Yuling Yan

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Appointments

University of Wisconsin-Madison, Madison, WI *Aug. 2024 - Now*

- Assistant Professor, Department of Statistics

Education

Massachusetts Institute of Technology, Cambridge, MA *July. 2023 - Aug 2024*

- Norbert Wiener Postdoctoral Associate
- Mentors: Philippe Rigollet and Martin J. Wainwright

Princeton University, Princeton, NJ *Sept. 2018 - June 2023*

- Ph.D. in Operations Research and Financial Engineering (M.A. awarded in Sept 2020)
- Advisors: Yuxin Chen and Jianqing Fan

Peking University, Beijing, China *Sept. 2014 - July 2018*

- B.S. in Statistics, School of Mathematical Sciences

Research Interests

Statistics, optimization, diffusion models, reinforcement learning, and their applications in generative AI and social sciences. A few highlights of my recent research:

- **Inference and uncertainty quantification for low-rank models.** We solved open problems on optimal construction of confidence intervals for noisy matrix completion [J10., P2.], and use it to evaluate effects of *Affordable Care Act* across U.S. states [P3.]. We developed the first inferential algorithm for PCA [J5.].
- **Learning in the space of probability measures.** We developed the first efficient algorithm for solving the nonparametric MLE of Gaussian mixture models [J4.]. We established state-of-the-art convergence theory for diffusion generative models [J2.] and its adaptivity to unknown low-dimensional structures [C2., P6.].
- **Mechanism design for peer review.** Our *isotonic mechanism* provably elicit private information from the authors to improve peer review process in machine learning conferences [J1.], and the improved efficiency is confirmed by *an experiment conducted during ICML 2023* [J3.].
- **Bridging convex and nonconvex optimization.** We settled minimax optimality of convex optimization for noisy matrix completion [J11.], robust PCA [J9.], and blind deconvolution [J8.] by establishing the striking connection that *nonconvex optimization is essentially solving convex relaxation with nuclear norm penalization*.
- **Offline reinforcement learning.** We designed sample-optimal offline RL algorithms in both single- and multi-agent setups [J7., J6.], as well as minimax optimal reward-agnostic exploration schemes [C3.].

Awards

IMS Lawrence D. Brown Award, Institute of Mathematical Statistics *2024*
ICCM Best Thesis Award, International Consortium of Chinese Mathematicians *2023*
— *declined due to inability to attend the award ceremony*
Norbert Wiener Postdoctoral Fellowship, Massachusetts Institute of Technology *2023*
IMS Hannan Graduate Student Travel Award, Institute of Mathematical Statistics *2023*
Charlotte Elizabeth Procter Honorific Fellowship, Princeton University *2022*
Best Student Paper Award (Statistical Learning & Data Science), American Statistical Association *2022*
Excellent Graduate, Peking University *2018*
Yang Xin Lotus Virtue Fellowship, Peking University *2017*
The May 4th Fellowship, Peking University *2016*
Samsung Fellowship, No. 2 High School Affiliated to East China Normal University *2013*

JOURNAL PUBLICATIONS

J1. **Yuling Yan**, Weijie J. Su, Jianqing Fan, "Isotonic Mechanism for Exponential Family Estimation in Machine Learning Peer Review," *Journal of the Royal Statistical Society: Series B*, in press, 2025.

J2. Gen Li*, **Yuling Yan*** ($*$ = **equal contribution**), "$O(d/T)$ Convergence Theory for Diffusion Probabilistic Models under Minimal Assumptions," *Journal of Machine Learning Research*, in press, 2025 (accepted in part to ICLR 2025).

J3. Buxin Su, Jiayao Zhang, Natalie Collina, **Yuling Yan**, Didong Li, Kyunghyun Cho, Jianqing Fan, Aaron Roth, Weijie J. Su, "Analysis of the ICML 2023 Ranking Data: Can Authors' Opinions of Their Own Papers Assist Peer Review in Machine Learning?" *Journal of the American Statistical Association*, in press, 2025.

J4. **Yuling Yan***, Kaizheng Wang*, Philippe Rigollet ($*$ = **equal contribution**), "Learning Gaussian Mixtures Using Wasserstein-Fisher-Rao Gradient Flow," *Annals of Statistics*, vol. 52, no. 4, pp. 1774-1795, 2024.

J5. **Yuling Yan**, Yuxin Chen, Jianqing Fan, "Inference for Heteroskedastic PCA with Missing Data," *Annals of Statistics*, vol. 52, no. 2, pp. 729-756, 2024.

J6. **Yuling Yan**, Gen Li, Yuxin Chen, Jianqing Fan, "Model-based Reinforcement Learning for Offline Zero-Sum Markov Games," *Operations Research*, vol. 72, no. 6, pp. 2430-2445, 2024.

