Xiangjian Zeng

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Research Objective

To research cognitive basis of the brain with computational modeling and create a functional neuromodulation system with engineering toolsets

Education

Massachusetts Institute of Technology, Cambridge, MA
Ph.D in Electrical Engineering and Computer Science, GPA: 5.00/5.00   Expected: 06/2030

Carnegie Mellon University, Pittsburgh, PA
M.S. in Electrical and Computer Engineering, GPA: 4.00/4.00   12/2023

University of California San Diego, La Jolla, CA
B.S. in Electrical and Computer Engineering (Minor in Cognitive Science), GPA: 3.91/4.00   12/2020
Honor: Magna Cum Laude

Research Experience

Lewis Lab, Massachusetts Institute of Technology, Cambridge, MA   09/2024-present
Closed-loop Auditory Modulation of Cerebrospinal Fluid during sleep

- Design algorithms to use auditory stimulation to promote cerebrospinal fluid circulation during sleep to enhance waste clearance

Insanally Lab, University of Pittsburgh, Pittsburgh, PA   05/2023-08/2024
Bayesian Ensemble Neural Decoding

- Developed an ensemble decoder in Python that incorporates information from multiple neurons to predict mouse behavior in auditory discrimination tasks, revealed the significance of non-classically-response neurons in task learning, and published the findings in a paper in review

Spiking RNN Simulation

- Collaborated with advisor to design a spiking RNN in Python and Julia that follows biological constraints to simulate cerebral mechanisms in mouse auditory discrimination tasks and expand the simulation to discover how a flexible network is attained in long-term training, and presented results at a conference as first author

Chamanzar Lab, Carnegie Mellon University, Pittsburgh, PA   05/2022-04/2023
Neural Probe Waveguide Characterization System

- Created a neural optical probe characterization system based on light scattering, incorporate systems consisting of robotics, computer vision, and signal processing, and published a characterization performance that's previously only obtainable by destructive methods as first author

Lerman Lab, UC San Diego, La Jolla, CA   03/2020-01/2021
Adaptive Neural Signal Noise Cancellation

- Led research and implementation of an adaptive filtering algorithm to eliminate powerline noise contaminating peripheral nerve recordings, prototyped a hardware demo achieving 45dB noise reduction in 60Hz band, and presented a conference paper on project as first author

Peripheral Nerve Magnetoneurography

- Created signal cleaning and processing scripts in Matlab for experiment data on magnetic nervous system recordings by tailoring functions to individual signal, contributing to publication of another paper
- Ran test subject for human trials in neuroscience studies involving electric stimulation

Spitzer Lab, UC San Diego, La Jolla, CA   10/2019-12/2020
Automated Fluorescence Cell Counting
- Developed an automatic cell recognition program for fluorescence brain splices in Matlab utilizing correlation to count and map a variety of brain cells, obtaining an accuracy that's close to expert's manual selection

Neuroelectronics Group, La Jolla, San Diego, CA   07/2019-08/2019
Neural Recording Amplifier PCB Design
- Created and soldered a PCB design using Altium for an amplifier chip to be used in in vivo cell recording, producing a miniature board with size 3cm*1cm and more than two times smaller than previous design

Publications
Paper Publications
- **Zeng X**, Reddy J, Chamanzar M. Automated Photonic Waveguide Loss Measurement using Out-scattering Light Method. Integrated Systems Design and Technology Conference 2023 book proceedings.
- Toth J, Sidleck B, Lombardi O, Hou T, Eldo A, Kerlin M, **Zeng X**, Saeed D, Agarwal P, Leonard D, Andrino L, Inbar T, and Insanally M. Dynamic gating of perceptual flexibility by non-classically responsive neurons (manuscript in review).

Conference Publications
- **Zeng X**, Toth J, Albana B. F., & Insanally M. N. Contributions and synaptic basis of diverse cortical neuron response to flexible task performance. Poster presented at: Society for Neuroscience. (2024). Oct 5-9; Chicago IL, United States. https://www.sfn.org/meetings/neuroscience-2024
- **Zeng X**, Yu G.,, Albana B. F., & Insanally M. N. Contributions and synaptic basis of diverse cortical neuron response to flexible task performance. Poster presented at: COSYNE. (2024). Mar 27-30; Montreal, Canada. https://www.cosyne.org/
- **Zeng X**, Lerman I, Bu Y, Kimball D. RLS Harmonic Powerline Noise Cancellation in Radial Nerve Recording. Poster presented at: North American Neuromodulation Society Virtual Meeting; 2021 Jan 15-16; Orlando FL, United States. https://conference.neuromodulation.org/
- Bu Y, Lerman I, Borna A, Coleman T, Rao R, Huang M, Shah V, Kimball D, Morton T, **Zeng X**. Capturing the Magnetic Signature of Small Fiber Neuronal Activity. Poster presented at: North American Neuromodulation Society Virtual Meeting; 2021 Jan 15-16; Orlando FL, United States. https://conference.neuromodulation.org/
- Hou T., Toth J., Sidleck B., Lombardi O., Eldo A., Saeed D., Kerlin M., **Zeng X.**, Agarwal P., Leonard D., Andrino L., Inbar T., & Insanally M. N. Dynamic gating of perceptual flexibility by diverse cortical responses. Society for Neuroscience. (2023).

Academic Project
Automatic Fake News Detection   Fall 2022
- Jointly created a Bidirectional Encoder Representations from Transformers (BERT) based neural network model to automatically extract relevant evidence and classify misinformation from political statements, achieving a two-way accuracy of 72%

EEG-based Music Recommendation   Fall 2022
- Led to write a K Nearest Neighbor(KNN) prediction system to automatically detect musical preferences from brain EEG recordings of listening subjects and update music recommendation in real-time

Relevant Courses

Computing: CMU - Intro to Deep Learning, Machine Learning for Signal Processing
Neuroscience: MIT - Functional Magnetic Resonance Imaging: Data Acquisition and Analysis, CMU - Neuroengineering Laboratory, Advanced System Neuroscience, UCSD - Cognitive Neuroscience
Electrical Engineering: UCSD - Linear Electronic Systems, Introduction to Digital Design, Components and Circuits Laboratory
MEMS: CMU - Micro and Nano Systems Fabrication, Nano-Bio-Photonics

Technical Skills

Programming Languages: Verilog, C/C++, Matlab, Python, R, Mathematica
Circuit/System Software: Altium, Simulink
Mathematical Packages: Matlab, Mathematica
CAD Software: SolidWorks, Autodesk, Blender

References

Professor Laura D. Lewis, Electrical Engineering and Computer Science, Massachusetts Institute of Technology, ldlewis@mit.edu
Professor Michele Insanally, Otolaryngology & Neurobiology, University of Pittsburgh
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Professor Badr F. Albanna, Neuroscience, University of Pittsburgh School of Medicine
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