Xiaoling Hu

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Current Position

- **Harvard Medical School, Athinoula A. Martinos Center for Biomedical Imaging, USA** Aug. 2023 - Present
  Postdoctoral Research Fellow
  - Hosted by Prof. Juan Eugenio Iglesias and Prof. Bruce Fischl

Research Interests

My research focuses on **Machine Learning for Healthcare**, with an emphasis on developing core AI/ML algorithms for healthcare applications. In particular, I am interested in:

- **Topology-Driven Deep Image Analysis**
- **Trustworthy Machine Learning**
- **Multimodal AI and Generative AI (GenAI)**
- **Healthcare Applications**

Education

- **Stony Brook University, Department of CS, USA** Jan. 2018 - June 2023
  Doctor of Philosophy
  - Advisor: Chao Chen
  – Thesis: Learning Topological Representations for Deep Image Understanding
  – Committee: Chao Chen, Dimitris Samaras, Haibin Ling, Li Fuxin

- **Tsinghua University, Department of EE, China** Sep. 2014 - June 2017
  Master of Science

- **Huazhong University of Science and Technology, Department of EE, China** Sep. 2010 - June 2014
  Bachelor of Science

Selected Publications

(* indicates equal contribution, __ denotes students (co-)mentored by me, ‡ denotes (co)-senior supervision)

[1] **MATCH: Multi-faceted Adaptive Topo-Consistency for Semi-Supervised Histopathology Segmentation**
Meilong Xu*, **Xiaoling Hu***, Shahira Abousamra, Chen Li, Chao Chen
*Thirty-Ninth Conference on Neural Information Processing Systems (**NeurIPS**)*, 2025
*Short version is selected as **Oral Presentation** at Imageomics Workshop at NeurIPS 2025*

[2] **Text-Driven Weakly Supervised OCT Lesion Segmentation with Structural Guidance**
Jiaqi Yang, Nitish Mehta, **Xiaoling Hu**, Chao Chen, Chia-Ling Tsai
*The Journal of Biomedical and Health Informatics (**JBHI**)*, 2025

[3] ***Learn2Synth*: Learning Optimal Data Synthesis Using Hypergradients for Brain Image Segmentation**
Xiaoling Hu, Xiangrui Zeng, Oula Puonti, Juan Eugenio Iglesias, Bruce Fischl‡, Yaël Balbastre‡
*International Conference on Computer Vision (**ICCV**)*, 2025

[4] ***TopoCellGen*: Generating Histopathology Cell Topology with a Diffusion Model**

Meilong Xu, Saumya Gupta, **Xiaoling Hu**, Chen Li, Shahira Abousamra, Dimitris Samaras, Prateek Prasanna, Chao Chen

*The IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**)*, 2025 (**Oral Presentation, acceptance rate < 1%**)

Short version is also presented at CVPR 2025 Workshop GMCV

[5] **Hierarchical Uncertainty Estimation for Learning-based Registration in Neuroimaging**

Xiaoling Hu, Karthik Gopinath, Peirong Liu, Malte Hoffmann, Koen Van Leemput, Oula Puonti‡, Juan Eugenio Iglesias‡

*International Conference on Learning Representations (**ICLR**)*, 2025

[6] **Semi-supervised Segmentation of Histopathology Images with Noise-Aware Topological Consistency**

Meilong Xu, **Xiaoling Hu**, Saumya Gupta, Shahira Abousamra, Chao Chen

*European Conference on Computer Vision (**ECCV**)*, 2024

[7] **Brain-ID: Learning Contrast-agnostic Anatomical Representations for Brain Imaging**

Peirong Liu, Oula Puonti, **Xiaoling Hu**, Daniel C. Alexander, Juan Eugenio Iglesias

*European Conference on Computer Vision (**ECCV**)*, 2024

[8] **Registration by Regression (RbR): a framework for interpretable and flexible atlas registration**

Karthik Gopinath*, **Xiaoling Hu***, Malte Hoffmann, Oula Puonti‡, Juan Eugenio Iglesias‡

*Workshop on Biomedical Image Registration-MICCAI (**WBIR**)*, 2024

[9] ***P-Count*: Persistence-based Counting of White Matter Hyperintensities in Brain MRI**

Xiaoling Hu, Annabel Sorby-Adams, Frederik Barkhof, William Kimberly, Oula Puonti, Juan Eugenio Iglesias

