Seungjae Baek

Last Update: November 2025
seungjab@andrew.cmu.edu
https://seungjaebk.github.io/

Research Interests

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

Affiliations

Carnegie Mellon University — Pittsburgh, PA
Visiting Researcher at Robotics Institute — Aug. 2024 – Present
Supervisor: Sebastian Scherer — *(Remote: Mar. 2025 – Jul. 2025)*

Ulsan National Institute of Science and Technology — Ulsan, Korea
M.S. in Artificial Intelligence (GPA: 4.25/4.3) — Aug. 2023 – Aug. 2026 (exp.)
Advisor: Jeong hwan Jeon
B.S. in Electrical Engineering (GPA: 3.54/4.3, Major: 3.66/4.3) — Feb. 2017 – Aug. 2023*

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

Publications

**** denotes equal contributions.***

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

Research Experiences

Carnegie Mellon University — Pittsburgh, PA
Robotics Institute, AirLab — Aug. 2024 – Present
Visiting Researcher (Supervisor: Prof. Sebastian Scherer) — *(Remote: Mar. 2025 – Jul. 2025)*

- Led 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.
- Leading the system integration of a full-stack aerial platform; **containerized** *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 implementing metrics for coverage and efficiency.

Ulsan National Institute of Science and Technology — Ulsan, Korea
Robotics & Mobility Lab
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 covariance of target estimation up to 50%**.

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 course racing competition.

Teaching & Working Experiences

Ulsan National Institute of Science and Technology — Ulsan, Korea

- ITP117: Introduction to AI Programming II, Head Teaching Assistant — Spring 2024
- EEE351: Automatic Control, Student Lecturer — 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) — Aug. 2026 – Aug. 2029 (exp.)
  Government of the Republic of Korea. Competitive national scholarship intended to support three years of PhD study at selected overseas institutions.
- **Industrial Innovation Talent Growth Support (Overseas Linkage)** (USD 21,500) — Aug. 2025 – Jan. 2026
  Korea University. Funding for visiting research at Carnegie Mellon University.
- **AI Excellence Global Innovative Leader Education Program** (USD 40,000 incl. tuition) — Aug. 2024 – Feb. 2025
  Sogang University. Funding for visiting research at Carnegie Mellon University.

Scholarships

- **Government-funded Graduate Scholarship (Fully funded)** — Aug. 2023 – Aug. 2025
  Ministry of Science and ICT. 2-year, fully funded for Master's degree.
- **UNIST Academic Performance Scholarship** — Feb. 2017 – Aug. 2023
  Ulsan National Institute of Science and Technology. 4-year, fully funded for undergraduate.

Awards & Grants

- **IEEE IES SYPA Travel Award (IROS 2025)** (USD 1,500) — Oct. 2025
  IEEE Industrial Electronics Society. Selected for participation in IROS 2025.
- **Undergraduate Research Excellent Poster Session Award** — Jul. 2023
  Department of Electrical Engineering, Ulsan National Institute of Science and Technology

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)