Yi Sun

CONTACT INFORMATION	Address:	Department of Statistics, The University of Chicago, Chicago, IL 60637.
	Email:	`yisun@statistics.uchicago.edu`
	Webpage:	`yisun.io`

RESEARCH	Probability and applications to machine learning and high-dimensional statistics.

EMPLOYMENT	**The University of Chicago**	Chicago, IL
	Assistant Professor (tenure-track), 2020–present.	
	Columbia University	New York, NY
	Joseph F. Ritt Assistant Professor, 2019–2020; Simons Fellow, 2016–2019.	

EDUCATION	**Massachusetts Institute of Technology**	Cambridge, MA
	Ph.D., Mathematics, advised by Pavel Etingof, 2011–2016.	
	University of Cambridge	Cambridge, UK
	M.A.St., Mathematics, with distinction, 2010–2011.	
	Harvard University	Cambridge, MA
	A.M., Mathematics, 2006–2010.	
	A.B., Mathematics, *magna cum laude*, with secondary field in Economics, 2006–2010.	
	Phi Beta Kappa (one of 24 juniors inducted)	

GRANTS FELLOWSHIPS AND AWARDS

NSF Grant DMS-2054838, 2021–2024. ($238,603, Highly Recommended)
NSF Grant DMS-1701654/2039183, 2017–2021. ($141,999, Highly Recommended)
Simons Junior Fellowship, 2016–2019. ($364,214)
Open Philanthropy Project Grant, 2019. ($10,000, co-PI)
NSF Mathematical Sciences Postdoctoral Research Fellowship, 2016–2019 (declined).
Johnson Prize for best research paper by MIT graduate student in mathematics, 2016.
NSF Graduate Research Fellowship, 2012–2015.
Churchill Scholarship, 2010–2011. / MIT Praecis Presidential Fellowship, 2011–2012.
COMAP Math Contest in Modeling, Outstanding Winner, SIAM Prize, 2008 and 2009.
Intel Science Talent Search, 2nd Place, 2006. / Putnam Competition, 10th Place, 2009.
Int'l Math Olym., Silver Medal, 2006. / Asian Pacific Math Olym., Gold Medal, 2005.
Int'l Physics Olympiad, Gold Medal, 2004. / USA Computing Olympiad, Finalist, 2005.

MATHEMATICS AND STATISTICS RESEARCH

21. *Maximum likelihood for high-noise group orbit estimation and single-particle cryo-EM* (with Z. Fan, R. Lederman, T. Wang, and S. Xu). `arXiv:2107.01305`

20. *Likelihood landscape and maximum likelihood estimation for the discrete orbit recovery model* (with Z. Fan, T. Wang, and Y. Wu), Comm. Pure Appl. Math., to appear. `arXiv:2004:00041`

19. *Probabilistic conformal blocks for Liouville CFT on the torus* (with P. Ghosal, G. Remy, and X. Sun), submitted, 2020. `arXiv:2003.03802`

18. *Principal components in linear mixed models with general bulk* (with Z. Fan and Z. Wang), Ann. Stat. **49** (2021), 1489-1513. `arXiv:1903.09592`

17. *Gaussian fluctuations for products of random matrices* (with V. Gorin), Amer. J. Math, to appear. `arXiv:1812.06532`

16. *Spiked covariances and principal components analysis in high-dimensional random effects models* (with Z. Fan and I. Johnstone), preprint, 2018. `arXiv:1806.09529`

15. *Affine Macdonald conjectures and special values of Felder-Varchenko functions* (with E. Rains and A. Varchenko), Sel. Math. N. S. **24** (2018), 1549–1591. `arXiv:1610.01917`

14. *Laguerre and Jacobi analogues of the Warren process* (single author, with an appendix by A. Sarantsev), submitted, 2017. `arXiv:1610.01635`

13. *Traces of intertwiners for quantum affine algebras and difference equations (after Etingof-Schiffmann-Varchenko)* (single author), Transform. Groups **23** (2018), 1167–1215. `arXiv:1609.09038`

