ZHUO LI

: 852-53318472 **: li_zhuo@hust.edu.cn **: https://www.zhuoli-academic.com/

Education

The Chinese University of Hong Kong **Sep. 2023 - present**

P.h.D in Robotic Engineering, Department of MAE, Supervised by Prof. Fei CHEN *HongKong, China*

- PhD Thesis: Interactive Humanoid Manipulation Skill learning from Language-Embodiment Demonstration

Huazhong University of Science and Technology (985) **Sep. 2020 – Jul.2023**

M.S. in Robotic Engineering, Department of ME, Supervised by Prof. Shiqi LI *Wuhan, China*

- GPA: 3.63/4.0 (Core Courses: Robotics (95), Robot Operating System (90))
- Master Thesis: Grasp Synthesis and Motion Planning for Dexterous Manipulation of Humanoid Service Robots

Research Interests

- Embodied Intelligence
- Humanoid Bimanual Manipulation
- Learning-based Dexterous Grasping and Perception

Selected Publications

- **Li, Z.,** Liu J.,Chen F. (2024). Language-Guided Dexterous Functional Grasping by LLM Generated Grasp Functionality and Synergy for Humanoid Manipulation. Accepted by IEEE TASE. **(JCR Q1, IF = 5.9)**
- **Li, Z.,** Li, S., Han, K., Li, X., Xiong, Y., & Xie, Z. (2023). Planning Multi-fingered Grasps with Reachability Awareness in Unrestricted Workspace. Journal of Intelligent & Robotic Systems, 107(3), 39. **(JCR Q2, IF = 3.1)**
- Gu, W., **Li, Z.,** Dai, M. (2021). An Energy-efficient Multi-objective Permutation Flow Shop Scheduling Problem using an Improved Hybrid Cuckoo Search Algorithm. *Advances in Mechanical Engineering*, 13(6), 16878140211023603 (with the advisor as the first author). **(JCR Q2, IF = 3.6)**
- Gu, W., **Li, Z.,** Chen, Z. (2020). An Energy-consumption Model for Establishing an Integrated Energy-consumption Process in a Machining System. *Mathematical and Computer Modelling of Dynamical Systems*, 26(6), 534-561 (with the advisor as the first author). **(JCR Q2, IF = 3.8)**
- Li, S., Han, K., He, P., **Li, Z**. (2022). Human-like redundancy resolution: an integrated inverse kinematics sche me for anthropomorphic manipulators with radial elbow offset. Advanced Engineering Informatics, 54, 101812. **(JCR Q1, IF = 8.2)**
- Yu, M., **Li, Z.**, Li, Z., Liu, J., Teng, T., & Chen, F. (2024, August). A Deep Learning-based Grasp Pose Estimation Approach for Large-Size Deformable Objects in Clutter. In *2024 33rd IEEE International Conference on Robot and Human Interactive Communication (ROMAN)* (pp. 285-290). IEEE. (**Best Industry Application Award Finalist**)
- Li, S., **Li, Z.,** Han, K. (2021). An End-to-End Spatial Grasp Prediction Model for Humanoid Multi-fingered Hand Using Deep Network. *In 2021 IEEE 6th International Conference on Control, Robotics and Cybernetics (CRC)* (pp. 130-136) (with the advisor as the first author). **(EI)**

Research Experience

TCDG: Target-driven Collision-aware Dexterous Grasping for Novel Objects in Clutter **Feb. 2022 – Present**

Team Leader, HUST & UBTECH Intelligent Humanoid Service Robots Joint Lab *Wuhan, China*

- Proposed a Target-driven Collision-aware Dexterous Grasping pipeline that achieves single-shot recognition for novel objects and requires only single planning for robust collision-free multi-fingered grasping in cluttered environments.
- Designed a Grasp Collision Predictor that models the correlation between the spatial information and the collision-free probability of multi-fingered grasp configurations with a 3D CNN.
- Designed a Target Object Recognizer that exploits the depth information in simulation with Siamese Networks for single-shot recognition and sim-to-real generalization.

