Xiaoyu Liang

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EDUCATION

Cornell University, College of Engineering   *May 2025*
B.S. in Electrical and Computer Engineering (Magna Cum Laude) Minor in Robotics
Cumulative GPA: 3.99
Relevant Courses: Foundations of Robotics, Computer Architecture, VLSI, HLS, Machine Learning, Practicum in AI, Embedded OS, Integrated Micro Sensors and Actuators, Microelectronics, Signal and Systems, Microcontrollers

RESEARCH

Cornell CSL - Zhang Lab   Ithaca, NY
Research Intern | Advisor: Prof. Zhiru Zhang   *July 2025 - Present*
Topic: **Deployment of Vision-Language-Action Models on NPUs**
- Explored deployment of Vision-Language-Action (VLA) models on AMD Ryzen AI Engines using the Allo compiler framework; verified correctness and performance of a single-layer end-to-end prototype.
- Implemented custom computation kernels (e.g., sine, cosine, SiLU, GELU, GEMM) tailored for AIE compute-tile architecture; applied tiling, vectorization, and dataflow strategies to improve efficiency.
- Developed key model components, including vision embedding, vision backbone, LLaMA-based transformer layer, rotary embeddings, attention, and MLP, to construct the first mapping of smolVLA model to NPU.
- Profiled VLA components on CPU and NPU to identify latency bottlenecks and guide optimization strategies.
- Ongoing work focuses AI agent driven methods for iteratively code generation and optimization to enable scalable and efficient deployment of embodied AI workloads on NPU.

Cornell EmPRISE Lab   Ithaca, NY
Undergraduate Researcher | Advisor: Prof. Tapomayukh Bhattacharjee   *Feb 2023 - Present*
Topic: **Multimodal Dataset for Robot Caregiving [1]**
- Collaborated with Columbia University and NUS researchers to design the caregiving protocol and data collection setup for a large-scale multimodal dataset that supports robot learning in physical caregiving tasks.
- Collected 21 occupational therapists (OTs) demonstrating 15 activities of daily living (ADL) tasks through 5 modalities: tactile sensing, pose tracking, gaze tracking, RGBD recording, and high-level task annotations.
- Designed and fabricated a flexible tactile sensing skin for hospital manikins with 88 piezo-resistive sensors to capture caregiver-manikin physical interactions. The engineered skin achieved durability under a 200 lb load, flexible attachment to curved surfaces, and accurate force measurement across different body regions.
- Led post-collection processing, including data inspection, cleaning, multimodal alignment, visualization, and coordination of labeling workflows to support 3D keypoint reconstruction under occlusion cases.

Topic: **Robot Arm Tactile Sensing and Manipulation [2][3]**
- Fabricated an innovative whole-arm soft stretchable tactile sensing skin for assistive limb manipulation tasks.
- Formulated mathematical models to analyze capacitance changes under varied compression conditions; applied model-based filtering to enhance sensor measurement under high-noise environments.
- Redesigned sensing circuitry and fabrication process to enhance durability and responsiveness of the tactile skin for robotic manipulation; increased sampling frequency from 3 Hz to 60 Hz.
- Conducted user studies and performed comprehensive sensor characterization experiments (durability, stretchability, and compression tests) for evaluating the safety, comfort, and performance of the skin.

Carnegie Mellon University Robotics Institute   Pittsburgh, PA
Research Assistant | Advisor: Prof. James McCann   *May 2024 - Aug 2024*
Topic: **Paint-On Sensing**
- Explored and designed a novel, low-cost, and easily accessible fabrication method for a mutual capacitive sensing using nickel-based conductive paints to support proximity and tactile sensing for industrial robots.
- Implemented signal generation and RMS-based amplitude detection using 100 kHz sine waves; optimized hardware cost by replacing expensive analog components with microcontroller-based sampling.
- Designed and built a motorized testbed to automate proximity sensing experiments; conducted EM simulations to analyze electric field distribution and quantify signal behavior.
- Designed modular capacitive sensing PCBs supporting up to 16×16 grids; enabled I²C chaining for scalable integration across articulated, multi-link robotic arms.
- *Poster presented in CMU Manufacturing Futures Institute, 2024* [PDF]

