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

- **Topology-Driven Deep Image Analysis**
- **Learning with Reliability, Interpretability, and Robustness**
- **Multimodal AI and Generative AI (GenAI) for Healthcare**
- **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] ***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**)

[2] **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

[3] **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

[4] **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

[5] **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

[6] ***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

[7] **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

[8] **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

[9] **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

[10] **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

[11] **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

[12] **Calibrating Uncertainty for Semi-Supervised Crowd Counting**

Chen Li†, Xiaoling Hu, Shahira Abousamra, Chao Chen

*International Conference on Computer Vision (**ICCV**)*, 2023

[13] **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

[14] **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*

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

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

[17] **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, 2.7%**)

[18] **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

[19] **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

[20] **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

[21] **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%**)

[22] **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

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

[24] **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] ***Learn2Synth*: Learning Optimal Data Synthesis Using Hypergradients for Brain Image Segmentation**
Xiaoling Hu, Xiangrui Zeng, Oula Puonti, Juan Eugenio Iglesias, Bruce Fischl[‡], Yaël Balbastre[‡]
Tech Report, 2025

[2] ***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

[3] **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

[4] **A Multimodal Approach Combining Structural and Cross-Domain Textual Guidance for Weakly Supervised OCT Segmentation**
Jiaqi Yang[†], Nitish Mehta, Xiaoling Hu, Chao Chen, Chia-Ling Tsai
Tech Report, 2024

[5] **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%)

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

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

Professional Service

Organizer

- 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

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) — 2020 - 2024

- 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**
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- **Juan Eugenio Iglesias**
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