

# GAOTIAN WANG

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

## EDUCATION

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| SEP 2022 - PRESENT  | <b>Rice University, Houston, TX</b><br>Ph.D. in COMPUTER SCIENCE<br>Advisor: Dr. Kaiyu Hang   |
| SEP 2018 - JUN 2022 | <b>University of Science and Technology of China, Hefei, China</b><br>B.S. in OPTICAL ENGINEERING and COMPUTER SCIENCE<br>Advisor: Dr. Nikolaos M. Freris |

## RESEARCH INTERESTS

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- ◇ Robot Manipulation, Manipulation under Uncertainties, Compliant Mechanisms
- ◇ Machine Learning, Deep Learning, Reinforcement Learning, Large Language Models Applications
- ◇ Optimal Control, Motion Planning

## RESEARCH EXPERIENCE

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| SEP 2022 - PRESENT  | <b>RobotII Lab</b> at Rice University, Houston, TX<br>Graduate Student, Advisor: Dr. Kaiyu Hang <ul style="list-style-type: none"><li>◇ <b>Unified Nonprehensile Object Pushing via Non-Parametric Estimation and Model Predictive Control (UNO Push):</b> A combined framework addressing system modeling, action generation, and precise pushing via non-parametric estimation. It includes system motion models from few exploratory actions and precise pushing manipulation with continuously updated imprecise system models using in-task experiences.</li><li>◇ <b>Manipulation Funnels for Robust Object Manipulation and a Case Study on Planar Pushing:</b> A new robotic manipulation schematic, validated via extensive experiments. It efficiently conducts planar pushing tasks in open-loop scenarios, without requiring object specifics. The method's durability and adaptability to complex paths and shapes were confirmed through in-task disruptions.</li></ul> |
| NOV 2021 - JUN 2022 | <b>AloT Lab</b> at USTC, Hefei, China<br>Undergraduate Researcher, Advisor: Dr. Nikolaos M. Freris <ul style="list-style-type: none"><li>◇ <b>Modeling and Control of Soft Arm via Piecewise Universal Joint Model:</b> Introduced 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.</li></ul>  |
| APR 2021 - SEP 2021 | <b>Reconfigurable Robotics Lab</b> at EPFL, Lausanne, Switzerland<br>Guest Researcher, Supervisor: Dr. Fabio Zuliani and Dr. Jamie Paik <ul style="list-style-type: none"><li>◇ <b>Origami Structures Stiffness Modeling:</b> 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.</li></ul>   |
| AUG 2020 - OCT 2021 | <b>USTC Soft Robotics Lab</b> at USTC, Hefei, China<br>Undergraduate Researcher, Dr. Hao Jiang and Dr. Xiaoping Chen <ul style="list-style-type: none"><li>◇ <b>Sim to Real Transfer of the Soft Robotics Arm via Q-learning:</b> Proposed a scalable 3D model for a soft manipulator with realistic actuation and workspace. Also, proposed a Q-learning controller for a physical soft robot using pre-trained models from a rough simulator. Experimental validation showed our method's robustness, improved accuracy, and faster convergence rate by reducing real-world training data.</li></ul>  |

## PROFESSIONAL SERVICE

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

## SKILLS

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Programming Capabilities: ROS, C, C++, Matlab, Python, Arduino  
Simulation Environments: PyBullet, Isaac gym, MuJoCo, Taichi  
Deep Learning Frameworks: PyTorch, Tensorflow  
Others: 3D modeling and printing, Solidworks, soldering, Mathematica, COMSOL Multiphysics, OMPL, RViz

## PUBLICATIONS

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### Preprints under review

- P1. **Gaotian Wang**<sup>†</sup>, Kejia Ren<sup>†</sup>, Andrew S. Morgan, and Kaiyu Hang. "Title withheld for double-blind review." In *Robotics: Science and Systems*, 2024. <sup>†</sup> Equal Contribution. Under Review
- P2. **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*, 2024. 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* 7 (4): 12006–13. <https://doi.org/10.1109/LRA.2022.3196789>.

### Peer-Reviewed Conference Papers

- 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 *2024 IEEE International Conference on Robotics and Automation (ICRA)* (To appear)
- 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 *2024 IEEE International Conference on Robotics and Automation (ICRA)* (To appear)
- 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 *2023 IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 1–6. Koh Samui, Thailand: IEEE. <https://doi.org/10.1109/ROBIO58561.2023.10354732>.
- 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 *2021 IEEE International Conference on Robotics and Biomimetics (ROBIO)*, 839–45. Sanya, China: IEEE. <https://doi.org/10.1109/ROBIO54168.2021.9739524>.

### 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

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- 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

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