

Sebin Jung

Graduate Student Researcher, Robotics Institute at Carnegie Mellon University

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RESEARCH INTERESTS

My research focuses on **robot safety, optimal control, and machine learning**. I aim to develop autonomous systems embedded with an intrinsic understanding of **safety** while preserving **high performance**. I envision robots that proactively execute intelligent safe, goal-directed maneuvers to maintain performance under uncertainty.

EDUCATION

Carnegie Mellon University

Master of Science in Mechanical Engineering - Research

May. 2026 (Expected)

Pittsburgh, PA

- Advisors: Dr. Changliu Liu (Robotics Institute), Dr. John Dolan (Robotics Institute)
- GPA: 4.00/4.00

Kyungpook National University

Bachelor of Science in Mechanical Engineering

Feb. 2024

Daegu, South Korea

University of California, Berkeley

Summer Session

Jul. - Aug. 2022

Berkeley, CA

PUBLICATIONS & PREPRINTS

S=SUBMITTED, P=PREPRINT, I=IN PREPARATION

* Equal Contribution

- [I.1.] Maitham F. AL-Sunni*, **Sebin Jung***, Juan Alvarez-Padilla, Changliu Liu, John M. Dolan **LLA-MPPI: Rapidly Adaptive Whole-Body Control for Legged Robots**. Scheduled submission for *IEEE Robotics and Automation Letters (RA-L)*, 2025.
- [S.1.] **Sebin Jung**, Abulikemu Abuduweili, Jiaying Li, Changliu Liu, **Whole-Body Safe Control of Robotic Manipulators with Koopman Neural Dynamics**. Submitted to *2026 IEEE International Conference on Robotics and Automation (ICRA)*, 2025.
- [P.1.] Yifan Sun, Rui Chen, Kai S. Yun, Yikuan Fang, **Sebin Jung**, Feihan Li, Bowei Li, Weiye Zhao, Changliu Liu, **SPARK: A Modular Benchmark for Humanoid Robot Safety**. Submitted to *2025 Robotics: Science and Systems (RSS)*. **Video**, 2025.
- [P.2.] Yifan Sun, Rui Chen, Kai S. Yun, Yikuan Fang, **Sebin Jung**, Weiye Zhao, Changliu Liu, **Safe Humanoid Autonomy and Teleoperation with Safe Set Algorithm**. Extended abstract accepted to *Joint 10th IFAC Symposium on Mechatronic Systems and 14th Symposium on Robotics*, 2025.

HONORS & SCHOLARSHIPS

Outstanding Learner, Hyundai Motor Group,

Feb. 2024

Excellent achievement award for *H-Mobility Class*

1st-Place Award in Graduation Project, Kyungpook National University,

Spring 2023

Best research award for *Capstone Design of Mechanical Engineering Project 1* course

Scholarship Recommended by Dean, Kyungpook National University

2022, Spring 2023

Scholarship of Academic Excellence, Kyungpook National University

Fall 2021 - Spring 2023

RESEARCH EXPERIENCE

Intelligent Control Lab (CMU Robotics Institute)

Oct. 2024 – Present

Advisor: Dr. Changliu Liu

Pittsburgh, PA

- Research on whole-body safe control of robotic manipulators using Koopman neural dynamics[S.1.]
 - Designed unified quadratic programming framework combining safety filter and nominal controller through global linearization of high-dimensional nonlinear dynamics
 - Adversarial fine-tuning of safety index for lifted dynamics
 - Experimental verification on Kinova Gen3 manipulator
- Research on developing toolbox for safe humanoid autonomy and benchmarking[P.1., P.2.]
 - Contributed to SPARK, a modular benchmark for evaluating humanoid safety through standardized metrics, safety filters, and fault-injection environments
 - Studied safety-critical task evaluation, including fall recovery, collision avoidance assessment

DRIVE Lab (CMU Robotics Institute)

