Reinforcement Learning Lab

Samuele Bortolotti, Steve Azzolin

Reinforcement Learning

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- The agent should learn just from experience

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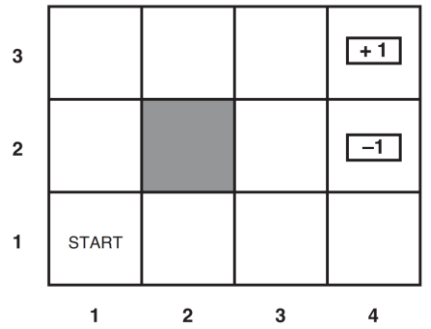

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- Teach an agent to perform (optimal) actions in an (unknown) environment
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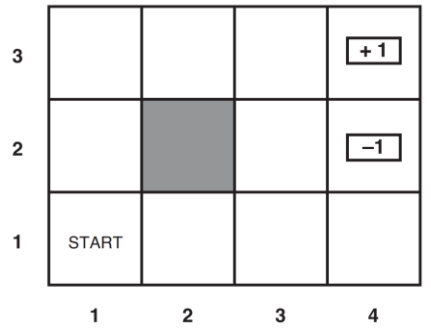
A *state* is a description of the status of the agent in the environment.



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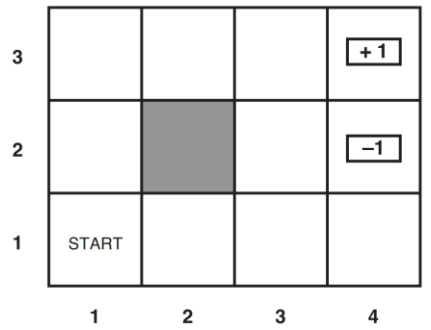
A *state* is a description of the status of the agent in the environment.

An *agent* can be seen as a function from states to actions π: $S \rightarrow A$



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- Teach an agent to perform (*optimal*) actions in an (*unknown*) environment
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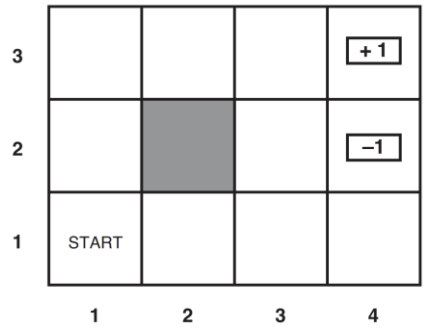
$$\pi(s) = argmax_a \sum_{s' \in S} p(s' \mid s, a)\, V(s')$$

State s	V(s)
(1,1)	?
(1,2)	?
(2,1)	?
...	?
(3,4)	+1
(4,3)	-1



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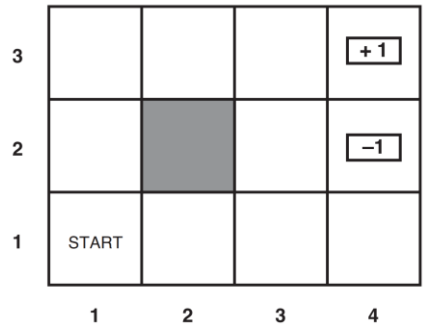
$$\pi(s) = argmax_a \sum_{s' \in S} p(s' \mid s, a)\, V(s')$$

Value iteration
Policy iteration
Temporal Difference

State s	V(s)
(1,1)	?
(1,2)	?
(2,1)	?
...	?
(3,4)	+1
(4,3)	-1



Reinforcement Learning

- Teach an agent to perform (*optimal*) actions in an (*unknown*) environment
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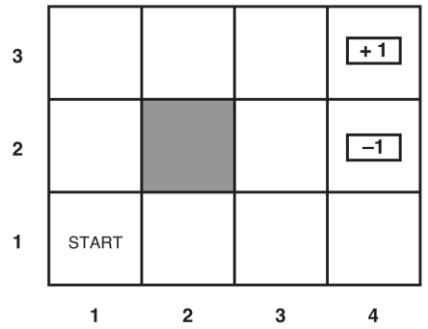
State s	Action a	Q(s,a)
(1,1)	Up	?
(1,1)	Right	?
(2,1)	Left	?
(2,1)	Right	?
…		?



Reinforcement Learning

- Teach an agent to perform (*optimal*) actions in an (*unknown*) environment
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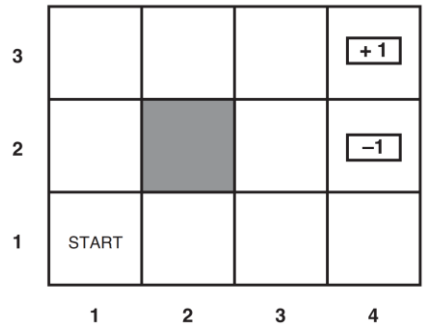
$$\pi(s) = argmax_a Q(s, a)$$

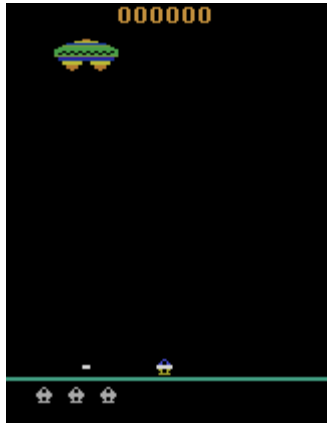
State s	Action a	Q(s,a)
(1,1)	Up	?
(1,1)	Right	?
(2,1)	Left	?
(2,1)	Right	?
…		?

