

# Xiaoling Hu

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|-----------------------|---|---|
| Current Position      | <ul style="list-style-type: none"><li>• <b>Harvard Medical School, Athinoula A. Martinos Center for Biomedical Imaging, USA</b><br/><i>Postdoctoral Research Fellow</i><br/>- Hosted by Prof. Juan Eugenio Iglesias and Prof. Bruce Fischl</li></ul>  | Aug. 2023 - Present   |
| Research Interests    | My research focuses on <b>Machine Learning for Healthcare</b> , with an emphasis on developing core AI/ML algorithms for healthcare applications. In particular, I am interested in: <ul style="list-style-type: none"><li>• <b>Topology-Driven Deep Image Analysis</b></li><li>• <b>Trustworthy Machine Learning</b></li><li>• <b>Multimodal AI and Generative AI (GenAI)</b></li><li>• <b>Healthcare Applications</b></li></ul>   |   |
| Education             | <ul style="list-style-type: none"><li>• <b>Stony Brook University, Department of CS, USA</b><br/><i>Doctor of Philosophy</i><br/>- Advisor: Chao Chen<br/>- Thesis: Learning Topological Representations for Deep Image Understanding<br/>- Committee: Chao Chen, Dimitris Samaras, Haibin Ling, Li Fuxin</li><li>• <b>Tsinghua University, Department of EE, China</b><br/><i>Master of Science</i></li><li>• <b>Huazhong University of Science and Technology, Department of EE, China</b><br/><i>Bachelor of Science</i></li></ul>   | Jan. 2018 - June 2023<br>Sep. 2014 - June 2017<br>Sep. 2010 - June 2014 |
| Selected Publications | (* indicates equal contribution, __ denotes students (co-)mentored by me, <sup>†</sup> denotes (co)-senior supervision)   |   |
|                       | <p>[1] <b>MATCH: Multi-faceted Adaptive Topo-Consistency for Semi-Supervised Histopathology Segmentation</b><br/>Meilong Xu*, <b>Xiaoling Hu</b>*, Shahira Abousamra, Chen Li, Chao Chen<br/><i>Thirty-Ninth Conference on Neural Information Processing Systems (NeurIPS), 2025</i><br/><i>Short version is selected as <b>Oral Presentation</b> at Imageomics Workshop at NeurIPS 2025</i></p> <p>[2] <b>Text-Driven Weakly Supervised OCT Lesion Segmentation with Structural Guidance</b><br/>Jiaqi Yang, Nitish Mehta, <b>Xiaoling Hu</b>, Chao Chen, Chia-Ling Tsai<br/><i>The Journal of Biomedical and Health Informatics (JBHI), 2025</i></p> <p>[3] <b>Learn2Synth: Learning Optimal Data Synthesis Using Hypergradients for Brain Image Segmentation</b><br/><b>Xiaoling Hu</b>, Xiangrui Zeng, Oula Puonti, Juan Eugenio Iglesias, Bruce Fischl<sup>†</sup>, Yaël Balbastre<sup>†</sup><br/><i>International Conference on Computer Vision (ICCV), 2025</i></p> |   |

- [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<sup>‡</sup>, Juan Eugenio Iglesias<sup>‡</sup>  
*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<sup>‡</sup>, Juan Eugenio Iglesias<sup>‡</sup>  
*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 Tasiopoulos, 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] **Unrolled Networks are Conditional Probability Flows in MRI Reconstruction**  
Kehan Qi, Saumya Gupta, **Xiaoling Hu**, Qingqiao Hu, Weimin Lyu, Chao Chen  
*Tech Report*, 2025
- [3] **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
- [4] **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
- [5] **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
- [6] **Uncertainty Estimation for Pretrained Medical Image Registration Models via Transformation Equivariance**  
Lin Tian, **Xiaoling Hu**, Juan Eugenio Iglesias  
*Tech Report*, 2025
- [7] **Bézier Meets Diffusion: Robust Generation Across Domains for Medical Image Segmentation**  
Chen Li, Meilong Xu, **Xiaoling Hu**, Weimin Lyu, Chao Chen  
*Tech Report*, 2025
- [8] **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

[9] **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

[10] **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 Organizer Service**

- 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, 2026
- 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, Massachusetts General Hospital & 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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- **Juan Eugenio Iglesias**  
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- **Bruce Fischl**  
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