

Admission Committee

Faculty

Subject

January 1, 2025

To whom it may concern,

I am writing to express my interest in the PhD position at your university, specializing in **Machine Learning on large databases for interventional cardiac PCI treatment**. My academic background and research experience have prepared me well for advanced study in this field.

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 GANs-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 Sentinel Axillary 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 am confident that I am a strong candidate for this position within your research group. The focus of this PhD position—analyzing large databases of angiograms, detecting key events in real-time during PCI treatment, and automating the identification of left and right coronary tree structures in angiograms—closely aligns with my research interests and expertise. I am particularly passionate about developing feature vectors to describe relevant attributes, designing machine learning algorithms to extract these vectors, and creating algorithms for real-time lookups in clustered ontology databases. My interdisciplinary background, programming expertise, and research experience uniquely equip me to excel in and make meaningful contributions to the challenges and rigor of this PhD opportunity.

My long-term goal is to build a career in academia, contributing to the fields of Electrical Engineering, Computer Science, and Mathematics through impactful research and innovation. The interdisciplinary nature of your research and team, coupled with the expertise and accomplishments of its members, aligns seamlessly with my academic and professional aspirations. This position represents an ideal next step toward achieving my goals. I am eager to join an environment that fosters intellectual rigor, collaboration, and access to the resources essential for realizing my ambitions.

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

## Education

**09.2019–07.2022** 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

**09.2014–07.2018** 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.

**Advisors** 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.

**Advisors** Prof. Yao Lu, Dr. Xiang Zhang

**Task Focus** Breast Cancer, Dual-Energy CT, Sentinel Lymph Nodes, Metastatic 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 Medical Physics*: “*DECT-Based 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.

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## Other Work Experience

### Funding

**Proposal Writing** Accepted; National Key Research and Development Program of China [No. 2023YFE0204300].

**Report Writing** Succeeded; Finished three Completion Reports and three Progress Reports; National Natural Science Foundation of China [No. 81971691, 12126610]; R&D Program of Pazhou Lab (Huangpu) [No. 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.*

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## Language Proficiency

**Mandarin** Native

**English** Professional Level: IELTS 6.5; CET6 476/710; CET4 544/710.

**Cantonese** Intermediate

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## Skills

**Technical** Python, PyTorch, Tensorflow + Keras,  $\LaTeX$ , Git, C/C++, MATLAB

**Other** Linux (Ubuntu), Microsoft Office, Adobe Photoshop

**GitHub repository** <https://github.com/pigejianghai/projects>

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## Interest

Artificial Intelligence, Mathematics, Physics

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## 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.

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## References

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Associate Professor in Machine Learning at Lanzhou University

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