12. *Matrix models for multilevel Heckman-Opdam and multivariate Bessel measures* (single

author), submitted, 2016. `arXiv:1609.09096`

11. *Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions* (single author), Commun. Math. Phys. **347** (2016), 573-653. `arXiv:1508.03918`

10. *The polynomial representation of the type A_{n-1} rational Cherednik algebra in characteristic $p \mid n$* (with S. Devadas), Commun. Algebra **45** (2016), 1926-1934. `arXiv:1505.07891`

9. *A representation-theoretic proof of the branching rule for Macdonald polynomials* (single author), Math. Res. Lett. **23** (2016), 887–927. `arXiv:1412.0714`

8. *A new integral formula for Heckman-Opdam hypergeometric functions* (single author), Adv. Math. **289** (2016), 1157–1204. `arXiv:1406.3772`

7. *Finite dimensional representations of the rational Cherednik algebra for G_4* (single author), J. Algebra **323** (2010), 2864–2887. `arXiv:0910.5527`

COMPUTER
SCIENCE
RESEARCH

6. B. Hanin* and Y. Sun*, *Data augmentation as stochastic optimization*, submitted, 2020. DeepMath 2020, OPT 2020. `arXiv:2010.11171`

5. D. Kang*, Y. Sun*, D. Hendrycks, T. Brown, and J. Steinhardt, *Testing robustness against unforeseen adversaries*, submitted, 2019. `arXiv:1908.08016`

4. T. Hashimoto, Y. Sun, and T. Jaakkola, *From random walks to distances on unweighted graphs*, NIPS 2015. `arXiv:1511.00573`

3. T. Hashimoto, Y. Sun, and T. Jaakkola, *Metric recovery from directed unweighted graphs*, NIPS 2014 workshop (Best Student Paper), AISTATS 2015. `arXiv:1411.5720`

2. Y. Sun and M. Sundararajan, *Axiomatic attribution for multilinear functions*, ACM Conf. on Electronic Commerce 2011. `arXiv:1102.0989`

OTHER
RESEARCH

1. R. G. Yang*, P. Y. Wang*, Y. Sun, A. Litwin-Kumar, R. Axel, and LF Abbott, *Evolving the olfactory system*, submitted, 2019. CCN 2019, NeurIPS 2019 Neuro+AI Workshop.

RESEARCH
PRESENTATIONS

51.	UChicago: Statistics Consulting Seminar Learning under a group action and the orbit recovery problem	February 2021
50.	UChicago: Probability Seminar Probabilistic conformal blocks for Liouville CFT on the torus	February 2021
49.	NeurIPS 2020 Workshop: OPT 2020 Data augmentation as stochastic optimization (poster)	December 2020
48.	DeepMath 2020 Data augmentation as stochastic optimization	November 2020
47.	Bernoulli-IMS One World Symposium Likelihood landscape and maximum likelihood estimation for the discrete orbit recovery model	August 2020
46.	Google X Testing robustness against unforeseen adversaries	March 2020
45.	UW Madison: Mathematics Colloquium Fluctuations for products of random matrices	February 2020
44.	UChicago: Statistics Colloquium Fluctuations for products of random matrices	January 2020
43.	AMS Fall Western Sectional Meeting Fluctuations for products of random matrices	November 2019
42.	ICML 2019 Workshop: Uncertainty and Robustness in DL (poster) Transfer of robustness against adversarial and stochastic distortions	June 2019
41.	OpenAI Transfer of robustness against adversarial and stochastic distortions	June 2019
40.	Virginia: Integrable Probability Summer School Fluctuations for products of random matrices	June 2019

39. UCSD: Probability Seminar   January 2019
    Fluctuations for products of random matrices

38. Yale: Geometry, Symmetry, and Physics Seminar   April 2018
    Affine Macdonald conjectures and special values of Felder-Varchenko functions

