

Yifan Chen

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Updated Oct, 2024

EMPLOYMENT

Courant Institute, New York University

Assistant Professor/Courant Instructor

New York, NY

2023/9–

EDUCATION

California Institute of Technology

Ph.D. in Applied and Computational Mathematics

Advisors: Thomas Y. Hou, Houman Owhadi, Andrew M. Stuart

Pasadena, California

2018–2023

Tsinghua University

B.S. in Pure and Applied Mathematics, GPA ranked 1st

Beijing, China

2014–2018

RESEARCH INTERESTS

My research involves analyzing and developing algorithms for high-dimensional statistical and computational problems in physics, data science, and machine learning, with a focus on partial differential equations, multiscale and statistical numerical methods, Bayesian inference, and the sampling and learning of probability distributions.

PUBLICATIONS

Preprints

- [1] Yifan Chen, Xiaoou Cheng, Jonathon Niles-Weed, Jonathon Weare. Convergence of Unadjusted Langevin in High Dimensions: Delocalization of Bias. *arxiv: 2408.13115*, 2024.
- [2] José A. Carrillo, Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Dongyi Wei. Fisher-Rao Gradient Flow: Geodesic Convexity and Functional Inequalities. *arxiv: 2407.15693*, 2024
- [3] Yifan Chen, Bamdad Hosseini, Houman Owhadi, Andrew M. Stuart. Gaussian Measures Conditioned on Nonlinear Observations: Consistency, MAP Estimators, and Simulation. *arxiv: 2405.13149*, 2024
- [4] Huan Zhang, Yifan Chen, Eric Vanden-Eijnden, Benjamin Peherstorfer. Sequential-in-time training of nonlinear parametrizations for solving time-dependent partial differential equations. *arxiv: 2404.01145*, 2024
- [5] Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich, Andrew M. Stuart. Sampling via Gradient Flows in the Space of Probability Measures. *arxiv: 2310.03597*, 2023

Conference publications

- [1] Yifan Chen, Mark Goldstein, Mengjian Hua, Michael S. Albergo, Nicholas M. Boffi, Eric Vanden-Eijnden. Probabilistic Forecasting with Stochastic Interpolants and Föllmer Processes. *ICML*, 2024.
- [2] Xinzhe Dai, Peichen Zhong, Bowen Deng, Yifan Chen, and Gerbrand Ceder. Inpainting crystal structure generations with score-based denoising. *ICML Workshop AI4Science*, 2024.

- [3] Zihui Wu, Yu Sun, Yifan Chen, Bingliang Zhang, Yisong Yue, Katherine L. Bouman. Principled Probabilistic Imaging using Diffusion Models as Plug-and-Play Priors. *NeurIPS*, 2024

