HaoChen Xia

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Education

University of Illinois at Urbana Champaign **Graduation Date 2026**

Major in Computer Engineering with Minor in Mathematics GPA: 3.87/4.0

- Relevant coursework: Computer System Engineering, Machine Learning, Algorithm, Artificial Intelligence, Data Structure, Robotics, Probability with Engineering Application, Linear Algebra, Data Science, Fundamental Mathematics

Publications

1. S Liu, **H Xia**, FC Pouria, K Hong, N Chakraborty, Z Hu, J Biswas, K Driggs-Campbell, "HEIGHT: Heterogeneous Interaction Graph Transformer for Robot Navigation in Crowded and Constrained Environments", under review, [Paper, Website, Video].
2. **H Xia,** A Hasan, H Chen, and K Driggs-Campbell, "HomE: A homogeneous ensemble framework for dynamic hand gesture recognition," in *Proceedings of the 2025 IEEE 19th International Conference*, May 2025, [Paper, Code].

Research Experience

Human-Centered Autonomy Lab Champaign, IL

Advisor: Professor Katie Driggs-Campbell

Undergraduate Research Assistant February 2024 – Present

- **HomE: Homogeneous Ensemble Framework for Dynamic Hand Gesture Recognition**
  - Co-proposed HomE, a router-guided ensemble that partitions gesture classes into smaller, coherent subsets, boosting accuracy and robustness without changing backbone networks
  - Designed heterogeneous sampling that blends hierarchical and generative clustering with an LLM-driven semantic sampler to build balanced expert subsets and curb inter-class confusion
  - Benchmarked HomE on three public datasets, lifting baseline accuracy by up to 4.8 pp on depth data and 4.5 pp on skeleton data, while narrowing error under noise tests
  - Led ablation studies showing complementary strengths across sampling strategies and validating scalability to depth & skeleton modalities
- **HEIGHT: Heterogeneous Interaction Graph Transformer for Robot Navigation in Crowded and Constrained Environments**
  - Collaborated on HEIGHT, a deep-reinforcement-learning transformer policy built on a heterogeneous spatio-temporal graph for crowd navigation.
  - Applied an A* search baseline to probe architectural choices during ablation studies
  - Built an attention-free neural baseline to isolate the graph's contribution to policy quality
  - Implemented Dynamic Window Approach and Optimal Reciprocal Collision Avoidance in a simulator as non-learning references for benchmarking
- **Robot AI Engineer: Dragon Dialogue Navigation Port on Stretch Robot**
  - Ported Dragon perception, planning, and dialogue nodes to ROS2 Python on Stretch, enabling voice-driven navigation and fetch commands
  - Streamlined NLU, CLIP, and VQA pipelines with asynchronous calls and embedding cache to lower command latency
  - Conducted real-world experiments to validate reliable voice-to-motion performance and obstacle-free navigation
- **Generative Model for In-car Hand Gesture Video Generation**
  - Built variational autoencoder and generative adversarial pipelines to synthesize realistic in-car hand-gesture videos
  - Tuned network depth, temporal kernels, and latent size with systematic searches to lower reconstruction error and improve image quality metrics
  - Designed transformer classifiers over latent tokens to assess motion realism and guide generator refinement

Research in ECE Department at UIUC Champaign, IL

Advisor: Professor David M. Nicol

Undergraduate Research Assistant January 2024 – Present

- **High-Performance Fault Tolerant Communication Protocols in Safety-Critical Industry**
  - Engineered a Data Plane Development Kit (DPDK) implementation of PRP in C to achieve wire-speed redundant packet forwarding
  - Benchmarked legacy PRP to uncover throughput and latency bottlenecks eliminated by DPDK acceleration
  - Simulated large-scale topologies in OMNeT++ with Monte Carlo trials to pinpoint high-risk nodes and links for redundancy
  - Constructed a fault-injection testbed to compare conventional and optimized PRP under realistic network failures

