Discrete VS Continuous Control

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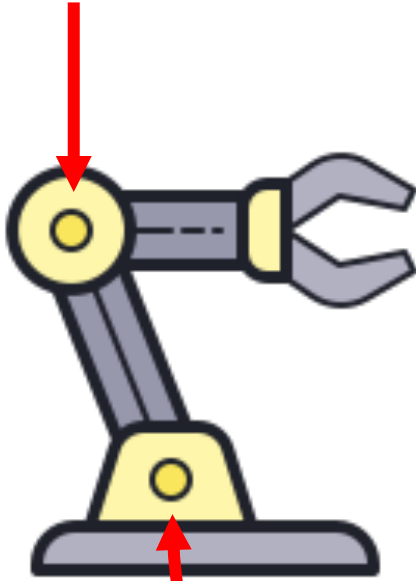
Discrete Action Space

up

left ← Agent → right
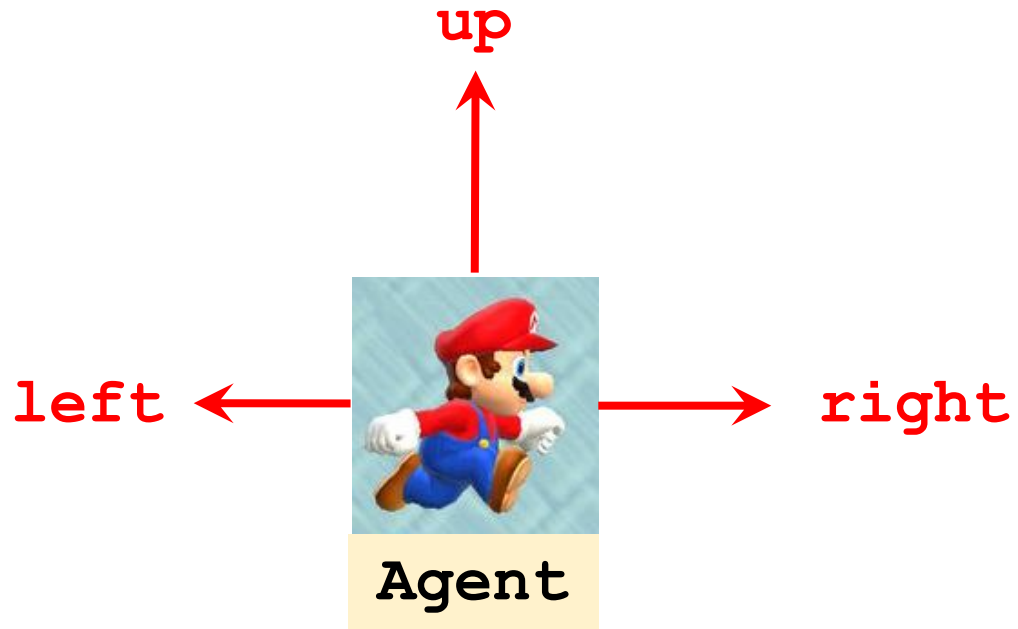
- Action space $\mathcal{A} = \{\text{left}, \text{right}, \text{up}\}$.

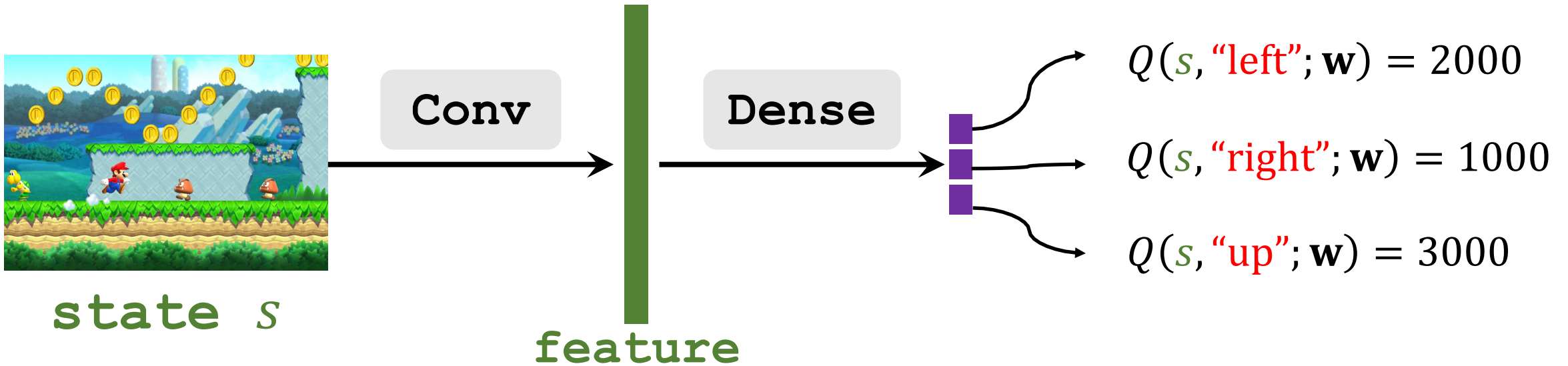- The action space $\mathcal{A}$ is discrete.
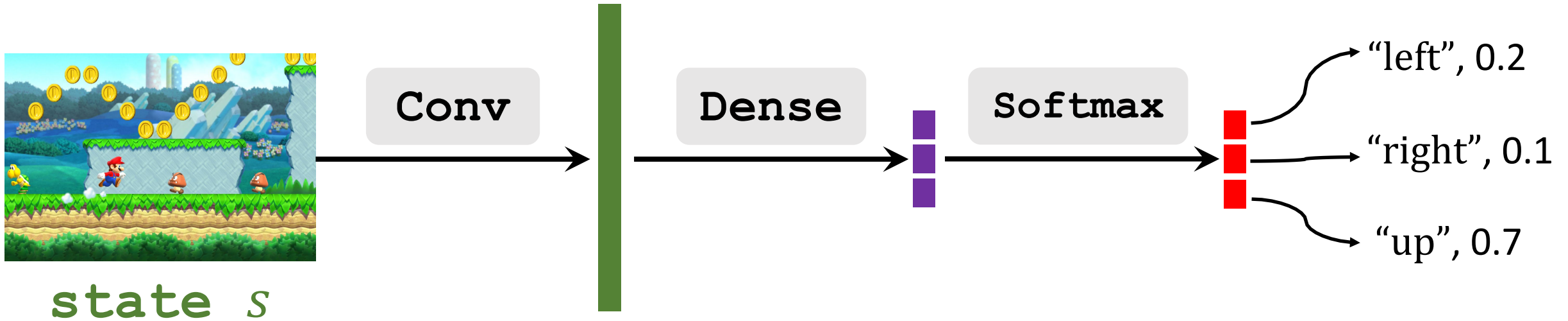
Continuous Action Space