Oct. 2024 – Present

Advisor: Dr. John Dolan

Pittsburgh, PA

- Research on whole-body gradient-free adaptive optimal control of quadrupeds in uncertain dynamics using Look-back Look-ahead Adaptive MPPI (LLA-MPPI)[I.1.]
 - LLA module harvesting dynamics models bank and selecting one with least discrepancy from ground truth
 - Combined LLA with MPPI module for sampling-based whole-body optimal control
- Other roles: Lab server manager for compute resource allocation and maintenance

- Research on model-free reinforcement learning for autonomous driving
 - Employed Twin Delayed DDPG (TD3) for control policy learning
 - Designed reward functions incorporating cross-track, heading angle errors inspired by the Stanley controller
 - Experimental validation in industry-level simulation using IPG CarMaker
- Research on autonomous drifting of ground vehicles using reinforcement learning
 - Employed twin SAC algorithms for distinct control policies in lane following and drifting
 - Developed high-level neural decision-making logic that switches driving modes based on road curvature

ACADEMIC PROJECTS

Modern Control and Estimation for Autonomous Robots (24-677 Course Project)

2024, CMU

- Designed advanced control systems for autonomous vehicles and aerial robots using state-space representations
- Implemented full-state feedback and LQR controllers for trajectory tracking and stability under disturbances
- Developed Extended Kalman Filter (EKF) SLAM for localization and mapping with uncertain sensor data
- Applied Model Reference Adaptive Control (MRAC) to enable quadrotor flight under partial actuator failure

Quanser Self-Driving Car Student Competition (Won 4th Place)

2024, ACC

- Student challenge for designing autonomous driving pipeline in urban traffic
- Combined Pure Pursuit and adaptive speed control to minimize lap time
- Integrated YOLOv7 camera perception and LiDAR scan for obstacle and traffic detection

CARLA Tutorial for Korean Students

2023, KNU

- Compiled and documented a complete CARLA simulator guide for new researchers and students
- Structured materials into four sections: installation/execution, scenario implementation, sensor utilization, and basic API usage
- Facilitated accessibility of autonomous driving research for Korean undergraduate students

H-Mobility Class

Jul. 2023 – Feb. 2024

- Completed Hyundai Motor Group's autonomous driving curriculum covering perception, decision-making, control, and communication
- Awarded as an *Outstanding Learner* among national participants

F1Tenth Korea Championship

2023, ICCAS

- Performed SLAM using the Iterative Closest Point (ICP) algorithm
- Optimized global trajectory to minimize lap time and exploit terrain information
- Applied Pure Pursuit control with a finely tuned speed profile for high-speed racing

SKILLS

- **Programming/Tools:** Python, C/C++, Julia, MATLAB, Simulink, Bash, Git, ROS1/2, Docker, CUDA, Creo, $\LaTeX$
- **Libraries:** PyTorch, scikit-learn, NumPy, SciPy, matplotlib, Gazebo, MuJoCo, Pybullet, Webots, CARLA, IPG CarMaker
- **Robots/Hardware:** Unitree Go2, Unitree G1, Kinova, F1Tenth, Jetson, OptiTrack
- **Languages:** Fluent in **English**(TOEFL iBT 112), Native in **Korean**

LEADERSHIP EXPERIENCE

72nd Aviation Maintenance Battalion (ROK Army Aviation Operations Command)

Mar. 2019 - Oct. 2021

Squad Leader, Utility Helicopter Repairman

South Korea

- Sergeant discharged
- Completed Sikorsky UH-60 maintenance engineering and crew training courses
- Participated in maintenance operations of UH-60, KUH-1, wartime condition helicopter maintenance drill

SELECTED COURSES

Carnegie Mellon University

Intermediate Deep Learning (10-617), Provably Safe Robotics (16-883), Optimal Control and Reinforcement Learning (16-745), Modern Control Theory (24-677), Machine Learning and Artificial Intelligence for Engineers (24-787)

Kyungpook National University

Optimization Theory (ELEC 0842), Chassis and Vehicle Dynamics (MECH 0589), System Control (MECH 0482), Mechatronics (MECH 0358), Mechatronics Experiment (MECH 0588), Kinematics & Mechanics of Machinery (MECH 0356), Numerical Analysis (STAT 0452), Dynamics (MECH 0225)