# Gaotian Wang

gwang@rice.edu https://vector-wangel.github.io/ LinkedIn

## 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

## Professional Experience

Sep 2022 - Present | **Robot$\Pi$ 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:*** *Developed a new modeling method for soft robot arms under a piecewise universal joint (PUJ) assumption for improved interaction and dynamics with validated kinematic and dynamic models and a configuration space and a task space controller 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, incorporating stiffness modeling and testing methodologies, validated on an origami joystick with less than 10% error under linear spring assumption.*

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:*** *Proposed a scalable 3D model for soft manipulator with realistic actuation and workspace. Also, proposed a Q-learning controller for a physical soft robot 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 |
| 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

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