Journal publications

- [1] Yifan Chen, Ethan N. Epperly, Joel A. Tropp, and Robert J. Webber. Randomly pivoted Cholesky: Practical approximation of a kernel matrix with few entry evaluations. *arXiv:2207.06503*, 2022. To appear in *Communications on Pure and Applied Mathematics*.
- [2] Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich, Andrew M. Stuart. Efficient, Multimodal, and Derivative-Free Bayesian Inference With Fisher-Rao Gradient Flows. *Inverse Problems*, 2024
- [3] Pau Batlle, Yifan Chen, Bamdad Hosseini, Houman Owhadi, Andrew M. Stuart. Error Analysis of Kernel/GP Methods for Nonlinear and Parametric PDEs. *Journal of Computational Physics*, 2024.
- [4] Yu Sun, Zihui Wu, Yifan Chen, Berthy T. Feng, Katherine L. Bouman. Provable Probabilistic Imaging using Score-Based Generative Priors. *IEEE Transactions on Computational Imaging*, 2024.
- [5] Yifan Chen, Houman Owhadi, Florian Schaefer. Sparse Cholesky Factorization for Solving Nonlinear PDEs via Gaussian Processes. *Mathematics of Computation*, 2024.
- [6] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale methods for 2D high frequency heterogeneous Helmholtz equations. *SIAM Multiscale Modeling & Simulation*, 21(3): 849–883, 2023.
- [7] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale finite element method. *Communications on Applied Mathematics and Computation*, 1–17, 2023.
- [8] Yifan Chen and Thomas Y. Hou. Multiscale elliptic PDE upscaling and function approximation via subsampled data. *SIAM Multiscale Modeling & Simulation*, 20(1):188–219, 2022.
- [9] Yifan Chen, Bamdad Hosseini, Houman Owhadi, and Andrew M. Stuart. Solving and learning nonlinear PDEs with Gaussian processes. *Journal of Computational Physics*, 447:110668, 2021.
- [10] Yifan Chen, Houman Owhadi, and Andrew M. Stuart. Consistency of empirical Bayes and kernel flow for hierarchical parameter estimation. *Mathematics of Computation*, 90(332):2527–2578, 2021.
- [11] Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponential convergence for multiscale linear elliptic PDEs via adaptive edge basis functions. *SIAM Multiscale Modeling & Simulation*, 19(2):980–1010, 2021.
- [12] Yifan Chen and Thomas Y. Hou. Function approximation via the subsampled Poincaré inequality. *Discrete & Continuous Dynamical Systems-A*, 41(1), 2021.
- [13] Yifan Chen and Wuchen Li. Optimal transport natural gradient for statistical manifolds with continuous sample space. *Information Geometry*, 3(1):1–32, 2020.
- [14] Yifan Chen, Yuejiao Sun, and Wotao Yin. Run-and-Inspect Method for nonconvex optimization and global optimality bounds for R-local minimizers. *Mathematical Programming*, 176(1): 39–67, 2019.
- [15] Jing Chen, Yifan Chen, Hao Wu, and Dinghui Yang. The quadratic Wasserstein metric for earthquake location. *Journal of Computational Physics*, 373:188–209, 2018.

TEACHING

Instructor at NYU Courant

- Discrete Mathematics Fall 2023
- Discrete Mathematics Spring 2024
- Numerical Analysis Fall 2024

Teaching Assistant at Caltech

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|---|-------------|
| • ACM 109: Mathematical Modeling | Spring 2021 |
| • ACM 118: Stochastic Processes and Regression | Winter 2020 |
| • ACM 117: Probability and Stochastic Processes | Fall 2020 |
| • ACM 109: Mathematical Modeling | Spring 2020 |

INDUSTRIAL EXPERIENCES

Citadel Securities

Quantitative Research Intern

Miami, Florida

6/2022-8/2022

- Project on Alpha Research: Predicting APAC Market Returns

Microsoft

Part Time Researcher, Mentor: Pengchuan Zhang

(virtual) Redmond, Washington

9/2021-2/2022

- Project: Stabilizing Large Scale Neural Network Training of Vision Transformers

REFEREE SERVICES

- Reviewer for NeurIPS 2024
- Reviewer for Journal of Functional Analysis
- Reviewer for Mathematics of Computation
- Reviewer for Journal of Computational Physics
- Reviewer for SIAM on Uncertainty Quantification
- Reviewer for SIAM on Control and Optimization
- Reviewer for SIAM on Numerical Analysis
- Reviewer for SIAM on Multiscale Modeling and Simulation
- Reviewer for Linear Algebra and Its Applications
- Reviewer for Research in the Mathematical Sciences
- Reviewer for European Journal of Applied Mathematics
- Reviewer for Nature Machine Intelligence
- Reviewer for IMA Journal of Numerical Analysis
- Reviewer for Foundations of Data Science
- Reviewer for Computational Methods in Applied Mathematics
- Reviewer for International Journal of Computer Mathematics
- Reviewer for the 4th International Conference on Geometric Science of Information

