

Yuwei Wu

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RESEARCH OVERVIEW

My research aims to push the fundamental limits of optimization to improve system robustness and provide long-horizon guarantees for next-generation robots capable of intelligent decision-making. Key areas of my work include:

- (Multi-agent) Task and motion planning
- (Learning-enabled) Trajectory generation and optimization
- Robot applications (exploration, tracking, navigation, foundation models)

EDUCATION

University of Pennsylvania

Ph.D. in Electrical and Systems Engineering

M.S.E. in Systems Engineering

Adviser: Vijay Kumar

Philadelphia, PA

May 2022 - Present

Sep 2019 - May 2022

Beijing Jiaotong University

B.E. Transportation Engineering

Beijing, China

Sep 2015 - Jun 2019

The Hong Kong Polytechnic University

Exchange Program in Industrial and Systems Engineering

Hong Kong, China

Sep 2018 - Dec 2018

PUBLICATIONS

Journals

* co-first authors

- [1]. **Yuwei Wu**, Igor Spasojevic, Pratik Chaudhari, Vijay Kumar, “Towards Optimizing a Convex Cover of Collision-Free Space for Trajectory Generation”, in IEEE Robotics and Automation Letters, vol. 10, no. 5, pp. 4762-4769, May 2025, [[paper](#)] [[video](#)], present at [2025 GRASP Lab Summit](#)
- [2]. **Yuwei Wu**, Xiatao Sun, Igor Spasojevic and Vijay Kumar, “Deep Learning for Optimization of Trajectories for Quadrotors,” in IEEE Robotics and Automation Letters (RA-L), vol. 9, no. 3, pp. 2479-2486, March 2024, [[paper](#)] [[video](#)], present at IEEE ICRA@40
- [3]. Zhichao Han*, **Yuwei Wu***, Tong Li, Lu Zhang, Liuao Pei, Long Xu, Chengyang Li et al. “An efficient spatial-temporal trajectory planner for autonomous vehicles in unstructured environments.” in IEEE Transactions on Intelligent Transportation Systems (T-ITS), vol. 25, no. 2, pp. 1797-1814, Feb. 2024 [[paper](#)] [[video](#)]
- [4]. Ankit Prabhu, Xu Liu, Igor Spasojevic, **Yuwei Wu**, Yifei Shao, Dexter Ong, Jiuzhou Lei, Patrick Corey Green, Pratik Chaudhari, Vijay Kumar, “UAVs for forestry: Metric-semantic mapping and diameter estimation with autonomous aerial robots.” Mechanical Systems and Signal Processing 208 (2024): 111050 [[paper](#)]
- [5]. **Yuwei Wu**, Ziming Ding, Chao Xu and Fei Gao, “External Forces Resilient Safe Motion Planning for Quadrotor,” in IEEE Robotics and Automation Letters (RA-L), vol. 6, no. 4, pp. 8506-8513, Oct. 2021 [[paper](#)] [[video](#)]

Conferences

- [1]. Zhehui Huang, Guangyao Shi, **Yuwei Wu**, Vijay Kumar, and Gaurav S. Sukhatme. “Compositional Coordination for Multi-Robot Teams with Large Language Models,” 2025 IEEE International Symposium on Multi-Robot & Multi-Agent Systems [[preprint](#)]
- [2]. **Yuwei Wu**, Yuezhan Tao, Peihan Li, Guangyao Shi, Gaurav S. Sukhatme, Vijay Kumar, Lifeng Zhou, “Hierarchical LLMs In-the-Loop Optimization for Real-Time Multi-Robot Target Tracking Under Unknown Hazards,” 2025 IEEE International Symposium on Multi-Robot & Multi-Agent Systems [[preprint](#)]
- [3]. Peihan Li, **Yuwei Wu**, Jiazen Liu, Gaurav S. Sukhatme, Vijay Kumar, Lifeng Zhou, “Resilient Multi-Robot Target Tracking with Sensing and Communication Danger Zones,” 2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (**Best Paper Award Finalist**) [[preprint](#)] [[video](#)]

