

RAN LIU

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SUMMARY

I am a Senior Research Scientist at Apple Health AI, with a Ph.D. in Machine Learning from Georgia Tech. My research focuses on large-scale foundation models and reasoning systems for multimodal health and wearable data, spanning physiological, behavioral, visual, and audio signals. I aim to build intelligent systems that redefine how we understand and enhance human health, well-being, and performance.

EDUCATION

Georgia Institute of Technology

Ph.D. in Machine Learning (*with minor in Statistics*)

Aug 2019 - Jul 2024

Advised by Professor Eva L. Dyer

Fudan University

Bachelor of Science in Physics

Jun 2019

INDUSTRY EXPERIENCE

Apple AI/ML, Cupertino, CA

Aug 2024 - Present

Senior Research Scientist, advised by Dr. Ellen Zippi

- Led end-to-end machine learning research, encompassing the full machine learning lifecycle from study design and data collection to model development, evaluation, and results reporting, to drive novel user experience incubation and sensor validation.
- Generated impactful research findings that were presented to multiple cross-functional teams and senior leadership (e.g., John Ternus, John Giannandrea, and Sumbul Desai), while contributing to the field through publications and patents on novel machine learning techniques.

Apple AI/ML, Cupertino, CA

Jan 2023 - Aug 2023

Research Scientist Intern, advised by Dr. Ali Moin (collaborator: Dr. Hadi Pouransari)

- Led a research project developing efficient transformer architectures with Fourier Neural Operators for large-scale pretraining on multi-modal time series and biosignals. Project was patented.

Cajal Neuroscience, Seattle, WA

May 2022 - Aug 2022

Machine Learning Research Intern, advised by Dr. Jennifer Whitesell

- Developed biological prior-guided contrastive methods for learning on high-resolution images ($>10,000^2$ pixels). Applied various class activation mapping (CAM) visualization techniques for image analysis to assist in drug development for treating neurodegenerative diseases (e.g. Alzheimer's disease).

Facebook (now Meta Platforms), Menlo Park, CA

May 2021 - Aug 2021

Research Intern, advised by Dr. Andrew Grier

- Designed a physics-assisted generative learning method (based on U-Net) to learn time-varying sequential systems. Performed modeling on the environmental change process guided by Partial Differential Equations (e.g. Navier–Stokes equations), and forecasting through predicted physical parameters.

PUBLICATIONS

Preprints

- C14 Wenrui Ma, Zihao Chen, **Ran Liu**, Eva L. Dyer., “Learning Hard Cross-Domain Pairs with Optimal Transport for Biosignal Domain Generalization.”, submitted to the Conference on Neural Information Processing Systems (**NeurIPS**), 2026.

