Ruoqu Chen

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Education

Tsinghua University *Sept 2022 – Now*
Department of Automation

- Overall GPA: 3.86/4.0 (29/145), Senior GPA: 3.91/4.0
- TOEFL: 102
- **Coursework:** Theory of Automatic Control(4.0), Principles of Artificial Intelligence(4.0), Computer Languages and Programming (4.0), Advanced Python Programming (4.0), Signal and System (4.0), Digital Electronics (4.0), Discrete Mathematics (4.0), Operation Research(4.0)

Publications

UltraDP: Generalizable Carotid Ultrasound Scanning with Force-Aware Diffusion Policy, Website ↗ — Submitted to IROS 2025

Ruoqu Chen, Xiangjie Yan, Kangchen Lv, Gao Huang, Xiang Li

Whole-Body Model Predictive Control for Mobile Manipulation with Task Priority Transition, Website ↗ — Accepted by ICRA 2025

Yushi Wang, *Ruoqu Chen*, Mingguo Zhao

Technical Skills

Developement Languages: Skilled at C++, C, Python, Matlab

Robotics Tools: ROS, ROS2, Moveit, IssacGym, Gazebo

Deep Learning Skills: Pytorch, Familiar with Machine Learning and Deep Learning, including several Deep Learning Frameworks. Familiar with Linux.

Awards

Overall Excellence Scholarship (Top 5%): Department of Automation, Tsinghua University, 2024
Sports Excellence Scholarship: Tsinghua University, 2023
Champion, Women's Orienteering, Short Distance Event, Tsinghua University, 2024
Champion, Orienteering Team Event, Beijing Capital University Sports Games, 2024
Social Work Excellence Scholarship: Tsinghua University, 2023
Tsinghua University Friends – Zhou Huiqi Scholarship: Tsinghua University, 2023, 2024
Honorable Mention (H Award), American Mathematical Modeling Contest (MCM): 2023
Second Prize, Senior Group (NOIP): National Olympiad in Informatics in Provinces, 2018

Research Experience

Research Assistant *IRM-Lab, Tsinghua*
UltraDP: Generalizable Carotid Ultrasound Scanning with Force-Aware Diffusion *University*
Policy *Dec 2024 – Feb 2025*

- Developed a diffusion-based model with multi-modal inputs (ultrasound images, wrist camera images, and force sensor data) to predict both position and desired contact force, enabling autonomous ultrasound scanning with improved generalization across various volunteers, including unseen subjects.
- Implemented a hybrid force-impedance controller to enhance safety in human-robot interaction, ensuring precise tracking of policy-predicted forces and achieving stable, safe scanning behavior compared to baseline methods.
- This work has been submitted to **IROS 2025** , where I am listed first author.

Research Assistant   *Robot Control Lab,*
Whole-Body Model Predictive Control for Mobile Manipulation with Task Priority   *Tsinghua University*
Transition   *July 2024 – Sep 2024*

- ○ Developed a Whole-Body Model Predictive Control (WBMPC) framework to manage task priorities and scheduling in multi-task mobile manipulation scenarios. Integrated task priorities into a unified weight matrix, enabling smooth transitions across tasks in both spatial and temporal dimensions.
- ○ Conducted simulation and real-world experiments to validate the framework, demonstrating improved task execution fluidity and responsiveness compared to baseline methods.
- ○ This work has been accepted by **ICRA 2025** , where I am listed second author. To the best of our knowledge, this work represents one of **the first successful** implementations of **a non-holonomic mobile manipulator opening and traversing through self-closing doors** in real-world conditions.

Research Assistant   *IRM-Lab, Tsinghua*
Planning and Control for Carotid Artery Ultrasound Robots in Clinical Dynamic   *University*
Environments   *Dec 2023 – Dec 2024*

- ○ Utilized point cloud camera for body tracking and detecting obstacles for motion planning. Applied RRT* algorithm for motion planning and obstacle avoidance using the Franka robotic arm.
- ○ Developed communication pipelines between the simulation and the physical robot, enabling smooth execution of planned motions. Implemented impedance control to follow joint and cartesian trajectories.
- ○ Integrated human intention recognition for various situations, including human-intended guidance and obstacle avoidance with stable end-effector contact, tested on multiple volunteers.
- ○ The planning achieved a success rate of over 90% while maintaining an average computation time around 1.2s.

Research Assistant   *Robot Control Lab,*
Reinforcement Learning-Based Humanoid Robot Running Control   *Tsinghua University*
                                                                        Sep 2024 – Present

- ○ Trained the Booster-T1 humanoid robot for standing, walking, and running using RMA and PPO algorithms in the IsaacGym simulation environment, designing reward and penalty functions based on human movement patterns.
- ○ Exploring the integration of physical principles into the robot's locomotion control, aiming to enhance the robot's running efficiency and natural movement patterns.
- ○ Verified the robot's performance in the Mujoco environment, achieving a running speed exceeding 1.5 m/s and stable omnidirectional walking motions in simulation.

Short-term Visiting Student   *Innowing Center,*
Utilizing AprilTags' 6-DOF Pose for Robotic Arm Manipulation   *Hongkong University*
                                                                        July 2024

- ○ Designed a calibration-free framework to control the end-effector pose of a robotic arm using Apriltags.
- ○ Utilized a Realsense camera to detect Apriltags and computed relative pose transformations through coordinate frame calculations. Successfully tested the framework on the Aloha, demonstrating precise and reliable pose adjustments.

Projects

A Path Planning Visualization Tool that includes a companion Franka   *github repo* ↗
Robot Controller for Receiving and Executing Trajectories

- ○ A path planning visualization tool with state-of-the-art planning algorithms for robot arm planning.
- ○ Companion Franka joint position/impedance controller for receiving trajectories.
- ○ Able to plan and follow joint-trajectories smoothly while avoiding obstacles, with over 90% success rate and 0.6s computing cost.

Food Classification Convolutional Neural Network   *Dec 2024*

- ○ Constructed and trained AlexNet, ResNet and a custom CNN model for the classification of 10 types of common foods. Applied data augmentation techniques (random rotation, flipping, and cropping) to improve model generalization and reduce overfitting. Demonstrated a 20% reduction in model overfitting

by employing dropout, early stopping and data augmentation techniques.

○ The custom CNN model achieved similar classification accuracy to ResNet on the same dataset, demonstrating its efficiency.

Apriltag 6-Dof pos end-effector controller   *July 2024*

○ A framework for controlling end-effector of robotic arms using a Realsense camera detecting apriltags.

○ Allowing the end-effector to follow the movement of the cube, while not relying on calibration.

Vision-based Robot Dog soccer player   *2023*

○ Designed a state machine controller for a real-world four-legged robot dog to play 2v2 football, incorporating ball tracking using OpenCV algorithms.

○ Won 2nd prize in the competition, with the robot successfully tracking, kicking the ball, and guarding the goal.