Zhou Fan

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EDUCATION

2018   Ph.D. Statistics, Stanford University

2011   M.A.St. Mathematics, with distinction, University of Cambridge

2010   S.M. Computer Science, Harvard University

2010   A.B. Mathematics, summa cum laude, Harvard University

EMPLOYMENT

2018 – present   Assistant Professor, Statistics and Data Science, Yale University

2011 – 2013   Scientific Programmer, D. E. Shaw Research, New York

PUBLICATIONS AND PREPRINTS

1. Zhou Fan, Renyuan Ma. "Kronecker-product random matrices and a matrix least squares problem." Available at arXiv:2406.00961.

2. Kaylee Yang, Timothy L. H. Wee, Zhou Fan. "Asymptotic mutual information in quadratic estimation problems over compact groups." Available at arXiv:2404.10169.

3. Zhou Fan, Leying Guan, Yandi Shen, Yihong Wu. "Gradient flows for empirical Bayes in high-dimensional linear models." Available at arXiv:2312.12708.

4. Michael Celentano, Zhou Fan, Licong Lin, Song Mei. "Mean-field variational inference with the TAP free energy: Geometric and statistical properties in linear models." Available at arXiv:2311.08442.

5. Zhou Fan, Yufan Li, Subhabrata Sen. "TAP equations for orthogonally invariant spin glasses at high temperature." Available at arXiv:2202.09325.

6. Zhou Fan, Iain M. Johnstone, Yi Sun. "Spiked covariances and principal components analysis in high-dimensional random effects models." Available at arXiv:1806.09529.

7. Zhou Fan, Yihong Wu. "The replica-symmetric free energy for Ising spin glasses with orthogonally invariant couplings." *Probability Theory and Related Fields*, to appear.

8. Xinyi Zhong, Tianhao Wang, Zhou Fan. "Approximate Message Passing for orthogonally invariant ensembles: Multivariate non-linearities and spectral initialization." *Information and Inference: Journal of the IMA*, 13(3): iaae024, 2024.

9. Tianhao Wang, Xinyi Zhong, Zhou Fan. "Universality of Approximate Message Passing algorithms and tensor networks." *Annals of Applied Probability,* 34(4): 3943-3994, 2024.

10. Zhichao Wang, Denny Wu, Zhou Fan. "Nonlinear spiked covariance matrices and signal propagation in deep neural networks." *Proceedings of the 37th Conference on Learning Theory (COLT)*, PMLR 247: 4891-4957, 2024.

11. Yufan Li, Zhou Fan, Subhabrata Sen, Yihong Wu. "Random linear estimation with rotationally-invariant designs: Asymptotics at high temperature." *IEEE Transactions on Information Theory*, 30(3): 2118-2153, 2024.

12. Zehao Dou, Zhou Fan, Harrison Zhou. "Rates of estimation for high-dimensional multi-reference alignment." *Annals of Statistics*, 52(1): 261-284, 2024.

13. Zhou Fan, Roy R. Lederman, Yi Sun, Tianhao Wang, Sheng Xu. "Maximum likelihood for high-noise group orbit estimation and single-particle cryo-EM." *Annals of Statistics*, 52(1): 52-77, 2024.

14. Ran Cui, Roy A Elzur, Masahiro Kanai, Jacob C Ulirsch, Omer Weissbrod, Mark J Daly, Benjamin M Neale, Zhou Fan, Hilary K Finucane. "Improving fine-mapping by modeling infinitesimal effects." *Nature Genetics*, 56: 162-169, 2024.

15. Michael Celentano, Zhou Fan, Song Mei. "Local convexity of the TAP free energy and AMP convergence for Z_2-synchronization." *Annals of Statistics*, 51(2): 519-546, 2023.

16. Zhou Fan, Cheng Mao, Jiaming Xu, Yihong Wu. "Spectral graph matching and regularized quadratic relaxations I: Algorithm and Gaussian analysis." *Foundations of Computational Mathematics*, 23: 1511-1565, 2023.

