Yifan Chen

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Education

Caltech — Pasadena, California
Ph.D. Candidate in Applied and Computational Mathematics — 2018–present
Advisors: Profs. Thomas Y. Hou, Houman Owhadi, Andrew M. Stuart

Tsinghua University — Bejing, China
B.S. in Pure and Applied Mathematics, GPA ranked 1st — 2014–2018

Research Interests

My research lies in the intersection of **applied and computational mathematics**, **computer science**, and **data science**. My current work centers around **probabilistic** inference and **multiscale** analysis & algorithms for scientific computing, uncertainty quantification, and machine learning, in physics and data science.

Publications

1. Yifan Chen, Houman Owhadi, Florian Schaefer. Sparse Cholesky Factorization for Solving Nonlinear PDEs via Gaussian Processes. *Submitted to SIAM Scientific Computing, arxiv: 2304.01294*, 2023.
2. Yifan Chen, Daniel Zhengyu Huang, Jiaoyang Huang, Sebastian Reich, Andrew M. Stuart. Gradient flows for sampling: mean-field models, gaussian approximations and affine invariance. *Submitted to Foundations of Computational Mathematics, arxiv: 2302.11024*, 2023.
3. 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. *Submitted to SIAM Mathematics of Data Science, arXiv:2207.06503*, 2022.
4. Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale methods for high frequency heterogeneous Helmholtz equations. *To appear in SIAM Multiscale Modeling & Simulation*, 2023.
5. Yifan Chen, Thomas Y. Hou, and Yixuan Wang. Exponentially convergent multiscale finite element method. *arXiv:2212.00823. To appear in Communications on Applied Mathematics and Computation*, 2023.
6. 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.
7. 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.
8. 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.
9. 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.
10. Yifan Chen and Thomas Y. Hou. Function approximation via the subsampled Poincaré inequality. *Discrete & Continuous Dynamical Systems-A*, 41(1), 2021.
11. Yifan Chen and Wuchen Li. Optimal transport natural gradient for statistical manifolds with continuous sample space. *Information Geometry*, 3(1):1–32, 2020.

12. 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.

13. 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

Teaching Assistant at Caltech

- 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 — Miami, Florida
Quantitative Research Intern — 6/2022-8/2022

- Project on Alpha Research: Predicting APAC Market Returns

Microsoft — (virtual) Redmond, Washington
Part Time Researcher, Mentor: Pengchuan Zhang — 9/2021-2/2022

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

Referee Services

- Reviewer for Journal of Functional Analysis
- 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 Research in the Mathematical Sciences
- Reviewer for the 4th International Conference on Geometric Science of Information, 2019.

Conferences and Seminars

- 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

- Kortschak Scholars Program, Department of Computational and Mathematical Sciences, Caltech 2018–present
- 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)