Practical Machine Learning

Reinforcement Learning

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Supervised Learning

Input Image
224 x 244 x 3

VGG16 Model

1000 Classes
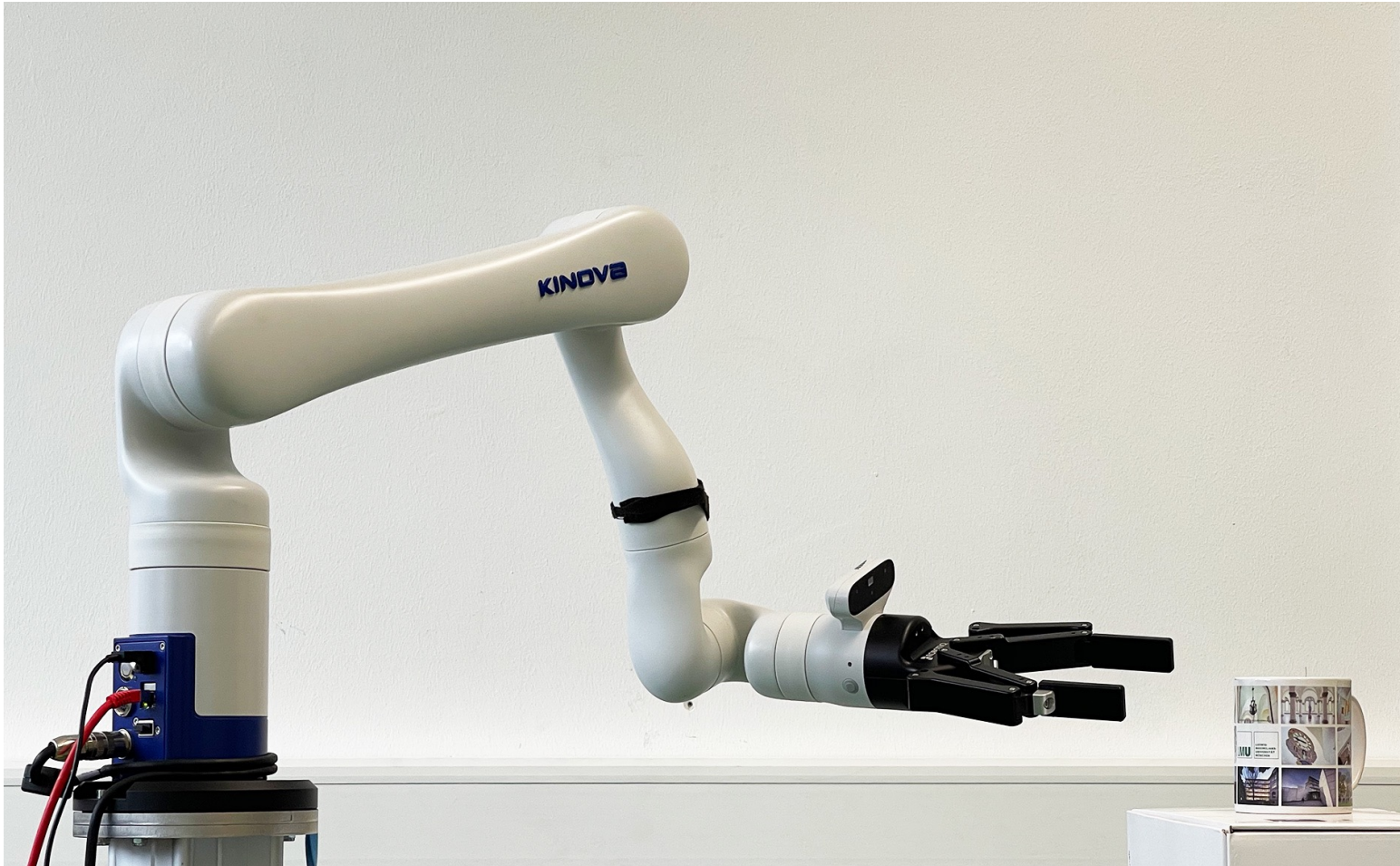e.g. milk, traffic light, printer
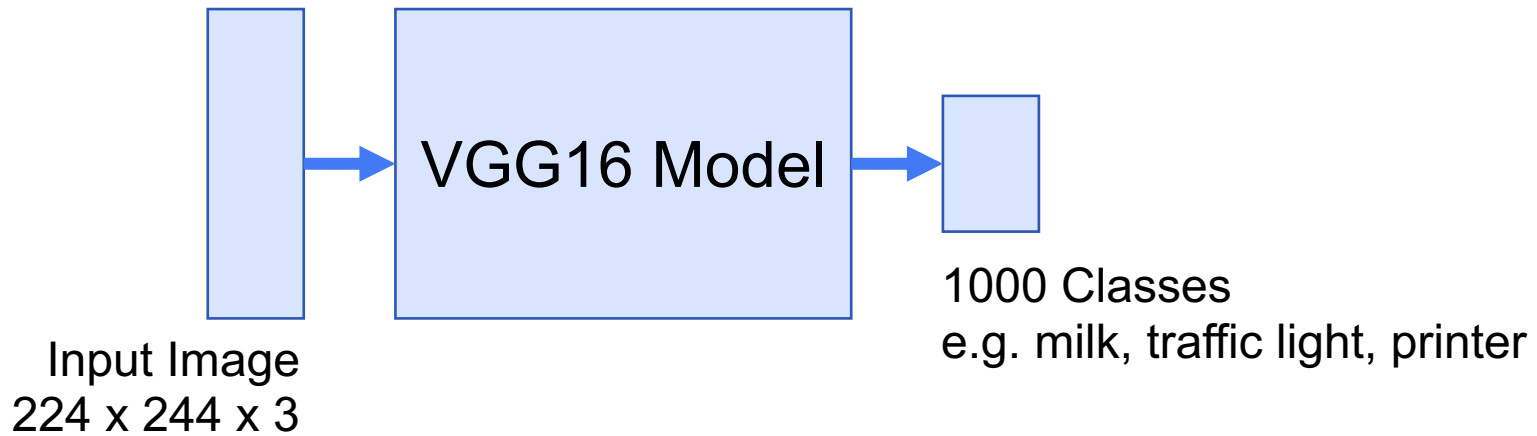
- Labeled Data Needed
- The model can not be better then the labels

