

# Shizhou Xu

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## Research Interests

- **Mathematics:** Probability theory, optimal transport, stochastic dynamical systems, ergodic theory, mathematics of data science, mathematical foundation of machine learning.
- **Statistics:** Mathematical statistics, high-dimensional statistics, causal inference.
- **Mathematics of Data Science and Machine Learning:** Fairness, privacy, robustness, generalizability, explainable AI, AI4science, and machine unlearning.

## Education

2021–2024	PhD in Applied Mathematics	University of California, Davis (UC Davis)
	Dissertation: <i>Fairness in Machine Learning via Optimal Transport</i>	
	Advisor: Prof. Thomas Strohmer	
	Key Achievements: Solved three open problems in machine learning fairness, as listed by NeurIPS 2022, using optimal transport theory.	
2016–2018	MSc in Mathematics	New York University (NYU)
2013–2016	BA in Mathematics, BA in Economics	Emory University
	Graduated with Honors, Dean's List (2013-2016)	

## Employment History

Present	Postdoctoral Scholar	UC Davis
	Advisor: Prof. Thomas Strohmer	
	Contributed as Co-PI to the NSF Award (2027248) on <i>A Mathematical Framework for Generating Synthetic Data</i>	
2022–2024	Graduate Student Researcher	UC Davis
	Contributed to the NSF TRIPODS project on <i>Mathematics of Data Science</i> .	
2021–2023	Teaching Assistant	UC Davis
	Courses: Vector Analysis, Linear Algebra, Calculus	
2019–2021	Graduate Research Assistant	NYU
	Research focusing on Stochastic dynamical systems, optimal transport, and graph theory with applications in large-scale networks.	

## Publications

### JOURNAL ARTICLES

2024

- Shizhou Xu, Thomas Strohmer. “WHOMP: Improving Upon Randomized Controlled Trials via Wasserstein Homogeneity,” *Annals of Statistics*, under review.
- 2023 Shizhou Xu, Thomas Strohmer. “On the (In)Compatibility between Individual and Group Fairness,” *SIAM Journal on Mathematics of Data Science (SIMODS)*, under review.
- 2023 Shizhou Xu, Thomas Strohmer. “Fair Data Representation for Machine Learning at the Pareto Frontier,” *Journal of Machine Learning Research (JMLR)*, 24 (2023), 1-63.

#### PREPRINTS

- 2024 Shizhou Xu, Yuan Ni. “Feature Extraction and Link Prediction via Regular Partition,” in preparation.
- 2020 Shizhou Xu, Quanyan Zhu. “State-Driven Dynamic Graphon Model,” *arXiv:2011.0076*.

### Conference Presentations

- 2024 “Fair Data Representation for Machine Learning at the Pareto Frontier,” *International Conference on Machine Learning 2024 (ICML 2024)*.
- 2022 “Fair Data Representation for Machine Learning,” *SIAM Conference on Mathematics of Data Science 2022 (MDS22)*.

### Invited Talks

- 2024 “Fair Data Representation for Machine Learning at the Pareto Frontier,” *Computational Harmonic Analysis in Data Science and Machine Learning*, Casa Matemática Oaxaca & Banff International Research Station.
- 2023 “Fair Data Representation for Machine Learning at the Pareto Frontier,” *Explainable AI for the Sciences Workshop*, Institute for Pure & Applied Mathematics, University of California Los Angeles (UCLA).
- 2022 “Fairness in Machine Learning,” *Inclusivity, Equity, and Ethics in Research and Data Science*, UC Davis.

### Teaching Experience

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| 2022 | Teaching Assistant, <i>Vector Analysis</i> , Winter Quarter              | UC Davis |
| 2022 | Teaching Assistant, <i>Vector Analysis</i> , Fall Quarter                | UC Davis |
| 2022 | Teaching Assistant, <i>Linear Algebra</i> , Summer Session               | UC Davis |
| 2022 | Teaching Assistant, <i>Calculus I</i> , Spring Quarter                   | UC Davis |
| 2021 | Teaching Assistant, <i>Vector Analysis</i> , Winter Quarter              | UC Davis |
| 2019 | Recitation Leader, <i>Mathematics for Economics II</i> , Spring Semester | NYU      |
| 2017 | Recitation Leader, <i>Mathematics for Economics II</i> , Fall Semester   | NYU      |
| 2017 | Recitation Leader, <i>Mathematics for Economics I</i> , Spring Semester  | NYU      |

### Awards and Honors

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|-----------|----------------------------|----------|
| 2024      | Yueh-Jing Lin Scholarship  | UC Davis |
| 2023–2024 | Co-PI of NSF Award 2027248 | UC Davis |

2022–2024	Supported by NSF TRIPODS Grant	UC Davis
2022	Long Program Fellowship, Institute for Pure & Applied Mathematics	UCLA
2021–2022	Mathematics Department Fellowship	UC Davis
2019–2021	School of Engineering Scholarship	NYU
2013–2016	Emory Dean’s List	Emory

## Service and Professional Activities

### JOURNAL REVIEWER

present	<i>SIAM Journal on Mathematics of Data Science</i>
present	<i>Journal of the European Optical Society</i>

### CONFERENCE REVIEWER

2024	<i>NeurIPS 2024</i>
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### SEMINAR (CO-)ORGANIZER

2024–2025	<i>Mathematics of Data and Decisions Seminar</i> (MADDD), UC Davis
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### WORKSHOP CHAIR

2022	Machine Learning Session I, <i>SIAM Conference on Mathematics of Data Science</i> .
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## Industry Experience

2023	Summer Associate (Quantitative Strategy)	Goldman Sachs
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## Technical Skills

- Programming Languages: Python (PyTorch, Numpy, Scipy, Pandas), MATLAB, L<sup>A</sup>T<sub>E</sub>X
- Libraries/Frameworks: PyTorch, Pandas, Matplotlib