PERSONAL

北京理工大學
BEIJING INSTITUTE OF TECHNOLOGY

Wanyong Qiu

Federated Learning for Healthcare · Privacy-Computational Psychophysiology

Beijing Institute of Technology, No. 5 Zhongguancun South Street, Haidian District, Beijing 100081, China

HomePage | qiuwy@bit.edu.cn | Wanyong Qiu | W Qiu

Education

Beijing Institute of Technology Beijing, China

PhD.-Ing | School of Computer Science | Electronic Information 2021.09-Exp.2025.06

- Research Interests: Federated Medical, Privacy-preserving
- Supervised by Prof. Bin Hu 胡斌(*Fellow, IEEE*) and Prof. Kun Qian 钱昆

Northwest Normal University Lanzhou, China

Master.-Eng | School of Computer Science & Engineering | Computer Technology 2018.09-Exp.2021.06

- Research Interests: Machine learning and privacy protection
- Supervised by Prof. Junjie Jia (贾俊杰)

Personal Interests http://qiuwy.com

Topics of interest include, but are not limited to, the following:

Computer Science and Technology

- **Artificial Intelligence**：Machine learning, Computer audition
- **Information Security**：Privacy-preserving computing

Engineering Medicine and Technology

- **Artificial Intelligence Medicine**：Federated learning for healthcare
- **Medical Information Privacy**： Psychophysiology of privacy computing

Research Group https://bhe-lab.org

Key Laboratory of Brain Health Intelligent Evaluation and Intervention, Ministry of Education, P. R. China (Beijing Institute of Technology)

- The Key Experiment on Brain Health Intelligent Evaluation and Intervention of the Ministry of Education applies **Artificial Intelligence, Big Data, Ubiquitous Computing, Internet of Health Things (IoHT), Medical Electronics**, and other advanced technologies to **achieve the "Identification-Intervention-Treatment-Rehabilitation" of functional brain disorders.** The lab develops innovative methods, technologies and products for the diagnosis and treatment of functional brain disorders. It addresses issues such as the scarcity of indicators, high subjectivity, low accuracy, difficulty in evaluating efficacy, and limited generalisability.
- In brain medicine, **Prof. Bin Hu** introduced the concept of "**Computational Psychophysiology**" (the 431st Xiangshan Science Conference in 2012), pioneering a data-driven approach to studying cognitive function and psychological states. This shift advanced **mental health diagnosis and treatment technologies from "Symptom-descriptive" to "Data-driven"**. Prof. Hu also proposed a **future transformation of mental health diagnosis and treatment technologies**

from "Data-driven" to "Systematic Interpretation" (the 735th Xiangshan Science Conference in 2022). This forward-thinking approach imposes higher demands on the IoHT based on wearable devices and diagnosis and treatment systems.

- **Since the smart healthcare system is highly connected to advanced wearable devices, IoHT, and mobile internet, valuable patient information and other significant medical records are stored in wearable smart terminals.** This data aids healthcare professionals in making informed decisions and assists in devising effective treatments, accurate diagnosis, and daily monitoring plans. **However, these smart terminals pose risks of data leakage and privacy breaches, which could significantly impact national information security.** Ensuring data security and privacy while maintaining availability for smart terminals is crucial. Thus, proper medical information security is becoming equally important in smart healthcare. **Motivated by these facts, we explore and share novel ideas, methods, theories, and practices focus on information security and privacy solutions for the computational psychophysiology smart healthcare industry.**

Publications

[1] **Qiu W**, Feng Y, Li Y, Chang Y, Qian K*, Hu B*, Yamamoto Y, and Schuller B W. Fed-MStacking: Heterogeneous Federated Learning with Stacking Misaligned Labels for Abnormal Heart Sound Detection[J]. ***IEEE Journal of Biomedical and Health Informatics***, vol.28, no.9, pp.5055-5066, Sept.2024. [PDF] [Page]

[2] **Qiu W**, Quan C, Zhu L, Yu Y, Wang Z, Ma Y, Sun M, Chang Y, Qian K*, Hu B*, Yamamoto Y, and Schuller B W. Heart Sound Abnormality Detection from Multi-institutional Collaboration: Introducing a Federated Learning Framework[J]. ***IEEE Transactions on Biomedical Engineering***, vol.71, no.10, pp.2802-2813, Oct. 2024. [PDF] [Page]

[3] **Qiu W**, Quan C, Yu Y, Kara E, Qian K*, Hu B*, Schuller B W. and Yamamoto Y. Federated Abnormal Heart Sound Detection with Weak to No Labels[J]. ***Cyborg and Bionic Systems***, pp.1-17, 2024; 5: 0152. [PDF] [Page]

[4] Zhu L, **Qiu W**, Ma Y, Tian F, Sun M, Wang Z, Qian K*, Hu B*, Yamamoto Y, and Schuller B W. LEPCNet: A Lightweight End-to-End PCG Classification Neural Network Model for Wearable Devices[J]. ***IEEE Transactions on Instrumentation and Measurement***, 2024, 73: 3315401. [PDF] [Page]

