Chenshu Liu

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Research Interests

The main research topic of interest is to foster healthcare ecosystems that combine **artificial intelligence**, **human-machine interaction**, and **wearable technologies** that empower patients to maintain autonomy and well-being. Specifically, I will address the following three research questions:

- How to minimize the disruption from medical practices to patients' normal lives and natural abilities?
- How to configure affective medical AI that can empathize and offer decision support based on the conscious needs of the patient?
- How to make healthcare services more accessible and break from clinical settings?

Publications

2024

Chenshu Liu, Pinyi Yang, Tong Zhou, Haolin Fan, Lingdi Zhao, Yiran Wang, Yangzhi Zhu, Bingbing Li (2024). Democratizing Healthcare: The Synergy of Electronic Skin and Multidomain AI. *ACS Chemical Reviews* (**submitted**)

Chenshu Liu, Hyo-Jeong Choi, Chenguang Zhang, Pengrui Dang, Wangjie Chen, Yongju Lee, Bingbing Li, Meyer Dawn, Pete Kollbaum, Hyeok Kim, Ali Khademhosseini, Yangzhi Zhu (2024). OPTMISE: Ocular Platform with Telemetric Mechano-Electro-Chromic Intelligent Sensing Ecosystem. *Nature Biomedical Engineering* (**under review**)

Haolin Fan, **Chenshu Liu**, Shijie Bian, Changyu Ma, Xuan Liu, Marshall Doyle, Thomas Lu, Lianyi Chen, Jerry Ying Hsi Fuh, Wen Feng Lu, Bingbing Li (2024). New Era Towards Autonomous Additive Manufacturing: A Review of Recent Trends and Future Perspectives. *International Journal of Extreme Manufacturing* (**accepted**)

Haolin Fan, **Chenshu Liu**, Neville Elieh Janvisloo, Shijie Bian, Jerry Ying Hsi Fuh, Wen Feng Lu, Bingbing Li (2024). MaV-iLa: Unlocking New Potentials in Smart Manufacturing through Vision Language Models. *Journal of Manufacturing Systems* (**under review**)

Chenshu Liu*, Songbin Ben, Chongwen Liu, Xianchao Li, Qingxia Meng, Yilin Hao, Qian Jiao, Pinyi Yang (2024). Web-based diagnostic platform for microorganism-induced deterioration on paper-based cultural relics with iterative training from human feedback. *Heritage Science*, 12(1), 148, doi: 10.1186/s40494-024-01267-5

Yi Tang, **Chenshu Liu**, Xiang Yuan (2024). Recognition of bird species with birdsong records using machine learning methods. *Plos One*, 19(2), e0297988, doi: 10.1371/journal.pone.0297988

Chenshu Liu, Songbin Ben, Pinyi Yang, Jiayi Gong, Yin He (2024). A practical evaluation of online self-assisted previewing architecture on rain classroom for biochemistry lab courses. *Frontiers Education*, Vol. 9, p. 1326284, doi: 10.3389/feduc.2024.1326284

2023

Qingxia Meng, Xianchao Li, Junqiang Geng, **Chenshu Liu**, Songbin Ben (2023). A biological cleaning agent for removing mold stains from paper artifacts. *Heritage Science*, 11(1), 243, doi: 10.1186/s40494-023-01083-3

Chenshu Liu, Chongwen Liu, Allison Wall (2023). Ai-Assisted Classification of Microorganism Strains on Paper-Based Cultural Relics. *Art Bio Matters Conference* (**Oral Presentation**)

Education

MS **University of California, Los Angeles**, Bioengineering — Sept 2022 – Dec 2023

- **Coursework:** Computational Medical Imaging, Signal Processing, Database Management and Security, Knowledge Representation and Inference

BS **University of California, Los Angeles**, Statistics — Sept 2020 – March 2022

- **Coursework:** Generalized Linear Models, Data Mining, Optimization, Monte Carlo Methods, Computational Statistics and Consulting

BS **University of California, Los Angeles**, Neuroscience — Sept 2018 – March 2022

- **Coursework:** Neuroanatomy, Cell and Systems Neuroscience, Molecular and Developmental Neuroscience, Behavioral and Cognitive Neuroscience, Neurophysiology, Neurophysics

Experience

Terasaki Institute of Biomedical Innovation — Los Angeles, CA
Research Intern — Dec 2022 – Present

- Supervised by Prof. Yangzhi Zhu and Prof. Chongming Jiang
- Adapted different BERT models, including BERTrand and ProtTrans, for immunogenicity prediction for short epitope sequences.
- Designed triboelectric nanogenerator (TENG) -powered colorimetric sensing system in the OPTMISE lens for eyelid pressure measurement.
- Implemented real-time segmentation to track ROI and extract RGB value from the OPTMISE lens during dry eye syndrome diagnosis and trained multilinear regression model to predict pressure changes according to real-time RGB values for mechanochromic contact lenses.
- Designed TENG electrodes to delivery endogenous electric field (EF) to accelerate corneal damage restoration.

