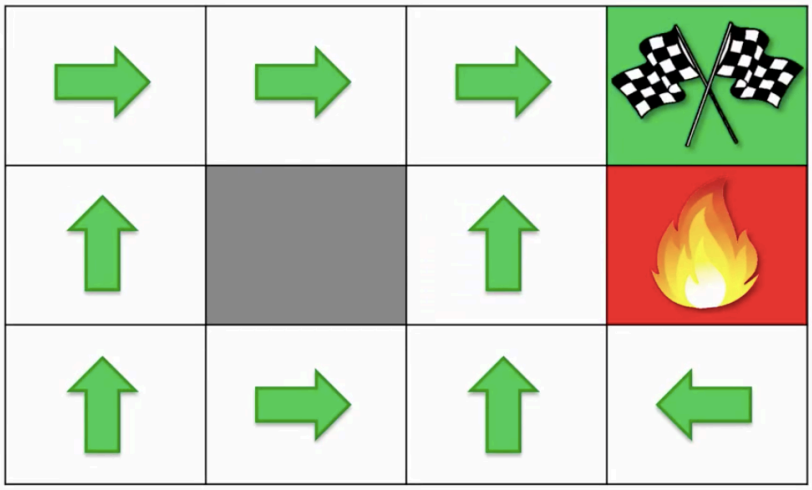
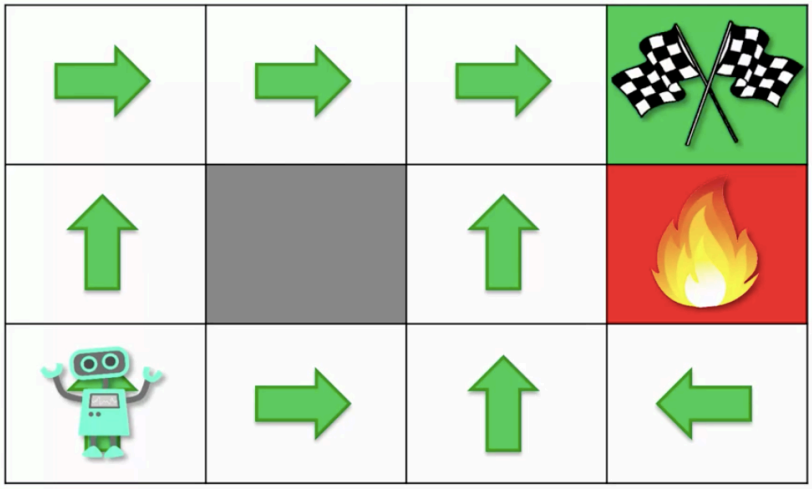
Markov decision process (MDP)

Markov Decision Process (MDP)

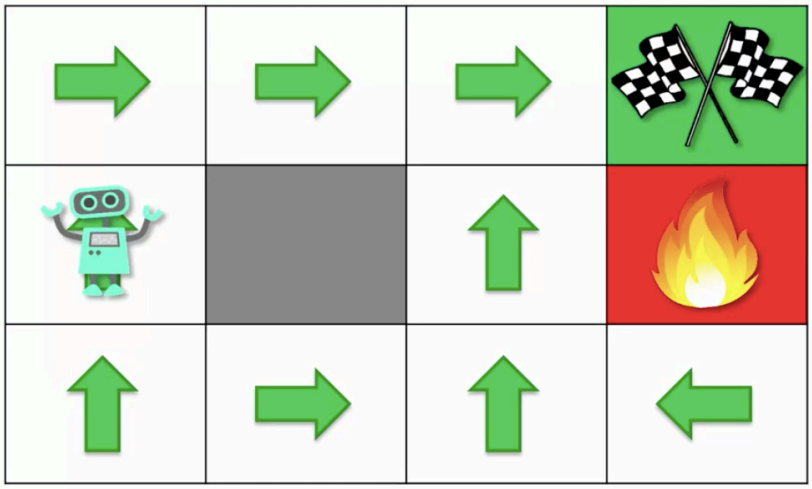
Markov Decision Process (MDP)



