

# Yi Sun

CONTACT INFORMATION	Address: Department of Statistics, The University of Chicago, Chicago, IL 60637. Email: <a href="mailto:ysisun@statistics.uchicago.edu">ysisun@statistics.uchicago.edu</a> Webpage: <a href="http://ysisun.io">ysisun.io</a>
RESEARCH	Probability and applications to machine learning and high-dimensional statistics.
EMPLOYMENT	<b>The University of Chicago</b> Chicago, IL Assistant Professor (tenure-track), 2020–present. <b>Columbia University</b> New York, NY Joseph F. Ritt Assistant Professor, 2019–2020; Simons Fellow, 2016–2019.
EDUCATION	<b>Massachusetts Institute of Technology</b> Cambridge, MA Ph.D., Mathematics, advised by Pavel Etingof, 2011–2016. <b>University of Cambridge</b> Cambridge, UK M.A.St., Mathematics, with distinction, 2010–2011. <b>Harvard University</b> Cambridge, MA A.M., Mathematics, 2006–2010. A.B., Mathematics, <i>magna cum laude</i> , with secondary field in Economics, 2006–2010. Phi Beta Kappa (one of 24 juniors inducted)
GRANTS	NSF Grant DMS-1701654/2039183, 2017–2021. (\$141,999, Highly Recommended)
FELLOWSHIPS	Simons Junior Fellowship, 2016–2019. (\$364,214)
AND AWARDS	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, 2 <sup>nd</sup> Place, 2006. / Putnam Competition, 10 <sup>th</sup> 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	20. <i>Likelihood landscape and maximum likelihood estimation for the discrete orbit recovery model</i> (with Z. Fan, T. Wang, and Y. Wu), submitted, 2020. <a href="https://arxiv.org/abs/2004.00041">arXiv:2004.00041</a> 19. <i>Probabilistic conformal blocks for Liouville CFT on the torus</i> (with P. Ghosal, G. Remy, and X. Sun), submitted, 2020. <a href="https://arxiv.org/abs/2003.03802">arXiv:2003.03802</a> 18. <i>Principal components in linear mixed models with general bulk</i> (with Z. Fan and Z. Wang), Ann. Stat., to appear. <a href="https://arxiv.org/abs/1903.09592">arXiv:1903.09592</a> 17. <i>Gaussian fluctuations for products of random matrices</i> (with V. Gorin), Amer. J. Math, to appear. <a href="https://arxiv.org/abs/1812.06532">arXiv:1812.06532</a> 16. <i>Spiked covariances and principal components analysis in high-dimensional random effects models</i> (with Z. Fan and I. Johnstone), preprint, 2018. <a href="https://arxiv.org/abs/1806.09529">arXiv:1806.09529</a> 15. <i>Affine Macdonald conjectures and special values of Felder-Varchenko functions</i> (with E. Rains and A. Varchenko), Sel. Math. N. S. <b>24</b> (2018), 1549–1591. <a href="https://arxiv.org/abs/1610.01917">arXiv:1610.01917</a> 14. <i>Laguerre and Jacobi analogues of the Warren process</i> (single author, with an appendix by A. Sarantsev), submitted, 2017. <a href="https://arxiv.org/abs/1610.01635">arXiv:1610.01635</a> 13. <i>Traces of intertwiners for quantum affine algebras and difference equations (after Etingof-Schiffmann-Varchenko)</i> (single author), Transform. Groups <b>23</b> (2018), 1167–1215. <a href="https://arxiv.org/abs/1609.09038">arXiv:1609.09038</a> 12. <i>Matrix models for multilevel Heckman-Opdam and multivariate Bessel measures</i> (single author), submitted, 2016. <a href="https://arxiv.org/abs/1609.09096">arXiv:1609.09096</a> 11. <i>Traces of intertwiners for quantum affine <math>\mathfrak{sl}_2</math> and Felder-Varchenko functions</i> (single author), Commun. Math. Phys. <b>347</b> (2016), 573–653. <a href="https://arxiv.org/abs/1508.03918">arXiv:1508.03918</a> 10. <i>The polynomial representation of the type <math>A_{n-1}</math> rational Cherednik algebra in char-</i>

