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; Class rank: 1/305

Experience

Department of Computer Science, University of North Carolina at Chapel Hill — Chapel Hill, U.S.
Research assistant, supervised by Dr. Marc Niethammer — Feb 2019 – Present

Research on developing physics-informed algorithms for understanding time-series data, mainly focus on learning physics parameters of PDEs (particularly advection-diffusion PDEs) from transport dynamics. Applications include CT/MR perfusion imaging and stroke diagnosis.

- Developed a transfer learning based framework (YETI) for learning physics parameters from transport dynamics of real world data. **[CVPR 2021 Submission]**
  - Proposed a transfer learning based framework for learning advection-diffusion processes, which outputs both the transport dynamics and the underlying physics parameter fields.
  - Introduced representation theorems for incompressible flow and symmetric positive semi-definite (PSD) diffusion, which help model learn divergence-free velocity and symmetric PSD diffusion *tensor* fields by construction while bypassing directly imposing these constraints.
  - Developed an advection-diffusion PDE solver (1/2/3D) with various boundary conditions in PyTorch, for advection-diffusion PDEs numerical solutions and advection-diffusion time-series simulation.
  - Created a 3D brain advection-diffusion simulation dataset, which integrates (1) brain vessel segmentation, blood flow direction estimation; (2) diffusion tensor estimation, diffusion scalar maps computation; (3) advection-diffusion transport time-series simulation.
- Proposed a data-assimilation approach (PIANO) which estimates the velocity and diffusion fields of the contrast agent in perfusion imaging via variable-coefficient advection-diffusion PDEs. **[MICCAI**, **TMI Submission]**

IDEA Group, University of North Carolina at Chapel Hill — Chapel Hill, U.S.
Research assistant, supervised by Dr. Dinggang Shen and Dr. Pew-Thian Yap — Aug 2018 – Dec 2018

- Proposed a graph-convolution-based deep learning architecture that longitudinally predicts infant cortical growth, with spatial-temporal knowledge. **[IPMI]**
- Researched on geometric deep learning and its application on infant cortical surfaces development.

Department of Mathematics, Shanghai University — Shanghai, China.
Undergraduate researcher, supervised by 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". *Computer Vision and Pattern Recognition (CVPR)*, 2021. (Submitted)

Peirong Liu, Yueh Z. Lee, Stephen R. Aylward, Marc Niethammer. "Perfusion Imaging: A Data Assimilation Approach". *IEEE Transactions on Medical Imaging*, 2020. (In revision)

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. (Early accept (13% acceptance rate), Student Travel Award)

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.

Zhipeng Ding, Xu Han, **Peirong Liu**, Marc Niethammer. "Local Temperature Scaling for Probability Calibration". *CoRR*, 2020.

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))

Honors

MICCAI Student Travel Award, *Lima*	2020
IPMI Scholarship, *Hong Kong*	2019
Outstanding Graduate, *Shanghai*	2018
Presidential Scholarship, *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 Modelling (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
- English: TOEFL: 112 (R-29, L-29, S-26, W-28), GRE: 327+4.5 (V-157, Q-170, AW-4.5)

Interests:

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