PUBLICATION

[1] OpenRoboCare: A Multi-Modal Multi-Task Expert Demonstration Dataset for Robot Caregiving
<u>Xiaoyu Liang</u>, Ziang Liu, Kelvin Lin, Edward Gu, Ruolin Ye, Tam Nguyen, Cynthia Hsu, Zhanxin Wu, Xiaoman Yang, Christy Sum Yu Cheung, Harold Soh, Katherine Dimitropoulou, Tapomayukh Bhattacharjee
In International Conference on Intelligent Robots and Systems (IROS), 2025 [PDF] [website]

[2] Not All Collisions are Bad: Adapting to User Contact Preferences for Whole-Arm Manipulation
Rishabh Madan, Jiawei Lin, Mahika Goel, Amber Li, Angchen Xie, <u>Xiaoyu Liang</u>, Marcus Lee, Justin Guo, Pranav N. Thakkar, Rohan Banerjee, Jose Barreiros, Kate Tsui, Tom Silver, Tapomayukh Bhattacharjee [PDF] [website]
In Conference on Robot Learning (CoRL), 2025

[3] CushSense: Soft, Stretchable, and Comfortable Tactile Sensing Skin for Physical Human-Robot Interaction
Boxin Xu, Luoyan Zhong, Grace Zhang, <u>Xiaoyu Liang</u>, Diego Virtue, Rishabh Madan, and Tapo Bhattacharjee.
In International Conference on Robotics and Automation (ICRA), 2024 [PDF] [website]

GROUP PROJECT

TCAM | High-speed, compact 32×32 TCAM array with integrated highest-index priority encoder
with Prof. Alyosha Molnar   *Spring 2025*
- Designed and implemented TCAM in Cadence; optimized transistor sizing for reliable matchline timing.
- Automated Verilog-A testbench using Python scripts to simulate full 32-bit write and search operations.

PiLooper | Raspberry Pi Pico music device for real-time audio recording, looping, and playback
with Dr. Hunter Adams and Dr. Bruce Robert Land   *Fall 2023*
- Designed an analog circuit for audio noise elimination, signal amplification, and overvoltage prevention.
- Engineered an interface pipeline for user input detection, input processing, state management, and execution.

IntelliGlove | Smart sensing glove translating hand gestures into English words and numerical values
with Prof. Nils Napp   *Spring 2023*
- Developed sensor architecture and circuitry; designed finger classification and gesture recognition algorithm.
- Ranked top 10 out of 80 teams in the final project showcase.

MazeBot | Autonomous maze-navigating robot with wireless communication and audio processing
with Dr. Carl Bernard   *Fall 2022*
- Implemented software algorithms for DFS navigation, PID control, FFT analysis, and RF communication.
- Ranked 1st out of 20 teams in the final competition.

AWARD AND MEMBERSHIP

- **Faculty Nominated CS Course Staff Award**   *Spring 2024*
- **Cornell Engineering Undergraduate Research Award** with $2000 research funding   *Fall 2023*
- **Best Software Award** in Cornell Engineering Makeathon   *Spring 2023*
- **IEEE-HKN** member (invited, top 20% of ECE sophomore class)   *since Spring 2023*
- **Dean's Honor List** for outstanding scholastic performance   *multiple semesters since Fall 2021*

TEACHING

Teaching Assistant (TA)
- ECE 5725   Design with Embedded Operating Systems   *Fall 2024, Spring 2025, Fall 2025*
- CS   4770   Foundations of Robotics   *Fall 2023, Fall 2024*
- ECE 2300   Digital Logic and Computer Organization   *Spring 2024*
- ECE 1210   The Computing Technology Inside Your Smartphone   *Spring 2023*

Teaching Consultant
- CS   1112   Introduction to Computing Using MATLAB   *Fall 2022, Spring 2023*

SKILLS AND INTERESTS

Programming: Python, C++, C, Java, Verilog, Pytorch, ROS, MATLAB/Simulink, SQL, HTML
Applications: Embedded Linux, Vivado, Vitis HLS, Cadence Virtuoso, Quartus, Altium, LTspice, COMSOL
Hardware: Embedded Systems, Microcontrollers, PCB design, 3D printing, laser cutting, soldering
Languages: Fluent in English and Mandarin
Creative Work: Lead songwriter and producer of Night Espresso Band.