Kai Yun

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Education

August 2023— Present
Degree: Master of Science in Mechanical Engineering - Research
Institution: Carnegie Mellon University
GPA: 4.00 of 4.00

August 2017— May 2023
Degree: Bachelor of Science in Mechanical Engineering
Institution: University of California, Berkeley
GPA: 3.68 of 4.00
Minor in Electrical Engineering and Computer Science (EECS). Two-year absence for military service in the Republic of Korea Army (2019 - 2020).

Research Positions

June 2023— Present
Lab: Intelligent Control Lab
Interests: Safety-critical control, learning-based control, motion planning
Advisors: Dr. Changliu Liu
Experience:

- Research on robust-adaptive safe controller for uncertain systems.
- Research on learning-based safe controller for drone control.
- Research on motion planning for manipulating moving objects.
- Developed *ModelVerification.jl*, a library for neural network verification.

August 2021— April 2022
Lab: Hybrid Robotics Lab
Interests: Reinforcement learning (RL), path planning, quadruped robots
Advisors: Dr. Koushil Sreenath
Experience:

- Research on worst-case constraint for safe reinforcement learning.
- Path planning algorithm development for A1 quadruped robot.
- Developed quadruped simulation and RL training framework.

Professional Positions

May 2022— August 2022
Company: Tesla, Inc.
Position: Vehicle Dynamics / Sofware Intern
Experience:

- Designed a data correlation framework for vehicle dynamics data.
- Analyzed vehicle dynamics data for Models S, 3, Y, and Semitruck.
- Developed internal ticketing, reporting, and logging tools.

October 2020— July 2021
Company: NeuroCore.ai
Position: Reinforcement Learning Research Intern
Experience:

- Designed and developed the RL training and deployment framework.
- Developed a simulation for Supply Chain Management (SCM) tasks.
- These are currently deployed in Korean semiconductor manufacturers.

Military Service

January 2019— August 2020

Branch: Republic of Korea Army
Position: K-1 Tank Mechanic
Rank: Sergeant
Experience:

- Performed malfunction diagnostics of K-1 tank systems.
- Assisted with logistics at the Control Center of Combat Service Battalion.
- Served as a Squad Leader for a squad of 10 soldiers.

Publications

[1] Simin Liu*, **Kai S. Yun***, John M. Dolan, Changliu Liu, "Synthesis and Verification of Robust-Adaptive Safe Controllers". *arXiv preprint at arxiv.org:2311.00822, 2023*, Accepted at 2024 European Control Conference (ECC), 2024.

[2] 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". Under submission at 2024 International Conference on Computer Aided Verification (CAV), 2024.

[3] 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". *Journal of Molecular Spectroscopy*, 2019.

Projects

- **Extended Kalman Filter (EKF) for Autonomous Racing.** EKF system identification for tire loads and side-slip angles for a lateral stability MPC for the *Indy Autonomous Challenge*.
- **Model-based RL (MBRL) for Trajectory Optimization.** Image-based model-learning using MBRL to locally approximate the linear dynamics and cost function for iterative LQR.
- **Dart-launching Robot.** Track dart boards with computer-vision and launch darts using spring-actuated dart-launcher with Sawyer manipulator for bullseye.

Selected Coursework

- **CMU**. Provably Safe Robotics *(16.883)*, Optimal Control & Reinforcement Learning *(16.745)*, Advanced Control Systems Integration *(24.774)*.
- **Berkeley**. Deep Reinforcement Learning *(CS 285)*, Nonlinear Systems *(EE C222)*, Machine Learning *(CS 189)*, Robotic Manipulation & Interaction *(EECS C106B)*, Introduction to Robotics *(EECS C106A)*, Vehicle Dynamics and Control *(ME 131)*, Dynamic Systems & Feedback *(ME 132)*, Mechatronics Design *(ME 102B)*, Experimentation and Measurements *(ME 103)*.

Teaching & Mentorship

- **CMU:** Graduate Research Mentor for Robotics Institute Summer Scholars (RISS) program (2024).
- **Berkeley:** TA for Undergraduate Statistics and Data Science for Engineers (2023).

Skills

- **Area of expertise:** safety, nonlinear controls, reinforcement learning, differential constraints, uncertain models, adaptive and robust methods, trajectory optimization, quadrotors.
- **Libraries:** PyTorch, TensorFlow, PyBullet, Gazebo, OpenAI Gym, PX4, Ray, Numpy, Pandas.
- **Programming:** Python, MATLAB, Julia, C++.
- **Languages:** Fluent in English, Korean.
- **Physical Robots/Machines:** Sawyer, Kinova, PX4 Autopilot Quadrotor, CrazyFlie, Tanks.
- **Other skills:** ROS, Git, SolidWorks, LaTeX, Linux, Simulink, CAN Bus, MoTeC.