

Xuzhe Zhang

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EDUCATION

Columbia University

Ph.D. in Biomedical Engineering

Proposed Dissertation: Robust Learning and AI Models for Medical Image Analysis

Advisor: Prof. Andrew F. Laine

New York, US

2020 – 2025(expected)

Columbia University

M.Sc. in Biomedical Engineering

Courses: computer vision, deep learning, machine learning, computational mathematics

New York, US

2018 – 2020

Northeastern University

B.Eng. in Biomedical Engineering

Thesis: Segmentation and Classification of Lung Nodules on CT via Machine Learning

Courses: digital signal/image processing, medical imaging, C/C++, data structure, computer network

Shenyang, China

2014 – 2018

RESEARCH INTERESTS

My research interests primarily lie in the intersection of *deep learning*, *computer vision*, and *medical image analysis/computing*, with a focus on model robustness and generalist AI. I was/am focusing on the following problems and techniques:

Problems: semantic segmentation, model robustness, image generation/synthesis, image classification

Techniques: self-supervised learning, domain adaptation, vision-language models, self-attention, generative models, multimodal fusion

Some of my previous works* were accepted to venues like CVPR, IEEE-TMI, and Medical Image Analysis. Recently, I've found the topics about reasoning segmentation in vision language models quite exciting and seems to be a promising pathway to generalist medical vision, and I am actively exploring them.

RESEARCH EXPERIENCE

Heffner Biomedical Imaging Lab, Columbia University

Research Assistant, supervised by Prof. Andrew F. Laine

New York, US

Jan 2019 – Present

- Generative Models for Medical Images:
 - Utilized synthetic lung MRI mask-image pairs (via unconditional & conditional GANs) for augmentation^[3].
 - Proposed Pyramid Transformer Network for infant brain MRI cross-modality (contrast) translation^{[1][12]}.
- Transformers for Medical Image Analysis:
 - Developed fully attention-based network for image translation^{[1][12]} and for skin lesion segmentation and classification^[2].
- Robustness and Generalization of AI Models:
 - Proposed **MAPSeg**, the first unified unsupervised domain adaptation (UDA) framework for heterogeneous medical image segmentation via 3D **M**asked **A**utoencoding and **P**seudo-labeling^[10]. MAPSeg works for centralized, federated, and test-time scenarios. **Accepted to CVPR 2024!**
 - Curated an entropy-based UDA framework for cross-sequence lung MRI segmentation^[8].
 - (*ongoing*) Robust and vendor-agnostic segmentation framework^[11] to quantify pulmonary emphysema from CT, a pathology that is highly sensitive to subtle intensity change. Multimodal fusion (vision feature + quantitative scanner priors) is mainly explored.
 - (*ongoing*) Reasoning segmentation for medical images.
 - (*ongoing*) Working with our clinical collaborators and other Ph.D. and M.S. students, we are extending MAPSeg to resolve more challenges in fetal brain MRI and pulmonary MRI. We will soon release the **first-of-its-kind** AI model for airway segmentation from MRI.
- Open-source/accessible implementations of my projects: [here](#)

- A 12-week research internship at GE Healthcare AI and data science team.
 - Implemented and evaluated various designs of vision foundation model for robust MRI segmentation.
 - Project outcomes were accepted to *ISMRM 2024*, a prestigious conference focusing on MRI.

PUBLICATIONS

Journal Papers:

1. **Xuzhe Zhang**[†], Xinzi He[†], Jia Guo, Nabil Ettehad, Natalie Aw, David Semanek, Jonathan Posner, Andrew Laine, Yun Wang, “PTNet3D: A 3D High-Resolution Longitudinal Infant Brain MRI Synthesizer Based on Transformers”, *IEEE Transactions on Medical Imaging*, 2022 (**TMI**)
2. Xinzi He, Ee-Leng Tan, Hanwen Bi, **Xuzhe Zhang**, Shijie Zhao, Baiying Lei, “Fully transformer network for skin lesion analysis”, *Medical Image Analysis*, 2022 (**MedIA**)
3. **Xuzhe Zhang**, Elsa D Angelini, Fateme S Haghpanah, Andrew F Laine, Yanping Sun, Grant T Hiura, Stephen M Dashnaw, Martin R Prince, *et al.*, “Quantification of lung ventilation defects on hyperpolarized MRI: The Multi-Ethnic Study of Atherosclerosis (MESA) COPD study”, *Magnetic Resonance Imaging*, 2022
4. Nabil Ettehad, Pratik Kashyap, **Xuzhe Zhang**, Yun Wang, David Semanek, Karan Desai, Jia Guo, Jonathan Posner, Andrew F Laine, “Automated Multiclass Artifact Detection in Diffusion MRI Volumes via 3D Residual Squeeze-and-Excitation Convolutional Neural Networks”, *Frontiers in Human Neuroscience*, 2022
5. Vishwanatha M Rao, Zihan Wan, Soroush Arabshahi, David J Ma, Pin-Yu Lee, Ye Tian, **Xuzhe Zhang**, Andrew F Laine, Jia Guo, “Improving across-dataset brain tissue segmentation for MRI imaging using transformer”, *Frontiers in Neuroimaging*, 2022
6. Naz P Taskiran, Grant T Hiura, **Xuzhe Zhang**, R Graham Barr, Stephen M Dashnaw, Eric A Hoffman, Daniel Malinsky, *et al.*, “Mapping Alveolar Oxygen Partial Pressure in COPD Using Hyperpolarized Helium-3: The Multi-Ethnic Study of Atherosclerosis (MESA) COPD Study”, *Tomography*, 2022
7. Yun Wang, Fateme Sadat Haghpanah, **Xuzhe Zhang**, Katie Santamaria, *et al.*, “ID-Seg: an infant deep learning-based segmentation framework to improve limbic structure estimates”, *Brain Informatics*, 2022
8. **Xuzhe Zhang**, Christopher B. Cooper, Martin R. Prince, Bharath Ambale-Venkatesh, *et al.*, “MRI Assessed Dynamic Hyperinflation Induced by Tachypnea in Chronic Obstructive Pulmonary Disease: The SPIROMICS-HF Study”, *In press at Radiology: Cardiothoracic Imaging*, 2024

