2. Literature Review

This chapter discusses the various other related works. The first part discusses about state of art autonomous vehicle simulators available and identifies its key features advantages and limitations. The second part summarizes about the preceding approaches for defining a comparative metric for the comparison of Autonomous vehicle simulators. The last part of this chapter discusses about the different types of Generative Adversarial networks, an Generative AI algorithm which is applied in this thesis and highlights the key advantages in those approaches.

2.1 State of art simulators

There are numerous simulators available in the market, However this section discusses about some of the relevant and popular simulators

2.1.1 CARLA

CARLA (Car learning to act) is an open source simulator developed by the Computer Vision Center (CVC) and the Barcelona Supercomputing Centre (BSC) in collaboration with the Toyota Research Institute for research and development of autonomous driving. It provides realistic and diverse environments with various Urban scenarios, climates sensors. It is developed using unreal engine 4 and uses OpenDRIVE standard 1.4 to define roads and urban settings. The key feature of this simulator is that it is built as a server client architecture. The server handles the physics and computation of simulators whereas the user can control the simulator using C++ and python APIs making it scalable. Another upside of this simulator is that it facilitates the flawless process of developing, training and validating machine learning algorithms. Various algorithms like modular pipeline, Imitation learning, Reinforcement learning can be trained and validated in this simulator making it one the best choices for researchers. Since it runs on a gaming engine, unreal engine4 it render high quality realistic environment. The figure 1 depicts a scene from the simulators in various weather. Moreover, it provides variety of sensor data that can be retrieved such as cameras, Lidars, various meta data and ground truth which makes it more powerful in its performance. This simulator also provides access to various digital assests (actors) in the environment carefully designed to maintain high level of realism. However, currently it supports only 2 pre-defined urban maps with 2.9 kms and 1.4 kms of driving failing to provide diversity and generalization.

**CLEAN TEXT**

2. Literature Review

This chapter explores different works related to the topic. The initial section examines the existing state-of-the-art autonomous vehicle simulators. The second part provides a summary of previous methodologies used to define a comparative metric for evaluating autonomous vehicle simulators. The last part of this chapter discusses about the different types of Generative Adversarial networks (GANs), a type of Generative AI algorithm utilized in this thesis. It identifies the key advantages associated with these approaches.

2.1 State-of-the-Art Simulators

Numerous simulators are available in the market, but this section highlights some relevant and popular simulators and highlighting their advantages, limitations and applications.

2.1.1 CARLA

CARLA, (Car Learning to Act) is an open-source simulator developed collaboratively by the Computer Vision Centre (CVC) and the Barcelona Supercomputing Centre (BSC) in partnership with the Toyota Research Institute. It is designed for autonomous driving research and development which presents diverse and realistic environments featuring various climates, and sensors. CARLA operates on a server-client architecture, built on Unreal Engine 4 and utilizing the OpenDRIVE standard 1.4 to define roads and urban settings. This unique structure allows the server to manage simulator physics and computation while enabling user control through C++ and Python APIs, providing scalability.

A notable feature of CARLA is its seamless support for developing, training, and validating machine learning algorithms. Researchers can employ various algorithms like modular pipelines, imitation learning, and reinforcement learning within this simulator [2], making it a preferred choice for researchers. Leveraging Unreal Engine 4, CARLA offers high-quality, realistic rendering of environments. Figure 1 showcases scenes from the simulator in different weather conditions. Additionally, it provides an array of sensor data such as cameras, LiDAR’s, various metadata, and ground truth, enhancing its useability. Moreover, CARLA offers access to diverse digital assets (actors) within the environment, meticulously designed to maintain a high level of realism. However, it currently offers support for only two pre-defined urban maps covering 2.9 km and 1.4 km, which limits its diversity and generalization capabilities.

Figure1: Scenes from the CARLA simulator in different weather conditions.

List of figures

Figure 1: Scenes from the CARLA simulator in different weather conditions.

List of tables

References

[2]: Dosovitskiy, A., Ros, G., Codevilla, F., Lopez, A. &amp; Koltun, V.. (2017). CARLA: An Open Urban Driving Simulator. <i>Proceedings of the 1st Annual Conference on Robot Learning</i>, in <i>Proceedings of Machine Learning Research</i> 78:1-16 Available from https://proceedings.mlr.press/v78/dosovitskiy17a.html.