

# ZHENGE JIA

Address: 308 Cushing Hall, Notre Dame, IN 46556

Homepage: <https://zhengejia.github.io/>

Email: [zjia2@nd.edu](mailto:zjia2@nd.edu)

Phone: (+1) 412-708-5174

## RESEARCH INTERESTS

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

## EMPLOYMENT

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### 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

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### 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

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- **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

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### 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

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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

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### 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

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- **Second Place 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

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### 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
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## MENTORING EXPERIENCES

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### 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.
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