

Xiaochen LIU

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- Working Experience** ◇ **Research Fellow** (Jun. 2022 – Now)
Athinoula A. Martinos Center for Biomedical Imaging at Massachusetts General Hospital & Harvard Medical School
- Education** ◇ **Ph.D. student** in College of Information Science and Electronic Engineering
Zhejiang University, R.P. China (Sep. 2016 – Dec. 2021)
- ◇ **B.S.** in College of Information Science and Electronic Engineering
Zhejiang University, R.P. China (Sep. 2012 – Jun. 2016)
*Mixed Honors Class, Chu Kochen Honors College**, *Zhejiang University*,* Prestigious Program gathering top 5% of students for their first two years of study at Zhejiang University
- Skills** ◇ **Research Skills:** Machine learning, Neural network, Multimodal biosignal analysis (fMRI, EEG, fiber photometry, ultrasound), Image Reconstruction, MR Physics, In vivo imaging, Pupil tracking.
- ◇ **Technical Proficiencies:** Proficient in Python, MATLAB, Bash, AFNI, DEEPLABCUT.
- Research Experience** ◇ **Functional MRI in Awake Animal Models** Led the development of a novel awake-mouse fMRI platform, integrating ultra high-field MRI with real-time physiological monitoring to investigate neural circuits, brain state dynamics, and neurovascular coupling.
- **Investigating Alzheimer’s Disease (AD) Pathophysiology:**
 - Engineered a novel platform for awake mouse fMRI, integrating real-time pupillometry and whisker tracking.
 - Conducted pupillometric-fMRI analysis to identify dysfunction of neuromodulatory pathways affected by AD degeneration in the 5xFAD mice model.
 - Applied an explainable AI (XAI) model to a 3D-CNN network to distinguish between AD and wild-type mice using fMRI maps to localize key pathological brain nuclei.
 - Implemented a deep learning super-resolution and vessel segmentation method to quantify cerebrovascular density from CBV images, revealing vascular abnormalities in AD.
 - **Mapping Brain-wide Vessel-related Oscillations:**
 - Detected vasomotion in awake mouse brains using high-resolution (100um) whole brain CBV fMRI and high-temporal-resolution (8Hz) cortical CBV fMRI. Spatial-frequency SVD analysis was successfully used to map global phase gradient and propagation speed patterns.
 - **Characterizing Brain State Dynamics and Biological Rhythms:**
 - Characterized brain-wide network dynamics during anesthesia-based changes in consciousness (awake to anesthetized and emergence). Whole-brain fMRI with real-time respiration recording and pupillometry was used to identify critical nodes in the reticular ascending pathway and cortico-thalamic circuits that govern changes in consciousness.
 - Leveraged multimodal neuroimaging (high-resolution/high-speed BOLD fMRI, CSF flow, and CBFv) to identify and model physiological alterations related to circadian rhythms.

- ◇ **EEG Analysis for Clinical Neuroscience** Designed and executed studies using EEG/iEEG to identify biomarkers and neural networks in human subjects, focusing on epilepsy and cognitive function.
- **Epilepsy Biomarker Identification and Seizure Onset Zone Localization:**
 - Created a MATLAB application for automated high-frequency oscillation (HFO) detection in extended iEEG recordings of patients with epilepsy.
 - Proposed a multi-domain feature-extraction method and a transfer-learning based classifier to automatically distinguish between epileptic, interictal, and healthy EEG signals.
 - Developed a Graph Convolutional Network (GCN) framework to identify seizure onset zones through the integration of seizure and HFO propagation networks.
 - Analyzed P300 event-related potentials and spike event features to quantitatively assess memory and cognitive deficits in patients with epilepsy.

- Journal Papers**
- ◇ **Xiaochen Liu**, David Hike, Sangcheon Choi, Weitao Man, Chongzhao Ran, Xiaoqing Alice Zhou, Yuanyuan Jiang, and Xin Yu “Identifying the bioimaging features of Alzheimers disease based on pupillary light response-driven brain-wide fMRI in awake mice”. *Nature Communications*, 2024, 15(1): 9657.
 - ◇ David Hike, **Xiaochen Liu**, Zeping Xie, Bei Zhang, Sangcheon Choi, Xiaoqing Alice Zhou, Andy Liu, Alyssa Murstein, Yuanyuan Jiang, Anna Devor, and Xin Yu. “High-resolution awake mouse fMRI at 14 Tesla”. *Elife*, 13: RP95528, 2025.
 - ◇ Xiaoqing Alice Zhou, **Xiaochen Liu**, Hongwei Bran Li, David Hike, Yuanyuan Jiang, Matthew S. Rosen, Juan Eugenio Iglesias, and Xin Yu “Mapping the Cerebrovascular Abnormality in Transgenic Alzheimers Disease (AD) Mice with deep-learning-based super-resolution cerebral blood volume (CBV)-MRI”. *Advanced Science*, under revision.
 - ◇ **Xiaochen Liu**, Lingli Hu, Shuang Wang, and Jizhong Shen. “Localization of seizure onset zone with epilepsy propagation networks based on graph convolutional network”. *Biomedical Signal Processing and Control*, 74: 103489, 2022.
 - ◇ **Xiaochen Liu**, Lingli Hu, Chenglin Xu, Shuai Xu, Shuang Wang, Zhong Chen, and Jizhong Shen. “An Automatic HFO detection method combining visual inspection features with multi-domain features”. *Neuroscience Bulletin*, 37: 777-788, 2021.
 - ◇ **Xiaochen Liu**, Jizhong Shen, and Wufeng Zhao. “Epileptic EEG identification based on hybrid feature extraction”. *Journal of Mechanics in Medicine and Biology*, 20: 2050025, 2020.
 - ◇ Jizhong Shen, Jianwei Liang, and **Xiaochen Liu**. “P300-based deception detection in simulated network fraud condition”. *Electronics Letters*, 52: 1136-1138, 2016.
- Conference Papers and Abstracts**
- ◇ **Xiaochen Liu**, David Hike, Xiaoqing Alice Zhou, and Xin Yu. “Detecting vasomotion of awake mice with 14T CBV fMRI.” *International Society for Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition*, Honolulu, Hawaii, USA, 2025.
 - ◇ **Xiaochen Liu**, William Xu, David Hike, Zeping Xie, Andy Liu, Sangcheon Choi, Biyue Zhu, Chongzhao Ran, Yuanyuan Jiang, and Xin Yu. “Pupil-fMRI correlation-based explainable AI to classify Alzheimer’s disease.” *International Society for Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition*, Singapore, 2024.
 - ◇ **Xiaochen Liu**, Jizhong Shen, and Wufeng Zhao. “P300-based deception detection of mock network fraud with modified genetic algorithm and combined classification.” *7th International Winter Conference on Brain-Computer Interface (BCI)*, Gangwon, Korea (South), 2019.