Zhe Huang

Contact Information

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Education

08/2019 – 08/2024	**University of Illinois at Urbana-Champaign**
	Ph.D. in Electrical and Computer Engineering (Expected)
09/2017 – 06/2019	**Stanford University**
	M.S. in Mechanical Engineering
09/2013 – 07/2017	**Xi'an Jiaotong University**
	B.Eng. in Energy and Power Engineering, Honors Engineering Program

Journal Publications

1. J. Xu, **Z. Huang**, Y. Wang, Z. Xiang, and B. Xiong. Identification of Novel Tumor Microenvironment Regulating Factor that Facilitates Tumor Immune Infiltration in Cervical Cancer. Frontiers in Oncology, 2022.
2. **Z. Huang**, R. Li, K. Shin, and K. Driggs-Campbell. Learning Sparse Interaction Graphs of Partially Detected Pedestrians for Trajectory Prediction. IEEE Robotics and Automation Letters (RA-L), 2021.
3. **Z. Huang**, A. Hasan, K. Shin, R. Li, and K. Driggs-Campbell. Long-Term Pedestrian Trajectory Prediction Using Mutable Intention Filter and Warp LSTM. IEEE Robotics and Automation Letters (RA-L), 2020.
4. L. T. Gan, L. H. Blumenschein, **Z. Huang**, A. M. Okamura, E. W. Hawkes, and J. A. Fan. 3D Electromagnetic Reconfiguration Enabled by Soft Continuum Robots. IEEE Robotics and Automation Letters (RA-L), 2020.

Peer Reviewed Conference Publications

The (*) indicates equal contribution.

1. **Z. Huang**, H. Chen, and K. Driggs-Campbell. Neural Informed RRT* with Point-based Network Guidance for Optimal Sampling-based Path Planning. Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2024.
2. **Z. Huang***, Y. J. Mun*, X. Li, Y. Xie, N. Zhong, W. Liang, J. Geng, T. Chen, and K. Driggs-Campbell. Hierarchical Intention Tracking for Robust Human-Robot Collaboration in Industrial Assembly Tasks. IEEE International Conference on Robotics and Automation (ICRA), 2023.

3. S. Liu, P. Chang, **Z. Huang**, N. Chakraborty, K. Hong, W. Liang, D. McPherson, J. Geng, and K. Driggs-Campbell. Intention Aware Robot Crowd Navigation with Attention-Based Interaction Graph. IEEE International Conference on Robotics and Automation (ICRA), 2023.

4. P. Du, **Z. Huang**, T. Liu, T. Ji, K. Xu, Q. Gao, H. Sibai, K. Driggs-Campbell, and S. Mitra. Online Monitoring for Safe Pedestrian-Vehicle Interactions. IEEE International Conference on Intelligent Transportation Systems (ITSC), 2020.

5. C. Chatar, **Z. Huang**, and P. Hadrovic. A Voice Interface for Drilling Systems. IADC/SPE International Drilling Conference and Exhibition, 2020.

Workshop Papers

1. **Z. Huang**, Y. J. Mun, H. Chen, Y. Xie, Y. Niu, X. Li, N. Zhong, H. You, D. L. McPherson, and K. Driggs-Campbell. Towards Safe Multi-Level Human-Robot Interaction in Industrial Tasks. IEEE International Conference on Automation Science and Engineering (CASE) Special Session: The Next-Generation Resilient Cyber-Physical Manufacturing Networks, 2023.

2. H. Chen, Y. J. Mun, **Z. Huang**, Y. Niu, Y. Xie, D. L. McPherson, and K. Driggs-Campbell. Learning Task Skills and Goals Simultaneously from Physical Interaction. IEEE International Conference on Automation Science and Engineering (CASE) Special Session: The Next-Generation Resilient Cyber-Physical Manufacturing Networks, 2023.

3. **Z. Huang***, Y. J. Mun*, X. Li, Y. Xie, N. Zhong, W. Liang, J. Geng, T. Chen, and K. Driggs-Campbell. Seamless Interaction Design with Coexistence and Cooperation Modes for Robust Human-Robot Collaboration. IEEE International Conference on Automation Science and Engineering (CASE) Special Session: Adaptive and Resilient Cyber-Physical Manufacturing Networks, 2022.

