Qiushi (George) Zhang

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Education

New York University   **September 2020 - May 2024**

Bachelor of Science Mechanical engineering with minor in robotics

Carnegie Mellon University   **September 2024 - May 2026**

Master of Science in Mechanical Engineering -Research (Current GPA: 4.0)

Publications

EgoPAT3Dv2: Predicting 3D Action Target from 2D Egocentric Vision for Human-Robot Interaction.

Irving Fang,∗ , Yuzhong Chen,∗ , Yifan Wang,∗ , Jianghan Zhang,† , Qiushi Zhang1,† , Jiali Xu1,† , Xibo He ,
Weibo Gao , Hao Su , Yiming Li , Chen Feng

Accepted at IEEE International Conference on Robotics and Automation (**ICRA**), 2024

See Project Website

See Script PDF

Engineering Portfolio

Please see this PDF for visual and more illustrious description of various research and individual projects

Research experience

Carnegie Mellon University – Momentum Robotic Lab: September 2024 – present

Prop Hand – Fully actuated hand for manipulation with proprioception:

- Developed high performance FOC algorithm with up to 20kHz frequency with torque current sensing capabilities (see video)
- Developed General-Momentum-Observer based estimator to compute external torque based only on joint torque/motor current sensing capabilities for proprioceptive perception of contact-rich manipulation (see video)
- Designed and analyzed tendon driven 3DOF dexterous finger/hand to implement joint torque control and proprioceptive estimation

Reflex Exoskeleton – Realistic Force-Feedback lightweight Exoskeleton for contact-rich manipulation data collection:

- Developed fully actuated haptic feedback exoskeleton that adapt to any people's finger length. Each finger possesses 3 DOF of actuated haptic feedback (extendable to 4) for teleoperation and data collection of contact-rich manipulation tasks – device will enable nearly full reconstruction of force experienced by slave robot and proprioceptive state-action data collection integrated with Prop Hand.

New York University - Machine in Motion (MIM) lab: June 2022 - 2024

Differentiable Physics based MPC:

- Developed trajectory optimization algorithm with a Differential Dynamic Programming (DDP) based on a differentiable simulator (Mujoco). The error in end-effector position in a reaching test with Kuka Iiwa robot reaches 1-e-4 m (0.001%) and trajectory is comparable to DDP algorithm with analytical gradient. The goal of this project is to enable model predictive control for manipulation and locomotion tasks involving contacts
  Skillsets: Differential Dynamic programming, Robot kinematics and dynamics, Model Predictive Control, Mujoco simulator

Bilateral teleoperator with precise force feedback:

- Developed a bilateral teleoperator on 3-DOF Tri-finger robot platform that have both trajectory tracking and end-effector force and torque feedback, the teleoperator achieve 3% tracking error ([see this video for demo](#)). Also this project win a 10,000 USD prize in one of the [NYU entrepreneurial competition(team neurobotica)](#).
  Skillsets: robotic kinematics and dynamics, filtering,

Robotic hardware design:
- Developed Custom robotic end-effector for the lab and maintain hardware for Trifinger and Solo12 quadruped for research. Redesigned "Trifinger" robot to enable absolute joint angle sensing without calibration during robot's initialization when turned on. Please see all hardware works in the Engineering Portfolio section
  Skillsets: Fusion360, 3D printing, Embedded systems

New York University - Artificial Intelligence for Civil Engineering (AI4CE) lab:

June 2023 -September 2023

Reactive controller based on egocentric vision for human-robot collaboration:
- Developed position control programming interface for UR10e robot. Also improved human-robot collaboration safety by developing a Differential Dynamic Programming based model predictive controller to make the robot remain in task position while avoiding predicted user hand position. This controller is used as experimental validation of Egocentric action target predictor algorithm developed at the lab. Paper accepted at ICRA 2024 (see publication)
  Skillsets: Robotic kinematics and dynamics (Inverse kinematics, Inverse dynamics, Impedance control), Computer vision, Machine learning, Differential Dynamic Programming, Model Predictive Control

Relevant Courses

Carnegie Mellon University:
Robotics: 16831 Introduction to Robot Learning
Computer vision: 16720 Introduction to Computer Vision, 16824 Visual learning and Recognition, 16831 Introduction to Robot Learning

New York University:
Robotics: Robotic Locomotion and Manipulation, Robot motion and planning, Haptics and telerobotics in medicine, Reinforcement Learning and Optimal Control for robotics, Robot Vision
Math: Calculus, Linear Algebra, Statistics and Probability