Tianhao Wang **Last update: 06/2024**

CONTACT INFORMATION

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EMPLOYMENT

Research Assistant Professor, Toyota Technological Institute at Chicago 2024 – present

EDUCATION

Ph.D. in Statistics and Data Science, Yale University 2018 – 2024

- Advisor: Prof. Zhou Fan

B.S. in Mathematics, University of Science and Technology of China (USTC) 2014 – 2018

- B.E. in Computer Science (dual)

INTERNSHIP

Student researcher, Google DeepMind 09/2023 – 11/2023

Research intern, Google DeepMind 06/2023 – 08/2023

RESEARCH INTERESTS

1. High-dimensional statistics and learning
2. Deep learning theory
3. Data-driven decision making

PREPRINTS

(*: equal contribution)

1. Heejune Sheen, Siyu Chen, Tianhao Wang, and Harrison H. Zhou. "Implicit Regularization of Gradient Flow on One-Layer Softmax Attention". Available at arXiv:2403.08699.
2. Angeliki Giannou, Liu Yang, Tianhao Wang, Dimitris Papailiopoulos, and Jason D. Lee. "How well can Transformers emulate in-context Newton's method?" Available at arXiv:2403.03183.

PUBLICATIONS

(*: equal contribution)

1. Xinyi Zhong*, Tianhao Wang*, and Zhou Fan. "Approximate Message Passing for orthogonally invariant ensembles: Multivariate non-linearities and spectral initialization". *Information and Inference*, to appear. Available at arXiv:2110.02318.
2. Siyu Chen, Heejune Sheen, Tianhao Wang, and Zhuoran Yang. "Training dynamics of multi-head softmax attention for in-context learning: emergence, convergence, and optimality". *Conference on Learning Theory (COLT)*, 2024. Available at arXiv:2402.19442.
3. Zhou Fan, Roy R. Lederman, Yi Sun, Tianhao Wang, Sheng Xu. ''Maximum likelihood for high-noise group orbit estimation and single-particle cryo-EM". *The Annals of Statistics*, 2024. Available at https://arxiv.org/abs/2107.01305.
4. Tianhao Wang, Xinyi Zhong, and Zhou Fan. "Universality of Approximate Message Passing algorithms and tensor networks". *The Annals of Applied Probability*, to appear. Available at arXiv:2206.13037.
5. Runzhe Wang, Sadhika Malladi, Tianhao Wang, Kaifeng Lyu, and Zhiyuan Li. "The Marginal Value of Momentum for Small Learning Rate SGD". *International Conference on Learning Representations (ICLR)*, 2024. Available at arXiv:2307.15196.
6. 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*, 2023.
7. Ruitu Xu, Yifei Min, and Tianhao Wang. "Noise-adaptive Thompson sampling for linear contextual bandits". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2023.

8. Yifei Min, Jiafan He, Tianhao Wang, Quanquan Gu. "Cooperative multi-agent reinforcement learning: Asynchronous communication and linear function approximation". *International Conference on Machine Learning (ICML), 2023*.

9. Ruitu Xu, Yifei Min, Tianhao Wang, Michael I. Jordan, Zhaoran Wang, Zhuoran Yang. "Finding regularized competitive equilibria of heterogeneous agent macroeconomic models via reinforcement learning". *International Conference on Artificial Intelligence and Statistics (AISTATS), 2023*.

10. Zhiyuan Li, Tianhao Wang, Dingli Yu. "Fast mixing of stochastic gradient descent with normalization and weight decay". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2022.

11. Zhiyuan Li*, Tianhao Wang*, Jason D. Lee, Sanjeev Arora. "Implicit bias of gradient descent on reparametrized models: on equivalence to mirror descent". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2022.

12. Jiafan He*, Tianhao Wang*, Yifei Min*, Quanquan Gu. "A simple and provably efficient algorithm for asynchronous federeted linear bandits". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2022.

