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 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, † denotes students (co-)mentored by me, ‡ denotes co-senior supervision)

[1] **TopoSemiSeg: Enforcing Topological Consistency for Semi-Supervised Segmentation of Histopathology Images**
Meilong Xu†, 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‡, Juan Eugenio Iglesias‡
*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†, 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†, 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†, 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†, Nitish Mehta, Gozde Merve Demirci†, Xiaoling Hu, Meera Ramakrishnan, Mina Naguib, Chao Chen, Chialing Tsai
*Medical Image Analysis (**MedIA**)*, 2024

[9] **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

[10] **Calibrating Uncertainty for Semi-Supervised Crowd Counting**
Chen Li†, 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†, 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†, 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*†, 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%**)

[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*†, Xiaoling Hu*, 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*†, Xiaoling Hu*, 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‡, Juan Eugenio Iglesias‡
Tech Report

[2] ***Learn2Synth*: Learning Optimal Data Synthesis Using Hypergradients**
Xiaoling Hu, Oula Puonti, Juan Eugenio Iglesias, Bruce Fischl‡, Yaël Balbastre‡
Tech Report

[3] ***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
Tech Report

[4] ***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

[5] **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
- 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 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

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)

Talks

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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  https://chaochen.github.io/
- **Juan Eugenio Iglesias**
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- **Bruce Fischl**
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- **Dimitris Samaras**
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