

Advanced Topics in AI

Markov Decision Processes



Instructor: Prof. Dr. techn. Wolfgang Nejdl

Leibniz University Hannover



[These slides were created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley. All materials are available at <http://ai.berkeley.edu>.]

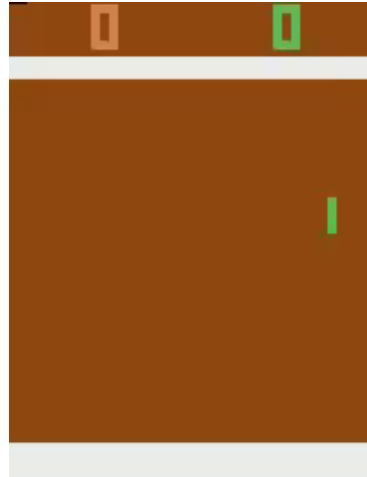


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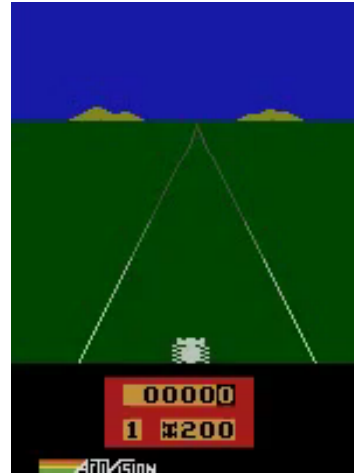
Deep Reinforcement Learning

2013

Atari (DQN)
[Deepmind]



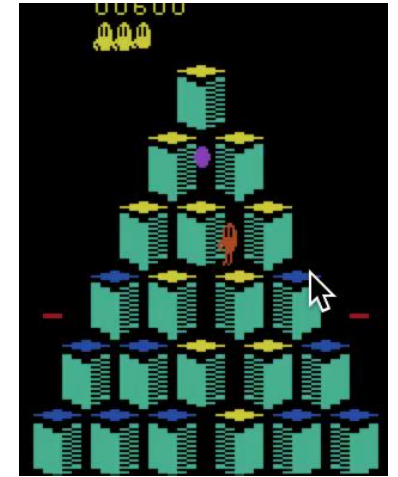
Pong



Enduro



Beamrider



Q*bert

Deep Reinforcement Learning

2013

Atari (DQN)
[Deepmind]

2015

AlphaGo
[Deepmind]



AlphaGo Silver et al, Nature 2015

AlphaGoZero Silver et al, Nature 2017

AlphaZero Silver et al, 2017

Tian et al, 2016; Maddison et al, 2014; Clark et al, 2015

Deep Reinforcement Learning

- 2013 Atari (DQN)
[Deepmind]
- 2015 AlphaGo
[Deepmind]
- 2016 3D locomotion (TRPO+GAE)
[Berkeley]



[Schulman, Moritz, Levine, Jordan, Abbeel, ICLR 2016]

