# Hanxue Gu

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Phd Candidate at Duke University
Google Scholar

## About me

*Machine learning researcher specializing in deep learning for medical imaging. My Ph.D. research focuses on developing and adapting* ***foundation models (e.g., VFMs, VLMs)****, leveraging* ***self-/semi-supervised learning (e.g., MAE, DINO, CLIP)****, and applying* ***parameter-efficient fine-tuning*** *techniques, transformer architectures, and generative models for tasks like segmentation and registration; developing clinical models for outcome prediction and risk stratification. I have hands-on experience with PyTorch, MONAI, HuggingFace Transformers, and Diffusion Models, and have built pipelines that integrate de-identification, 3D medical image processing (e.g., NIfTI/DICOM), and multimodal data fusion. Passionate about bridging research and real-world clinical deployment, I work at the intersection of AI, imaging, and healthcare to develop models that are robust, interpretable, and clinically relevant.*

## Education

**Duke University** — *Durham, NC*
*Ph.D. in Electrial and Computer Engineering* — *Sep. 2020 - Aug. 2025 (Expected)*
- Maciej Mazurowski's Lab
- GPA: 3.97/4.00

**Zhejiang University** — *Zhejiang, China*
*B.E. in Electrical & Information Engineering* — *Sep. 2016 - June. 2020*
- Chu Kochen Honors College (**Top 5% selected**)
- The National Scholarship awarded (**Top 1% awarded, awarded 3 times**)
- GPA: 3.97/4.00, ranking 2/139

**University of Oxford** — *Oxford, UK*
*Visiting student for Summer School* — *July. 2018 - Aug. 2018*
- Excellent Achievement awarded

## Research Experience

**Mazurowski's Lab, Duke University** — *Durham, NC, US*
*Doctoral Researcher at Mazurowski Lab, Duke AI Health Spark Initiative* — *Sep. 2020 - Now*

- Supervisor: Dr. Maciej A. Mazurowski
- Key Skills: Deep learning, Computer Vision, Foundation models, and Interpretable clinical decision models.

  - **Foundation models for medical imaging**: Led one of the most cited studies on applying Segment Anything Model (SAM) to 19 medical datasets MIA; rapidly analyzed SAM 2 on 3D medical data within 3 days of its release, positioning among the first responders in the field Link. Developed the first model capable of segmenting bones in MRIs across diverse anatomical regions and imaging sequences, demonstrating broad generalizability in musculoskeletal imaging MIA; developed a MRI foundation model based on DINO-v2 similar strategy MRI-CORE.

  - **Fine-tuning and self-supervised learning**: Investigated 18+ fine-tuning strategies for foundation models in medical imaging; developed a self-supervised model achieving a 2% improvement in Dice score over prior methods MELBA. Released step-by-step tutorials on GitHub, earning 200+ stars.

  - **2D to 3D reconstruction**: Developed SuperMask to reconstruct precise 3D structures from low-resolution 2D slices MIDL; also built an automatic algorithm to reconstruct real 3D fractures from 2D X-ray projections MIDL.

  - **Domain Adaptation and Image Generation**: Explored the intrinsic dimension for the generalization ability for medical datasets MICCAI; Developed an algorithm for test-time adaptation CVPR; developed metric RaD for out-of-domain detection Link; designed an anatomical controllable diffusion model for unpaired medical image translation Link.

  - **AI for clinical applications**: Developed an interpretable method for scoliosis angle measurement and led a multi-reader study against seven experienced clinicians BJR: AI; built algorithms for automated muscle and fat segmentation to support body composition analysis, identifying stronger predictors of mortality and complications in major abdominal surgery Link.

**Harvard Unversity** — *Cambridge, US*
*Research assistant in Athinoula A. Martinos Center for Biomedical imaging, MGH* — *Jul. 2019 - Jul. 2020*

- Supervisor: Dr. Stefan A. Carp and Dr. Bin Deng

- Key Skills: Deep learning, Computer Vision, Inversion Problem, Image Reconstruction, Optical Imaging.

  - **Image Reconstruction**: Developed a fast, noninvasive method to characterize breast tissue optical properties and lesion locations using diffuse optical tomography (DOT), with enhanced simulation efficiency, accuracy, and resolution. Designed a novel network architecture for robust 3D DOT image reconstruction from noisy data TMI. Key results from this project also contributed to R01 grant.

