Han Liu

Curriculum Vitae

Phone: +1(412) 680-6732
Email: han.liu@vanderbilt.edu
Homepage | GitHub | Google Scholar

Education

2019-2024 **Vanderbilt University**
Ph.D. in Computer Science
Advisors: Ipek Oguz

2016-2017 **Yale University**
M.S. in Biomedical Engineering
Advisor: James S. Duncan

2012-2016 **Rensselaer Polytechnic Institute**
B.S. in Biomedical Engineering & Electrical Engineering
Advisor: Ge Wang

Skills

- **Medical Image Processing and Analysis**: Solid knowledge and hands-on experience on deep learning-based methods for medical image classification, segmentation, object detection and registration.
- **Programming Languages**: Python, MATLAB, C++, HTML
- **Image Processing Software:** PyTorch, MONAI, SimpleITK, ANTs, ITK-SNAP, 3D Slicer
- **Communication:** 4+ years' experience working closely with doctors and surgeons.

Experience

Siemens Healthineers, Princeton, NJ
Research Internship, May 2022-Dec 2022

- Developed a novel method to learn a unified segmentation model from multiple partially labeled CT datasets. Compared to training separate models on each partially labeled dataset, our method not only has faster inference speed, but also achieves better segmentation results. Compared to other partial-label learning approaches, our method consistently yields better performance on different datasets.

Department of Computer Science, Vanderbilt University, Nashville, TN
Research Assistant, Sep 2019-Present

- Established a benchmark for cold-start active learning for 3D medical image segmentation.
- Developed a novel method to improve the widely used modality dropout method for multiple sclerosis lesion segmentation. The developed method helped to tackle the missing modality issue when dealing with heterogenous modality MRI images collected across different institutions.

- Developed an automatic method to segment vestibular schwannoma and cochlea in high-resolution T2 MRI images, while only annotated yet unpaired contrast enhanced T1 images and unannotated T2 images available. Our proposed method achieved the **1st place** in the CrossMoDA2023 challenge.
- Developed a deep-learning based method using conditional Generative Adversarial Networks to generate synthetic CT skull from T1-weighted MRI for Transcranial MR Imaging–Guided Focused Ultrasound Interventions.
- Performed an extensive comparative study to explore the effectiveness of various localization algorithms for Deep Brain Stimulation as well as intra- and inter-rater variability analysis.
- Developed a deep learning-based method for automatic target localization in Deep Brain Stimulation procedures for epilepsy patients. Uncertainty estimation was performed to detect unreliable predictions during inference phase.

Teaching Assistant, Sep 2019-Present

- Achieved an overall TA score of 4.83, where the average score for TAs is 4.08.
- Courses:
    - Intermediate Software Design (C++)
    - Prog. and Prob. Solv. with Python (Python)
    - Advanced Medical Image Processing (MATLAB)
    - Foundations of Machine Learning (Python)
    - Projects in Machine Learning (Python)

Imaging Research Lab, Pittsburgh University, Pittsburgh, PA
Research Associate, Sep 2017-June 2019

- Developed a novel deep learning-based thoracic disease classification method which improved the classification performances consistently for 14 thoracic diseases and provided better interpretability compared to the previous state-of-the-art method.
- Developed an automatic object detection method for pneumonia detection.
- Assisted in developing an automatic optic disc/cup segmentation algorithm and a glaucoma severity assessment method in colored fundus images.

Image Processing and Analysis Group, Yale University, New Haven, CT
Research Assistant, Sep 2016-May 2017

- Developed a dictionary learning method for segmentation of myocardium and blood pool in left ventricle from echocardiography.
- Developed a liver tumor segmentation in multiparametric MR images using Gaussian Mixture Model.

Publications

1. **Liu, H.,** Li, H., Yao, X., Fan, Y., Hu, D., Dawant, B. M., Nath, V., Xu, Z. and Oguz. I., 2023, October, COLosSAL: A Benchmark for Cold-start Active Learning for 3D Medical Image Segmentation. MICCAI 2023.

