

Basic

***SLAM Tutorials for Everyone**

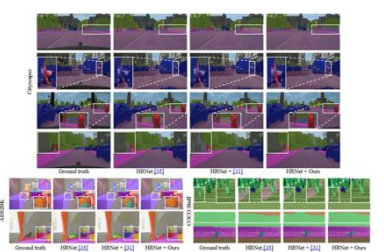
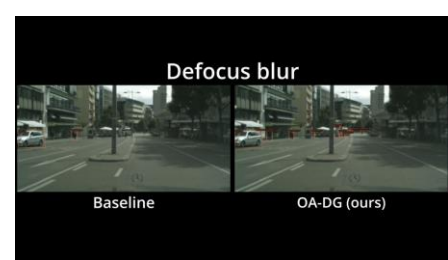
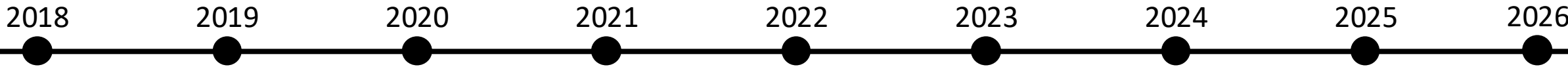
Lec. #1. Overview of lectures

*SLAM: Simultaneous Localization and Mapping

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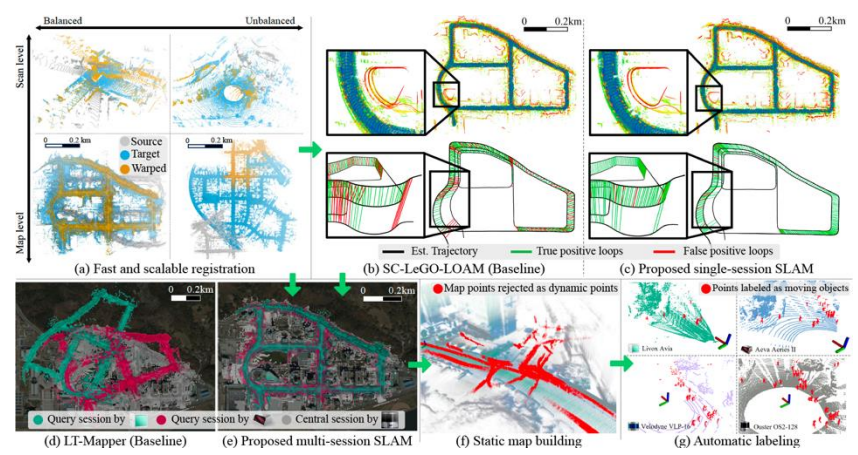
Introduction



Outside expert of CTO division, LG Electronics



Three-Time SLAM Competition Winner in IEEE ICRA



CES 2023 Innovation Award via tech. transfer

- Liang, Jacky
- Liao, Yiyi
- Liarokapis, Minas
- **LIM, HYUNGTAE**
- Lin, Pei-Chun
- Lin, Qin
- Lin, Shan



(L→R) IEEE RA-L associate editor (100+ peer reviews),
 2024 RSS pioneer (out of 202),
 2025 IEEE ICRA Outstanding Reviewer (out of 7,400)

