Introduction to Reinforcement Learning

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December 30, 2022

Markov Decision Process

- A markov decision process is a tuple:

$$(S, A, \{P_{SA}\}, \gamma, R)$$

where

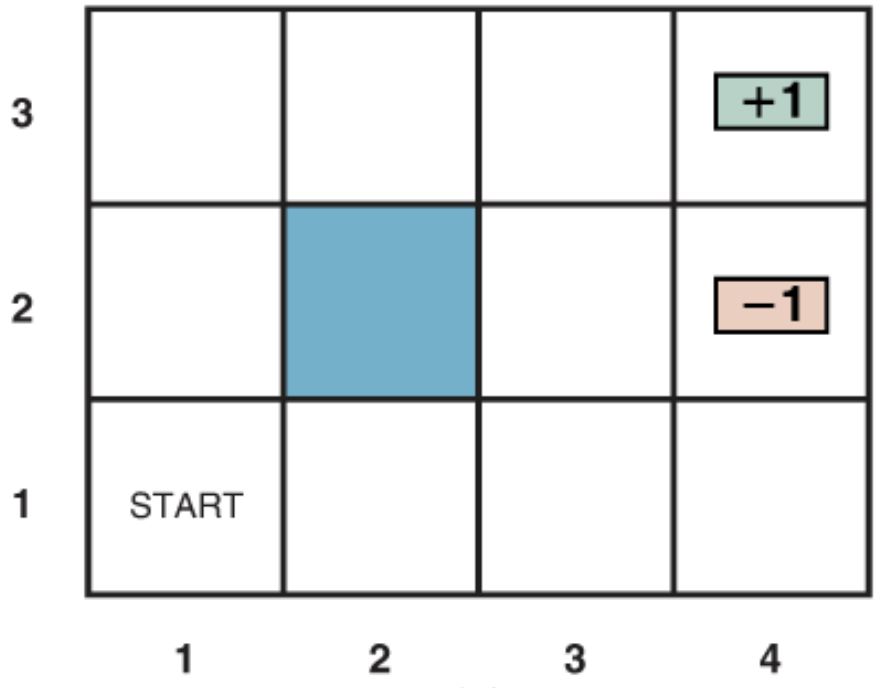
- S is a set os states.
- A is a set of actions.
- P_{SA} are the state transition probabilites:

$$\sum_{s'} P_{SA}(s') = 1, \quad P_{SA}(s') \geq 0$$

- $\gamma \in [0, 1)$ is a discount factor.
- R is a reward function.$R : S \rightarrow \mathcal{R}$.

Example

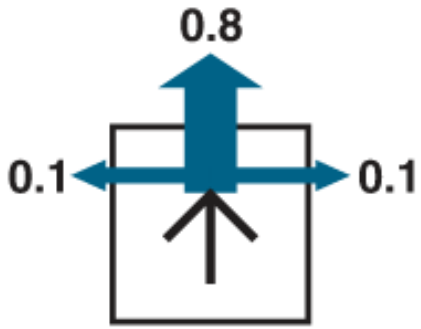
- Suppose that an agent is situated in the 4 $\times$ 3 environment shown in the Figure



- Beginning in the start state, it must choose an action at each time step.
- The interaction with the environment terminates when the agent reaches one of the goal states, marked +1 or –1.

Example

- The “intended” outcome occurs with probability 0.8, but with probability 0.2 the agent moves at right angles to the intended direction:



- A collision with a wall results in no movement.
- Transitions into the two terminal states have reward +1 and –1, respectively.
- All other transitions have a reward of –0.02 (to avoid the robot wasting time).

References I

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