Markov Decision Process (MDP)



Markov Decision Process (MDP)



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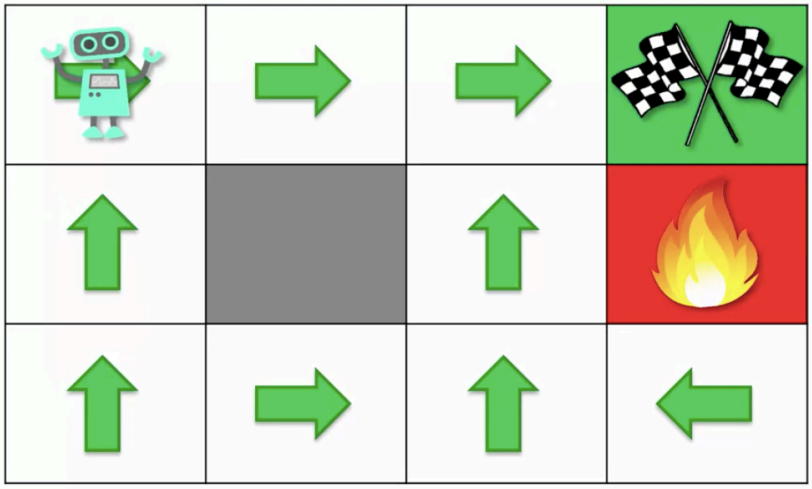

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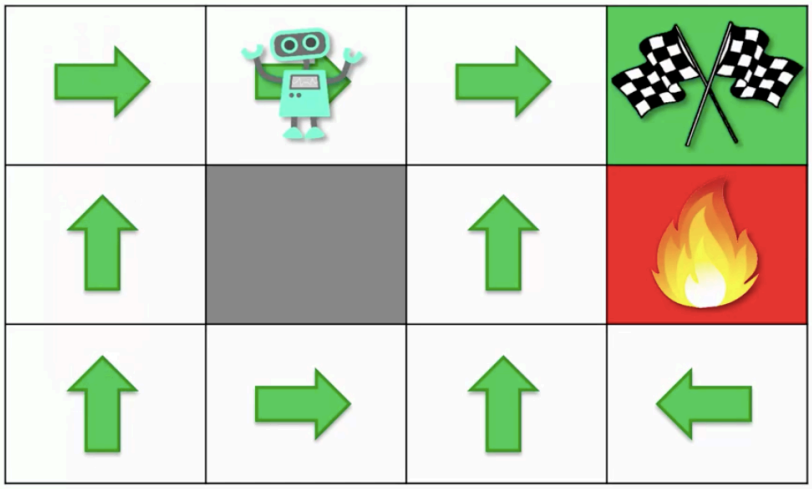
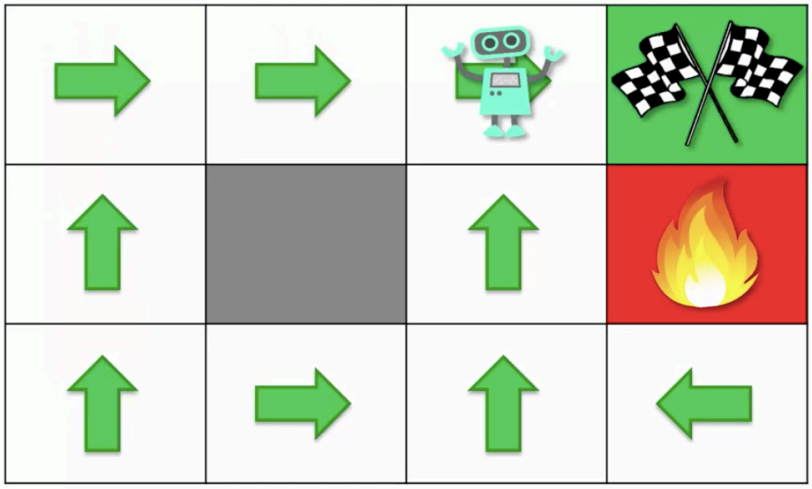
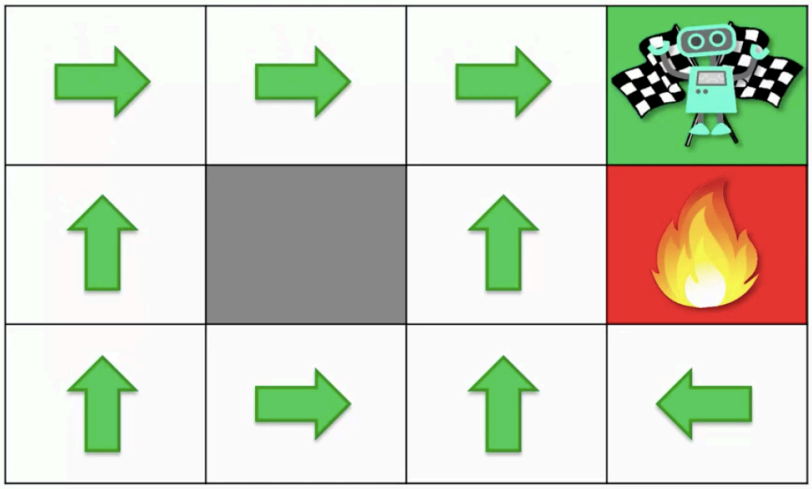