17. Zhou Fan, Cheng Mao, Jiaming Xu, Yihong Wu. "Spectral graph matching and regularized quadratic relaxations II: Erdos-Renyi graphs and universality." *Foundations of Computational Mathematics*, 23: 1567-1617, 2023.

18. Zhou Fan, Yi Sun, Tianhao Wang, Yihong Wu. "Likelihood landscape and maximum likelihood estimation for the discrete orbit recovery model." *Communications on Pure and Applied Mathematics*, 76(6): 1208-1302, 2023.

19. Zhou Fan, Iain M. Johnstone. "Tracy-Widom at each edge of real covariance and MANOVA estimators." *Annals of Applied Probability*, 32(4): 2967-3003, 2022.

20. Xinyi Zhong, Chang Su, Zhou Fan. "Empirical Bayes PCA in high dimensions." *Journal of the Royal Statistical Society: Series B*, 84(3): 853-878, 2022.

21. Zhou Fan. "Approximate Message Passing algorithms for rotationally invariant matrices." *Annals of Statistics,* 50(1): 197-224, 2022.

22. Zhou Fan, Yi Sun, Zhichao Wang. "Principal components in linear mixed models with general bulk." *Annals of Statistics*, 49(3): 1489-1513, 2021.

23. Sheng Xu, Zhou Fan. "Iterative Alpha Expansion for estimating gradient-sparse signals from linear measurements." *Journal of the Royal Statistical Society: Series B*, 83(2): 271-292, 2021.

24. Zhou Fan, Song Mei, Andrea Montanari. "TAP free energy, spin glasses, and variational inference." *Annals of Probability*, 49(1): 1-45, 2021.

25. Zhou Fan, Zhichao Wang. "Spectra of the Conjugate Kernel and Neural Tangent Kernel for linear-width neural networks." *Advances in Neural Information Processing Systems (NeurIPS)*, 33: 7710-7721, 2020. (Oral presentation)

26. Sheng Xu, Zhou Fan, Sahand Negahban. "Tree-projected gradient descent for estimating gradient-sparse parameters on graphs." *Proceedings of the 33rd Conference on Learning Theory (COLT)*, PMLR 125: 3683-3708, 2020.

27. Zhou Fan, Cheng Mao, Yihong Wu, Jiaming Xu. "Spectral graph matching and regularized quadratic relaxations: Algorithm and theory." *Proceedings of the 37th International Conference on Machine Learning (ICML)*, PMLR 119: 2985-2995, 2020.

28. Ganlin Song, Zhou Fan, John Lafferty. "Surfing: Iterative optimization over incrementally trained deep networks." *Advances in Neural Information Processing Systems (NeurIPS)*, 32, 2019. (Spotlight presentation)

29. Zhou Fan, Iain M. Johnstone. "Eigenvalue distributions of variance components estimators in high-dimensional random effects models." *Annals of Statistics*, 47(5): 2855-2886, 2019.

30. Zhou Fan, Andrea Montanari. "The spectral norm of random inner-product kernel matrices." *Probability Theory and Related Fields*, 173: 27-85, 2019.

31. Zhou Fan, Leying Guan. "Approximate l_0-penalized estimation of piecewise constant signals on graphs." *Annals of Statistics*, 46(6B): 3217-3245, 2018.

32. Leying Guan, Zhou Fan, Robert Tibshirani. "Supervised learning via the 'hubNet' procedure." *Statistica Sinica*, 28: 1225-1243, 2018.

33. Zhou Fan, Lester Mackey. "Empirical Bayesian analysis of simultaneous changepoints in multiple data sequences." *Annals of Applied Statistics*, 11(4): 2200-2221, 2017.

34. Zhou Fan, Andrea Montanari. "How well do local algorithms solve semidefinite programs?" *Proceedings of the 49th Annual ACM SIGACT Symposium on the Theory of Computing (STOC)*, 604-614, 2017.