37. Simons Society of Fellows Retreat   February 2018
    A probabilistic view on random covariance matrices

36. PCMI: Research Program on Random Matrices   July 2017
    Algebraic structures for multilevel eigenvalue densities

35. Rochester: Probability Seminar   April 2017
    Laguerre and Jacobi analogues of the Warren process

34. Perimeter Institute: Mathematical Physics Seminar   April 2017
    Affine Macdonald conjectures and special values of Felder-Varchenko functions

33. Rutgers: Lie Group / Quantum Mathematics Seminar   April 2017
    Affine Macdonald conjectures and special values of Felder-Varchenko functions

32. Columbia-Princeton Probability Day   March 2017
    Laguerre and Jacobi analogues of the Warren process

31. ESI: Workshop on Elliptic Hypergeometric Functions   March 2017
    Affine Macdonald conjectures and special values of Felder-Varchenko functions

30. Columbia: Probability Seminar   November 2016
    Laguerre and Jacobi analogues of the Warren process

29. Columbia: Mathematical Physics Seminar   October 2016
    Affine Macdonald conjectures and special values of Felder-Varchenko functions

28. IESC: QIS's, CFT's, and Stochastic Processes (poster)   September 2016
    Laguerre and Jacobi analogues of the Warren process

27. MIT: Infinite-Dimensional Algebra Seminar   March 2016
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

26. MIT: Integrable Probability Seminar   February 2016
    Laguerre and Jacobi analogues of the Warren process

25. HCM: Asymptotic Analysis in Strongly Coupled Systems (poster)   January 2016
    Laguerre and Jacobi analogues of the Warren process

24. NIPS 2015 (poster)   December 2015
    From random walks to distances on unweighted graphs

23. ETH Zurich: ITS Talks in Theoretical Sciences 2015   November 2015
    Random matrices and representation theory

22. UC Berkeley: RTGC Seminar   November 2015
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

21. ETH Zurich: Mathematical Physics Seminar   October 2015
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

20. NEU: Geometry, Physics and Representation Theory Seminar   October 2015
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

19. Columbia: Mathematical Physics Seminar   October 2015
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

18. Yale: Geometry, Symmetry, and Physics Seminar   September 2015
    Traces of intertwiners for quantum affine $\mathfrak{sl}_2$ and Felder-Varchenko functions

17. FPSAC 2015 (poster)   July 2015
    A representation-theoretic proof of the branching rule for Macdonald polynomials

16. Clay Math Inst.: Random Polymers and Algebraic Combinatorics   May 2015
    A representation-theoretic proof of the branching rule for Macdonald polynomials

15. AISTATS 2015 (poster)   May 2015
    Metric recovery from directed unweighted graphs

<table>
<tr><td></td><td>14. ICERM: Workshop on Limit Shapes (poster)
A representation-theoretic proof of the branching rule for Macdonald polynomials</td><td>April 2015</td></tr>
<tr><td></td><td>13. NIPS 2014: Workshop on Networks (poster)
Metric recovery from directed unweighted graphs</td><td>December 2014</td></tr>
<tr><td></td><td>12. UC Berkeley: GRASP Seminar
A representation-theoretic proof of the branching rule for Macdonald polynomials</td><td>November 2014</td></tr>
<tr><td></td><td>11. IHP: Workshop on Macdonald Processes and Hecke Algebras
A new integral formula for Heckman-Opdam hypergeometric functions</td><td>May 2014</td></tr>
<tr><td></td><td>10. MIT: Integrable Probability Seminar
A new integral formula for Heckman-Opdam hypergeometric functions</td><td>April 2014</td></tr>
</table>

OUTREACH
PRESENTATIONS

9.	Math Olympiad Program 2018 Threshold signatures	June 2018
8.	MIT "Meta-Math" Meetup 2017 How to do a Literature Search	May 2017
7.	Summer Program in Applied Rationality and Cognition 2016 Problem Solving: Contests vs. Real Life	August 2016
6.	Math Olympiad Summer Program 2016 Distribution Testing: Is this die fair?	June 2016
5.	MIT Open House 2016 Universality: Mathematics in the real world	April 2016
4.	Math Olympiad Summer Program 2015 Fair coin flips from unfair coins	June 2015
3.	Math Olympiad Summer Program 2014 The Ising model	June 2014
2.	Math Olympiad Summer Program 2013 Random matrices	June 2013
1.	Math Olympiad Summer Program 2012 Random partitions and Fock space	June 2012

OTHER
PUBLICATIONS

6. 54th *International Mathematical Olympiad* (with J. Berman and Z. Feng), Mathematics Magazine **86** (2013), 309–313.

