Xiangxiang, Wang

Phone: 775-501-2266
Email: wangx306@msu.edu
Homepage: https://xiangxiangjy.github.io/xxw/

Research Interests: Topological Data Analysis, Geometric Data Analysis, Riemannian Manifolds, Grassmannian Geometry, Matrix Methods, Geometric Deep Learning, Computer Vision, Single-Cell Analysis

EDUCATION

2021-2025	Ph.D. in Applied Mathematics (Graduation Date: August 13, 2025)
	Department of Mathematics and Statistics, University of Nevada, Reno
	GPA: 4.00 (out of 4)
2017-2020	M.Sc. in Statistics
	Shanghai University
	Average Score: 90.25 (out of 100)
2013-2017	B.Sc. in Information and Computing Science
	North China University of Water Resources and Electric Power
	GPA: 4.14 (out of 4.5) Consistently ranked first in my major each semester

RESEARCH EXPERIENCE

Research Associate, Michigan State University   2025-now

Advisor: Guowei Wei, Michigan State University

My research focuses on mathematical and computational modeling in biomedical data analysis, particularly in the development of machine learning and topological data analysis methods for multi-omics and spatial transcriptomics (ST) data. I aim to design novel algorithms that integrate mathematical frameworks, such as differential geometry, algebraic topology, with biological insights to enhance the understanding of cellular heterogeneity and disease mechanisms at the single-cell level.

Ph.D. Researcher, University of Nevada, Reno   2021-2025

Ph.D. Advisor: Tin-Yau Tam, University of Nevada, Reno

Conducted machine learning research projects on advanced geometric data representations (Grassmannians, quaternion matrices), driving new methods for image and video processing. Designed, implemented, and evaluated ML models for color image set recognition. Collaborated cross-institutionally (University of Nevada, Shanghai University, Auburn University), delivering production-quality research.

Statistical Analyst, Provost Office of University of Nevada, Reno   June 2023-August 2023

Designed and implemented data processing workflows to support the Co-Requisite Assessment Program, performing data cleaning, transformation, and statistical modeling (SPSS, R, Python). Developed dashboards and reports to inform business decisions at the university level.

Master Researcher, Shanghai University   2017-2020

Advisor: Qing-Wen Wang, Shanghai University

Researched quaternion matrices and eigenvalue problems, developed a fast algorithm for computing eigenvalues of large-scale quaternion matrices, and explored image processing applications. This work resulted in 1 publication in the *Journal of Scientific Computing*.

TECHNICAL SKILLS

- Programming: Python, MATLAB, R, SQL (basic-in progress)

- Machine Learning: Computer Vision, Topological Deep Learning, Mathematical Representation, Data Analysis
- Tools: Github, Jupyter, PyTorch, SPSS

LEADERSHIP&COLLABORATION

- Organized multi-institutional collaborations between University of Nevada and Shanghai University for ML research
- Served as Local Organizer for the 2024 Workshop Matrices and Operators (Mao 2024), UNR
- Organized the Bi-Weekly Matrix Seminar Department of Mathematics and Statistics, UNR (2023-2024)
- Mentored students through the Nevada GAIN Program (2023)
- Chaired sessions at major conferences (JMM 2025, MAO 2024)
- Moderated and supported the 2025 Youth Security Forum, developing strong cross-functional communication skills

PUBLICATIONS

Preprint

- X.X. Wang, T.Y. Tam, Quaternion Grassmannians for Color Image Set Recognition. Preprint available on arXiv: https://arxiv.org/abs/2505.23629
- T.Y. Tam, X.X. Wang, Geometric Means and Their Properties of Grassmannians. Preprint available on arXiv: https://arxiv.org/abs/2412.15161.
- X.X. Wang, S. Cottrell, G.W. Wei, Multiscale Grassmann Manifolds for Single-Cell Data Analysis. Preprint available on arXiv: https://arxiv.org/abs/2511.11717

Published

- Z.H. He, T.T. Liu, X.X. Wang, Eigenvalues of Quaternion Tensors: Properties, Algorithms and Applications, Advances in Applied Clifford Algebras, 35 (2025), 4 (23 pages).
- Z.H. He, W.L. Qin, J. Tian, X.X. Wang, Y. Zhang, A new Sylvester-type quaternion matrix equation model for color image data transmission, Computational and Applied Mathematics. 43 (2024), 227 (30 pages)
- Z.H. He, X.X. Wang, Y.F. Zhao, Eigenvalues of Quaternion Tensors with Applications to Color Video Processing, Journal of Scientific Computing. 94 (2023), 1(15 pages)
- Z.H. He, C. Navasca, X.X. Wang, Decomposition for a quaternion tensor triplet with applications, Advances in Applied Clifford Algebras, 32 (2022), 9 (19 pages).
- Z.H. He, W.L. Qin, X.X. Wang, Some applications of a decomposition for five quaternion matrices in control system and color image processing, Computational and Applied Mathematics, 40 (2021), 205 (29 pages).
- S.W. Yu, Z.H. He, T.C. Qi, X.X. Wang, The equivalence canonical form of five quaternion matrices with applications to imaging and Sylvester-type equations, Journal of Computational and Applied Mathematics, 393 (2021), 113494 (20 pages).
- Z.H. He, C. Chen, X.X. Wang, A simultaneous decomposition for three quaternion tensors with applications in color video signal processing, Analysis and Applications, 19 (3) (2020) 529-549 (21 pages).
- Q.W. Wang, X.X. Wang, Arnoldi method for large quaternion right eigenvalue problem, Journal of Scientific Computing, 82 (2020), 58 (20 pages).
- G.H. Peng, X.X. Wang, Y.Z. Zhang, Multidimensional scaling analysis based on attribute reduction of bivariate mutual information, International Mathematical Forum, 12 (3) (2017) 111-118 (9 pages).