35. Zhou Fan, Ron O Dror, Thomas Mildorf, Stefano Piana, David E Shaw. "Identifying localized changes in large systems: Change-point detection for biomolecular simulations." *Proceedings of the National Academy of Sciences USA* 112(24): 1-6, 2015.

36. Dominico Aiello, Hansheng Diao, Zhou Fan, Daniel King, Jessica Lin, and Cesar E Silva. "Measurable time-restricted sensitivity." *Nonlinearity* 25(12): 3313-3325, 2012.

INVITED TALKS AND SEMINARS

08/2025	Joint Statistical Meetings, Nashville
07/2025	ICML Workshop on High-dimensional learning dynamics, Vancouver
06/2025	APS Informs Applied Probability Conference, Atlanta
06/2025	Workshop on Random matrices and high-dimensional learning dynamics, CRM Montreal
05/2025	Workshop on Machine learning and neural network theory, EPFL
04/2025	Yale University, applied math seminar
03/2025	Workshop on Efficient Bayesian inference, BIRS Alberta
03/2025	Columbia University, statistics seminar
12/2024	University of Waterloo, probability seminar
11/2024	National Academy of Sciences Kavli Frontiers of Science Symposium, Beijing
09/2024	UCLA, level set seminar
09/2024	Workshop on Statistical aspects of non-linear inverse problems, Cambridge

08/2024	IMS World Congress in Probability and Statistics, Bochum
07/2024	Workshop on The blessing of dimensionality, Storrs
06/2024	Workshop on Modeling randomness in neural network training, DIMACS
05/2024	Random Matrices and Applications, ICERM
02/2024	Harvard University, statistics seminar
02/2024	Georgia Institute of Technology, stochastics seminar
01/2024	National University of Singapore, statistics seminar
01/2024	Program on Mathematics of Data, IMS Singapore
09/2023	Institute of Systems Science, Chinese Academy of Sciences
07/2023	Stochastic Processes and Applications, Lisbon
07/2023	Workshop on Learning and inference from structured data, ICTP Trieste
06/2023	APS Informs Applied Probability Conference, Paris
06/2023	Random Matrix Theory and Applications, Shenzhen
06/2023	Workshop on High dimensional statistics and random matrices, Porquerolles
11/2022	Workshop on Learning in networks: Performance limits and algorithms, BIRS Oaxaca
11/2022	UC Davis, probability seminar
10/2022	Brown University, applied mathematics (pattern theory) seminar
10/2022	MIT, stochastics and statistics seminar
10/2022	Wharton UPenn, statistics seminar
09/2022	SIAM Conference on Mathematics of Data Science, San Diego
06/2022	IMS Annual Meeting, London
06/2022	Workshop on Random matrix theory and numerical linear algebra, Seattle
05/2022	ICMS Workshop on Structural breaks and shape constraints, Edinburgh
03/2022	Boston University, probability and statistics seminar
10/2021	Rutgers University, statistics seminar
10/2021	Workshop on Computational complexity of statistical inference, Simons Institute
10/2021	HKUST, statistics seminar
09/2021	ICSA Applied Statistics Symposium
09/2021	Workshop on Noncommutative algebra, probability, and analysis in action, Greifswald
08/2021	IMSI Workshop on eliciting structure in genomics data, Chicago
07/2021	IMS World Congress in Probability and Statistics (virtual)
06/2021	Youth in High Dimensions workshop, ICTP Trieste (virtual)
06/2021	University of Warwick, statistics seminar
05/2021	Harvard University, Probabilitas seminar
05/2021	Workshop on RMT and machine learning (virtual)
01/2021	UC Davis, statistics seminar
12/2020	Workshop on Covariance matrices in large dimensions (virtual)
12/2020	ETH Zurich, Young Data Science Researcher Seminar
09/2020	USC, probability and statistics seminar
08/2020	Joint Statistical Meetings (virtual)
05/2020	Random Matrices and Their Applications (virtual)
12/2019	ICSA International Conference, Hangzhou
10/2019	NYU Stern, statistics seminar
09/2019	Allerton Conference, Urbana
09/2019	Cornell University, statistics seminar
07/2019	Joint Statistical Meetings, Denver
05/2019	New England Statistical Symposium, Hartford
05/2019	Workshop on Random matrices and related topics, Korea IAS
03/2019	Workshop on New developments in free probability and applications, CRM Montreal
02/2019	MIT, stochastics and statistics seminar
01/2019	Workshop on Universality in random structures, ICTS Bangalore
10/2018	Workshop on Robust and high-dimensional statistics, Simons Institute
07/2018	IMS annual meeting, Vilnius
06/2018	Workshop on Matrix estimation meets statistical network analysis, Oberwolfach
02/2018	NYU, Math and Data seminar
02/2018	Harvard University, statistics seminar