Working Experience

Aviatrix Champaign, IL

Software Development Engineer Intern June 2025 – August 2025

- Built a security AI agent to inspect node-to-node traffic in real time and dynamically enforce Distributed Cloud Firewall policies based on the threat levels
- Developed a C++ Apache Traffic Server plugin that classifies MCP/LLM packets with less than 1 µs overhead at 10 Gbps
- Benchmarked the plugin on AWS, demonstrating around 25% higher throughput and 40% lower latency
- Fortified gateways with policies to block 98% prompt injection and tool poisoning attacks in LLM and MCP
- Implemented lightweight tools to expose qdisc and Distributed Cloud Firewall policies in the cloud gateways
- Automated end-to-end alerting by wiring GitHub Actions, Prometheus, and Alertmanager to enable real-time notifications and cut CI/CD failure detection to less than 1 minute

Nokia Naperville, IL

5G Arch January 2025 – May 2025

- Optimized the distributed search index with a nested multi-vector schema, trimming storage around 30% and matching chunk boundaries to LLM context windows for higher answer precision
- Enabled image upload and visual search in both the chatbot and web portal to cut data and diagram lookup latency
- Deployed a vision-language encoder to convert images into dense text captions to cut LLM token calls by 45% and lower cloud-storage traffic
- Integrated LlamaIndex with a LangChain-driven RAG pipeline, cutting token spend by more than 35% while preserving top-3 recall
- Embedded LLM-powered summarization, comparison, and scoring widgets into a React/FastAPI stack

Garg Group at UIUC Champaign, IL

Computer Vision Engineer May 2024 – Aug 2024

- Engineered a DeepSORT pipeline to track and count waste objects at 30fps with 80% counting accuracy
- Boosted YOLO mean-average-precision 12% by fusing color and depth cues at the decision layer
- Automated database labeling by pairing YOLO detections with Segment Anything masks to trim manual annotation time by 70%
- Collected and annotated 2600+ images in Roboflow to produce a balanced multi-class waste dataset that cuts false positives in live tests

Applied Technologies for Learning in the Art & Science Internship Program Urbana, IL

Data Analyst & Educational Technologist January 2023 – May 2023

- Consolidated and cleansed K-12 program data from 70+ schools in Python, producing an analysis-ready dataset in a single sprint
- Analyzed 100+ pre-/post-program survey items to measure learning gains and steer curriculum improvements
- Built interactive Power BI and Tableau dashboards that visualize attendance, engagement, and outcome KPIs for educators and district leaders
- Produced step-by-step video and Word tutorials that enabled non-technical staff to self-serve insights, cutting ad-hoc report requests by 40%

Leadership Experience

1Shan AI Team Hybrid

Cofounder & Tech Lead March 2024 – Present

- **Shantou AI – AI Agent for Job Application**
  - Developed a Chrome extension to scrape job posts and resumes, auto-filling applications with 85% field-match accuracy
  - Integrated an AI agent to craft tailored answers to application questions by aligning resume content with each job description
  - Launched a dashboard for users to customize resume variants and monitor submission history
- **Mythoverse AI – AI-Powered Video Storytelling**
  - Developed an AI-powered text-to-video generation system with advanced semantic understanding for high-quality video creations with various LLM and VLM, such as GPT and FLUX
  - Collaborated to implement real-time AI-generated voiceovers, subtitles, and sound effects to enhance video storytelling with TTS AI
  - Designed and developed an interactive platform for users to script stories, preview scenes, and share outputs
- **1Shan AI – Aesthetic Intelligence for Visual Content**
  - Collaborated to develop an AI-driven aesthetic model to evaluate, rank, and enhance clothing visuals to enable personalized and high-quality custom apparel design
  - Fine-tuned a text-to-image generator with reinforcement learning to preserve fabric fidelity and high-quality visuals
  - Designed and developed a Django studio for users to upload designs, receive ranked variants, and iterate live
- **Automated Codebase Modification with Large Language Model**
  - Analyzed a Django/Vue warehouse-management codebase, documenting safe edit paths for language-model agents
  - Adapted repo-agent and SWE-agent frameworks to generate fully-formed pull requests and migration patches
  - Crafted prompt schemas and configuration files guiding LLMs toward concise, standards-compliant code changes