Deep Reinforcement Learning

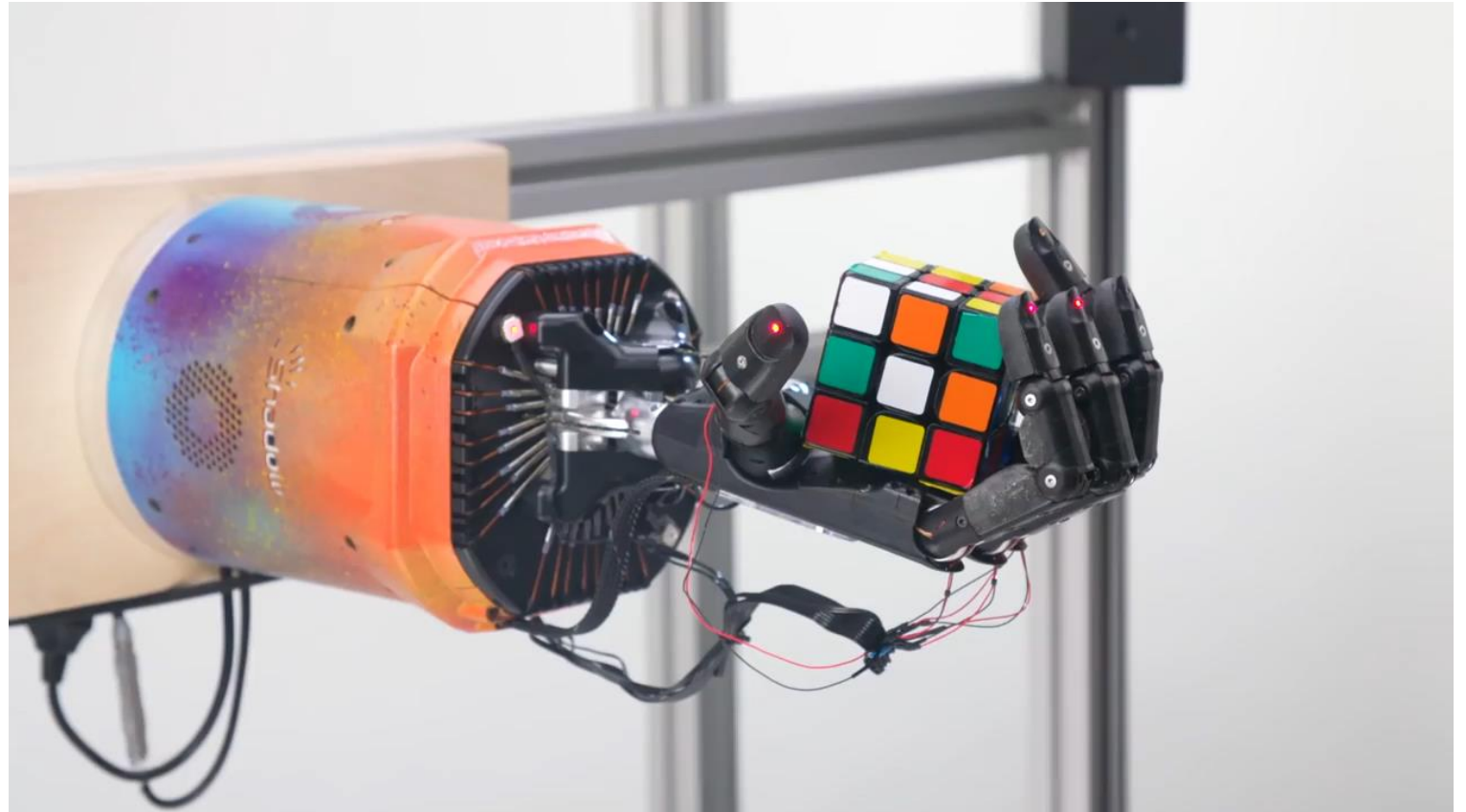
- 2013 Atari (DQN)
[Deepmind]
- 2015 AlphaGo
[Deepmind]
- 2016 3D locomotion (TRPO+GAE)
[Berkeley]
- 2016 Real Robot Manipulation (GPS)
[Berkeley]



[Levine*, Finn*, Darrell, Abbeel, JMLR 2016]

Deep Reinforcement Learning

- 2013 Atari (DQN)
[Deepmind]
- 2015 AlphaGo
[Deepmind]
- 2016 3D locomotion (TRPO+GAE)
[Berkeley]
- 2016 Real Robot Manipulation (GPS)
[Berkeley]
- 2019 Rubik's Cube (PPO+DR)
[OpenAI]

