Jiayi (Joanna) Li

Contact Information

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Brief Bio

I am a dissertation-year Ph.D. candidate specializing in mathematical machine learning. I enjoy investigating connections between numerical algebraic geometry and the representation and optimization of neural networks. In the long term, I aim to develop innovative and powerful mathematical and statistical tools for machine learning theory. Currently, I serve as the Editor-in-Chief (2022 -) of the Association for Computing Machinery (ACM) XRDS Magazine.

Education

University of California, Los Angeles, CA, USA
Ph.D. Statistics, 2019 - 2024
Mathematical Machine Learning, Algebraic Statistics
Thesis advisor: Guido Montúfar

The University of Hong Kong & **Stony Brook University, New York, USA**
B.S. (Pure) Mathematics, 2018
Algebraic Geometry
Thesis advisor: Robert Lazarsfeld

Research Experience

Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG)
Dresden, Germany (Host: Prof. Heather Harrington)
Postdoctoral Scholar, 01/2025 -

Institute for Pure & Applied Mathematics (IPAM)
Los Angeles, CA, USA
Graduate Fellow, *Long Program: Mathematics of Intelligences*, 09/2024 - 12/2024

Simons Institute for the Theory of Computing
Berkeley, CA, USA
Short-Term Visitor, *Modern Paradigms in Generalization*, 11/2024 - 12/2024
Short-Term Visitor, *Summer Cluster: Deep Learning Theory*, 08/2022

St John's College, University of Oxford
Oxford, UK
Short-Term Visitor, *Workshop for Women in Algebraic Statistics*, 07/2024

Institute for Mathematical & Statistical Innovation (IMSI)
Chicago, IL, USA
Short-Term Visitor, *Learning Collective Variables and Coarse Grained Models*, 04/2024
Long-Term Visitor, *Algebraic Statistics and Our Changing World*, 09/2023 - 12/2023

Max Planck Institute for Mathematics in the Sciences (MPI MiS)
Leipzig, Germany (Host: Prof. Guido Montufar)
Visiting Researcher, *Mathematical Machine Learning*, 07 - 09/2023, 07 - 08/2024

University of California, Los Angeles (UCLA)
Los Angeles, CA, USA
Graduate Researcher, *Mathematical Machine Learning*, 09/2019 - 03/2025

Caltech
Pasadena, CA, USA (Collaborator: Prof. Matt Thomson)
Pre-doctoral Researcher, *Mathematical Machine Learning*, 09/2018 - 06/2019

Stony Brook University
Stony Brook, NY, USA
Undergraduate Researcher, *Algebraic Geometry*, 09/2017 - 06/2018

Teaching Experience

Teaching Summary:
Instructor/TA 28 times for 8 courses/training programs, with 1000+ students enrolled in-person and/or online, at UCLA (MSOL, Statistics) and University of Oxford.

Fall 2024, Teaching Fellow, UCLA MSOL
28. ENGR 205 - Model-Based Systems Engineering
Instructor: Dr. Myron J. Hecht (Aerospace Corporation)

Fall 2024, Instructor, UCLA Department of Statistics
27. Maths Camp for Master of Applied Statistics & Data Science (MASDS) Program

Summer 2024, Teaching Fellow, UCLA MSOL
26. ENGR 203 - System Architecture
Instructor: Dr. Steven J. Silverman (Northrop Grumman)
25. ENGR 116 - Statistics for Management Decisions
Instructor: Dr. Alireza Mehrnia

Summer 2024, Teaching Assistant, University of Oxford
24. Oxford Machine Learning Summer School
Instructor: Dr. Mihaela van der Schaar (University of Cambridge)

Spring 2024, Teaching Associate, UCLA MSOL
23. ENGR 202 - Reliability, Maintainability, and Supportability
Instructor: Dr. Myron J. Hecht

Winter 2024, Teaching Associate, UCLA MSOL
22. ENGR 200 - Program Management Principles for Engineers and Professionals
Instructors: Dr. Jay F. Chance (Boeing), Dr. Leslie M. Lackman

Fall 2023, Teaching Associate, UCLA MSOL
21. ENGR 205 - Model-Based Systems Engineering
Instructor: Dr. Myron J. Hecht