*Workshop on Topology- and Graph-Informed Imaging Informatics-MICCAI (**TGI3**)*, 2024

[10] **Semi-Supervised Contrastive VAE for Disentanglement of Digital Pathology Images**

Mahmudul Hasan, **Xiaoling Hu**, Shahira Abousamra, Prateek Prasanna, Joel Saltz, Chao Chen

*International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**)*, 2024

[11] **Hard Negative Sample Mining for Whole Slide Image Classification**

Wentao Huang, **Xiaoling Hu**, Shahira Abousamra, Prateek Prasanna, Chao Chen

*International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**)*, 2024

[12] **Spatial Diffusion for Cell Layout Generation**

Chen Li, **Xiaoling Hu**, Shahira Abousamra, Meilong Xu, Chao Chen

*International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**)*, 2024

[13] **Anomaly-guided weakly supervised lesion segmentation on retinal OCT images**
Jiaqi Yang, Nitish Mehta, Gozde Merve Demirci, **Xiaoling Hu**, Meera Ramakrishnan, Mina Naguib, Chao Chen, Chialing Tsai
*Medical Image Analysis (**MedIA**)*, 2024

[14] **Topology-Aware Uncertainty for Image Segmentation**
Saumya Gupta, Yikai Zhang, **Xiaoling Hu**, Prateek Prasanna, Chao Chen
*Thirty-Seventh Conference on Neural Information Processing Systems (**NeurIPS**)*, 2023

[15] **Calibrating Uncertainty for Semi-Supervised Crowd Counting**
Chen Li, **Xiaoling Hu**, Shahira Abousamra, Chao Chen
*International Conference on Computer Vision (**ICCV**)*, 2023

[16] **Enhancing Modality-Agnostic Representations via Meta-Learning for Brain Tumor Segmentation**
Aishik Konwer, **Xiaoling Hu**, Xuan Xu, Joseph Bae, Chao Chen, Prateek Prasanna
*International Conference on Computer Vision (**ICCV**)*, 2023

[17] **Learning Probabilistic Topological Representations Using Discrete Morse Theory**
Xiaoling Hu, Dimitris Samaras, Chao Chen
*International Conference on Learning Representations (**ICLR**)*, 2023 (**Spotlight Presentation, notable-top-25% of accepted papers**)
*Short version is selected as **Oral Presentation** at Medical Imaging meets NeurIPS Workshop, 2023*

[18] **Confidence Estimation Using Unlabeled Data**
Chen Li, **Xiaoling Hu**, Chao Chen
*International Conference on Learning Representations (**ICLR**)*, 2023

[19] **Structure-Aware Image Segmentation with Homotopy Warping**
Xiaoling Hu
*Thirty-Sixth Conference on Neural Information Processing Systems (**NeurIPS**)*, 2022

[20] **Learning Topological Interactions for Multi-Class Medical Image Segmentation**
Saumya Gupta*, **Xiaoling Hu***, James Kaan, Michael Jin, Mutshipay Mpoy, Katherine Chung, Gagandeep Singh, Mary Saltz, Tahsin Kurc, Joel Saltz, Apostolos Tassiopoulos, Prateek Prasanna, Chao Chen
*European Conference on Computer Vision (**ECCV**)*, 2022 (**Oral Presentation, acceptance rate 2.7%**)

[21] **Trigger Hunting with a Topological Prior for Trojan Detection**
Xiaoling Hu, Xiao Lin, Michael Cogswell, Yi Yao, Susmit Jha, Chao Chen
*International Conference on Learning Representations (**ICLR**)*, 2022

[22] **A Manifold View of Adversarial Risk**
Wenjia Zhang, Yikai Zhang, **Xiaoling Hu**, Mayank Goswami, Chao Chen, Dimitris Metaxas
*International Conference on Artificial Intelligence and Statistics (**AISTATS**)*, 2022

[23] **Topology-Attention ConvLSTM Network for 3D Image Segmentation**
Jiaqi Yang*, **Xiaoling Hu***, Chao Chen, Chialing Tsai
*International Conference on Medical Image Computing and Computer Assisted Intervention (**MICCAI**)*, 2021

[24] **Topology-Aware Segmentation Using Discrete Morse Theory**
Xiaoling Hu, Yusu Wang, Li Fuxin, Dimitris Samaras, Chao Chen
*International Conference on Learning Representations (**ICLR**)*, 2021 (**Spotlight Presentation, acceptance rate 5.6%**)

