

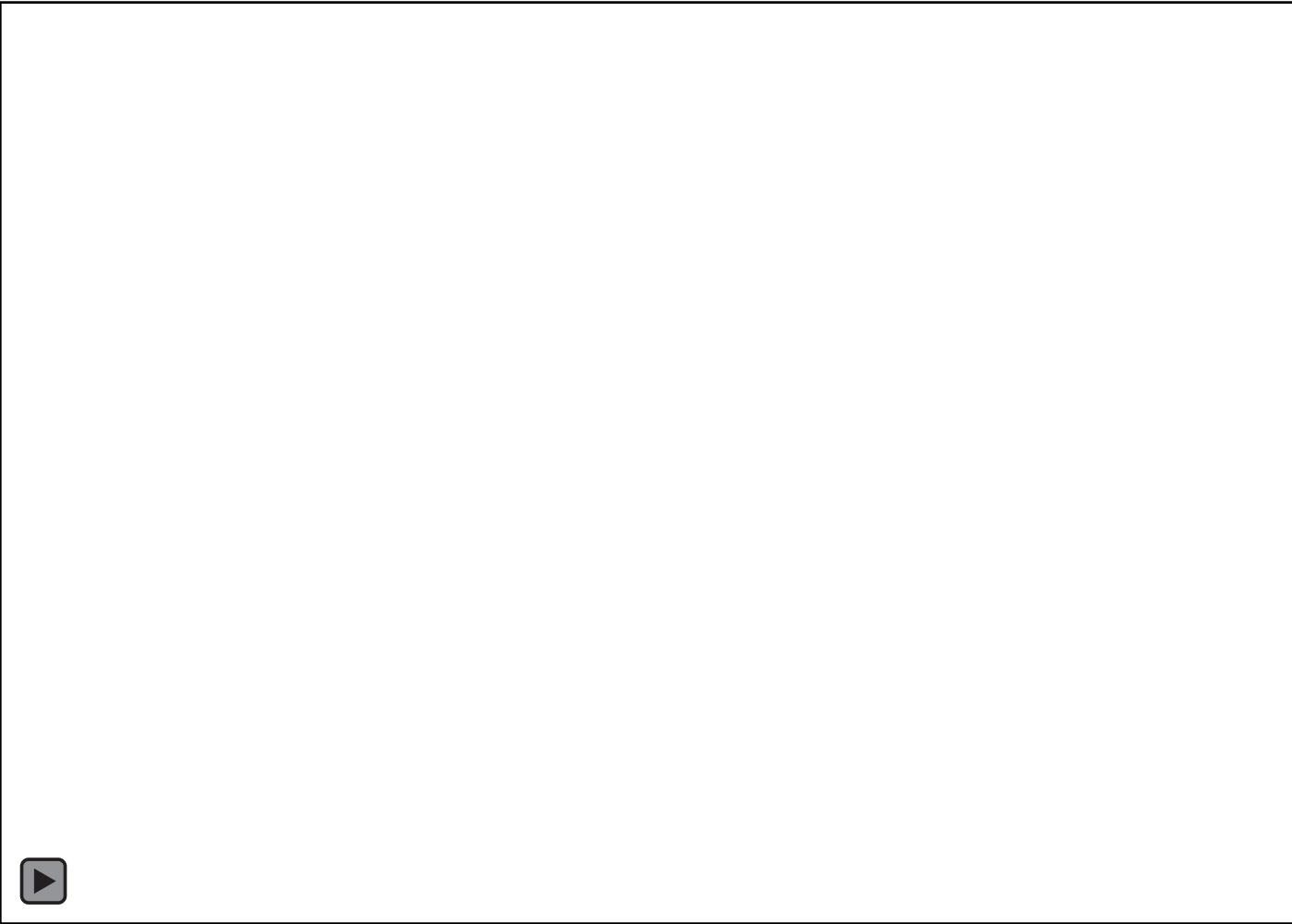


# RE510: Self-Driving Car Making Project in CARLA simulator

Teaching Assistant :

Jeong-Hoon Kim ([jeonghoon.kim@kaist.ac.kr](mailto:jeonghoon.kim@kaist.ac.kr)) and Seokjun Lee ([seokjunlee@kaist.ac.kr](mailto:seokjunlee@kaist.ac.kr))

Special thanks to Sangjae Cho for preparing the materials



## SW setup

<https://github.com/carla-simulator/carla/releases>

Find  
'0.9.12'

