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Wanyong Qiu

Federated Learning for Healthcare | Computer Audition | Privacy-Preserving

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Education

Beijing Institute of Technology

Beijing, China

PhD | School of Computer Science & Technology | Computer Technology

2021.09-Exp.2025.06

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

Northwest Normal University

Lanzhou, China

Master | College 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 Laboratory of Brain Health Intelligent Evaluation and Intervention of the Ministry of Education leverages advanced technologies such as **Artificial Intelligence, Big Data, Ubiquitous Computing, the Internet of Health Things (IoHT), and Medical Electronics** to achieve the comprehensive process of “**Identification-Intervention-Treatment-Rehabilitation**” for functional brain disorders. The laboratory focuses on developing innovative methods, technologies, and products for diagnosing and treating functional brain disorders. It addresses critical challenges, including the scarcity of indicators, high subjectivity, low diagnostic accuracy, difficulty in evaluating treatment efficacy, and limited generalisability of solutions.
- ✚ In brain medicine, **Prof. Bin Hu** introduced the concept of “**Computational Psychophysiology**” at the 431st Xiangshan Science Conference in 2012, pioneering a data-driven methodology for studying cognitive function and psychological states. This innovation transitioned **mental health diagnosis and treatment technologies from “Symptom-descriptive”**

to “Data-driven”. At the 735th Xiangshan Science Conference in 2022, Prof. Hu proposed a **future transformation of mental health diagnosis and treatment technologies from “Data-driven” to “Systematic Interpretation**. This forward-looking approach places greater demands on IoHT systems, particularly those involving wearable devices and diagnostic and treatment technologies.

✚ **Prof. Kun Qian** has been extensively involved in advancing theoretical research and technological applications of artificial intelligence and signal processing within the field of medical engineering. In 2020, he proposed and has been actively advancing the cutting-edge research direction of “**Computer Audition for Healthcare (CA4H)**”. The key innovative contributions include: **Intelligent body sound perception**, **Brain-inspired auditory methods** and **Intelligent audio intervention**. These innovations advance the frontiers of AI and signal processing in healthcare, underscoring the practical potential of CA4H technologies to enhance human health.

✚ **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 formulating effective treatments, accurate diagnosis, and daily monitoring plans. **However, these smart terminals pose risks of data leakage and privacy breaches, potentially compromising 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* (IF=6.7), 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* (IF=4.4), 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* (IF=10.5), 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* (IF=5.6), 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* (IF=4.5), vol. 10, no. 2, Sep 2023. [\[PDF\]](#) [\[Page\]](#)
- [10] "A Federated Learning-Based Heart Sound Monitoring System", 202211091843.8, China, 2022.11.21. [\[Patent\]](#)
- [11] "Federated Client for Intelligent Body-Sound Perception", 2023SR1107177, China, 2023.05.01. [\[Software Copyright\]](#)

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.