

# Peirong Liu

✉ peirong@cs.unc.edu • ☎ (919)-519-8893 • 🌐 peirong26

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

## Skills

**Computer:** Python, MATLAB, C/C++,  $\text{\LaTeX}$ , 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