Aug 3, 2021  
bernatx  
0.9.12  
d23f3dc  
Compare ▾

## CARLA 0.9.12

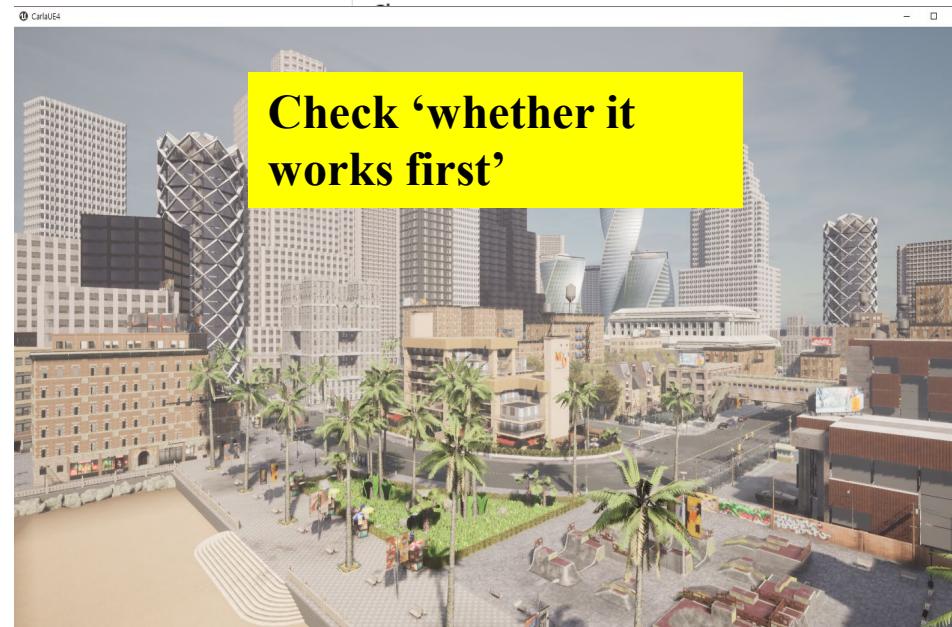
### Release 0.9.12

- [Ubuntu] [CARLA\\_0.9.12.tar.gz](#)
- [Ubuntu] [AdditionalMaps\\_0.9.12.tar.gz](#)
- [Ubuntu] [CARLA\\_0.9.12\\_RSS.tar.gz](#)
- [Windows] [CARLA\\_0.9.12.zip](#)
- [Windows] [AdditionalMaps\\_0.9.12.zip](#)

Decompress the zip file to your path

CarlaUE4	8/3/
Co-Simulation	8/3/
Engine	8/3/
HDMaps	8/3/
Plugins	8/3/
PythonAPI	8/3/
<b>CarlaUE4.exe</b>	<b>8/3/</b>
CHANGELOG	8/3/
Dockerfile	8/3/
LICENSE	8/3/
README	8/3/

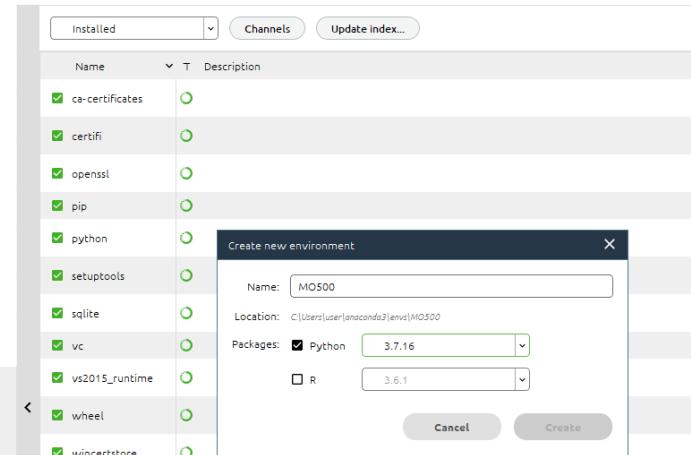
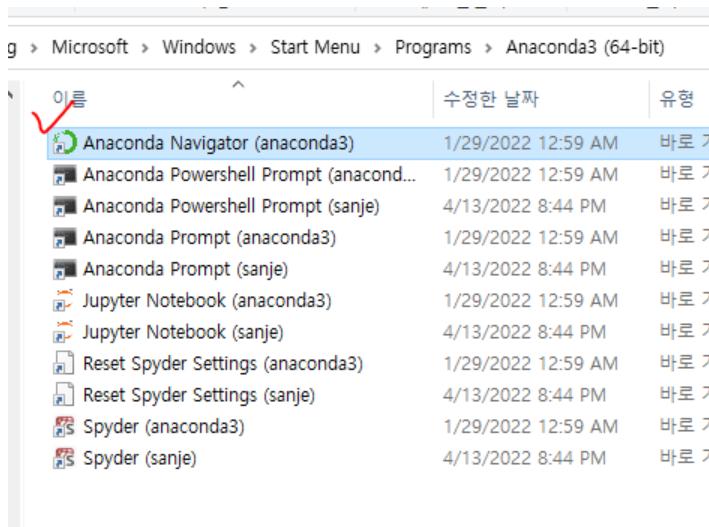
Run CarlaUE4.exe



