

Carla Simulator

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Introduction

CARLA (**Car** Learning to **Act**) ^[1] is an *open-source* simulator specifically designed for research on *driving* scenarios.

- Developed by Intel and the Computer Vision Center at the Autonomous University of Barcelona
- Realistic environment for testing vehicles in different conditions.
- Allows *testing*, *training*, and *validating* algorithms for autonomous driving, reducing the costs and risks associated with real-world testing.

Why CARLA

- **Realistic and safe tests:** it offers a safe and cost-effective way to simulate complex scenarios, such as weather, lighting, traffic, and different roads, reducing the need for real-world tests, which can be risky and expensive.
- **Open-source:** the source code is available on GitHub [\[2\]](#), with customization possibilities, and integration of sensors and driving models.
- **Multi-sensor systems:** a wide range of supported sensors, such as cameras, LiDAR, radar, and GPS. Ideal for developing and testing components of autonomous driving systems based on multiple physical inputs.

- **Wide usage:** widely used both in academic research and industry. It is used by organizations such as Intel, NVIDIA, and Toyota, as well as universities and startups [\[3\]](#).
- **Community:** an active developer community contributing to the project, with extensive documentation and shared resources to help solve problems and improve the platform.
- **Integration with ROS:** compatible with **ROS (Robot Operating System)** [\[4\]](#), one of the most widely used standards in robotics and the development of autonomous systems. This integration facilitates the development of complex algorithms for autonomous navigation.

Some negative aspects

- **Hardware requirements:** demanding hardware specifications make it difficult to use on lower-spec machines.

CPU	RAM	Graphics Card	OS
Intel i7/i9 gen 9th - 11th AMD Ryzen 7/9	+32 GB RAM	NVIDIA RTX 3070/3080/4090	Ubuntu / Windows

- **Learning curve:** configuration and usage can be complex, requiring knowledge of programming (Python, C++), simulator management, and graphic software.
- **Simulation:** being a simulated environment, it simplifies reality. Traffic and pedestrian behavior are far from the realistic, complex, and chaotic urban environments.
- **Limited support:** the framework is mainly available for Linux and Windows operating systems with limited or no support for other platforms (e.g. macOS) and architectures (e.g. ARM).

Installation and usage

To install CARLA, you can follow the official guide available on the project's website: <https://carla.org>.

Optional requirements

- **conda**: for managing *Python* virtual environments.

1. Simulator

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

1.2 **Execution:** through the user interface or terminal

```
.\CarlaUE4.exe -quality-level={Low, Epic}
```

2. Python environment

2.1 Creation

```
conda create -n carla-env python=3.7  
conda activate carla-env  
python --version # Python 3.7.x
```

2.2 Dependency installation

```
pip install -r PythonAPI/examples/requirements.txt  
pip install carla
```

3. Running examples

```
cd PythonAPI/examples
```

3.1 Manual driving via keyboard

```
python manual_control.py
```

3.2 Traffic generation

```
python generate_traffic.py
```

Python API

```
import carla

# Connect to the server
client = carla.Client('isi-simcar.campusfc.dir.unibo.it', 2000)
world = client.get_world()
```

Bibliography

1. Alexey Dosovitskiy, German Ros, Felipe Codevilla, Antonio Lopez, & Vladlen Koltun (2017). CARLA: An Open Urban Driving Simulator. In Proceedings of the 1st Annual Conference on Robot Learning (pp. 1–16).
2. <https://github.com/carla-simulator/carla>
3. M. Andruccioli, M. Mengozzi, R. Presta, S. Mirri, and R. Girau, "Arousal effects on Fitness-to-Drive assessment: algorithms and experiments," 2023 IEEE 20th Consumer Communications & Networking Conference (CCNC), Las Vegas, NV, USA, 2023.
4. <https://www.ros.org>