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) Exploring physics-constrained, PDE-integrated algorithms for understanding time-series of mass transport (especially fluid flow and mass diffusion). Applications include blood flow simulation, CT/MR perfusion image analysis, stroke lesion detection and localization. (2) 3D point cloud registration with optimal transport. Applications include lung registration, meshed human modeling.

Industry Experience

Computer Vision, Facebook AI	New York, U.S.
Research Intern, Supervisor: Dr. Rui Wang	May 2021 – Aug 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 a general learning framework for constraint-free representation learning of physics fields from mass transport time series. **[CVPR'21 Oral]**
- 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.
- Proposed a data-assimilation approach (PIANO) which estimates the divergence-free velocity and isotropic diffusion fields of the contrast agent in perfusion imaging via variable-coefficient advection-diffusion PDEs. **[MICCAI'20 Oral, IEEE TMI]**

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, 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**, Zhenyang 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]

Zhipeng Ding, Xu Han, **Peirong Liu**, Marc Niethammer. "Local Temperature Scaling for Probability Calibration". *CoRR*, 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