

Kai S. Yun

Legal Name: SirkHoo Yun

Ph.D. Student, Laboratory for Information & Decision Systems (LIDS) at MIT
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RESEARCH INTEREST

My research is focused on **safe and high-performance control** of autonomous robots in the wild.
My methodology encompasses **control theory**, **deep learning**, and their **intersection**.
My vision is to develop a **unified framework** for highly reactive robot controllers in complex, dynamic environments.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA Class of 2030 (Expected)
Doctor of Philosophy in **Mechanical Engineering** 4.00/4.00
Advisor: Dr. Navid Azizan

Carnegie Mellon University, Pittsburgh, PA Class of 2025
Master of Science in **Mechanical Engineering** 4.00/4.00
Advisors: Dr. Changliu Liu, Dr. John M. Dolan
* *ATK-Nick G. Vlahakis Fellowship*, 2024 — 2025
* *Best Master's Research Paper 2025 Commencement Award*

University of California, Berkeley, Berkeley, CA Class of 2023
Bachelor of Science in **Mechanical Engineering** 3.68/4.00
Minor in **Electrical Engineering and Computer Science (EECS)**
Military Service (Leave of Absence, 2019 — 2020)

PUBLICATIONS & PREPRINTS

* Equal Contribution

- [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”. [arxiv.org:2502.03132](#), 2025, [Website](#).
- [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.
- [3] **Kai S. Yun**, Rui Chen, Chase Dunaway, John M. Dolan, Changliu Liu, “Safe Control of Quadruped in Varying Dynamics via Safety Index Adaptation”. Published in 2025 IEEE International Conference on Robotics and Automation (ICRA), [arxiv.org:2409.09882](#), **Oral Presentation** in Atlanta, Georgia, 2025, [Website](#).
- [4] Simin Liu*, **Kai S. Yun***, John M. Dolan, Changliu Liu, “Synthesis and Verification of Robust-Adaptive Safe Controllers”. Published in [European Control Conference \(ECC\)](#), **Oral Presentation** in Stockholm, Sweden, 2024.
- [5] Tianhao Wei, Luca Marzari*, **Kai S. Yun***, Hanjiang Hu*, Peizhi Niu*, Xusheng Luo, Changliu Liu, “ModelVerification.jl: a Comprehensive Toolbox for Formally Verifying Deep Neural Networks”. [arxiv.org:2407.01639](#), 2024, [GitHub](#).
- [6] Jack C. Harms, Ethan M. Grame, **SirkHoo Yun**, Bushra Ahmed, Leah C. O'Brien, James J. O'Brien, “Mass-independent Dunham Analysis of the $[7.7]Y^2\Sigma^+ - X^2\Pi_i$ and $[16.3]A^2\Sigma^- - X^2\Pi_i$ Transitions of Copper Monoxide, CuO”. Published in [Journal of Molecular Spectroscopy](#), 2019.

RESEARCH EXPERIENCE

Laboratory for Information & Decision Systems (MIT) Cambridge, MA
Advisor: Dr. Navid Azizan Jul 2025 — Present

- Research on observation-based safe control theory.
- Research on learning-based robust control of legged robots.

Intelligent Control Lab (Robotics Institute at CMU) Pittsburgh, PA
Advisors: Dr. Changliu Liu, Dr. John M. Dolan Jun 2023 — Jul 2025

- Research on safe humanoid autonomy and toolbox development (Unitree G1 platform) [1, 2].
- Research on adaptive safe controller for quadrupeds in varying dynamics (Unitree Go2 platform) [3].
- Research on algorithm development for synthesizing robust-adaptive safe controllers for robotic systems [4].
- Developed [ModelVerification.jl](#), a Julia library containing state-of-the-art neural network verification algorithms [5].
- Additional Roles: Lab Manager, Lab Safety Coordinator, Robot Manager (Unitree G1, Go2), Server Manager

Hybrid Robotics Lab (Mechanical Engineering at UC Berkeley)

Berkeley, CA

Advisor: Dr. Koushil Sreenath

Aug 2021 — Apr 2022

- Research on *PPO-Worst-Case*, a novel safe reinforcement learning algorithm for worst-case scenarios.
- Developed simulations for legged robots in safety-critical scenarios.