Research: Robust 3D perception/mapping

Deployment & industry

Academic leadership & recognition



SLAM: Simultaneous Localization and Mapping

SLAM is an Essential Tech. for Robotics



Cleaning robot

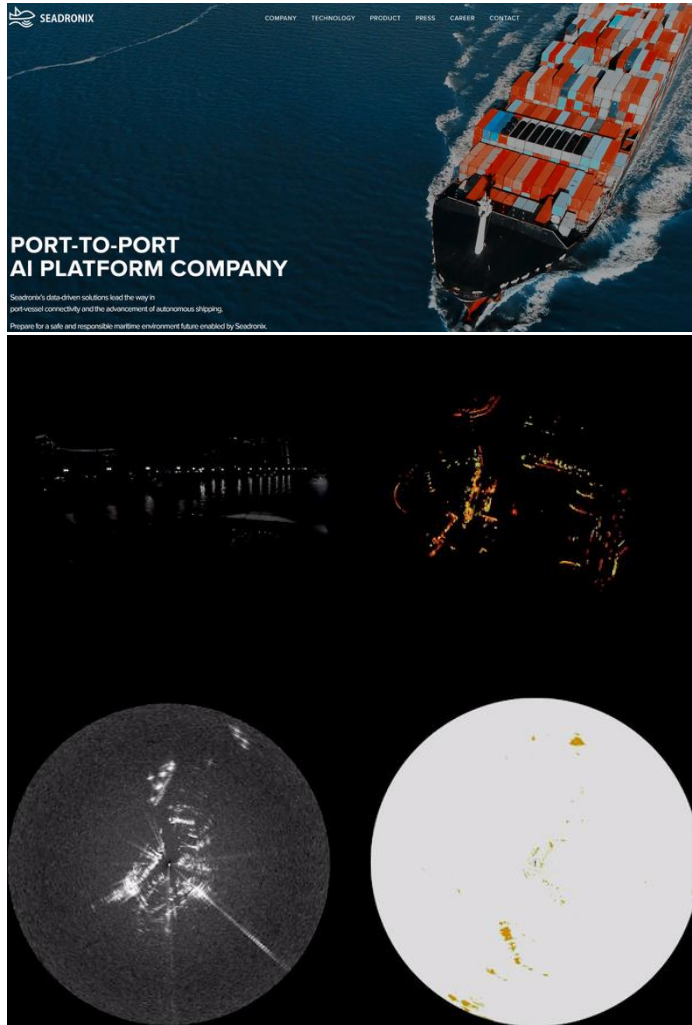


Delivery robot



Robotaxi

SLAM is an Essential Tech. for Robotics (Cont'd)



SEADRONIX: <https://www.seadronix.com/>



UROBOTICS: <https://urobotics.ai/>

3D Scene Understanding Matters



<https://about.fb.com/news/2024/09/introducing-orion-our-first-true-augmented-reality-glasses/>

MOVIN: <https://www.movin3d.com/>

Target audience

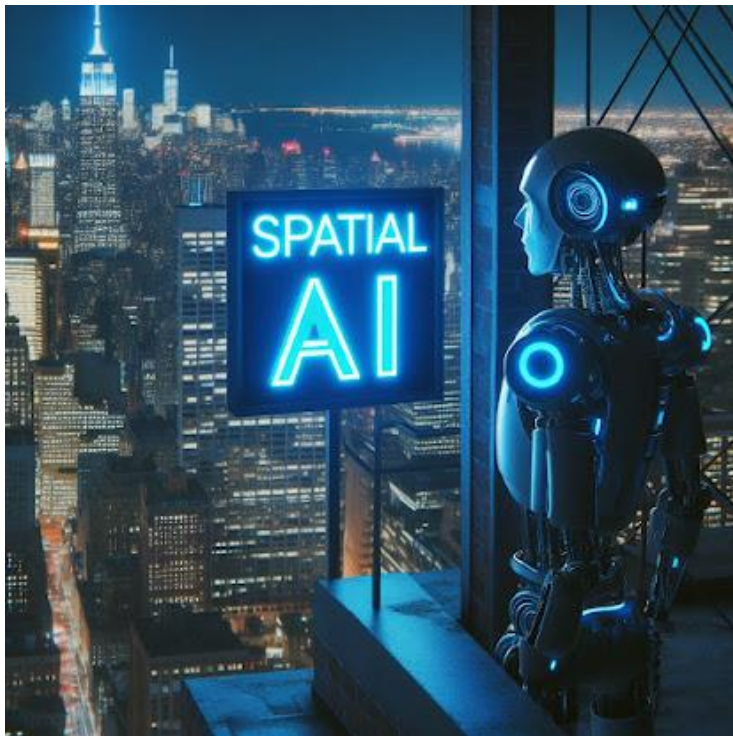
- Want to understand basic 3D robotic vision/SLAM
- No/weak math/computational science background
- Want to use SLAM as a black box with basic understanding
 - to better use open-source libraries



Just like learning how to turn on a computer

Goal: Support Understanding of SLAM

- Especially for those who need to employ SLAM for a real robot/hardware in the era of *Spatial AI*