4. T. Chen, **Z. Huang**, J. Motes, J. Geng, Q. M. Ta, H. Dinkel, H. Abdul-Rashid, J. Myers, Y. J. Mun, W. C. Lin, Y. Y. Huang, S. Liu, M. Morales, N. M. Amato, K. Driggs-Campbell, T. Bretl. Insights from an Industrial Collaborative Assembly Project: Lessons in Research and Collaboration. IEEE International Conference on Robotics and Automation (ICRA) Workshop: Collaborative Robots and the Work of the Future, 2022.

5. **Z. Huang**, H. Zhao, C. Liu, X. Chen, F. Kopsaftopoulos, and F. K. Chang. High Accuracy Flight State Identification of a Self-Sensing Wing via Machine Learning Approaches. International Workshop on Structural Health Monitoring: Enabling Intelligent Life-Cycle Health Management for Industry Internet of Things, 2019.

Invited Talks and Demonstrations

- **Representing Interactions for Robot Navigation** (joint talk with Prof. Katherine Driggs-Campbell)
  - 5^{th} Robot Learning Workshop: Trustworthy Robotics (NeurIPS), 12/2022
- **Human Behavior Modeling in Autonomous Driving and Collaborative Manufacturing**
  - 9^{th} Wuhan University International Forum for Interdisciplinary Sciences and Engineering, 04/2022
- **Human-Robot Interaction Demo: Make a Fist Bump with Robot!**
  - Illinois Saturday Engineering for Everyone, 03/2022
- **Demo of Human-Robot Collaboration in Industrial Assembly Tasks**
  - Robotics Session at the Annual CSL Student Conference, 02/2022

Research Experience

- **Graduate Research Assistant, University of Illinois at Urbana-Champaign (08/2019 - present)**
  - Human-Centered Autonomy Lab, Department of Electrical and Computer Engineering and Coordinated Science Laboratory
  - Advisor: Prof. Katherine Driggs-Campbell
  - Developed an optimal sampling-based path planning algorithm by incorporating PointNet++ into Informed Rapidly-exploring Random Tree Star (IRRT*), where IRRT* helps PointNet++ focus guidance state inference on the important region for solution improvement, and PointNet++ helps IRRT* sample critical states in the informed subset for convergence acceleration.
  - Built a robust human-robot collaboration system with a hierarchical human intention tracking method for free-form industrial assembly tasks, where human trajectory prediction is integrated into robot motion planning by tracking human intention in real-time, to boost collaboration efficiency under safety monitoring.
  - Developed a novel framework that incorporates particle filtering and Long-Short Term Memory (LSTM) Networks, to simultaneously estimate pedestrian intentions and generate multi-modal long-term trajectory prediction with a flexible sampling strategy. Deployed the trajectory prediction algorithm on an autonomous vehicle.
  - Developed an end-to-end Transformer-based approach which recognizes multi-agent interaction patterns by inferring sparse interaction graphs, and performs trajectory prediction for crowds in public scenes. The effectiveness is demonstrated in addressing freezing robot problems and minimizing disturbances from unimportant neighbors.
- **Advanced Robotics Research Co-op, Amazon Robotics (08/2022 - 12/2022)**
  - Supervisors: Jane Shi, Fan Wang
  - Developed a learning-based instance-wise multi-modal grasp policy algorithm using RGB images and point cloud as input for picking Amazon Fresh groceries with a hybrid gripper.
- **Ph.D. Intern, Nuro (05/2022 - 08/2022)**
  - Supervisors: Rushina Shah, Clark Zhang
  - Developed causal reasoning metrics in terms of trajectory prediction and evaluated the metrics on scene sets of interactive agents.
- **Digital Technology Intern, Schlumberger Software Technology and Innovation Center (04/2019 - 06/2019)**
  - Supervisors: Bernard Van Haecke, Crispin Chatar
  - Developed a voice interface for drilling systems using a Dialogflow NLP agent and Google Cloud services. Demonstrated the interface on a drilling rig model. Received the highest rating in the innovative technologies session.
  - Developed decision tree models on a machine learning chip integrated with accelerometer and gyroscope for drilling pattern recognition and fault diagnosis.
- **Graduate Research Assistant, Stanford University (03/2018 - 12/2018)**
  - Stanford Robotics Lab, Department of Computer Science
  - Advisor: Prof. Oussama Khatib