Markov Decision Process (MDP)



Markov Decision Process (MDP)



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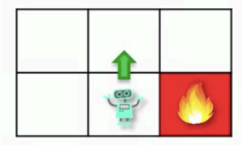
In reality thing are a little different than this.

Markov Decision Process (MDP)

Deterministic Search

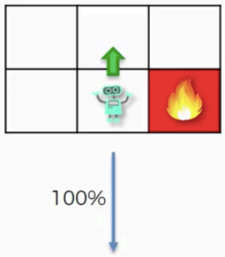
Markov Decision Process (MDP)

Deterministic Search



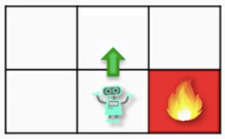
Markov Decision Process (MDP)

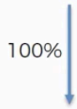
Deterministic Search



Markov Decision Process (MDP)

Deterministic Search





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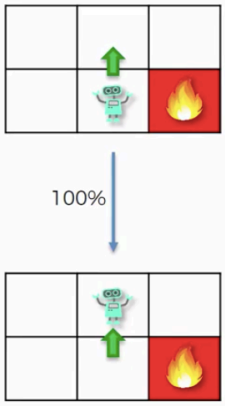
Markov Decision Process (MDP)

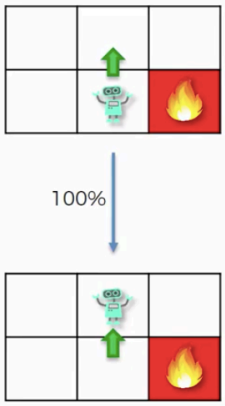
Deterministic Search



Markov Decision Process (MDP)

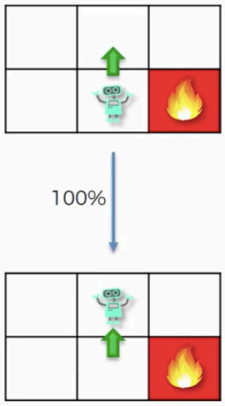
Deterministic Search

Non-Deterministic Search

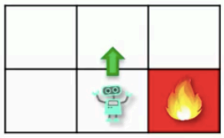


Markov Decision Process (MDP)

Deterministic Search

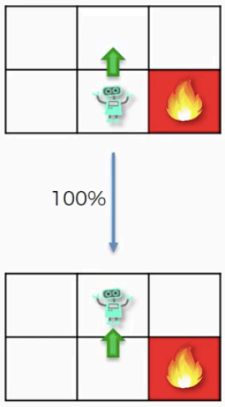


Non-Deterministic Search

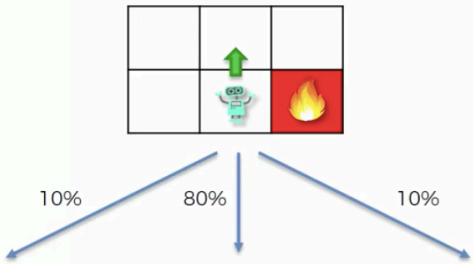


Markov Decision Process (MDP)