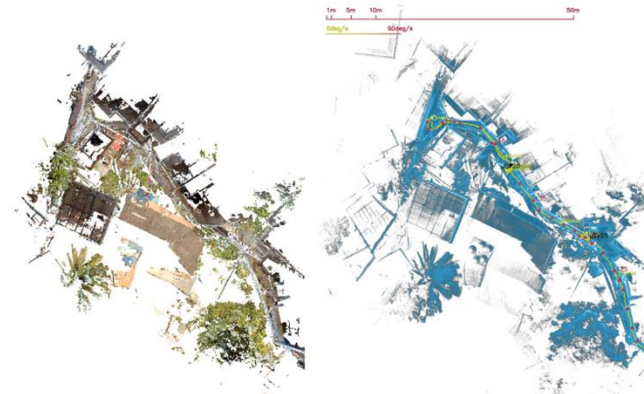


Why Do We Need to Study SLAM in Spatial AI Era?

- 3D scene understanding itself is a crucial domain



Autonomous construction



(a) Collected colored point cloud (b) Top view (Orthographic projection)

Urban informatics



Autonomous air pollution monitoring



River water quality monitoring

Why Do We Need to Study SLAM in Spatial AI Era? (Cont'd)

- E.g., VGGT-SLAM: Incremental Dense 3D Mapping With VGGT

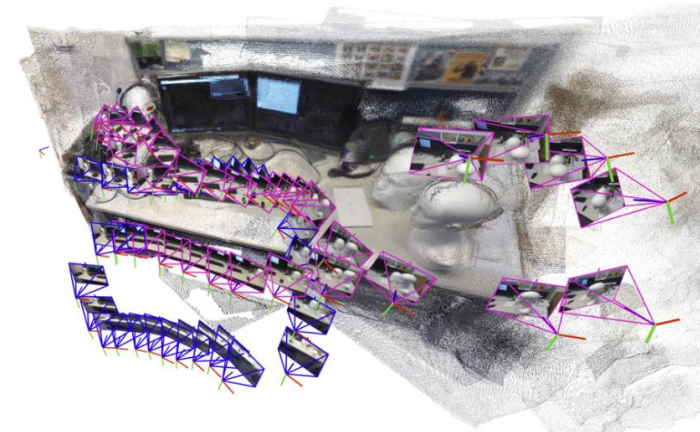
MIT News
ON CAMPUS AND AROUND THE WORLD

SUBSCRIBE

Teaching robots to map large environments

A new approach developed at MIT could help a search-and-rescue robot navigate an unpredictable environment by rapidly generating an accurate map of its surroundings.

Adam Zewe | MIT News
November 5, 2025



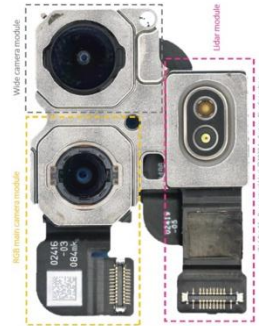
<https://github.com/MIT-SPARK/VGGT-SLAM>

Schedule

- Introduction
- Categories & Terminology of Robot Navigation
- State, measurement, and estimation
- Maximum likelihood estimation (MLE), Maximum a posteriori (MAP)
- Kalman filter
- Representation of 2D/3D pose
- Optimization-based SLAM: Graph SLAM & Backend Solvers
- Understanding of camera, LiDAR, radar, etc.
- Why my SLAM trial does not work well? (Degeneracy, Calibration, Sync issues)
- ...

Let's dive into SLAM!

HW #1



You can try it using these apps:



Polycam



3d Scanner App




Mapping the hotel room by iPad Pro
(from Prof. Giseop Kim: <https://aprl.dgist.ac.kr>)

HW #2



스스로 만드는 위치 지도 슬램(SLAM) 기술의 원리

조회수 1.5만회 · 3년 전

 LG디스커버리랩

스스로 집안을 돌아다니며 청소하는 로봇 청소기, 어떻게 로봇 청소기는 알아서 구석구석까지 청소할 수 있는 걸까요? 바로 로봇 ...