- [4]. Songhao Huang*, **Yuwei Wu***, Yuezhan Tao, Vijay Kumar, “Safe Interval Motion Planning for Quadrotors in Dynamic Environments,” 2025 IEEE International Conference on Robotics and Automation (ICRA), pp. 2780-2786. IEEE, 2025. [\[paper\]](#) [\[video\]](#)
- [5]. Anish Bhattacharya, Nishanth Rao, Dhruv Parikh, Pratik Kunapuli, **Yuwei Wu**, Yuezhan Tao, Nikolai Matni, Vijay Kumar, ”Vision Transformers for End-to-End Vision-Based Quadrotor Obstacle Avoidance,” 2025 IEEE International Conference on Robotics and Automation (ICRA), Atlanta, GA, USA, 2025, pp. 1-8 [\[paper\]](#)
- [6]. **Yuwei Wu**, Yuezhan Tao, Igor Spasojevic, and Vijay Kumar. “Trajectory Optimization with Global Yaw Parameterization for Field-of-View Constrained Autonomous Flight,” 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Abu Dhabi, United Arab Emirates, 2024, pp. 10590-10596 (**Selected Oral Presentation**)[\[paper\]](#) [\[preprint\]](#) [\[video\]](#)
- [7]. Jiazen Li, Peihan Li, **Yuwei Wu**, Gaurav S. Sukhatme, Vijay Kumar, Lifeng Zhou. “Multi-Robot Target Tracking with Sensing and Communication Danger Zones,” 2024 International Symposium on Distributed Autonomous Robotic Systems (**Best Paper Nomination**) [\[preprint\]](#) [\[video\]](#)
- [8]. Yifei Simon Shao*, **Yuwei Wu***, Laura Jarin-Lipschitz*, Pratik Chaudhari, Vijay Kumar, “Design and Evaluation of Motion Planners for Quadrotors with Varying Complexities,” 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, 2024, pp. 10033-10039 [\[paper\]](#) [\[preprint\]](#) [\[video\]](#)
- [9]. Yuezhan Tao, **Yuwei Wu**, Beiming Li, Fernando Cladera, Alex Zhou, Dinesh Thakur, Vijay Kumar, “SEER: Safe Efficient Exploration for Aerial Robots using Learning to Predict Information Gain,” 2023 IEEE International Conference on Robotics and Automation (ICRA), London, United Kingdom, 2023, pp. 1235-1241 [\[paper\]](#) [\[preprint\]](#) [\[video\]](#)

Preprints

- [1]. Xiaofan Yu, **Yuwei Wu**, Katherine Mao, Ye Tian, Vijay Kumar, Tajana Rosing. “DroneFL: Federated Learning for Multi-UAV Visual Target Tracking,” 2025 [\[preprint\]](#)
- [2]. Songhao Huang*, **Yuwei Wu***, Guangyao Shi, Gaurav S. Sukhatme, and Vijay Kumar. “SPAR: Scalable LLM-based PDDL Domain Generation for Aerial Robotics,” 2025 [\[preprint\]](#)
- [3]. Xiatao Sun, **Yuwei Wu**, Subhrajit Bhattacharya, Vijay Kumar, “Multi-Agent Exploration of an Unknown Sparse Landmark Complex via Deep Reinforcement Learning,” 2022 [\[preprint\]](#)
- [4]. Xingguang Zhong, **Yuwei Wu**, Dong Wang, Qianhao Wang, Chao Xu, Fei Gao, “Generating Large Convex Polytopes Directly on Point Clouds,” 2020 [\[preprint\]](#)

Workshops and Posters

- [1]. **Yuwei Wu**, Igor Spasojevic, Pratik Chaudhari, Vijay Kumar, Optimal Convex Cover as Collision-free Space Approximation for Trajectory Generation, WAFR 2024 [\[poster\]](#)
- [2]. Jiazen Liu, Peihan Li, **Yuwei Wu**, Vijay Kumar, Lifeng Zhou, Risk-Aware Multi-Robot Target Tracking with Dangerous Zones, 2023 IROS IPPC Workshop
- [3]. Peihan Li, Jiazen Liu, **Yuwei Wu**, Vijay Kumar, Lifeng Zhou, Resilient multi-robot target tracking with dangerous zones, 2023 IROS Workshop: Robotics for Climate Resiliency
- [4]. Fernando Cladera*, **Yuwei Wu***, Xu Liu, Yuezhan Tao, Ian D. Miller, Camillo Jose Taylor, Vijay Kumar, Open Source Tools for Deployment of GPS-Denied Autonomous UAVs in Real-World Application, ICRA 2023 Workshop Lab-to-Real Gap [\[abstract\]](#)

Talks

- [1]. *Building Resilient and Efficient Robot Autonomy* Sep 2025
RGSO - CARS Seminar, University of Delaware [\[abstract\]](#)
- [2]. *Real-Time Spatiotemporal Motion Planning for Autonomous Robots* Mar 2025
ESE PhD Colloquium, University of Pennsylvania [\[abstract\]](#)
- [3]. *Learning Optimal Trajectories for Quadrotors* Jan 2024
Invited Talk, Nikolai Matni Group, University of Pennsylvania

EXPERIENCE

Teaching Assistant

School of Engineering and Applied Science, University of Pennsylvania

Jul 2020 - May 2024

- MEAM 620: Advanced Robotics (Spring 2022, 2023, 2024), design final projects with local motion planners for quadrotors using replanning strategies.
- ESE 542: Statistics for Data Science (Fall 2021).
- MEAM 520: Introduction to Robotics (Summer 2020, Fall 2025), with a focus on manipulator.

