ZHENGE JIA

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RESEARCH INTERESTS

On-Device AI, Personalized AI/ML, TinyML, Embedded and Real-Time Systems

EMPLOYMENT

University of Notre Dame Notre Dame, Indiana
Postdoctoral Research Associate, Computer Science and Engineering Aug. 2022 - Present
Advisor: Yiyu Shi
Focus: Personalized On-Device AI for Better Healthcare on Mobile and Implantable Devices

EDUCATION

University of Pittsburgh Pittsburgh, Pennsylvania
Ph.D., Electrical and Computer Engineering Jan. 2018 - Aug. 2022
Advisor: Jingtong Hu
Dissertation: Personalized Deep Learning for IoT-Enabled Health Monitoring

Australian National University Canberra, Australia
B.S., Advanced Computing (Honors) Jan. 2014 - Dec. 2017
Advisor: Weifa Liang
Dissertation: The Efficient Rule Caching and Replacement of TCAM in Software-Defined Networking

RESEARCH & GRANTS

- **Co-PI (50%), Health Equity Data Lab Grants by Lucy Family Institute at University of Notre Dame,** "An Unsupervised Federated Learning Framework to Improve Fairness in AI-Assisted Healthcare", 10/01/2023 – 09/30/2024, $52,000 (PI: Prof. Yiyu Shi).
- **Co-PI (50%), Indiana Clinical and Translational Sciences Institute (CTSI),** "Promoting Fairness in AI-Enabled Healthcare through Unsupervised Federated Learning: A Pilot Study", 09/18/2023 – 09/17/2025, $15,000 (PI: Prof. Yiyu Shi).

PUBLICATIONS

JOURNALS (*Corresponding Author)

- **[J9] Hardware Design and the Fairness of A Neural Network**
  Yuanbo Guo, Zheyu Yan, Xiaoting Yu, Qingpeng Kong, Joy Xie, Dewen Zeng, Yawen Wu, **Zhenge Jia***, Yiyu Shi*
  Nature Electronics (**NE**). [Under Review]
  Impact Factor 38.3.

- **[J8] Personalized Meta-Federated Learning for IoT-Enabled Health Monitoring**

Zhenge Jia, Tianren Zhou, Zheyu Yan, Jingtong Hu, Yiyu Shi
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**). [Under Review]
Impact Factor 2.8.

- **[J7] TinyML Design Contest for Life-Threatening Ventricular Arrhythmia Detection**
  Zhenge Jia, Dawei Li, Cong Liu, Liqi Liao, Xiaowei Xu, Lichuan Ping, Yiyu Shi
  IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2023.
  Impact Factor 2.8.

- **[J6] The Importance of Resource Awareness in Artificial Intelligence for Healthcare**
  Zhenge Jia, Jianxu Chen, Xiaowei Xu, John Kheir, Jingtong Hu, Han Xiao, Sui Peng, Sharon Hu, Danny Chen, Yiyu Shi
  Nature Machine Intelligence (**NMI**), 2023.
  Impact Factor 25.9.

- **[J5] Life-Threatening Ventricular Arrhythmia Detection Challenge in Implantable Cardioverter Defibrillators**
  Zhenge Jia, Dawei Li, Xiaowei Xu, Na Li, Feng Hong, Lichuan Ping, Yiyu Shi
  Nature Machine Intelligence (**NMI**), 2023.
  Impact Factor 25.9.

- **[J4] Low-Power Object-Detection Challenge on Unmanned Aerial Vehicles**
  Zhenge Jia, Xiaowei Xu, Jingtong Hu, Yiyu Shi
  Nature Machine Intelligence (**NMI**), 2023.
  Impact Factor 25.9.

- **[J3] Personalized Neural Network for Patient-Specific Health Monitoring in IoT: A Meta-Learning Approach**
  Zhenge Jia, Yiyu Shi, Jingtong Hu
  IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2022.
  Impact Factor 2.8.