Peer Reviewed Conference Proceedings

- C13 Kexin Geng, Siying Chen, Tingjun Chen, **Ran Liu**, Jingping Nie., “A Multimodal Wearable Platform with Self-Supervised Biosignal Pretraining for Gesture and Cardio-Biometric Sensing.”, IEEE/ACM conference on Connected Health: Applications, Systems and Engineering Technologies (**CHASE**), 2026.
- C12 Wenhui Cui, Chris Sandino, Hadi Pouransari, **Ran Liu**, Juri Minxha, Ellen L Zippi, Erdrin Azemi, Behrooz Mahasseni., “Embridge: Enhancing gesture generalization from emg signals through cross-modal representation learning.”, International Conference on Learning Representations (**ICLR**), 2026.
- C11 Zihao Chen, Chi-Heng Lin, **Ran Liu**, Jingyun Xiao, Eva L Dyer., “Your contrastive learning problem is secretly an alignment problem.”, Neural Information Processing Systems (**NeurIPS**), 2024.
- C10 Chiraag Kaushik*, **Ran Liu**^{*1}, Chi-Heng Lin, Amrit Khara, Matthew Y Jin, Wenrui Ma, Vidya Muthukumar, Eva L Dyer., “Balanced Data, Imbalanced Spectra: Unveiling Class Disparities with Spectral Imbalance.”, International Conference on Machine Learning (**ICML**), 2024.
- C9 Jingyun Xiao, **Ran Liu**, Eva L Dyer., “GAFormer: Enhancing timeseries transformers through adaptive group-aware embeddings.”, International Conference on Learning Representations (**ICLR**), 2024.
- C8 **Ran Liu**, Sahil Khose, Jingyun Xiao, Lakshmi Sathidevi, Keerthan Ramnath, and Eva L Dyer., “LatentDR: Improving model generalization through sample-aware latent degradation and restoration.”, Winter Conference on Applications of Computer Vision (**WACV**), 2024.
- C7 Mehdi Azabou, Venkataramana Ganesh, Shantanu Thakoor, Chi-Heng Lin, Lakshmi Sathidevi, **Ran Liu**, Michal Valko, Petar Velickovic, Eva L Dyer., “Half-Hop: A graph upsampling approach for slowing down message passing.”, the International Conference on Machine Learning (**ICML**), 2023.
- C6 **Ran Liu**, Mehdi Azabou, Max Dabagia, Jingyun Xiao, and Eva L Dyer., “Seeing the forest and the tree: Building representations of both individual and collective dynamics with transformers.”, the Conference on Neural Information Processing Systems (**NeurIPS**), 2022.
- C5 Jorge Quesada, Lakshmi Sathidevi, **Ran Liu**, Nauman Ahad, Joy M Jackson, Mehdi Azabou, Jingyun Xiao, Chris Liding, Carolina Urzay, William Gray-Roncal, Erik Christopher Johnson, Eva L Dyer., “MTNeuro: A Benchmark for Evaluating Representations of Brain Structure Across Multiple Levels of Abstraction.”, the Conference on Neural Information Processing Systems (**NeurIPS** Datasets and Benchmarks Track), 2022.
- C4 Joy M Jackson, **Ran Liu**, Eva L Dyer., “Building representations of different brain areas through hierarchical point cloud networks.”, Medical Imaging with Deep Learning (**MIDL**), 2022.
- C3 **Ran Liu**, Mehdi Azabou, Max Dabagia, Chi-Heng Lin, Mohammad Gheshlaghi Azar, Keith Hengen, Michal Valko, Eva L Dyer., “Drop, Swap, and Generate: A Self-Supervised Approach for Generating Neural Activity”, the Conference on Neural Information Processing Systems (**NeurIPS**), **oral presentation (top 1%)**, 2021.
- C2 Aishwarya Balwani, Joseph Miano, **Ran Liu**, Lindsey Kitchell, Judy A Prasad, Erik C Johnson, William Gray-Roncal, Eva L Dyer., “Multi-scale modeling of neural structure in X-ray imagery”, the IEEE International Conference on Image Processing (**ICIP**), 2021.
- C1 **Ran Liu**, Cem Subakan, Aishwarya H Balwani, Jennifer Whitesell, Julie Harris, Sanmi Koyejo, Eva L Dyer., “A generative modeling approach for interpreting population-level variability in brain structure”, the International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**), 2020.

Workshops and Posters

¹Contributed equally, ordered alphabetically.

- W6 Geeling Chau, **Ran Liu**, Juri Minxha, Wenhui Cui, Erdrin Azemi, Ellen L Zippi, Behrooz Mahasseni, Chris Sandino., “Device Passport: Enabling Spatio-Temporal Pretrained Models to Generalize Across Input Layouts.”, the Structured Data for Health Workshop at **ICML**, 2026.
- W5 Wenrui Ma, **Ran Liu**, Ellen L Zippi, Christopher Michael Sandino, Juri Minxha, Behrooz Mahasseni, Erdrin Azemi, Ali Moin, Eva L Dyer., “Narrative of Time across Scales (NoTS).”, the Time Series in the Age of Large Models Workshop at **ICLR**, 2026.
- W4 Wenhui Cui, Chris Sandino, Hadi Pouransari, Juri Minxha, **Ran Liu**, Ellen L. Zippi, Aman Verma, Anna Sedlackova, Behrooz Mahasseni, Erdrin Azemi., “CPEP: Contrastive Pose-EMG Pre-training Enhances Gesture Generalization on EMG signals.”, the Foundation Models for the Brain and Body Workshop at **NeurIPS**, 2025.
- W3 **Ran Liu**, Ellen L. Zippi, Hadi Pouransari, Chris Sandino, Jingping Nie, Hanlin Goh, Erdrin Azemi, Ali Moin., “Frequency-aware masked autoencoders for multimodal pretraining on biosignals.”, **ICLR** Time Series for Health Workshop, 2024.
- W2 Mehdi Azabou, Max Dabagia, **Ran Liu**, Chi-Heng Lin, Keith B Hengen, Eva L Dyer., “Using self-supervision and augmentations to build insights into neural coding”, **NeurIPS** 2021 Workshop: Self-Supervised Learning Theory and Practice, 2021.
- W1 Mehdi Azabou, Mohammad Gheshlaghi Azar, **Ran Liu**, Chi-Heng Lin, Erik C Johnson, Kiran Bhaskaran-Nair, WashU-St Louis, Max Dabagia, Bernardo Avila-Pires, Lindsey Kitchell, Keith B Hengen, William Gray-Roncal, Michal Valko, Eva L Dyer., “Mine Your Own view: Self-supervised learning through across-sample prediction”, **NeurIPS** 2021 Workshop: Self-Supervised Learning Theory and Practice, 2021.