## SW setup

Install Conda

<https://www.anaconda.com/>



Make your own virtual environment

## SW setup

1. ~\WindowsNoEditor\PythonAPI\carla\dist>pip install carla-0.9.12-cp37-cp37m-win\_amd64.whl
2. conda activate (your\_env\_name)
3. Pytorch Install

- See your CUDA version with ‘nvcc –V’

```
C:\Users\user>nvcc -V
nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2021 NVIDIA Corporation
Built on Mon_May_3_19:41:42_Pacific_Daylight_Time_2021
Cuda compilation tools, release 11.3, V11.3.109
Build cuda_11.3.r11.3/compiler.29920130_0
C:\Users\user>
```

- <https://pytorch.org/get-started/previous-versions/>

```
(M0500_3) D:\> cd \WindowsNoEditor\PythonAPI\carla\dist>nvcc -V
NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2021 NVIDIA Corporation
Built on Mon May _3 19:41:42 Pacific Daylight Time 2021
Cuda compilation tools, release 11.3, V11.3.109
Build cuda_11.3.r11.3/compiler.29920130_0
(M0500_3) D:\> cd \WindowsNoEditor\PythonAPI\carla\dist>python
Python 3.10.6 (default, Jan 17 2023, 16:06:28) [MSC v.1916 64 bit (AMD64)] ::Anaconda, Inc. on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import torch
>>> torch.__version__
'1.12.1'
```

v1.12.1

Conda

OSX

```
# conda
conda install pytorch==1.12.1 torchvision==0.13.1 torchaudio==0.12.1 -c pytorch
```

Linux and Windows

```
# CUDA 10.2
conda install pytorch==1.12.1 torchvision==0.13.1 torchaudio==0.12.1 cudatoolkit=10.2 -c pytorch
# CUDA 11.3
conda install pytorch==1.12.1 torchvision==0.13.1 torchaudio==0.12.1 cudatoolkit=11.3 -c pytorch
# CUDA 11.6
conda install pytorch==1.12.1 torchvision==0.13.1 torchaudio==0.12.1 cudatoolkit=11.6 -c pytorch -c conda-forge
# CPU Only
conda install pytorch==1.12.1 torchvision==0.13.1 torchaudio==0.12.1 ccpuonly -c pytorch
```

Pytorch Version check on your conda virtual env

4. pip install pygame
5. pip install opencv-python

**SW setup**

- SW requirements :

**CARLA == 0.9.12**

**Python ≥ 3.7**

**cuda == 11.3**

**pytorch == 1.12.1**

- The minimum requirements :

VRAM: 8 GBytes ( $\geq$  GTX 1070)

RAM: 8 Gbytes

Available HDD Space: 20 Gbytes

CPU: Intel 10th generation or newer

- Unzip ‘carla\_ad\_students.zip’
  - carla\_ad.py → Main code for the project
  - dataset.py → The dataloader when you follow the default approach which is ‘Imitation learning-based End-to-end driving(IL-based E2E)’
  - train.py → The training code for IL-based E2E
  - CarlaUE4.exe → Carla server exe file shortcut
  - fv\_out → The dataset folder for IL-based E2E
  - model → The folder include IL-based E2E network
    - ADMModel → default network (you can modify!)
  - weight → The folder include trained model
- Install Carla 0.9.12 API (on command prompt)
  - \$ conda activate ‘your vir. env.’
  - \$ pip install carla==0.9.12
    - If you already installed, the display shows as below:

```
C:\Users\user>conda activate M0500_3
(M0500_3) C:\Users\user>pip install carla==0.9.12
Requirement already satisfied: carla==0.9.12 in c:\users\user\anaconda3\envs\m0500_3\lib\site-packages (0.9.12)
```

- Now let’s do activity for Autonomous Driving

- Recommand to install Visual studio code
1. Open Carla server named as ‘CarlaUE4.exe’ first
  2. Type  
\$ conda activate ‘your vir. env.’  
\$ python carla\_ad.py
  3. Let’s see whether it works or not. If not, please check SW requirements again.
  4. If works, it shows as below

