Jiayi (Joanna) Li

CONTACT INFORMATION

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RESEARCH INTERESTS

I am broadly interested in theory and applications of statistical machine learning and optimization. Other interests include algebraic statistics and manifold learning.

EDUCATION

University of California Los Angeles, Los Angeles, CA
Ph.D. Statistics, September 2019 - present
Concentrated on **theory of machine learning**
Summer School, Mathematics, June 2016 - August 2016
Exchange, Mathematics, September 2015 - December 2015

Stony Brook University, Stony Brook, NY
B.S. Mathematics, September 2016 - May 2018

The University of Hong Kong, Hong Kong, China
B.Sc. Mathematics, September 2013 - August 2015

HONORS AND AWARDS

University of California Los Angeles
Summer Mentored Research Fellowship, 2022
ACM-W Scholarship, 2020
Cathay Bank Scholarship, 2020
Stony Brook University
William Lowell Putnam Competition, school team, 2017, 2018
MSRI Travel Fund, 2017
The University of Hong Kong
Overseas Research Fellowship, 2016
Research Open House Competition Prize, Faculty of Science, 2015
Undergraduate Research Fellowship, 2015

PUBLICATIONS

Journal Papers

[JP5] Shen, Y.†, Huang, Z.†, **Li, J.**, Fey, M., Brecher, C. "*A Survey on AI-Driven Digital Twins in Intelligent Infrastructure: Energy, Smart City, and Healthcare*," Sensors, pp. 1-24.
https://www.mdpi.com/1424-8220/21/19/6340

[JP4] Guo, D., Jin, X., Shao, D., **Li, J.**, Shen, Y., Tan, H. "*Image-Based Regulation of Mobile Robots without Pose Measurements*", IEEE Control Systems Letters (L-CSS), vol. 6, pp. 2156-2161, 2022
https://doi.org/10.1109/LCSYS.2021.3139288

[JP3] Huang, Z.†, Shen, Y.†, **Li, J.**, Fey, M., Brecher, C. "*A Survey on AI-Driven Digital Twins in Industry 4.0: Smart Manufacturing and Advanced Robotics*," Sensors. 2021; 21(19): 6340.
https://doi.org/10.3390/s21196340

[JP2] **Li, J.** and Wang, Y. "*An Interview with Owen McCall from TREECYCLE*". XRDS 27, 4 (Summer 2021), pp. 42-45, 2021.
https://doi.org/10.1145/3466892

[JP1] **Li, J.** and Ahuja, K. "*Making with a Sustainable Purpose: an Interview with*

Matthew L. Mauriello". XRDS 27, 4 (Summer 2021), pp. 38-41, 2021. https://doi.org/10.1145/3466888

Preprints

[PR1] Raghavan, G., **Li, J.**, and Thomson, M. "*Geometric Algorithms for Predicting Resilience and Recovering Damage in Neural Networks*", arXiv, 2020.

Workshop Posters

[WP3] Raghavan, G., **Li, J.**, and Thomson, M. "*Employing Geometry for Rescuing Neural Networks*", Southern California Machine Learning Symposium (SCMLS), San Diego, CA, 2020.

[WP2] **Li, J.**, Tseran, H., and Montúfar, G. "*Tropical Geometry for Understanding Expressivity of Neural Networks*", Frontiers in Machine Learning for the Physical Sciences, Irvine, CA, 2020.

[WP1] Shen, Y., **Li, J.**, Jung, S., Sun, J., Ma, J., and Rosen, J. "*Providing Assistance to Stroke Patients Using an Intelligent Exoskeleton Robot*", UCLA MAE-IAB Research Open House, Los Angeles, CA, 2019.

Research Experience

University of California Los Angeles 2019-present

Working with Prof. Guido Montúfar on 'learning theory and algebraic statistics'

- Expressive power of deep neural networks
- Linear regions classification
- Tropical geometry applied to classifying network structures
- Implicit bias

Collaborated with Prof. Jacob Rosen on 'reinforcement learning in stroke rehabilitation'

- Intersection of machine learning and robotics
- Modelled stroke recovery with rehabilitation robotics
- Developed reinforcement learning algorithm for upper-limb exoskeleton
- Acknowledged in Shen, Y., Hsiao, B. P., Ma, J., Rosen, J. "*Upper Limb Redundancy Resolution Under Gravitational Loading Conditions: Arm Postural Stability Index Based on Dynamic Manipulability Analysis*", IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS), Birmingham, UK, 2017

Worked with Prof. Peter Petersen on 'differential geometry'

- *"Differential Geometric Approach to the Uniformization Theorem"* (unpublished)
- Differential Geometry/Low-Dimensional Topology/Complex Analysis
- Studied classics in Riemannian Geometry and existing proofs of the Uniformization Theorem
- Studied the properties of Gaussian curvature on low dimensional manifolds

California Institute of Technology 2019-2020

Worked with Prof. Matt Thomson on 'neural network resilience and repair'

University of Hong Kong 2013-2015

Worked on with Prof. Kai Man Tsang on 'number theory'

- *"Generalization of the Factorial Function and its Properties"* (unpublished)
- Analytic number theory
- Generalized analytic functions on real numbers to fields and commutative rings

Directed Studies

Topology, Stony Brook University 2018
Advised by Prof. Dennis Sullivan
- Studied *Three-Dimensional Geometry and Topology* by Williams Thurston
- Elliptic/hyperbolic geometry, geometric structure on manifolds, hyperbolic Dehn surgery

Real Analysis, Stony Brook University 2017
Advised by Prof. Raanan Schul
- Studied *Real Analysis: Modern Techniques and Their Applications* by G. Folland
- Measure theory, Lebesgue integral, and Fourier Analysis

