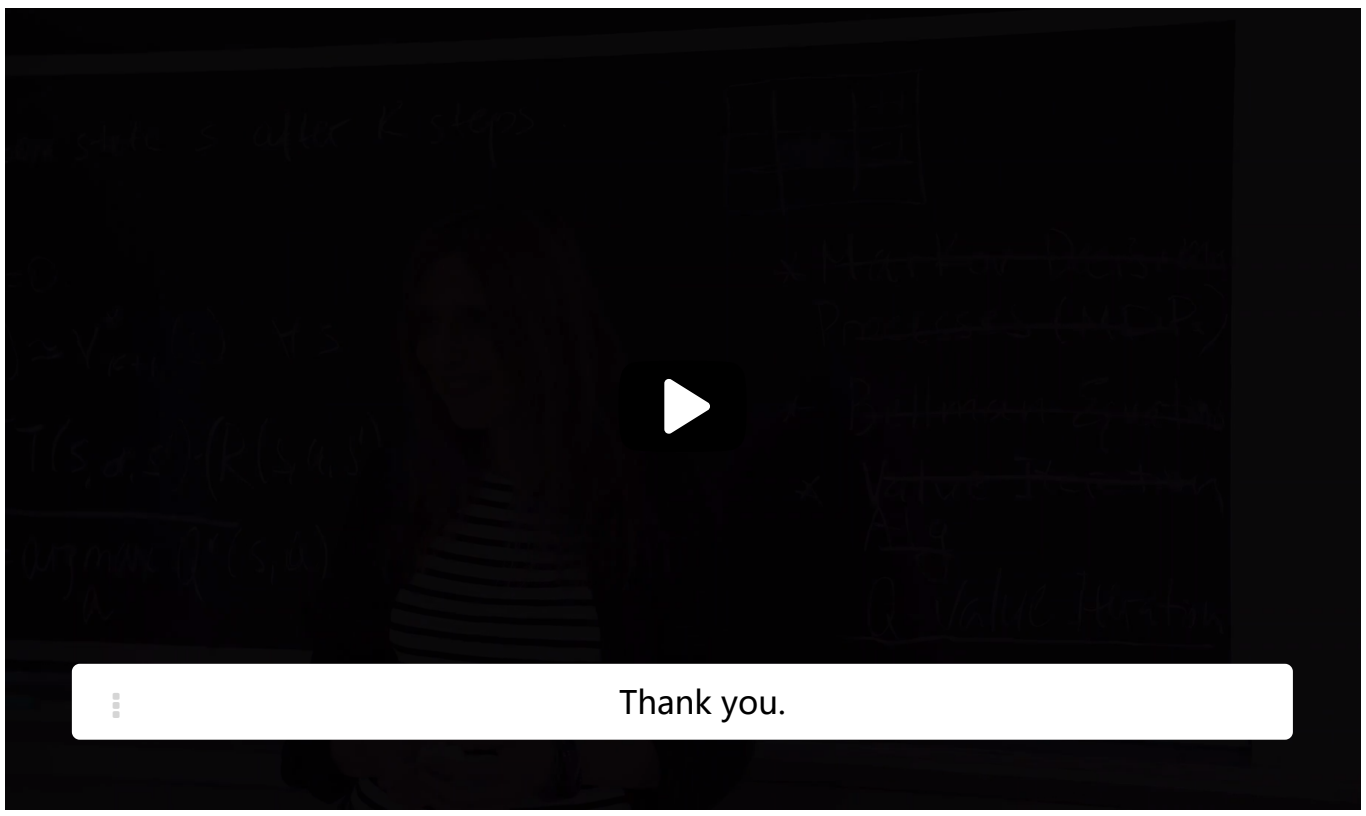
8. Q-value Iteration
Q-value Iteration



0:59 / 0:59 1.0x

and directly get Qs.

And that's exactly what you will do in your exercise.

You will reformulate this algorithm

and get a new algorithm which is called Q value iterations.

But the idea-- exactly the same.

And we will use this algorithm in our discussion

about reinforcement learning next time.

Thank you.

End of transcript. Skip to the start.

Video
Download video file

Transcripts
Download SubRip (.srt) file
Download Text (.txt) file

The derivation of the Q-value iteration update rule from the equation above is similar to the derivation of the value iteration update rule.

First, recall the Bellman equations:

$$\begin{aligned} V^*(s) &= \max_a Q^*(s,a) \\ Q^*(s,a) &= \sum_{s'} T(s,a,s') \left[R(s,a,s') + \gamma V^*(s') \right]. \end{aligned}$$

Plugging first equation into the second, we get:

$$Q^*(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma \max_{a'} Q^*(s',a') \right).$$

Now, let $Q_k^*(s,a)$ be the expected rewards from state s followed by action a, and then acting optimally for k steps afterwards. (Hence, $V_k^*(s) = \max_a Q_k^*(s,a)$.)

Q-value Iteration Update Rule

1/1 point (graded)
Referring to the equations above, what should the Q-value iteration update rule be?

- $Q^*_{k+1}(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma \max_{s'} Q^*_k(s',a)\right)$
- $Q^*_{k+1}(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma V^*(s')\right)$
- $Q^*_{k+1}(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma \max_{a'} Q^*_k(s',a')\right)$ ✔
- $Q^*_{k+1}(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma Q^*_k(s',a)\right)$

Solution:

Q-value iteration would use the previous iteration of the Q-value on the right hand side of the equation

$$Q^*(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma \max_{a'} Q^*(s',a')\right)$$

to update the Q value estimate of the current step. Hence, the Q value update for k^{th} step would look like:

$$Q^*_{k+1}(s,a) = \sum_{s'} T(s,a,s') \left(R(s,a,s') + \gamma \max_{a'} Q^*_k(s',a')\right).$$

Submit You have used 1 of 2 attempts

Answers are displayed within the problem

Discussion

Show Discussion

Topic: Unit 5 Reinforcement Learning (2 weeks) :Lecture 17. Reinforcement Learning 1 / 8. Q-value Iteration