Fall 2023, Instructor, UCLA Department of Statistics
20. Maths Camp for Master of Applied Statistics & Data Science (MASDS) Program

Summer 2023, Teaching Associate, UCLA MSOL
19. ENGR 203 - System Architecture
Instructor: Dr. Steven J. Silverman
18. ENGR 116 - Statistics for Management Decisions
Instructor: Dr. Alireza Mehrnia

Spring 2023, Teaching Associate, UCLA MSOL
17. ENGR 202 - Reliability, Maintainability, and Supportability
Instructor: Dr. Myron J. Hecht

Winter 2023, Teaching Associate, UCLA MSOL
16. ENGR 200 - Program Management Principles for Engineers and Professionals
Instructor: Dr. Jay F. Chance

Fall 2022, Teaching Associate, UCLA MSOL
15. ENGR 205 - Model-Based Systems Engineering
Instructor: Dr. Myron J. Hecht

Fall 2022, Instructor, UCLA Department of Statistics
14. Maths Camp for Master of Applied Statistics (MAS) Program

Summer 2022, Teaching Associate, UCLA MSOL
13. ENGR 203 - System Architecture
Instructor: Dr. Steven J. Silverman

Spring 2022, Teaching Associate, UCLA MSOL
12. ENGR 202 - Reliability, Maintainability, and Supportability
Instructor: Dr. Myron J. Hecht

Winter 2022, Teaching Associate, UCLA MSOL
11. ENGR 200 - Program Management Principles for Engineers and Professionals
Instructor: Dr. Leslie M. Lackman

Fall 2021, Teaching Associate, UCLA MSOL
10. ENGR 205 - Model-Based Systems Engineering
Instructor: Dr. Myron J. Hecht

Fall 2021, Instructor, UCLA Department of Statistics
9. Maths Camp for Master of Applied Statistics (MAS) Program

Summer 2021, Instructor, UCLA Department of Statistics
8. STATS 13 DIS 2A/2B - Intro to Statistical Methods for Life and Health Sciences

Summer 2021, Teaching Associate, UCLA MSOL
7. ENGR 203 - System Architecture
Instructor: Dr. Steven J. Silverman

Spring 2021, Teaching Associate, UCLA MSOL
6. ENGR 202 - Reliability, Maintainability, and Supportability
Instructor: Dr. Myron J. Hecht

Winter 2021, Teaching Associate, UCLA MSOL
5. ENGR 200 - Program Management Principles for Engineers and Professionals
Instructor: Dr. Leslie M. Lackman

Fall 2020, Teaching Assistant, UCLA MSOL
4. ENGR 205 - Model-Based Systems Engineering
Instructor: Dr. Myron J. Hecht

Summer 2020, Teaching Assistant, UCLA MSOL
3. ENGR 116 - Statistics for Management Decisions
Instructors: Dr. Hamed Mamani (University of Washington), Dr. Lara Dolecek

Spring 2020, Teaching Assistant, UCLA MSOL

2. ENGR 202 - Reliability, Maintainability, and Supportability
Instructor: Dr. Myron J. Hecht

Winter 2020, Teaching Assistant, UCLA MSOL
1. ENGR 200 - Program Management Principles for Engineers and Professionals
Instructor: Dr. Vandana Mangal

Invited Talks

12. Joint Mathematics Meetings (JMM) 2025
AMS-ASA-SIAM Special Session on Mathematics of Deep Learning: A High-Dimensional Probability Perspective
01/11/2025, Seattle, WA, USA
"Algebro-geometric Approaches to Optimization and Generalization in Mathematical Machine Learning"

11. 2024 UC Davis Peter Hall Conference on Statistics in the Age of AI
11/09/2024, Davis, CA, USA
"Optimization in Polynomial Neural Networks: Insights from Algebraic Geometry"

10. Algebraic Geometry and Machine Learning Workshop, SIAM Conference on Mathematics of Data Science
10/25/2024, Atlanta, GA, USA
"Geometry of Polynomial Neural Networks"

9. Women in Algebraic Statistics Workshop, St John's College, University of Oxford
07/12/2024, Oxford, UK
"Algebraic Structures in Terminal Phase of Neural Network Training"

8. Numerical Analysis Seminar, Institute of Mathematical Research/Dept. of Maths, The University of Hong Kong
04/30/2024, Hong Kong
"Geometry of Polynomial Neural Networks"