## Selected Publications (See full list on Google scholar)

- *SegmentAnyBone: A Universal Model that Segments Any Bone at Any Location on MRI*
  **H. Gu**, R. Colglazier, H. Dong, et al. *Medical Image Analysis, 2025*
- *How to Build the Best Medical Image Segmentation Algorithm Using Foundation Models: A Comprehensive Empirical Study with Segment Anything Model*
  **H. Gu**, H. Dong, J. Yang, M.A. Mazurowski. *Journal of Machine Learning for Biomedical Imaging (MELBA, selected as journal to conference's oral presentation), 2025*
- [**Co-first**] *Segment Anything Model 2: An Application to 2D and 3D Medical Images*
  H. Dong, **H. Gu**, Y. Chen, J. Yang, M.A. Mazurowski. *Under review at IEEE EMBC.*
- [**Co-first**] *Deep Learning Automates Cobb Angle Measurement Compared with Multi-Expert Observers*
  K. Li, **H. Gu**, R. Colglazier, et al. *British Journal of Radiology: Artificial Intelligence, 2025*
- *Predicting 3D Forearm Fracture Angle from Biplanar X-ray Images with Rotational Bone Pose Estimation*
  **H. Gu**, R. Colglazier, J. Zhang, et al. *Medical Imaging with Deep Learning (MIDL, poster), 2024*
- *SuperMask: Generating High-Resolution Object Masks from Multi-View, Unaligned Low-Resolution MRIs*
  **H. Gu**, H. He, R. Colglazier, et al. *Medical Imaging with Deep Learning (MIDL, oral), 2023*
- [**Co-first**] *FDU-net: Deep Learning-Based Three-Dimensional Diffuse Optical Image Reconstruction*
  B. Deng, **H. Gu**, H. Zhu, et al. *IEEE Transactions Medical Imaging, 2023*
- *Segment Anything Model for Medical Image Analysis: An Experimental Study*
  M. Mazurowski, H. Dong, **H. Gu**, et al, *Medical Image Analysis 2023*
- *The intrinsic manifolds of radiological images and their role in deep learning*
  N. Konz, **H. Gu**, H. Dong, et al. *MICCAI, 2022*
- *Medical image segmentation with intent: Integrated entropy weighting for single image test-time adaptation*
  H. Dong, N. Konz, **H. Gu**, et al. *Oral, DEF-AI-MIA at CVPR 2024*
- *SWSSL: sliding window-based self-supervised learning for anomaly detection in high-resolution images*
  H. Dong, Y. Zhang, **H. Gu**, et al. *IEEE Transactions on Medical Imaging, 2023*
- *Accelerating Volumetric Medical Image Annotation via Short-Long Memory SAM 2*
  Y. Chen, Z. Yildiz, Q. Li, Y. Chen, H. Dong, **H. Gu**, et al. *Under review at IEEE Transactions on Medical Imaging, 2025*
- *Breast density in MRI: an AI-based quantification and relationship to assessment in mammography*
  Y. Chen, L. Li, **H. Gu**, et al. *Accepted by NPJ Breast Cancer*, 2025
- *Automated Muscle and Fat Segmentation in CT for Comprehensive Body Composition Analysis*
  Y. Chen, **H. Gu**, et al. *Under review at Journal of Machine Learning for Biomedical Imaging*, 2025
- *How to Efficiently Annotate Images for Best-Performing Deep Learning-Based Segmentation Models*
  Y. Zhang, S. Zhao, **H. Gu**, M.A. Mazurowski. *Journal of Imaging Informatics in Medicine*, 2025
- *Touchstone benchmark: Are we on the right way for evaluating AI algorithms for medical segmentation?*
  P.R.A.S. Bassi, W. Li, Y. Tang, F. Isensee, Z. Wang, J. Chen, Y.C. Chou, **H. Gu**, et al. *NeurIPS*, 2024
- *RaD: A Metric for Medical Image Distribution Comparison in Out-of-Domain Detection*
  N. Konz, Y. Chen, **H. Gu**, et al. *arXiv:2412.01496*, 2024
- *SegmentWithSAM: 3D Slicer Extension for Segment Anything Model (SAM)*
  Z. Yildiz, **H. Gu**, et al. *Medical Imaging with Deep Learning*, 2024
- *SAM-Geo3D: A Geometrical Method to Extend SAM to 3D*
  J. Zhang, Z. Yildiz, **H. Gu**, et al. *Medical Imaging with Deep Learning*, 2024

## Skills

**Technical Skills**: Python (NumPy, Pandas, scikit-learn, etc), PyTorch, C++/C, Bash, Latex, HTML; Git, Docker, Vim, Open-Source sharing, etc.

**Professional Skills**: Experienced in academic writing, reviewing, and presenting at internal conferences and seminars. Contributed as a lead writer on multiple large grant proposals (e.g., NIH R01s). Strong communicator and collaborator, with a track record of mentoring junior researchers across diverse projects.