

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.

Specifically, I focus on motion planning and trajectory optimization for mobile robots operating in dynamic, uncertain, and complex real-world environments. Key areas of my work include:

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

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**, Xiaotao 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]. Han, Zhichao*, **Yuwei Wu***, Tong Li, Lu Zhang, Liuaopai, 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**, Yuezhao 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**, Jiazhen 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. [[preprint](#)] [[video](#)]
- [5]. **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 [[paper](#)] [[preprint](#)] [[video](#)]
- [6]. Jiazhen 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](#)]
- [7]. 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](#)]
- [8]. 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]. Jiazhen 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, Jiazhen 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 auto-graders and final projects with local motion planners using replanning strategies.
- ESE 542: Statistics for Data Science (Fall 2021).
- MEAM 520: Introduction to Robotics (Summer 2020). Extended my final project about Lynx robot arm motion planning and simulation on ROS/Gazebo, and set up for virtual lab.

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

UISEE Technology (Beijing) Ltd

Dec 2018 - Apr 2019

- 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

- 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

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| 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 |