Changhao Wang | Curriculum Vitae

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I am a first-year Ph.D. student at UC Berkeley advised by Prof. Masayoshi Tomizuka. My research interest lies in the interdisciplinary combination of robotics, optimization, artificial intelligence and control theories with applications to robotic manipulation and motion planning.

Education Background

Academic Qualifications

University of California, Berkeley — **Berkeley, CA**
Ph.D. Major: Controls , Mechanical Engineering Department. **GPA:4.0** — *2018.8–2023.6 (expected)*

University of California, Berkeley — **Berkeley, CA**
Visiting Student Researcher, College of Engineering — *2017.6–2017.9*

Shanghai Jiao Tong University — **Shanghai, CHN**
B.S. Major: Mechanical Engineering, School of Mechanical Engineering — *2014.9–2018.7*

Selected Research Experiences

Real-time Motion Planning for Industrial Robots — **UC Berkeley**
Advisor: Prof. Masayoshi Tomizuka — *2018.8–Present*

1. Combine sample (RRT*) and optimization (SQP and CFS) based motion planning to achieve an efficient and optimal motion.
2. Utilize parallel structure to facilitate to motion planning algorithm.
3. Applied to different applications, such as cable assembly and cloth folding.

Deformable Object Manipulation by Transfer 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 transfer learning-based method to do robotic manipulation tasks like grasping, rope knotting, and cloth folding
3. Designed 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. Propose 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. Proposed a novel uniform framework for Object Classification and Size Recognition.
2. For object classification, SHOT descriptor was utilized, which combine the signature and histogram feature together to achieve a better performance.
3. For size recognition, we combined RANSAC and color-based region grow algorithms together to segment the target objects. PCA and Least Square method were used for size detection.
4. Spectral clustering was introduced to deal with overlapping and occlusion situations. It is showed this method can achieve the best performance among other clustering algorithms, such as K-Means and Gaussian Mixture Model.

Path Planning and Navigation of a Fuel-cell Powered UAV — **Shanghai Jiao Tong University**
Advisor: Prof. Xinjun Sheng — *2016.7–2018.5*

1. Designed a new UAV model based on a new material (AZ31B) which can perfectly fit the Fuel-Cell UAV.

2. Designed an embedded system using microcontrollers for battery management which can control and balance the output of Fuel Cells and Lithium Cells automatically so that the power of the cell can keep up with the motor's change.
3. Designed the path planning system, in addition to PID, using NURBS to improve the efficiency and robustness of the UAV.
4. Developed a system, based on an optical flow sensor and PID, to control the position and navigation of UAVs during flight.

○ **Intelligent Furniture and its Control System Design**   **Shanghai Jiao Tong University**
Advisor: Prof. Xingcai Lyu   *2015.9–2016.2*

1. Designed an automatically switched window based on a feedback system, using Arduino, a temperature transducer, and a humidity sensor, which can automatically determine the amount that a window should be open based on collected data.
2. Designed an automatically-folding table using UG and Solidworks and created a new 1 DOF mechanism to unfold the table.
3. Designed the control system of the table using Arduino Mega 2560 and programmed an App by MIT App Inventor on the phone that can identify the voice of the user and who can then control the table to unfold.

Awards

○ **Outstanding Graduate of Shanghai Jiao Tong University**   2018
○ **HONGYI Scholarship** (Top 8 at SJTU)   2018
○ **Shanghai Jiao Tong University Scholarship**   2015-2017
○ **The First Prize in Shanghai in the China Undergraduate Mathematical Contest in Modelling**   2016
○ **The Second Prize in the China Undergraduate Mathematical Contest in Modelling** (Top 1%)   2016
○ **2016 SGMW Scholarship** (4/485)   2016
○ **Best Innovative Award of School of Mechanical Engineering** (1/374)   2015

Publications and Patents

[1] 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.

[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)*, Under Review.

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

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

Technical and Personal skills

○ **Programming Languages:** Proficient in: Matlab, Python, C++, Arduino, TeX, ROS, PCL

○ **Industry Software Skills:** SolidWorks, Origin, Ansys (Intermediate), Most MS Office products

○ **General Business Skills:** Good presentation skills, Works well in a team.