YUNHAI HAN

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EDUCATION BACKGROUND

Georgia Institute of Technology 06/2022 - present
Ph.D. in Robotics *GPA: 4.00/4.00*

· **Advisor:** Harish Ravichandar and Ye Zhao

University of California, San Diego (UCSD) 09/2019 - 06/2021
M.S. in Dynamics & Controls, Mechanical and Aerospace Engineering *GPA: 3.846/4.00*

· **Relevant Course:** Robotics
· **Thesis & publication:** A Numerical Verification Framework for Differential Privacy in Estimation

Yanshan University 09/2015 - 07/2019
B.S. in Mechatronics, Mechanical Engineering *GPA: 3.761/4.5, Major GPA: 3.804/4.5*

· **Relevant Course:** Mechatronics *Ranking:* 2^{nd} of 594 (First six semesters)
· **Thesis (in Chinese):** Automatically tracking system using monocular vision algorithm PnP

FILED OF INTERESTS

Learning for contact-rich manipulation, Robot learning

PUBLICATIONS

- **Han. Y**, Liu. Y, Paz. D, and Christensen. I. H, "Auto-calibration Method Using Stop Signs for Urban Autonomous Driving Applications", arXiv:2010.07441
- Christensen. I. H, Paz. D, H. Zhang, D. Meyer, Hao. X, **Han. Y**, Liu. Y, Andrew. L , Z. Zhong, S. Tang, "Autonomous Vehicles for Micro-Mobility", Springer Link
- **Han. Y**, Liu. F and M. C. YIP, "A 2D Surgical Simulation Framework for Tool-Tissue Interaction", arXiv:2010.13936
- Liu. F, Li. Z, **Han. Y**, J Lu, F Richter and M. C. YIP, "*Real-to-Sim* Registration of Deformable Soft Tissue with Position-Based Dynamics for Surgical Robot Autonomy", arXiv:2011.00800
- **Han. Y** and Martínez. S, "A Numerical Verification Framework for Differential Privacy in Estimation", arXiv:2108.12094
- **Han. Y**, Batra. R, Boyd. N, Zhao. T, She. Y, Hutchinson. S, Zhao. Y, "Learning Generalizable Vision-Tactile Robotic Grasping Strategy for Deformable Objects via Transformer", arXiv:2112.06374
- M. E. Cao, J. Warnke, **Han. Y**, Ni. Xinpei, Zhao. Y, Coogan. S, "Leveraging Heterogeneous Capabilities in Multi-Agent Systems for Environmental Conflict Resolution", arXiv:2206.01833
- **Han. Y**, Boyd. N, Ni. Xinpei, Zhao. Y, "Multi-Robot Collaboration with Heterogeneous Capabilities", Ieeexplore Link

RESEARCH PROJECTS

Auto-calibration Method for Urban Autonomous Driving Applications

- Present a system for dynamic camera calibration based on recognition of stop signs

- Track camera intrinsic parameters with clear convergences to stable values
- Published a paper at **ICRA 2021** as first-author
- Describe the system in a journal paper accepted by **Autonomous Intelligent Systems (AIS), Springer**

Surgical Simulation Framework for Tool-Tissue Interaction

- Propose a framework that continuously tracks the motion of tool and simulates the soft tissue deformation under the tool-tissue interactions
- Compute the implicit Euler energy for the future control and planning task
- Published a paper at **IROS Workshop (Cognitive Robotic Surgery)** as first-author and gave a spotlight presentation

***Real-to-Sim* Registration of Deformable Soft Tissue with Position-Based Dynamics**

- Propose an online, continuous, registration method to bridge from 3D visual perception to position-based dynamics modeling of soft tissues
- Account for differences between the simulation and the real, live surgical scenes
- Published a paper at **ICRA 2021** as third-author

Differentiable Position-based dynamics framework for manipulating soft tissues

- Design a backpropagation algorithm for the inverse control task in PBD framework, which is inspired by the methods used in Neural network
- Compute the optimal control actions to manipulate the soft tissues so that it can be deformed into a target shape

Numerical Verification Framework for Differential Privacy in Estimation

- Design a differential privacy test framework for distributional sensing systems using numerical verification method
- Capable of being easily extended to various estimators for verifying the claimed differential privacy
- Wrap up the algorithms, theoretical & simulation results in **Master's Thesis**
- Published a paper at **L-CSS with ACC option** as first-author

Learning Generalizable Tactile-based Robot Grasping Strategy for Deformable Objects via Transformer

- Propose a Transformer-based robot grasping framework for rigid grippers that leverage tactile information from a GelSight sensor for safe object grasping
- Learn physical feature embeddings from visual & tactile feedback and predict a final grasp through a multilayer perceptron (MLP) under the given grasping strength
- Command an optimal grasping strength to the gripper for safe grasping tasks by sampling through the predictions
- Submitted a paper to **RA-L** as first-author

SELECTED GROUP PROJECTS

RoboMaster Competition

- Design and build a squad of multi-purpose robots from scratch that are capable of completing different tasks required for the competition

- Responsible for the system design of visual components(including object tracking and monocular vision) and the PID stability adjustment of the gimbal unit on the mobile tank (to prevent bumps and collisions during movement)
- Divide the whole task into several modules for each group member as the leader of vision group

National Undergraduate Electronic Design Contest (China)

- Design and build a single inverted pendulum system using PID controller of the DC motor
- Design and build a wind panel control device that is capable of maintaining the panel at a target degree or rotating it at a constant angular velocity by controlling the motors on both sides (PID feedback)
- Design and build a plate-ball control system that enables the ball to move across the plate through several target points by adjusting the pitch angle of the plate using vision-feedback control (with a camera fixed above the plate)

AWARDS & HONORS

AWARDS

· *06/2016* China Undergraduate Mathematical Contest in Modelling (CUMCM) *Second Prize*
· *03/2017* Zhou Peiyuan Mechanics Competition *National Excellence Award*
· *05/2017* National Undergraduate Electronic Design Contest *Successful Entry Certificate*
· *09/2017* Asia-Pacific Mathematical contest in modeling (APMCM) *Second Prize*
· *01/2018* Mathematical Contest in Modeling (MCM/ICM) *Honorable Mention*
· *08/2018* RM RoboMasters *Second Prize*

HONORS

· *11/2017* National Scholarship from Chinese Ministry of Education
· *07/2018* Certificate for Attendance of CDIO 2018 Academy (Japan)
· *06/2019* Certificate of Excellent Graduate in Hebei Province
· *09/2022* Georgia Tech IRIM Robotics PhD Fellowship

PROFESSIONAL SERVICE

ICRA 2021 Reviewer
AIM 2021 Reviewer
ICRA 2022 Reviewer
IROS 2022 Reviewer
ACC 2022 Session Chair
SSRR 2022 Reviewer

TEACHING EXPERIENCE

MAE145: Robotic Estimation & Planning Winter. 2021
Teaching Assistant
MAE146: Introduction to ML Algorithms Spring. 2021
Teaching Assistant

WORKING EXPERIENCE

Georgia Institute of Technology Summer. 2021 - Spring. 2022
Research Assistant

TECHNICAL SKILLS

Programming	C/C++, Python, MATLAB/Simulink
Tool	STM32, ROS, Drake, Git, Linux, LaTeX
Language	Proficient in English and Chinese