Jongwon Lee

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Interests

State Estimation: Navigation, Mapping, Sensor Fusion, Calibration

Robot Perception & AI: Computer Vision, Spatial AI

Education

University of Illinois Urbana-Champaign (UIUC) *Aug 2020 - Dec 2025*
Ph.D. in Aerospace Engineering *(Expected)*

- Dissertation: "Robust and Reliable Sensor Fusion and Localization for Autonomous Robotic Systems"
- Advisor: Dr. Timothy W. Bretl

Korea Advanced Institute of Science and Technology (KAIST) *Mar 2014 - Aug 2020*
B.S. in Mechanical Engineering

- GPA: 4.11/4.3, *Summa Cum Laude*
- Includes a two-year leave from Fall 2016 to Spring 2018 for compulsory military service

Experience

Graduate Research Assistant *Urbana, IL*
Bretl Research Group, UIUC *Aug 2020 - Current*

- **(2025-)** Designed, developed, and validated a **highly efficient** visual localization (from **over 10s** to **about 0.1s** per image) on 3D Gaussian splatting using feature correspondence ([J3]).
- **(2023-2024)** Designed, developed, and validated visual-inertial SLAM for flying vehicle takeoff and landing, **improving robustness and accuracy** with visible and infrared fiducial markers, resulting in publications ([C3], [C2], [W1]).
- **(2023-2024)** Led the design and development of takeoff and landing navigation using multi-scale fiducial markers for urban air mobility (Supernal, LLC).
- **(2020-2022)** Designed, developed, and validated extrinsic calibration algorithms for multiple inertial sensors, eliminating the need for aiding sensors or prescribed trajectories. **Matched or surpassed the baseline** in error, success rate, and runtime ([J1]), with **two orders of magnitude faster** calibration using informative measurement selection ([C4]).
- **(2020-2022)** Contributed to the development of a distributed inertial sensor system for CubeSat applications in a NASA STTR-funded project.

Research Scientist II Intern *North Reading, MA*
Amazon Robotics *May 2025 - Aug 2025*

- Improved ground robot navigation accuracy by **9%** through developing and implementing a multi-IMU calibration and fusion framework, with no hardware modifications required.
- Evaluated learning-based IMU bias estimation methods on ground robots, identified key limitations, and proposed potential improvements for ground robot applications.

Student Researcher *Mountain View, CA*
Google *Sep 2024 - Dec 2024*

- Designed, developed, and validated a visual navigation pipeline using learning-based scene representations and scene understanding, resulting in a patent filing (in progress).

Research Intern *Seongnam, Korea*
NAVER LABS *Feb 2020 - Aug 2020*

- Developed and validated learning-based image retrieval methods within a large-scale outdoor visual navigation pipeline.

Research Intern *Daejeon, Korea*
Intelligent Robotic Autonomy and Perception Laboratory, KAIST *Mar 2018 - Dec 2019*

- Developed and validated depth estimation methods under low-light conditions using stereo infrared cameras, comparing conventional and learning-based approaches.
- Developed and validated a learning-based image retrieval for urban environments under scene changes, leveraging fisheye images and resulting in a publication ([C1]).

Research Intern *Daejeon, Korea*
Electronics and Telecommunications Research Institute (ETRI) *Jan 2019 - Feb 2019*

- Designed and developed robot localization algorithm from 2D LiDAR data with reflective markers as landmarks.

Publications

[**J3**] **Jongwon Lee**, Timothy Bretl. "GSFeatLoc: Visual Localization Using Feature Correspondence on 3D Gaussian Splatting". *IEEE Robotics and Automation Letters* (RA-L), 2025. (Under Review)

[**W2**] Su Yeon Choi, **Jongwon Lee**, Timothy Bretl. "Design and Detection of an Infrared Fiducial Marker". ICRA Workshop on Thermal Infrared in Robotics, 2025.

