Peirong Liu

Postdoctoral Researcher
Athinoula A. Martinos Center for Biomedical Imaging
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Summary

My research interest lies in **AI for Healthcare**, at an intersection of machine learning, computer vision, and medical image computing. My recent research topics include

- Physics-driven learning for time-varying dynamic systems
- Modality-agnostic foundation models for medical imaging data
- Image registration, synthesis, and segmentation with potential pathologies
- Clinical applications: CT/MR imaging, brain perfusion, stroke detection and diagnosis

Education

University of North Carolina at Chapel Hill — Chapel Hill, U.S
Ph.D. in Computer Science — Aug 2018 – Jun 2023

- Advisor: Dr. Marc Niethammer
- Thesis Committee: Dr. Yueh Z. Lee, Dr. Stephen Aylward, Dr. Colin Raffel, Dr. Gedas Bertasius

Shanghai University — Shanghai, China
B.S. in Mathematics and Applied Mathematics — Sep 2014 – Jun 2018

- GPA: 3.95/4.00 (Rank: 1/305); Presidential Scholarship; National Scholarship

Awards

Rising Stars in Data Science, *UCSD & UChicago & Stanford* 2024
Rising Stars in EECS, *MIT* 2024
MICCAI NIH Award, *Marrakesh* 2024
MICCAI Travel Award, *Lima* 2020
IPMI Scholarship, *Hong Kong* 2019
Presidential Scholarship, *Shanghai University (Highest Honor, Top 10)* 2018
National Scholarship, *Ministry of Education of China (Top 1%)* 2018
Outstanding Graduate, *Ministry of Education of China* 2018
Baogang National Scholarship, *Shanghai (Top 4)* 2017
Finalist Winner, *U.S. Mathematical Contest In Modeling (MCM) (Team leader, Top 0.4%, 36/8843)* 2017
Third Prize, *Shanghai Mathematics Competitions (Math Major)* 2016
Top Grade Scholarship, *Shanghai University (Top 3%)* 2015-2017
Outstanding Student Award, *Shanghai University* 2015-2017
Public Service Award, *Shanghai University* 2015-2016

Experience

Harvard Medical School & Massachusetts General Hospital — Boston, U.S
Postdoctoral researcher (Host: Dr. Juan Eugenio Iglesias) — Aug 2023 – present

- Modality-agnostic foundation models for medical imaging
- Pathology representation and anomaly detection, low-field MRI analysis

Department of Computer Science, University of North Carolina at Chapel Hill — Chapel Hill, U.S
Research assistant (Advisor: Dr. Marc Niethammer) — Jan 2019 – Aug 2023

- Partial differential equations, physics-driven learning for time-varying dynamic systems
- Perfusion image analysis, image and point cloud registration
- Stroke detection and diagnosis

Computer Vision (Generative AI), Meta AI — New York, U.S
Research Intern: open-world object detection, multi-object tracking — May 2022 – Nov 2022

Computer Vision (Content Understanding), Facebook AI — New York, U.S
Research Intern: unsupervised image synthesis, motion transfer — May 2021 – Nov 2021

Biomedical Research Imaging Center, University of North Carolina at Chapel Hill — Chapel Hill, U.S
Research assistant (Advisors: Dr. Dinggang Shen and Dr. Pew-Thian Yap) — Aug 2018 – Dec 2018

- Geometric deep learning for mesh-structured and longitudinal data

Selected Publications

Journal

P. Liu, Y. Z. Lee, S. Aylward, and M. Niethammer, "Perfusion Imaging: An Advection Diffusion Approach," *IEEE Transactions on Medical Imaging (**IEEE TMI**)*, 2021. [paper] [code]

Refereed Conference

P. Liu, O. Puonti, X. Hu, D. C. Alexander, and J. E. Iglesias, "Brain-ID: Learning Contrast-agnostic Anatomical Representations for Brain Imaging," ***ECCV***, 2024. [paper] [code]

P. Liu, O. Puonti, A. Sorby-Adams, W. T. Kimberly, and J. E. Iglesias, "PEPSI: Pathology-Enhanced and Pulse-Sequence-Invariant Representations for Brain MRI," ***MICCAI***, 2024. [paper] [code]

P. Liu, Y. Z. Lee, S. Aylward, and M. Niethammer, "Deep Decomposition for Stochastic Normal-Abnormal Transport," ***CVPR***, 2022. (Oral - 4.0%) [paper] [code]

