

# SHENGKAI (SAM) XU

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## EDUCATION

**M.Sc. Computer Engineering** | University of North Carolina at Charlotte    Aug 2022 - Aug 2024

- Research in Deep Learning and Computer Vision on Edge Devices/Servers

**B.Sc. Computer Engineering** | University of North Carolina at Charlotte    Jan 2018 - Dec 2022

- Dean's List
- Concentration in Machine Learning
- Minor in Mathematics

## SKILLS

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|------------------------|---|
| <b>Programming</b>     | Python, SQL, Embedded C, C++, VHDL              |
| <b>ML/AI</b>           | Pytorch, TensorFlow, Keras, Panda, scikit-learn |
| <b>Embedded System</b> | ESP32, STM32, Arduino, RaspberryPi              |
| <b>CAD</b>             | SOLIDWORKS, EAGLE, KiCAD                        |
| <b>Cloud Service</b>   | AWS, Google Cloud, OpenAI, RunPod               |
| <b>Misc</b>            | Git, GitHub, Linux, Vivado, LaTeX               |

## EXPERIENCE

**Research Assistant** | Dr. Hongfei Xue    Jan 2024 - Present

- Under Creating and implementing a ground truth model that utilizes a system of RGB and Depth Cameras in a remote setting. This model will enable a radio mmWave device to accurately estimate human poses.

*Dr. Hongfei Xue is an Assistant Professor in the Department of Computer Science at the University of North Carolina at Charlotte. His research interests lie at the intersection of Internet of Things (IoT) and Artificial Intelligence (AI), with a focus on developing intelligent wireless sensing systems.*

**Research Assistant** | TeCSAR    Aug 2022 - Jan 2023

- Developing and implementing an AI pipeline for civilian security and public safety systems, especially in the realm of video processing and anomaly action detection, involves a complex set of skills and experiences.
- Achieved a 50% increase in processing speed, leading to significantly enhanced video output smoothness and faster response times.

*TeCSAR (Transformative Computer Systems and Architecture Research Lab) is a UNC Charlotte research lab led by Dr. Hamed Tabkhi. The lab uses machine learning, deep learning, and data analytics to improve community safety, health, and well-being.*

**Embedded Firmware Engineer** | Oxit    May 2021 - May 2023

*Awarded Letter of Recommendation for excellent performance*

- Led research and development initiatives, effectively creating innovative tools that substantially enhanced project efficiency.
- Developed and deployed Internet of Things (IoT) service and device automation pipelines in AWS and Google Cloud platforms.
- Designed modular libraries to streamline embedded applications across various chipsets, significantly enhancing system efficiency and compatibility.

*Oxit is an engineering company specializing in low-power, long-range RF communication technology for IoT applications, including LoRa.*

## PROJECTS

**AI-Powered Discord ChatBot** | PyTorch, Huggingface.co, LangChain, PrivateGPT    2023

**LLM-Discord-Bot**

- Engineered an innovative Discord assistant bot by integrating LangChain and Hugging Face's large language models, facilitating complex and dynamic user interactions.
- Ensured the bot operates locally, prioritizing privacy and data security for users within Discord communities.
- Demonstrated expertise in AI and chatbot technology, leading to a notable enhancement in user engagement and experience on private Discord servers.

## **Fungus Classifier on Edge device** | TensorFlow, TensorFlow Lite, Android

2023

### **Applied-AI-Fungus-Detector**

- Spearheaded the design and development of a mobile application focused on fungus image classification, catering to foraging and wilderness survival needs.
- Integrated an AI model that operates locally on mobile devices, ensuring the app's functionality in remote, off-grid locations.
- Enhanced the app's reliability and accessibility for outdoor enthusiasts, providing a valuable tool for identification in environments without internet or cellular service.

## **SR-GAN Implementation** | PyTorch, TensorFlow, Generative Adversarial Networks

2023

### **Applied-AI-SRGAN**

- Developed a binary classification model utilizing an existing dataset, focusing on initial data analysis and model training.
- Implemented a Super-Resolution Generative Adversarial Network (SRGAN) to upscale low-resolution data, enhancing its quality and detail.
- Created a second binary classification model that utilized the high-resolution output from the SRGAN, integrating advanced AI techniques for improved accuracy.
- Conducted a comprehensive comparative analysis between the two models, showcasing the effectiveness of SRGAN in boosting data resolution and classification performance.