13. Yifei Min, Tianhao Wang, Ruitu Xu, Zhaoran Wang, Michael I. Jordan, Zhuoran Yang. "Learn to match with no regret: Reinforcement learning in Markov matching market". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2022. **(Oral)**

14. Yifei Min, Jiafan He, Tianhao Wang, Quanquan Gu. "Learning stochastic shortest path with linear function approximation". *International Conference on Machine Learning (ICML)*, 2022.

15. Zhiyuan Li, Tianhao Wang, Sanjeev Arora. "What happens after SGD reaches zero loss? – A mathematical framework". *International Conference on Learning Representations (ICLR)*, 2022. **(Spotlight)**

16. Pamela L Valentino, Tianhao Wang, Veronika Shabanova, Vicky Lee Ng, John C Bucuvalas, Amy G Feldman, Regino P Gonzalez-Peralta, Nitika Arora Gupta, Tamir A Miloh, Saeed Mohammad, Erika Pace, Shikha S Sundaram, Nada A Yazigi, Kyle Soltys, Society of Pediatric Liver Transplantation (SPLIT). "North American biliary stricture management strategies in children post liver transplant: multicenter analysis from the SPLIT Registry". *Liver Transplatation*, 2021.

17. Yifei Min*, Tianhao Wang*, Dongruo Zhou, Quanquan Gu. "Variance-aware off-policy evaluation with linear function approximation". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2021.

18. Tianhao Wang*, Dongruo Zhou*, Quanquan Gu. "Provably efficient reinforcement learning with linear function approximation under adaptivity constraints". *In Advances in Neural Information Processing Systems (NeurIPS)*, 2021.

19. Pan Xu*, Tianhao Wang*, Quanquan Gu. "Continuous and discrete-time accelerated stochstic mirror descent for strongly convex functions". *International Conference on Machine Learning (ICML)*, 2018.

20. Pan Xu*, Tianhao Wang*, Quanquan Gu. "Accelerated stochastic mirror descent: From continuous-time dynamics to discrete-time algorithms". *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2018.

Honors and Awards

- Leonard F. Savage Prize — Yale, 2024
- Conference Travel Fellowship — Yale, 2023
- Student Poster Competition Award — Rutgers University, 2023
  - At Conference on Recent Advances in Statistics and Data Science
- NeurIPS 2022 top reviewer — NeurIPS, 2022

- Wedworth W. Clarke Fellowship — Yale, 2021
- ICML 2018 travel award — ICML, 2018
- Huang Yu Memorial Scholarship — USTC, 2017

Invited Talks and Seminars

- Joint Statistical Meetings — 08/2024
- University of Notre Dame, ACMS Colloquium — 02/2024
- UIUC, Statistics Seminar — 02/2024
- Columbia University, Statistics Seminar — 01/2024
- UCSD, Halıcıoğlu Data Science Institute, Special Seminar Series — 01/2024
- UC Davis, Statistics Seminar — 01/2024
- UCSD, Department of Mathematics Colloquium — 12/2023
- INFORMS Annual Meeting — 10/2023
  - Universality of Approximate Message Passing algorithms and tensor networks
- International Conference on Machine Learning — 07/2022
  - Learning stochastic shortest path with linear function approximation
  - Implicit bias of gradient descent on reparameterized models

Teaching Experience

- High-Dimensional Phenomena in Statistics and Learning — Spring 2023
- Intermediate Machine Learning — Spring 2022
- Statistical Inference — Fall 2020, Fall 2021
- Information Theory — Spring 2021
- Probability and Statistics — Fall 2019
- Stochastic Processes — Spring 2019, Spring 2020

Service

- Journal reviewer
  - IEEE Transactions on Information Theory
  - The Annals of Statistics
- Conference reviewer
  - AISTATS 2022, 2023, 2024
  - ECML 2023
  - ICLR 2023, 2024
  - ICML 2022, 2023, 2024
  - IEEE ITW 2023
  - NeurIPS 2022, 2023