Chang Liu

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EDUCATION

Expected May 2025	**Ph.D. in Biomedical Engineering** Department of Biomedical Engineering Boston University, Boston, MA Advisor: Prof. Lei Tian	**GPA: 3.80/4.00**
May 2020	**M.S. in Biomedical Engineering** Department of Biomedical Engineering Carnegie Mellon University, Pittsburgh, PA Advisor: Prof. Bin He	**GPA: 3.85/4.00**
July 2018	**B.S. in Biomedical Engineering** Department of Biomedical Engineering Tsinghua University, Beijing, China Advisor: Prof. Bo Hong	**GPA: 85/100**

JOURNAL PUBLICATIONS

4] Platisa, J., Ye, X., Ahrens, A. M., **Liu, C.**, Chen, I. A., Davison, I. G., ... & Chen, J. L. (2021). High-speed low-light in vivo two-photon voltage imaging of large neuronal populations. *BioRxiv*.

3] **Liu, C.***, Yu, K.*, Niu, X., & He, B. (2021). Transcranial focused ultrasound enhances sensory discrimination capability through somatosensory cortical excitation. *Ultrasound in Medicine & Biology*, *47*(5), 1356-1366.

2] Yu, K., **Liu, C.**, Niu, X., & He, B. (2020). Transcranial focused ultrasound neuromodulation of voluntary movement-related cortical activity in humans. *IEEE Transactions on Biomedical Engineering*, *68*(6), 1923-1931.

1] Liu, D., **Liu, C.**, Chen, J., Zhang, D., & Hong, B. (2020). Doubling the speed of N200 speller via dual-directional motion encoding. *IEEE Transactions on Biomedical Engineering*, *68*(1), 204-213.

CONFERENCE ABSTRACTS

2] **Liu, C.**, Platisa, J., Ye, X., Ahrens, A. M., Chen, I. A., Davison, I. G., ... & Tian, L. (2022, April). DeepVID: A Self-supervised Deep Learning Framework for Two-photon Voltage Imaging Denoising. In *Optics and the Brain* (pp. BTu4C-4). Optica Publishing Group.

1] Liu, D., **Liu, C.**, & Hong, B. (2019, March). Bi-directional visual motion based BCI speller. In *2019 9th International IEEE/EMBS Conference on Neural Engineering (NER)* (pp. 589-592). IEEE.

AWARD & HONORS

Boston University Distinguished Biomedical Engineering Fellowship 2020

RESEARCH EXPERIENCE

DeepVID: A Self-supervised Deep Learning Framework for Two-photon Voltage Imaging Denoising

Advisor: Prof. Lei Tian Boston University June 2021 – Present

- Developed self-supervised denoising framework for shot-noise limited voltage imaging data based on independent temporal and spatial statistics, without need of ground-truth high SNR measurements.
- Inferred kilohertz fluorescence signals in single frames and identified potential spiking events for population-level neurons.
- Assessed frame-to-frame variability in fluorescence signals in raw data and confirmed that fluctuation in each pixel was proportional to square root of mean fluorescence that was expected for shot noise limited signals.
- Achieved 15-fold improvement in signal-to-noise ratio (SNR) when comparing denoised and raw image data.

Transcranial Focused Ultrasound Enhances Sensory Discrimination through Cortical Excitation

Advisor: Prof. Bin He Carnegie Mellon University January 2019 – August 2020

- Designed frequency discrimination tasks under tactile vibration stimuli; programmed in Python.
- Performed tasks in sham and ultrasound conditions in which tFUS was directed onto somatosensory cortex.
- Investigated simultaneous brain responses at both EEG sensor and source domain by means of electrophysiological source imaging (ESI); compared both behavior data and EEG patterns between sham and ultrasound conditions.
- Revealed that tFUS stimulation is able to improve the sensory discrimination capability with higher percentage of response correct through excitatory neuromodulation at targeted sensory cortical areas.

Doubling the Speed of N200 Speller via Dual-directional Visual Motion Encoding

Advisor: Prof. Bo Hong Tsinghua University February 2018 – December 2018

- Built multi-process platform for EEG-based wireless motion-onset visual evoked potential (mVEP) BCI by Python.
- Discovered spatiotemporal asymmetry of mVEP responses elicited by visual motion stimuli in different directions.
- Designed novel dual-directional visual N200 speller which presented visual stimuli moving in two directions simultaneously; programmed interface and algorithm by Python.
- Implemented non-flashing online typing with wireless mVEP BCI system for ten subjects, achieved information transfer rate (ITR) up to 124.8 bits/min and median gain of 202% on ITR over conventional N200 speller.

Blood Pressure Prediction with Single-channel PPG based on Deep Learning

Advisor: Prof. Tzyy-Ping Jung University of California, San Diego July 2017 – October 2017

- Designed novel convolution-recurrent neural network model to predict blood pressure from single-channel PPG which significantly outperformed existing method with up to 15% improvement on mean absolute error.
- Compared predictions among CNN, RNN, CRNN networks in UCI Cuff-less Blood Pressure Estimation Data Set.
- Validated generalizability of models in MIMIC II Waveform Database Matched Subset, which contains records from over 150 subjects.

TEACHING EXPERIENCE

ENG BE 403 Biomedical Signals and Controls (undergraduate, 4 credits) Fall 2021
Teaching Assistant, College of Engineering, Boston University

PRESENTATIONS

4] "DeepVID: A Self-supervised Deep Learning Framework for Two-photon Voltage Imaging Denoising" (poster), Sculpted Light in the Brain, Boston, MA, June 26, 2022.

3] "DeepVID: A Self-supervised Deep Learning Framework for Two-photon Voltage Imaging Denoising" (oral), Optica Biophotonics Congress: Biomedical Optics, Fort Lauderdale, FL, April 26, 2022.

2] "DeepVID: A Self-supervised Deep Learning Framework for Two-photon Voltage Imaging Denoising" (poster), Neurophotonics Center's 5th Annual Symposium, Boston University, Boston, MA, January 12, 2022.

1] "Bi-directional visual motion based BCI speller" (poster), 9th International IEEE/EMBS Conference on Neural Engineering (NER), San Francisco, CA, March 21-22, 2019.

TECHNICAL SKILLS

Programming: Python, Matlab, C/C++, VC++

Skills: Deep Learning (proficient in Pytorch and Tensorflow), Computational Imaging, Computer Vision, Signal Processing, EEG Analysis, MRI Processing, Electrophysiological Source Imaging