Deterministic Search



Non-Deterministic Search



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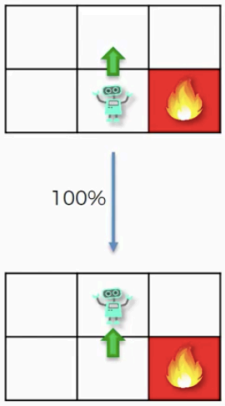
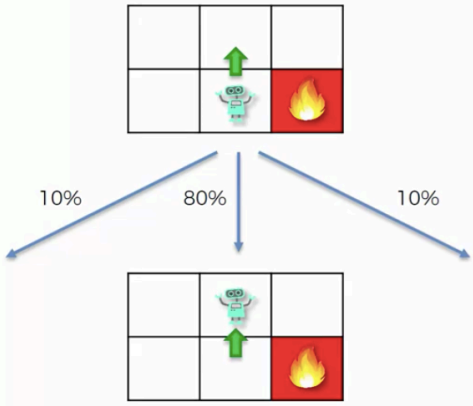
Markov Decision Process (MDP)

Deterministic Search

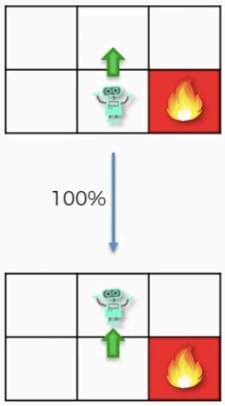


Non-Deterministic Search

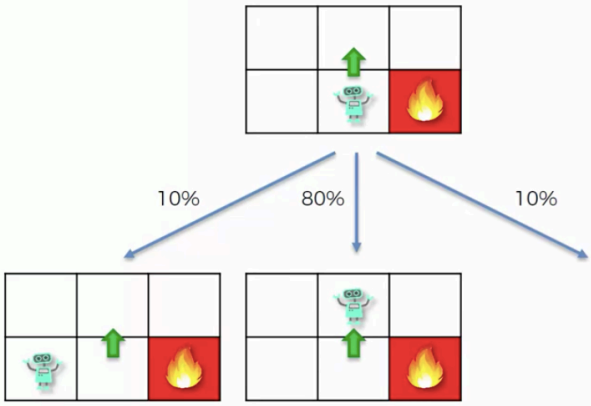


Markov Decision Process (MDP)

Deterministic Search



Non-Deterministic Search



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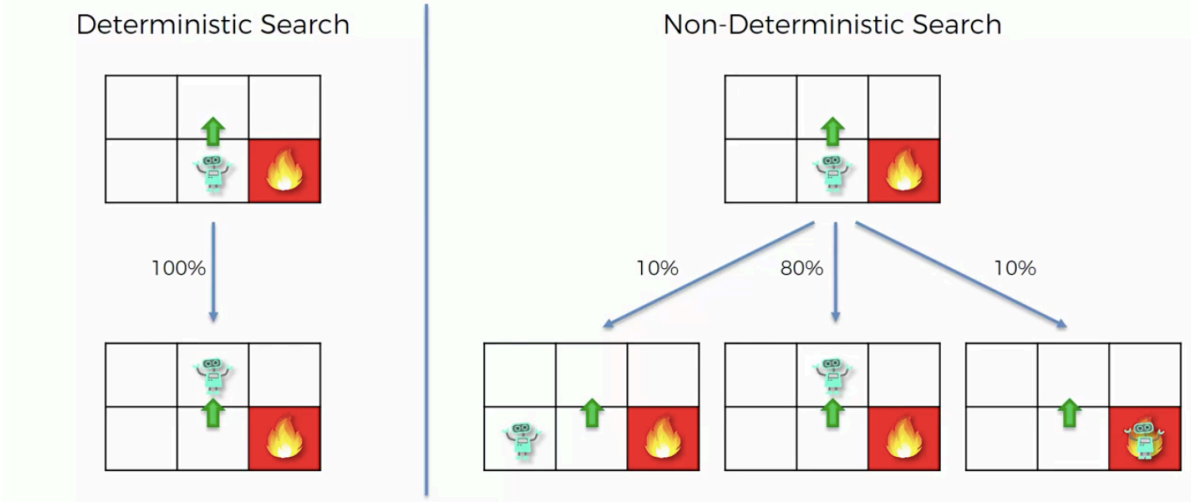
Markov Decision Process (MDP)



