Yuhan Zhao

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EDUCATION

New York University — New York, NY
Ph.D. Candidate in Electrical and Computer Engineering (ECE) — *Sept. 2019 - Jun. 2024 (Expected)*
Advisor: Quanyan Zhu | GPA: 3.95/4.00

University of Pennsylvania — Philadelphia, PA
Robotics Master of Science in Engineering (GRASP Lab) — *Sept. 2017 - Jun. 2019*
Advisor: Michael Posa | GPA: 3.95/4.00

Beijing Institute of Technology — Beijing, China
Bachelor of Science in Automation — *Sept2013 - Jun. 2017*
Advisor: Hongbin Ma | GPA: 3.93/4.00

Research Interests: Control, learning, and optimization in robotics, task planning and decision-making in autonomous and multi-robot systems

PUBLICATIONS

[1] **Y. Zhao** and Q. Zhu, "Stackelberg Meta-Learning for Strategic Guidance in Multi-Robot Trajectory Planning," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023*.

[2] **Y. Zhao** and Q. Zhu, "Stackelberg Meta-Learning Based Control for Guided Cooperative LQG Systems," *accepted by IFAC World Congress 2023.*

[3] **Y. Zhao**, B. Huang, J. Yu, and Q. Zhu, "Stackelberg Strategic Guidance for Heterogeneous Robots Collaboration," *2022 International Conference on Robotics and Automation (ICRA)*, 2022.

[4] T. Li, **Y. Zhao**, and Q. Zhu, "The Role of Information Structures in Game-Theoretic Multi-Agent Learning," *Annual Reviews in Control*, 2022.

[5] **Y. Zhao** and Q. Zhu, "Distributed and Resilient Planning-Control for Optimal LEO Satellite Constellation Coverage," *American Control Conference (ACC)*, 2022.

[6] S. Liu, **Y. Zhao**, and Q. Zhu, "Understanding the Interplay Between Herd Behaviors and Epidemic Spreading Using Federated Evolutionary Games," *American Control Conference (ACC)*, 2022.

[7] S. Liu, **Y. Zhao**, and Q. Zhu, "Herd Behaviors in Epidemics: A Dynamics-Coupled Evolutionary Games Approach," *Dynamic Games and Applications*, 2022.

[8] **Y. Zhao**, Y. Ge, and Q. Zhu, "Combating Ransomware in Internet of Things: A Games-in-Games Approach for Cross-Layer Cyber Defense and Security Investment," *International Conference on Decision and Game Theory for Security (GameSec)*, 2021.

[9] **Y. Zhao** and Q. Zhu, "Combating Online Counterfeits: A Game-Theoretic Analysis of Cyber Supply Chain Ecosystem," *International Conference on Decision and Game Theory for Security (GameSec)*, 2020.

Under Review

[10] **Y. Zhao**, J. Chen, and Q. Zhu, "Integrated Cyber-Physical Resiliency for Power Grids under IoT-Enabled Dynamic Botnet Attacks," *IEEE Transactions on Control Systems Technology*.

[11] **Y. Zhao** and Q. Zhu, "Autonomous and Resilient Control for Optimal LEO Satellite Constellation Coverage Against Space Threats," *IEEE Transactions on Control Systems Technology*.

RESEARCH EXPERIENCE

Meta-Learning in Multi-Robot Collaborative Task Planning [1,2] — New York University
Laboratory for Agile and Resilient Complex Systems, Prof. Quanyan Zhu — *Jul. 2022 - Present*

- Developed a generalized agent behavioral model to characterize different types of collaborative interactions in multi-robot teaming and trajectory guidance problems
- Designed adaptation algorithms that use a small amount of training data to generate the customized collaborative strategy for any specific type of collaboration task between robots based on the generalized model
- Reduced training data usage for learning collaborative strategies compared to supervised learning approaches

Heterogeneous Robots Collaboration for Multi-Object Rearrangement [3] New York University

Laboratory for Agile and Resilient Complex Systems, Prof. Quanyan Zhu *Jul. 2021 – Sept. 2021*

- Established a receding-horizon planning framework for two heterogeneous robotic arms to accomplish multi-object rearrangement tasks in smart warehouses using stochastic Stackelberg games
- Developed algorithms to find real-time and feedback collaboration strategies for moving objects using dynamic programming and mixed integer linear programming
- Built a simulation platform for evaluation and proved the algorithm is robust to random robot failure

Distributed Multi-Satellite Coverage Control in Adversarial Environments [5] New York University

Laboratory for Agile and Resilient Complex Systems, Prof. Quanyan Zhu *Jul. 2021 - Feb. 2022*

- Established a game-theoretic control framework for guiding multiple satellites to provide maximum coverage service to the earth ground
- Developed distributed planning algorithms and MPC control strategies to achieve resilient coverage control in different adversarial space environments such as space debris and satellite collisions
- Paper under review for IEEE Transactions on Control Systems Technology

Security Design in Industrial IoT and Cyber Supply Chains [8,9] New York University

Laboratory for Agile and Resilient Complex Systems, Prof. Quanyan Zhu *Jan. 2020 - Sept.2021*

- Assessed and simulated adversarial ransomware attacks in industrial IoT networks using Markov games
- Developed ransom-payment strategy to mitigate existing attack loss and security-investment strategy to prevent potential cyber attacks
- Modeled counterfeit attacks in the cyber supply chain ecosystem with nested Stackelberg games
- Analyzed market loss under counterfeit attacks and consumer behavioral factors that exacerbate counterfeits

Optimization for Robot Trajectory Planning with Contact University of Pennsylvania

Dynamic Autonomy and Intelligent Robotics Lab, Prof. Michael Posa *May. 2018 - Apr. 2019*

- Established an optimization-based model for robot trajectory planning with contact such as robot gait planning
- Developed planning algorithms using penalty methods and mixed integer quadratic programming to find heuristic and local optimal trajectories that outperform brute-force solutions (globally optimal) in computational time

HONORS AND AWARDS

- ACC 2022 Student Travel Grant — National Science Foundation, 2022
- Dean's Scholarship — New York University, 2019-2020
- Outstanding Graduate Representative — Beijing Institute of Technology, 2017
- Scholarship for Academic Excellence (Top 5%) — Beijing Institute of Technology, 2017

PROFESSIONAL ACTIVITIES

Conference/Journal Peer Reviewer

- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- IEEE Conference on Decision and Control (CDC)
- IEEE Conference on Control Technology and Applications (CCTA)
- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Aerospace and Electronic Systems
- Annual Reviews in Control
- Nonlinear Dynamics

TECHNICAL SKILLS

Programming: Python, MATLAB, C/C++, Julia

Research Software: PyTorch, ROS, PyBullet, Gurobi, IPOPT, CVX, LaTeX, Linux