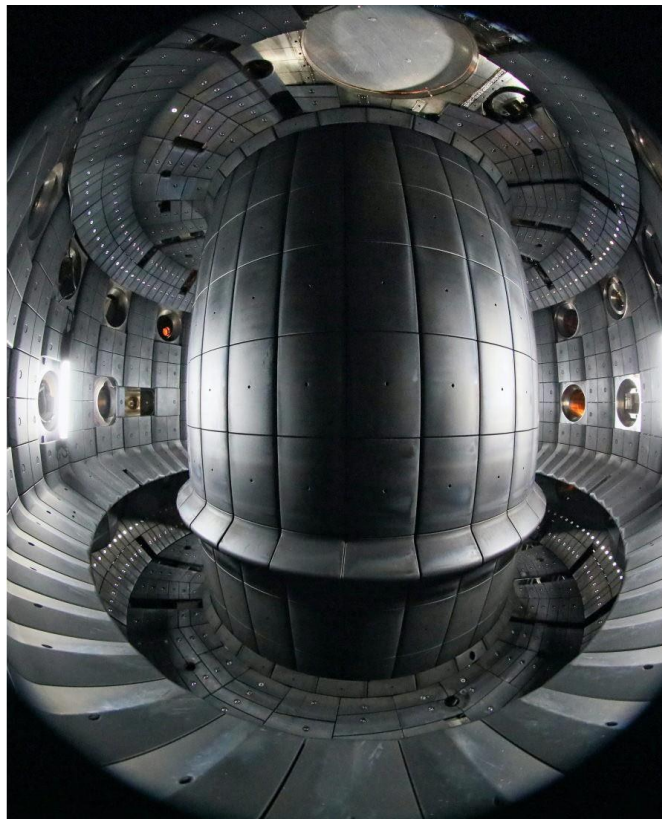


OpenAI

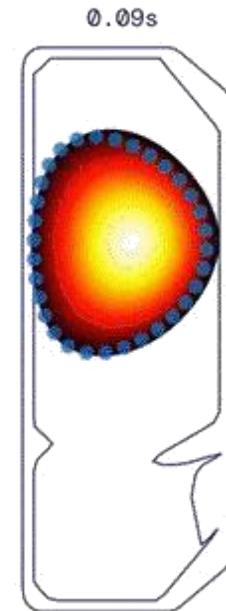
Examples of (Deep) Reinforcement Learning

2022: Nuclear fusion plasma control

[Magnetic control of tokamak plasmas through deep reinforcement learning.
Degraeve et al. Nature 2022]