Markov Decision Process (MDP)

Markov Process

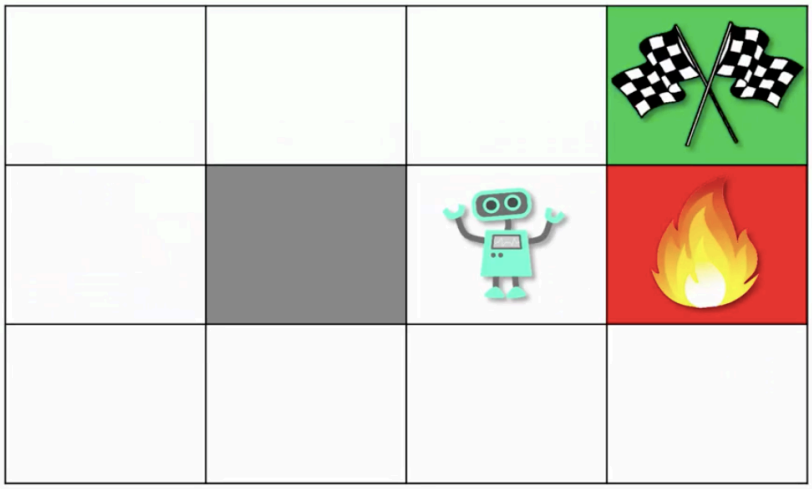
Markov Decision Process (MDP)

Markov Decision Process (MDP)

A stochastic process has the **Markov property** if the conditional probability distribution of future states of the process (conditional on both past and present states) depends only upon the present state, not on the sequence of events that preceded it. A process with this property is called a **Markov process**.

Wikipedia

Markov Decision Process (MDP)



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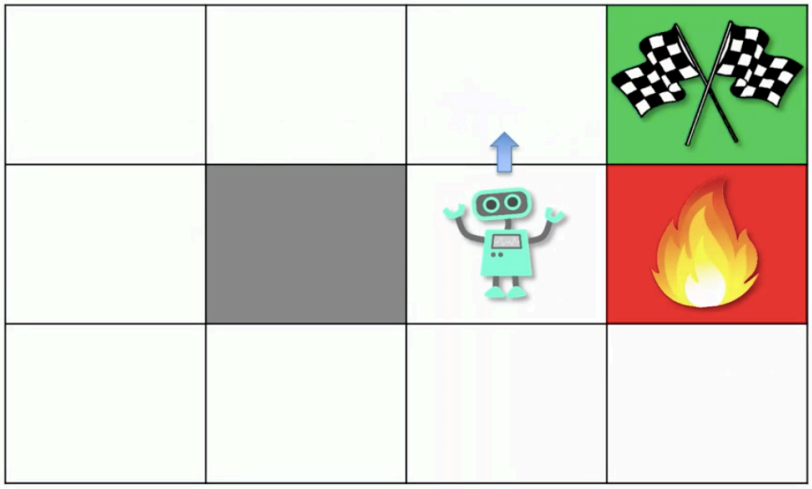
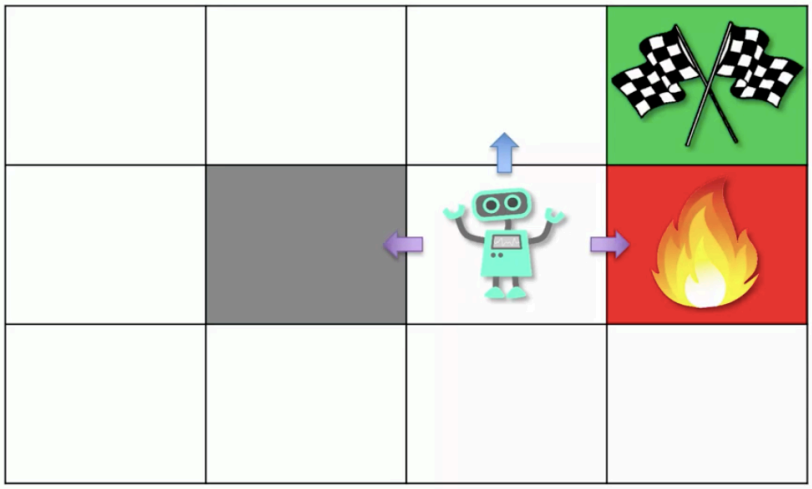
Suppose we put the agent at a random state. In here (Markov process) the agent doesn't care how it ended up in here and it does not matter what happened before. The only thing matter in here is in what state is it in.

