Luoyan Zhong

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EDUCATION

Cornell University September 2024 - June 2029 (Expected)

Ph.D. in Electrical and Computer Engineering, Advisor: Prof. Cara Nunez

- **Overall GPA:** 4.0/4.3
- **Courses:** Analog Integrated Circuit Design (A); Embedded Operating System (A)

University of Science and Technology of China (USTC) September 2020 - June 2024

B.E. at School of Information Science and Technology, Major:Automation

- **Overall GPA:** 4.0/4.3 (92.08/100). Ranking: 1/80
- **Selected Courses:** Nonlinear Electronic Circuits (95); Sensor Principles and Technology (93); Principles of Automatic Control (98); Design and Practice of Robot (A)
- **Intern Program:** B.S. intern in Computer Science at Cornell University (July 2023 - Jan 2024)

PUBLICATIONS

1. **Curvature-Aware Calibration of Tactile Sensors for Accurate Force Estimation on Non-Planar Surfaces**
   Luoyan Zhong, Heather Jin Hee Kim, Dylan P. Losey, Cara M. Nunez.
   Accepted by 2026 IEEE Haptics Symposium **(HS 2026)**

2. **CushSense: Soft, Stretchable, and Comfortable Tactile Sensing Skin for Physical Human-Robot Interaction**
   Boxin Xu*, **Luoyan Zhong***, Grace Zhang, Xiaoyu Liang, Diego Virtue, Rishabh Madan, Tapomayukh Bhattacharjee.
   Accepted by 2024 IEEE International Conference on Robotics and Automation **(ICRA 2024)**

3. **A Robot-Assisted Bed Bathing System with Multimodal Perception and Integrated Compliance**
   Rishabh Madan*, Skyler Valdez*, David Kim, Sujie Fang, **Luoyan Zhong**, Diego Virtue, Tapomayukh Bhattacharjee
   Accepted by the 19th Annual ACM/IEEE Conference on Human Robot Interaction (**HRI 2024**)

RESEARCH EXPERIENCES

Curvature-Aware Calibration of Flexible Tactile Sensors on Non-Planar Surfaces (paper)(code) Jan 2025 - Oct 2025

Cornell University, supervised by Prof. Cara Nunez

Developed a curvature-aware calibration approach for resistive tactile sensors that predicts local surface curvature from baseline signals and improves force estimation accuracy on curved surfaces.

- Designed a flexible resistive tactile sensor with a simple, low-cost structure that is easy to fabricate.
- Built a calibration testbench and collected force measurements on curved surfaces to construct a third-order polynomial force calibration model.
- Trained a multilayer perceptron (MLP) to predict local surface curvature from baseline (no-load) sensor outputs, achieving an R^2 score of 0.91.
- Developed an end-to-end calibration pipeline that integrates curvature prediction and force estimation into a unified workflow.
- Validated the approach on five daily objects with varying curvatures under forces from 2 N to 8 N, demonstrating consistent force accuracy compared to flat-surface calibration, which increasingly underestimates force with curvature.

Tactile Servoing for Robotic Manipulation (presentation) Aug 2024 - Sep 2024

Shanghai Jiaotong University, supervised by Prof. Daolin Ma

Summer research project on vision-based tactile servoing, focusing on learning contact pose from tactile images and integrating perception with closed-loop robot control for contact-rich manipulation.

- Implemented a pose-based tactile servoing pipeline that estimates 6-DoF contact pose from tactile images and uses the estimated pose as feedback for robot motion control
- Collected 5,000 real-world tactile image–pose pairs using a GelSlim sensor on an ABB robot, and generated an additional 5,000 simulated tactile image–pose pairs using Tactile Gym.
- Trained a GAN-based image translation network to transform real tactile images into simulation-style images, and applied filtering and linear contrast transformations to improve domain alignment.
- Implemented and trained a CNN-based pose regression network to estimate 6-DoF contact pose directly from simulated tactile images.
- Integrated tactile pose estimation with PID-based position control to realize a closed-loop pose-based tactile servoing system.

Soft, Stretchable Tactile-Sensing Skin for Physical Human-Robot Interaction (paper)(code)(website) July 2023 - Jan 2024

Cornell University, supervised by Prof. Tapomayukh Bhattacharjee

Designed a soft, stretchable, and low-cost whole-arm tactile sensing skin that enables accurate force sensing while improving safety and comfort in physical human–robot interaction.

- Fabricated a soft, stretchable, fabric-based capacitive tactile skin with compliant dielectric layers for large-area robot arm coverage.
- Integrated custom PCBs, capacitance-to-digital converters, and I^2C multiplexing, enabling scalable sensing up to 200+ taxels with a single microcontroller.
- Performed sensor characterization (accuracy, hysteresis, noise, durability), achieving 0.58 $\%$ relative force error and less than 0.1 $\%$ performance degradation after 1000 interactions.
- Deployed the tactile skin on a 7-DoF robot arm and conducted a human-subject user study (n=15) demonstrating significantly improved perceived safety and comfort in assistive limb-manipulation tasks.
- Released open-source hardware, fabrication procedures, calibration tools, and ROS-based visualization, supporting reproducibility and adoption in pHRI research.

SELECTED COURSEWORK

Switched Capacitor MAC for Edge Detection (report) Fall 2024

Cornell University, supervised by Prof. Alyosha Molnar

Implemented analog multiply-and-accumulate computation using switched-capacitor circuits to enable signal processing prior to digitization.

- Designed and simulated a passive switched-capacitor MAC circuit for analog signal processing.
- Implemented charge-based multiplication and accumulation using capacitor ratios and multi-phase clocking.
- Analyzed error sources, including residual charge and accumulation error, to guide capacitor sizing and stability.
- Verified functionality through transient simulations and system-level integration with a SAR ADC.

Deep Learning Practice Fall 2022

USTC, supervised by Prof. Yueyi Zhang, Prof. Xinwei Zheng, and Prof.Zhiwei Xiong

- Deep Learning Network (code)
  - Implemented and analyzed core CNN architectures and backpropagation, with comparative studies of LeNet, AlexNet, and ResNet.
  - Evaluated architectural design choices through targeted modifications to ResNet.
- Oriented Object Detection (Oriented R-CNN) (code)
  - Reproduced the network to generate high-quality oriented proposals which achieves 75.87%mAP, 15.1FPS on DOTA and 96.50% mAP on HRSC2016
  - Investigated alternative loss functions (Smooth L1, Focal Loss) and proposal representations to improve detection performance.
  - Explored alternative methods to represent the oriented proposals

TEACHING EXPERIENCE

Teaching Assistant - ECE 2720: Data Science for Engineers Fall 2024

Instructed by Prof. Jayadev Acharya

- Led discussion sections and office hours covering the data science workflow, including data cleaning, statistical inference, regression, classification, and model evaluation, supported Python-based programming projects

SKILLS

Programming Python, C++, C
Embedded and Robotics ROS, Pytorch, Arduino, Raspberry Pi, ESP32, STM32
Hardware and Analysis Autodesk Fusion 360, KiCad, Soldering, Matlab

AWARDS

China National Scholarship, 2022 (Highest-level governmental scholarship, 0.2% award ratio)
13th National Mathematics Competition for College Students (FIRST PRIZE), 2021
Outstanding Student Scholarship, USTC, 2020

OUTREACH AND ACTIVITIES

Presented a research poster at Northeast Robotics Colloquium (NERC) 2024
Volunteered and demonstrated lab research at NERC 2025
Participated in multiple lab outreach activities including CURIE Academy, CATALYST Academy, Stem Fest, showcasing tactile sensing and robotics research to broader audiences.