Ziming Liu

125 Peterborough St, Apt 25, Boston, MA, 02215
(615) 423-8637 | zliu56@bwh.harvard.edu

Research Experience

Brigham and Women's Hospital and Harvard Medical School, Boston, MA
Host: Dr. Alexander Turchin; Co-host: Dr. Marinka Zitnik

Postdoctoral Fellow   August 2024 – Present
- Leveraging large language models to analyze clinical notes from diabetes patients
- Using explainable AI to identify and understand gaps in diabetes treatment effectiveness

University of Tennessee, Knoxville, TN
Advisor: Dr. Xiaopeng Zhao

Graduate Research Assistant   September 2019 – May 2024
- Alzheimer's Disease detection using Natural Language Processing
- A cognitive model-inspired dialogue system for people with a mental disorder
- Trustworthy AI for goal-oriented human-computer communication
- Neurofeedback training to improve cognitive capacity in Mild Cognitive Impairment
- Social robot-assisted cognitive assessment in Alzheimer's disease
- Explainable AI for Alzheimer's risk factors in electrical health record

Mayo Clinic, Rochester, MN
Mentor: Dr. Sunghwan Sohn

Bioinformatics Intern, Ph.D.   May 2023 - August 2023
- Investigate sex-based variations in the progression of Alzheimer's disease

Education

University of Tennessee, Knoxville, TN

Ph.D. Mechanical Engineering   September 2019 – May 2024
Major: Robotics and Control

M.S. Computer Science   December 2020 - December 2023

Lipscomb University, Nashville, TN

B.S. Mechanical Engineering   December 2015- May 2019
B.S., Applied Mathematics

Peer-Reviewed Publications

1. **Liu, Z.,** Liu, L., Heidel, R., & Zhao, X. Explainable AI and Transformer Models: Unraveling the Nutritional Influences on Alzheimer's Disease Mortality. *Connected Health: Applications, Systems and Engineering Technologies (CHASE 2024).*
2. **Liu, Z.,** Garg, M., Fu, S., Sarkar, S., Vassilaki, M., Peterson, R., Sauver., J., & Sohn, S., Harnessing Transfer Learning for Dementia Prediction: Leveraging Sex-Different Mild Cognitive Impairment Prognosis. *IEEE International Conference on Bioinformatics and Biomedicine (BIBM 2023).*
3. **Liu, Z.,** Collier, P., Paek, E. J., Casenhiser, D., Zhou, W., & Zhao, X. Generating Natural Language Responses in Robot-Mediated Referential Communication Tasks to Simulate Theory of Mind. *14th International Conference on Social Robotics (ICSR 2022).*

4. **Liu, Z.,** Collier, P., Paek, E. J., Yoon, S. O., Casenhiser, D., Zhou, W., Simpson, S., & Zhao, X. Estimating Human Attitude during Robot-mediated Referential Communication Tasks. *In 2022 IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (IEEE/ACM CHASE 2022).*

5. **Liu, Z.,** Grant, J., Simpson, S., A. Khattak., Anderson. J., Gao. Z., & Zhao. X. (2022)., "Driving Ability Evaluation and Rehabilitation for People with Alzheimer's and Related Dementia", Alzheimer Disease & Associated Disorders, 10-1097.

6. Pan, R., **Liu, Z.,** Yuan, F., Zare, M., Zhao, X., & Passonneau, R., A Database of Multimodal Data to Construct a Simulated Dialogue Partner with Varying Degrees of Cognitive Health. *In 2022 Resources and ProcessIng of linguistic, para-linguistic and extra-linguistic Data from people with various forms of cognitive/psychiatric/developmental impairments (RaPID-2022).*

7. **Liu, Z.,** Paek, E. J., Yoon, S. O., Casenhiser, D., Zhou, W., & Zhao, X. (2022). Detecting Alzheimer's Disease Using Natural Language Processing of Referential Communication Task Transcripts. Journal of Alzheimer's Disease.

8. Jao, Y., Liao, Y., Yuan F, **Liu, Z.,** Zhao, X., Liu, W., Berish, D., Wang, J. (2022). AI-ASSISTED METHODS FOR ASSESSING AFFECT AND BEHAVIORAL SYMPTOMS IN DEMENTIA: A SYSTEMATIC REVIEW. Innovation in Aging.

9. Jiang, Y., Jessee, W., Hoyng, S., Borhani, S., **Liu, Z.,** Zhao, X., Price, L. K., High, W., Suhl, J., & Cerel-Suhl, S. (2022). Sharpening Working Memory With Real-Time Electrophysiological Brain Signals: Which Neurofeedback Paradigms Work? Frontiers in Aging Neuroscience, 14. https://doi.org/10.3389/fnagi.2022.780817

10. **Liu, Z.,** Proctor, L., Collier, P. N., & Zhao, X. Automatic Diagnosis and Prediction of Cognitive Decline Associated with Alzheimer's Dementia through Spontaneous Speech. *In 2021 IEEE International Conference on Signal and Image Processing Applications (ICSIPA)* (pp. 39-43), IEEE, Virtual Event, Sep 13-15, 2021.

