

REINFORCEMENT LEARNING Exercise 5



0 Lecture

Watch *Lecture 06: Advanced Q-learning Algorithms*¹ and *Lecture 07: Introduction to Policy Gradients*² before the upcoming sessions on Friday, November 30, and Friday, December 06. This exercise sheet is based on **Lecture 05 and Lecture 06**. The solution and code snippets will be based on TensorFlow – so you can follow the tutorials³ if you need some introduction. However, feel free to use any library of your choice.

1 Q-learning with Function Approximation

- (a) Implement Q-learning with function approximation in `q_learning_fa.py`. Apply it on the modified Gym Mountain Car environment which you find in `mountain_car.py`. It includes a shaped reward and a deterministic initial state. Run the control loop. You can play around with the parameters, but an exemplary setting is already given (using a soft target network update). Create learning curves of your experiments. You can use the plotting function which is given in the script.
- (b) Now add experience replay and a target network. You do not update on the transition you collect in a time step, but sample a minibatch and train on that. The targets are calculated using the target network. Again, create learning curves and write a short comparison about your experiences with Q-learning – with and without experience replay and target networks.
- (c) Now implement Double-Q-learning. The **action for target calculation** is then based on the current actual Q-network and not the target network. The **value** estimation however is **still based on the target network**.

2 Experiences

Make posts in threads *Week 05: Value Function Approximation* and *Week 06: Advanced Q-learning Algorithms* in the forum⁴, where you provide a brief summary of your experience with this exercise, the corresponding lecture and the last meeting.

¹ https://ilias.uni-freiburg.de/goto.php?target=xvid_1121351&client_id=unifreiburg

² https://ilias.uni-freiburg.de/goto.php?target=xvid_1121352&client_id=unifreiburg

³ https://www.tensorflow.org/get_started/

⁴ https://ilias.uni-freiburg.de/goto.php?target=frm_1121060&client_id=unifreiburg