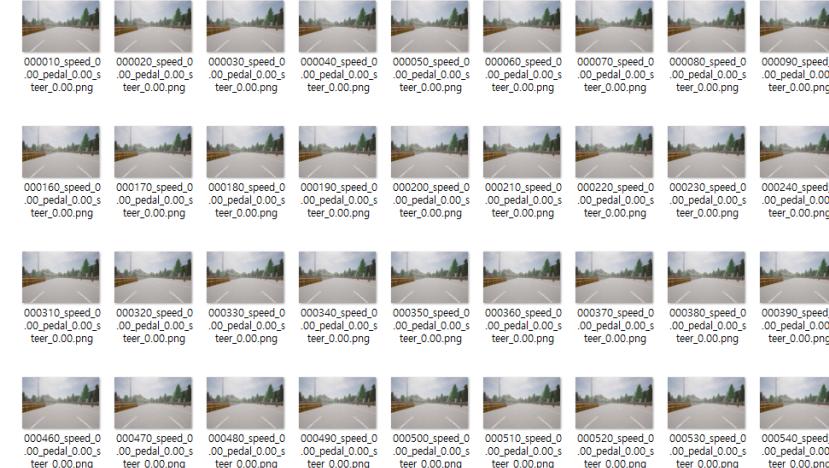
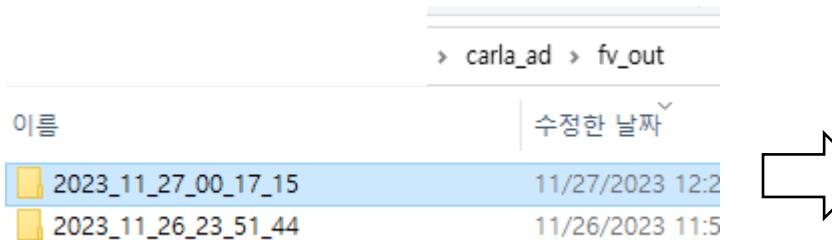


## 5. Mode description (Press '1', '2', or '3')

1. Manual Driving → Practice to be a good driver
2. Collecting Data → When you feel that you are now a best driver
3. Autonomous Driving → After training model, it will work after you put exact model path as below

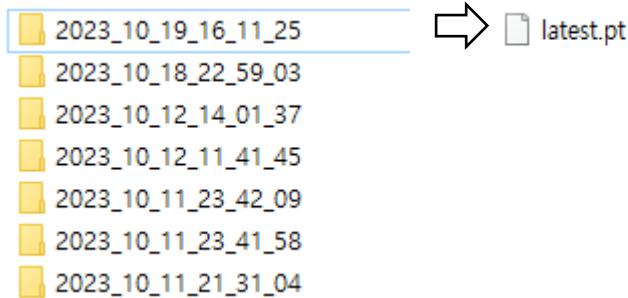
```
ad_model = None
weight_path = "weights/2023_10_12_11_41_45/latest.pt"
if os.path.exists(weight_path):
    device = torch.device("cuda:0")
```

## 6. After('Ctrl+c') you collect the data, you can check the collected data as below



All folders included fv\_out are used as a dataset

5. Train the model with collected data (\$ python train.py)
6. After it finish training, please see ‘weight’ folder whether it generate the weight as below



7. Specify the weight path as below

```
437     ad_model = None
438     weight_path = "weights/2023_10_12_11_41_45/latest.pt"
439     if os.path.exists(weight_path):
```

8. If all is fine, excute the main code with '\$ python carla\_ad.py'

- Proceeding with default settings is acceptable
- The race consists of a single lap in highway, and the number of collisions will also be included in the scoring
- Obstacles will appear during the drive, and their locations are fixed (You can not change the location of vehicles)
- For implementing autonomous driving with a novel approach, bonus points will be awarded
- If your computer's specifications are insufficient, you may use someone else's computer.  
However, the development environment must be kept separate.

## Submission (before 6/9 23:59)

1. Recorded video of your test run
  - File name : studentID\_name\_testrun.mp4
2. All files and directories in carla\_ad\_students.zip
  - File name : studentID\_name\_testrun.zip
3. Report (if you want)
  - File name : studentID\_name\_testrun.pdf
  - You can get some bonus points (max 20 points) if you submit the report.
  - If you want to receive novelty bonus points (max 10 points), you must submit the report.

## Evaluation Metric

Metric	Score	Note
Running CARLA simulator	0, 30	If CARLA simulator runs properly, you will receive 30 points
Lap accomplishment	20, 40	If your autonomous driving agent starts to drive, you will receive 20 points. If your agent finishes one lap, you will receive another 20 points.
Collision	-5	5 points deducted for each collision. (The maximum number of points that can be deducted for collisions is 20.)
(Bonus) Report	0 ~ 20	Bonus score for submitting the report
(Bonus) Novelty	0 ~ 10	Bonus score for novel ideas