11. Sweely, B., **Liu, Z.,** Wyatt, T., Newnam, K., Qi, H., & Zhao, X. Camera-Based Remote Photoplethysmography for Physiological Monitoring in Neonatal Intensive Care. In *2021 IEEE International Conference on Signal and Image Processing Applications (ICSIPA)* (pp. 146-149), IEEE, Virtual Event, Sep 13-15, 2021

12. **Liu, Z.,** Yuan, F., Wang, M., & Zhao, X. A Mind-Controlled Drone for Virtual Tour in Mixed Reality. *In The 2021 World Congress in Computer Science, Computer Engineering, & Applied Computing (CSCE'21),* Las Vegas, USA, Jul 26-29, 2021.

13. **Liu, Z.,** Shore, J., Wang, M., Yuan, F., Buss, A., & Zhao, X. (2021). A systematic review on hybrid EEG/fNIRS in brain-computer interface. *Biomedical Signal Processing and Control*, *68*, 102595.

14. Yuan, F., Klavon, E., **Liu, Z.,** Lopez, R. P., & Zhao, X. (2021). A Systematic Review of Robotic Rehabilitation for Cognitive Training. *Frontiers in Robotics and AI*, *8*, 105.

15. S. Borhani, R. Arvin, **Liu**, **Z.** , A. Khattak, M. Wang, and X. Zhao, "Prediction drivers' reaction time in unexpected lane departure situations using brainwave signals: Application of machine learning techniques", *Proc. Transportation Research Board '21*, Virtual Event, Jan. 21-22, 2021.

16. **Liu, Z.,** Bryan, J., Borkoski, R., Yuan, F., Li, Y., & Zhao, X. On a Gamified Brain-Computer Interface for Cognitive Training of Spatial Working Memory. In *Dynamic Systems and Control Conference* (Vol. 84270, p. V001T08A002). American Society of Mechanical Engineers. Virtual Event, Oct 5-7, 2020.

Manuscripts in Preparation

1. **Liu, Z.**, Collier, P., Paek, E. J., Yoon, S. O., Casenhiser, D., Zhou, W., Simpson, S., & Zhao, X. Multi-modal Vision-and-Language Analysis of Communication Deficits due to Alzheimer's Disease. Scientific Reports. ***Preprint.***

2. **Liu, Z.,** Paek, E. J., Yoon, S. O., Casenhiser, D., Zhou, W., & Zhao, X. User Study of A Robotic Platform for Referential Communication. ***To be submitted.***

3. **Liu, Z**., Jiang, Y., Cerel-Suhl, S., Suhl, J& Zhao, X., Real-time Memory-related Neurofeedback Training Improves Intrinsic Brain Oscillations in Older Adults. ***Under Review.***

Conference Posters and Presentations

1. **Liu, Z**., Jiang, Y., Cerel-Suhl, S., Suhl, J& Zhao, X. Real-time Memory-related Neurofeedback Training Improves Intrinsic Brain Oscillations in Older Adults. *In 2023 Alzheimer's Association International Conference*. ALZ. Amsterdam, Netherlands. Jul 16-20, 2023.

2. **Liu, Z**., Collier, P., Paek, E. J., Yoon, S. O., Casenhiser, D., Zhou, W., Simpson, S., & Zhao, X., Understanding referents' relationships in referential communication of people with Alzheimer's Disease using Vision and Language Learning, *Research Symposium Emerging Technologies in Aging and Dementia (Hybrid).*, Knoxville TN, June 8-9, 2022

3. **Liu, Z**., Jiang, Y., & Zhao, X. Real-time Neurofeedback Rewards Memory-related Potentials in Older Brains. *In 2022 Alzheimer's Association International Conference. ALZ.* San Diego, USA. Jul 31-Aug 4, 2022.

4. Jao, Y-L., Liao, Y-J., Yuan, F., **Liu, Z**, Zhao, X, Liu, W., Berish, D., & Wang, J. AI-assisted methods for assessing affect and behavioral symptoms in dementia: systematic review. GSA Annual Scientific Meeting, Indianapolis, IN, Nov 2-6, 2022.

5. Jiang. Y., Zhao. X., Zheng. Z., Latham. J., Wang. B., **Liu. Z.,** Zhao. X., Jicha. G., MD, &Li. J. Validating Frontal Memory-related Neuromarkers for Mild Cognitive Impairment using Identical Protocols in Two Racial and Culturally Distinct Cohorts. *In 2022 Alzheimer's Association International Conference. ALZ.* San Diego, USA. Jul 31-Aug 4, 2022.