- **[J2] On-Device Prior Knowledge Incorporated Learning for Personalized Atrial Fibrillation Detection**
  Zhenge Jia, Yiyu Shi, Samir Saba, Jingtong Hu
  ACM Transactions on Embedded Computing Systems (**TECS**), 2021.
  ***Impact Factor* 1.8.**

- **[J1] Cooperative Communication Between Two Transiently Powered Sensor Nodes by Reinforcement Learning**
  Yawen Wu, **Zhenge Jia**, Fei Fang, Jingtong Hu
  IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (**TCAD**), 2021.
  Impact Factor 2.8.

REFEREED CONFERENCE PROCEEDINGS

- **[C7] Learning to Learn Personalized Neural Network for Ventricular Arrhythmias Detection on Intracardiac EGMs**
  Zhenge Jia, Zhepeng Wang, Feng Hong, Lichuan Ping, Yiyu Shi, Jingtong Hu
  In Proceedings of the 30th International Joint Conference on Artificial Intelligence (**IJCAI**), 2021.
  Acceptance Rate 13.9%.

- **[C6] Enabling On-Device Model Personalization for Ventricular Arrhythmias Detection by Generative Adversarial Networks**
  Zhenge Jia, Feng Hong, Lichuan Ping, Yiyu Shi, Jingtong Hu
  In Proceedings of the 58th IEEE/ACM Design Automation (**DAC**), 2021.
  ***Acceptance Rate* 22.4%.**

- **[C5] Personalized Deep Learning for Ventricular Arrhythmias Detection on Medical IoT Systems**
  Zhenge Jia, Zhepeng Wang, Feng Hong, Lichuan Ping, Yiyu Shi, Jingtong Hu
  In Proceedings of the 39th IEEE/ACM International Conference on Computer-Aided Design (**ICCAD**), 2020.

- **[C4] ICD-BAS: Detecting Ventricular Arrhythmia using Binary Architecture Search for Implantable Cardioverter Defibrillators**
  Qing Lu, **Zhenge Jia**, Jingtong Hu and Yiyu Shi
  In Proceedings of the 7th IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (**CHASE**), 2022.

- **[C3] Opportunistic Communication with Latency Guarantees for Intermittently-Powered Devices**
  Kacper Wardega, Wenchao Li, Hyoseung Kim, Yawen Wu, **Zhenge Jia** and Jingtong Hu
  In Proceedings of the 25th ACM/IEEE Design, Automation and Test in Europe (**DATE**), 2022.

- **[C2] Lightweight Run-Time Working Memory Compression for Deployment of Deep Neural Networks on Resource-Constrained MCUs**
  Zhepeng Wang, Yawen Wu, **Zhenge Jia**, Yiyu Shi, Jingtong Hu
  In Proceedings of the 26th Asia and South Pacific Design Automation Conference (**ASP-DAC**), 2021.

- **[C1] Intermittent Inference with Non-uniformly Compressed Multi-Exit Neural Network for Energy Harvesting Powered Devices**
  Yawen Wu, Zhepeng Wang, **Zhenge Jia**, Yiyu Shi, Jingtong Hu
  In Proceedings of the 57th IEEE/ACM Design Automation Conference (**DAC**), 2020.
  Acceptance rate: 23.2%

RESEARCH EXPERIENCE

Postdoctoral Research Associate, University of Notre Dame Aug. 2022 – Present

Supervisor: Yiyu Shi

- `Resource Awareness in AI/ML for Healthcare`: Conducted in-depth analysis on the importance of resource sustainability issues in AI/ML for healthcare and outlined the critical next steps to tackle these issues proactively and prospectively **[J6]**.
- `TinyML Design Contest`: Organized (main organizer) the world's first TinyML design contest for health in life-threatening ventricular arrhythmia detection on implantable device. The contest attracted more than 150 teams from academia and industry around the world **[J5][J7]**.
- `PMFed`: Designed and built a personalized and communication-efficient meta-federated learning framework for IoT-enabled health monitoring to improve the global model generalization, achieve better model personalization, and reduce training overhead **[J8]**.

