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 – Present
Shanghai University — Shanghai, China
B.S. in Mathematics — Sep 2014 – Jun 2018
- GPA: 3.94/4.00 (Rank: 1/305); President's List (Top 10); National Scholarship (Top 1%)

Summary

My research interests center on computer vision, machine learning and medical imaging. Recent research include (1) Physics-conditioned deep learning PDE algorithms for transport time series (e.g., fluid flow and mass diffusion). Applications include flow simulation, CT/MR perfusion image analysis, lesion detection and localization. (2) 3D point cloud registration with optimal transport. Applications include lung registration, meshed human modeling. (3) Image animation and motion transfer.

Industry Experience

Computer Vision, Facebook AI — New York, U.S.
Research Intern, Supervisor: Dr. Rui Wang — May 2021 – Nov 2021

Research Experience

Department of Computer Science, University of North Carolina at Chapel Hill — Chapel Hill, U.S.
Research assistant, Supervisor: Dr. Marc Niethammer — Feb 2019 – Present
- Proposed general PDE-based frameworks for learning constraint-free physics fields from transport time series, from optimization and deep learning perspectives. **[MICCAI'20 Oral**, **TMI**, **CVPR'21 Oral**, **arXiv'21]**
- Built a PyTorch advection-diffusion PDE solver toolkit (in 1/2/3D) with various boundary conditions, which can be used for both numerical solutions and data simulation.
- Created a 3D brain advection-diffusion simulator, which integrates (1) brain vessel segmentation, blood flow estimation; (2) diffusion tensor estimation; (3) 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 and its application on mesh structured data.
- Proposed a graph-convolution-based deep learning framework for longitudinally prediction of infant cortical growth, integrated with spatial-temporal constraints. **[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.
- Assisted in teaching graduate course *Shape Spaces*.

Publications

Peirong Liu, Yueh Lee, Stephen Aylward, Marc Niethammer. "Deep Decomposition for Stochastic Normal-Abnormal Transport". *Arxiv Preprint*, 2021. [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]

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

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

Peirong Liu, Yueh Z. Lee, Stephen R. Aylward, Marc Niethammer. "PIANO: Perfusion Imaging via Advection-diffusion". *Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2020. (Oral, early accept - 13% acceptance rate, student travel award) [paper] [code]

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% acceptance rate, IPMI scholarship) [paper] [code]

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

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)

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