

# Curriculum Vitae/Resume

## Joonkyung Kim

Graduate Program in Robotics Ph.D.

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My research focuses on ensuring the safe application of robots seamlessly to real-world scenarios and extending these principles to multi-agent systems. Building on my experience in safe navigation for mobile and multi-robot systems, I am driven to develop algorithms that guarantee robot safety in uncertain environments while promoting cooperative frameworks for multi-agent collaboration. Through my research journey, I am committed to shaping a future where robots integrate effortlessly into complex, unpredictable settings, including human society.

- **Research Interests:** Cooperative Multi-Robot/Agent Systems, Safety Control/Navigation

### Educations

#### Sogang University

- M.S. in Electronic Engineering (Advisor: Prof. Changjoo Nam)
- B.S. in Electronic Engineering (Cum Laude)

Seoul, South Korea

Mar. 2023 – Present

Mar. 2017 – Feb. 2023

#### Carnegie Mellon University

- Visiting Scholar at S3D in School of Computer Science (AI Intensive Education Program)
- Fully funded by the South Korean Government (IITP, Ministry of Science and ICT)

Pittsburgh, United States

Aug. 2024 – Present

### Research Experiences

#### Advanced Agent-Robotics Technology Lab, Carnegie Mellon University

Visiting Scholar

Pittsburgh, United States

Oct. 2024 – Present

- Analyzing potential multi-agent conflicts, including collisions, in Multi-Agent Informative Path Planning (MAIPP) during cooperative information gathering (under the guidance of Dr. Woojun Kim and Prof. Katia Sycara).
- Researching MAIPP adaptability in dynamic environments(e.g., fire scenarios).

#### AI Robotics Lab, Sogang University

Graduate Researcher

Seoul, South Korea

Mar. 2023 – Aug. 2024

- Focused on resolving conflicts and ensuring safety in (decentralized) multi-robot navigation.
- Developed dynamic simulation environments for testing omnidirectional and differential-drive multi-robot navigation using PyBullet ([Video1](#)) and Isaac Sim ([Video2](#)) .
- Implemented interactive simulation environments using PyBullet to control mobile robot navigation modes for collecting human demonstration data.
- Designed and implemented a multi-robot testing system with real robots using ROS2 and TurtleBot4. ([Video1](#)), ([Video2](#))

#### AI Robotics Lab, Sogang University

Undergraduate Intern

Seoul, South Korea

Sep. 2022 – Feb. 2023

- Developed a 3D simulation environment using PyBullet and Gymnasium (formerly OpenAI Gym) to train mobile robots for collision-free navigation in confined spaces with randomly placed obstacles.
- Participated in Pick-and-Place projects with a mobile manipulator, gaining experience with the ROS Navigation Stack. ([Video](#))

#### Machine Decision Intelligence & Learning Lab, KAIST

Undergraduate Visiting Student

Daejeon, South Korea

Jan. 2022 – Feb. 2022

- Participated in an 8-week seminar on Reinforcement Learning (RL), focusing on the mathematical and theoretical foundations of RL algorithms.
- Implemented Reinforcement Learning algorithms (e.g., Q-learning, DQN, DDPG, PPO) using Python and PyTorch.

## Publications

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[PREPRINTS][P]

[P2] **Joonyoung Kim**, Sangjin Park, Wonjong Lee, Woojun Kim, Nakju Doh, and Changjoo Nam, "Escaping Local Minima: Hybrid Artificial Potential Field with Wall-Follower for Decentralized Multi-Robot Navigation," *Under review (ICRA 2025)*, 2024. ([Paper](#)), ([Video](#))

- Developed decentralized multi-robot navigation algorithms, switching between Artificial Potential Field (APF) and Wall-Following (WF) methods in mapless, communication-free environments.
- Proposed adaptive switching methods using 2D-LiDAR to adjust robot navigation, extending APF-WF applicability in dynamic, non-convex environments.
- Proposed a learning-based switching model trained on (human) expert demonstration data to mitigate multi-robot conflicts from symmetric behaviors, even without inter-robot communication.

[P1] Joonyeol Sim, **Joonyoung Kim**, and Changjoo Nam, "Safe Interval RRT\* for Scalable Multi-Robot Path Planning in Continuous Space," *Under revision*, 2024. ([Paper](#))

- Implemented and reconstructed a Graph Transformer-based MAPF (Multi-Agent Path Finding) algorithm as a baseline to demonstrate the scalability of our methods through comparative analysis.
- Developed a dynamic 3D simulation environment in NVIDIA Isaac Sim to evaluate the feasibility of our algorithms on real-like robots, supporting up to 100 omnidirectional robots with dynamic controllers following planned paths. ([Video](#))

[CONFERENCES][C]

[C1] **Joonyoung Kim**, and Changjoo Nam. "Room for me?: Mobile Navigation for Entering a Confined Space Using Deep Reinforcement Learning." in *Proc. of Int. Conf. on Ubiquitous Robots (UR)*, IEEE, 2023. ([Paper](#)), ([Video](#))

- Motivated by the limitations in elevator usage of existing robots, such as reliance on designated boarding points or dedicated elevators.
- Proposed a deep reinforcement learning approach enabling safe navigation without collisions in confined spaces with randomly placed obstacles, such as elevators.

## Scholarships

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### Sogang Scholarship

Funded by Sogang University (graduate program)

Mar. 2023 – Present

## Selected Coursework (Graduate)

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|--|-------------|
| - [CMU   11-785] <i>Introduction to Deep Learning</i> ( <a href="#">Link</a> ) | Fall 2024   |
| - [CMU   11-775] <i>Large Scale Multimedia Analysis</i>                        | Fall 2024   |
| - [CMU   IITP] <i>Natural Language Processing</i>                              | Fall 2024   |
| - [SGU   EEE6600] <i>Intelligent Robotics System</i>                           | Spring 2024 |
| - [SGU   AIE6214] <i>Applied Linear Algebra</i>                                | Fall 2023   |
| - [SGU   EEE6557] <i>Reinforcement Learning</i>                                | Spring 2023 |
| - [SGU   EEE6431] <i>Neural Networks</i>                                       | Spring 2023 |
| - [SGU   EEE6470] <i>Optimization Theory</i>                                   | Spring 2023 |
| - [SGU   EEE5477] <i>Pattern Recognition</i>                                   | Fall 2022   |

## Academic Service & Teaching Assistant

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### Review

- Conference: *ICRA (2025)*

### Teaching Assistant

- [SGU | EEE3141] *Introduction to Control Systems* Spring 2024

## Technical Skills

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

**Experienced Tools (Frameworks):** PyTorch, Gymnasium(Gym), PyBullet, Isaac Sim, ROS2