7. Special Session: Applications of Algebra and Geometry, AMS 2024 Spring Central Sectional Meeting
04/20/2024, Milwaukee, WI, USA
"An Algebraic Approach to Supply Network Formation and Fragility"

6. Dept. of Mathematics and Statistics, University of Mass. Amherst
04/12/2024, Online
"Geometry of Polynomial Neural Networks"

5. Level Set Seminar (led by Prof. Stanley Osher), Dept. of Maths, UCLA
04/08/2024, Los Angeles, CA, USA
"Geometry of Polynomial Neural Networks"

4. Applied Algebra Seminar, Dept. of Maths, University of Wisc. Madison
12/2023, Madison, WI, USA
"Geometry of Polynomial Neural Networks"

3. Institute for Mathematical and Statistical Innovation (IMSI)
10/2023, Chicago, IL, USA
"Algebraic Structures in Terminal Phase of Neural Network Training"

2. Deep Learning Theory Seminar, UCLA
09/2023, Los Angeles, CA, USA
"Neural Collapse Beyond Unconstrained Feature Models"

1. SCISS, UCLA
07/2023, Los Angeles, CA, USA
"Mathematical Machine Learning: Theory & Beyond"

Academic and Community Services

Joint Mathematics Meetings (JMM) 2025
1/8/2025 - 1/11/2025, Seattle, WA, USA
AMS Special Session on Algebraic Methods in Machine Learning and Optimization
Organizers: **Jiayi Li*** (UCLA, USA), Guido Francisco Montufar (MPI MiS, Germany), Yulia Alexandr (UCLA, USA), Julia Lindberg (UT Austin, USA)

Association for Computing Machinery (ACM) XRDS Magazine
Editor-in-Chief, 2022 - present
Lead Editor, Digital Content Editor, 2021
Feature Editor, 2020

Reviewer
ICML, ICLR, Algebraic Statistics

Outreach
Distinguished Women in Statistics and Data Science Workshop Series 1st (Women in Academia, 05/23/2023), 2nd Symposium (Women in Industry, 10/17/2023)
UCLA Society of Women in Statistics (Chair, 2022 -)
UCLA Statistics Club (Mentor, 2022 -)
Rotary Club, Westwood Village, CA (Invited Speaker, 09/07/2023)
UCLA Bruin Professionals, Westwood, CA (Invited Speaker, 05/16/2024)
Dublin High School, Dublin, CA (Invited Speaker, 10/25/2024)

Selected Publications

Working Papers
4. **Jiayi Li**, Angélica Torres, Guido Montufar. "*Critical Points of Rational Neural Networks and Landscape Properties*".
3. Jane Coons, Nataliia Kushnerchuk, **Jiayi Li**, Sarah Lumpp, Janike Oldekop, Elina Robeva. "*Parameter Identification in Discrete Lyapunov Models*".
2. **Jiayi Li**, Guido Montufar. "*Optimization Landscape of Extended Unconstrained Feature Model*".
1. **Jiayi Li**, Jose Israel Rodriguez. "*An Algebraic Approach to Supply Network Formation and Fragility*".

Research Publications
7. Yulia Alexandr, Miles Bakenhus, Mark Curiel, Sameer K. Deshpande, Elizabeth Gross, Yuqi Gu, Max Hill, Joseph Johnson, Bryson Kagy, Vishesh Karwa, **Jiayi Li**, Hanbaek Lyu, Sonja Petrović, Jose Israel Rodriguez. "*New Directions in Algebraic Statistics: Three Challenges from 2023*", Algebraic Statistics.
6. Kaie Kubjas, **Jiayi Li**, Maximillian Wiesmann. "*Geometry of Polynomial Neural Networks*", Algebraic Statistics.
5. Shuang Liang, Renata Turkes, **Jiayi Li**, Nina Otter, Guido Montufar. "*Pull-back Geometry of Persistent Homology Encodings*", Transactions on Machine Learning Research (TMLR), 2024.
4. **Jiayi Li**, Yuantong Li, Xiaowu Dai. "*Discussion: Estimating Means of Bounded Random Variables by Betting" by Waudby-Smith and Ramdas*", Journal of the Royal

