John Z. Zhang

ROBOTICS · OPTIMIZATION · CONTROL

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Summary

I am a second-year Master's student in Robotics at Carnegie Mellon University, advised by Professor Zachary Manchester. My research focuses on principled algorithms that enable intelligent robot behavior and decision-making capabilities. My expertise lies in numerical optimization, deep learning, and control. **I am currently applying for Ph.D. programs in Mechanical Engineering, Robotics, and Computer Science.**

Education

Carnegie Mellon University
Pittsburgh, PA

M.S. IN ROBOTICS

Aug. 2022 - Aug. 2024 (expected)

- Model-Predictive Control, Motion Imitation, Numerical Optimization
- Advisor: Dr. Zachary Manchester
- Thesis Title: (Tentative) Toward Generalized Legged Agility
- GPA: 4.0/4.0

Georgia Institute of Technology
Atlanta, GA

B.S. IN MECHANICAL ENGINEERING

Aug. 2018 - May. 2022

- Multi-Agent Communication, Trajectory Optimization through Contact
- Advisors: Dr. Matthew Gombolay, Dr. Ye Zhao
- Highest Honors, GPA:3.9/4.0, Minor in Computer Science

Academic Experience

Robotic Exploration Lab, Carnegie Mellon University
Pittsburgh, PA

GRADUATE RESEARCH ASSISTANT

Aug. 2022 - present

- Motion imitation from monocular videos for legged robots
- Fast motion planning and state estimation through contact for legged robots
- GPU-accelerated Quadratic Programming solver for model-predictive control

C.O.R.E. Robotics Lab, Georgia Institute of Technology
Atlanta, GA

RESEARCH SCIENTIST

May. 2022 - Aug. 2022

- Developed novel deep graphical neural network architecture for end-to-end Multi-Agent Reinforcement Learning (MARL) of communication policies among heterogeneous agents in collaborative teams
- Our algorithm outperformed state-of-the-art benchmarks in multiple partially observable multi-agent domains, including predator-prey, predator capture, and StarCraft Multi-Agent Challenge

C.O.R.E. Robotics Lab, Georgia Institute of Technology
Atlanta, GA

UNDERGRADUATE RESEARCH ASSISTANT

Jan. 2021 - May. 2022

- Developed Neural Network-based Model Predictive Controller for high dimensional dynamics systems
- Empirically validated both meta-active learning and model predictive control algorithms on a physical RC quad-copter

L.I.D.A.R. Lab, Georgia Institute of Technology
Atlanta, GA

UNDERGRADUATE RESEARCH ASSISTANT

Aug. 2019 - Dec. 2021

- Developed novel algorithms for trajectory optimization through contact under uncertainty
- Demonstrated trade-off between trajectory robustness and feasibility in a robust optimal control problem with intermittent contact

School of Mechanical Engineering, Georgia Institute of Technology
Atlanta, GA

TEACHING ASSISTANT

Aug 2020 - May 2021

- Course: ME 3017 System Dynamics. Fall 2020 and Spring 2021
- Served as head TA for two semesters during COVID. Responsibility included: holding weekly office hours, grading homework and exams, writing exams, and handling course logistics

Industry Experience

Dynamic Systems and Controls Team, Cummins Inc.
Columbus, IN

SOFTWARE ENGINEERING INTERN

May. 2021 - Aug. 2021

- Developed *Kalman Filter* and *Gaussian Process Regression* algorithms for online vehicle acceleration estimation
- Implemented my estimation algorithm in the existing vehicle framework
- Successfully tested the new controls framework on vehicle and demonstrated improved acceleration performance
- Presented internship project entitled *Novel Methods for Online Acceleration Filtering and Estimation*

Publications

2023   **ReLU-QP: A GPU-Accelerated Quadratic Programming Solver for Model-Predictive Control**, Arun Bishop*, **John Zhang***, Swaminathan Gurumurthy, Kevin Tracy, Zachary Manchester.(*equal contribution). under review at ICRA

2023   **SLoMo: A General System for Legged Robot Motion Imitation from Casual Videos**, **John Zhang**, Shuo Yang, Gengshan Yang, Arun Bishop, Swaminathan Gurumurthy, Deva Ramanan, Zachary Manchester. IEEE Robotics and Automation Letters. To be presented at ICRA 2024.   *Yokohama, Japan*

2023   **PPR: Physically Plausible Reconstruction from Monocular Videos**, Gengshan Yang, Shuo Yang, **John Zhang**, Zachary Manchester, Deva Ramanan. IEEE Internation Conference on Computer Vision (oral)   *Paris, France*

2023   **Robust Low-Drift Multi-Sensor Visual-Inertial-Leg Odometry for Legged Robots**, Shuo Yang, Zixin Zhang, Ibrahima Sow, **John Zhang**, Zachary Manchester. under review at T-RO

2023   **Fast Contact-Implicit Model-Predictive Control**, Simon LeCleac'h*, Taylor Howell*, Shuo Yang, Chiyen Lee, **John Zhang**, Arun Bishop, Mac Schwager, Zachary Manchester. IEEE Transactions on Robotics

2023   **Heterogeneous Policy Networks for Composite Robot Team Communication and Coordination**, Esmaeil Seraj, Rohan Paleja, Luis Pimentel, Kin Man Lee, Zheyuan Wang, Daniel Martin, Matthew Sklar, **John Zhang**, Zahi Kakish, Matthew Gombolay. under review at T-RO

2022   **Mediating between Contact Feasibility and Robustness of Trajectory Optimization through Chance Complementarity Constraints**, Luke Drnach*, **John Zhang***, Ye Zhao (*equal contribution). Frontiers in Robotics and AI

Talks and Presentations

2024   **SLoMo: A General System for Legged Robot Motion Imitation from Casual Videos**, International Conference on Robotics and Automation (ICRA)   *Yokohama, Japan*

2023   **PPR: Physically Plausible Reconstruction from Monocular Videos**, International Conference on Computer Vision (ICCV)   *Paris, France*

2023   **SLoMo: A General System for Legged Robot Motion Imitation from Casual Videos**, Workshop on Model-based Optimization for Robotics   *Online*

2021   **Can Chance-Constrained Contact Uncertainty Quantification Improve Feasibility of Robust Trajectory Optimization?**, Dynamic Walking   *Online*

Honors and Awards

2020   **President's Undergraduate Research Fellowship Award**, Georgia Institute of Technology   *Atlanta, GA*

2018-2021   **Faculty Honors**, Georgia Institute of Technology   *Atlanta, GA*

Academic Services

2023   **Reviewer**, ICRA and RA-L

2022   **Reviewer**, Frontiers in Robotics and AI

Mentoring

Crhis Wu, Now an undergraduate student in Aerospace Engineering at Georgia Tech

Karthik Shaji, Now an undergraduate student in Aerospace Engineering at Georgia Tech

Skills

Programming   Python, MATLAB, Julia, C++, Java

Software Packages   Latex, Git, Linux, SNOPT, ROS, Adobe Illustrator, Torch, TensorFlow, Deep Graph Library, Simulink, MuJoCo, IssacGym

Relevant Courses   Machine learning, Computer Vision, Optimal Control, Rigid Body Dynamics, Robot Learning