

## Xiaoling Hu

*E-mail:* xihu3@mgh.harvard.edu, *Mobile:* 6312028413

*Website:* <https://huxiaoling.github.io/>

**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 interest is **Machine Learning for Healthcare**, and I am focusing on developing core machine learning algorithms applied to medical imaging problems. In particular, I am interested in:

- **Topology-Driven Deep Image Analysis**
- **Learning with Reliability, Interpretability, and Robustness**
- **Empowering Clinical and Biomedical 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, <sup>†</sup> denotes students (co-)mentored by me, <sup>‡</sup> denotes co-senior supervision)

- [1] **TopoSemiSeg: Enforcing Topological Consistency for Semi-Supervised Segmentation of Histopathology Images**  
Meilong Xu<sup>†</sup>, Xiaoling Hu, Saumya Gupta, Shahira Abousamra, Chao Chen  
*European Conference on Computer Vision (ECCV)*, 2024
- [2] **Brain-ID: Learning Robust Feature Representations for Brain Imaging**  
Peirong Liu, Oula Puonti, Xiaoling Hu, Daniel C. Alexander, Juan Eugenio Iglesias  
*European Conference on Computer Vision (ECCV)*, 2024
- [3] **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
- [4] **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

- [5] **Semi-Supervised Contrastive VAE for Disentanglement of Digital Pathology Images**  
Mahmudul Hasan<sup>†</sup>, [Xiaoling Hu](#), Shahira Abousamra, Prateek Prasanna, Joel Saltz, Chao Chen  
*International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2024
- [6] **Hard Negative Sample Mining for Whole Slide Image Classification**  
Wentao Huang<sup>†</sup>, [Xiaoling Hu](#), Shahira Abousamra, Prateek Prasanna, Chao Chen  
*International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2024
- [7] **Spatial Diffusion for Cell Layout Generation**  
Chen Li<sup>†</sup>, [Xiaoling Hu](#), Shahira Abousamra, Meilong Xu, Chao Chen  
*International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2024
- [8] **Anomaly-Guided Weakly Supervised Lesion Segmentation on Retinal OCT Images**  
Jiaqi Yang<sup>†</sup>, Nitish Mehta, Gozde Merve Demirci<sup>†</sup>, [Xiaoling Hu](#), Meera Ramakrishnan, Mina Naguib, Chao Chen, Chialing Tsai  
*Medical Image Analysis (MedIA)*, 2024
- [9] **Topology-Aware Uncertainty for Image Segmentation**  
Saumya Gupta<sup>†</sup>, Yikai Zhang, [Xiaoling Hu](#), Prateek Prasanna, Chao Chen  
*Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS)*, 2023
- [10] **Calibrating Uncertainty for Semi-Supervised Crowd Counting**  
Chen Li<sup>†</sup>, [Xiaoling Hu](#), Shahira Abousamra, Chao Chen  
*International Conference on Computer Vision (ICCV)*, 2023
- [11] **Enhancing Modality-Agnostic Representations via Meta-Learning for Brain Tumor Segmentation**  
Aishik Konwer<sup>†</sup>, [Xiaoling Hu](#), Xuan Xu, Joseph Bae, Chao Chen, Prateek Prasanna  
*International Conference on Computer Vision (ICCV)*, 2023
- [12] **Learning Probabilistic Topological Representations Using Discrete Morse Theory**  
[Xiaoling Hu](#), Dimitris Samaras, Chao Chen  
*International Conference on Learning Representations (ICLR)*, 2023 (**Spotlight, notable-top-25%**)  
*Short version is selected as **Oral presentation** at Medical Imaging meets NeurIPS Workshop, 2023*
- [13] **Confidence Estimation Using Unlabeled Data**  
Chen Li<sup>†</sup>, [Xiaoling Hu](#), Chao Chen  
*International Conference on Learning Representations (ICLR)*, 2023
- [14] **Structure-Aware Image Segmentation with Homotopy Warping**  
[Xiaoling Hu](#)  
*Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS)*, 2022

