



# SELF-DRIVING CARS

## EXERCISE 0 – INTRODUCTION

### 1 Important Information

#### a) Exercise Procedure

- We will have 3 Pen & Paper exercises and 3 coding challenge tasks.
- We provide solutions for the Pen & Paper exercises before the Q&A/Discussion session.
- The results of the coding challenge need to be submitted in ILIAS **before** the deadline stated on each exercise sheet.
- You are not allowed to share results and code of the coding challenge or make it public (e.g., GitHub).
- All lectures and exercises are relevant for the exam.
- Exercises are not graded but by ranking in the top 50% of the challenge leaderboard you can obtain a 0.3 bonus for the exam.
- **Please register to the course as follows:**
  1. Go to the ILIAS-website and login into your account using your personal ZDV credentials.
  2. In section **Wintersemester 2021-22/7 Mathe...Fakultät/Informatik/Autonomous Vision (Prof. Geiger)** please enroll in the lecture **Self-Driving Cars**: [https://ovidius.uni-tuebingen.de/ilias3/goto.php?target=crs\\_3311433&client\\_id=pr02](https://ovidius.uni-tuebingen.de/ilias3/goto.php?target=crs_3311433&client_id=pr02)
  3. If you have any questions regarding the exercises, please ask at the **Forum**.
- **Exercise sheets** will be available according to the schedule on the website: <https://uni-tuebingen.de/fakultaeten/mathematisch-naturwissenschaftliche-fakultaet/fachbereiche/informatik/lehrstuehle/autonomous-vision/lectures/self-driving-cars/>.
  - We encourage you to discuss these exercises within a group.
  - For the coding challenge you can work in teams of up to 2 people.
  - You can submit one solution per team but need to make clear who the team partner is.
  - We only include submissions to the leaderboard which are executable with the provided singularity image. Please make sure if this is the case before submitting.

#### b) Submitting your solutions:

- Please compress your submission using the ZIP format and *only* include necessary files.
- We will provide a template for most tasks. Please follow them to ensure a smooth procedure.

#### c) Infrastructure:

- You are eligible to use the Training Center for Machine Learning (TCML) cluster. Please read the cluster documentation for more details (<https://docs.google.com/document/d/1AgtLy28VVZaPe79TwOb9jjC4F1KVzffb8y1vZoURZE8/edit?usp=sharing>).

## 2 Tasks

### 0.1 Challenge Registration

- a) Find a team partner (you can use the ILIAS Forum for this).
- b) If you want to take part in the challenge please register here: <https://forms.gle/YLlrexWZ2Y7LWsSw7>. This is important especially if you need access to the TCML Cluster. After you registered you will receive your account details via e-mail within the next few days.

### 0.2 Local Installation

We use PyTorch for the exercises.

- a) It is recommended to manage your environment with Anaconda. Please install Anaconda with Python version 3.8 following instructions at <https://www.anaconda.com/download/>.
- b) Create a new conda environment: `conda create -n sdc_lecture python=3.8`
- c) Activate the conda environment: `conda activate sdc_lecture`
- d) Install PyTorch (version depends on your GPU or if you only use a CPU): <https://pytorch.org/get-started/locally/>
- e) Install matplotlib: `pip install matplotlib`
- f) Install pyvirtualdisplay: `pip install pyvirtualdisplay`
- g) To test the environment setup run the regression code `exercise_pytorch.py` we provided.

Additionally you need to install OpenAI Gym on your machine:

- a) Activate your conda environment.
- b) Install swig: `conda install swig`
- c) Install the Box2D environment using the provided file `sdc_gym.zip` by the following commands

```
unzip sdc_gym.zip
cd sdc_gym
pip install -e '.[box2d]'
cd ..
```

(If you copy the pip install command and the installation fails, please try to use different quotes it could be that the pdf does not present the correct quotes.)

- d) After installation, you should be able to start the car racing game by the command

```
python gym_manual_driving.py
```

### 0.3 Cluster Setup

To get familiar with the TCML cluster, we ask you to run a small Python script with the Singularity image we provided:

- a) Read the cluster documentation and log in to the cluster after you get the account.
- b) Download the Singularity image and copy it to your home directories on the cluster (you could use scp): [https://1drv.ms/u/s!Ai4dN5Z\\_UAPZy3Ymcsb\\_2ZUZ5\\_Nd?e=KGBDOC](https://1drv.ms/u/s!Ai4dN5Z_UAPZy3Ymcsb_2ZUZ5_Nd?e=KGBDOC)
- c) Submit a task to the cluster to run the Python script `exercise_gym.py`.
  - i) Look at the `gym.sbatch` script and adapt the parameters (e.g. fill in your e-mail address).

- ii) Note that you need to run python with our provided Singularity Container `sdc_gym.simg`, such as

```
# when using the OpenAI gym and rendering to a virtual display
singularity exec ~/sdc_gym.simg python your_python_script.py
# when training networks on GPUs in PyTorch
singularity exec --nv ~/sdc_gym.simg python your_python_script.py
```

- d) Submit the .sbatch file with: `sbatch start_job.sbatch`
- e) Check the status of your job with: `squeue | grep <username>`
- f) After running the job you should see the `job.err` and `job.out` files with the logs of your job. Check if there were any errors.