P. Liu, L. Tian, Y. Zhang, S. Aylward, Y. Z. Lee, and M. Niethammer, "Discovering Hidden Physics Behind Transport Dynamics," ***CVPR***, 2021. (Oral - 3.7%) [paper] [code]

Z. Shen, J. Feydy, **P. Liu**, A. H. Curiale, R. San José Estépar, and M. Niethammer, "Accurate Point Cloud Registration with Robust Optimal Transport," ***NeurIPS***, 2021. [paper] [code]

Z. Ding, X. Han, **P. Liu**, and M. Niethammer, "Local Temperature Scaling for Probability Calibration," ***ICCV***, 2021. [paper] [code]

P. Liu, Y. Z. Lee, S. Aylward, and M. Niethammer, "PIANO: Perfusion Imaging via Advection-diffusion," ***MICCAI***, 2020. (Early accept; Oral - 5.0%) [paper] [code]

L. Tian, C. Puett, **P. Liu**, Z. Shen, S. Aylward, Y. Z. Lee, and M. Niethammer, "Fluid registration between lung CT and stationary chest tomosynthesis images," ***MICCAI***, 2020. [paper] [code]

P. Liu, Z. Wu, G. Li, P.-T. Yap, and D. Shen, "Deep Modeling of Growth Trajectories for Longitudinal Prediction of Missing Infant Cortical Surfaces," ***IPMI***, 2019. (Oral - 10.0%) [paper] [code]

Under Review

P. Liu, O. Puonti, X. Hu, K. Gopinath, A. Sorby-Adams, W. T. Kimberly, and J. E. Iglesias, "A Modality-agnostic Multi-task Vision Foundation Model for Brain Imaging," *In Submission to IEEE Transactions on Medical Imaging (**IEEE TMI**)*, 2024.

P. Liu, Y. Z. Lee, S. Aylward, and M. Niethammer, "HARP: Hemisphere-normalized Atlas Representing Perfusion," *In Submission to **Radiology***, 2024.

P. Liu, Y. Z. Lee, S. Aylward, and M. Niethammer, "D^2-SONATA+: Deep Decompositions for Stochastic Normal-Abnormal Transport," *In Submission to IEEE Transactions on Pattern Analysis and Machine Intelligence (**IEEE TPAMI**)*, 2023.

Invited Talks

Linking Theory and Practice: Robust and Interpretable Learning for Modern Healthcare
Rising Stars in Data Science, UCSD & UChicago & Stanford, San Diego, US Nov 2024
Rising Stars in EECS, MIT, Cambridge, US Oct 2024

Towards Modality-Agnostic Foundation Models For Brain Imaging
Boston Medical Image Analysis Workshop, MIT, Cambridge, US Oct 2024

Perfusion Imaging via Mass Transport
Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School, Charlestown, US Mar 2023
Brigham and Women's Hospital, Harvard Medical School, Boston, US Jan 2023
Weill Cornell Medicine, Cornell University, New York, US Dec 2022

Deep Decomposition for Stochastic Normal-Abnormal Transport
CVPR'22, New Orleans, US Jun 2022

Discovering Hidden Physics Behind Transport Dynamics
CVPR'21, Virtual Jun 2021

Perfusion Imaging via Advection-diffusion
MICCAI'20, Virtual Oct 2020

Deep Modeling of Growth Trajectories for Longitudinal Prediction of Missing Infant Cortical Surfaces
IPMI'19, Hong Kong, China Jun 2019

DEI

Volunteer research mentor at Talaria Summer Institute, for students of underrepresented genders
Member and guest speaker at UNC GWiCS (Graduate Women in Computer Science)
Volunteer and invited presenter at WiCV WiCV (Women in Computer Vision)

Services

Journals: Computer Graphics Forum, Frontiers in Radiology, PLOS ONE
Conferences: NeurIPS, ICLR, CVPR, ICCV, ECCV, AAAI, AISTATS, MICCAI, IPMI, ISBI

Skills

Computer: Python, MATLAB, C/C++, LaTeX, HTML, JAVA, R
Libraries & OS: PyTorch, TensorFlow, ITK, FreeSurfer; Linux (Ubuntu), Mac OSX
Languages:

- Mandarin (Native Proficiency)
- English (Full Professional Proficiency)
  - TOEFL: 116 (R-30, L-30, S-27, W-29)
  - Shanghai Advanced-level English Interpretation Certificate

Misc: Guzheng (Professional Level-10 with Distinction); Piano; Drums; Rock Climbing