Hai Jiang
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Cover Letter December 11, 2024

To whom it may concern,

I am writing to express my interest in the PhD position at your university, specializing in **Data-Driven Healthcare Models for Pandemic Preparation**. My academic background and research experience have prepared me well for advanced study in this field, and I am highly motivated to contributed to cutting-edge research that combines AI with Mathematics.

My journey began with a strong foundation in Computer Science and Mathematics, leading me to pursue a Master's degree in Computational Mathematics in 2019, following a Bachelor's degree in Information Security in China. For my Master's project, I focused on Generative Adversarial Networks (GANs) of Deep Learning (DL), specifically for handwriting style imitation. In this project, I developed a GAN-based model to replicate individual handwriting styles, focusing on emulating the handwritten Chinese characters of Shiing Shen Chern from a dataset of around 220 characters. This experience provided me with hands-on expertise in GANs, data preprocessing, manuscript analysis, and code replication, culminating in my Master's thesis, *"GANs based Personal Style Imitation of Chinese Handwritten Characters."*

Following my Master's degree, I contributed to the Compressed Sensing MRI ADMM-Net project, which combined DL with numerical approximation theory. Traditional algorithms often lose image detail with repeated iterations, but by leveraging Convolutional Neural Networks (CNNs), our team demonstrated how DL can dynamically adjust parameters to preserve fine details. This project deepened my understanding of convergent algorithm theory, proof construction, and the balance between theoretical approaches and practical applications, while refining my programming and analytical skills.

After completing my degree, I joined a research group at Sun Yat-sen University focused on Computer-aided diagnosis, where I worked as a Research Assistant on several impactful projects. These included diagnosing Placenta Accreta Spectrum Disorders, predicting metastasis in Axillary Sentinel Lymph Nodes in breast cancer, and assessing responses to Neoadjuvant Chemotherapy via MRI. Through these projects, I gained further expertise in Python, PyTorch, and TensorFlow, along with experience in manuscript research and scientific writing.

I believe I am an excellent candidate for this position within your research group. Your focus on high-dimensional, discrete decision spaces in operations research, combined with stochastic programming and reinforcement learning, aligns closely with my research interests. Specifically, I am passionate about advancing multi-modal data analysis, improving the accuracy of pandemic patient forecasting, optimizing stochastic models to predict hospitalization numbers, and developing strategies to allocate patients to hospitals and regions efficiently. My interdisciplinary background, programming expertise, and research experience uniquely position me to contribute to and thrive in the challenges and rigor of this PhD position.

My long-term goal is to establish a career in academia, where I can contribute to the fields of Computer Science and Mathematics through meaningful research and innovation. The interdisciplinary nature of your group, alongside the expertise and contributions of its members, closely matches my academic and professional aspirations, making this position an ideal next step. I am eager to join an environment that fosters intellectual rigor and collaboration, providing the resources essential to realizing my goals.

I am enthusiastic about the opportunity to join your research community and contribute actively while continuing to develop my expertise. Thank you for considering my application, and I look forward to discussing how my background, skills, and goals align with your program.

Sincerely,

Hai Jiang

Attached: curriculum vitæ

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Education

2019–2022 **Master of Science in Computational Mathematics**, ***Nankai University (NKU)***, **China**

Thesis *GANs based Personal Style Imitation of Chinese Handwritten Characters.*

Advisors Prof. Yunhua Xue, Prof. Chunlin Wu

Related Courses Approximation Theory and Methods, Numerical Optimization, Convex Analysis, Variational Analysis, Real Analysis, Functional Analysis, Matrix Computation, Foundations of Measure Theory and Probability, Numerical Solutions of Partial Differential Equations, and more.

Cumulative GPA 3.06/4.00

2014–2018 **Bachelor of Engineering in Information Security**, ***Lanzhou University (LZU)***, **China**

Thesis *Improved Upper Bounds of Roman Domination Number in Maximal Outerplanar Graphs.*

Advisor Prof. Zepeng Li

Related Courses Discrete Mathematics, Operating Systems, Data Structures, C and C++ Programming Lab, Java Programming Lab, Database Theory and Lab, Computer Organization and Design, and more.