[25] **3D Topology-Preserving Segmentation with Compound Multi-Slice Representation**
Jiaqi Yang*, **Xiaoling Hu***, Chao Chen, Chialing Tsai
*IEEE International Symposium on Biomedical Imaging (**ISBI**)*, 2021

[26] **Topology-Preserving Deep Image Segmentation**
Xiaoling Hu, Li Fuxin, Dimitris Samaras, Chao Chen
*Thirty-Third Conference on Neural Information Processing Systems (**NeurIPS**)*, 2019

Preprints

[1] **Learning to Upscale 3D Segmentations in Neuroimaging**
Xiaoling Hu, Peirong Liu, Dina Zemlyanker, Jonathan Williams Ramirez, Oula Puonti, Juan Eugenio Iglesias
Tech Report, 2025

[2] **RB-FT: Rationale-Bootstrapped Fine-Tuning for Video Classification**
Meilong Xu, Di Fu, Jiaxing Zhang, Gong Yu, Jiayu Zheng, **Xiaoling Hu**, Dongdi Zhao, Feiyang Li, Chao Chen, Yong Cao
Tech Report, 2025

[3] **LoC-Path: Learning to Compress for Pathology Multimodal Large Language Models**
Qingqiao Hu, Weimin Lyu, Meilong Xu, Kehan Qi, **Xiaoling Hu**, Saumya Gupta, Jiawei Zhou, Chao Chen
Tech Report, 2025

[4] **Act Like a Pathologist: Tissue-Aware Whole Slide Image Reasoning**
Wentao Huang, Weimin Lyu, Peiliang Lou, Qingqiao Hu, **Xiaoling Hu**, Shahira Abousamra, Wenchao Han, Ruifeng Guo, Jiawei Zhou, Chao Chen, Chen Wang
Tech Report, 2025

[5] **Test-time Uncertainty Estimation for Medical Image Registration via Transformation Equivariant**
Lin Tian, **Xiaoling Hu**, Juan Eugenio Iglesias
Tech Report, 2025

[6] ***Bézier Meets Diffusion*: Robust Generation Across Domains for Medical Image Segmentation**
Chen Li, Meilong Xu, **Xiaoling Hu**, Weimin Lyu, Chao Chen
Tech Report, 2025

[7] ***RankByGene*: Gene-Guided Histopathology Representation Learning Through Cross-Modal Ranking Consistency**
Wentao Huang, Meilong Xu, **Xiaoling Hu**, Shahira Abousamra, Aniruddha Ganguly, Saarthak Kapse, Alisa Yurovsky, Prateek Prasanna, Tahsin Kurc, Joel Saltz, Michael L. Miller, Chao Chen
Tech Report, 2024

[8] **Adversarial Vessel-Unveiling Semi-Supervised Segmentation for Retinopathy of Prematurity Diagnosis**
Gozde Merve Demirci, Jiachen Yao, Ming-Chih Ho, **Xiaoling Hu**, Wei-Chi Wu, Chao Chen, and Chia-Ling Tsai
Tech Report, 2024

[9] **Deep Statistic Shape Model for Myocardium Segmentation**
Xiaoling Hu, Xiao Chen, Terrence Chen, Shanhui Sun
Tech Report, 2022

Selected Honors and Awards

- Catacosinos Fellowship (2 out of 200+ PhD students in SBU CS Department), 2023
- NeurIPS Travel Award, 2019
- First-class Scholarship, Tsinghua University, 2016 (5%)

Mentoring

- Chen Li (**ICLR'23, ICCV'23, MICCAI'24**), Ph.D. student at Department of BMI, Stony Brook University
  Since Fall 2021
- Meilong Xu (**ECCV'24, CVPR'25 Oral Presentation, NeurIPS'25**), Ph.D. student at Department of CS, Stony Brook University
  Since Summer 2023
- Wentao Huang (**MICCAI'24**), Ph.D. student at Department of CS, Stony Brook University
  Since Summer 2023
- Qingqiao Hu, Ph.D. student at Department of CS, Stony Brook University
  Since Fall 2024
- Kehan Qi, Ph.D. student at Department of BMI, Stony Brook University
  Since Fall 2025
- Jiaqi Yang (**MICCAI'21, ISBI'21, MedIA'24, JBHI'25**), Ph.D. student at Department of CS, CUNY
  Spring 2020 – Summer 2023
- Saumya Gupta (**ECCV'22 Oral Presentation, NeurIPS'23**), Ph.D. student at Department of CS, Stony Brook University
  Fall 2021 – Summer 2023
- Mahmudul Hasan (**MICCAI'24**), Ph.D. student at Department of CS, Stony Brook University
  Summer 2023 – Summer 2024
- Luca Drole, Master student in BME, ETH Zurich
  Spring - Fall 2025
- John Xie, High School student → University of Michigan
  Summer 2021