Markov Decision Process (MDP)



Markov Decision Process (MDP)



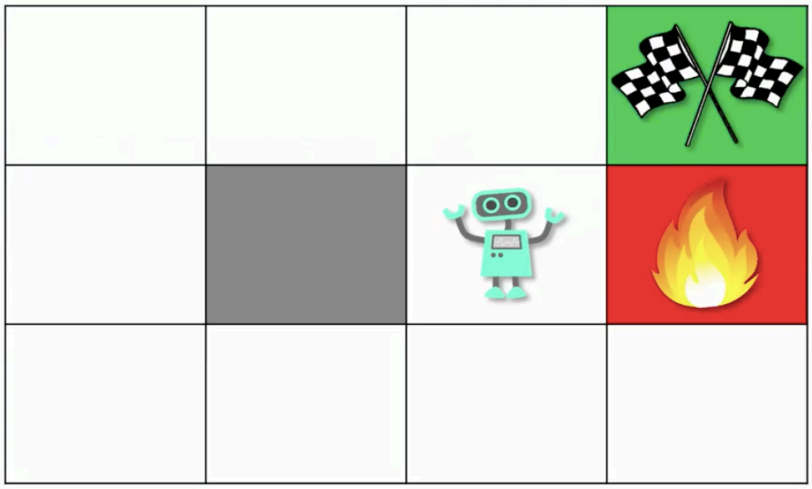
This is non-deterministic and we have that stochasticity in our environment or we have that randomness in our environment.

Markov Decision Process (MDP)

Markov Decision Processes (MDPs) provide a mathematical framework for modeling decision making in situations where outcomes are partly random and partly under the control of a decision maker.

Wikipedia

Markov Decision Process (MDP)



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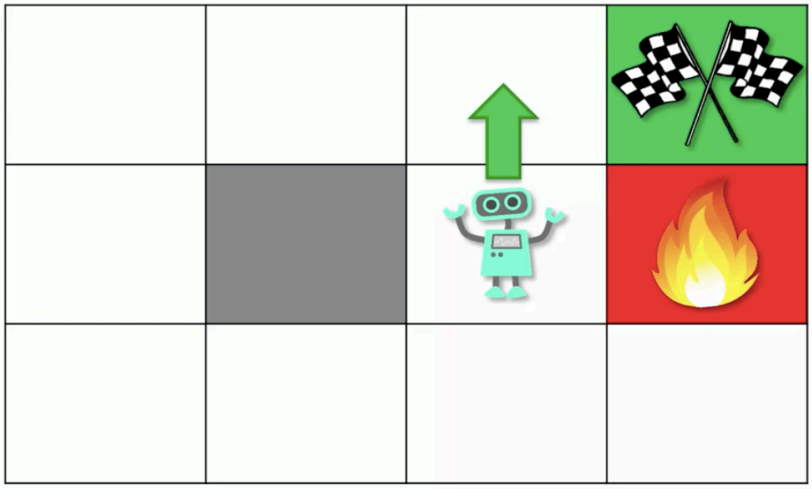

