VU Machine Learning

Winter Term 2025

Exercise 3.3

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Applying Reinforcement Learning for path finding

This is one of possible topics for exercise 3. See other possible topics from my colleague in tuwel. You have to select only one topic for exercise 3

Path finding

Consider a robot that starts in a starting line of a grid (see Figure 1). The objective is for the robot to reach the target as quickly as possible, without colliding with obstacles or walls. The robot is at one of a discrete set of grid positions. The velocity is also discrete, a number of grid cells moved horizontally and vertically per time step. The actions are increments to the velocity components. Each may be changed by +1, −1, or 0 in each step, for a total of nine (3 x 3) actions. Both velocity components are restricted to be less than 3, and they cannot both be zero except at the starting line.

Each episode begins in one of the randomly selected start states with both velocity components zero and ends when the robot reaches the target cell. The rewards are −1 for each step until the robot reaches the target. If the robot hits the walls/obstacles, it is moved back to a random position on the starting line, both velocity components are reduced to zero, and the episode continues. If robot reaches the target cell the episode ends.

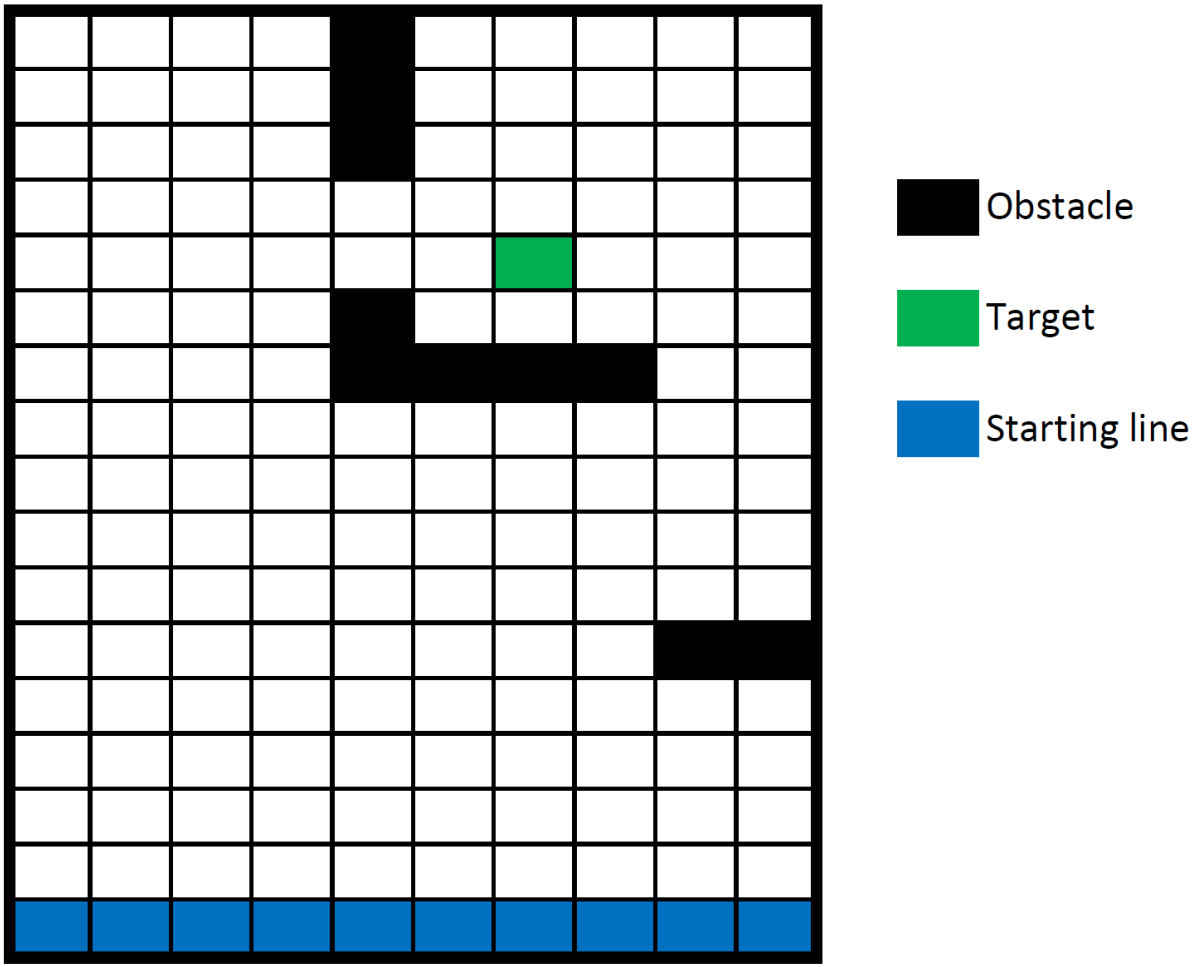

Figure 1

Path finding

- Implement and apply a Monte Carlo control method to this task to compute the optimal policy from each starting state
- You should implement the methods from scratch (Please do not use any part of existing code)
- Experiment with at least 3 different grids with different obstacles and target cell
- Create figures that show the found paths
- Report how adding more obstacles affect the runtime

Submission

- Your implementation
  - Students are not allowed to use existing code or to copy code produced by generative AI tools. Submissions that contain code created by generative AI or copied from other sources will receive zero points
- Around 10-15 slides with this structure
  - Main information for your implementation/experiments
  - Figures…
  - Discussion/Conclusions
- No report needed for this assignment (3.3.)
- Individual discussion of source code/presentation with each group

  + Demonstration of your approach
- Submission deadline:
  - Submission: 28.01.2026, Presentations: 29.1.2026 and 30.01.2026

Discussion of assignment

- Discussion of code
- Demonstration of your implementation
- Implementation issues
- Concepts about the RL method