Wanze Li

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EDUCATION

NATIONAL UNIVERSITY OF SINGAPORE, Singapore
- PhD Degree in Mechanical Engineering   Aug 2021 – Present
- Thesis: Robotic Manipulation of Household Objects: Hanging, Grasping, and Handover
- Advisor: Prof. Gregory Chirikjian

JOHNS HOPKINS UNIVERSITY, Baltimore, MD
- Master of Science Degree in Mechanical Engineering (GPA: 3.96/4.0)   Aug 2019 – May 2021
- Relevant Courses: Robot Device, Kinematics, Dynamics and Control; Algorithm for Sensor Based Robotics; Machine Learning; Artificial Intelligence; Mechatronics; Mathematical Method for Engineering
- Advisors: Prof. Russell Taylor & Prof. Iulian Iordachita

HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (HUST), China
- Bachelor of Mechanical Engineering Degree (GPA: 3.9/4.0)   Sept 2015 – Jun 2019
- Thesis: The Study of Copper Nanowire Integration process on Fiber Optic Probe Surface (The honor of Excellent Undergraduate Thesis)
- Advisor: Prof. Zirong Tang

RESEARCH

NATIONAL UNIVERSITY OF SINGAPORE, Singapore
Advisor: Prof. Gregory Chirikjian

Robot Manipulation and Perception Methods Based on Deep Learning   Apr 2024 – Present
- Proposed a robot visual motion strategy learning method based on Denoising Diffusion Probabilistic Models (DDPM), enhancing the robot's success rate in object-specific manipulation tasks.
- Built and trained an object visual forecasting model based on DDPM using PyTorch.
- Optimized the robot's manipulation strategies for objects using Model Predictive Control (MPC) and Cross-Entropy Method (CEM).

Pose Estimation Method for Cloths Based on Deep Learning   Apr 2024 – Sept 2024
- Proposed a deep learning-based pose estimation method for flexible objects, formatting the pose estimation problem into an RGB image generation problem solvable by a diffusion model.
- Built and trained a Denoising Diffusion Probabilistic Model (DDPM) based on U-Net using PyTorch to predict the complete pose of cloths.
- Fine-tuned the DDPM predictions using a point cloud registration algorithm based on the Expectation-Maximization (EM), further enhancing the algorithm's accuracy.

Closed-Loop Picking Generation Method for Hangable Objects   Apr 2024 – Jul 2024
- Identified features in objects suitable for hanging (e.g., cup handles, key rings) and generated closed-loop picking poses based on these structures to enhance success rates and stability.
- Developed and debugged Python programs for algorithm implementation.
- Tested the method by having a Franka fr3 robotic arm pick 15 common objects, demonstrating that this approach significantly outperformed baseline methods in terms of picking success rate.

Coordinated Strategy Planning Algorithm for Dual Robots Handover   Sept 2023 – Jan 2024
- Proposed a cooperative handover strategy generation algorithm to facilitate the Robot-to-Robot handover of arbitrary unknown objects.
- Completed the setup and calibration of a dual robotic arm system, and developed control programs based on MoveIt and ROS service.
- Validated the method through real-world experiments, demonstrating a significantly higher success rate compared to baseline methods.

A Novel Method to Predict Hanging Poses for Previously Unseen Objects   Apr 2022 – Aug 2023
- Proposed a hanging strategy generation algorithm for arbitrary objects, enabling the robot to accurately hang unknown objects without any prior training.
- Developed a Python program for the algorithm and mounted an RGBD camera on a Franka fr3 robotic arm, performing hand-eye calibration to enable object perception and algorithm testing in a real-world environment.
- Created a Python program for robot controlling based on ROS service and utilized the RRT-connect planner to generate trajectories for the robotic arm during algorithm execution.
- Demonstrated through simulations in Pybullet and real-world experiments that proposed method significantly outperformed baseline methods in terms of success rates for hanging objects.

JOHNS HOPKINS UNIVERSITY, LCSR, Baltimore, Maryland
Advisor: Prof. Russell Taylor & Prof. Iulian Iordachita

Automated Mosquito Salivary Gland Extraction Robot   Oct 2019 – May 2021
- Developed a novel robotic system to automate the mosquito salivary gland extraction process, accelerating the large-scale production of malaria vaccines.
- Completed calibration, experimentation, testing, and data collection for the entire system.
- Developed a simulation system based on ROS/C++ to simulate the motion of various components, assisting in the development of the overall control software and testing visual algorithms to enhance safety.
- Built a modular RQT Graphical User Interface (GUI) with C++ to facilitate the use of the simulation system and control software.

HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (HUST), Wuhan, China
Advisor: Prof. Zirong Tang

Graduation Project, Cu/CuO nanowires Integration on optical fiber   Dec 2018 – Jun 2019
- Synthesized Cu and CuO nanowires on the surface of optical fiber by oxidation and reduction under high temperature to get an optical fiber/nanowire hybrid structure.
- Explored the influence of various technological parameters and improved the process of integrating the copper nanowire array.
- Tested gas sensitivity and infrared sensing property of the optical fiber/copper oxide nanowire hybrid structure.

HONORS & AWARDS
- Nominated by IEEE CASE2021 Best Healthcare Automation Paper Award   08/2021
- Outstanding graduates, Huazhong University of Science and Technology   06/2019
- The honor of Excellent Undergraduate Thesis   Top 1%, 06/2019
- Honorable winner of Mathematical Contest In Modeling (MCM)   01/2018
- Second Prize in National College Students Mechanical Products Digital Design Competition   06/2017
- Merit Student at Huazhong University of Science and Technology   Top 2.8%, 2016 - 2017

TECHNICAL SKILLS
- **Robotics:** Proficient with ROS, Isaac Sim, the operation of Franka and UR robot arms, PyTorch, Pybullet.
- **Computer Aided Design:** Proficient in SolidWorks, Inventor, AutoCAD, CATIA, Fusion360 and Cura.
- **Machinery:** Formal training in 3D printer, laser cutter, machine tools and soldering station.
- **Programming:** Proficient in MATLAB, Java, C/C++ and Python.

PUBLICATIONS

CONFERENCE:

- Jikai Ye*, **Wanze Li***, Shiraz Khan, Gregory Chirikjian. RaggeDi: Diffusion-based State Estimation of Disordered Rags, Sheets, Towels and Blankets. *2025 IEEE International Conference on Robotics and Automation (ICRA)* [accepted]
- **Wanze Li**, Wan Su, Gregory S. Chirikjian. Hooking and Hanging: A Learning-Free Method for Picking Previously Unseen Objects. *2024 IEEE International Symposium of Robotics Research (ISRR)* [accepted]
- Boren Jiang, Yuanfeng Han, Ximeng Tao, **Wanze Li**, Gregory Chirikjian. Proprioceptive Model-Free and Learning-Free Humanoid Walk. *2023 International Symposium on Experimental Robotics*, Chiang Mai, Thailand.
- **Wanze Li**, Z. He, P. Vora, Y. Wang, B. Vagvolgyi, S. Leonard, A. Goodridge, I. Iordachita, S. L. Hoffman, S. Chakravarty, Russell Taylor. Automated Mosquito Salivary Gland Extractor for PfSPZ-based Malaria Vaccine Production. *2021 IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, 2021
- **Wanze Li** *et al*., "Progress in Development of an Automated Mosquito Salivary Gland Extractor: A Step Forward to Malaria Vaccine Mass Production," *2021 IEEE 17th International Conference on Automation Science and Engineering (CASE)*, 2021, pp. 968-974, doi: 10.1109/CASE49439.2021.9551500. [Nominated by IEEE CASE2021 Best Healthcare Automation Paper Award]

JOURNALS:

- **Wanze Li**, L. Pan, B. Jiang, Y. Wu, W. Liu and G. S. Chirikjian, "I Get the Hang of It! A Learning-Free Method to Predict Hanging Poses for Previously Unseen Objects," in *IEEE IROS/IEEE Robotics and Automation Letters (RAL)*, vol. 9, no. 4, pp. 3791-3798, April 2024
- Yuwei Wu, **Wanze Li**, Zhiyang Liu, Weixiao Liu, Gregory Chirikjian. Autonomous Learning-Free Grasping and Robot-to-Robot Handover of Unknown Objects. Autonomous Robots, 2024 [under review].

PATENTS:

- Bangjie Hu, **Wanze Li**, Shengqiang Zhao, Changlin Wu. An automatic food delivery robot. 2018, Utility Patent, ZL201720994506.8
- Huafeng Ye, Qianyu Dai, Shuting Zhang, **Wanze Li**, Daizhou Li. An extruder head that could feed 3D printer continuously. 2017, Invention Patent, 201711221245.7.