Machine Learning for Traffic Behavior Analysis in Smart Cities

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Team

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Motivation

When analyzing traffic behaviors in large city environments, pedestrians add a level of complexity that makes it difficult to test algorithms in the real world.

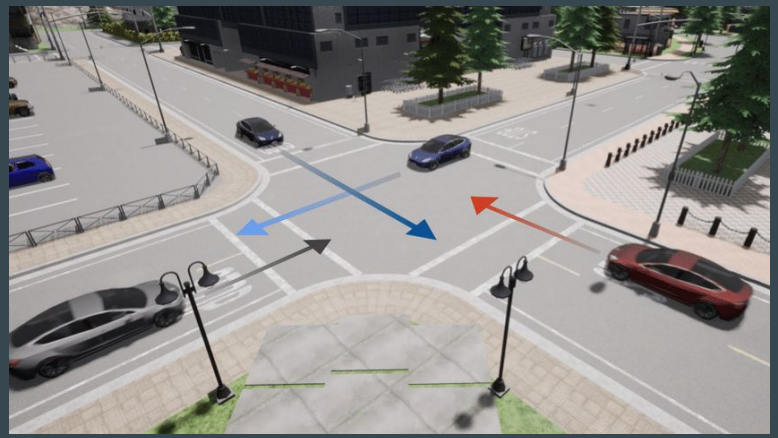
Why should we care?

When testing autonomous vehicles especially in a city environment, pedestrian safety is not a guarantee. In order to continue advancements in road safety and autonomous vehicles, there needs to be a robust environment to conduct experiments.

Project Goals

Goal: Create an environment that is able to run experiments on Carla, and implement/test multi agent reinforcement learning (MARL) algorithms to collect data on traffic behaviors.

- Setting up and connecting physical tools
- Creating digital twin map
- Implementing a MARL algorithm to CARLA
- Evaluate algorithm performance



CARLA (Car Learning to Act)

- Open-source driving simulator

- Customizable scenarios
  - Traffic, pedestrians, vehicles

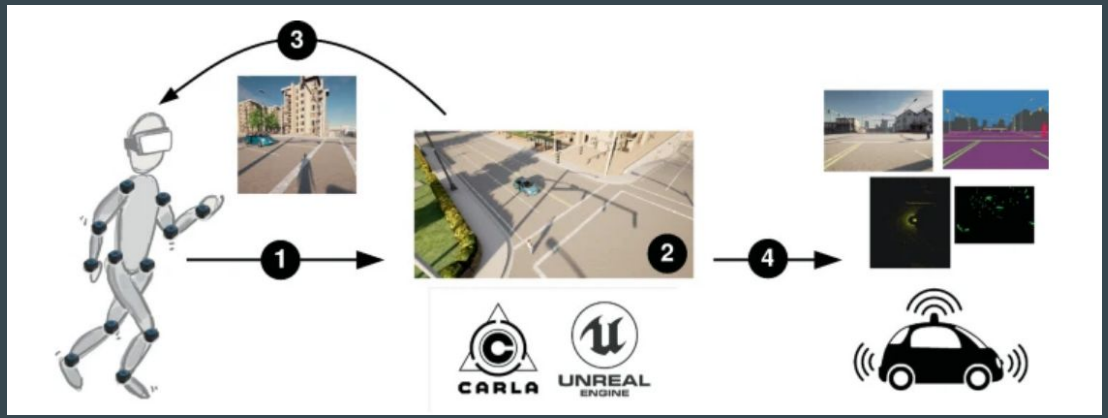
- Python API for configuration of environment
  - Cameras, autonomous driving scripts