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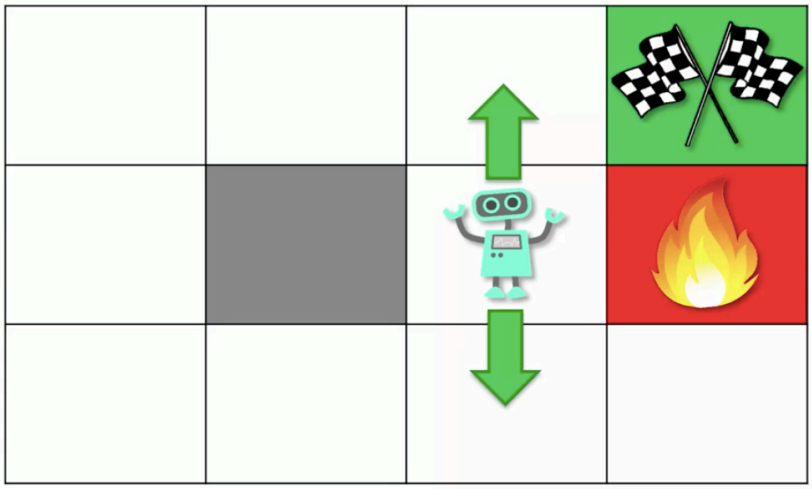

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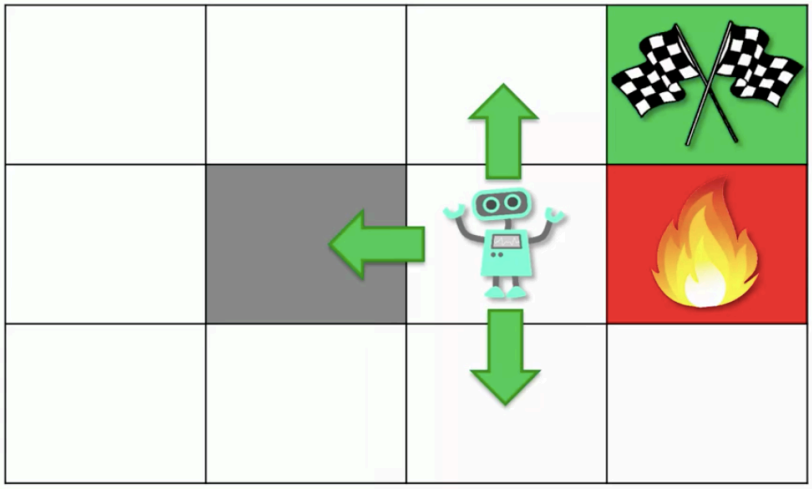

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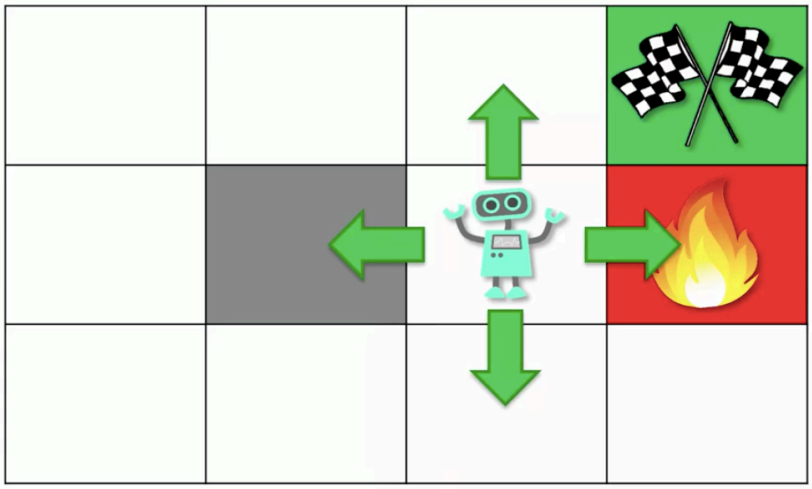

