

ZHENG JIA

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RESEARCH INTERESTS

On-Device AI, Personalized AI/ML for Health, 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

PUBLICATIONS

JOURNALS

- **[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]
- **[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%).

WORKSHOP PAPERS

- **[W1] Demo: Addressing Inter-Intra Patient Variability via Personalized Meta-Federated Learning in IoT-Enabled Health Monitoring**
Zhenge Jia, Yiyu Shi
In Proceedings of the 8th IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies (**CHASE**), 2023.

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-organizer of [2nd TinyML Design Contest](#).
- Lead Organizer of [1st TinyML Design Contest](#) (150 participated teams; world's first TinyML contest for health)
- Judge at Intel International Science and Engineering Fair (ISEF), 2018
- Student Assistance at IJCAI, 2021

ACHIEVEMENTS AND AWARDS

- 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
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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 submission.

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

- Mentored research on on-device and fair large language model. 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.

INDUSTRY EXPERIENCES

Algorithm Consultant, Singular Medical Inc. Apr. 2020 - Aug. 2020

- Investigated and explored the feasibility of deep learning in ventricular arrhythmia detection for next-generation smart implantable cardioverter defibrillators (ICDs).
- Emulated ventricular arrhythmia detection algorithms applied on commercial ICDs.