Putnam Competition, Stony Brook University 2017-2018
Advised by Dr. Ljudmila Kamenova
- Trained on problem solving skills toward the Putnam competition
- Competed on the university team

Teaching Experience

Instructor, Department of Statistics, University of California Los Angeles
Math Camp for Master in Applied Statistics students Summer 21, 22

Teaching Associate, MSOL*, University of California Los Angeles
*Ranked #1-2 online graduate engineering programs 2014-2022.
ENGR 200 "*Program Management Principles for Engineers and Professionals*"
Instructors: Leslie Lackman (UCLA), Vandana Mangal (LMU) Winter 20, 21, 22
ENGR 202 "*Reliability, Maintainability, and Supportability*"
Instructor: Myron Hecht (The Aerospace Corporation, UCLA) Spring 20, 21, 22
ENGR 203 "*System Architecture*"
Instructor: Steven Silverman (UCLA) Summer 21, 22
ENGR 205 "*Model-Based System Engineering*"
Instructor: Myron Hecht (The Aerospace Corporation, UCLA) Fall 20, 21, 22
ENGR 116 "*Statistics for Management Decisions*"
Instructors: Hamed Mamani (U Washington), Lara Dolecek (UCLA) Summer 20

Teaching Assistant, Department of Statistics, University of California Los Angeles
STATS 13 "*Intro to Statistical Methods for Life and Health Sciences*"
Instructor: Guani Wu (UCLA) Summer 21

Grader, Department of Statistics, University of California Los Angeles
STATS 10 "*Intro to Statistical Reasoning*"
Instructor: Miles Chen (UCLA) Summer 20

Grader, Mathematics Department, Stony Brook University
MATH 312 "*Applied Algebra*"
Instructor: Giulia Saccà (Columbia U) Spring 17

Conferences and Seminars Attended

[DLT2022†] Deep Learning Theory Workshop and Summer School 08/01-08/05, 2022
[AS2022†] Algebraic Statistics Conference 2022 05/16-05/20, 2022
[LMS2022†] LMS Invited Lecture Series 2022: The Mathematics of Deep Learning 02/28-03/04, 2022
[BIRS2021†] Banff International Research Station Workshop: Geometry & Learning from Data 10/24-10/29, 2021
[AbstractionFall2020†] Conceptual Abstraction and Analogy in Natural and Artificial Intelligence, AAAI Fall Symposium Series 11/13-11/14, 2020
[DeepMath2020†] Mathematical Theory of Deep Neural Network 11/05-11/06, 2020

[UC Irvine†] Frontiers in Machine Learning for the Physical Sciences	10/26, 2020
[brain-ai.jp†] International Symposium on AI and Brain Science	10/10-10/12, 2020
[MDCCSA†] IAS Missing Data Challenges in Computation, Statistics and Applications	09/08-09/11, 2020
[Bernoulli-IMS 2020†] Bernoulli-IMS One World Symposium 2020	08/24-08/28, 2020
[DSHEALTHKDD 2020†] KDD Workshop on Healthcare	08/24, 2020
[KDD 2020†] ACM Conf. on Knowledge Discovery & Data Mining	08/23-08/27, 2020
[Simons Institute for the Theory of Computing†] Probability, Geometry, and Computation in High Dimensions Boot Camp	08/19-08/28, 2020
[CMI-HIMR 2020†] Clay Mathematics Institute-Heilbronn Institute for Mathematical Research Integrable Probability Summer School	07/27-07/31, 2020
[MSML 2020†] Mathematical and Scientific Machine Learning	07/20-07/24, 2020
[ICML 2020†] 37^{th} International Conference on Machine Learning	07/12-07/18, 2020
[COLT 2020†] 33^{rd} International Conference on Learning Theory	07/09-07/12, 2020
[STOC 2020†] Theoretical Computer Science (TCS) Workshop	06/25, 2020
[Algebraic Statistics 2020†] Mini Algebraic Statistics Conference	06/22-06/26, 2020
[MSRI†] Optimal Transport and Applications to ML and Statistics	05/04-05/08, 2020
[ICLR 2020†] International Conference on Learning Representations	04/26-05/01, 2020
[MPI MIS + UCLA†] Math Machine Learninig Seminar Series	04/01-11/03, 2020
[Simons Institute for the Theory of Computing] Foundations of Deep Learning, Berkeley, CA	05/23-08/09, 2019
[IPAM] Geometry and Learning from Data in 3D and Beyond	03/11-06/14, 2019
[SOCAMS 2019] Southern Calif. Applied Mathematics Symposium	04/27, 2019
[SCMLS 2019] Southern Calif. Machine Learning Symposium	03/15, 2019
[MSRI] Geometry and Probability in High Dimensions, Berkeley, CA	08/17-08/18, 2017
[AGNES] Algebraic Geometry Northeastern Series, Stony Brook, NY	04/21-04/23, 2017

Editorship

ACM XRDS

Co Editor-in-Chief	2022 - present
Lead Editor	Summer 2021
Feature Editor	2020 - 2022

Grants Awarded

University of California Los Angeles

Simons Institute for the Theory of Computing Travel Grant	2022
Algebraic Statistics Travel Grant	2022
WiML ICML Registration Fee Grant	20,21
WiML ICLR Registration Fee Grant	20,21
PyData LA Registration Fee Grant	2019

Stony Brook University

MSRI Travel Fund	2017

Univeristy of Hong Kong

Overseas Exchange Travel Fund	2015

Programming Languages

Proficient: Python, R, LaTeX
Familiar: C++, Java, MATLAB

Professional Memberships

ACM

References

Available upon request.