J7. **Yuling Yan**, Gen Li, Yuxin Chen, Jianqing Fan, "The Efficacy of Pessimism in Asynchronous Q-Learning," *IEEE Transactions on Information Theory*, vol. 69, no. 11, pp. 7185-7219, 2023.

J8. Yuxin Chen, Jianqing Fan, Bingyan Wang, **Yuling Yan (alphabetical order)**, "Convex and Nonconvex Optimization Are Both Minimax-Optimal for Noisy Blind Deconvolution under Random Designs," *Journal of the American Statistical Association*, vol. 118, no. 542, pp. 858-868, 2023.

J9. Yuxin Chen, Jianqing Fan, Cong Ma, **Yuling Yan (alphabetical order)**, "Bridging Convex and Nonconvex Optimization in Robust PCA: Noise, Outliers, and Missing Data," *Annals of Statistics*, vol. 49, no. 5, pp. 2948-2971, 2021.

J10. Yuxin Chen, Jianqing Fan, Cong Ma, **Yuling Yan (alphabetical order)**, "Inference and Uncertainty Quantification for Noisy Matrix Completion," *Proceedings of the National Academy of Science*, vol. 116, no. 46, pp. 22931-22937, 2019.

J11. Yuxin Chen, Yuejie Chi, Jianqing Fan, Cong Ma, **Yuling Yan (alphabetical order)**, "Noisy Matrix Completion: Understanding Statistical Guarantees for Convex Relaxation via Nonconvex Optimization," *SIAM Journal on Optimization*, vol. 30, no. 4, pp. 3098-3121, 2020.

J12. **Yuling Yan**, Bret Hanlon, Sebastien Roch, Karl Rohe, "Asymptotic Seed Bias in Respondent-driven Sampling," *Electronic Journal of Statistics*, vol. 14, no. 1, pp. 1577-1610, 2020.

CONFERENCE PUBLICATIONS

C1. Gen Li*, **Yuling Yan*** ($*$ = **equal contribution**), "$O(d/T)$ Convergence Theory for Diffusion Probabilistic Models under Minimal Assumptions," *International Conference on Learning Representations (ICLR)*, 2025.

C2. Gen Li*, **Yuling Yan*** ($*$ = **equal contribution**), "Adapting to Unknown Low-Dimensional Structures in Score-Based Diffusion Models," *Neural Information Processing Systems (NeurIPS)*, 2024.

C3. Gen Li, **Yuling Yan**, Yuxin Chen, Jianqing Fan, "Minimax-Optimal Reward-Agnostic Exploration in Reinforcement Learning," *Conference on Learning Theory (COLT)*, 2024.

C4. Bingyan Wang*, **Yuling Yan***, Jianqing Fan ($*$ = **equal contribution**), "Sample-Efficient Reinforcement Learning for Linearly-Parameterized MDPs with a Generative Model," *Neural Information Processing Systems (NeurIPS)*, 2021.

C5. Kaizheng Wang, **Yuling Yan**, Mateo Díaz, "Efficient Clustering for Stretched Mixtures: Landscape and Optimality," *Neural Information Processing Systems (NeurIPS)*, 2020.

PREPRINTS

P1. Gen Li, **Yuling Yan**, Yuxin Chen, Jianqing Fan, "Minimax-Optimal Reward-Agnostic Exploration in Reinforcement Learning," arXiv preprint arXiv:2304.07278, under major revision at *Mathematics of Operations Research*, 2025 (accepted in part to COLT 2024).

P2. **Yuling Yan**, Martin J. Wainwright, "Entrywise Inference for Causal Panel Data: A Simple and Instance-Optimal Approach," arXiv preprint arXiv:2401.13665, 2024.

P3. Eric Z. Xia*, **Yuling Yan***, Martin J. Wainwright ($*$ = **equal contribution**), "Inference in staggered adoption: Effects of the Affordable Care Act," arXiv preprint arXiv:2412.09482, 2024.

P4. Gen Li*, **Yuling Yan*** ($*$ = **equal contribution**), "A Score-Based Density Formula, with Applications in Diffusion Generative Models," arXiv preprint arXiv:2408.16765, 2024.

P5. Jianqing Fan, **Yuling Yan**, Yuheng Zheng **(alphabetical order)**, "When Can Weak Latent Factors Be Statistically Inferred?" arXiv preprint arXiv:2407.03616, 2024.

P6. Jiaqi Tang, **Yuling Yan**, "Adaptivity and Convergence of Probability Flow ODEs in Diffusion Generative Models," arXiv preprint arXiv:2501.18863, 2025.

Invited Talks

T1. Towards Mathematical Foundations of Score-Based Diffusion Models
- Department Seminar, Department of Statistics and Data Science, Cornell University, Nov 2024.
- Institute for Foundations of Data Science, University of Wisconsin-Madison, Oct 2024.