Project Highlights

Keylogger with Large Language Model Urbana, IL

Independent project April 2023 – July 2024

- Developed a keylogger in Rust to capture file access, system events, and keystrokes for security review
- Designed and implemented pattern-matching filters to identify and highlight potentially sensitive information
- Implemented encryption and decryption algorithms to secure and disguise captured logs
- Integrated a large language model for automatic log summarization and event grouping to surface high-risk behaviors and accelerate analyst review

UR3 Robot Arms Tools Recognition and Handling in Collaborative Work Environments Urbana, IL

Project Team Lead March 2024 – May 2024

- Designed a real-time perception-to-control stack for a UR3 arm to classify 10+ tools, select stable grasp points, and perform human-safe handovers
- Developed shape and 6-DoF pose-estimation modules in Python and ROS to localize tools with mm-level accuracy
- Evaluated and optimized the algorithm in dynamic environments to ensure reliable and precise tool handling and delivery

SigAIDA Machine Learning and Computer Vision Projects Urbana IL

SigAIDA Project Team Lead August 2023 – February 2024

- Led a project team at SIGAIDA to deliver a Faster R-CNN that detects weapons with 86 % mAP
- Developed Long Short-Term Memory (LSTM) models to predict daily, weekly, and monthly stock prices
- Collaborated on developing CNN pipelines for potato-disease, animal, and firearm classification, reaching 95 % accuracy on 5k-image sets
- Deployed VGG19 and ResNet50 transfer-learning models for fine-grained plant-leaf

Honors

Yunni and Maxine Pao Memorial Scholarship 2024 - 2026
ECE Simmons Scholarship 2024 - 2025
Bradley A. Simmons Memorial Scholarship 2024 - 2025
Kaskowitz Family Scholarship 2024 - 2025
IL Engineering Outstanding Scholarship 2024 - 2025
James Scholar Honors Program 2023 - 2025

Certificates

IBM AI Engineering Professional Certificate December 2023
IBM Building Deep Learning Models with TensorFlow Certificate December 2023
IBM Deep Neural Networks with PyTorch Certificate November 2023
IBM Introduction to Computer Vision and Image Processing Certificate November 2023
Career Certificate – International Student October 2023
IBM Introduction to Deep Learning & Neural Networks with Keras Certificate October 2023
IBM Machine Learning with Python Certificate September 2023

Technical Skills

Programming language: C++/C, Python, Rust, Java, HTML, CSS, JavaScript, SQL
Machine Learning & AI: PyTorch, TensorFlow, Scikit-learn, OpenCV, Ultralytics (YOLO), RAG, LangChain, LlamaIndex, OpenAI API, Roboflow
Networking & Systems: DPDK, Apache Traffic Server, OMNeT++, INET, ROS/ROS2, Docker, Linux, AWS, GCP, Git, Cloud Security Policies
Web & Application Development: Django, FastAPI, React, Chrome Extensions, GitHub, OpenSearch

Extracurricular Activities

Association for Computing Machinery Urbana, IL
Participant September 2022 – Present
- Coordinated check-in and moderated Q&A at ACM's Reflection | Projection conference, interacting directly with guest speakers on emerging tech trends
- Expanded Python-based cybersecurity skills through weekly challenges in the SIG-Pwny offensive-security group

Institute of Electrical and Electronics Engineers Urbana, IL
Participant September 2022 – Present
- Completed hands-on TAG, Flask, and PCB workshops covering network protocols, web security, and board design fundamentals
- Connected with industry professionals in monthly tech talks to explore real-world ECE applications

Leadership I Program Urbana, IL
Participant October 2022 - December 2022
- Practiced innovation-driven problem-solving in team simulations, presenting a capstone solution to peer facilitators
- Strengthened self-awareness and communication through guided reflection and interpersonal-skills exercises