02/2018	Wharton UPenn, statistics seminar
02/2018	Carnegie Mellon University, statistics seminar
01/2018	Yale University, statistics seminar
01/2018	Columbia University, statistics seminar
01/2018	Booth School of Business, econometrics and statistics seminar
01/2018	University of Chicago, statistics seminar
01/2018	Texas A&M University, statistics seminar
01/2018	Duke University, statistical science seminar
01/2018	Princeton University, ORFE colloquim
01/2018	University of Michigan Ann Arbor, statistics seminar
11/2017	Georgia Institute of Technology, job candidate talk
11/2017	University of California Irvine, probability seminar
11/2017	AMS western fall sectional meeting, Riverside
04/2017	SLAC National Accelerator Laboratory, AI-AT-SLAC/FEL-R&D seminar
04/2017	Columbia University, Columbia-Courant probability day
04/2017	Georgia Institute of Technology, stochastics seminar
01/2017	Workshop on Random matrix theory and applications, Harvard CMSA
07/2016	IMS World Congress in Probability and Statistics, Toronto
04/2016	Stanford University, probability seminar

GRANTS

NSF DMS-2142476, "CAREER: High-dimensional inference and applications to modern biology." Sole PI, $400,000, 2022-2027.

NSF DMS-1916198, "Non-convex landscapes and high-dimensional latent variable models." Sole PI, $182,654, 2019-2022.

HONORS AND AWARDS

Sloan Research Fellowship, 2024
Arthur Greer Memorial Prize, Yale University, 2023
NSF CAREER Award, 2022
Probability Dissertation Award, Stanford Department of Statistics, 2018
Hertz Graduate Fellowship, 2013-2018
NDSEG Graduate Fellowship, 2013-2016
Churchill Scholarship, 2010-2011
Siebel Scholarship, 2009-2010

TEACHING

S&DS 242/542: Theory of Statistics
    Spring 2025. Enrollment: TBD
    Spring 2022. Enrollment: 234
    Spring 2020. Enrollment: 225

S&DS 410/610: Statistical Inference
    Fall 2022. Enrollment: 40
    Fall 2021. Enrollment: 37
    Fall 2020. Enrollment: 59
    Fall 2019. Enrollment: 34
    Fall 2018. Enrollment: 31

S&DS 602: High-Dimensional Probability and Applications
    Fall 2024. Enrollment 26

S&DS 615: Introduction to Random Matrix Theory and Applications
    Spring 2019. Enrollment: 27

S&DS 686: High-Dimensional Phenomena in Statistics and Learning
    Spring 2023. Enrollment: 30

DOCTORAL AND POSTDOCTORAL TRAINEES

Supervised postdoctoral scholars:
    Yandi Shen, 2023-2024
        First position: Carnegie Mellon University (assistant professor)

Supervised Ph.D. students:
    Garrett Wen (co-advised with Theodor Misiakiewicz), Yale S&DS, 2024-present
    Jack Ma, Yale S&DS, 2023-present
    Kaylee Yang (co-advised with Andre Wibisono), Yale S&DS, 2023-present
    Max Lovig (co-advised with Ilias Zadik), Yale S&DS, 2023-present
    Tianhao Wang, Yale S&DS, 2019-2024
        First position: TTIC (research assistant professor), UC San Diego (assistant professor)
    Xinyi Zhong, Yale S&DS, 2019-2023
        First position: Two Sigma Investments
    Chang Su (co-advised with Hongyu Zhao), Yale Biostatistics, 2019-2023
        First position: Emory University (assistant professor)
    Sheng Xu (co-advised with Sahand Negahban), Yale S&DS, 2018-2022
        First position: Princeton University (postdoc)