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Pick Up the Cup

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Learning Strategies

Supervised Learning

Unsupervised Learning

Reinforcement learning

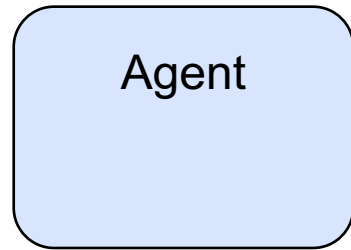Sven Mayer

Learning Strategies

Supervised Learning	Unsupervised Learning	Reinforcement learning

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Reinforcement Learning

*Learning from the environment what works
by getting positive feedback/reward*

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Reinforcement Learning

Agent

Reinforcement Learning

Agent

Environment

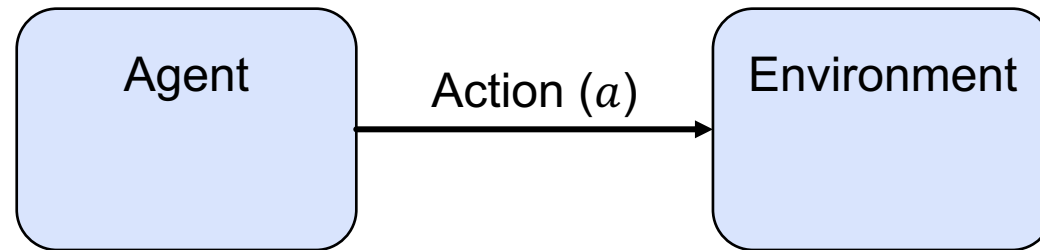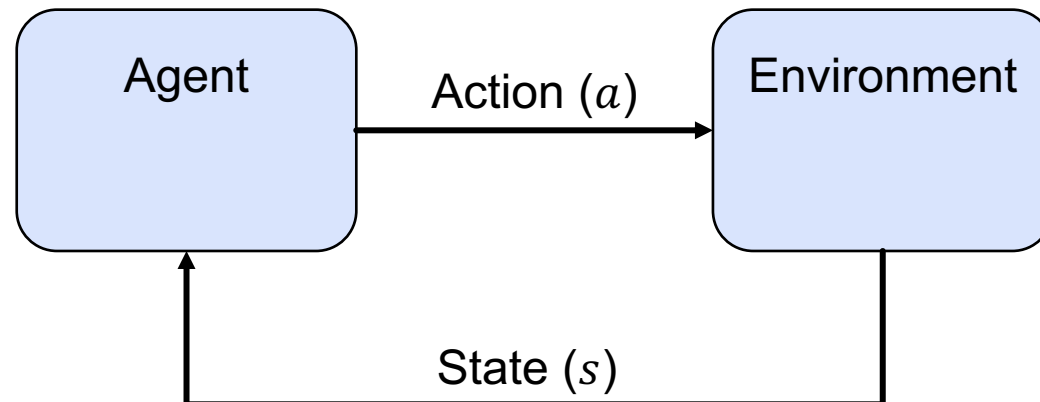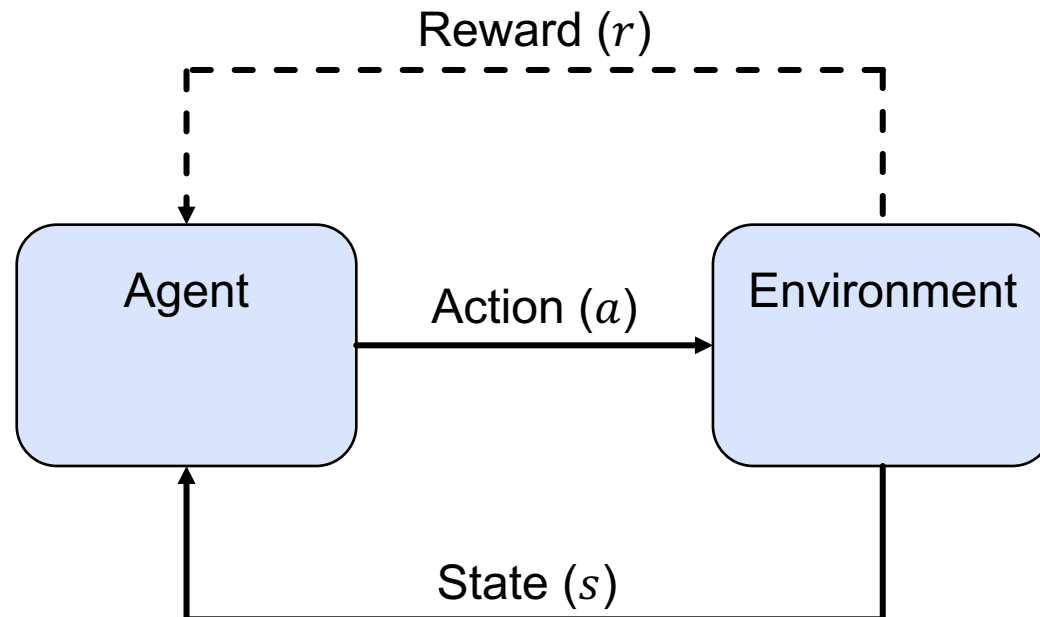# Reinforcement Learning
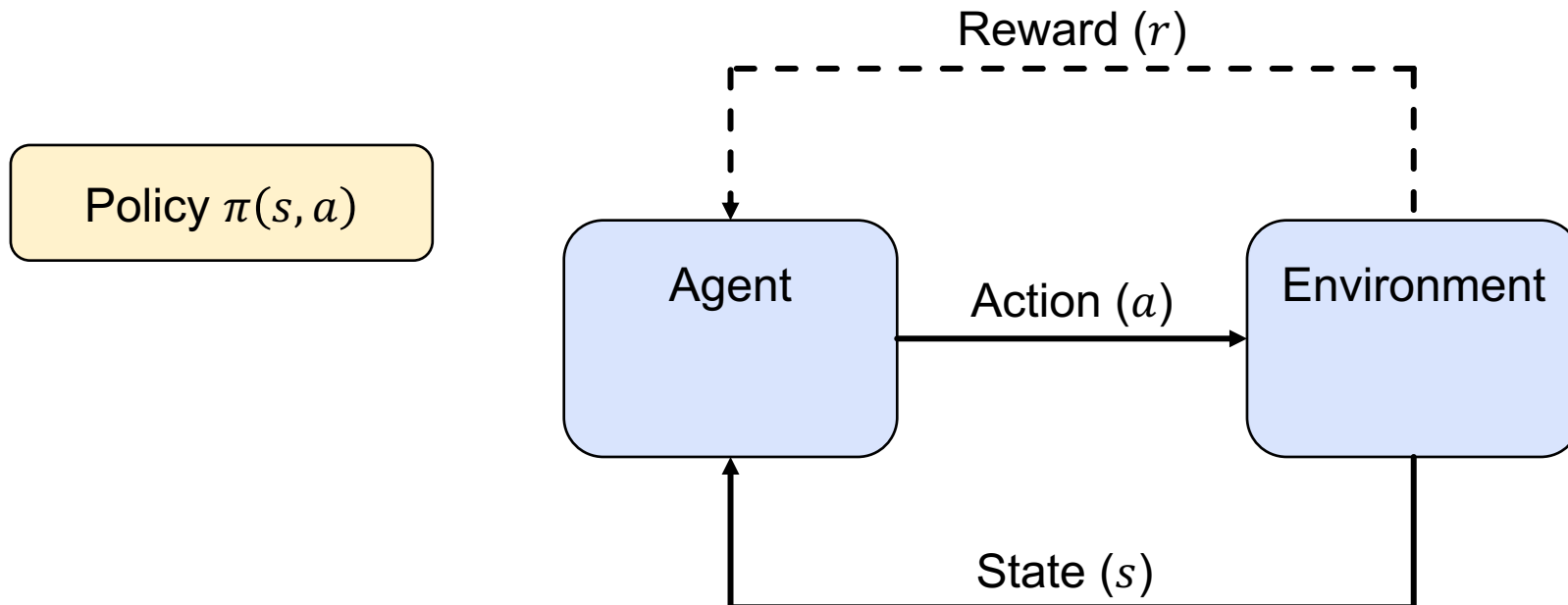
Reinforcement Learning

