Qipeng Qian

+1 608-960-2756 | qqian@arizona.edu |
https://qqian99.github.io/personal-website/index.html

Research Objective

I am looking for Postdoc/faculty position in ECE, AI, and other related fields.

EDUCATION

Shanghai Jiao Tong University Sep 2017 - Jun 2021

Mathematics, Bachelor degree in mathematics Shanghai, China

GPA: 3.4/4.0

Main Courses: Real/Complex Analysis, Mathematical Statistics, Graph Theory and Networks, Numerical Methods, Differential Geometry, Random Process, Statistic Learning.

University of Wisconsin-Madison Sep 2020 - Jun 2022

Mathematics, Master degree in mathematics, Joint program with Shanghai Jiao Tong University Madison, Wisconsin

GPA: 4.0/4.0

Main Courses: Real Analysis, Functional Analysis; Linear and Non-linear Partial Differential Equations; Nonlinear Optimization; Fourier Analysis; Reading course of wavelets.

University of Arizona Aug 2022 - Aug 2026

Applied Mathematics, PhD Program Tucson, Arizona

GPA:4.0/4.0

Main Courses: Quantum Physics; Quantum Information Theory; Stochastic Processes; Reinforcement & Imitation Learning; Optimization & Algorithms.

SKILLS LIST

- Quantum application: Quantum information processing, Quantum machine learning, Covert communication;
- Math: Graph theory, Fourier analysis, Statistic methods, Matrix theory, Optimization theory, PDE;
- Machine learning: Graph neural networks, Generative Models, Reinforcement learning;
- Programming: Python (Pytorch, Tensorflow, Pennylane), MatLab, Mathematica, R, C++;
- Language: Chinese (native), English with excellent listening, speaking, reading and writing skills.

SUMMARY

During Ph.D, I investigated Quantum Information Processing and Qantum communication. I'm also experienced in signal processing and machine learning. Related work has been published in Physical Review A, ICASSP, IGARSS, and TGRS.

My academic journey reflects a consistent effort to integrate theoretical foundations with practical applications, spanning quantum optics, statistical inference, and large-scale data modeling. Looking ahead, my goal is to advance the emerging field of quantum signal processing by combining classical signal processing, and deep learning techniques with the quantum technics. I am particularly interested in exploring how quantum resources can enhance information extraction, representation, and learning from complex data, thereby bridging the gap between traditional methodologies and next-generation quantum technologies.

RESEARCH EXPERIENCE

Covert Time-Position Coding with Change-Point Decoders Aug 2025 - Present

Supervised by Prof. Christos Gagatsos and Prof. Boulat Bash in Department of ECE, University of Arizona.

Over bosonic thermal-loss channels, we integrate covert communication/sensing with Quantum change-point detection by using time-position coding and QUSUM decoding, deriving minimum slot-length laws and upper bounds on segment-wise payload under a prescribed covertness budget and false-alarm constraints.

Estimating Phase Shift using Covariant Measurement Sep 2024 - Present

Supervised by Prof. Christos Gagatsos.

We systematically characterize the necessary and sufficient conditions for optimal input states under covariant measurements for phase-shift estimation task, and prove that these optimal inputs render the (average) cost asymptotically zero.

The effect of partial post-selection on quantum discrimination Apr 2025 - Jul 2025

Supervised by Prof. Christos Gagatsos.

We investigate how partial post-selection impacts quantum state discrimination under a newly proposed LOCC scheme. We prove that the minimum average error, averaged across all post-selected branches, cannot surpass the minimum error achievable with the original input. However, we exhibit specific branches that deliver strictly better conditional discrimination performance—at the cost of their occurrence probability.

Q. Qian, C. N. Gagatsos, "The effect of partial post-selection on quantum discrimination," arXiv. https://arxiv.org/abs/2506.14105

Lower Bound of Wigner Entropy for Qubit with Non-negative Wigner Function Sep 2023 - Nov 2023

Supervised by Prof. Christos Gagatsos.

Uncertainty relations are of fundamental interest in quantum information theory and are closely related to the wave-particle duality in quantum mechanics and also illustrate one of the essential difference between quantum and classical mechanics. Further-more, uncertainty relations directly put constraints on the precision of measurements and indicates inherent limitations in our understanding of quantum systems. For this particular project, we look into the Wigner entropy conjecture which will induce a tighter uncertainty relation w.r.t classic Shannon entropy. Although we did not completely prove the conjecture, we derived a sufficient condition for it.

