Peirong Liu

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Education

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

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

Summary

My research interests broadly lie in computer vision, machine learning and medical imaging, especially learning-based PDEs, transfer learning, multi-modal and multi-task learning. My recent research topics include (1) Physics-informed deep learning for transport video understanding and video anomaly detection; (2) Vision transformer (ViT) based, open-vocabulary image-video object detection; (3) Unsupervised motion transfer and video synthesis; (4) Fluid-based image registration; (5) CT/MR perfusion imaging, lesion detection and segmentation.

Publications

Peirong Liu, Yueh Lee, Stephen Aylward, Marc Niethammer. "Deep Decomposition for Stochastic Normal-Abnormal Transport". *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022. (Oral - 4.0%) [paper]

Peirong Liu, Marc Niethammer. "Detect Anomalies from Stochastic Transport Perspective". *In submission to IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2022.

Maxime Oquab, Daniel Haziza, Ludovic Schwartz, Katayoun Zand, Tao Xu, **Peirong Liu**, Rui Wang, Camille Couprie. "Efficient Conditioned Face Animation Using Frontally-viewed Embedding". *Arxiv Preprint*, 2022. [paper]

Peirong Liu, Rui Wang, Xuefei Cao, Yipin Zhou, Ashish Shah, Maxime Oquab, Camille Couprie, Ser-Nam Lim. "Self-appearance-aided Differential Evolution for Motion Transfer". *arXiv preprint*, 2021. [paper]

Peirong Liu, Lin Tian, Yubo Zhang, Stephen Aylward, Yueh Lee, Marc Niethammer. "Discovering Hidden Physics Behind Transport Dynamics". *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021. (Oral - 3.7%) [paper]

Zhengyang Shen*, Jean Feydy*, **Peirong Liu**, Ariel Hernán Curiale, Ruben San José Estépar, Raúl San José Estépar, Marc Niethammer. "Accurate Point Cloud Registration with Robust Optimal Transport". *Conference on Neural Information Processing Systems (NeurIPS)*, 2021. [paper]

Zhipeng Ding, Xu Han, **Peirong Liu**, Marc Niethammer. "Local Temperature Scaling for Probability Calibration". *IEEE/CVF International Conference on Computer Vision (ICCV)*, 2021. [paper]

Peirong Liu, Yueh Lee, Stephen Aylward, Marc Niethammer. "Perfusion Imaging: An Advection Diffusion Approach". *IEEE Transactions on Medical Imaging (TMI)*, 2021. [paper]

Peirong Liu, Yueh Lee, Stephen Aylward, Marc Niethammer. "PIANO: Perfusion Imaging via Advection-diffusion". *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2020. (Oral - 5%, student travel award) [paper]

Lin Tian, Connor Puett, **Peirong Liu**, Zhengyang Shen, Stephen Aylward, Yueh Lee, Marc Niethammer. "Fluid registration between lung CT and stationary chest tomosynthesis images". *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2020. [paper]

Peirong Liu, Zhengwang Wu, Gang Li, Pew-Thian Yap, Dinggang Shen. "Deep Modeling of Growth Trajectories for Longitudinal Prediction of Missing Infant Cortical Surfaces". *Information Processing in Medical Imaging (IPMI)*, 2019. (Oral - 10%, IPMI scholarship) [paper]

Industry Experience

Computer Vision, Meta AI — New York, U.S.
Research Intern, Supervisor: Dr. Rui Wang and Dr. Ser-Nam Lim — May 2022 – Nov 2022

- Research on vision transformer based, open-vocabulary image and video object detection, multi-object tracking.

Computer Vision, Meta AI — New York, U.S.
Research Intern, Supervisor: Dr. Rui Wang and Dr. Ser-Nam Lim — May 2021 – Nov 2021

- Researched on self-supervised, neural-ODE-based general framework for multi-view motion transfer. **[arXiv]**

Research Experience

Department of Computer Science, University of North Carolina at Chapel Hill — Chapel Hill, U.S.
Research assistant, Supervisor: Dr. Marc Niethammer — Jan 2019 – Present

- Research on PDE/Physics-informed solutions for transport time series, from optimization-based and deep-learning-based perspectives. **[MICCAI'20 Oral**, **TMI**, **CVPR'21 Oral**, **CVPR'22 Oral]**
- Built a PyTorch stochastic advection-diffusion PDE solver toolkit (in 2/3D), which can be used for numerical solutions, fluid simulation, or as a general module in deep learning frameworks.
- Created a 3D brain advection-diffusion pseudo dataset and simulator which integrates (1) brain vessel segmentation, blood flow estimation; (2) diffusion tensor estimation; (3) brain advection-diffusion transport simulation.

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

- Researched on geometric deep learning for mesh-structured data. Proposed a spatio-temporal-aware graph convolution neural network (GCNN) for longitudinal prediction of infant cortical growth. **[IPMI'19 Oral]**

Department of Mathematics, Shanghai University — Shanghai, China.
Undergraduate researcher, Supervisor: Dr. Shihui Ying — Sep 2016 – Jun 2018

- Researched on Riemannian spaces of shapes via the diffeomorphism group representation.

Honors

MICCAI Student Travel Award, *Lima*	2020
IPMI Scholarship, *Hong Kong*	2019
Outstanding Graduate, *Shanghai*	2018
President's List, *Shanghai University (the Highest honor, Top 10)*	2017
National Scholarship, *Shanghai University (Top 1%)*	2017
Baogang Outstanding Student Award, *Shanghai (Top 4)*	2017
Finalist Winner, *U.S. Mathematical Contest In Modeling (MCM) (36 out of 8843 teams)*	2017
Third Prize, *Shanghai Mathematics Competitions (Math Major)*	2016
Top Grade Scholarship, *Shanghai University (Top 3%)*	2015, 2016, 2017
Outstanding Student, *Shanghai University*	2015, 2016, 2017
Academic Innovation & Leadership & Public Service Award, *Shanghai University*	2015, 2016, 2017

Professional Services

Editorial board of Artificial Intelligence in Radiology
Review editor of Frontiers in Radiology
Reviewer of ICCV'21, CVPR'22, ECCV'22, MICCAI'22

Skills

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

- Mandarin (Native Proficiency)
- English (Full Professional Proficiency)
  - TOEFL: 112 (R-29, L-29, S-26, W-28), GRE: 327+4.5 (V-157, Q-170, AW-4.5)
  - Advanced-level English Interpretation Certificate (Same level as Test for English Majors-Band 8 (TEM-8) for students in English major)

Hobbies:

- Guzheng: Professional level-10 certificate ("Distinction"), Duke Music Ensemble member
- Piano; Keyboard; Climbing; Hiking; Running; Table tennis