Professional Service

Organizer

- MICCAI'25 workshop on *Topology- and Graph-Informed Imaging Informatics (TGI3)* 2025
- MICCAI'24 workshop on *The First Workshop on Topology- and Graph-Informed Imaging Informatics (TGI3)* 2024
- MICCAI'23 tutorial on *Topology-Driven Image Analysis* 2023

Area Chair

- International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2025
- Conference on Neural Information Processing Systems (NeurIPS) 2025
- The IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2026
- International Conference on Artificial Intelligence and Statistics (AISTATS) 2026

Reviewing

- International Conference on Machine Learning (ICML) Since 2022
- International Conference on Learning Representations (ICLR) Since 2022
- Conference on Neural Information Processing Systems (NeurIPS) 2021 - 2024
- Computer Vision and Pattern Recognition (CVPR) 2021 - 2025
- European Conference on Computer Vision (ICCV) Since 2021
- European Conference on Computer Vision (ECCV) Since 2022
- Winter Conference on Applications of Computer Vision (WACV) Since 2022
- International Conference on Artificial Intelligence and Statistics (AISTATS) 2022 - 2025
- Learning on Graphs Conference (LoG) 2022 - 2025
- Medical Imaging with Deep Learning (MIDL) Since 2022
- AAAI Conference on Artificial Intelligence (AAAI) Since 2022
- International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2020 - 2024

- Transactions on Machine Learning Research (TMLR)
- IEEE Transactions on Medical Imaging (TMI)
- Medical Image Analysis (MedIA)

Talks

Principled Learning for Medical AI: Structure, Reliability, and Interpretability

- HIT Webinar - *Healthcare, Intelligence, Technology* Aug. 2025
- Department of CSE, University of North Texas Nov. 2025

***Learn2Synth*: A Learnable Data Synthesis Strategy for Image Segmentation**

- Nobrainer Seminar, Massachusetts Institute of Technology June 2024

Deep Structural Reasoning for Biomedical Imaging

- School of CAI, Arizona State University Feb. 2024

Topology-Aware Deep Image Segmentation

- MICCAI'23 tutorial on *Topology-Driven Image Analysis*, Vancouver Oct. 2023

Learning Topological Representations for Deep Image Understanding

- Department of CS, Florida State University Apr. 2023
- Department of BMI, Ohio State University Mar. 2023
- Department of CS, Rochester Institute of Technology Feb. 2023
- Department of ECE, University of California, Riverside Feb. 2023
- Athinoula A. Martinos Center for Biomedical Imaging, MGH/Harvard Medical School Nov. 2022

Learning Probabilistic Topological Representations Using Discrete Morse Theory

- Medical Imaging meets NeurIPS Workshop, New Orleans Dec. 2022

Topology-Informed Image Analysis

- Center for Computational Neuroscience, Flatiron Institute Oct. 2022

Topology-Aware Deep Image Segmentation

- Geometry and Topology meet Data Analysis and Machine Learning Aug. 2021

Topology-aware Segmentation Using Discrete Morse Theory

- International Conference on Learning Representations (ICLR) May 2021

Industry Experiences

- **Allen Institute, USA** May 2022 - Aug. 2022
  Research Intern
  Mentor: *Dr.* Matheus Viana
  Topic: Topology-Aware Image Segmentation
- **United Imaging Intelligence (UII), USA** May 2021 - Aug. 2021
  Research Intern
  Mentor: *Dr.* Shanhui Sun
  Topic: Deep Shape Model Based Network
- **Tencent Youtu Lab, China** Jun. 2017 - Jan. 2018
  Research Intern
  Mentor: *Dr.* Yuwing Tai
  Topic: Clothes Detection, Attribute Prediction

References

- **Chao Chen**
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  `https://chaochen.github.io/`
- **Juan Eugenio Iglesias**
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- **Bruce Fischl**
  Professor, MGH & Harvard Medical School

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