[5] Yu Y†, **Qiu W**†, Quan C, Qian K*, Wang Z, Ma Y, Hu B*, Schuller B W, and Yamamoto Y. Federated Intelligent Terminals Facilitate Stuttering Monitoring[C], in *Proceedings of ICASSP 2023-2023 IEEE International Conference on Acoustics, Speech and Signal Processing (**ICASSP**). IEEE*, 2023: 1-5. [Slide] [Page]

[6] **Qiu W**, Qian K*, Wang Z, Chang Y, Bao Z, Hu B*, Schuller B W, and Yamamoto Y. A Federated Learning Paradigm for Heart Sound Classification[C], in *2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (**EMBC**). IEEE*, 2022: 1045-1048. [Slide] [Page]

[7] Jia J, **Qiu W***, Ma H, An Ensemble Classification Algorithm under Differential Privacy[J], ***Journal of Cyber Security*** vol. 6, no. 4, pp. 1-12, Sept 2021. [PDF] [Page]

[8] Shen X†, **Qiu W†**, Zhang H, Yu Y, Qian K*, Hu B*, "Self-Supervised Federated Learning for Heart Sound Recognition," in *Proceedings of the 19th National Conference on Man-Machine Speech Communication (NCMMSC)* , Urumq, China, August 2024:1-7. [Slide] [Page]

[9] Tian G*, Qian K*, Li X, Sun M, Jiang H, **Qiu W**, Xie X, Zhao Z, Huang L, Luo S, Guo T, Cai R, Wang Z, and Schuller B W, "Can a Holistic View Facilitate the Development of Intelligent Traditional Chinese Medicine? A Survey", ***IEEE Transactions on Computational Social Systems***, vol. 10, no. 2, Sep 2023. [PDF] [Page]

[10] 一种基于联邦学习的心音监测系统，中国，发明专利号：202211091843.8，已授权，2022 年 11 月 21 日

[11] 面向智能体音感知的联邦学习智能客户端 [简称：联邦智能体音感知客户端] V1.0，软件著作权，北京理工大学；胡斌；钱昆；邱万勇，2023SR1107177，2023 年 05 月 01 日

Projects

- Project Name: A Research of Federated Learning for Intelligent Body Sound Perception. (Grant Number: 2023YCXZ014)
  Supporter: BIT Research and Innovation Promoting Project [Funding: 20,000 RMB]
  Run Time: 2023.05.01–2025.05.01
  Role: Principal Investigator.
- Project Name: The Research on Multi-modal Open Identification and Accurate Diagnosis Technology for Complex Symptoms for Mental Disorders and Psychiatric Diseases. (Grant Number: 2023YFC2506804)
  Supporter: Ministry of Science and Technology of the People's Republic of China, China
  Run Time: 01.11.2023 – 31.10.2026.
  Role: Project Participants
- Project Name: Science and Technology Innovation 2030 – "Brain Science and Brain-like Research" Major Project. (Grant Number: 2021ZD0201900)
  Supporter: Ministry of Science and Technology of the People's Republic of China, China
  Run Time: 01.11.2023 – 31.10.2026.
  Role: Project Participants
- Project Name: The Research on Quantitative Models of Sleep Disorders based on Body Sound Sensing. (Grant Number: 62272044)
  Supporter: National Natural Science Foundation of China, China
  Run Time: 01.01.2023 – 31.12.2026.
  Role: Project Participants

Competitions

- Won the special scholarship and the title of outstanding student at the School of Computer Science of Beijing Institute of Technology for the 2023-2024 academic year, with supervisor Prof. Hu B and Prof. Qian K, October 30, 2024.
- Won the third prize in the "Huawei Cup" 6th China Graduate Artificial Intelligence Innovation Competition, "Intelligent body sound perception edge device and system for multi-disease auxiliary diagnosis", participating team: Zhang H, Sun M, Zhao Z, Qiu W, supervisor: Prof. Qian K, Prof. Hu B, October 21, 2024.
- Won the third prize in the "9th National Undergraduate Biomedical Engineering Innovation Design Competition", "Intelligent Body Sound Perception Edge Device and System for Federal Medical Internet of Things", participating team: Zhao Z, Qiu W, Sun M, Zhang H, Zhou J, supervisor: Prof. Qian K, Prof. Hu B, July 18, 2024.
- Won the first prize in the artificial intelligence track of the "2022 FinTechathon Shenzhen International Financial Technology Competition", "Federated Learning System for Intelligent Body and Sound Perception - Based on FATE Platform", participating team: Qiu W, Quan C, supervisor: Prof. Hu B, Prof. Qian K, February 4, 2023.
- Won the third prize at the school level of the "9th China International "Internet +" College Students Innovation and Entrepreneurship Competition", "Healthy Listener-A New Era of Intelligent Body Sound Perception under Federal Medical Care", recommended by: School of Medical Technology, School of Computer Science, participating team: Qiu W, Bao Z, Yu Y, supervisor: Prof. Hu B, Prof. Qian K, July 10, 2023.
- The undergraduate team I co-supervised won the BIT Innovation and Entrepreneurship School Award for the third consecutive year.