T2. Entrywise Inference for Causal Panel Data: A Simple and Instance-Optimal Approach.
- Department Seminar, Mitch Daniel School of Business, Purdue University, Apr 2025
- SDSCon 2024, Massachusetts Institute of Technology, Apr 2024.

T3. Learning Gaussian Mixtures Using the Wasserstein-Fisher-Rao Gradient Flow.
- Bernoulli-IMS World Congress in Probability and Statistics, Bochum, Germany, Aug 2024.
- ICORS meets DSSV 2024, George Mason University, July 2024.

T4. The Isotonic Mechanism for Exponential Family Estimation.
- CMStatistics, King's College London, Dec 2024.
- Joint Statistical Meeting, Portland, OR, Aug 2024.
- ICSA Applied Statistics Symposium, Ann Arbor, MI, Jun 2023.

T5. Inference and Uncertainty Quantification for Low-Rank Models.
- TOPS Department Seminar, NYU Stern School of Business, Feb 2023.
- Econometrics and Statistics Workshop, University of Chicago Booth School of Business, Feb 2023.
- Department Seminar, Department of Statistics, Rutgers University, Jan 2023.
- Department Seminar, Department of Statistics, University of Wisconsin-Madison, Jan 2023.
- Department Seminar, Department of Statistics, UC Davis, Jan 2023.
- Young Data Science Researcher Seminar, ETH Zurich, Dec 2022.
- Department Seminar, Department of Data Science and Operations, Marshall School of Business, University of Southern California, Dec 2022.
- CMStatistics, King's College London, Dec 2022.
- Department Colloquia, Department of Mathematics, University of Maryland, Nov 2022.

T6. Model-based Reinforcement Learning for Offline Zero-Sum Markov Games.
- INFORMS Annual Meeting, Indianapolis, IN, Oct 2022.
- ORIE Young Researchers Workshop, Cornell University, Oct 2022.

T7. Inference for Heteroskedastic PCA with Missing Data.
- INFORMS Annual Meeting, Indianapolis, IN, Oct 2022.
- Lunch Seminar, Department of Statistics, Harvard University, Oct 2022.
- Joint Statistical Meeting, Washington DC, Aug 2022.

T8. Bridging Convex and Nonconvex Optimization in Robust PCA: Noise, Outliers, and Missing Data.
- INFORMS Optimization Society Meeting, Greenville, SC, Mar 2022.
- Department Seminar, Department of Statistics and Applied Probability, UC Santa Barbara, Mar 2022.
- Two Sigma Ph.D. Research Symposium, Dec 2020.
- INFORMS Annual Meeting, Nov. 2020.
- ORFE Graduate Student Seminar, Princeton University, Oct 2020.

Teaching Experience

- STAT 615: Statistical Learning, University of Wisconsin-Madison, Spring 2025, Instructor.
- STAT 615: Statistical Learning, University of Wisconsin-Madison, Fall 2024, Instructor.
- ORF 309: Probability and Stochastic Systems, Princeton University, Spring 2021, Teaching Assistant.
- ELE 522: Large-Scale Optimization for Data Science, Princeton University, Fall 2019, Teaching Assistant.

Professional Service

- Journal reviewer for *Annals of Statistics*, *Journal of the Royal Statistical Society: Series B*, *Journal of the American Statistical Association*, *Biometrika*, *Management Science*, *Operations Research*, *IEEE Transactions on Information Theory*, *Information and Inference: A Journal of the IMA*, *Journal of Business and Economic Statistics*, *IEEE Transactions on Signal Processing*, *Journal of Machine Learning Research*, *Journal of Multivariate Analysis*, *Journal of Computational and Graphical Statistics*, *IEEE Transactions on Computational Imaging*, *IEEE Signal Processing Letters*, *Journal of Nonparametric Statistics*.
- Conference reviewer for *Neural Information Processing Systems* (NeurIPS 2021-2023), *International Conference on Machine Learning* (ICML 2020-2024), *International Conference on Learning Representations* (ICLR 2021), *Conference on Learning Theory* (COLT 2025), *IEEE International Symposium on Information Theory* (ISIT 2020-2021).
- Organizing committee for *Conference on Statistical Foundations of Data Science and their Applications in celebration of Jianqing Fan's 60th Birthday*, May 2023.
- Poster session committee for *The Women in Data Science (WiDS) Cambridge Conference*, Mar 2024.

Short-time Visiting Positions

Massachusetts Institute of Technology, MA, USA *Sep. 2022 - Dec. 2022*

- Visiting student at Department of Mathematics, hosted by Philippe Rigollet

University of California, Berkeley, CA, USA *Aug. 2021 - Nov. 2021*

- Visiting student at Simons Institute for the Theory of Computing