Xinghao Zhu

Mechanical Engineering Department, University of California Berkeley, CA USA
+1 (510)-610-0361 | zhuxh@berkeley.edu | rolandzhu.github.io

Education

University of California Berkeley — California, USA
PhD Student — Aug. 2018 - Present

- Major: Control, Minors: Robotics and Learning, GPA: 4.0, PhD Prelim Score: 98/100
- Research Interests: Robotic Grasping and Manipulation, Motion Planning, RL, Deep Learning
- Research Advisor: Prof. Masayoshi Tomizuka

Xi'an Jiaotong University (XJTU) — Xi'an, China
BEc. Major in Electrical Engineering & the Honors Youth Program — Sep. 2012 - July 2018

- Best Undergraduate Thesis Paper of XJTU in 2018 (awarded to top 1% of 4000)

Selected Researches and Projects

6-DoF Contrastive Grasp Proposal Network — Mar. 2020 - Oct. 2020
Mechanical Systems Control Lab — California, USA

- This work presents a contrastive grasp proposal network (CGPN) to infer 6-DoF grasps from a single-view depth image. The algorithm consists of a grasp proposal network and a grasp refinement network to generate grasps in an end-to-end manner. A contrastive learning and variant image processing techniques are introduced to improve the performance in reality and bridge the sim-to-real gap. CGPN is trained offline with synthetic samples and can locate robust collision-free grasps in reality within 0.5 seconds

Multi-Fingered Grasp Pose Detection using Point Cloud — Aug. 2019 - Mar. 2020
Mechanical Systems Control Lab — California, USA

- This work proposes a multi-fingered grasp pose detection (MF-GPD) algorithm to plan grasps in clutter. The algorithm takes a noisy single-view point cloud of the cluttered scene as input, and it generates grasp candidates using a cross-entropy sampler and assesses them with an evaluation model. Gripper's point cloud is rendered and combined with that of the object as the evaluation model's input. Top-ranked grasps are refined with a local grasp optimization to avoid collisions in clutter. MF-GPD can locate a collision-free grasp in the clutter within 1 second

Optimization Model for Planning Grasps with Multi-Fingered Hands — Aug. 2018 - June 2019
Mechanical Systems Control Lab — California, USA

- This work proposes an optimization model to solve the grasp planning problem. The optimization considers geometrical qualities and collisions and is relaxed with the proposed modelling method. The relaxed optimization is solved by iterating between the palm pose optimization (PPO) and the joint position optimization (JPO). The searching is robust to the incompleteness and noise of the point cloud. The algorithm can locate collision-free optimal precision grasps efficiently within 0.50 seconds

Robotic Manipulation of Deformable Objects with Real-Time Tracking — Apr. 2017 - Aug. 2017
Mechanical Systems Control Lab — California, USA

- This project aims to enable robots to accurately manipulate a deformable object (ropes) using complex motions. The algorithm consists of an observer with a coherent point drift (CPD) algorithm to track the rope in real-time, and a trajectory planner to generate motions for robots. With the proposed algorithm, the robot can manipulate the rope to a randomly given shape

Motor Imagery Based Electroencephalogram (EEG) Classification — Jan. 2018 - June 2018
XJTU (Undergraduate Thesis) — Xi'an, China

- This project aims to classify human's motor imagery EEG. The filter bank common spatial pattern (FBCSP) algorithm is utilized as the feature extractor, and support vector machine (SVM) is used to perform the classification tasks. The overall system can classify motor imagery signals with the accuracy of 82% in real-time

Application of Inkjet Technology in 3D Printing — Oct. 2015 - Apr. 2016
State Key Laboratory for Manufacturing System Engineering — Xi'an, China

- This project aims to improve the performance of the 3D inkjet printer. Design challenges and operation difficulties are analyzed and improved. The printhead's jamming is solved with the storage motion control, and the printing accuracy is improved with a low surface-tension material

Robotic Bottle Flipping and Landing with TRPO and Adaptive MPC Aug. 2019 - Dec. 2019
Course Project with Prof. Pieter Abbeel California, USA

- This work introduces a robotic bottle flipping and landing framework using two high degrees of freedom manipulators with customized grippers. Trust Region Policy Optimization (TRPO) and Adaptive Model Predictive Control (MPC) are used to throw and catch the bottle. A three-layer long short term memory (LSTM) network is utilized to approximate the dynamics of the flying bottle

Reshaping Soft Objects with Multi-fingered Hand Jan. 2019 - May 2019
Course Project with Prof. Ruzena Bajcsy California, USA

- This work proposes a method in which a robotic hand could reshape a dough into the desired shape. The algorithm has two phases: in the teaching, the robot tries to find a mapping from the reshaped point cloud to the applied force; in the testing, the robot infers the required force given a goal shape base on the prior knowledge

Publications and Patents

- **Xinghao Zhu**, Yongxiang Fan, Changhao Wang, Yefan Zhou, Shiyu Jin and Masayoshi Tomizuka "Multi-Fingered Grasp Pose Detection using Point Cloud", submitted to *2021 IEEE International Conference on Robotics and Automation (ICRA)*
- **Xinghao Zhu***, Lingfeng Sun*, Yongxiang Fan and Masayoshi Tomizuka "6-DoF Contrastive Grasp Proposal Network", submitted to *2021 IEEE International Conference on Robotics and Automation (ICRA)*
- **Xinghao Zhu**, Yongxiang Fan, Shiyu Jin, Changhao Wang and Masayoshi Tomizuka "Why Does Robotic Dexterous Hand Grasp Fail?" accepted by *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop*
- **Xinghao Zhu***, Shiyu Jin*, Changhao Wang*, Te Tang and Masayoshi Tomizuka "Real-time State Estimation of Deformable Objects with Dynamical Simulation" accepted by *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop*
- Yongxiang Fan, **Xinghao Zhu** and Masayoshi Tomizuka "Optimization Model for Planning Precision Grasps with Multi-Fingered Hands", accepted by *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*
- Shiyu Jin, **Xinghao Zhu**, Changhao Wang and Masayoshi Tomizuka "Contact Pose Identification for Peg-in-Hole Assembly under Uncertainties" submitted to *2021 American Control Conference (ACC)*
- Changhao Wang, Hsien-Chung Lin, Shiyu Jin, **Xinghao Zhu**, Liting Sun and Masayoshi Tomizuka "BTOMP: Bilevel Trajectory Optimization for Motion Planning" submitted to *2021 American Control Conference (ACC)*
- **Xinghao Zhu**, Te Tang and Tetsuaki Kato "Adaptive Grasp Planning for Bin Picking" US Utility Patent Filed No. US/61004-1/236264

Award

5th China "Internet Plus" Innovation and Entrepreneurship Competition Oct. 2019
Gold Award Zhejiang, China

- This project aims to improve the robustness and efficiency of the heat exchange device. A continuous spiral structure is designed and manufactured to achieve state-of-the-art heat transform performance in various scenarios. AI, optimal control, and robust optimization are introduced to minimize energy consumption. This work received a $560,000 investment in the seed round

Work Experience

Fanuc America Company (Fanuc Advanced Research Lab) June 2019 - Aug. 2019
Robotic Research Intern California, USA

Additional Information

- **Languages**: Python, MATLAB, C/C++, Verilog HDL, Karel
- **Developer Tools**: Ubuntu, the Robot Operating System (ROS), MuJoCo, Bullet, Arduino UNO, Fanuc Robot Controller, 3D Printing