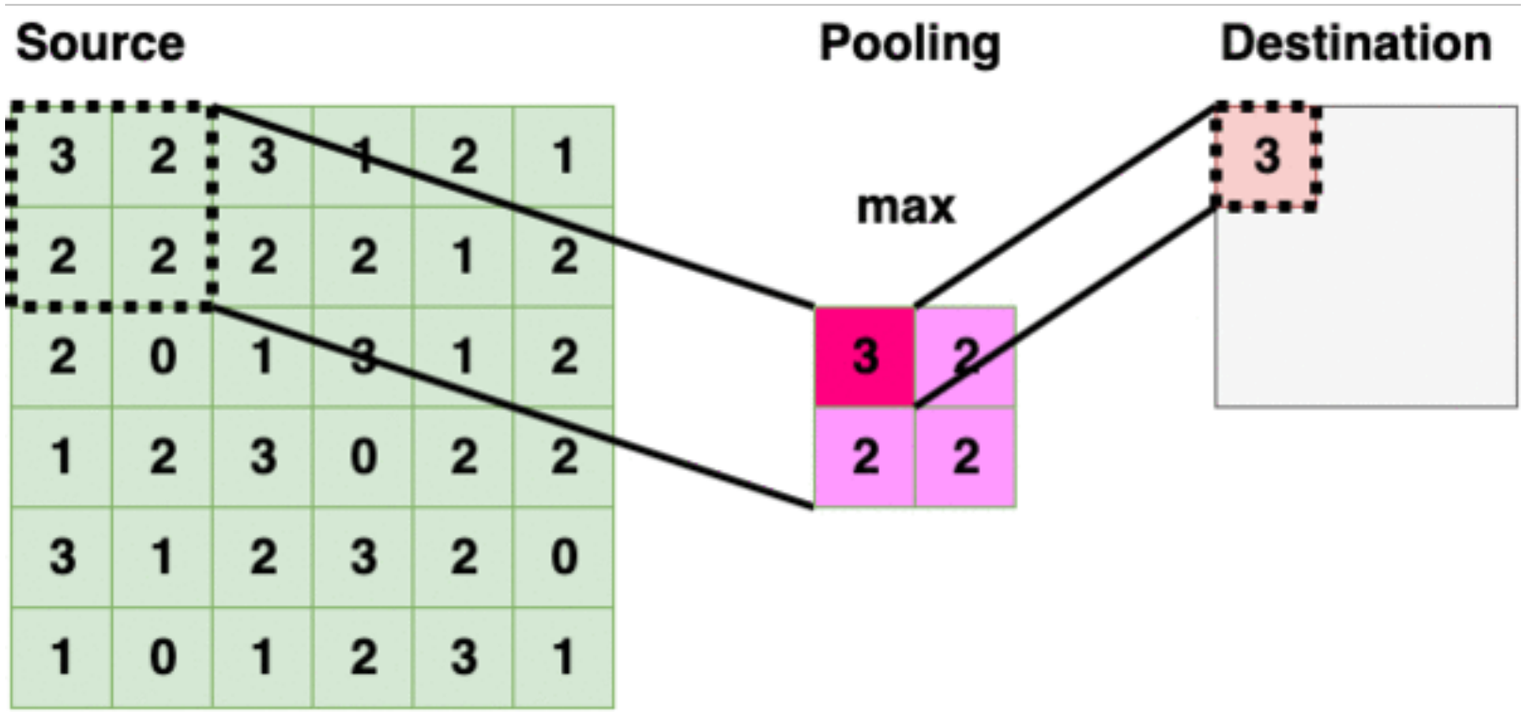
σ

s

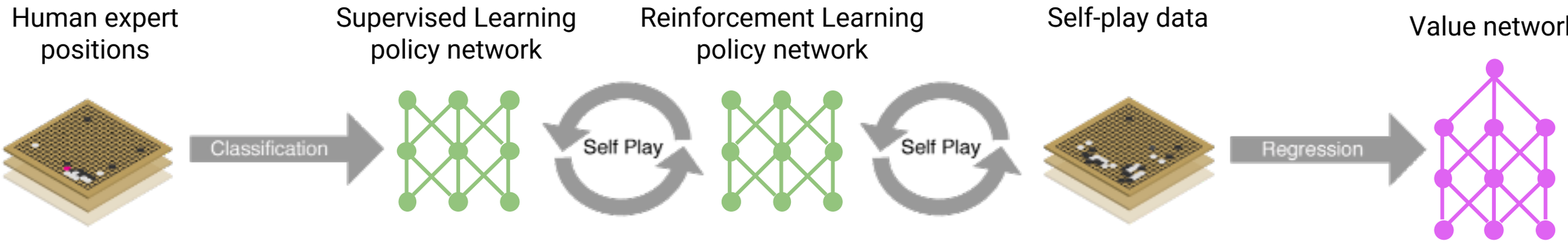
卷积神经网络——卷积



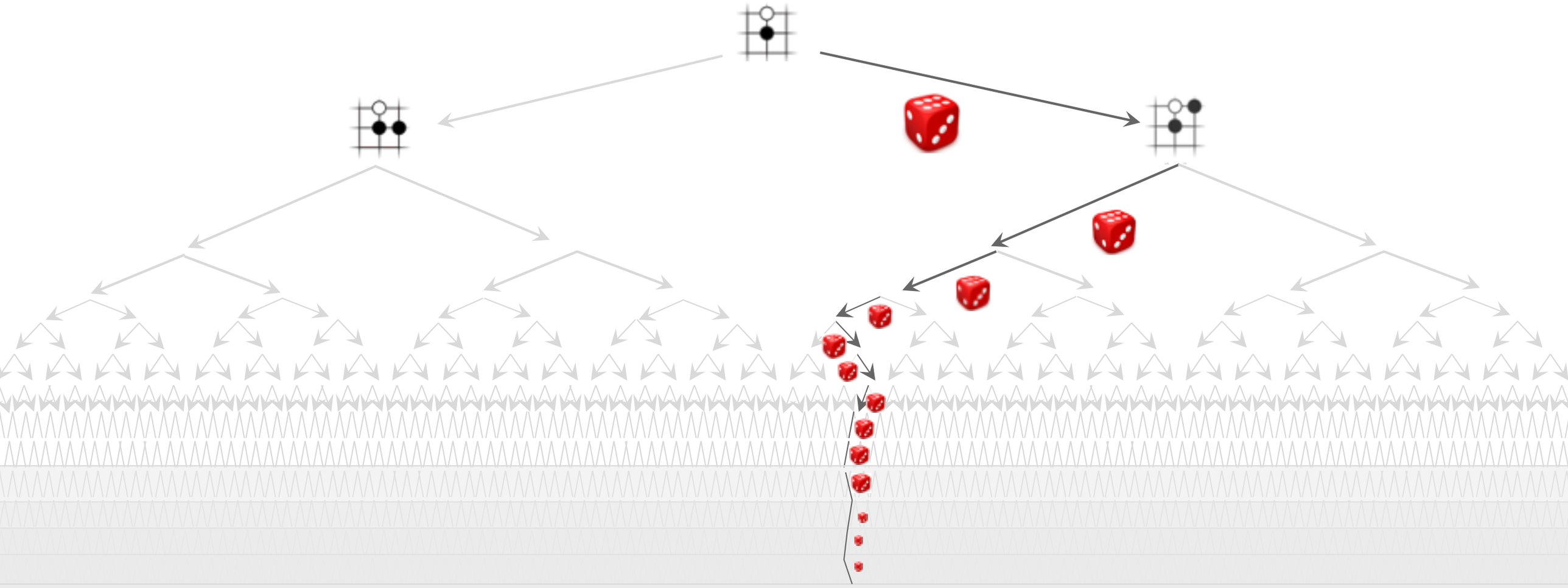
卷积神经网络——池化


Source
Pooling
Destination
max
3 2 3 1 2 1
2 2 2 2 1 2
2 0 1 3 1 2
1 2 3 0 2 2
3 1 2 3 2 0
1 0 1 2 3 1
3 2
2 2
3