CONFERENCES AND SEMINARS

- Co-organizing the minisymposium “Efficient computation and learning with randomized sampling and pruning” at the SIAM Conference on Mathematics of Data Science (MDS24), Atlanta, Georgia, Oct 2024
- Recent Advances and Future Directions for Sampling, Yale University, New Haven, Oct 2024
- Data Science Seminar, Department of Mathematics, University of Minnesota, Oct 2024
- Rising Stars in Computing for Science and Engineering, Harvard University, Sep 2024
- Computational Bayesian Statistics Journal Club, Flatiron Institute, New York, Sep, 2024

- Applied Mathematics Seminar, Nanyang Technology University, July, 2024
- International Conference on Scientific Computation and Differential Equations, National University of Singapore, July, 2024
- Conference on Multiscale Modeling based on Physics and Data, IPAM, UCLA, April, 2024
- Columbia Applied Math Colloquium, January, 2024
- Workshop on Scientific Computing and Large Data, University of South Carolina, Dec, 2023
- Numerical Analysis Seminar (virtual), Hong Kong University, Dec, 2023
- Measure Transport, Diffusion Processes and Sampling Workshop, Flatiron, New York, Dec, 2023
- Yau Mathematical Science Center CAM seminar, Tsinghua University (virtual), Nov, 2023
- International Workshop on Recent Developments in Applied Mathematics and its Applications, Caltech, Nov, 2023
- Scientific machine learning seminar, Courant Institute, Oct, 2023
- 17th U. S. National Congress on Computational Mechanics, Albuquerque, New Mexico, July 2023
- Mathematical and Scientific Machine Learning, ICERM, Providence, June, 2023
- The AIMS Conference on Dynamical Systems, Differential Equations and Applications, Wilmington, North Carolina, May 2023
- Southern California Applied Mathematics Symposium, University of California, Irvine, April 2023
- Peking University applied math colloquium (virtual), Feb, 2023.
- Columbia applied math colloquium (virtual), January, 2023.
- The International Conference on New Trends in Computational and Data Sciences, Caltech, December 2022.
- Co-organizing the minisymposium “Recent Advances in Kernel Methods for Computing and Learning” in SIAM Mathematics of Data Science, San Diego, September, 2022.
- Southern California Applied Mathematics Symposium, Harvey Mudd College, May, 2022
- Rough Path Interest Group, The Alan Turing Institute (virtual), April, 2022
- SIAM Uncertainty Quantification Minisymposium “New Developments in Gaussian Processes”, Atlanta, April 2022
- CMX Student and Postdoc Seminar, Caltech, November, 2020
- Second Symposium on Machine Learning and Dynamical Systems, Fields Institute (virtual), September, 2020
- Bernoulli-IMS One World Symposium (virtual), August, 2020
- Oberwolfach Seminar: Beyond Numerical Homogenization, June, 2019
- Machine Learning for Multiscale Model Reduction Workshop, Harvard University, March, 2019
- Mathematical Model and Computation of Nonlinear Problems, Tsinghua Sanya International Mathematics Forum, January, 2018
- Youth Forum in the 15th Annual Meeting of CSIAM, Qingdao, China, October, 2017

SCHOLARSHIPS AND AWARDS

• The W.P. Carey and Co. Prize in Applied Mathematics, 2023, Caltech	2023
• Kortschak Scholars Program, Department of Computational and Mathematical Sciences, Caltech	2018–2023
• Tsinghua Xuetang Mathematics Program, Department of Mathematical Sciences, Tsinghua University	2015–2018
• Outstanding Undergraduate, Tsinghua University and Beijing	2018
• Baosteel Scholarship, Baosteel Corporation	2017
• Scholarship in Memory of the “12.9” Student Movement, Tsinghua University	2016
• Qualcomm Scholarship, Qualcomm Corporation	2016
• Scholarship in Memory of Mathematics Professor Ou Li, Tsinghua University	2016
• National Scholarship, Ministry of Education of China	2015

COMPUTER SKILLS

Professional experiences in MATLAB, LaTeX, Python, Julia.

LANGUAGES

English (fluent), Chinese (native)