SERVICES

Moderator & Logistic Volunteer, 2025 Youth Security Forum: Telling Truth from Lies Misinformation,
Disinformation, AI Threats to National Security, UNR   May 2025
Local Organizer, The 2024 Workshop Matrices and Operators (Mao 2024), UNR   June 2024
Organizer, Bi-Weekly Matrix Seminar Department of Mathematics and Statistics, UNR   2023-2024
Mentor, Nevada GAIN Program   2023
Journal Reviewer for

- Linear and Multilinear Algebra
- Advances in Operator Theory
- zbMath
- The Electronic Journal of Linear Algebra
- Numerical Algorithms

Provided faculty feedback on *Mathematics for Economics and Finance* (2nd Edition), Cambridge University Press, May 2025 — for potential adoption in undergraduate economics courses.

AWARDS

Research Grants

Graduate Student Association (GSA) Research Grant Award, University of Nevada, Reno. ($1,000)	2021
Graduate Student Association (GSA) Travel Award, University of Nevada, Reno. ($500)	2022

Fellowships

Graduate Dean's Merit Scholarship, University of Nevada, Reno. ($10,000)	2021
National Scholarship, China. (CNY 8,000)	2015

Honors & Awards

College of Science Outstanding Graduate Assistant Award, University of Nevada, Reno.	2025
College Graduate Excellence Award of Shanghai City, China.	2020
Excellent Student Award of Shanghai University, China.	2018
Third Prize in the 15th China Post-Graduate Mathematical Contest in Modeling, China.	2018
Outstanding Graduate Award of Henan Province, China.	2017
"Three Good Students" Award of General Higher Education in Henan Province.	2016
Second Prize in the Sixth National College Mathematics Competition, China.	2014

PRESENTATIONS

Oral Presentations

- X.X. Wang, Grassmannian Methods for Visual and Single-Cell Data, Joint Mathematics Meetings (JMM 2026), Washington, January 4-7, 2026.
- X.X. Wang, Color Image and Video Recognition Based on Quaternionic Grassmannians, 2025 SIAM Great Lakes Section Annual Meeting, Chicago, September 27-28, 2025
- X.X. Wang, Quaternion Grassmannians for Color Image Set Recognition, Joint Mathematics Meetings (JMM 2025), Seattle, January 8-11, 2025.
- X.X.Wang, Some Properties of Geodesic Triangles in Grassmannians, The 2024 Workshop Matrices and

Operators (MAO 2024), Reno, USA, June 14-17, 2024.

- X.X.Wang, Some Inequalities of Geometric Means in Grassmannians, Joint Mathematics Meetings (JMM 2024), San Francisco, January 3-6, 2024.
- X.X. Wang, Geometric means and their properties of Grassmannians, The 10th International Conference on Matrix Analysis and Applications (ICMAA), Kunming, China, August 15-18, 2023.
- X.X. Wang, Geometric means and their properties of Grassmannians, International Workshop on Matrix Analysis and Its Applications, Quynhon, Vietnam, July7-8, 2023.
- X.X. Wang, Arnoldi method for right eigenvalue problem of the large-scale quaternion matrices, Joint Mathematics Meetings (JMM 2023), Boston, January 4-7, 2023.
- X.X. Wang, Arnoldi method for right eigenvalue problem of the large-scale quaternion matrices, Joint Mathematics Meetings (JMM 2022), Seattle, January 5-8, 2022, postponed due to COVID-19 and held virtually, April 6-9, 2022.

Poster presentations

- X.X.Wang, Some Inequalities of Geometric Means in Grassmannians, 6th Annual GSA Poster Symposium. 2023.