2. **Liu, H.,** Xu, Z., Gao, R., Li, H., Wang, J., Chabin, G., Oguz, I. and Grbic. S., 2023, COSST: Multi-organ Segmentation with Partially Labeled Datasets Using Comprehensive Supervisions and Self-training, *In submission to* IEEE Transaction of Medical Imaging.

3. **Liu, H.,** Fan, Y., Li, H., Wang, J., Hu, D., Cui, C., Lee, H.H., Zhang, H. and Oguz, I., 2022, September. Moddrop++: A dynamic filter network with intra-subject co-training for multiple sclerosis lesion segmentation with missing modalities. MICCAI 2022 (early accepted).

4. **Liu, H.,** Fan, Y., Oguz, I., & Dawant, B. M. (2022). Enhancing Data Diversity for Self-training Based Unsupervised Cross-modality Vestibular Schwannoma and Cochlea Segmentation. BrainLes 2022 MICCAI Workshop.

5. **Liu, H.**, Fan, Y., Cui, C., Su, D., McNeil, A., & Dawant, B. M. (2022). Unsupervised Domain Adaptation for Vestibular Schwannoma and Cochlea Segmentation via Semi-supervised Learning and Label Fusion. BrainLes 2021 MICCAI Workshop.

6. **Liu, H.**, Holloway, K. L., Englot, D. J., & Dawant, B. M. (2022). A Multi-rater Comparative Study of Automatic Target Localization Methods for Epilepsy Deep Brain Stimulation Procedures. SPIE Medical Imaging 2022.

7. **Liu, H.**, Sigona, M. K., Manuel, T. J., Chen, L. M., Dawant, B. M., & Caskey, C. F. (2022). Evaluation of Synthetically Generated CT for use in Transcranial Focused Ultrasound Procedures. Journal of Medical Imaging.

8. **Liu, H.**, Sigona, M. K., Chen, L., Caskey, C. F., & Dawant, B. M. (2022). Synthetic CT Skull Generation for Transcranial MR Imaging–Guided Focused Ultrasound Interventions with Conditional Adversarial Networks. SPIE Medical Imaging 2022.

9. **Liu, H.**, Fan, Y., Cui, C., Su, D., McNeil, A., & Dawant, B. M. (2021). Cross-Modality Domain Adaptation for Vestibular Schwannoma and Cochlea Segmentation. Technical Report.

10. **Liu, H.**, Cui, C., Englot, D. J., & Dawant, B. M. (2020). Uncertainty Estimation in Medical Image Localization: Towards Robust Anterior Thalamus Targeting for Deep Brain Stimulation. In Interpretable and Annotation-Efficient Learning for Medical Image Computing (pp. 130-137). Springer, Cham.

11. **Liu, H.**, Wang, L., Nan, Y., Jin, F., Wang, Q., & Pu, J. (2019). SDFN: Segmentation-based deep fusion network for thoracic disease classification in chest X-ray images. Computerized Medical Imaging and Graphics, 75, 66-73.

12. Fan, Y., Jianing W., Zhao Y., Li, R., **Liu, H.,** Labadie, R., Noble, J., & Dawant, B. M. A Unified Deep-Learning-Based Framework for Cochlear Implant Electrode Array Localization. MICCAI 2023.

13. Dorent, R., Kujawa, A., Ivory, M., Bakas, S., Rieke, N., Joutard, S., **Liu, H.**, ... & Vercauteren, T. (2023). CrossMoDA 2021 challenge: Benchmark of cross-modality domain adaptation techniques for vestibular schwannoma and cochlea segmentation. Medical Image Analysis.

14. Cui, C., **Liu, H.**, Liu, Q., Deng, R., Asad, Z., Wang, Y., ... & Huo, Y. (2022, September). Survival Prediction of Brain Cancer with Incomplete Radiology, Pathology, Genomic, and Demographic Data. MICCAI 2022.