PROFESSIONAL EXPERIENCE

Tesla, Inc.

Palo Alto, CA

Vehicle Dynamics / Software Engineering Intern

May 2022 — Aug 2022

- Developed a correlation framework for comparing subjective vehicle evaluation and objective test data.
- Analyzed vehicle dynamics data to improve the ride, handling, and steering experiences of Models S, 3, and Semitruck.
- Tested Tesla vehicles and competitor vehicles with sensors and robots. Conducted vehicle tests on proving grounds.
- Developed automated ticketing, reporting, and logging systems utilizing internal software and corresponding API.

NeuroCore.ai

Seoul, South Korea

Reinforcement Learning Engineering Intern

Oct 2020 — Jul 2021

- Designed and developed RL training and deployment frameworks, which increased training efficiency by 84%.
- Developed simulators for Supply Chain Management (SCM) tasks for semiconductor manufacturers.
- These are currently deployed in South Korean semiconductor manufacturers, such as SK Hynix.

TEACHING & LEADERSHIP EXPERIENCE

Robotics Institute at CMU

Pittsburgh, PA

Manager/Developer — [RoboticsKnowledgebase](#) (Funded by Google)

Oct 2024 — Present

Teaching Assistant — F1Tenth Autonomous Racing (16.663)

Jan 2025 — May 2025

Research Mentor — [Robotics Institute Summer Scholars \(RISS\)](#)

May 2024 — Aug 2024

Mentee: Chase Dunaway (Undergraduate at New Mexico Tech → Ph.D. at CMU)

Mechanical Engineering Department at CMU

Pittsburgh, PA

Teaching Assistant — Dynamic Systems and Controls (24.352)

Aug 2024 — Dec 2024

Mechanical Engineering Department at UC Berkeley

Berkeley, CA

Teaching Assistant — Statistics and Data Science for Engineers (ENG 178)

Jan 2023 — May 2023

Republic of Korea Army

South Korea

Squad Leader, Sergeant, K-1 Tank Mechanic — Combat Service Support (CSS)

Jan 2019 — Aug 2020

SKILLS

- **Area of expertise:** Humanoids, Quadrupeds, Quadrotors, Safety Index, Control Barrier Function, Control Lyapunov Function, Model Learning, Safe Reinforcement Learning, Optimal Control, Adaptive Control, Polynomial Optimization.
- **Physical Robots/Machines:** Unitree G1, Unitree Go2, Pixhawk Drones, CrazyFlie, Sawyer, F1Tenth, Tanks.
- **Libraries:** PyTorch, TensorFlow, Isaac Sim, Gazebo, OpenAI Gym, PyBullet, Mosek, CasADi, PX4, Ray, Numpy.
- **Programming/OS/Tools:** Python, MATLAB, Julia, C++, ROS, ROS2, Linux, Git, Docker.
- **Other skills:** Jetson, OptiTrack, Vicon, OpenSim, SolidWorks, \LaTeX , Simulink, CAN Bus, MoTeC, Scuba Diving.
- **Languages:** Fluent in English, Korean.

SELECTED COURSES

Carnegie Mellon University

Provably Safe Robotics (16.883), Optimal Control & Reinforcement Learning (16.745), Advanced Control Systems Integration (24.774), Engineering Optimization (24.785), Biomechanics of Human Movement (24.663).

UC Berkeley

Deep Reinforcement Learning (CS 285), Nonlinear Systems (EE C222), Machine Learning (CS 189), Robotic Manipulation & Interaction (EECS C106B), Vehicle Dynamics and Control (ME 131), Dynamic Systems & Feedback (ME 132), Mechatronics Design (ME 102B), Experimentation and Measurements (ME 103).