

Machine Learning 2024/25

Homework 2: Car racing

Master in Artificial Intelligence and Robotics



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Homeworks

Each homework will assign up to 2 points that will be added to the final score of the exam in any session within this academic year.

Homework points will remain valid independently of acceptance/failure in exam sessions.

Homeworks are not mandatory.

It is not possible to deliver homeworks outside the deadline given during the course.

Homework 2 : Car racing

Deadline: **5/1/2025 23:59 CET** (STRICT DEADLINE!!!)

Problem

- Driving racing car (2D simulator) [1]
- Target function: Image -> action
- RL used to collect data for image classification (trained policy)
- Actions
 - 0: do nothing
 - 1: steer left
 - 2: steer right
 - 3: gas
 - 4: brake



[1] https://gymnasium.farama.org/environments/box2d/car_racing/

Dataset

5-classes image classification

Train and test data with images in folders (0,1,2,3,4)

Images: 96x96x3 (PNG format)

[OPTIONAL] Explicit use of car sensors (speed, ABS, steering wheel position, and gyroscope) →



Download data from this folder

<https://drive.google.com/drive/folders/1bNL8icEqHNswHJfmhPsEcoxHy2zonAGd>

Assignment

Solve the image classification problem using any method (CNN strongly suggested)

Evaluate performance with proper metrics

Perform some hyper-parameter search and compare results

[OPTIONAL] Use the learned model to drive the car

See example in https://drive.google.com/file/d/1kaanIVX_yGaKTwcMXKrQiBJXDu3jD1jV/view

Deep Reinforcement learning (maybe later)

Use DRL to learn a policy in this environment

Assignment through Classroom

Deliver through the assignment:

- 1) A report (PDF file)
- 2) A ZIP file with the code you used in the project.
- 3) [OPTIONAL] Videos of car control

Assignment through Classroom

Report

- PDF file of about 10 pages excluding code, with your name and matricola
- implemented solutions
 - how data have been preprocessed
 - which methods/algorithms have been used
 - which configurations of the methods have been tried
 - performance metrics (e.g., plot results over training steps)
- hyper-parameter search
- results for different hyper-parameters
- computational training time
- conclusions and future work

Note: GenAI must be properly acknowledged!

Assignment through Classroom

Submit the files (PDF report, ZIPped code) through this assignment, make sure to turn the assignment in.

NOTES:

- 1) do ***NOT*** put the PDF report into the ZIP file!
- 2) no other submission mode will be considered (e.g. do ***NOT*** send submissions by email).

This assignment must be **individual** (i.e., one submission for each student) and **original** (i.e., not equal or too similar to other works either from other students in this class or from other sources).

Evaluation will be based on the appropriateness and correctness of the described solution, regardless of the numeric results (as long as they are reasonable).