5. 53nd *International Mathematical Olympiad* (with Z. Feng), Mathematics Magazine **85** (2012), 312–317.

4. 52nd *International Mathematical Olympiad* (with Z. Feng), Mathematics Magazine **84** (2011), 316–319.

3. 51st *International Mathematical Olympiad* (with Z. Feng and P. Loh), Mathematics Magazine **83** (2010), 320–323.

2. *A simulation based model of traffic circles* (with C. Chang and Z. Fan), The UMAP Journal **30** (2009), 225–244.

1. `hsolve`: *A difficulty metric and puzzle generator for Sudoku* (with C. Chang and Z. Fan), The UMAP Journal **29** (2008), 303–324.

TEACHING

University of Chicago　　　　　　　　　　　　　　　　2020–present
Instructor. Autumn 2020: Introduction to Mathematical Probability. Winter 2021: Topics in Deep Learning: Discriminative Models

Columbia University　　　　　　　　　　　　　　　　2017–2020
Instructor. Fall 2017: Calculus II. Spring 2019: Graduate reading course on representation theory. Fall 2019: Calculus II. Spring 2020: Calculus II.

Cyberspace Mathematical Competition　　　　　　　　Summer 2020
Problem Captain. Manage grading team for one of 8 problems for first year of international online math competition.

US National Math Olympiad Summer Program　　　　Summers 2007–2018

Instructor (2010, 2012–2018); Assistant (2007–2009). Design curriculum, give lectures, and personally coach US team to International Mathematical Olympiad.

MIT MathROOTS Summers 2015–2016

Academic Coordinator. Design curriculum, give lectures, and manage academic team, guest lectures, and website for first two years of outreach program in problem solving for underrepresented minority students. Covered on MIT homepage and Notices of the AMS.

MIT Undergraduate Research Opportunities Program Fall 2012–2015

Mentor two undergraduate research projects, leading to published research paper.

- Sheela Devadas (rational Cherednik algebras in char $p \leq n$), 2014–2015.

- Ryan Yoo (characters of rational Cherednik algebras in char $p > n$), 2012–2014.

Massachusetts Institute of Technology Spring 2015

Teaching Assistant for Differential Equations. Evaluations: 6.2 (7.0)

MIT Directed Reading Program January 2011

Mentor reading project on representation theory of the symmetric group.

Harvard University Spring 2009

Course Assistant for Probability Theory. Evaluations: 4.3 (5.0)

PROFESSIONAL ACTIVITIES	**Columbia Probability Seminar** Co-organize weekly probability seminar.	2016–2020

Summer School in Probability Summer 2017

Co-organize graduate summer school "Dyson-Schwinger equations, topological expansions, and random matrices" at Columbia.

MIT Interacting Particle Systems Learning Seminar 2012–2013

Organize learning seminar on recent developments in interacting particle systems.

Google Research Summer 2010

Research intern. Research attribution and cost-sharing methods, leading to paper published in EC 2010. Mentor: Mukund Sundararajan

SERVICE Reviewer: Probability Theory and Related Fields, Selecta Mathematica (N.S.), SIGMA, Journal of Theoretical Probability, Europhysics Letters, Information and Inference, Algebraic Combinatorics.

Qualifying Exam Committee: Ivan Danilenko (Columbia), Maithreya Sitaraman (Columbia)

Dissertation Committee: Qing Yan (UChicago)

LANGUAGES Python, PyTorch, C++, LaTeX, Magma, Mathematica / Mandarin (native), French

Last updated: July 14, 2021.