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Reinforcement Learning

Reward (r)

Policy $\pi(s, a)$

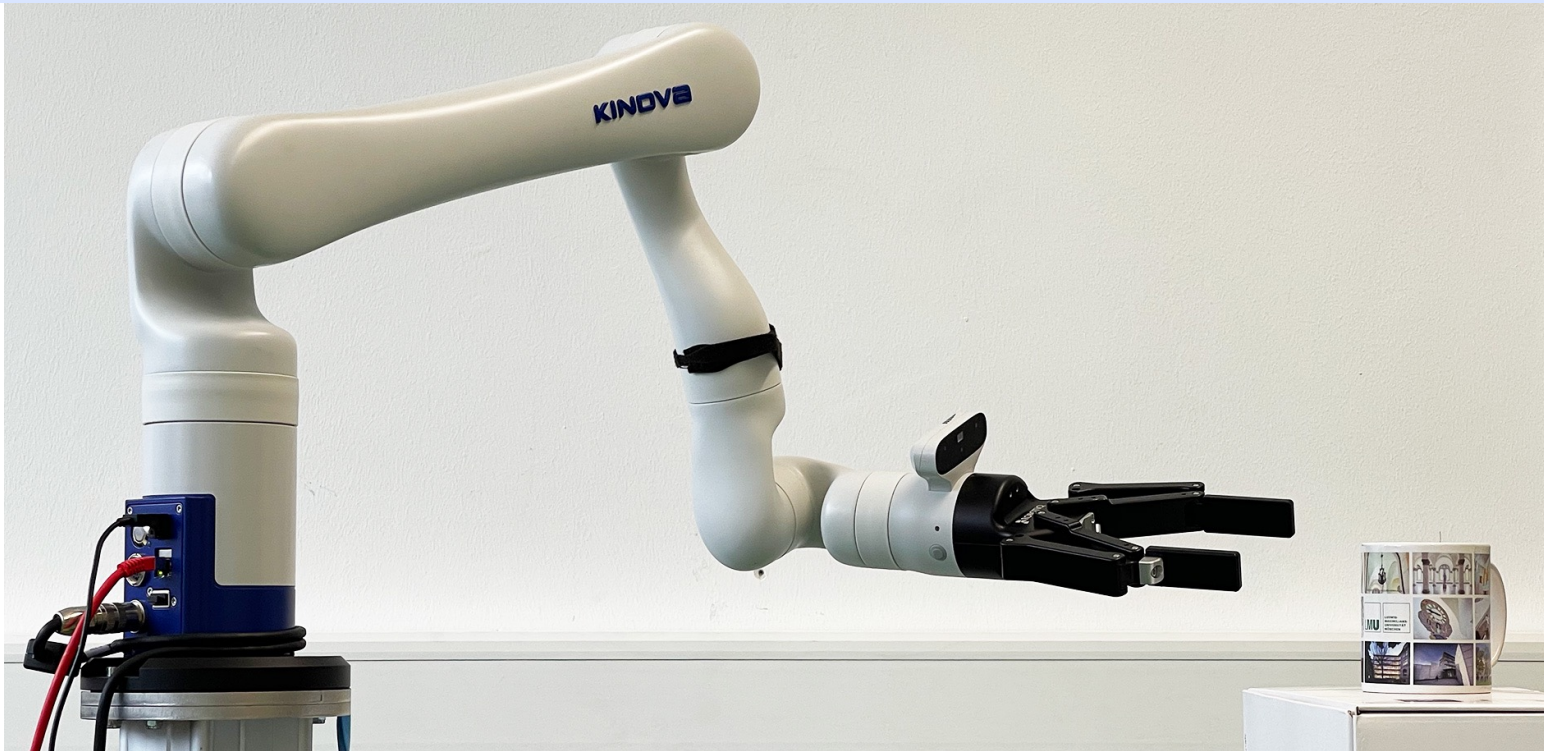Agent → Action (a) → Environment

State (s)

Reward $R_t = \sum_{t=0}^{\infty} \gamma^t r_t$
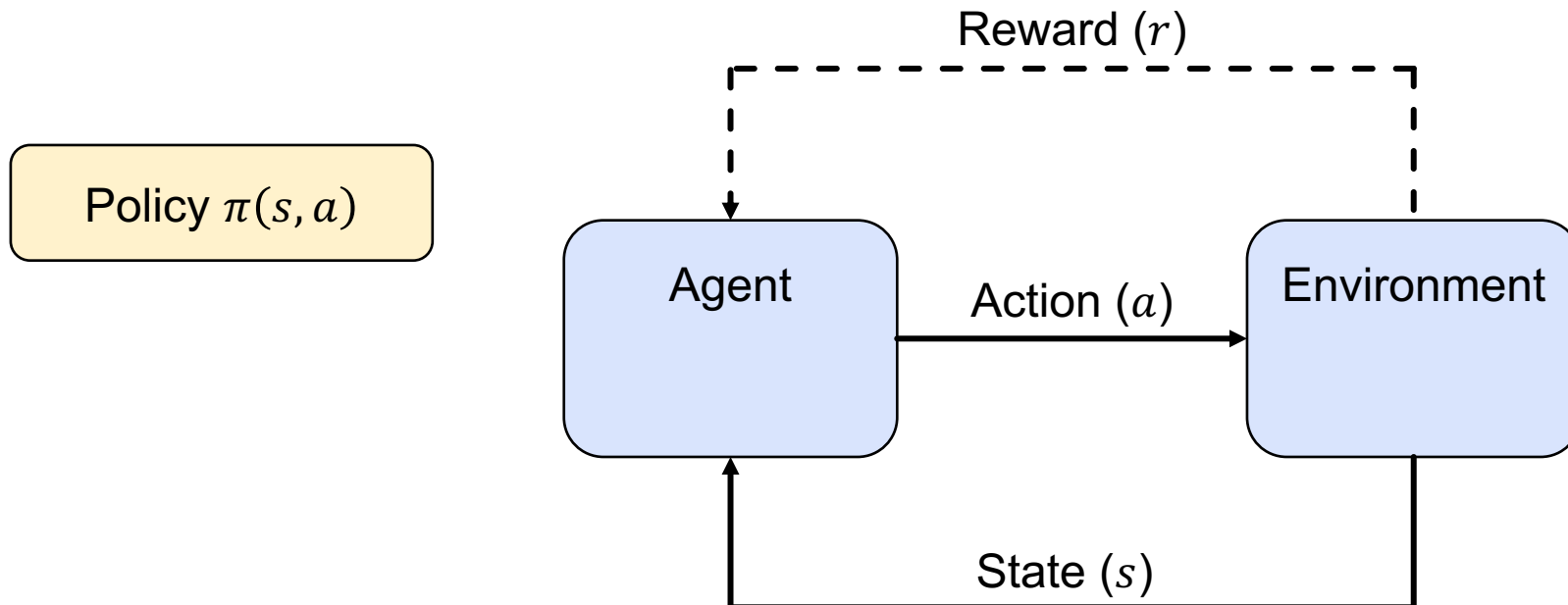
γ = Discount factor