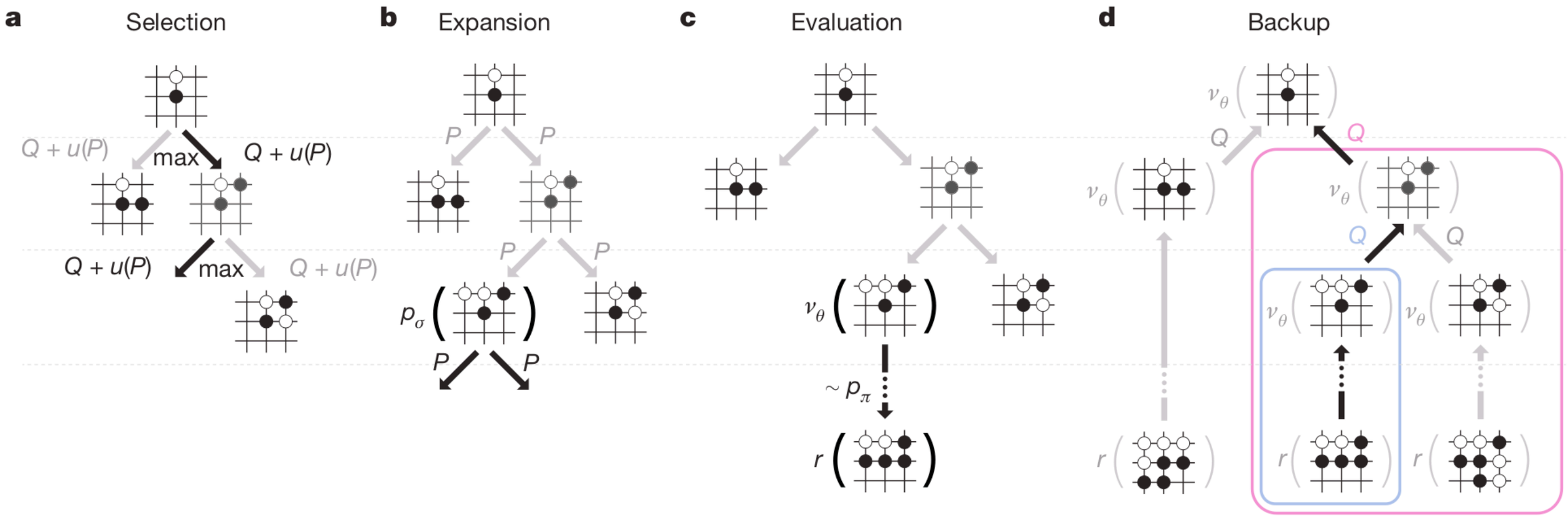
用监督学习和强化学习进行训练



加上随机性



蒙特卡洛树搜索


a
Selection
Q + u(P)
max
Q + u(P)
Q + u(P)
max
Q + u(P)
b
Expansion
P
P
P
P
P
P
p_σ
c
Evaluation
v_θ
$\sim p_\pi$
r
d
Backup
v_θ
Q
Q
v_θ
v_θ
Q
Q
v_θ
v_θ
r
r
r

Published: 27 January 2016

Mastering the game of Go with deep neural networks and tree search

David Silver, Aja Huang, Chris J. Maddison, Arthur Guez, Laurent Sifre, George van den Driessche, Julian Schrittwieser, Ioannis Antonoglou, Veda Panneershelvam, Marc Lanctot, Sander Dieleman, Dominik Grewe, John Nham, Nal Kalchbrenner, Ilya Sutskever, Timothy Lillicrap, Madeleine Leach, Koray Kavukcuoglu, Thore Graepel & Demis Hassabis

Nature **529**, 484–489 (2016) | Cite this article

Abstract

The game of Go has long been viewed as the most challenging of classic games for artificial intelligence owing to its enormous search space and the difficulty of evaluating board positions and moves. Here we introduce a new approach to computer Go that uses 'value networks' to evaluate board positions and 'policy networks' to select moves. These deep neural networks are trained by a novel combination of supervised learning from

Published: 19 October 2017

Mastering the game of Go without human knowledge

David Silver, Julian Schrittwieser, Karen Simonyan, Ioannis Antonoglou, Aja Huang, Arthur Guez, Thomas Hubert, Lucas Baker, Matthew Lai, Adrian Bolton, Yutian Chen, Timothy Lillicrap, Fan Hui, Laurent Sifre, George van den Driessche, Thore Graepel & Demis Hassabis

Nature **550**, 354–359 (2017) | Cite this article

Abstract

A long-standing goal of artificial intelligence is an algorithm that learns, *tabula rasa*, superhuman proficiency in challenging domains. Recently, AlphaGo became the first program to defeat a world champion in the game of Go. The tree search in AlphaGo evaluated positions and selected moves using deep neural networks. These neural networks were trained by supervised learning from human expert moves, and by reinforcement learning from self-play. Here we introduce an algorithm based solely on reinforcement learning, without human data, guidance or domain knowledge beyond

Editorial Summary

AlphaGo Zero goes solo

To beat world champions at the game of Go, the computer program AlphaGo has relied largely on supervised learning from millions of human expert moves. David Silver and colleagues have now produced a system called AlphaGo

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Learning to play Go from scratch

Satinder Singh, Andy Okun & Andrew Jackson

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