15. Fan, Y., Khan, M. M., **Liu, H.**, Noble, J. H., Labadie, R. F., & Dawant, B. M. (2023, April). Temporal bone CT synthesis for MR-only cochlear implant preoperative planning. SPIE Medical Imaging 2023.

16. Wang, J., Li, H., **Liu, H.**, Hu, D., Lu, D., Yoon, K., ... & Oguz, I. (2023, April). SSL2 Self-Supervised Learning meets semi-supervised learning: multiple sclerosis segmentation in 7T-MRI from large-scale 3T-MRI. SPIE Medical Imaging 2023.

17. Yao, X., Lou, A., Li, H., Hu, D., Lu, D., **Liu, H.**, ... & Oguz, I. (2023, April). Novel application of the attention mechanism on medical image harmonization. SPIE Medical Imaging 2023.

18. Hu, D., Li, H., **Liu, H.**, & Oguz, I. (2022, December). Domain generalization for retinal vessel segmentation with vector field transformer. In International Conference on Medical Imaging with Deep Learning (pp. 552-564). PMLR.

19. Li, H., **Liu, H.**, Hu, D., Wang, J., Johnson, H., Sherbini, O., ... & Oguz, I. (2022, September). Self-supervised Test-Time Adaptation for Medical Image Segmentation. In International Workshop on Machine Learning in Clinical Neuroimaging (pp. 32-41).

20. Cui, C., **Liu, H.**, Englot, D. J., & Dawant, B. M. (2021, February). Brain vessel segmentation in contrast-enhanced T1-weighted MR Images for deep brain stimulation of the anterior thalamus using a deep convolutional neural network. SPIE Medical Imaging 2021.

21. Li, H., Hu, D., **Liu, H.**, Wang, J., & Oguz, I. (2022, March). Cats: Complementary cnn and transformer encoders for segmentation. In 2022 IEEE 19th International Symposium on Biomedical Imaging (ISBI) (pp. 1-5). IEEE.

22. Zhao, W., **Liu, H.**, Leader, J. K., Wilson, D., Meng, X., Wang, L., ... & Pu, J. (2019). Computerized identification of the vasculature surrounding a pulmonary nodule. Computerized Medical Imaging and Graphics, 74, 1-9.

23. Wang, L., **Liu, H.**, Lu, Y., Chen, H., Zhang, J., & Pu, J. (2019). A coarse-to-fine deep learning framework for optic disc segmentation in fundus images. Biomedical signal processing and control, 51, 82-89.

24. Wang, L., **Liu, H.**, Zhang, J., Chen, H., & Pu, J. (2019, March). Computerized assessment of glaucoma severity based on color fundus images. SPIE Medical Imaging 2019.

25. Wang, L., **Liu, H.**, Zhang, J., Chen, H., & Pu, J. (2019, March). Automated segmentation of the optic disc using the deep learning. SPIE Medical Imaging 2019.

Honors & Awards

2019-2023 IBM fellowship
2012-2015 Dean's List, Rensselaer Polytechnic Institute.

Professional Activities

Journal Reviewer

- Medical Image Analysis (MedIA)
- IEEE Journal of Biomedical and Health Informatics (JBHI)
- The Journal of Machine Learning for Biomedical Imaging (MELBA)
- Computers in Biology and Medicine (CIBM)
- Computerized Medical Imaging and Graphics (CMIG)
- Neurocomputing
- Multidimensional Systems & Signal Process (MULT)
- BioMed Research International
- IEEE Transactions on Neural Networks and Learning Systems

Conference Reviewer

- Knowledge Discovery and Data Mining (KDD) 2021
- Medical Image Computing and Computer Assisted Interventions (MICCAI) 2022
- Medical Image Computing and Computer Assisted Interventions (MICCAI) 2023
- Medical Imaging with Deep Learning (MIDL) 2023

Guest Lecture

- CS-8395-02 [Graduate level]: Open Source Programming for Medical Image Processing