Cumulative GPA 4.15/5.00

Research Experience

11.2022–07.2024 **Research Assistant**, *Computational Medical Imaging Laboratory*
School of Computer Science and Engineering, Sun Yat-sen University, Guangzhou, China

Project China Department of Science and Technology Key Grant, focused on Breast Cancer, aims to develop models with clinical interpretability and generalization.

Correspondence Prof. Yao Lu, Dr. Ting Song

Task Focus Placenta Accreta Spectrum Disorders, T2-WI MRI, Prenatal Diagnosis, Multi-class classification.

Experience and Skills Literature research, data preprocessing, model building (programming), research paper writing.

Publication Submitted to ISBI 2025 and currently under review: *"Anatomy-guided Multitask Learning for MRI-based Classification of Placenta Accreta Spectrum and its Subtypes."*

12.2023–01.2024 **Research Assistant**, *Computational Medical Imaging Laboratory*
School of Computer Science and Engineering, Sun Yat-sen University, Guangzhou, China

Project National Natural Science Foundation of China, focused on Breast Cancer, aimed to develop a prediction model for the Chinese female population mainly with FFDM and US.

Correspondence Prof. Yao Lu, Dr. Xiang Zhang

Task Focus Breast Cancer, Dual-Energy CT, Sentinel Lymph Nodes, Metestatic status, Multi-class classification.

Experience and Skills The first comprehensive research experience involved conducting literature reviews, designing experiments, writing research papers, and working with the TensorFlow and Keras frameworks.

Publication Submitted to MICCAI 2024 and revised for submission to the Journal of *Physics in Medicine and Biology (PMB)*: *"Space-Squeeze Method for Multi-Class Classification of Metastatic Lymph Nodes in Breast Cancer."*

01.2022–06.2022 **Research Student**, *Image Analysis Team*
School of Mathematical Sciences, Nankai University, Tianjin, China

Task ADMM model from the manuscript "Deep ADMM-Net for Compressed-Sensing MRI."

Supervisors Prof. Chunlin Wu, Prof. Yunhua Xue

Focus Compressed-sensing Theory, Iterative Equations, Neural Networks, MRI reconstruction.

Experience and Skills The second programming experience involved proving mathematical equations and applying Deep Learning techniques. I reproduced the iterative mathematical equations using C++, Python, and PyTorch.

01.2021–04.2021 **Research Student**, *Image Analysis Team*
School of Mathematical Sciences, Nankai University, Tianjin, China

Task	ROF-model from the manuscript “Nonlinear Total Variation Based Noise Removal Algorithms.”
Supervisor	Prof. Yunhua Xue
Focus	Image Restoration, Denoise, PDE, Total-Variation Penalty.
Experience and Skills	My initial project experience included proving mathematical equations and using both C++ and Python to develop the ROF model.

Other Work Experience

Funding

Proposal Writing	Accepted; China Department of Science and Technology Key Grant 2023YFE0204300.
Report Writing	Succeeded; Finished three Completion Reports and three Progress Reports; the NSFC Grant 81971691, 12126610, the R&D project of Pazhou Lab (Huangpu) under Grant 2023K0606.

Specification

Patent	1 Patent Application Specification; under review.
Device	1 Medical Device Application Specification; succeeded.

Teaching Experience

Courses	Calculus; Mathematical Analysis
Thesis	*Breast Cancer Classification Method Based on Dual-Energy CT Images.*

Language Proficiency

Mandarin	Native
English	Professional Level: IELTS 6.5; CET6 476/710; CET4 544/710.
Cantonese	Intermediate

Skills

Technical	Python, PyTorch, Tensorflow + Keras, LaTeX, C/C++, MATLAB
Other	Linux (Ubuntu), Microsoft Office, Adobe Photoshop

Interest

Artificial Intelligence, Mathematics, Physics

Awards

2014 – 2018	Four-time recipient of the Third-Class Merit Scholarship for Academic Excellence at LZU.
2019 – 2022	Three-time recipient of the Third-Class Merit Scholarship for Academic Excellence at NKU.

References

Prof. Zepeng Li

Associate Professor in Machine Learning at Lanzhou University

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Prof. Yunhua Xue

Associate Professor in Computational Mathematics at Nankai University

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Dr. Yuanpin Zhou

Postdoctoral researcher in Medical Image Analysis at Zhejiang University

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