Shuqi Zhao

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SUMMARY

My research interest and previous work mainly focus on robotics manipulation, especially in **dexterous hand manipulation.** In my previous research, I've gained extensive experiences on **1)** transferring human demonstration to dexterous hand manipulation (learning from human demonstration), **2)** zero-shot sim-to-real transfer for complexed contact-rich dexterous hand manipulation, and **3)** developing reasoning algorithms for error and failure analysis for dexterous manipulation leveraging LLM. The primary goal of my research endeavors lies in achieving more precise and more generalizable manipulation skills on dexterous hands with high human/robot data efficiency and high quality of sim-to-real transfer. Besides dexterous manipulation, I've also worked on robot manipulation skills generalization and had some former projects related to deep learning, control theory and optimization. With ample experiences in PyTorch, C++, ROS, Isaac Gym and Pybullet, I have gained plenty experiences about large language model, transformer, reinforcement learning, control theory and optimization in both simulation and real world.

EDUCATION

Zhejiang University, Hangzhou, Zhejiang, China September 2019 – June 2023
College of Control Science and Engineering

- Major in automation and control science; Minor in Advanced Honor Class of Engineering Education
- Overall GPA: 3.98/4.00, 90.34/100, Major GPA:3.99/4.00, Integrated Rank: 6/106

University of California, Berkeley, California, the United State September 2023-Present
Control area in Department of Mechanical Engineering, second-year Ph.D.

- Supervisor: Prof. Masayoshi Tomizuka

MAIN RESEARCH EXPERIENCE

DexCtrl: Towards Sim-to-Real Dexterity with Adaptive Controller Learning. **University of California, Berkeley**
Supervisors: Prof. Masayoshi Tomizuka

- Identify the mismatch of robot controllers as a critical factor in the sim-to-real gap and propose a novel method to adjust the control parameters adaptively.
- Design a simple and elegant framework to jointly obtain actions and controller parameters through separate models based on historical information, which offers better adaptivity to force variation.
- Extensive experiments on two different tasks show our method can significantly outperform baselines in both simulation and the real world, along with thorough analysis of what control parameters impact.

DexH2R: Task-oriented Dexterous Manipulation from Human to Robot **University of California, Berkeley**
Supervisors: Prof. Masayoshi Tomizuka

- A tracking policy for dexterous hand that directly transfer human hand motions into dexterous hand actions, aiming at following human hand motions as well as finishing grasping tasks.
- Final actions are combined with two parts: Primitive actions computed by human hand poses through retargeting and residual actions obtained through a goal-conditioned reinforcement policy, taking in both human and object demonstrations.
- Outperformed other dexterous hand tracking policy greatly in both unseen and seen objects. Can be transferred on real robots.

A joint modeling of vision-language-action for target-oriented grasping in clutter **Zhejiang University, China**
Supervisors: Prof. Rong Xiong and Assistant Prof. Yue Wang

- A jointly model that leverage cross-attention transformer and SAC to realize automatic table re-organization. It can adjust to more flexible language instructions and is not limited by visual grounding error.
- With pre-processed images and language through CLIP and pre-given grasps for each object through GraspNet, this model uses cross-attention transformer to obtain the best grasp feature given images and language to train a SAC policy.
- Rearrangement performance has improved and can be transferred into real world.

MAIN PUBLICATIONS

- **S. Zhao**, K. Yang, Y. Chen, C. Li, Y. Xie, X. Zhang, C. Wang, and M. Tomizuka, "DexCtrl: Towards Sim-to-Real Dexterity with Adaptive Controller Learning," arXiv preprint arXiv:2505.00991, under review.
- **S. Zhao**, X. Zhu, Y. Chen, C. Li, X. Zhang, M. Ding, and M. Tomizuka, "Dexh2r: Task-oriented dexterous manipulation from human to robots," arXiv preprint arXiv:2411.04428, IEEE/ASME Transactions on Mechatronics (TMech).
- D. Guo, Y. Xiang, **S. Zhao**, X. Zhu, M. Tomizuka, M. Ding, and W. Zhan, "Phygrasp: Generalizing robotic grasping with physics informed large multimodal models," arXiv preprint arXiv:2402.16836, under review.
- K. Xu, **S. Zhao**, Z. Zhou, Z. Li, H. Pi, Y. Zhu, Y. Wang, and R. Xiong, "A joint modeling of vision-language-action for target-oriented grasping in clutter," in 2023 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2023, pp. 11 597–11 604.
- **S. Zhao**, D. Sun, J. Zhang, H. Lu, Y. Wang, R. Xiong, and K. Grattan, "Actuation and biomedical development of micro-/nanorobots–a review," Materials Today Nano, vol. 18, p. 100223, 2022.
- **S. Zhao**, H. Lu, R. Xiong, ELSEVIER; Lu-Untethered Small-scale Robots for Biomedical Applications; Introduction: Small-scale Robots for Biomedical Application.

MAIN INTERNSHIP EXPERIENCES

Developing reasoning algorithms for error and failure analysis for dexterous manipulation **Honda, San Jose**
Supervisors: Dr. Rana Soltani Zarrin. May 2025 – August 2025

- Methodology confidential for now (will be public after company procedure), but tactile usage is included.

Design and control of a specially designed 7-Dof redundant robot arm **CERN, Switzerland**
Supervisors: Dr. Mario Di Castro and Dr. Eloise Matheson November 2022 – May 2023

- Implemented low-level actuators communication, control theory and camera realization for the redundant robot arm using C++.
- Implemented and modified the inverse kinematics for redundant manipulator using C++ (cooperated with co-workers). By using this, the trajectory of end effector can satisfy certain requirements such as collision avoidance.
- Conducted real-world experiments on the 7-DoF robot arm and ensured stability of all algorithms above.

Weakly supervised semantic segmentation for images of surgical automation **The Chinese University of Hong Kong**
Supervisors: Prof. Yunhui Liu August 2022 – November 2022

- Put forward a low-cost idea in data enhancement: generating more reliable data (images with image-level annotation) based on original datasets by splicing background and foreground from different pictures in order to reduce the impact caused by back-and-fore relevance.
- Designed an algorithm that combined cross-attention mechanism and constructive learning, specifically to solve the problem of misclassification.
- Unfinished because my internship period is up.

HONOR & AWARD

- **Departmental First Year Doctoral Fellowships awarded in 2023 by Department of Mechanical Engineering in University of California, Berkeley.**
- Student Scholarship awarded in 2020 and 2022 by Zhejiang University
- Honorable Mention of Mathematical Contest in Modeling in 2021, rewarded by COMAP (Consortium for Mathematics and Its Applications)
- First-Class of Chinese University Intelligent Robot Creative Competition in Zhejiang University, Second-Class in Zhejiang Province

OTHERS

- Teaching assistant of Advanced Control Theory in Zhejiang University