

Multi-Modal Collaborative Camera Perception for V2X in CARLA

Bachelor's Thesis

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Description

This thesis investigates *camera fusion* for V2X localization in the *CARLA* simulator [2], focusing on integrating data from both vehicle-mounted and infrastructure cameras within SLAM pipelines. The objective is to enhance localization accuracy by extending traditional SLAM systems with external camera data, building on previous research [4].

To achieve this, a simulation environment is configured in *CARLA* with vehicle and infrastructure cameras placed at intersections. Various sensor fusion techniques are explored to incorporate infrastructure camera data into the SLAM framework. Performance is evaluated in terms of localization accuracy, robustness, and computational efficiency. Classical methods such as *Iterative Closest Point (ICP)* [1] serve as benchmarks, while advanced approaches like *Neural Radiance Fields (NeRF)* [3] are examined for their potential in improving spatial perception. Finally, the proposed approach is compared against conventional SLAM methods that rely solely on onboard sensors. By enhancing multi-camera data integration, this work aims to improve localization reliability, contributing to safer and more efficient urban driving.

Requirements

CARLA, Docker, Computer Vision, Machine Learning, SLAM

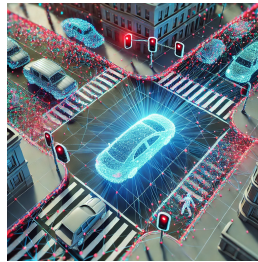


Figure 1: V2I Point Cloud

References

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- [2] Dosovitskiy, A., Ros, G., Codevilla, F., Lopez, A., and Koltun, V. "CARLA: An Open Urban Driving Simulator". In: *Proceedings of the 1st Annual Conference on Robot Learning (CoRL)*. 2017, pp. 1–16.
- [3] Mildenhall, B., Srinivasan, P. P., Tancik, M., Barron, J. T., Ramamoorthi, R., and Ng, R. "NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis". In: *European Conference on Computer Vision (ECCV)*. 2020, pp. 405–421.
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