6. **Liu, Z**., Jiang, Y., Jicha, G., & Zhao, X. Real-time Analyses of Memory-related Potentials: Implication for Closed-loop Neurofeedback. *In 2022 The Organization for Human Brain Mapping (OHBM 2022).* Glasgow, Scotland., Jun 19-23, 2022

7. **Liu, Z**., Proctor, L., Collier, P., Casenhiser, D., Paek, E. J., Yoon, S. O., & Zhao, X. Machine Learning of Transcripts and Audio Recordings of Spontaneous Speech for Diagnosis of Alzheimer's Disease. *In 2021 Alzheimer's Association International Conference. ALZ.* Denver, USA. Jul 26-30, 2021.

8. **Liu, Z**., Collier, P., Wang, C., Paek, E. J., Yoon, S. O., Casenhiser, D., & Zhao, X. A demonstration of human-robot communication based on multiskilled language-image analysis In *2021 IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (IEEE/ACM CHASE 2021).* IEEE. Washington D.C., USA., Dec 16 - 18, 2021

Selected Awards and Honors

- Rising Stars at Modeling, Estimation, and Control Conference (MECC) (2022). The ASME Dynamic Systems and Controls Division.
- Graduate Student Senate (GSS) Travel Award (2022). The University of Tennessee.
- NSF Student Travel Award (2022). 2022 IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (IEEE/ACM CHASE 2022).

- Graduate Student Senate (GSS) Travel Award (2021). The University of Tennessee.

Media Coverage

- Feature a Teacher: Pepper Robot as a Helper to People with Dementia (2022). RobotLAB.
- Robots visit Knoxville's neuroscience clinic to help improve their artificial intelligence. (2021). WVLT8.
- UT creating artificial intelligence to help slow dementia progression (2021). WVLT8.

Grant Writing

- Contributed to approximately 20% of the project narrative outlining the initial framework for "Early-Alzheimer's Screening and Scrutiny via Language Analysis Based on Referential Communication (EasyLAB)", HT9425-23-PRARP_TDA, Department of Defense, Defense Health Program (2023). Under review.
- Assisted in designing the artificial intelligence framework for "Tuning Up Memory-related Brain Potentials using Real-time Neurofeedback in Older Veterans", FY24, Department of Defense, Defense Health Program (2023). Funded.
- Contributed to approximately 20% of the project narrative outlining the initial framework for "Robot- and AI-based Social Engagement for Persons with Mild Cognitive Impairment (RAISE) " (2022). To be resubmitted to Smart Health and Biomedical Research in the Era of Artificial Intelligence and Advanced Data Science (SCH).
- Proposed individual research titled "Trustworthy AI for Goal-Oriented Human-Robot Communication" for the Graduate Advancement Training and Education (GATE) program, the University of Tennessee (2022).
- Collected preliminary data for "Robot-Enhanced Cognitive Assessment and Rehab for Mild Cognitive Impairment (RECOVER for MCI)" (2021). Funded.

Service to Professional Community

Reviewer
- Artificial Intelligence Review
- Journal of Alzheimer's Disease (JAD)
- International Conference on Social Robotics (ICSR)
- Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring (DADM)
- The Conference on Human Factors in Computing Systems (CHI 2022)
- The ACM SIGCHI Conference on Designing Interactive Systems (DIS 2022)

Research Exhibition
- Friendly AI and Robotics for Dementia Care, BMES & EMED, 2022
- AI-Mediated Screener on Discourse for Alzheimer's Disease, Tennessee State Government, 2022
- Symposium at University of Tennessee, 2022
- Social Robots for Dementia Care, University of Kentucky, 2022
- Session Co-chair, the 13th International Conference on Social Robotics, 2021
- Tutor on Social Robotics, UT Governor's School for the Sciences & Engineering, 2021
- Social Robots for Alzheimer's Diagnosis and Care, Alzheimer's Tennessee, 2021
- Brain-Computer Interface, UT Day on the Hill, 2020

Professional Membership
- o Member, Institute of Electrical and Electronics Engineers (IEEE)
- o The Alzheimer's Association International Society to Advance Alzheimer's Research and Treatment (ISTAART)

Student Supervision

Undergraduate Student Research Mentorship
- o 2023   Emily Landis, Nylan Alexander
    "Review on artificial intelligence vs. theoretical models in Alzheimer's"

- o 2022-2023 Jovan Yoshioka
    "Mobile app based early Alzheimer's screening"

- o 2022   Yigang Qin, Huiqi Zou
    "Natural language responses in robot-mediated referential communication"

- o 2022   Parker N. Collier
    "Review on driving ability for people with Alzheimer's disease"

- o 2021-2022 Parker N. Collier
    "Alzheimer's disease detection using natural language processing"

- o 2021   Jemery Shore
    "Review on EEG/FNIRS in brain-computer interface"

- o 2020   Jonathan Bryan
    "Gamified brain-computer interface for cognitive training"

Teaching Experience

University of Tennessee, Knoxville, TN

Teaching Assistant for System Dynamics   Fall 2019- Fall 2021

Teaching Assistant for Signal & Systems   Spring 2020-Spring 2022