	<i>acteristic <math>p \mid n</math> (with S. Devadas), Commun. Algebra <b>45</b> (2016), 1926-1934. <a href="#">arXiv:1505.07891</a></i>	
	9. <i>A representation-theoretic proof of the branching rule for Macdonald polynomials</i> (single author), Math. Res. Lett. <b>23</b> (2016), 887–927. <a href="#">arXiv:1412.0714</a>	
	8. <i>A new integral formula for Heckman-Opdam hypergeometric functions</i> (single author), Adv. Math. <b>289</b> (2016), 1157–1204. <a href="#">arXiv:1406.3772</a>	
	7. <i>Finite dimensional representations of the rational Cherednik algebra for <math>G_4</math></i> (single author), J. Algebra <b>323</b> (2010), 2864–2887. <a href="#">arXiv:0910.5527</a>	
COMPUTER SCIENCE RESEARCH	6. B. Hanin* and Y. Sun*, <i>Data augmentation as stochastic optimization</i> , submitted, 2020. DeepMath 2020, OPT 2020. <a href="#">arXiv:2010.11171</a>	
	5. D. Kang*, Y. Sun*, D. Hendrycks, T. Brown, and J. Steinhardt, <i>Testing robustness against unforeseen adversaries</i> , submitted, 2019. <a href="#">arXiv:1908.08016</a>	
	4. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>From random walks to distances on unweighted graphs</i> , NIPS 2015. <a href="#">arXiv:1511.00573</a>	
	3. T. Hashimoto, Y. Sun, and T. Jaakkola, <i>Metric recovery from directed unweighted graphs</i> , NIPS 2014 workshop (Best Student Paper), AISTATS 2015. <a href="#">arXiv:1411.5720</a>	
	2. Y. Sun and M. Sundararajan, <i>Axiomatic attribution for multilinear functions</i> , ACM Conf. on Electronic Commerce 2011. <a href="#">arXiv:1102.0989</a>	
OTHER RESEARCH	1. R. G. Yang*, P. Y. Wang*, Y. Sun, A. Litwin-Kumar, R. Axel, and LF Abbott, <i>Evolving the olfactory system</i> , 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 Fluctuations for products of random matrices	January 2019
	38. Yale: Geometry, Symmetry, and Physics Seminar Affine Macdonald conjectures and special values of Felder-Varchenko functions	April 2018

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
14. ICERM: Workshop on Limit Shapes (poster) April 2015  
A representation-theoretic proof of the branching rule for Macdonald polynomials
13. NIPS 2014: Workshop on Networks (poster) December 2014  
Metric recovery from directed unweighted graphs

	12. UC Berkeley: GRASP Seminar	November 2014
	A representation-theoretic proof of the branching rule for Macdonald polynomials	
	11. IHP: Workshop on Macdonald Processes and Hecke Algebras	May 2014
	A new integral formula for Heckman-Opdam hypergeometric functions	
	10. MIT: Integrable Probability Seminar	April 2014
	A new integral formula for Heckman-Opdam hypergeometric functions	
OUTREACH	9. Math Olympiad Program 2018	June 2018
PRESENTATIONS	Threshold signatures	
	8. MIT “Meta-Math” Meetup 2017	May 2017
	How to do a Literature Search	
	7. Summer Program in Applied Rationality and Cognition 2016	August 2016
	Problem Solving: Contests vs. Real Life	
	6. Math Olympiad Summer Program 2016	June 2016
	Distribution Testing: Is this die fair?	
	5. MIT Open House 2016	April 2016
	Universality: Mathematics in the real world	
	4. Math Olympiad Summer Program 2015	June 2015
	Fair coin flips from unfair coins	
	3. Math Olympiad Summer Program 2014	June 2014
	The Ising model	
	2. Math Olympiad Summer Program 2013	June 2013
	Random matrices	
	1. Math Olympiad Summer Program 2012	June 2012
	Random partitions and Fock space	
OTHER	6. 54 <sup>th</sup> <i>International Mathematical Olympiad</i> (with J. Berman and Z. Feng), <i>Mathematics Magazine</i> <b>86</b> (2013), 309–313.	
PUBLICATIONS	5. 53 <sup>rd</sup> <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> <b>85</b> (2012), 312–317.	
	4. 52 <sup>nd</sup> <i>International Mathematical Olympiad</i> (with Z. Feng), <i>Mathematics Magazine</i> <b>84</b> (2011), 316–319.	
	3. 51 <sup>st</sup> <i>International Mathematical Olympiad</i> (with Z. Feng and P. Loh), <i>Mathematics Magazine</i> <b>83</b> (2010), 320–323.	
	2. <i>A simulation based model of traffic circles</i> (with C. Chang and Z. Fan), <i>The UMAP Journal</i> <b>30</b> (2009), 225–244.	
	1. <i>hsolve: A difficulty metric and puzzle generator for Sudoku</i> (with C. Chang and Z. Fan), <i>The UMAP Journal</i> <b>29</b> (2008), 303–324.	
TEACHING	<b>University of Chicago</b>	2020–present
	Instructor. Autumn 2020: Introduction to Mathematical Probability. Winter 2021: Topics in Deep Learning: Discriminative Models	
	<b>Columbia University</b>	2017–2020
	Instructor. Fall 2017: Calculus II. Spring 2019: Graduate reading course on representation theory. Fall 2019: Calculus II. Spring 2020: Calculus II.	
	<b>Cyberspace Mathematical Competition</b>	Summer 2020
	Problem Captain. Manage grading team for one of 8 problems for first year of international online math competition.	
	<b>US National Math Olympiad Summer Program</b>	Summers 2007–2018
	Instructor (2010, 2012–2018); Assistant (2007–2009). Design curriculum, give lectures, and personally coach US team to International Mathematical Olympiad.	
	<b>MIT MathROOTS</b>	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** 2016–2020

Co-organize weekly probability seminar.

**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++, L<sup>A</sup>T<sub>E</sub>X, Magma, Mathematica / Mandarin (native), French