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Credit Assignment Problem

Which of the action contributed to getting the reward?

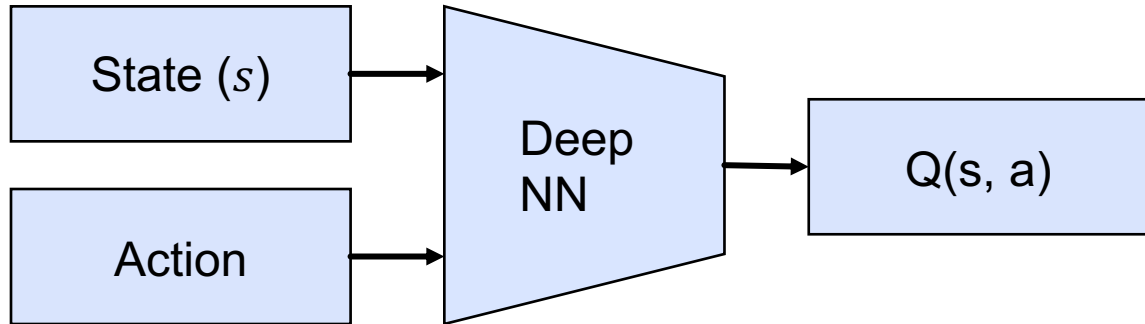Minsky, M. (1961). Steps toward artificial intelligence. *Proceedings of the IRE*, *49*(1), 8-30.

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Q – Learning

Reward (r)

Policy $\pi(s, a)$

Agent

Environment

Action (a)

State (s)

Reward $R_t = \sum_{t=0}^{\infty} \gamma^t r_t$

γ = Discount factor

Q-function
$Q(s_t, a_t) = \mathbb{E}(R_t | s_t, a_t)$

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Deep Q Networks (DQN)

State (s) → Deep NN → Q(s, a)