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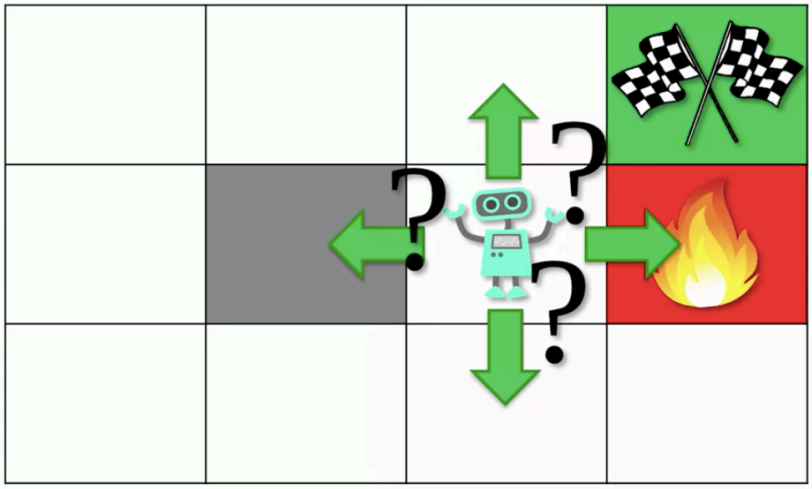
Markov Decision Process (MDP)



Markov decision process is similar to bellman equation but a little more sophisticated.

Markov Decision Process (MDP)

$$V(s) = \max_a(R(s,a) + \gamma V(s'))$$

In MDP we don’t know exactly our s’ and there is a randomness in there.

Markov Decision Process (MDP)

$$V(s) = \max_a(R(s,a) + \gamma V(s'))$$

$s'_1 \quad s'_2 \quad s'_3$

Markov Decision Process (MDP)

$$V(s) = \max_a(R(s,a) + \gamma V(s'))$$

$V(s'_1) \qquad V(s'_2) \qquad V(s'_3)$

Markov Decision Process (MDP)

$$0.8 * V(s'_1) + 0.1 * V(s'_2) + 0.1 * V(s'_3)$$

$$V(s) = \max_a (R(s,a) + \gamma V(s'))$$

these number are the probability of being in that state.

Markov Decision Process (MDP)

$$V(s) = \max_a \left(R(s,a) + \gamma \sum_{s'} P(s,a,s') V(s') \right)$$

in here instead of v we are getting expected value of the state we are getting into or more simply weighted average of what we're getting into.
P is probability.

Additional Reading

Additional Reading:

A Survey of Applications of Markov Decision Processes

By D. J. White (1993)

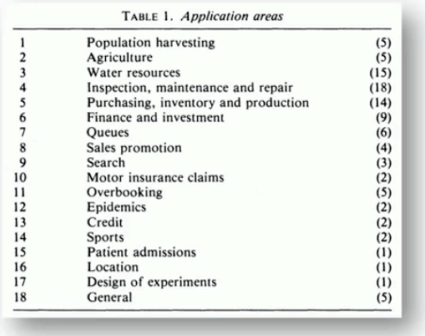


TABLE 1. *Application areas*

1	Population harvesting	(5)
2	Agriculture	(5)
3	Water resources	(15)
4	Inspection, maintenance and repair	(18)
5	Purchasing, inventory and production	(14)
6	Finance and investment	(9)
7	Queues	(6)
8	Sales promotion	(4)
9	Search	(3)
10	Motor insurance claims	(2)
11	Overbooking	(5)
12	Epidemics	(2)
13	Credit	(2)
14	Sports	(2)
15	Patient admissions	(1)
16	Location	(1)
17	Design of experiments	(1)
18	General	(5)

Link:

http://www.cs.uml.edu/ecg/uploads/AIfall14/MDPApplications3.pdf