

# Qipeng Qian

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## EDUCATION

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### Shanghai Jiao Tong University

Sep 2017 - Jun 2021

Mathematics, Bachelor

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 2021 - Jun 2022

Mathematics, Master

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

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

## SUMMARY

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I have long focused on graph learning and graph neural networks, graph representation learning, graph signal processing, and time-series analysis; I am proficient with spectral/spatial methods and spatio-temporal graph modeling, and can rapidly turn algorithms into reproducible, well-evaluated engineering systems. During Ph.D, I also investigated Quantum Information Theory and Quantum communication. Related work has been published in ICASSP, Physical Review A (PRA), IGARSS, and TGRS.

I think logically and learn quickly, excel at communication, collaboration, and cross-functional execution, and am fluent in English, effective at working and delivering in international environments.

## RESEARCH EXPERIENCE

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**"Covert Time-Position Coding with Quickest Quantum Change-Point Decoders", supervised by Prof. Christos Gagatsos and Prof. Boulat Bash in Department of Electrical and Computer Engineering, University of Arizona** Aug 2025 - Present

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.

**"Best Input State of Estimating Phase Shift under Covariant Measurement", supervised by Prof. Gagatsos** Sep 2024 - Aug 2025

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

**"The effect of partial post-selection on quantum discrimination", supervised by Prof. Gagatsos** Apr 2025 - Jul 2025

Within a general LOCC framework, we investigate how partial post-selection impacts quantum state discrimination. We rigorously prove that the minimum average error, when averaged across all post-selected branches, cannot surpass the optimum achievable with the original input. At the same time, we exhibit specific branches that deliver strictly better conditional discrimination performance—at the cost of their occurrence probability. These results clarify the distinction between average and conditional performance, and we provide formal proofs and illustrative examples.

**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", supervised by Prof. Christos Gagatsos in Department of Electrical and Computer Engineering, University of Arizona** Sep 2023 - Nov 2023

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", supervised by Tanwi Mallick in Argonne National Lab** May 2023 - Jul 2023

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", supervised by Prof. Y. Qian in Department of Computer Science, Zhejiang University** Sep 2022 - Jul 2023

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**, "Cross-Domain Hyperspectral Imaging Classification Based on Transformer", IGARSS, Pasadena, CA, USA, 2023.

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

**"Graph Wavelet Transforms and Applications", supervised by Prof. Z. Xu at Shanghai Jiao Tong University** Oct 2020 - May 2021

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", supervised by Prof. Y. Qian at Zhejiang University, Prof. M. Ye at China Ji Liang University, and Prof. J. Zhou at Griffith University** Sep 2018 - May 2020

Throughout this project, we 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.