

## Research Interests

Motion and 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  
Advisor: Jeong hwan Jeon

Ulsan, Korea

Aug. 2023 – Aug. 2026 (exp.)

B.S. in Electrical Engineering  
*Graduated Cum Laude*

Feb. 2017 – Aug. 2023\*

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

## Publications

\* indicates equal contributions.

### Conferences

#### 1. Prior-Constrained Explorative Guidance for Generalization in Diffusion Motion Planning

Sunhwi Kim, Junsu Kim, **Seungjae Baek**, Jungeun Lee, Jaechan Shin, Seongjae Lee, Kyungdon Joo, Jeong hwan Jeon  
*IEEE International Conference on Robotics and Automation (ICRA) 2026*

#### 2. 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. Manuscript of Spatio-temporal based attention Rebalancing for eco-friendly fleet control system

*Co-first author, Under Review at IJCAI 2026*

## Research Experiences

### Carnegie Mellon University

Robotics Institute, AirLab

Visiting Researcher (Supervisor: Prof. Sebastian Scherer)

Pittsburgh, PA

Aug. 2024 – Present

(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**  
**Robotics & Mobility Lab**  
Graduate Research Assistant (Advisor: Prof. Jeong hwan Jeon)

Ulsan, Korea

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

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**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

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### Fellowships

- Korean Government Scholarship Program for Study Overseas** (USD 150,000)  
Government of the Republic of Korea. Competitive national scholarship intended to support three years of PhD study at selected overseas institutions.  
Aug. 2026 – Aug. 2029 (exp.)
- Industrial Innovation Talent Growth Support (Overseas Linkage)** (USD 21,500)  
Korea University. Funding for visiting research at Carnegie Mellon University.  
Aug. 2025 – Jan. 2026
- AI Excellence Global Innovative Leader Education Program** (USD 40,000 incl. tuition)  
Sogang University. Funding for visiting research at Carnegie Mellon University.  
Aug. 2024 – Feb. 2025

### Scholarships

- Government-funded Graduate Scholarship (Fully funded)**  
Ministry of Science and ICT. 2-year, fully funded for Master's degree.  
Aug. 2023 – Aug. 2025
- UNIST Academic Performance Scholarship**  
Ulsan National Institute of Science and Technology. 4-year, fully funded for undergraduate.  
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.  
Oct. 2025
- Undergraduate Research Excellent Poster Session Award**  
Department of Electrical Engineering, Ulsan National Institute of Science and Technology  
Jul. 2023

## Skills & Services

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

**Programming Languages:** C++, Python, MATLAB

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

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

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