[**J2**] David Hanley, **Jongwon Lee**, Su Yeon Choi, Timothy Bretl. "The MagPIE2 Dataset: Magnetic Field-Based Mapping, Localization, and SLAM". *IEEE Transactions on Instrumentation and Measurement*, 2025. (Submitted)

[**C4**] **Jongwon Lee**, David Hanley, Timothy Bretl. "Efficient Extrinsic Self-Calibration of Multiple IMUs Using Measurement Subset Selection". *IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS), 2024.

[**C3**] **Jongwon Lee**, Su Yeon Choi, Timothy Bretl. "The Use of Multi-Scale Fiducial Markers to Aid Rotorcraft Navigation". *AIAA SciTech Forum*, 2024.

[**C2**] Su Yeon Choi, **Jongwon Lee**, Timothy Bretl. "The Impact of Adverse Environmental Conditions on Fiducial Marker Detection from Rotorcraft". *AIAA SciTech Forum*, 2024.

[**W1**] **Jongwon Lee**, Su Yeon Choi, David Hanley, and Timothy Bretl. "Comparative Study of Visual SLAM-Based Mobile Robot Localization Using Fiducial Markers". IROS Workshop on Closing the Loop on Localization, 2023.

[**J1**] **Jongwon Lee**, David Hanley, Timothy Bretl. "Extrinsic Calibration of Multiple Inertial Sensors from Arbitrary Trajectories". *IEEE Robotics and Automation Letters* (RA-L), 2022. (Presented at ICRA 2022)

[**C1**] **Jongwon Lee**, Ayoung Kim. "Neural Network-Based Long-Term Place Recognition from Omni-Images". *IEEE International Conference on Ubiquitous Robots* (UR), 2019.

Skills

Programming: Python, C++, MATLAB

Libraries & Frameworks: PyTorch, OpenCV, ROS, Ceres, g2o, SymForce

Tools: Git, Docker, SolidWorks (3D CAD), LaTeX

Awards and Honors

Mavis Future Faculty Fellows Program. *College of Engineering (CoE), UIUC*. 2024 - 2025.

Academic Excellence Award for Class of 2021. *Mechanical Engineering (ME), KAIST*. 2021.

Seong-Bu Kim Creative Activity Initiative Award. *ME, KAIST*. 2021.

The Korean Government Scholarship Program for Study Overseas. *Korean Ministry of Education*. 2020 - 2022.

Engineering Innovation Award. *CoE, KAIST*. 2020.

Travel Grants (ACCV 2018, UR 2019, IROS 2019, CES 2020). *KAIST*.

National Science and Engineering Scholarship. *Korea Student Aid Foundation*. 2014 - 2019.

Dean's List. *CoE, KAIST*. 2014 - 2016, 2019.

Scholarship for Honors Students. *ME, KAIST*. Spring 2019.

Outstanding Achievement Award. *ME, KAIST*. 2014 - 2015, 2018.

Best Instructor Award. *KAIST Science Outreach Program*. 2018.

Bronze Prize, CEE-URP. *Civil and Environmental Engineering, KAIST*. 2018.

Professional Services

Reviewer

- IEEE Transactions on Robotics (*T-RO*). 2024 - Current.
- IEEE Robotics and Automation Letters (*RA-L*). 2024 - Current.
- IEEE Transactions on Instrumentation and Measurement (*TIM*). 2022 - Current.
- IEEE International Conference on Robotics and Automation (*ICRA*). 2022 - Current.

Teaching Assistant

- Autonomous Systems Lab (AE 483). *UIUC*. Fall 2022, Fall 2025.
- Aerospace Control Systems (AE 353). *UIUC*. Spring 2025.

Mentorship

- Geonwoo Kim, ME 497, *UIUC*. Jan 2024 - May 2024.
- Chris Schreiber, Jiho Sim, and Katherine Ruiz, AE 298, *UIUC*. Jan 2024 - May 2024.
- Parth Shrotri and Shivani Atre, AE 298, *UIUC*. Jan 2023 - Dec 2023.
- Pradyun Narkadamilli, ECE 297, *UIUC*. Sep 2022 - Dec 2022.
- Arjun Shah and Varun Sarabudla, PURE, *UIUC*. Sep 2021 - Dec 2021.
- Chaemin Na, CEE-URP, *KAIST*. Jun 2018 - Dec 2018.