- [15] **Learning Topological Interactions for Multi-Class Medical Image Segmentation**  
 Saumya Gupta<sup>\*†</sup>, Xiaoling Hu<sup>\*</sup>, 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, 2.7%**)
- [16] **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
- [17] **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
- [18] **Topology-Attention ConvLSTM Network for 3D Image Segmentation**  
 Jiaqi Yang<sup>\*†</sup>, Xiaoling Hu<sup>\*</sup>, Chao Chen, Chialing Tsai  
*International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2021
- [19] **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, 5.6%**)
- [20] **3D Topology-Preserving Segmentation with Compound Multi-Slice Representation**  
 Jiaqi Yang<sup>\*†</sup>, Xiaoling Hu<sup>\*</sup>, Chao Chen, Chialing Tsai  
*IEEE International Symposium on Biomedical Imaging (ISBI)*, 2021
- [21] **Topology-Preserving Deep Image Segmentation**  
 Xiaoling Hu, Li Fuxin, Dimitris Samaras, Chao Chen  
*Thirty-third Conference on Neural Information Processing Systems (NeurIPS)*, 2019
- [22] **Saliency Detection based on Integration of Central Bias, Reweighting and Multi-Scale for Superpixels**  
 Xiaoling Hu, Wenming Yang, Fei Zhou, Qingmin Liao  
*IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2016

## Preprints

- [1] **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>  
*Tech Report*
- [2] **Learn2Synth: Learning Optimal Data Synthesis Using Hypergradients**  
 Xiaoling Hu, Oula Puonti, Juan Eugenio Iglesias, Bruce Fischl<sup>‡</sup>, Yaël Balbastre<sup>‡</sup>  
*Tech Report*
- [3] **TopoCellGen: Generating Histopathology Cell Topology with a Diffusion Model**  
 Meilong Xu<sup>†</sup>, Saumya Gupta, Xiaoling Hu, Chen Li, Shahira Abousamra, Dimitris Samaras, Prateek Prasanna, Chao Chen  
*Tech Report*

- [4] **RankByGene: Gene-Guided Histopathology Representation Learning Through Cross-Modal Ranking Consistency**  
 Wentao Huang<sup>†</sup>, Meilong Xu<sup>†</sup>, Xiaoling Hu, Shahira Abousamra, Aniruddha Ganguly, Saarthak Kapse, Alisa Yurovsky, Prateek Prasanna, Tahsin Kurc, Joel Saltz, Michael L. Miller, Chao Chen  
*Tech Report*
- [5] **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*
- [6] **A Multimodal Approach Combining Structural and Cross-Domain Textual Guidance for Weakly Supervised OCT Segmentation**  
 Jiaqi Yang<sup>†</sup>, Nitish Mehta, Xiaoling Hu, Chao Chen, Chia-Ling Tsai  
*Tech Report*
- [7] **Deep Statistic Shape Model for Myocardium Segmentation**  
Xiaoling Hu, Xiao Chen, Terrence Chen, Shanhui Sun  
*Tech Report*

#### 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%)

#### 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

#### Mentoring

- Jiaqi Yang (**MICCAI'21, ISBI'21, MedIA'24**), Ph.D. student at Department of CS, CUNY Since Spring 2020
- 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**), 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
- Mahmudul Hasan (**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
- Saumya Gupta (**ECCV'22**, **NeurIPS'23**), Ph.D. student at Department of CS,  
Stony Brook University  
Fall 2021 – Summer 2023
- John Xie, High School student → University of Michigan  
Summer 2021

## Professional Organizer Service

- 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

## Reviewing

- International Conference on Machine Learning (ICML)  
Since 2022
- International Conference on Learning Representations (ICLR)  
Since 2022
- Conference on Neural Information Processing Systems (NeurIPS)  
Since 2021
- Computer Vision and Pattern Recognition (CVPR)  
Since 2021
- 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
- Artificial Intelligence and Statistics (AISTATS)  
Since 2022
- Learning on Graphs Conference (LoG)  
Since 2022
- 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)  
Since 2020
- Pattern Recognition (PR)
- IEEE Transactions on Medical Imaging (TMI)
- Medical Image Analysis (MedIA)

## Talks

### ***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

### **References**

- **Chao Chen**  
Associate Professor, Stony Brook University  
chao.chen.1@stonybrook.edu  
<https://chaochen.github.io/>
- **Juan Eugenio Iglesias**  
Associate Professor, MGH & Harvard Medical School  
jiglesiasgonzalez@mgh.harvard.edu  
<https://lemon.martinos.org/pi/>
- **Bruce Fischl**  
Professor, MGH & Harvard Medical School  
bfischl@mgh.harvard.edu  
<https://scholar.google.com/citations?user=t7mytXkAAAAJ&hl=en>
- **Dimitris Samaras**  
SUNY Empire Innovation Professor, Stony Brook University  
samaras@cs.stonybrook.edu  
<https://www3.cs.stonybrook.edu/~samaras/>
- **Fuxin Li**  
Associate Professor, Oregon State University  
fuxin.li@oregonstate.edu  
<https://web.engr.oregonstate.edu/~lif/>
- **Prateek Prasanna**  
Assistant Professor, Stony Brook University  
prateek.prasanna@stonybrook.edu  
<https://you.stonybrook.edu/imaginelab/>