CONFERENCES ATTENDED

1. Co-organizer, Special Session on Matrix Analysis and Its Applications, Joint Mathematics Meetings (JMM 2026), Washington, January 4-7, 2026.
2. 2025 SIAM Great Lakes Section Annual Meeting, Chicago, September 27-28, 2025.
3. The 2025 Workshop on Matrices and Operators (MAO 2025) will be held at the University of Regina, Canada, August 19-21, 2025. (Upcoming)
4. Volunteer, The Association of Mathematics Teacher Educators (AMTE) 2025 Annual Conference, Grand Sierra Resort, Reno, NV, February 6–8, 2025.
5. Chair, Special Session on Matrix Analysis and Its Applications, Joint Mathematics Meetings (JMM 2025), Seattle, January 8-11, 2025.
6. The International Conference "Recent Progress in Operator Theory and Its Applications", Research Institute for Mathematical Sciences (RIMS), Kyoto University, Japan, November 6–8, 2024 (Virtual).
7. The 2024 Workshop Matrices and Operators (MAO 2024), Reno, USA, June 14-17, 2024.
8. Western Canada Linear Algebra Meeting (WCLAM), Calgary, Canada, May 25-26, 2024 (Virtual).
9. 2024 NSHE Corequisite Conference, Carson City, USA, April 25-26, 2024.
10. Joint Mathematics Meetings (JMM 2024), San Francisco, January 3-6, 2024.
11. The 10th International Conference on Matrix Analysis and Applications (ICMAA), KunMing, China, August 15-18, 2023 (Virtual).
12. International Workshop on Matrix Analysis and Its Applications, Quynhon, Vietnam, July 7-8, 2023 (Virtual).
13. Joint Mathematics Meetings (JMM 2023), Boston, January 4-7, 2023.
14. International Conference on Matrix Theory with Applications (ICMTA), Jeju, Korea, December 1-5, 2022 (Virtual).
15. Second international workshop on Matrix Theory and Applications, hosted by the Departments of Mathematics: AKFA University-Uzbekistan, Sukkur IBA University-Pakistan, Naresuan University-Thailand and Bukhara State University-Uzbekistan, November 15-17, 2022 (Virtual).
16. International Workshop on Matrix Analysis and Its Applications (MAA 2022), Quy Nhon, Viet Nam, June 4, 2022

(Virtual).

17. Joint Mathematics Meetings (JMM 2022), Seattle, January 5-8, 2022, postponed due to COVID-19 and held virtually April 6-9, 2022.

18. The First NU-SIBAU International Workshop on Matrix Theory and Its Applications, hosted by the Department of Mathematics at Sukkur IBA University, Pakistan and the Department of Mathematics at Naresuan University, Thailand, October 15-17, 2021 (Virtual).

19. The 2021 China-Korea International Conference on Matrix Theory with Applications & the 6th International Workshop on Matrix Inequalities and Matrix Equations (IRCTMT-AORC Joint Meeting & MIME 2021), Hainan Normal University, Hainan, China, and Shanghai University, China, November 26-27, 2021 (Virtual).

PROFESSIONAL ORGANIZATION MEMBERS

Member, Phi Kappa Phi Honor Society
Member, American Mathematical Society (AMS).
Member, International Linear Algebra Society (ILAS).

TEACHING EXPERIENCE

Instructor, Michigan State University   Fall 2025
Course: Mathematics-Assisted AI and AI-Inspired Mathematics
Responsibilities: Delivered four lectures on advanced topics including manifold theory and quaternionic Grassmannians as part of a multi-instructor course.

Instructor of Record, University of Nevada, Reno   Winter 2023, Summer 2023, Spring 2024
Course: Math 127 Precalculus II
Responsibilities: Developed and delivered two weekly 75-minutes lectures (over 100 students) and five weekly 3-hours lectures (20-30 students) in winter and summer semesters to non-majors from diverse backgrounds. Conducted instruction, setted up assignments and exams, evaluated performance, and submitted final grades.

Instructor of Record, University of Nevada, Reno   Fall 2023
Course: Math 126E Precalculus I Expanded
Responsibilities: Designed and conducted five weekly 50-minutes lectures to new undergraduate students. Enhanced student engagement by implementing an encouragement and class bonus system.

Instructor of Record, University of Nevada, Reno   Summer 2023, Fall 2024, Spring 2025, Summer 2025
Course: Math 176 Introductory Calculus for Business and Social Sciences
Responsibilities: Delivered lectures focused on fundamental calculus concepts tailored to business students, emphasizing real-world applications in economics, finance, and social sciences. Designed assignments and exams that applied calculus to business scenarios, evaluated student performance, and provided comprehensive feedback.

Teaching Assistant, University of Nevada, Reno   Fall 2022, Spring 2023
Course: Math 126 Precalculus I
Responsibilities: Overseeing instruction and evaluating quizzes

Teaching Assistant, University of Nevada, Reno   Spring 2022
Course: Math 176 Introductory Calculus for Business and Social Sciences
Responsibilities: Overseeing instruction and evaluating quizzes

Grader, University of Nevada, Reno   Fall 2021, Fall 2023

Course: Theory of Positive Integers

Responsibilities: Evaluating assignments for Professor Raúl Rojas González, a distinguished faculty member known for his expertise in number theory.

PEDAGOGICAL TRAINING

Seminar in Teaching Mathematics and Statistics   Fall 2022

University of Nevada, Reno

This course is designed to prepare graduate students for success as teaching assistants in mathematics and statistics. The activities, discussions, and work are designed to be useful and practical during the first semester of teaching and beyond.

2024 NSHE Corequisite Conference   April 25-26, 2024

Western Nevada College Carson City, USA

This conference provided a platform for educators to reflect on and celebrate their achievements, strengthen professional relationships, and expand their networks.