## **Pet Detector** | Keras, Embedded C, Nvidia Jetson Nano, ESP32, TensorFlow Lite, OpenCV

2022

- Implemented transfer learning with Edge Impulse's FOMO (Faster Objects, More Objects) model to develop a pet activity detection system for office pets. Successfully deployed the solution on edge devices, including Nvidia Jetson Nano and ESP32 embedded systems, demonstrating proficiency in IoT and AI technologies for real-time monitoring applications.

## **Optical Inventory System** | OpenCV, Robotic, Electronics, Raspberry Pi

2021

- Developed an innovative inventory management system for Oxit, designed to monitor vaccine stocks in a medical refrigerator. Utilized a Raspberry Pi to control a camera mounted on a stepper motor, enabling precise X and Y axis movements. This system captured detailed images of individual shelf sections, seamlessly stitched into a comprehensive image, providing the client with an efficient solution for real-time inventory tracking.

## **Mask Detector** | PyTorch, Kaggle, YOLO, OpenCV

2020

- Implemented YOLOv4/5 models to analyze mask usage in crowds from video footage, enabling statistical insights on mask-wearing in the surrounding area.

## **High-altitude Weather Balloon** | Electronic, Embedded System, Wireless Communication

2020

*Sponsored by Wake Tech Community College and North Carolina Space Grant*

- Engineered and executed a high-altitude weather balloon project, reaching an altitude of approximately 30,000 meters.
- Developed and integrated a specialized payload for advanced outer space air and pollen sampling. Successfully designed and implemented a retrieval system, ensuring the payload's safe and intact return to Earth post-data collection.

## **PUBLICATIONS**

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S. Xu, M. N. Hasan, R. E. Thomas, A. Lopez, and S. Shue, "Charlotte Area Traffic Light Dataset," in *IEEE HONET 2023*, 2023. In Press.

A new dataset with over 4,000 dashcam images from Charlotte, NC, includes diverse weather and lighting conditions to benchmark traffic light detection models.

The dataset reveals performance variations in models like YOLOv5 under different conditions, emphasizing region-specific factors in traffic light perception.

A. Brooks, B. Bryant, C. Spoerer, M. Lust, S. S. Xu, Y. Li, N. N. BouSaba, and D. Maity, "Path Planning for Robotic Delivery Systems," in *SoutheastCon 2022*, pp. 421-426, 2022. doi: 10.1109/SoutheastCon48659.2022.9764058.

The study uses a modified Dijkstra's algorithm and a directed graph, based on GPS locations from Open Street Map, for efficient path planning across a university campus.

A node-abstraction method compresses the graph to reduce time complexity, significantly improving computation time in simulation results.

## EXTRACURRICULAR

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### **IEEE-Eta Kappa Nu**

*Honor Society Member*

2022

- IEEE-HKN, founded in 1904, is an honor society within IEEE that fosters excellence in education and the profession, emphasizing scholarship, character, attitude, professional accomplishment, service, and leadership in electrical and computer engineering, and related IEEE fields.

### **UNC Charlotte Engineering Leadership Academy** | Electronic, CAD, Hardware

2020 - 2021

*UNC Charlotte Engineering Leadership Training*

- The Leadership Academy is a two-year program that equips undergraduates with leadership skills through five modules taught by faculty and industry experts, including practical off-campus experiences, preparing for roles in the engineering industry.

### **Student Formula Society of Automotive Engineers** | Electronic, CAD, Hardware

2019

*UNC Charlotte Student Club*

- Contributed to the electrical power and wiring department of the Student Formula Racing club, assisting the team in their participation in the Formula SAE Student engineering competition.

### **UNC Charlotte Area Robotic Team** | 3D-Printing, CAD, Electronic, Embedded System

2018

*UNC Charlotte Student Club*

- Designed and programmed an autonomous robotic vehicle for IEEE SoutheastCon 2018, focusing on navigating diverse courses and solving complex challenges. This project involved creating a simulation of extraterrestrial environments to demonstrate the robot's potential for planetary exploration applications.

### **Vice President of Engineering Club** | Leadership, Engineering Problem Solving

2017

*Wake Tech Community College Student Club*

- Assisted the President in overseeing club operations and ensuring that all activities aligned with the club's goals and objectives.
- Coordinated and planned events, workshops, or competitions related to engineering, fostering a collaborative environment for members to share ideas and work on projects.