Graduate School of Science and Technology Master's Thesis Abstract

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Thesis title	Sensor Pose Estimation from Low-Resolution SPAD Sensor Measurements		

Abstract

The aim of this study is to improve sensor pose estimation using low-resolution, cost-effective, SPAD-based 3D imaging sensors that capture spatial and temporal scene data. By combining accurate sensor pose information with reliable sensor measurements, tasks like robotics, navigation, and 3D imaging become feasible. Conventionally, high-resolution sensors or external calibration frameworks, such as Structure-from-Motion (SfM) or mechanical robot arms, are used. However, these methods are not practical for low-resolution SPAD measurements. In this study, we propose combining the Interactive Closest Point (ICP) algorithm with bundle adjustment to handle sparse and noisy measurements without relying on external tools. We generate ground-truth data through simulation, iteratively estimating the sensor pose. Evaluation results show accurate recovered pose and improved 3D scene rendering using Gaussian splatting, which we also adapt to allow for further pose refinement. We also display the rotation and translation error trend pointing towards improved accuracy. Overall, we demonstrate the feasibility of SPAD-based pose estimation without relying on external calibration tools, enabling future work on dynamic scene reconstruction and improved real-time performance research.