Krystal Luo

neural signal processing • spike decoding • brain–computer interfaces • bioelectronic systems • medical imaging

Objective

Graduate researcher with interdisciplinary experience in neural signal processing, bioelectronics, and medical imaging, aiming to advance brain-computer interface systems through neural decoding and integrated hardware-software approaches. Passionate about developing adaptive, high-resolution neural interfaces for real-time decoding and seamless human-machine interaction.

Education

2021-2025 **University of North Carolina at Chapel Hill**, NC
BS Biomedical Engineering, ***Highest Honors***
BA Biological and Medical Physics, ***Highest Honors***
Minored in Mathematics
Dean's List

Awards

Mar 2025 Carnegie Mellon University - Biomedical Engineering Department; Head's Fellowship

Silver (33/1692) in *LLMs – You Can't Please Them All*

Feb 2025 Robert N. Shelton Award for Outstanding Research (Department of Physics and Astronomy)

Oct 2024 Bronze (59/1151) in *NeurIPS 2024: Ariel Data Challenge*

Silver (49/1874) in *RSNA 2024: Lumbar Spine Degenerative Classification*

Sep 2024 University of North Carolina at Chapel Hill - Lampe Joint Department of Biomedical Engineering; Abrams Scholarship

Research experience

2022-2025 Research Assistant, Bai Lab, **Bioelectronics**, UNC-CH, NC
Advisor: Wubin Bai

Project 1: Hydrogel-Based Soft Robotics for Drug Delivery and Minimally Invasive Manipulation

- Synthesized PNIPAM hydrogels and fabricated temperature-responsive actuators; supported device prototyping with 3D mechanical simulations.

Project 2: Microelectrode Array Platform for Brain Organoid Recordings

- Designed and fabricated electrodes using photolithography. Validated electrode functionality via impedance testing; applied adaptive filtering, spike detection, and clustering to extracellular data; visualized neural dynamics with heatmaps and raster plots to study chemical perturbations.

Project 3: MST-DCBS – Multi-Scale Transformer Framework for Spike Sorting & Decoding (Honor Thesis)

- Developed a transformer-based spike sorting model integrating convolutional frequency features,

attention blocks, soft clustering, and a self-supervised decoder; validated performance on simulated and real extracellular datasets; benchmarked efficiency and interpretability.

2024-2025 Research Assistant, Applied Nanotechnology Lab, **Medical Imaging**, UNC-CH, NC
Advisor: Otto Zhou
Project 4: Improving the predictability of dental implant primary stability using a multisource CBCT (Honor Thesis)

- Gained proficiency in operating X-ray machines by performing regular maintenance checks, calibrating the machines for optimal performance, positioning samples accurately to capture precise images.
- Utilized 3D Slicer software for advanced image segmentation tasks, practicing precise delineation of anatomical structures in medical images.
- Conducted segmentation of complex datasets, facilitating accurate quantitative analysis and interpretation of imaging data.

2023-2023 Summer Research Assistant, State Key Laboratory of **Bioelectronics**, Southeast University, Nanjing
Advisor: Nongyue He

- Trained in cell culture techniques, maintaining and propagating various cell lines under sterile conditions.
- Conducted tumor injection procedures in mice, following ethical guidelines and ensuring precise delivery of cells to target sites.
- Monitored mice post-injection, recording tumor growth and health parameters to assess experimental outcomes.

2022-2022 Summer Research on **Brain-Computer Interface**, UCLA, CA
Advisor: Dehan Markovic

- Conducted extensive research on methods for acquiring and processing neural signals, aiming to improve the accuracy and reliability of BCI systems; Focused on creating a minimally invasive, flexible device that adheres to the skin and provides continuous monitoring of brain activity.

Publications

2025 Luo, W. Hu, Y. Stadler, A. Moretti, A. Tyndall, D. Inscoe, C. Lee, Y. Lu, J. Zhou, O.* Improving the predictability of dental implant primary stability using a multisource CBCT: a feasibility study (Submitted to ***Scientific Reports***)

Wu, Y. Xing, S. Yang D. Liu, Y. Ding, C. Li, Z. Zhang, A. Guo, Z. Liu, S. Luo, W. Wang, M. Wang, Y. Dickey, M.* Intrinsically Stretchable Giant Magnetoresistance Systems (Submitted to ***Nature Nanotechnology***)

Wu, Y. Yuan, G. Chen, Z. Liang, K. Yang, D. Luo, W. Dong, J. Wang, Y. Bai, W.* Symmetry engineering in 2D transition metal enables reconfigurable P- and N-type FETs. (Published on ***Nano Letters***)

2024 Zhang, L. Xing, S. Yin, H. Weisbecker, H. Tran, H. Guo, Z. Han, T. Wang, Y. Liu, Y. Wu, Y. Xie, W. Huang, C. Luo, W. Demaesschalck, M. McKinney, C. Hankley, S. Huang, A. Brusseau, B. Messenger, J. Zou, Z. Bai, W.* Skin-Inspired Hydrogel Soft Robotics. (Published on ***Nature Communication***)

Teaching experience

2023-2025 UNC-CH, NC

Teaching Assistant, Lampe Joint Department of Biomedical Engineering

- Taught **BMME 301: Human Physiology: Electrical Analysis** and **BMME 207: Biomedical Electronics**.
- Led lab sections, guiding students through hands-on experiments and practical exercises. Provided instructions and demonstrations on a wide range of topics, including the EKG, EEG, heart and eye dissection, action potential of earthworm, etc; Held office hours to assist students with complex concepts and offered academic guidance and mentoring.
- Assisted students in debugging their biomedical electronic circuits, helping them identify and resolve issues to ensure proper functionality; Delivered micro lectures to introduce and illustrate new concepts in biomedical electronics, bridging theoretical knowledge with practical applications.

2021-2022 TestDaily, Beijing

Online Teaching Assistant

- Delivered online instruction for AP Calculus BC, AP Calculus AB, AP Physics 1, and TOEFL Speaking to a diverse group of students; Developed detailed lesson plans and practice materials that adhered to AP and TOEFL standards, resulting in over 85% of students achieving a score of 5 on AP exams.