View from inside the tokamak



Plasma state reconstruction

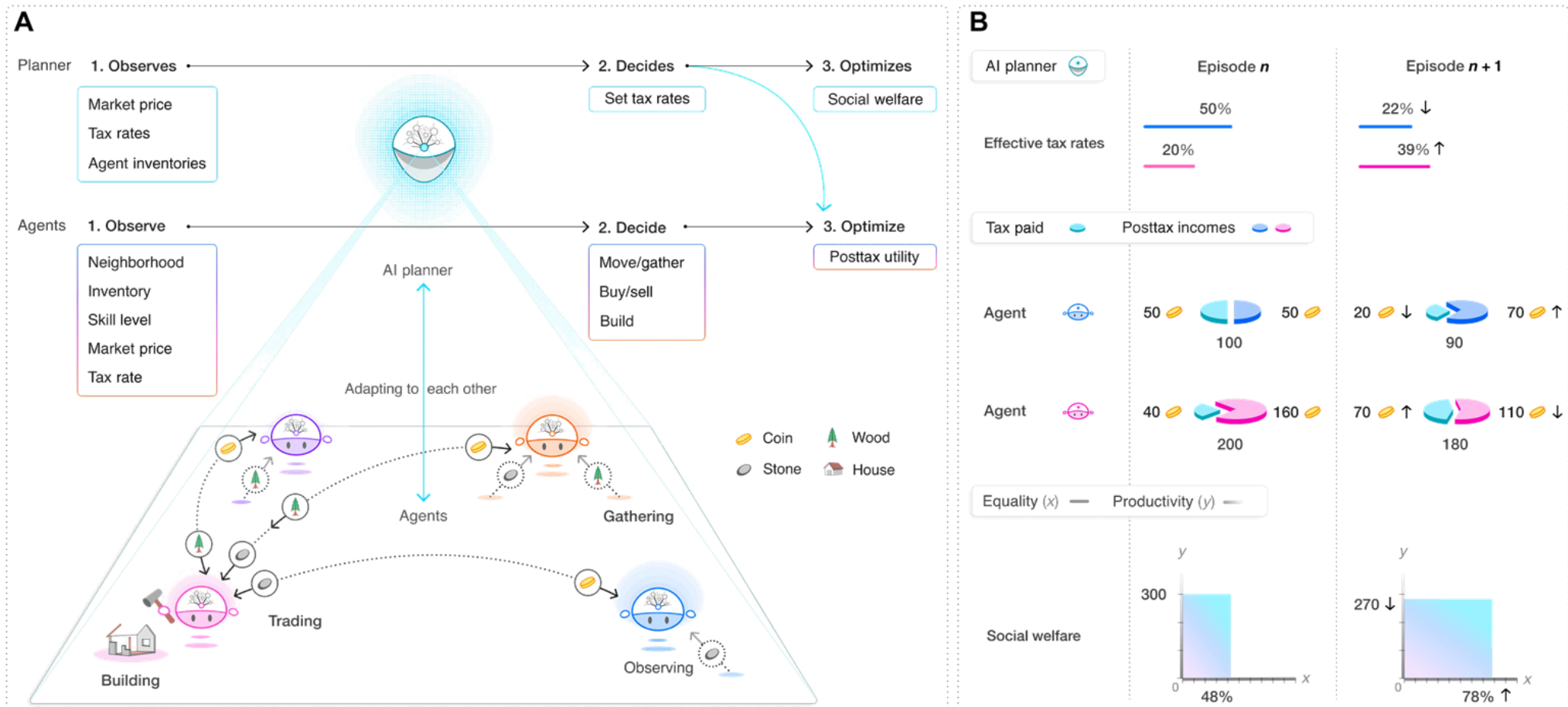
Photo Credits: DeepMind and SPC/EPFL



Examples of (Deep) Reinforcement Learning

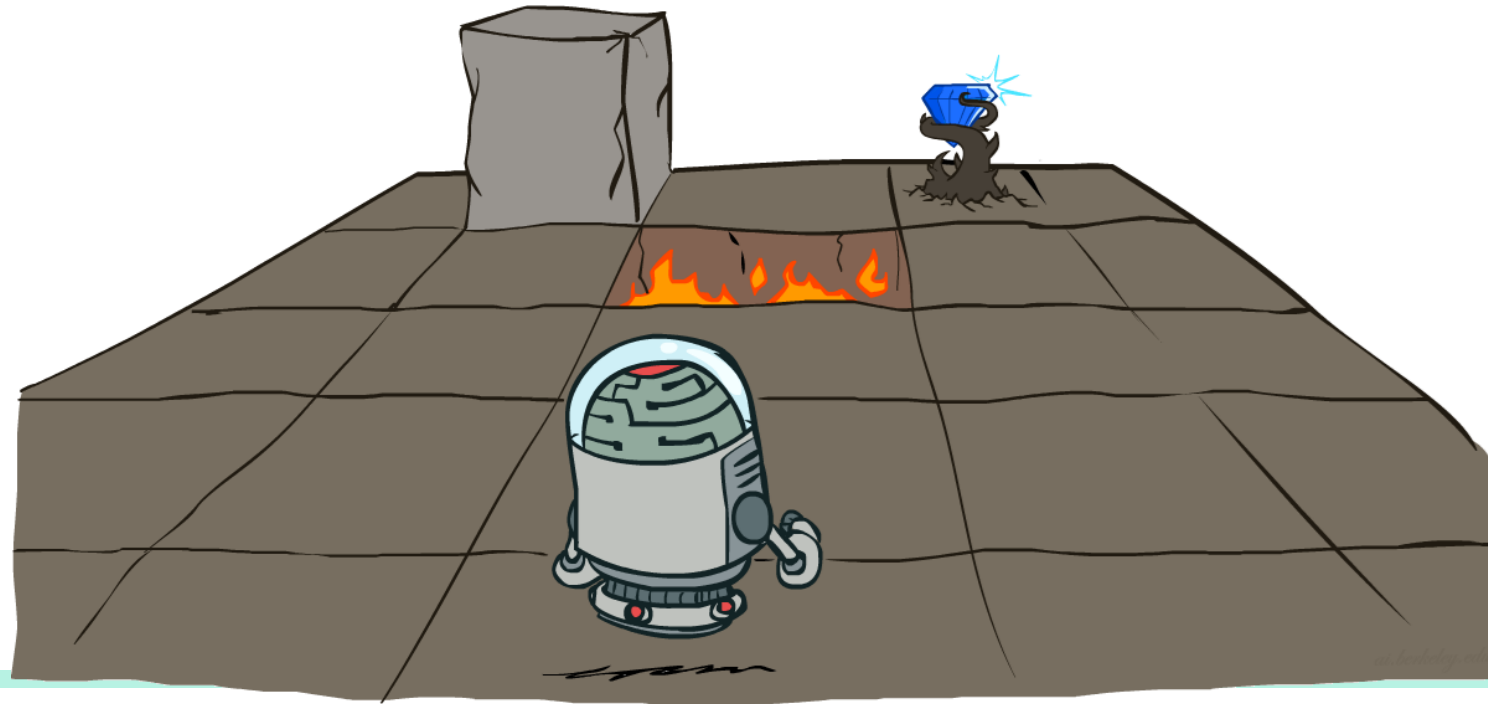
2022: Economic policy design?

[The AI Economist: Taxation policy design via two-level deep multiagent RL.
Zheng et al. Science 2022]



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Next: Markov Decision Processes



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