  - Designed a 6-DoF Gough-Stewart parallel mechanism and a 5-DoF 5-RPUR parallel mechanism for a mining robot, and conducted a comparative study with focus on constant orientation workspace analysis and torsion test. Designed a curved drilling measurement setup, and conducted finite element analysis with a safety factor of 2 on the setup.
  - Developed a virtual underground environment within CHAI3D framework for haptics simulation of a multi-drill-head mining robot. Developed material removal simulation with Axis-Aligned-Bounding-Box and Bounding-Box-Hierarchy algorithms for collision check between rock and drill bits. Derived the model of drilling velocity and force feedback, proved the feasibility in multi-drill-head cases, and integrated the model into proxy method for force feedback rendering during curved drilling simulation.

- **Graduate Research Assistant, Stanford University (09/2017 - 12/2017)**
  - Stanford Collaborative Haptics and Robotics in Medicine Lab, Department of Mechanical Engineering
  - Advisor: Prof. Allison Okamura
  - Developed a prototype of reconfigurable antenna based on the vine robot, a soft robot whose compact features and varied helical shape are ideal for satellite communication applications. Designed a cross actuator to enable the change of the antenna's signal transmission directions. Derived the expression of the deformed shape of vine robot and the helix of actuator connections based on design parameters to facilitate the helical antenna design. Integrated separate conductor design with actuator design to ensure the antenna is activated only when the vine robot is in the helix shape.

Teaching Experience

- ECE598: Human-Robot Interaction, University of Illinois at Urbana-Champaign, Fall 2023 (teaching assistant)
- ECE598: Human-Robot Interaction, University of Illinois at Urbana-Champaign, Spring 2022 (teaching assistant)
- CS223A: Introduction to Robotics, Stanford University, Spring 2019 (teaching assistant)

Professional Activities

- **Reviewer for Conferences**
  - IEEE International Conference on Robotics and Automation (ICRA) 2024
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2021/2022
  - Robotics: Science and Systems (RSS) 2022
  - AAAI Conference on Artificial Intelligence (AAAI) 2023/2024
  - IEEE International Conference on Automation Science and Engineering (CASE) 2023
  - IEEE International Conference on Intelligent Transportation Systems (ITSC) 2020
  - IEEE-RAS International Conference on Humanoid Robots (Humanoids) 2022
- **Reviewer for Journals**
  - IEEE Transactions on Intelligent Transportation Systems (T-ITS) 2023
  - IEEE Transactions on Network Science and Engineering (TNSE) 2023
  - IEEE Transactions on Intelligent Vehicles (T-IV) 2022
  - IEEE Vehicular Technology Magazine (VTM) 2022
  - IEEE Robotics and Automation Letters (RA-L) 2021/2023
  - IEEE Signal Processing Letters (SPL) 2021

Awards and Fellowships

- Best Robotics Demo at the Annual CSL Student Conference, 2022
- Chiang Chen Overseas Fellowship as one of ten recipients in China awarded $ 50,000, 2017
- Delivered the commencement speech at Xi'an Jiaotong University graduation ceremony as the representative of over 3,000 Bachelor's degree recipients, 2017
- Outstanding Student, Xi'an Jiaotong University, 2014-2016
- Pengkang Scholarship as top 2%, Xi'an Jiaotong University, 2015-2016
- China National Scholarship as top 1%, 2014
- National First Prize in China Undergraduate Mathematical Contest in Modeling as top 1%, 2014

Mentoring

Zhaoxu Deng (UIUC ECE BS, 2021)
Ruohua Li (UIUC ECE BS, 2021). Now in UMich ECE MS program.
Kazuki Shin (UIUC ECE BS, 2021). Now in UIUC ECE MS program.
Yiqing Du (ZJU-UIUC ECE BS, 2022)
Shilan He (ZJU-UIUC ECE BS, 2022)
Shiqi Yu (ZJU-UIUC ECE BS, 2022)
Linghao Zhang (ZJU-UIUC ECE BS, 2022). Now in UIUC ECE MS program.
Ninghan Zhong (UIUC CS BS, 2022)
Xiang Li (UIUC ECE MS, 2023)
Yiqing Xie (UIUC ECE MS, 2023)
Adithya Ramakrishnan (UIUC ME BS, 2023). Now in UMich MS Robotics program.
Haoyuan You (UIUC ECE BS, 2023)