# **Peirong Liu**

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### **Education** University of North Carolina at Chapel Hill

Ph.D. Candidate in Computer Science

**Shanghai University** 

B.S. in Mathematics

■ GPA: 3.94/4.00; Class rank: 1/305

Chapel Hill, U.S.
Aug 2018 – Present
Shanghai, China
Sep 2014 – Jun 2018

## **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))

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	s) 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**

Honors

**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