ZHIXUAN XU

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EDUCATION

National University of Singapore, Singapore   08/2024-Present
PhD Student at School of Computing
  Supported by the President's Graduate Fellowship (PGF).

Zhejiang University, Hangzhou, Zhejiang, China   09/2020-06/2024
Bachelor of Engineering in Robotics Engineering (Chu Kochen Honor College)
  GPA: 3.96/4.0(90.7/100)   Rank: 2/33
  Micro-minors: "AI+X" Program Co-organized by East China Five Schools, Huawei, Baidu, etc.

Massachusetts Institute of Technology , Cambridge, MA, USA   07/2021-08/2021
Machine Learning Plus in Autonomous Driving Summer Online Program
  Group Leader, Score: 97.5/100+

PUBLICATIONS

1. **Zhixuan Xu***, Chongkai Gao*, Zixuan Liu*, Gang Yang*, Chenrui Tie, Haozhuo Zheng, Haoyu Zhou, Weikun Peng, Debang Wang, Tianyi Chen, Zhouliang Yu, Lin Shao.*ManiFoundation Model for General-Purpose Robotic Manipulation of Contact Synthesis with Arbitrary Objects and Robots.* IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024). Oral Presentation.

2. Xinghao Zhu, Jinghan Ke, **Zhixuan Xu**, Zhixin Sun, Bizhe Bai, Jun Lv, Qingtao Liu, Yuwei Zeng, Qi Ye, Cewu Lu, Masayoshi Tomizuka and Lin Shao. *Diff-LfD: Contact-aware Model-based Learning from Visual Demonstration for Robotic Manipulation via Differentiable Physics-based Simulation and Rendering.* The 7th Annual Conference on Robot Learning (CoRL 2023). Oral Presentation(6.6%).

3. **Zhixuan Xu**, Kechun Xu, Yue Wang and Rong Xiong. *Object-centric Inference for Language Conditioned Placement: A Foundation Model based Approach.* The IEEE International Conference on Advanced Robotics & Mechatronics (ICARM 2023).

4. Zhenyu Wei*, **Zhixuan Xu***, Jingxiang Guo, Yiwen Hou, Chongkai Gao, Lin Shao. $\mathcal{D}(\mathcal{R}, \mathcal{O})$*Grasp: A Unified Representation for Cross-Embodiment Dexterous Grasping.* In submission to The IEEE International Conference on Robotics & Automation (ICRA 2025).

RESEARCH EXPERIENCES

PhD Student, LinS Lab, National University of Singapore   07/2024-Present

Unified Representation for Cross-Embodiment Dexterous Grasping
- **First time to be a mentor** of an undergraduate student(Zhenyu Wei).
- We propose a novel representation, $\mathcal{D}(\mathcal{R}, \mathcal{O})$, tailored for dexterous grasping tasks. This interaction-centric formulation transcends conventional robot-centric and object-centric paradigms, facilitating robust generalization across diverse robots, objects, and environments.
- We propose a configuration-invariant pretraining approach that learns correspondences across different robot configurations, thereby enhancing the model's capability to capture motion constraints for high-DOF robotic systems.
- We perform extensive experiments in both simulation environments and real-world settings, validating the efficacy of our proposed representation and framework in grasping novel objects with multiple robots.

Research Assistant, LinS Lab, National University of Singapore   03/2023-02/2024
Model-based Learning from Visual Demonstration

- Proposed a self-supervised approach to reconstruct and extract object shapes and 6D poses from monocular human demonstration RGB videos by using differentiable rendering.
- Combined global contact sampling with a robust gradient approximation technique for model-based robotic manipulation with the aid of differentiable simulation.

Robotic Manipulation Foundation Model for Contact Synthesis

- **First time to be a leader of a large project.**
- Generated a large-scale dataset for contact synthesis and developed a neural network for arbitrary manipulators to choose contact positions on a random rigid or articulated rigid object to generate a specified target wrench.
- Proposed a collision-free optimization framework to optimize robot configurations, contact force, and positions.
- Design and implement the ManiFoundation model consisting of both neural network backbones for visual and physical feature extraction.
- Build 2 LeapHands and conduct real-world experiments in various scenarios.

Advisor: Prof. Lin Shao

Research Intern, Robotics Lab, Zhejiang University   10/2022-02/2023
Learning Language-conditioned Manipulation
- Proposed to leverage pre-trained large language models and visual language models, and to train residual blocks for better generalization to unseen instructions and objects, and for higher sample efficiency.

Advisors: Prof. Rong Xiong and Prof. Yue Wang

Research Training, Robotics Lab, Zhejiang University   05/2021-05/2022
Object Detection with Millimeter Wave Radar
- Project Leader. Implemented a network to fuse camera and radar information to improve object detection robustness. The project is evaluated as top-10 outstanding.

Advisors: Prof. Rong Xiong and Prof. Yue Wang

COMPETITIONS AWARDS

1. **First Prize** of the 13th National College Student Mathematics Competition (Non-Mathematical Category)
2. **First Place** in the 16th Zhejiang University College Student "China Control Cup" Robot Competition
3. **First Place** in the 3rd Zhejiang University College Student Intelligent Robot Creative Competition
4. **Honorable Mention** in 2022 Mathematical Contest in Modeling

HONORS & FELLOWSHIPS

2021&2022	Zhejiang Provincial Government Scholarship
2021&2022	Zhejiang University Scholarship
2022	Chu Kochen Honor College Pioneer Scholarship - Second Prize
2022	Top 10 In-depth Research Training Program at Chu Kochen Honor College

SKILLS & INTERESTS

Self-built Robots: Mobile Manipulators, A Quadcopter, A Holographic Imaging System, etc.
Language: Chinese(Native), English(TOEFL:98, GRE:323+4.0)
Programming: Python, C/C++, MATLAB
Tools: LaTeX, Blender, SOLIDWORKS, STM32, Arduino
Interests: Singing, Reading, Table Tennis