Action → Deep NN

The goal is to approximate the Q-function
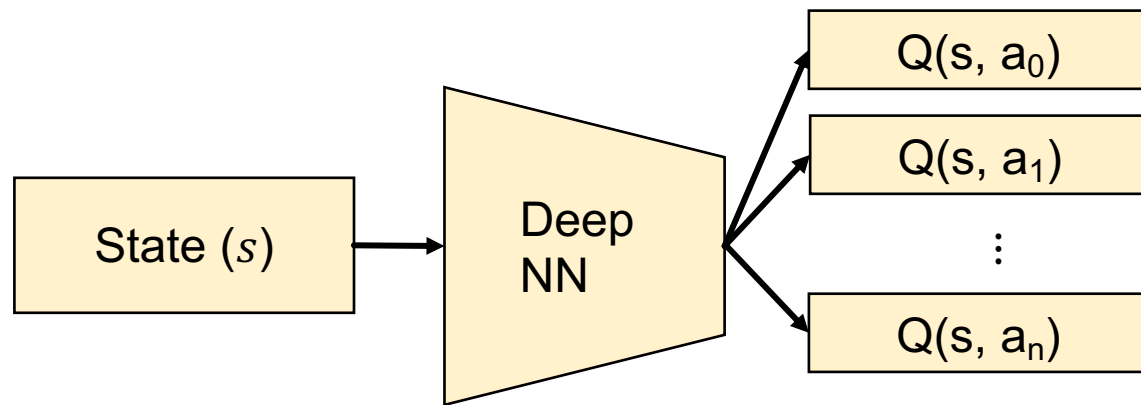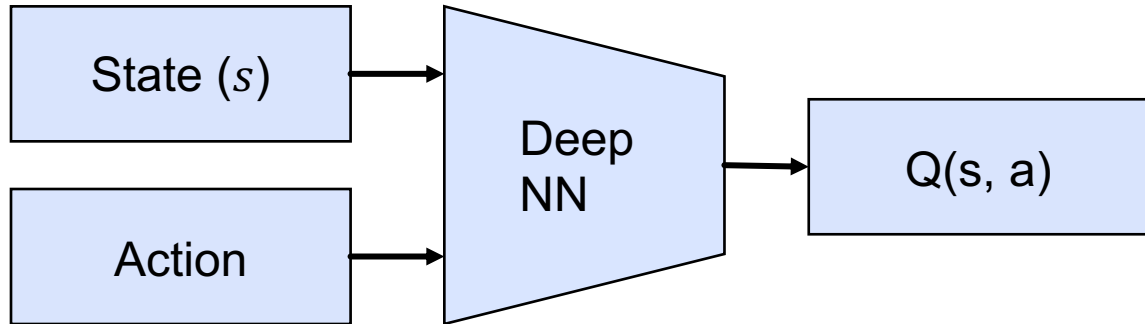
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Deep Q Networks

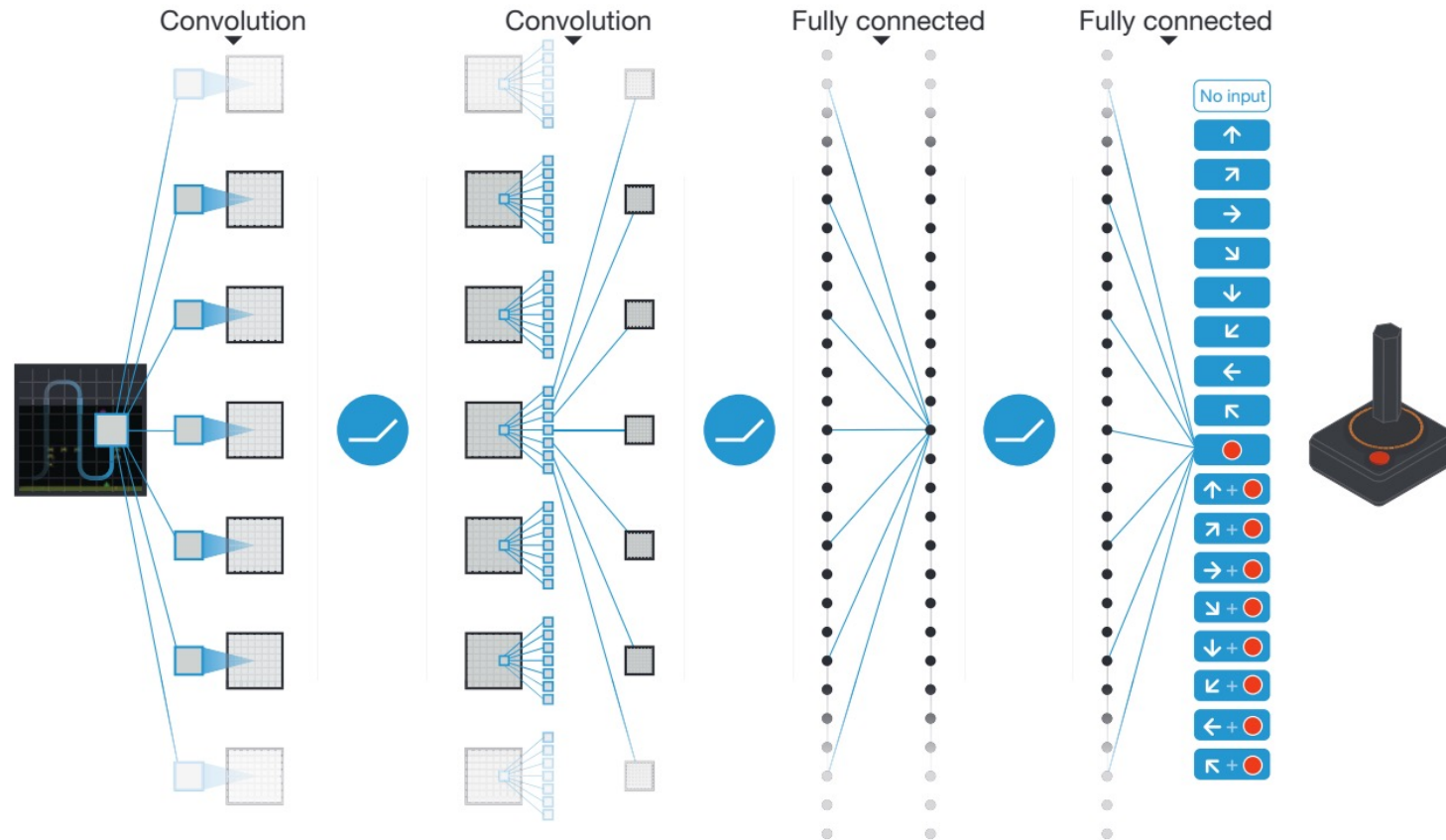Mnih, Volodymyr, Koray Kavukcuoglu, David Silver, Andrei A. Rusu, Joel Veness, Marc G. Bellemare, Alex Graves et al. "Human-level control through deep reinforcement learning." *nature* 518, no. 7540 (2015): 529-533.