Q. Qian, C. N. Gagatsos, "Wigner non-negative states that verify the wigner entropy conjecture," Phys. Rev. A 110, 012228 (2024).

A Wavelet-Inspired Aggregated Multiscale Graph Convolutional Recurrent Network for Traffic Forecasting May 2023 - Jul 2023

Supervised by Tanwi Mallick in Argonne National Lab.

This work was completed during the NSF MSGI 2023 Summer Internship, where we proposed a method called Wavelet-Inspired Multiscale Graph Convolutional Recurrent Network (WavGCRN). This approach leverages neural networks to emulate wavelet transforms and integrates multiscale graph learning to effectively capture information from input signals and their underlying graph structures across multiple scales.

Q. Qian, T. Mallick, "Wavelet-Inspired Multiscale Graph Convolutional Recurrent Network for Traffic Forecasting," IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2024.

Hyperspectral Image Denoising and Classification Sep 2022 - Jul 2023

Supervised by Prof. Yunao Qian in Department of Computer Science, Zhejiang University and Prof. Minchao Ye in Department of Computer Science, China Jiliang University.

During the project, my colleagues and I were dedicated to exploring noise-model-free self-supervised techniques based on hierarchical graph relations and diffusion models for hyperspectral image denoising and employing graph convolutional networks and transformers to address hyperspectral image classification challenges in cross-domain scenarios.

K. Deng, Z. Jiang, **Q. Qian**, Y. Qiu, Y. Qian, "A Noise-Model-Free Hyperspectral Image Denoising Method Based on Diffusion Model", IEEE International Geoscience and Remote Sensing Symposium (IGARSS), Pasadena, CA, USA, 2023.

Z. Jiang, **Q. Qian**, Y. Qiu, Y. Qian, "Hierarchical Superpixel Relation Graph Combined with Convolutional Sparse Coding for Self-Supervised Hyperspectral Image Denoising", IGARSS, Pasadena, CA, USA, 2023.

J. Ling, M. Ye, Y. Qian, **Q. Qian**, "Corss-Domain Hyperspectral Imaging Classification Based on Transformer", IGARSS, Pasadena, CA, USA, 2023.

Y. Li, M. Ye, Y. Qian, **Q. Qian**, "Corss-Domain Hyperspectral Imaging Classification Based on Graph Convolutional Networks", IGARSS, Pasadena, CA, USA, 2023.

Graph Wavelet Transforms and Applications Oct 2020 - May 2021

supervised by Prof. Zhenli Xu in Department of Mathematics, Shanghai Jiao Tong University.

This constitutes my undergraduate thesis project, where I focused on delineating various fundamental approaches to defining wavelet transforms grounded in graph structures. Furthermore, I conducted a thorough analysis of the theoretical underpinnings of widely employed graph neural networks, including Graph Convolutional Networks and Graph Wavelet Neural Networks.

Machine learning in Hyperspectral remote sensing image processing Sep 2018 - May 2020

supervised by Prof. Yuntao Qian at Zhejiang University, Prof. Minchao Ye at China Jiliang University, and Prof. Jun Zhou at Griffith University.

Throughout this project, I harnessed the power of deep neural networks and graph wavelet transformations to tackle challenges in hyperspectral unmixing and pixel-level classification. I actively engaged in knowledge exchange and discussions with my supervisors on model construction employing mathematical tools.

Y. Qian, F. Xiong, **Q. Qian**, J, Zhou, "Spectral Mixture Model Inspired Network Architectures for Hyperspectral Unmixing," IEEE Transactions on Geoscience and Remote Sensing, 58(10): 7418-7434, 2020.

Q. Qian, F. Xiong, J. Zhou, "Deep Unfolded Iterative Shrinkage-Thresholding Model for Hyperspectral Unmixing," IGARSS, Yokohama, Japan, 2019.

Q. Qian, X. Fan, M. Ye, "Improving Hyperspectral Image Classification Using Graph Wavelets," IGARSS, Waikoloa, HI, USA, 2020.