Mingxin Liu

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Personal Profile

As a 1st-year Ph.D. student in Artificial Intelligence at Nanjing University of Information Science and Technology, I specialise in **Medical Image Analysis** (especially **Whole Slide Image** (WSI) **Analysis**), **Computational Pathology**, **Multimodal Learning**. My objective is to design and develop trustworthy and effective AI solutions in clinical cancer diagnosis and prognosis. During my former studies, I have developed multiple methods for computational pathology from various angles such as patch / slide-level histopathology image classification, survival outcome prediction, and multimodal learning. Additionally, I also have some experience in the research of other medical image modalities such as diffusion magnetic resonance imaging (dMRI), digital retinal imaging, and late gadolinium enhanced magnetic resonance imaging (LGE MRI). At present, I primarily focus on the following research topics: **Data-Efficient**, **Weakly/Self-Supervised Learning**, **Multimodal Learning**, **Interpretability**, **Visual Foundation Models** *etc.* in medical image analysis, particularly those in computational pathology.

Education

Nanjing University of Information Science and Technology — *Nanjing, China*

Ph.D. Student in Artificial Intelligence — *Sept. 2024 - PRESENT*

- Advisor: Prof. Jun Xu

Heilongjiang University — *Harbin, China*

MSc. Student in Computer Technology — *Sept. 2021 - Jun. 2024*

- Advisor: Prof. Jiquan Ma
- GPA: **3.91/4.00**, Overall Average Score: **88.83**
- Courses: Deep Learning (4.0/4.0), Computer Vision (4.0/4.0), Artificial Intelligence (4.0/4.0), Design and Analysis of Algorithms (4.0/4.0), Combinatorial Mathematics (4.0/4.0), Academic Writing (4.0/4.0)

Heilongjiang International University — *Harbin, China*

B.Eng. in Computer Science and Technology — *Sept. 2017 - Jul. 2021*

Publications

- C. Cai, J. Li, **M. Liu**, Y. Jiao, J. Xu†: **SeqFRT: Towards Effective Adaption of Foundation Model via Sequence Feature Reconstruction in Computational Pathology**. Submitted to International Conference on Bioinformatics and Biomedicine (**BIBM**), 2024.
- G. Li, **M. Liu**, J. Lu, J. Ma†: **Edge and Dense Attention U-Net for Atrial Scar Segmentation in LGE-MRI**. Biomedical Physics & Engineering Express, 2024.
- **M. Liu**, Y. Liu, P. Xu, H. Cui, J. Ke, J. Ma†: **Exploiting Geometric Features via Hierarchical Graph Pyramid Transformer for Cancer Diagnosis using Histopathological Images**. IEEE Transactions on Medical Imaging (**TMI**), 2024.
- **M. Liu**, Y. Liu, P. Xu, J. Ma†: **Unleashing the Infinity Power of Geometry: A Novel Geometry-Aware Transformer (GOAT) for Whole Slide Histopathology Image Analysis**. International Symposium on Biomedical Imaging (**ISBI**), 2024. (Oral Presentation)
- **M. Liu**, Y. Liu, H. Cui, C. Li†, J. Ma†: **MGCT: Mutual-Guided Cross-Modality Transformer for Survival Outcome Prediction using Integrative Histopathology-Genomic Features**. International Conference on Bioinformatics and Biomedicine (**BIBM**), 2023.
- J. Ma, P. Xu, G. Chen*, H. Jiang, **M. Liu**, F. Kong, H. Cui, D. Shen. **White Matter Tract Segmentation with Dense Criss-Cross U-Shape Transformer**. Submitted to Artificial Intelligence in Medicine (**AIM**).
- Y. Wang, **M. Liu**, G. Li, P. Xu, J. Ma†. **DC-WNet: Dual Cascaded W-Shaped Neural Network for Retinal Vessel Segmentation**. In preparation for submission.

Research Experience

Whole Slide Image Classification — *Harbin, China*

Heilongjiang University — *Aug. 2023 - Oct. 2023*

- Proposed a transformer-enabled **weakly-supervised** model to exploit the **multiple magnifications** of the gigapixel WSIs
- Designed a **cross-magnification** module to integrate multi-resolution feature to obtain a holistic whole slide image representation
- Built a **geometry-aware** set-based transformer framework to effectively leverage the **geometric representation** in whole slide images

Pathological Image Classification *Harbin, China*

Heilongjiang University *Nov. 2022 - Sep. 2023*

- Proposed a novel **hybrid GCN-Transformer** architecture which can jointly consider the geometric and global representation
- Designed a graph feature learning module to detect **geometric structure** between the high morphological homogeneity patches
- Present a feature enhancement module to highly enhance the **2D local feature perception** which vanilla vision transformers lack
- Achieved **state-of-the-art** binary/multi-categories cancer classification performance across multiple public histopathology datasets

Multimodal Feature Integration *Harbin, China*

Heilongjiang University *Jan. 2023 - Aug. 2023*

- Proposed a **multimodal** framework to address the **data heterogeneity** problem of the feature integration between WSIs and genomics
- Designed a novel **cross-modality** attention mechanism to capture **genotype-phenotype interactions** in the tumor microenvironment
- Achieved a maximum **32.97%** overall performance improvement across five different cancer datasets (almost **3,600** WSIs) from TCGA

Project Experience

Sensitive Image Detection *Habin, China*

Beijing Tongtech Co., Ltd. *Apr. 2023 - Nov. 2023*

- Implemented a **speed & accuracy trade-off** approach to tackle the **real-time tremendous** image recognition challenge
- Achieved a **nanosecond-level** sensitive image detection efficiency with a relative observable accuracy performance (over 90%)

Electricity Meter Number & Safety Helmet Wearing Detection *Habin, China*

China United Network Communications Group Co., Ltd. *Jun. 2022 - Nov. 2022*

- Designed a **transductive transfer learning** framework to address the data scarcity problem in the target domain
- Collected two in-house traditional electricity meter & safety helmet wearing datasets to **fine-tune** the feature extractor
- Improved the object detection performance to **98%** overall accuracy under the condition of using a relative **light-weight** network

Professional Service

- Reviewer for The Conference Neural Information Processing Systems (**NeurIPS**) 2022 Cell Segmentation Challenge

Skills

Programming Languages	Python, LaTeX, Markdown, Git.
Python Libraries	PyTorch, OpenSlide, OpenCV, Sklearn, Skimage, Numpy, Scipy, Matplotlib
Soft Skills	Teamwork, Documentation, Engaging Presentation, Scientific Drawing
English	CET4, CET 6, IELTS 7.0 (L: 7.5, R: 7.5, W: 6.5, S: 6.0)

Honours & Awards

2024	**Outstanding Master's Degree Thesis**, **Top 10%** in Heilongjiang University	*Heilongjiang University*
2023	**2nd-Class Graduate Scholarship**, **Top 30%** in Dept. of Computer Science and Technology	*Heilongjiang University*
2022	**1st-Class Graduate Scholarship**, **Top 10%** in Dept. of Computer Science and Technology	*Heilongjiang University*
2021	**1st-Class Graduate Scholarship**, **Top 10%** in Dept. of Computer Science and Technology	*Heilongjiang University*