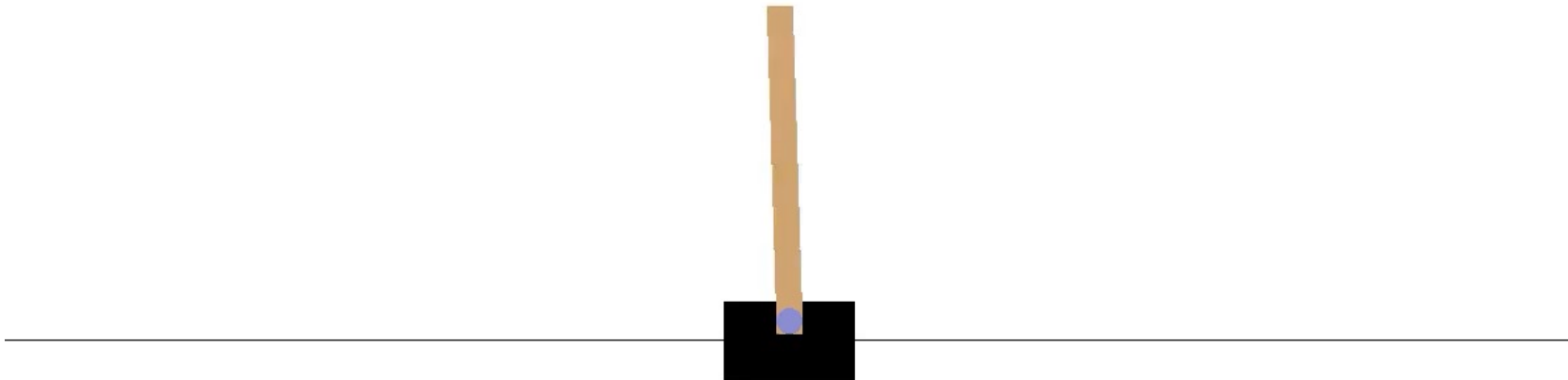Sven Mayer

Deep Reinforcement Learning

Mnih, Volodymyr, Koray Kavukcuoglu, David Silver, Andrei A. Rusu, Joel Veness, Marc G. Bellemare, Alex Graves et al. "Human-level control through deep reinforcement learning." *nature* 518, no. 7540 (2015): 529-533.

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Exercise

https://github.com/tensorflow/agents/blob/
master/docs/tutorials/1_dqn_tutorial.ipynb

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Conclusion
Reinforcement Learning

- What is Reinforcement Learning?

- Agent in environments

- Policy for next action

- Learning from reward

- Using Deep Neuronal Networks in RL

  - Deep Q Learning

  - Next steps: Policy Gradient

  - … and many more approaches

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