CSUN Autonomy Research Center for STEAHM (ARCS) — Los Angeles, CA
Research Intern — Dec 2022 – Present

- Supervised by Prof. Bingbing Li
- Explored knowledge-graph (KG) and Retrieval-Augmented Generation (RAG) methods for enhancing domain support in human-machine interaction in Additive Manufacturing (AM) processes.
- Investigated the role of reinforcement learning (RL) in enhancing the efficiency of autonomous AM tasks.
- Experimented with vision language model (VLM) in enhancing AM process quality control and debugging.
- Developed recurrent neural network (RNN)–based models to identify individual machine states by disaggregating energy consumption among a manufacturing system.

UCLA W.M.Keck Center for Neurophysics — Los Angeles, CA
Research Assistant — Dec 2020 - April 2022

- Supervised by Prof. Mayank Mehta.
- Designed and developed and created virtual reality mazes (8-shape, diamond, hexagon, octagon, pentagon mazes, etc.) for rats.
- Perfected C# parsing code for Unity virtual reality creating to handle the creation of a wider variety of mazes.
- Handled and trained rats to perform tasks in virtual reality environments.

UCLA Guo's Lab — Los Angeles, CA
Research Assistant — Dec 2019 - June 2020

- Supervised by Prof. Zhefeng Guo
- Designed DNA primer for mutagenesis and performed sequencing analysis.
- Performed protein purification, Mutagenesis, Inoculation, DNA transformation, Expression, and Electron Paramagnetic Resonance to investigate molecular mechanics for protein aggregation in neurodegenerative diseases.

Projects

TangibleMIDI github.com/TangibleMIDI

- TangibleMIDI uses hand landmarks, captured by Mediapipe, to dynamically control audio data. Breaking the constraint from physical musical instruments.
- Tools Used: Mediapipe (motion tracking), Librosa (audio processing)

Posture2Melody github.com/Posture2Melody

- Posture2Melody uses GAN-Transformer-based architecture to generate melodies from human postures. By synchronizing bodily movement and music, Posture2Melody seeks to develop a creative technique that could be used in emotional therapy.
- Tools Used: Pytorch (modeling), Mediapipe (body landmark extraction)

NeuroMT github.com/NeuroMT

- NeuroMT introduces a closed-loop theranostic device combining electromyography (EMG), to detect irregularities in muscle activation associated with neurodegenerative disorders, and Transcutaneous Electrical Nerve Stimulation (TENS) unit, to restore normal neuromuscular activity in real-time. Our approach offers a novel solution for neurodegenerative patients, potentially improving mobility, reducing symptoms, and enhancing overall quality of life.
- Tools Used: Electromyography (neuromuscular signal acquisition), Transcutaneous Electrical Nerve Stimulation (treatment delivery)

Teaching

LS 23L Introduction to Laboratory and Scientific Methodology — UCLA, March 2023 - Dec 2023

- Course Website: LIFESCI 23L
- Instructing three three-hour lab sessions per week for biology laboratory techniques, including using polyacrylamide gel for protein subunit analysis, agarose gel electrophoresis for DNA segment analysis, bioinformatics for genotyping, epidemiology, physiology, cell biology, etc.

AP Biology — Panopath, Jan 2022 - April 2022

- Constructed full AP biology course, recorded over 30 hours of on-line tutorial videos for AP biology exam.

Technologies

Programming Languages: Python, C++, C#, JavaScript, CSS, HTML

Machine Learning Packages: Pytorch, NumPy/SciPy, NLTK, Open-CV, Pandas, TensorFlow, Librosa, MediaPipe

Academic Softwares: Adobe Illustrator (2D graphics design), Adobe Lightroom, Adobe Dimension (3D graphics design), Arduino (prototyping), Matlab (physics simulation), LaTeX(formatting), Blender (3D modeling)