Gaotian Wang

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Research Interests

◇ Robot Robust Manipulation under Uncertainties, Motion Planning and Control

◇ Machine Learning, Deep Learning, Reinforcement Learning, Multi-modal Learning

◇ LLMs Applications, Embodied AI, Generative AI, 3D Computer Vision, Diffusion models

Professional Experience

Sep 2022 - Present	**RobotⅡ Lab** *at Rice University, Houston, TX* Graduate Student, Advisor: Prof. Kaiyu Hang ◇ **Unified Nonprehensile Object Pushing via Non-Parametric Estimation and Model Predictive Control (UNO Push):** *A unified framework that achieves precise pushing on random objects with continuously updated system models using in-task experiences.* ◇ **Caging in Time for Robust Object Manipulation:** *A novel framework for robust manipulation, enabling open-loop control without detailed object knowledge or real-time feedback, validated through extensive experiments in challenging quasi-static and dynamic tasks.*
Nov 2021 - Jun 2022	**AIoT Lab** *at USTC, Hefei, China* Undergraduate Researcher, Advisor: Prof. Nikolaos M. Freris ◇ **Modeling and Control of Soft Arm via Piecewise Universal Joint Model:** *A novel model for soft arms that enables* **accurate prediction of interactions and dynamics**, *as well as* **dynamic control** *in both configuration and task spaces for dynamic trajectory tracking.*
Apr 2021 - Sep 2021	**Reconfigurable Robotics Lab** *at EPFL, Lausanne, Switzerland* Guest Researcher, Supervisor: Prof. Jamie Paik ◇ *Origami Structures Stiffness Modeling: An efficient origami simulator using* **Taichi GPU platform** *for stiffness modeling and testing, validated on an origami joystick with* **less than 10% error**.
Aug 2020 - Oct 2021	**USTC Soft Robotics Lab** *at USTC, Hefei, China* Undergraduate Researcher, Advisor: Prof. Xiaoping Chen ◇ **Sim to Real Transfer of the Soft Robotics Arm via Q-learning:** *A scalable 3D model for soft manipulator with realistic actuation and workspace, as well as a* **Q-learning-based controller** *for soft robot arm using pre-trained models from this rough simulator.*

Skills

Programming Capabilities:	ROS, ROS2, C, C++, Matlab, Python
Simulation Environments:	PyBullet, Isaac Gym/Sim, MuJoCo, Taichi, Sapien
Deep Learning Frameworks:	PyTorch, Tensorflow, Diffusion models
Others:	Ollama, 3D modeling and printing, Solidworks, Mathematica, COMSOL Multiphysics, OMPL, RViz, Blender

Education

Sep 2022 - Present	**Rice University**, *Houston, TX* Ph.D. in Computer Science Advisor: Dr. Kaiyu Hang
Sep 2018 - Jun 2022	**University of Science and Technology of China**, *Hefei, China* B.S. in Optical Engineering and Computer Science Advisor: Dr. Nikolaos M. Freris

Professional Service

Referee: ◇ IEEE International Conference on Robotics and Automation (ICRA), 2025
◇ IEEE International Conference on Robotics and Automation (ICRA), 2024
◇ IEEE Robotics and Automation Letters (RAL), 2024
◇ IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023

Publications

Preprints under review

P1. **Gaotian Wang**[†], Kejia Ren[†], Andrew S. Morgan, and Kaiyu Hang. "Caging in Time: A Framework for Robust Object Manipulation under Large Uncertainties." *The International Journal of Robotics Research (IJRR).* [†] Equal Contribution. Under Review

P2. Kejia Ren, **Gaotian Wang**, Andrew S. Morgan, Lydia E. Kavraki, and Kaiyu Hang. "Object-Centric Kinodynamic Planning for Nonprehensile Robot Rearrangement Manipulation." *The IEEE Transactions on Robotics (T-RO).* Under Review

P3. Kejia Ren, **Gaotian Wang**, Andrew S. Morgan, and Kaiyu Hang. "Collision-inclusive Manipulation Planning for Occluded Object Grasping via Compliant Robot Motions." *ArXiv preprint.*

Peer-Reviewed Journal Papers

J1. Yinghao Gan, Peijin Li, Hao Jiang, **Gaotian Wang**, Yusong Jin, Xiaoping Chen, and Jianmin Ji. 2022. "A Reinforcement Learning Method for Motion Control With Constraints on an HPN Arm." *IEEE Robotics and Automation Letters (RAL)*

Peer-Reviewed Conference Papers

C5. **Gaotian Wang**, Kejia Ren, and Kaiyu Hang. "UNO Push: Unified Nonprehensile Object Pushing via Non-Parametric Estimation and Model Predictive Control." In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024.*

C4. Howard Qian, Yangxiao Lu, Kejia Ren, **Gaotian Wang**, Ninad Khargonkar, Yu Xiang, and Kaiyu Hang. 2024 "RISeg: Robot Interactive Object Segmentation via Body Frame-Invariant Features." In *IEEE International Conference on Robotics and Automation (ICRA) 2024*

C3. Zhanchi Wang, **Gaotian Wang**, Xiaoping Chen, and Nikolaos M Freris. 2024 "Kinematic Modeling and Control of a Soft Robotic Arm with Non-constant Curvature Deformation." In *IEEE International Conference on Robotics and Automation (ICRA) 2024*

C2. Zhanchi Wang, **Gaotian Wang**, Xiaoping Chen, and Nikolaos M. Freris. 2023. "Dynamic Modeling and Control of a Soft Robotic Arm Using a Piecewise Universal Joint Model." In *IEEE International Conference on Robotics and Biomimetics (ROBIO) 2023*

C1. Peijin Li, **Gaotian Wang**, Hao Jiang, Yusong Jin, Yinghao Gan, Xiaoping Chen, and Jianmin Ji. 2021. "A Q-Learning Control Method for a Soft Robotic Arm Utilizing Training Data from a Rough Simulator." In *IEEE International Conference on Robotics and Biomimetics (ROBIO) 2021*

Theses

T1. **Gaotian Wang**. A Randomized Kinodynamic Planner for Soft Robots based on Piecewise Universal Joint Model. Bachelor's thesis, USTC, Hefei, China, 2022

Scholarships and Certificates

2022	Mengzhilan (Dream Of Blue) China Aerospace Foundation Scholarship, USTC
2020	Outstanding Student Scholarship, *Gold* (Top 3%), USTC
2019	Endeavor Student Scholarship, USTC
2018	Yan Jici Talent Program Scholarship (Top 10%), USTC

Teaching

Fall 2023	Teaching Assistant for **Algorithmic Robotics** COMP/ELEC/MECH 450/550 *at Rice University*
Spring 2023	Teaching Assistant for **Deep Learning for Vision & Language** COMP 646 *at Rice University*
Fall 2020-2022	In-lab Teaching Assistant for **College Physics-Comprehensive Experimentation** *at University of Science and Technology of China*