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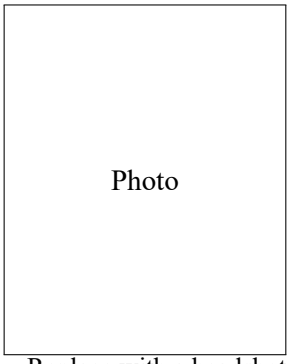

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Education

2017.9–2021.7	Zhejiang University	B.Eng. in Information Engineering
2021.9–2026.7	ShanghaiTech University (Joint Ph.D. Program with CAS)	Ph.D. Candidate in Computer Science and Technology (expected Jul 2026)

Research Focus

Overview: Brain–computer interface paradigms and algorithms that exploit binocular vision cues to enable efficient wearable BCIs tightly integrated with VR/AR headsets.

- Conduct comparative analyses of stereo-dependent SSVEP targets to quantify their impact on VR BCI performance.
- Designed 3D and 3D-Blink paradigms that leverage stereoscopic comfort to enhance user experience and system robustness in immersive environments.

2024.7 Novel binocular steady-state visual evoked potential (SSVEP) modulation

- Developed a VR dual-view SSVEP modulation approach that combines left/right view layers to encode nine targets with only two frequencies, significantly improving robustness.
- Implemented the FusionCA neural-fusion interface platform, establishing multi-channel information pathways for binocular headsets and richer immersion.

2024.9 Scalable high-density EEG acquisition and analytics platform

- Built an FPGA-based modular EEG acquisition system providing standardized hardware interfaces suitable for laboratory BCI studies and clinical scenarios.

2025.1 High-precision neuromodulation with ultraflexible electrode arrays

- Created a brain-to-brain interface that routes human BCI commands to rodent locomotion control through ultraflexible electrode arrays.
- Established online transmission and DNN decoding pipelines to map human-side BCI commands within bio-inspired systems.

Project Experience

2022.7–2022.11 SariBCI EEG acquisition system

- Designed a high-precision ADS1299-based EEG module achieving 24-bit resolution and 250–1000 Hz sampling, with WiFi AP/Station modes and synchronized multi-channel acquisition.

- Built Unity-based dual-view 3D cue interfaces and analytics for SSVEP paradigms, incorporating 3D/3D-Blink stimuli for improved efficacy.

2023.5–2023.9 Hololens-oriented AR-BCI closed-loop platform

- Developed UWP applications for Hololens and other headsets, streamlining the SariBCI data pipeline for VR/AR closed-loop control.
- Integrated Zigbee peripherals to extend multi-sensor nodes, supporting brain-controlled multi-gesture interaction and mobile deployment.

2024.3–2025.7 Multimodal sensing and data fusion

- Engineered sensor terminals combining EEG, ECG, EMG, and IMU signals; coordinated hardware cooperation through host-side inference to realize multimodal fusion.
- Proposed online deep-learning models capturing temporal and spatiotemporal features, deploying them onto FPGA platforms for embedded edge inference.

2024.6–2025.9 Ultra-wideband EEG acquisition and remote streaming

- Introduced multi-channel time-domain compression with ultra-wideband high-speed acquisition, enabling low-power wireless EEG across heterogeneous sensors.
- Completed multi-channel porting and real-time cloud interaction to form a long-range EEG transmission and management infrastructure.

Publications

[1] H. Liu, Z. Wang, R. Li, X. Zhao, T. Xu, T. Zhou, H. Hu, "A Comparative Study of Stereo-Dependent SSVEP Targets and Their Impact on VR-BCI Performance," *Frontiers in Neuroscience*, vol. 18, p. 1367932, 2024. doi:10.3389/fnins.2024.1367932

[2] H. Liu, Z. Wang, R. Li, et al., "A Novel SSVEP Modulation Method Utilizing VR-Based Binocular Vision," *IEEE EMBC*, 2024, pp. 1–4. doi:10.1109/EMBC53108.2024.10781783

[3] H. Liu, Z. Zhu, Z. Wang, et al., "Design and Implementation of a Scalable and High-Throughput EEG Acquisition and Analysis System," *Moore and More*, vol. 1, p. 14, 2024. doi:10.1007/s44275-024-00017-w

[4] Y. Ye, X. Tian, H. Liu, J. Liu, C. Zhou, H. Nie, W. Yu, L. Qin, Z. Zhou, X. Wei, J. Zhao, Z. Wang, M. Li, T. H. Tao, L. Sun, "High-Precision, Low-Threshold Neuromodulation With Ultraflexible Electrode Arrays for Brain-to-Brain Interfaces," *Exploration*, e70040, 2025. doi:10.1002/EXP.70040

[5] A. Li, H. Liu, T. Xu, T. Zhou, H. Hu, Z. Wang, "Enhancing Real-Time Online Motor Imagery BCI Performance: A Co-Adaptive Meta-Learning Approach," *IEEE Journal of Biomedical and Health Informatics*, revision in progress.

[6] H. Liu, Z. Wang, R. Li, X. Zhao, T. Xu, T. Zhou, H. Hu, "A Novel Binocular-Encoded SSVEP Framework for Efficient VR-Based Brain-Computer Interface," *IEEE Journal of Biomedical and Health Informatics*, accepted Oct. 23, 2025.

Patents

- National Invention Patent: Hongsong Hu; Haifeng Liu; Zhenyu Cui; Ting Zhou; Tianwei Xu; Yuling Ouyang; Yu Zhao, "SSVEP-ERP Based BCI Visual Paradigm Generation, Detection Method, System, Medium, and Terminal," CN202310369762.8 (published).
- National Invention Patent: Hongsong Hu; Haifeng Liu; Yuan Qin; Zhenyu Wang; Ting Zhou; Tianwei Xu; Yuling Ouyang, "Augmented-Reality Brain Feedback System Based on Brain-Computer Interfaces," 202410293427.9 (preliminary examination).

Selected Grants & Collaborations

- National Natural Science Foundation (Key Area Joint Fund): Brain-Computer Communication and Brain Internet Technologies
- NSFC Key Program: Open-Loop Brain-Computer Interface System Techniques
- NSFC Young Scientists Program: Novel BCI System Technologies and Validation
- Shanghai Science and Technology Innovation Action (Instrumentation): High-Throughput Scalable EEG Acquisition Analyzer
- Shanghai STIA (MR Pre-Research): Brain Internet Key Technologies and Systems
- Shanghai Science and Technology Commission Key Project: Interpretable Invasive BCI Systems and Scalable Deployment
- Shanghai "Tongchuang Nest" Initiative: Multimodal Human–Computer Interface Signal Fusion Technologies
- Shanghai VR Innovation Program: Multidimensional Biosignal-Based Platforms for Neurological Disorder Modulation

Skills

- Academic writing expert; advanced LaTeX typesetting.
- MATLAB and Python for signal processing, data analytics, feature extraction, and decoding.
- Proficient with Neuroscan and NeuroPro EEG systems plus Curry, EEGlab, Psychtoolbox, and related BCI software platforms.
- C++, C#, and Unity for interactive system development; hands-on VR/AR experience with Hololens2 and PicoVR devices.
- Embedded development with ESP32, Nordic nRF5340, and Zephyr RTOS.
- Fusion 360 for 3D printing workflows and FPGA prototyping expertise.
- Visual/graphical programming (e.g., LabVIEW, Vive Coding) for rapid construction of BCI demos and control prototypes.