Graduate Research Assistant

Kumar Lab, GRASP, University of Pennsylvania

Aug 2021 – May 2022

- Work on motion planning for heterogeneous swarms in the dense environment, and multi-agent planning framework with coordination localization and drift elimination using semantic information.

Field Autonomous System & Computing Lab (FAST), Zhejiang University

Jul 2020 – Aug 2021

- Implemented a sum-of-squares trajectory optimization for quadrotors based on the application of safe flight corridors directly generated on point clouds.
- Proposed a systematic (re)planning framework that considers estimated external forces on quadrotors. Developed an online nonlinear model predictive control with safe ellipsoid boundaries constrained in a safe flight corridor to enforce reliable obstacle avoidance.
- Research on whole-body safe trajectory generation for autonomous vehicles in the urban traffic environment. The back-end optimization is based on a differential-flat system while encoding dynamic obstacle avoidance with surrounding vehicles.

Algorithm Engineer Intern

Dec 2018 - Apr 2019

UISEE Technology (Beijing) Ltd

- Improved a multiple objects assignment algorithm for tracking trajectories
- Developed an evaluation tool for the performance of different MOT methods with leak detection on daily logs
- Implemented feature analysis on point cloud to repair errors on parameters and keep consistency of object IDs

PROFESSIONAL ACTIVITIES

Academic Service

- Session Chair:
 - * INFORMS Annual Meeting: Invited session on Intelligent and Safe Autonomy for Aerial Systems under the Air Transportation Section (ATS) track. [\[website\]](#) 2025
- Workshop Organizers:
 - * Robotics: Science and Systems (RSS): 1st Workshop on Leveraging Implicit Methods for Aerial Autonomy. [\[website\]](#) 2025
- Journals Reviews:
 - * Autonomous Robots 2025 -
 - * Journal of Field Robotics 2025 -
 - * IEEE Transactions on Vehicular Technology (T-VT) 2025 -
 - * The Journal of Supercomputing 2025 -
 - * The Journal of the Astronautical Sciences 2025 -
 - * IEEE Transactions on Robotics (T-RO) 2024 -
 - * IEEE Transactions on Automation Science and Engineering (T-ASE) 2024 -
 - * IEEE Robotics and Automation Letters (RA-L) 2022 -
- Conference Reviews:
 - * Robotics: Science and Systems (RSS) 2025 -
 - * IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024 -
 - * IEEE International Conference on Robotics and Automation (ICRA) 2023 -

Public Service

- Gave a talk on “Flying Robot Swarms” at Roxborough Library

Apr 2025

- Gave a talk on “How robots find their way” at Roxborough Library “Fun With Robots” program Apr 2024
- Judge for VEX Robotics Competition Feb 2020
- Assistant referee in 2nd World Robot Conference Aug 2018

Department Service

- Leader of ESE PhD Association Aug 2023 -
- Multi-robot Planning Demo Experiments for ICRA 2022 GRASP Lab Tour May 2022
- Kumar Lab Demo for PhD Open House GRASP at PERCH Tour Mar 2022

MENTORING

Graduate Student

Jinyuan Zhang, ROBO MSE, UPenn Jun 2025 -

- (Ongoing) Research on “Adaptive Multi-Robot Formation Planning in Constrained Environments”

Songhao Huang, MEAM MSE, UPenn → Ph.D, The Hong Kong Polytechnic University Oct 2023 - Jul 2025

- Dynamic obstacle avoidance project with a paper titled ”Safe Interval Motion Planning for Quadrotors in Dynamic Environments” published at ICRA 2025.

Xiatao Sun, ROBO MSE, UPenn → Ph.D, Yale University May 2022 - Aug 2023

- Master Thesis on “Imitation Learning for Autonomous Quadrotor Flight”
- Learning trajectory with optimization layers with a paper titled “Deep Learning for Optimization of Trajectories for Quadrotors” published at RA-L.
- Research on “Multi-Agent Exploration of an Unknown Sparse Landmark Complex via Deep Reinforcement Learning”.

HONORS AND AWARDS

Oral Highlights at the ICRA 2025 Doctoral Consortium	2025
The Dean’s Fellowship	2022
Outstanding Undergraduate Student (<i>by Beijing Jiaotong University</i>)	2019
Honorable Mention of 2018 Mathematical Contest in Modeling	2018
Science Innovative Talent (<i>by Beijing Jiaotong University</i>)	2018
First Prize of the 10th Undergraduate Physical Experiment Competition of Beijing	2017
Second Prize of the 8th China Undergraduate Physicists’ Tournament	2017
Second Prize of the 7th Transportation Technique Competition of Beijing	2017
First Prize of the 8th Undergraduate Mathematics Competition of China	2016
First Prize of the 33rd Undergraduate Physical Competition in China	2016