Research Assistant, University of Pittsburgh Jan. 2018 – Aug. 2022

Supervisor: Jingtong Hu

- `Meta-Learning for Health`: Devised a meta-learning methodology and built a framework for learning to learn personalized model to enable neural network to achieve better detection performances on health monitoring for each individual **[J3][C7]**.
- `Self-Supervised and On-device Personalization`: Designed and implement a self-supervised and on-device model personalization framework for implantable cardioverter defibrillators (ICDs) based on the patient-specific intracardiac electrograms (IEGMs) synthesized by on-device generative adversarial network (GAN) mimicking individual morphological characteristics **[C6]**.
- `Prior-Incorporated Learning`: Devised a prior knowledge incorporated learning framework to regulate model personalization with prior medical knowledge for personalized atrial fibrillation detection **[J2]**.
- `Personalized Medical IoT System:` Designed and implemented a personalized medical IoT system for deep learning based life-threatening ventricular arrhythmia detection on implantable cardioverter defibrillators (ICDs) with real-time cooperative inference on surface and intracardiac rhythm and dynamic model personalization **[C5][C2]**.

SERVICES

TPC Member

- International Conference on Computer-Aided Design (ICCAD) 2023

Journal Reviewer

- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- Nature Scientific Report
- IEEE Trans. On Circuits and System I (TCAS-I)
- IEEE Trans. On Circuits and System II (TCAS-II)
- ACM Trans. on Cyber-Physical Systems (TCPS)
- ACM Journal on Emerging Technologies in Computing Systems (JETC)
- IEEE Embedded Systems Letters (ESL)
- IEEE Access

Volunteer

- **Co-chair** of 2nd TinyML Design Contest.
- **Chair** of 1st TinyML Design Contest (150 participated teams; world's first TinyML design contest for health)
- **Judge** at Intel International Science and Engineering Fair (ISEF), 2018
- **Student Assistance** at IJCAI, 2021

ACHIEVEMENTS AND AWARDS

- **Second Plance in Fair and Intelligent Embedded System Design Contest** (out of 75 submissions), ESWEEK 2023
- **Second Place in Ph.D. Forum** (out of 60 submissions), DAC 2023
- **Presenter at Ph.D. Forum**, ASP-DAC 2022
- **Student Grant**, IJCAI 2021
- **Young Student Fellow Award**, DAC 2021
- **Young Student Fellow Award**, DAC 2020

TEACHING EXPERIENCES

Teaching Assistance, University of Pittsburgh

ECE 0142 - Computer Organization — Jan. 2018 – May 2018

ECE 0132 - Digital Logic — Aug. 2018 – Dec. 2018

ECE 0501 - Digital Logic Laboratory — Jan. 2019 – May 2019

CoE 1502 - Advanced Digital Design Concepts — Aug. 2019 – Dec. 2019

Guest Lecturer, University of Pittsburgh

ECE 0132 - Digital Logic — Aug. 2018 – Dec. 2018

MENTORING EXPERIENCES

Graduate

Yuanbo Guo (Ph.D., University of Notre Dame) — Dec. 2022 - Present

- Mentored research on AI fairness for skin disease detection. Papers currently under review by Nature Electronics.

Ruiyang Qin (Ph.D., University of Notre Dame) — Dec. 2022 - Present

- Mentored research on on-device and fair large language model (LLM). Papers currently under submission.

Tianren Zhou (M.S., Shandong University -> Ph.D., Shandong University) — Aug. 2022 - Present

- Mentored research on personalized AI for health monitoring. Second author on a paper under review.

Undergraduate

Xiaoting Yu (B.S., Southern University of Science and Technology) — Jul. 2023 - Present

- Mentored research on analyzing the effect of device noise on AI fairness.