Patents

- P1 Ali Moin, **Ran Liu**, Ellen L. Zippi, Mohammad Hadi Pouransari, Chris Sandino, Erdrin Azemi., “Frequency-aware masked autoencoders for multimodal pretraining on frequency-based signals”, Patent No. US 2025/0036940 A1, Jan 2025.

Journal Articles

- J3 Ce Huang, Benjamin T Zhou, Huiqin Zhang, Bingjia Yang, **Ran Liu**, Hanwen Wang, Yimin Wan, Ke Huang, Zhiming Liao, Enze Zhang, Shanshan Liu, Qingsong Deng, Yanhui Chen, Xiaodong Han, Jin Zou, Xi Lin, Zheng Han, Yihua Wang, Kam Tuen Law, Faxian Xiu., “Proximity-induced surface superconductivity in Dirac semimetal Cd_3As_2 ”, **Nature Communications**, 2019.
- J2 Cheng Zhang, Yi Zhang, Xiang Yuan, Shiheng Lu, Jinglei Zhang, Awadhesh Narayan, Yanwen Liu, Huiqin Zhang, Zhuoliang Ni, **Ran Liu**, Eun Sang Choi, Alexey Suslov, Stefano Sanvito, Li Pi, Hai-Zhou Lu, Andrew C Potter, Faxian Xiu., “Quantum Hall effect based on Weyl orbits in Cd_3As_2 ”, **Nature**, 2019.
- J1 Ce Huang, Awadhesh Narayan, Enze Zhang, Yanwen Liu, Xiao Yan, Jiaxiang Wang, Cheng Zhang, Weiyi Wang, Tong Zhou, Changjiang Yi, Shanshan Liu, Jiwei Ling, Huiqin Zhang, **Ran Liu**, Raman Sankar, Fangcheng Chou, Yihua Wang, Youguo Shi, Kam Tuen Law, Stefano Sanvito, Peng Zhou, Zheng Han, Faxian Xiu., “Inducing Strong Superconductivity in WTe_2 by Proximity Effect”, **ACS nano**, 2018.

AWARDS

Apple Research Program Sponsorship (received as co-PI)	2024
NSF CloudBank Sponsorship (received as co-PI)	2024
CSIP Outstanding Research Award	2023
Rising Stars in EECS (1 of 101 awardees)	2023

ICML Diversity and Inclusion Fellowship	2020
Cox Fellowship	2019
China National Scholarship (highest undergraduate scholarship nationally)	2018
Chun-Tsung Scholar	2018
Outstanding Leadership Awards (1 of 10 awardees)	2018
First Prize of Outstanding Students Scholarship (awarded to top 5%)	2016

PROFESSIONAL EXPERIENCES

Talks and Presentations

- “Generalizable and Interpretable Representation Learning for Neuroscience”, EECS Rising Star, 2023.
- “Interpretable and generalizable representation learning methods for neural data”, speaker and panelist at Georgia Tech/Emory NeuroAI Summer Course, 2023.
- “Seeing the forest and the tree: Building representations of both individual and collective dynamics with transformers”, presentation at the Conference on Neural Information Processing Systems (NeurIPS), 2022.
- “Towards interpretable representation learning methods for neural data”, invited by the Computational Neuroscience Center (CNC) at the University of Washington, 2022.
- “Drop, swap, and generate: A self-supervised approach for generating neural activity”, oral presentation at the Conference on Neural Information Processing Systems (NeurIPS), 2021.
- “A generative modeling approach for interpreting population-level variability in brain structure”, oral presentation at the International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2020.

Reviewing

Reviewer for TMLR, BMVC 2026, ICLR 2026, ICML 2026, NeurIPS 2025, ICLR 2025, CVPR 2024, AAAI 2024, ICLR 2024, NeurIPS 2024, ICML 2024, ICLR 2024, NeurIPS 2023, ICML 2023, ICLR 2023, NeurIPS 2022, NeurIPS 2021, ICML 2021, ICLR 2021, NeurIPS 2020, ACL 2019

Teaching

- **Teaching Assistant.** “Introduction to Signal Processing”, Georgia Institute of Technology, 2019.

Mentoring

- Amrit Khera, M.S. at Georgia Tech
- Wenrui Ma, M.S. at Georgia Tech (now Ph.D. at Georgia Tech)
- Keerthan Ramnath, M.S. at Georgia Tech
- Sahil Khose, M.S. at Georgia Tech
- Jingyun Xiao, M.S. at Georgia Tech (now Ph.D. at Georgia Tech)
- Joy M Jackson, B.S. at University of Miami (now Ph.D. at Georgia Tech)