Closing the Loop for Multi-fingered Grasping **Jul. 2021 – Jan. 2022**

Team Leader, HUST & UBTECH Intelligent Humanoid Service Robots Joint Lab *Wuhan, China*

- Proposed a generative Multi-fingered Volumetric Grasping Network that can directly synthesize high-DoF grasp configurations from a voxel grid in real-time.
- Developed a closed-loop reactive multi-fingered grasping pipeline that is capable of grasping dynamic objects and reacting to control errors.

- Achieved 85% real-world grasping success rate for dynamic novel objects on a humanoid multi-fingered robot hand.

Planning Multi-fingered Grasps with Reachability Awareness in Unrestricted Workspace **Dec. 2020 – Jun.2021**

Team Leader, HUST & UBTECH Intelligent Humanoid Service Robots Joint Lab *Wuhan, China*

- Proposed a Voxel-based Multi-fingered Grasp Prediction Network that generates feasible multi-fingered grasp configurations in unrestricted workspace with reachability awareness.
- Developed a self-supervision data-collection framework that can automatically generate training data in simulation, and collected a large-scale synthetic grasp dataset, including approximately 1.4 million multi-fingered grasp configurations covering 285 unique object meshes and 35000 diversified cluttered scenes.
- Achieved 91.4% real-world grasping success rate for novel objects on a humanoid multi-fingered robot hand.

Online Trajectory Replanning for Anthropomorphic Arms **May. 2020 – Nov. 2020**

Participant, HUST & UBTECH Intelligent Humanoid Service Robots Joint Lab *Wuhan, China*

- Proposed an RRT-based hierarchical replanning framework that rapidly modulates the ongoing trajectory to help 7-DoF redundant humanoid manipulators avoid dynamic obstacles in physical human-robot interaction.
- Developed a heuristic path optimization method based on primary geometric descriptors that can trim the unsmooth path while ensuring the motion margin of the manipulator.

Go Fetch: Mobile Dexterous Manipulation in Unstructured Environments **Oct. 2019 – Mar. 2020**

Participant, HUST & UBTECH Intelligent Humanoid Service Robots Joint Lab *Wuhan, China*

- Developed a mobile dexterous manipulation system that combines the state-of-the-art mapping, perception, localization, navigation, motion planning and dexterous grasping skills into one common workflow.
- Successfully achieved an object retrieval task where the robot has to autonomously find, pick up and bring an object to a specified location in an unstructured domestic environment, which verified the feasibility of the proposed system.

Energy-saving-oriented Modeling of Machining Process **Jun. 2017 – Sep. 2019**

Team Leader, Wenbin Gu's Intelligent Manufacturing lab *Nanjing, China*

- Proposed an action-element-based energy-consumption model that considers the full states of machining processes.
- Proposed a hybrid cuckoo algorithm to solve the green multi-objective permutation flow shop scheduling problem.

Working Experience

Research Intern **Jun. 2021** – **Sep. 2021**

UBTECH Robotics Co., Ltd, Humanoid Robot Innovation Center (HRIC) *Shenzhen, China*

- Developed a semantic multi-fingered grasping framework that comprises a YOLO-based semantic segmentation module and a CNN-based planar grasp point detection module.
- Achieved 90.1% semantic grasping success rate for 40 unknown household objects on a humanoid service robot.

Assistant Lecturer **Mar. 2021 – May. 2021**

Huazhong University of Science and Technology, Department of ME *Wuhan, China*

- Instructor of ME101 Human-machine Collaboration and Interaction (Spring).
- Taught Robot Operating System (ROS) fundamentals, such as Gazebo, Rviz and MoveIt!

Honors and Awards

- **Global Runner-up for Hackathon Humanoid Robot Challenge**, WAIC, 2020
- Best Oral Presentation, IEEE 6th International Conference on Control, Robotics and Cybernetics, 2021
- The First Prize Scholarship, HUST, 2021
- **China National Scholarship (Award rate 0.2%),** HHU**,** 2018
- Outstanding Graduates of Jiangsu Province **(Award rate 2%)**, 2020
- Science & Technology Scholarship, HHU, 2018, 2019, 2020
- Academic Excellence Scholarship, HHU, 2018, 2019, 2020

Professional Skills

- **Programming**: Python, C/C++, Matlab, Linuxs
- **Machine Learning**: PyTorch, Tensorflow, Keras
- **Robotics**: ROS, Webots, Pybullet, OpenCV, Open3D, PCL, Solidworks