Yuwei Wu

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RESEARCH OVERVIEW

My research focuses on motion planning and trajectory optimization for mobile robots, particularly in dynamic, uncertain, and complex real-world environments.

Specifically, my work explores the following areas:

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

EDUCATION

University of Pennsylvania — Philadelphia, PA
Ph.D. in Electrical and Systems Engineering — *May 2022 - Present*
M.S.E. in Systems Engineering — *Sep 2019 - May 2022*
Adviser: Vijay Kumar

Beijing Jiaotong University — Beijing, China
B.E. Transportation Engineering — *Sep 2015 - Jun 2019*

The Hong Kong Polytechnic University — Hong Kong, China
Exchange Program in Industrial and Systems Engineering — *Sep 2018 - Dec 2018*

PUBLICATIONS

Journals

[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 (RA-L), 2025, to appear [preprint]

[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]

[3]. Han, Zhichao*, **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]

[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]

Conferences

[1]. 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) (to appear) [preprint]

[2]. **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]

[3]. 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]

[4]. 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]

[5]. 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]

Preprints

[1]. **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, 2024 [preprint]

[2]. Peihan Li, **Yuwei Wu**, Jiazhen Liu, Gaurav S Sukhatme, Vijay Kumar, Lifeng Zhou, Resilient and Adaptive Replanning for Multi-Robot Target Tracking with Sensing and Communication Danger Zones, 2024 [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

[1]. Jiazhen Liu, Peihan Li, **Yuwei Wu**, Vijay Kumar, Lifeng Zhou, Risk-Aware Multi-Robot Target Tracking with Dangerous Zones, 2023 IROS IPPC Workshop

[2]. 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

[3]. Fernando Cladera*, **Yuwei Wu***, Xu Liu, Yuezhan Tao, Ian D Miller, CJ Taylor, Vijay Kumar, Open Source Tools for Deployment of GPS-Denied Autonomous UAVs in Real-World Application, ICRA 2023 Workshop Lab-to-Real Gap

* co-first authors

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

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

Reviewers

- Review 30+ papers on T-RO, T-ASE, T-VT, RA-L, RSS, ICRA, IROS *2022 -*

Public Service

- 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 2021 GRASP Lab Tour *May 2022*
- Kumar Group Demo - PhD Open House GRASP at PERCH Tour *Mar 2022*

MENTORING

Graduate Student

Songhao Huang, University of Pennsylvania, MEAM MSE *Oct 2023 -*

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

Xiatao Sun, University of Pennsylvania, ROBO MSE *May 2022 - Aug 2023*

- 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

Outstanding Undergraduate Student (*by Beijing Jiaotong University*)	2019
Honorable Mention of 2018 Mathematical Contest in Modeling	2018
Science Innovative Talent (*by Beijing Jiaotong University*)	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