$a_1 \in [0°, 360°]$

$a_2 \in [0°, 180°]$

- The action space $\mathcal{A}$ is a subset of $\mathbb{R}^2$.

- The action space $\mathcal{A}$ is continuous:

$$\mathcal{A} = [0°, 360°] \times [0°, 180°].$$

- Actions are 2-dim vectors.

DQN for Discrete Action Space

$Q(s, \text{"left"}; \mathbf{w}) = 2000$

$Q(s, \text{"right"}; \mathbf{w}) = 1000$

$Q(s, \text{"up"}; \mathbf{w}) = 3000$

state s

feature

Conv

Dense

Policy Network for Discrete Action Space

state s → **Conv** → **Dense** → **Softmax** → "left", 0.2 / "right", 0.1 / "up", 0.7
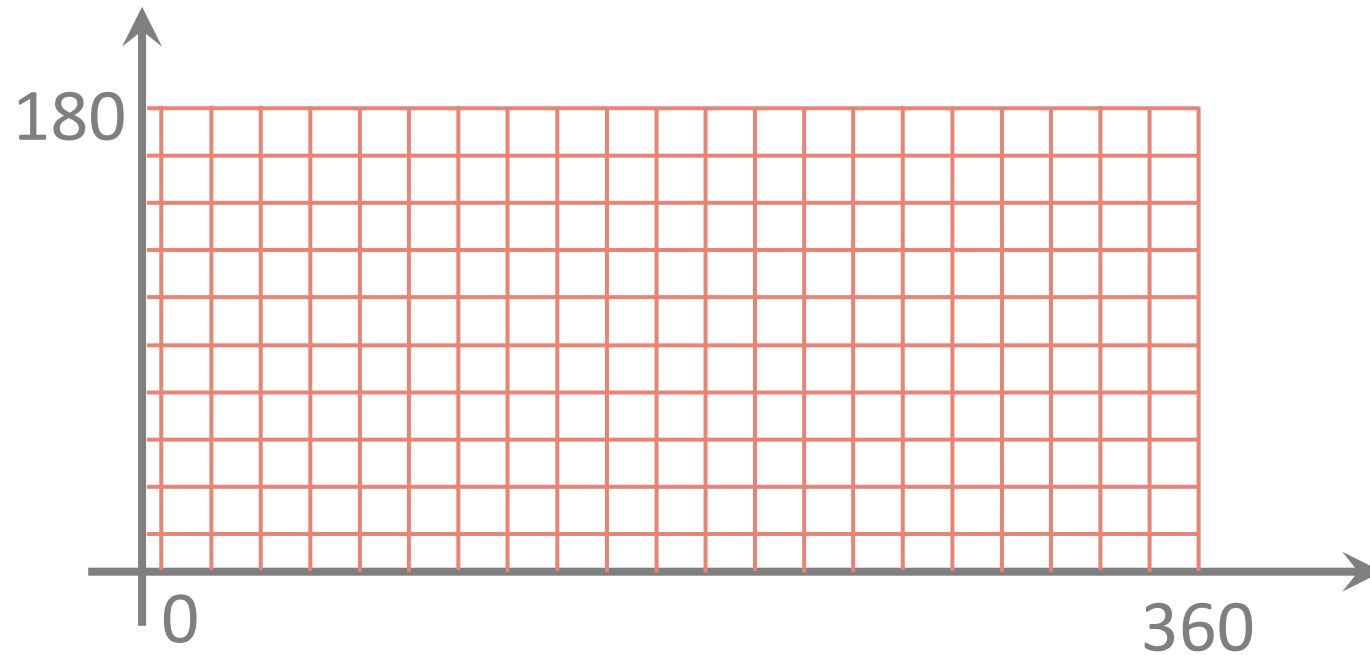
Discretization

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- Problem: curse of dimensionality.

    - Let d be the degree of freedom.

    - The number of actions grows exponentially with d.

Better Approaches to Continuous Control

1. Deterministic policy network (the second lecture).

2. Stochastic policy network (the third lecture).

Thank you!