Changhao Wang | Curriculum Vitae

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Seeking for 2020 summer internship opportunities in the field of robotics.
I am a second-year Ph.D. student at UC Berkeley advised by Prof. Masayoshi Tomizuka. My research interest lies in the interdisciplinary combination of robotics, optimization, reinforcement learning and control theories with applications to robotic manipulation, motion planning, and robot skill learning.

Education Background

- **University of California, Berkeley** — **Berkeley, CA**
  Ph.D. Major: Controls, Minor: Artificial Intelligence and Robotics — *2018.8–2023.6 (expected)*
  Mechanical Engineering Department, **GPA:4.0/4.0**
- **Shanghai Jiao Tong University** — **Shanghai, CHN**
  B.S. Major: Mechanical Engineering, School of Mechanical Engineering. ***Top 1%*** — *2014.9–2018.7*

Technical Skills

- **Programming Languages:** Proficient in: Matlab, Python, C++
- **Industry Software Skills:** SolidWorks, Origin, Ansys (Intermediate), Most MS Office products
- **General Business Skills:** Good presentation skills, Works well in a team.

Professional Experience

- **FANUC Advanced Research Lab** — **Union City, CA**
  Robotics Research Intern — *2019.6–2019.8*
  1. Proposed a next generation collision avoidance algorithm with nonlinear programming
  2. Proved the proposed method is able to guarantee continuous trajectory safety in theory
  3. Simulated the robot motion in RoboGUIDE and did various real world experiments with FANUC robots.

Selected Research Experiences

- **Robotic Bottle Filpping and Landing with TRPO and Adaptive MPC** — **UC Berkeley**
  Advisor: Prof. Pieter Abbeel and Prof. Masayoshi Tomizuka — *2019.9–Present*
  1. Utilized Trust Region Policy Optimization (TRPO) for bottle flipping with a FANUC LRMate 200 iD robot
  2. Trained a LSTM network for bottle trajectory prediction
  3. Designed an adaptive MPC controller to stabilize the bottle
  4. Validated the framework in the Pybullet Simulator (Check the video here: https://changhaowang.github.io)
- **Worst State Trajectory Optimization (WSTO) for Robotic Motion Planning** — **UC Berkeley**
  Advisor: Prof. Masayoshi Tomizuka — *2019.3–2019.6*
  1. Proposed a novel trajectory optimization framework that considers in-between states collision efficiently
  2. Introduced a state parameterization method to represent every state on a continuous trajectory by one parameter
  3. Proved the proposed WSTO framework is robust under various scenarios with a FANUC M20iA robot
- **Robust Deformation Model Approximation for Cable Manipulation** — **UC Berkeley**
  Advisor: Prof. Masayoshi Tomizuka — *2018.9–2019.3*
  1. Proposed a real-time robust deformation model approximation method by solving robust optimization problems
  2. Combined the robsut model approximation method with SPR tracking algorithm in the presence of sensor noise

,outliers, and occlusions

- **Deformable Object Manipulation with Imitation Learning** **UC Berkeley**
  Advisor: Prof. Masayoshi Tomizuka *2017.6–2017.9*
  1. Designed a robust real-time tracker that estimates the state of a deformable object even under occlusion and among outliers.
  2. Applied a imitation learning-based method on robotic manipulation tasks (grasping, rope knotting, and cloth folding)
  3. Developed state recognition, trajectory warping, and failure detection algorithms with non-rigid point set registration to improve the efficiency and robustness of deformable object manipulation
  4. Proposed a tangent space non-rigid registration method to prevent objects from being overstretched.
- **Vision Based Object Classification and Size Recognition** **Shanghai Jiao Tong University**
  Advisor: Prof. Ye Ding *2018.1–2018.6*
  1. Constructed a novel uniform framework for Object Classification and Size Recognition
  2. Utilized SHOT descriptor for object classification to combine the signature and histogram feature for better performance
  3. Implemented RANSAC, color-based region grow, PCA and Least Square algorithms for size recognition
  4. Demonstrated spectral clustering achieves better performance than K-Means and Gaussian Mixture Model in dealing with overlapping and occlusion situations

Awards

1. **Chin Leung Shui Chun Fellowship** (UC Berkeley) 2020
2. **Graduate Division Block Grant Award** (UC Berkeley) 2020
3. **Outstanding Graduate of Shanghai Jiao Tong University** 2018
4. **HONGYI Scholarship** (Top 8 at SJTU) 2018
5. **Shanghai Jiao Tong University Scholarship** 2015-2017
6. **The First Prize in Shanghai in the China Undergraduate Mathematical Contest in Modelling** 2016
7. **The Second Prize in the China Undergraduate Mathematical Contest in Modelling** (Top 1%) 2016
8. **2016 SGMW Scholarship** (4/485) 2016
9. **Best Innovative Award of School of Mechanical Engineering** (1/374) 2015

Publications and Patents

[1] **Changhao Wang** and Masayoshi Tomizuka. Worst state trajectory optimization: A novel framework for motion planning. In *Robotics: Science and Systems (RSS)*, Submitted.

[2] Shiyu Jin*, **Changhao Wang***, and Masayoshi Tomizuka. Robust deformation model approximation for cable manipulation. In *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019.

[3] Te Tang*, **Changhao Wang***, and Masayoshi Tomizuka. A framework for manipulating deformable linear objects by coherent point drift. *IEEE Robotics and Automation Letters*, 3(4):3426–3433, 2018.

[4] **Changhao Wang**. The use of nano technology in solar cell. *IEnergy Conservation in Petroleum and Petrochemical Industry*, 5, 2016.

[5] **Changhao Wang**, Yikai Hu, and Mengjie Jing. Fuel-cell uav frame based on az31b, 2017. 201710408661.1.