Statistical Society: Series B (JRSSB), 2023.
3. Dejun Guo, Xu Jin, Dan Shao, **Jiayi Li**, Yang Shen, Huan Tan. "*Image-Based Regulation of Mobile Robots without Pose Measurements*", IEEE Control Systems Letters (L-CSS), vol. 6, pp. 2156-2161, 2022.
2. Guruprasad Raghavan, **Jiayi Li**, and Matt Thomson. "*Geometric Algorithms for Predicting Resilience and Recovering Damage in Neural Networks*", preprint.
1. Ziqi Huang, Yang Shen, **Jiayi Li**, Marcel Fey, Christian Brecher. "*A Survey on AI-Driven Digital Twins in Industry 4.0: Smart Manufacturing and Advanced Robotics*", Sensors, 2021.

Editorial Articles

10. **Jiayi Li**, "*Advice: Navigating the Academic Path: Insights from Professor Jens Palsberg*". XRDS 31, 1 (Fall 2024), pp. 10-11, 2024.
9. **Jiayi Li**, "*Letter from the Editors: Exploring the Frontiers of Machine Learning in Education*". XRDS 31, 1 (Fall 2024), pp. 5-5, 2024.
8. Jasmine Lu, **Jiayi Li**, "*Technology is Not Neutral: Locating Sites of Resistance as Computing Students*". XRDS 30, 4 (Summer 2024), pp. 5-6, 2024.
7. **Jiayi Li**, Konstantin Klemmer, "*Unveiling Patterns of the Earth through Machine Learning and Geospatial Analysis*". XRDS 30, 3 (Spring 2024), pp. 32-33, 2024.
6. **Jiayi Li**, "*Letter from the Editors: Join Our Team: A Unique Opportunity for Aspiring Computer Science Students*". XRDS 30, 3 (Spring 2024), pp. 5-6, 2024.
5. **Jiayi Li**, "*Code of Life: Unraveling Biological Mysteries through Computational Innovation*". XRDS 30, 2 (Winter 2023), pp. 5-6, 2024.
4. **Jiayi Li**, "*Computational Creativity: Bridging Art and Computer Science*". XRDS 29, 4 (Summer 2023), pp. 5-6, 2023.
3. **Jiayi Li**, "*Letter from the Editors: Looking Ahead, 2023 and Beyond*". XRDS 29, 2 (Winter 2022), pp. 5-6, 2023.
2. **Jiayi Li**, Karan Ahuja, "*Making with a Sustainable Purpose: an Interview with Matthew L. Mauriello*". XRDS 27, 4 (Summer 2021), pp. 38-41, 2021.
1. **Jiayi Li**, Yingfei Wang, "*An Interview with Owen McCall from TREECYCLE*". XRDS 27, 4 (Summer 2021), pp. 42-45, 2021.

Honors, Awards and Grants

Dimitris N. Chorafas Foundation Award (*as 1 of 31 awardees globally*), 2024
Dissertation Year Fellowship, UCLA, 2024
Distinguished Teaching Assistant Award Nominee of Statistics/MSOL, UCLA, 2024
Travel Grant, St John's College, University of Oxford, 2024
Travel Grant, Statistics in the Age of AI, Washington, DC, 2024
Travel Grant, MPI-CBG, 2024
Travel Grant, Institute for Mathematical and Statistical Innovation (IMSI), 2023, 2024
Travel Grant, Simons Institute for the Theory of Computing, Berkeley, CA, USA, 2022
Travel Grant, Algebraic Statistics Conference, Honolulu, HI, USA, 2022
Summer Mentored Research Fellowship, UCLA, 2022
Travel Grant, International Conference on Machine Learning (ICML), 2020, 2021
Travel Grant, International Conference on Learning Representation (ICLR), 2020, 2021
ACM-W Scholarship, Association of Computing Machinery, 2020
Cathay Bank Scholarship, 2020
Travel Grant, PyData LA, 2019
William Lowell Putnam Competition, SBU University Team, 2017, 2018
Travel Grant, MSRI (now SLMath), 2017
Overseas Research Fellowship, HKU, 2016
Undergraduate Research Fellowship, HKU, 2015

Memberships

American Statistical Association (ASA)

Institute of Mathematical Statistics (IMS)
Association for Computing Machinery (ACM)