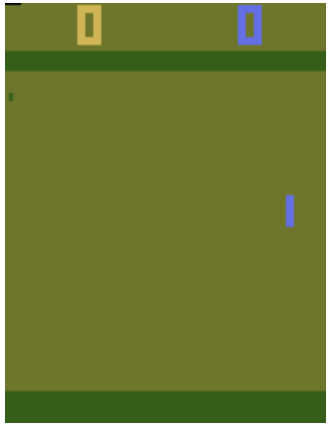
SARSA
Q-learning
Deep Q-learning

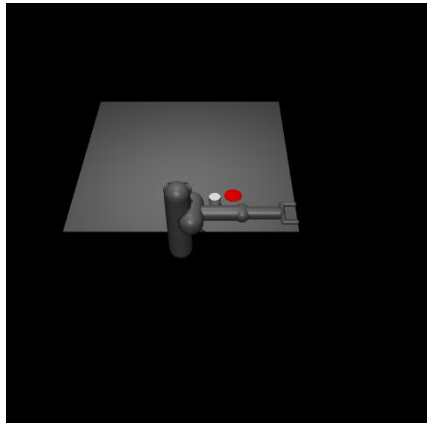


Reinforcement Learning

- The tabular representation of Q(s,a) works only for simple settings







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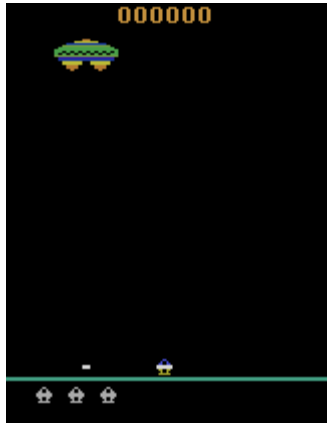
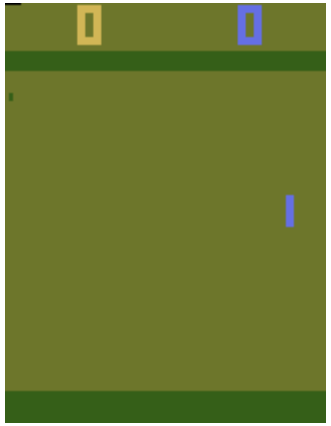
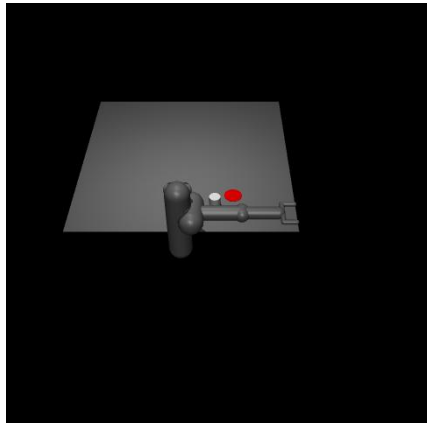


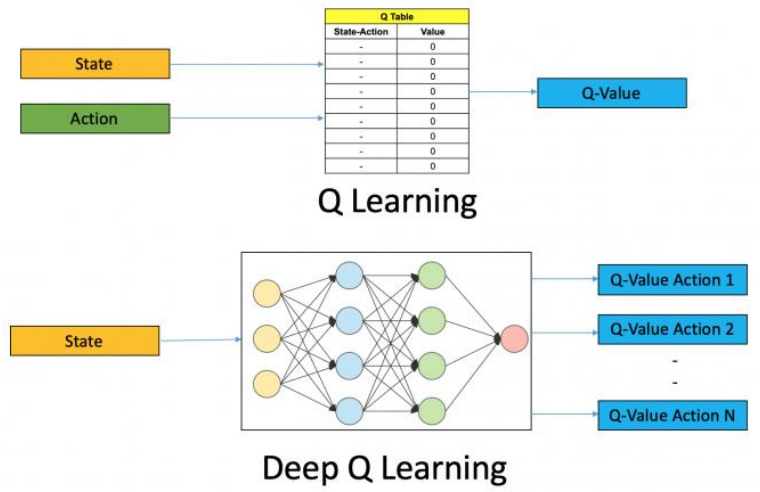




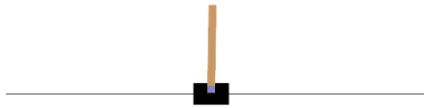
Implement π* with a Neural Network

* *Q(s,a)*

Reinforcement Learning



Code code code code code



Course Information

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Office hours: Arrange by email

Lecture time: Monday 8:30-10:30 (room b109)
Wednesday 11:30-13:30 (room b109)

Communications: Please check the moodle page of the course for news and updates.

Bibliography: R.O. Duda, P.E. Hart and D.G. Stork, *Pattern Classification (2nd edition)*, Wiley-Interscience, 2001.
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Videos: Registered lectures (from previous year) made available on Moodle