Setting up and Connecting Physical Tools

- Setup CARLA at CoRE building

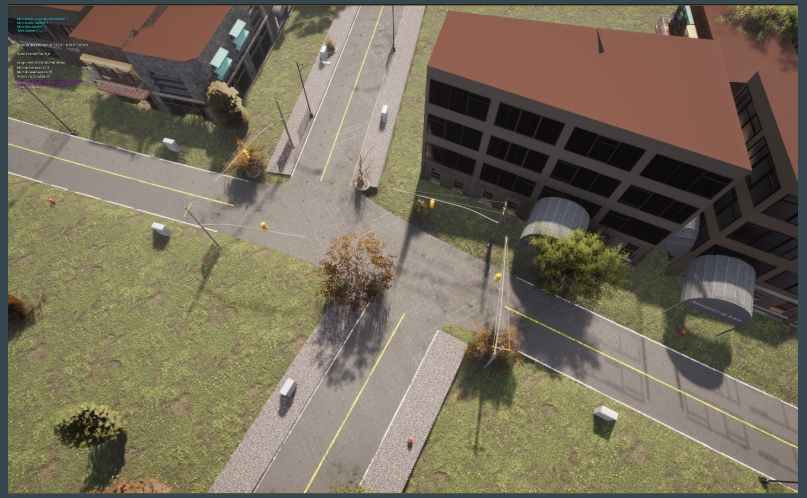
- Meta Quest 2 VR

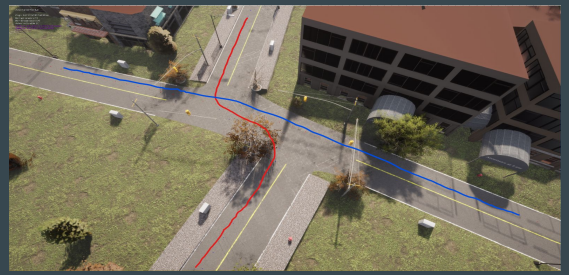
- Steering Wheel and Pedals

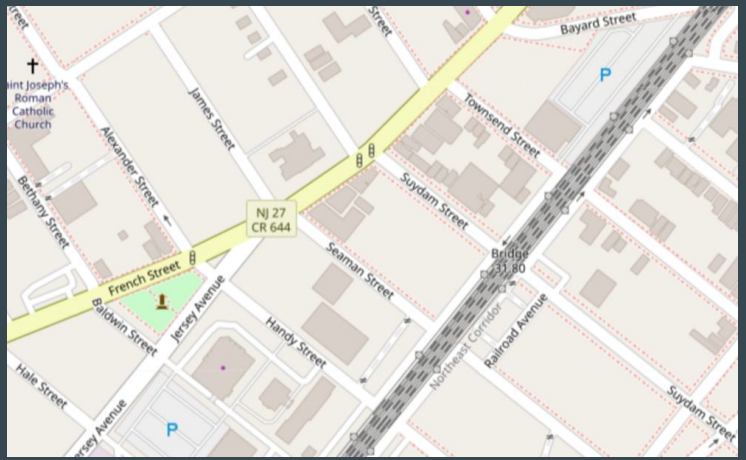


Creating Digital Twin Map

- What is a Digital Twin?
- Using Digital Twin Tool in CARLA
- Adjusted .xodr file, added waypoint routes





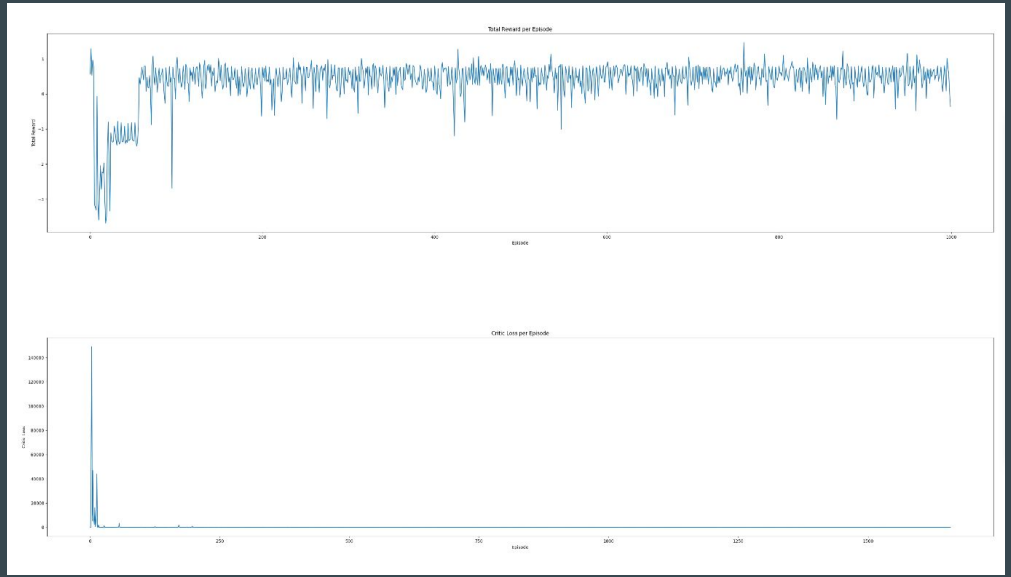


Implementing MARL Algorithm to CARLA

- Creating a CARLA environment
- Implementing MARL code to control cars
- Evaluate their performance

Evaluating Algorithm Performance

- Looking at:
  - Loss
  - Reward values
  - How close to optimal route?



Future Plans

- Optimize and fine tune algorithm for better performance
- Implement different multi-agent algorithms to CARLA for testing
- Create different scenarios and digital twin maps
- Collect data from human interaction

Acknowledgements

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Thank you!