UNIVERSITY SERVICE

Supervised undergraduate research students and senior theses:
    David Dong, Spring 2024-present
    Jorge Blanco, Spring 2024
        First position: UC Berkeley Statistics, Ph.D.
    Matthew Li, Fall 2023
    Sarah Zhao, 2020-2022
        First position: Stanford Statistics, Ph.D.
    Max Ranis, Spring 2022
    Brian Zhu, Fall 2021
        First position: Columbia IEOR, Ph.D.
    Maya Jeyendran, Spring 2020
        First position: Harvard Law School, J.D.
    Ryan Taggarse, Spring 2019

Ph.D. dissertation committee member:
    Leqi Xu, Yale Biostatistics (current)
    Timothy Wee, Yale S&DS, 2024
    Soham Jana, Yale S&DS, 2022
    Yiliang Zhang, Yale BIS, 2022
    Geyu Zhou, Yale CBB, 2022
    Jerome Yu, Yale CBB, 2022
    Zifan Li, Yale S&DS, 2021
    Ganlin Song, Yale S&DS, 2021

Ph.D. oral exam committee member:
    Chris Xu, Yale S&DS (current)
    Xinyang Hu, Yale S&DS (current)
    Heejune Sheen, Yale S&DS (current)
    Awni Altabaa, Yale S&DS (current)
    Conor Sheehan, Yale S&DS (current)

S&DS Director of Graduate Studies, 2024-present
S&DS Ph.D. admissions committee, Spring 2020, 2023, 2025
S&DS curriculum committee, 2021-present
S&DS department seminar organizer, 2018-2023
S&DS faculty search committee, Spring 2022
S&DS undergraduate thesis committee, Spring 2021, 2023
Foundations of Data Science Institute postdoctoral search committee, Spring 2023
Grace Hopper College freshman/sophomore advisor, 2019-2023

PROFESSIONAL SERVICE

K-12 educational outreach coordinator, Connecticut Chapter of the American Statistical Association, 2018-present

Editorial boards:
    Annals of Statistics, 2025 - present

Conference organization:
    Joint Statistical Meetings 2024 (invited session organizer)
    International Symposium on Nonparametric Statistics 2024 (invited session organizer)
    Conference on Learning Theory 2022, 2023, 2024, 2025 (program committee)
    Joint Statistical Meetings 2021 (invited session chair)

Grant reviewer for:
    US National Science Foundation, 2024
    European Research Council, 2024

Journal reviewer for:
    Annals of Applied Probability
    Annals of Applied Statistics
    Annals of Statistics
    Applied and Computational Harmonic Analysis
    Biometrika
    Biostatistics
    Communications in Mathematical Physics
    Communications on Pure and Applied Mathematics
    Electronic Journal of Statistics
    ESAIM: Probability and Statistics
    Foundations of Computational Mathematics
    IEEE Transactions on Information Theory
    IEEE Transactions on Vehicular Technology
    Information and Inference
    Journal of Econometrics
    Journal of Machine Learning Research
    Journal of Mathematical Physics
    Journal of Multivariate Analysis
    Journal of the Royal Statistical Society: Series B
    Linear and Multilinear Algebra

Mathematical Programming
Nature Genetics
Physical Review E
Probability and Mathematical Physics
Proceedings of the National Academy of Sciences USA
Random Matrices: Theory and Applications
SIAM Journal on Mathematics of Data Science
Statistics and Probability Letters
Stochastic Processes and their Applications

Conference reviewer for:
AISTATS 2019
COLT 2022, 2023, 2024, 2025
ICML 2019
ISIT 2022
NeurIPS 2019, 2020, 2021, 2022
SODA 2018, 2020
STOC 2022