Xinzhe Luo

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Education

School of Data Science, Fudan University — Shanghai, China
Ph.D. in Statistics — *Sep 2019 – Jun 2024 (Expected)*

School of Mathematical Sciences, Fudan University — Shanghai, China
B.S. in Mathematics — *Sep 2015 – Jun 2019*

Research Experience

School of Data Science, Fudan University — Shanghai, China
Ph.D. Student, Advisor: Prof. Xiahai Zhuang — *Sep 2019 – Jun 2024*

- Research interests include the interdisciplinary area of medical image computing, statistics, artificial intelligence, and mathematics. I am currently working on using statistical modelling and machine learning techniques to achieve multi-modal groupwise image analysis, including groupwise registration and combined computing of cardiac, brain, and abdominal medical images.

Selected Publications

Multi-modal Groupwise Registration and Combined Computing ** denotes equal contribution*

- **Xinzhe Luo***, Xin Wang*, Linda Shapiro, Chun Yuan, Jianfeng Feng, and Xiahai Zhuang. "Bayesian Intrinsic Groupwise Image Registration: Unsupervised Disentanglement of Anatomy and Geometry." *arXiv preprint arXiv: 2401.02141*.
- Xin Wang*, **Xinzhe Luo***, and Xiahai Zhuang. "BInGo: Bayesian Intrinsic Groupwise Registration via Explicit Hierarchical Disentanglement." *International Conference on Information Processing in Medical Imaging* (IPMI 2023, Oral Presentation).
- **Xinzhe Luo** and Xiahai Zhuang. "$\mathcal{X}$-Metric: An N-Dimensional Information-Theoretic Framework for Groupwise Registration and Deep Combined Computing." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 45 (2023): 9206-9224.
- **Xinzhe Luo** and Xiahai Zhuang. "MvMM-RegNet: A new image registration framework based on multivariate mixture model and neural network estimation." *International Conference on Medical Image Computing and Computer-Assisted Intervention* (MICCAI 2020, Oral Presentation).

Medical Image Segmentation

- Qian Yue, **Xinzhe Luo**, Qing Ye, Lingchao Xu, and Xiahai Zhuang: "Cardiac segmentation from LGE MRI using deep neural network incorporating shape and spatial priors." *International Conference on Medical Image Computing and Computer-Assisted Intervention* (MICCAI 2019).

Challenge Benchmarks

- Xiahai Zhuang, Jiahang Xu, **Xinzhe Luo**, ..., Lei Li: "Cardiac segmentation on late gadolinium enhancement MRI: a benchmark study from multi-sequence cardiac MR segmentation challenge." Medical Image Analysis 81 (2022): 102528.

Awards & Achievements

IEEE TMI Distinguished Reviewer, 2022-2023

China National Scholarship, 2023

Honourable Mention for the Francois Erbsmann Prize, IPMI 2023

China National Scholarship, 2020

Projects

BInGo (IPMI 2023, Oral Presentation) | *Paper*

- A project which proposed a learning-based multi-modal groupwise registration framework using Bayesian inference and disentangled representation learning.

$\mathcal{X}$-Metric (TPAMI 2023) | *GitHub*, *Paper*

- A PyTorch implementation of a novel probabilistic framework for multi-modal groupwise image registration using information-theoretic metrics.
- The project also includes implementation of several previous groupwise registration methods for benchmarking.

Mutual Information Image Registration | *GitHub*

- A PyTorch implementation of the mutual information for multi-modal image registration.
- The project also includes the lecture notes of a guest lecture at the course *DATA630015: Medical Image Analysis (postgrad)*.

MvMM-RegNet (MICCAI 2019, Oral Presentation) | *GitHub*, *Paper*

- A TensorFlow project which implements a multi-atlas segmentation framework with learning-based groupwise registration.

MvMM | *GitHub*

- A PyTorch implementation of the Multivariate Mixture Model for Myocardial Segmentation Combining Multi-Source Images (Zhuang X., TPAMI 2019).
- The project also includes the lecture notes of a guest lecture at the course *DATA630015: Medical Image Analysis (postgrad)*.

Diffeomorphic Demons | *GitHub*

- A TensorFlow implementation of the Diffeomorphic Demons algorithm for medical image registration (Vercauteren, Tom, et al., NeuroImage 2009).
- The project also includes the lecture notes of a guest lecture at the course *DATA630015: Medical Image Analysis (postgrad)*.

Skills

Programming: Python, PyTorch, TensorFlow

Techniques: Bayesian statistics, Probabilistic graphical model, Image registration, Representation learning

Languages: Chinese (Native), English (Professional)

Relevant Coursework

Major Coursework: Calculus, Linear Algebra, Real Analysis, Differential Equations, Probability Theory, Statistics, Stochastic Processes, High-Dimensional Statistics, Optimization, Machine Learning, Medical Image Analysis