

# Zirui Song

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## EDUCATION

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- **Cornell University** Ithaca, NY  
*Master of Engineering in Electrical and Computer Engineering*  
Expected Dec 2024  
GPA:3.83
- **The Hong Kong Polytechnic University** Hong Kong  
*Bachelor of Engineering in Electronic and Information Engineering*  
Aug 2019 - May 2023

## SKILLS SUMMARY

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- **Languages:** Python, Java, C++, JavaScript, SQL, MATLAB
- **Frameworks:** TensorFlow, PyTorch, Spring, MyBatis, Keras, Pandas, Neo4j, Vue
- **Tools:** IntelliJ, Docker, GIT, VSCode, MySQL, SQLite
- **Platforms:** Linux, Windows, Mac, Raspberry, STM32

## WORK EXPERIENCE

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- **Machine Learning Engineer Intern — Xiaomi** Beijing, China  
*Multimodal Learning with Automotive Property Prediction* May 2024 - Aug 2024
  - **Multimodal Learning:** Applied **multimodal learning** algorithms to predict mechanical properties of automotive components, building an **Intermediate fusion** model to integrate images and tabular data.
  - **End-to-End ML System Design:** Designed and implemented an end-to-end ML system for data processing, model training, and multimodal fusion. Deployed an **SQL** database on a **Kubernetes** server for convenient usage across functional teams.
  - **Feature Extraction:** Utilized pre-trained **CLIP** model, RGB histogram features, and **Auto-Encoder** to enhance feature extraction, reducing **MAE** and **MAPE** over 50%.
  - **Semi-Supervised:** Employed Semi-Supervised learning techniques to utilize the unlabelled data, leveraging the constraint of data.
- **Research Assistant — ROMI Lab, HKPolyU** Hong Kong  
*Automatic Ultrasound Examination Robot* Sep 2022 - May 2023
  - **Communication Tool Development:** Developed the communication service between a PC and an Ultrasound probe with **JavaScript**.
  - **Object Detection & Localization:** Designed and trained a new-structured Deep Neural Network based on **ResNet18** to detect and localize certain human organs. Overall accuracy reached **80%**.
  - **Robot Arm Control:** Developed a robot arm controller to conduct automatic ultrasound detection.
- **Research Assistant — Sharc Lab, Georgia Tech** Atlanta, GA  
*Federated Learning Communication Cost Optimization* May 2022 - Sep 2022
  - **Federated Learning Model:** Learned the concept and algorithms of Federated Learning. Aimed at optimizing multi-device learning process based on **FedAvg**.
  - **Communication Cost Reduction:** Applied **low-rank algorithm** on the data communication to reduce the cost.
  - **Better Learning Efficiency:** Proposed a new client selection mechanism to reduce the imbalance among multiple devices.

## PROJECTS

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- **Federated Learning with Adaptive Edge Device Selection (Federated Learning):** 1. Developed and implemented adaptive edge device selection strategies in **federated learning**, significantly enhancing learning efficiency and mitigating heterogeneity issues across edge devices; 2. Designed experiments comparing **FedAvg**, **FedProx**, and **q-FedAvg** algorithms, highlighting the trade-off between performance and fairness under IID and Non-IID data conditions; 3. Conducted a comprehensive **literature review** and implemented **algorithms**, such as FedCS, FedPNS, and OCEAN, to address challenges such as system heterogeneity, statistical heterogeneity, and resource management. (2023 - 2024)
- **An Automatic Archived Film Restoration System (Deep Learning, Signal Processing, UI Design):** 1. Employed the Low-rank detection method and the **Deep Image Prior** restoration method to restore degraded films; 2. Proposed new algorithms: Pixel Substitution & Alternating Reference; 3. Designed a presentation UI to demonstrate the restoration results. (2022 - 2023)
- **Embedded RFID Phonograph Music Player (Raspberry Pi, Linux, Python):** 1. Developed an embedded system based on **Raspberry Pi**, piTFT Screen, PN532 RFID Receiver and an **LED Matrix Panel**; 2. Built an internal **database** storing different songs and corresponding lyrics; 3. Once an RFID tag is attached to the receiver, the embedded system will start work, where the piTFT showed the lyrics and music was played; 3. The LED Matrix Panel will display the rhythm by showing frequency band based on the **FFT** algorithm. (Fall 2023)
- **A Human Resource Management System (Front End, Back End):** 1. Applied **Vue** and **ElementUI** to develop the front end; 2. Employed **SpringBoot** to develop the container and MVC framework; 3. **MyBatis** was also involved in ORM framework. (October 2022)

## HONORS AND AWARDS

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- **HKSAR Government Scholarship - Reaching Out Award** 2021 - 2022  
*Awarded by The HKSAR Government*
- **Hong Kong, China - Asia-Pacific Economic Cooperation Scholarship** 2021 - 2022  
*Awarded by The HKSAR Government*