

Research Interests

Informative Path Planning, Robotic Decision Making, Multi-agent Systems, Reinforcement Learning

Affiliations

Carnegie Mellon University

Visiting Researcher at Robotics Institute

Supervisor: Sebastian Scherer

Pittsburgh, PA

Aug. 2024 – Present

(Remote: Mar. 2025 – Jul. 2025)

Ulsan National Institute of Science and Technology

M.S. in Artificial Intelligence (GPA: 4.25/4.3)

Advisor: Jeong hwan Jeon

B.S. in Electrical Engineering (GPA: 3.54/4.3, Major: 3.63/4.3)

Ulsan, Korea

Aug. 2023 – Aug. 2026 (exp.)

Feb. 2017 – Aug. 2023

* Including military service, Republic of Korea Army, Feb. 2020 – Sep. 2021

Publications

* indicates equal contribution

Conferences

1. **PIPE Planner: Pathwise Information Gain with Map Predictions for Indoor Robot Exploration**
Seungjae Baek*, Brady Moon*, Seungchan Kim*, Muqing Cao, Cherie Ho, Sebastian Scherer, Jeong hwan Jeon
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2025

[Link]

Journals

1. **Cooperative Multi-Agent Reinforcement Learning for Multiple Anti-Aircraft Target Surveillance**
Kangbeen Lee*, Seungjae Baek*, Philjoon Jung, Tae-Hyun Kim, Jeong hwan Jeon
Journal of the Institute of Control, Robotics and Systems June 2024

[Link]

Preprints & In Preparation

1. **Prior-Constrained Explorative Guidance for Generalization in Diffusion Motion Planning**
Co-author, Under Review at ICRA 2026
2. **Multi-Objective Deep Reinforcement Learning for Eco-Friendly Fleet Rebalancing in Autonomous Mobility-on-Demand Systems**
Co First-author, Under Review at AAMAS 2026
3. **Collaborative Map Prediction and Exploration Framework for Multi-Robot Systems**
Seungchan Kim*, Seungjae Baek* et al, In preparation
4. **Learning Robust Exploration Priors from Expert Demonstrations via Flow Matching**
Seungjae Baek et al, In preparation

Research Experiences

Carnegie Mellon University

Robotics Institute, AirLab

Visiting Researcher (Supervisor: Prof. Sebastian Scherer)

Pittsburgh, PA

Aug. 2024 – Present

(Remote: Mar. 2025 – Jul. 2025)

- Spearheaded the development of **PIPE Planner**, a predictive exploration framework; achieved **10% higher reconstruction quality** and a **zero-failure rate** in benchmarks by integrating deep learning-based map prediction.
- Led the system integration of a full-stack aerial platform; **containerized (Dockerized)** the **SuperOdometry** SLAM framework to ensure real-time performance on resource-constrained onboard computers.

- Successfully demonstrated autonomous aerial inspection capabilities during a high-profile showcase for the **Pittsburgh Steelers organization**, validating system robustness in real-world settings.
- Developing a simulation environment for multi-drone inspection of unstructured construction sites, formulating evaluation metrics for coverage and efficiency.

Ulsan National Institute of Science and Technology
Robotics & Mobility Lab

Ulsan, Korea

Graduate Research Assistant (Advisor: Prof. Jeong hwan Jeon)

Aug. 2023 – Present

- Developed a **CTDE-based cooperative MARL framework** for urban fleet management; achieved scalability from **5 to 100 agents** while substantially reducing **carbon emissions** and maintaining service rates.
- Designed cooperative reinforcement learning algorithms for aerial surveillance, optimizing formation control to **minimize target estimation uncertainty (covariance)**.

Undergraduate Research Assistant

Jul. 2022 – Aug. 2023

- Adapted a centralized training with decentralized execution (CTDE) MARL method to video-game simulations and authored a B.S. thesis.
- Engineered an autonomous race car platform as a team leader; addressed real-world sensor noise and drift, winning **1st place** in a university racing competition.

Teaching & Working Experiences

Ulsan National Institute of Science and Technology

Ulsan, Korea

- ITP117: Introduction to AI Programming II, Head Teaching Assistant
- EEE351: Automatic Control, Student Lecturer

Spring 2024
Fall 2022

Clinomics Inc.

Ulsan, Korea

- Project Based Learning (PBL) Teaching Assistant

Feb. 2023 – Jul. 2023

Achievements

Fellowships

- **Korean Government Scholarship Program for Study Overseas** (USD 150,000)
Government of the Republic of Korea. Funding for first 3 years of PhD.
- **Industrial Innovation Talent Growth Support (Overseas Linkage)** (USD 21,500)
Korea University. Funding for visiting research at Carnegie Mellon University.
- **AI Excellence Global Innovative Leader Education Program** (USD 40,000 incl. tuition)
Sogang University. Funding for visiting research at Carnegie Mellon University.

Aug. 2026 – Aug. 2029 (exp.)
Aug. 2025 – Feb. 2026
Aug. 2024 – Feb. 2025

Scholarships

- **Government-funded Graduate Scholarship (Fully funded)**
Ministry of Science and ICT. 2-year, fully funded for Master's degree.
- **UNIST Academic Performance Scholarship**
Ulsan National Institute of Science and Technology. 4-year, fully funded for undergraduate.

Aug. 2023 – Aug. 2025
Feb. 2017 – Aug. 2023

Awards & Grants

- **IEEE IES SYPA Travel Award (IROS 2025)** (USD 1,500)
IEEE Industrial Electronics Society. Selected for participation in IROS 2025.
- **Undergraduate Research Excellent Poster Session Award**
Department of Electrical Engineering, Ulsan National Institute of Science and Technology

Oct. 2025
Jul. 2023

Skills & Services

Languages: Korean – Native, **English** – Advanced (TOEFL iBT: 106/120)

Programming Languages: C++, Python, MATLAB

Software and Tools: ROS, Gazebo, Git, Docker, CARLA, SUMO, NVIDIA Isaac Sim

Reviewer: *IROS* (2025), *ICRA* (2026), *RA-L*

Misc. & Interests: Marathon, Baseball, General Knowledge (TV Quiz Show Champion)