Conference Proceedings:

9. Nabil Ettehad, **Xuzhe Zhang**, Yun Wang, David Semanek, Jia Guo, Jonathan Posner, Andrew F Laine, “Automatic volumetric quality assessment of diffusion MR images via convolutional neural network classifiers”, 2021 43rd *Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC 2021)*
10. **Xuzhe Zhang**[†], Yuhao Wu[†], Elsa Angelini, Ang Li, Jia Guo, Jerod M. Rasmussen, Thomas G. O’Connor, Pathik D. Wadhwa, Andrea Parolin Jackowski, Hai Li, Jonathan Posner, Andrew F. Laine[‡], Yun Wang[‡], “MAPSeg: Unified Unsupervised Domain Adaptation for Heterogeneous Medical Image Segmentation Based on 3D Masked Autoencoding and Pseudo-Labeling”, **accepted** to *IEEE/CVF Conference on Computer Vision and Pattern Recognition 2024 (CVPR 2024)* [arXiv](#)
11. **Xuzhe Zhang**, Elsa Angelini, Eric Hoffman, Karol Watson, Benjamin Smith, R Graham Barr, Andrew Laine, “Robust Quantification of Percent Emphysema on CT via Domain Attention: the Multi-Ethnic Study of Atherosclerosis (MESA) Lung Study”, **accepted** to *IEEE International Symposium on Biomedical Imaging 2024 (ISBI 2024)*

Preprints:

12. **Xuzhe Zhang**[†], Xinzi He[†], Jia Guo, Nabil Ettehad, Natalie Aw, David Semanek, Jonathan Posner, Andrew Laine, Yun Wang, “PTNet: A high-resolution infant MRI synthesizer based on transformer”, [arXiv](#) 2022
13. Xinzi He, Jia Guo, **Xuzhe Zhang**, Hanwen Bi, Sarah Gerard, David Kaczka, Amin Motahari, Eric Hoffman, Joseph Reinhardt, R Graham Barr, Elsa Angelini, Andrew Laine, “Recursive refinement network for deformable lung registration between exhale and inhale ct scans”, [arXiv](#) 2022

[†] and [‡] denote co-first and co-senior authors, respectively.

OPEN-SOURCE

Online Infant Neuroimaging Analysis platform | <https://www.finneas.ai/>

- An ongoing effort to facilitate neuroscience and early brain development studies by providing robust segmentation and quantification of subcortical regions via a web-based platform powered by AWS.
- Featured robust model pretrained and semi-supervised fine-tuned on around **8,000** volumetric newborn-to-toddler structural brain MRI based on MAPSeg^[10].
- More features are coming soon, including test-time and federated adaptation, open-source support, and preprocessing tools.

PTNet3D | [GitHub](#)

- Public code repository for PTNet3D^[1], one of the first works introducing transformers to medical image synthesis.

MAPSeg | [GitHub](#)

- Official implementation of MAPSeg^[10], the first unified UDA framework for heterogeneous medical image segmentation.

SERVICES & TALKS & AWARDS

Recognition

IEEE TMI Distinguished Reviewer (Gold Level, 15 reviews from Sept 2023-Oct 2024) 2024

Reviewer

TMI: IEEE Transactions on Medical Imaging 2023-
MedIA: Medical Image Analysis 2023-
JBHI: IEEE Journal of Biomedical and Health Informatics 2024-
MICCAI: International Conference on Medical Image Computing and Computer-Assisted Intervention 2023-
NeurIPS: Conference on Neural Information Processing Systems 2024-
ICLR: International Conference on Learning Representations 2025-
AISTATS: International Conference on Artificial Intelligence and Statistics 2025-
TNNLS: IEEE Transactions on Neural Networks and Learning Systems 2024-

Lightning Talk

Robust Vision Models for Medical Images CHIL 2024 Doctoral Symposium

Teaching Assistant

Deep Learning in Biomedical Imaging (Columbia BMEN4460, graduate-level) Spring 2022 & 2023

Guest Lecturer

Avoiding Data Loss for Infant Brain Structural MRI via Generative Models Columbia BMEN4460 2022 & 2023

Challenge Organization

IEEE COVID-19 Imaging Informatics Challenge IEEE Healthcare Summit (IHS) 2021

Oral Presentation

Ventilation defect quantification on 3He MRI through deep learning: the MESA COPD Study ERS 2020

Scholarships

Northeastern University Scholarship 2016 & 2017
Sino-Dutch Biomedical and Information Engineering School Scholarship 2016

SKILLS

Programming: Python, L^AT_EX, Shell, MATLAB, C/C++

Libraries/Tools/Softwares: PyTorch, Tensorflow, Git, GCP/AWS, ANTs, ITK-SNAP, 3D Slicer, MeshLab, ImageJ

Research Directions: Deep Learning, Computer Vision, Generative Models, Vision Language Models, Robustness and Generalization, Medical Imaging

Languages: Chinese (native), English (advanced)