Xianyi Cheng

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Education

Ph.D. in Mechanical Engineering — Aug 2019 - Present
Carnegie Mellon University
Advisor: Matthew T. Mason and Howie Choset

M.S. in Robotics — Aug 2017 - Aug 2019
Carnegie Mellon University
Advisor: Matthew T. Mason

B.S. in Aerospace Engineering — Aug 2013 - Jun 2017
Harbin Institute of Technology

Publication

- Huang, Eric; **Cheng, Xianyi**; and Mason, Matthew T. **Contact-Rich Action Generation From Inverse Task Mechanics.** Submitted to International Conference on Robotics and Automation (ICRA), 2020.
- **Cheng, Xianyi**; Hou, Yifan; and Mason, Matthew T. **Manipulation with Suction Cups using External Contacts.** International Symposium on Robotics Research (ISRR), 2019. PDF
- **Cheng, Xianyi**; Jia, Zhenzhong; and Mason, Matthew T. **Data-Efficient Process Monitoring and Failure Detection for Robust Robotic Screwdriving.** International Conference on Automation Science and Engineering (CASE), 2019. PDF
- **Cheng, Xianyi**; Jia, Zhenzhong; Bhatia, Ankit; Aronson, Reuben M.; and Mason, Matthew T. **Sensor Selection and Stage and Result Classifications for Automated Miniature Screwdriving.** International Conference on Intelligent Robots (IROS), 2018. PDF.

Research Experience

The Manipulation Lab — Carnegie Mellon University
Research Assistant — Oct 2017 - Present

Action Generation and Planning From Inverse Task Mechanics

- Developing algorithms that generate manipulation actions in contact-rich manner without motion primitives

Dexterous Manipulation with Vacuum Grippers

- Built statistical contact models and physical models for vacuum suction cups
- Modeled suction cups as passive elastic joints to perform dexterous manipulation tasks
- Executed robot actions to tilt a block with a suction cup under external contacts

Data-efficient Fault Detection and Process Monitoring for Automatic Screwdriving

- Developed realtime stage classification and result prediction system for screwdriving assembly
- Developed sensor reduction algorithms to select for minimal sensor set for high prediction accuracy
- Incorporated process models into hidden markov model to achieve data-efficiency

Parallel Force Position Control of the Assembly Plane

- Built hardware and control system for xy compliance stage

- Implemented parallel force position control to reduce screwdriving failure rate

Spacecraft System Research Center Harbin Institute of Technology
Research Assistant Jan 2017 - Jun 2017

Indoor SLAM and 3D Object Segmentation

- Implemented RGB-D SLAM and 3D point cloud reconstruction using Kinect V2 camera
- Designed Object Segmentation algorithms on 3D point cloud using region growing method

Pattern Recognition Lab Harbin Institute of Technology
Research Assistant May 2016 - Sept 2016

Interactive Segmentation of Objects in Cluttered Environment

- Selected and tracked features using KLT feature tracking method.
- Segregated features into different clusters by their trajectories.
- Segmented object contours and identify objects given multiple fixations.

Project Experience

Reasoning and Learning for Robot Construction Dec 2018 - Sept 2018

- Developed a relation graph representation as the state representation for robot construction
- Designed symbolic planning based on the relational graph representation
- Trained a visual learning system for pre- and post- condition prediction

Stable Motion Planning under Multiple Contacts Dec 2018- Sept 2018

- Implemented RRT planning for object manipulation under multiple contacts
- Implemented kinematic analysis for finger contact selection and stability analysis

Deep Learning for Video Game Music Generation May 2018 - Feb 2018

- Combined RNN with CRBM for music generation (on tensorflow)
- Built a video game music dataset

Handheld Detergent-free Ultrasonic Washer Aug 2016 - Dec 2015

- 1st Prize of the 9th National University Student Contest on Energy Saving and Emission Reduction
- Developed a series of prototypes for handheld ultrasonic washers
- Verified the effectiveness of ultrasound with mechanical vibration cleaning oil stains on the clothes without detergent

Honors and Awards

Aug 2019	NSF Student Travel Award
Aug 2018	Foxconn Student Fellowship
Nov 2016	The First Place in the 4th Start-up Competition in Harbin Institute of Technology
Oct 2016	Excellent Student Award in School of Astronautics
Aug 2016	First Prize of the 9th National University Student Social Practice and Science Contest on Energy Saving and Emission Reduction
Jan 2016	Selected in Outstanding Engineering Leader Program in Harbin Institute of Technology
Apr 2015	People's Scholarship (awarded to top 5% students)

Technical Skills

Programming Languages: Python, C/C++, MATLAB
Tools: ROS, PyBullet, Vrep, Mujoco, Tensorflow, OpenCV, Point Cloud Library, SolidWorks, AutoCAD, Multisim, Satellite Tool Kit