VU Machine Learning

Summer Term 2025

Applying Reinforcement Learning for Breakout

Exercise 3.3

Nysret Musliu

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

Breakout

- Implement a minimalistic clone of the Atari game breakout
  - The game consists of a ball, bricks to shoot and a paddle
    - See https://en.wikipedia.org/wiki/Breakout_(video_game)
  - Size of elements:
    - Ball 1*1
    - Paddle 5*1
    - Bricks 3*1
  - Ball has constant speed of 1 in vertical direction and between -2 and 2 in the horizontal direction
  - Depending on which pixel of the paddle is hit the ball goes in different directions. At the start the direction is chosen at random.

Breakout

- Implement a minimalistic clone of the Atari game breakout
  - If a brick is hit the ball gets reflected and the brick disappears
  - If the ball goes past the paddle (hits the bottom of the screen) all blocks reappear, the paddle gets placed at the center with speed 0 and the ball is shot in a random direction one of out the five choices
  - At each time step you can change the speed of the paddle by either +1, -1 or 0 (actions) moving it left and right, the maximum speed of the paddle should be 2
  - Goal is to make all bricks disappear as fast as possible (-1 reward per timestep)
  - To reduce learning times only use a small number of bricks (5-10) for your experiments and work with a small grid (e. g. 15*10 or smaller)

Breakout

- Apply a Monte Carlo control method to this task to compute the optimal policy for each possible start (ball trajectory)
- Experiment with at least 3 different layouts (Rectangle and other forms!) with different brick amounts
- Create figures that show the found trajectories
- Report how adding more bricks and different brick layouts affect the runtime

Submission

- Your implementation
- Around 10 slides with this structure
  - Main information for your implementation/experiments
  - Figures…
  - Discussion/Conclusions
- No report needed for this assignment
- Individual discussion of source code/presentation with each group

  + Demonstration of your approach
- Submission deadline:
  - Submission: one day before your presentation
  - Presentations/Discussions: 30.06., 01.07. 24.07., 25.07.

    (if you need a slot before 30.06. please write to nysret.musliu@tuwien.ac.at)

Discussion of assignment

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