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: 96/100, ranked 1/89 — 2014–2018

Experience

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

- Project: Stablizing Neural Network Training of Vision Transformers
- Understand the mathematical properties of stochastic depth, layer scale, weight decay and more for training networks

Research Interest

I have my background in **Applied and Computational Mathematics**. I have been working on theoretical and computational math problems in *scientific computing* and *machine learning*.

- **Multiscale Methods for PDEs**: numerical analysis of multiscale PDEs [2], [3], [5], [6]
- **Kernel Methods / Gaussian Processes**: solve and learn nonlinear PDEs [1] and and hierarchical learning [4]
- **Computational Science and Engineering**: natural gradient [7], inverse problems [9], nonconvex optimization [8]

Publications

[1] Y. Chen, B. Hosseini, H. Owhadi, and A. M. Stuart, "Solving and learning nonlinear pdes with Gaussian processes", *Journal of Computational Physics*, vol. 447, p. 110 668, 2021.

[2] Y. Chen, T. Y. Hou, and Y. Wang, "Exponential convergence for multiscale linear elliptic pdes via adaptive edge basis functions", *Multiscale Modeling & Simulation*, vol. 19, no. 2, pp. 980–1010, 2021.

[3] Y. Chen, T. Y. Hou, and Y. Wang, "Exponentially convergent multiscale methods for high frequency heterogeneous helmholtz equations", *submitted to SIAM Journal on Numerical Analysis, arXiv preprint arXiv:2105.04080*, 2021.

[4] Y. Chen, H. Owhadi, and A. M. Stuart, "Consistency of empirical bayes and kernel flow for hierarchical parameter estimation", *Mathematics of Computation*, 2021.

[5] Y. Chen and T. Y. Hou, "Function approximation via the subsampled poincaré inequality", *Discrete and Continuous Dynamical Systems-A*, 2020.

[6] Y. Chen and T. Y. Hou, "Multiscale elliptic pdes upscaling and function approximation via subsampled data", *submitted to Multiscale Modeling & Simulation, arXiv preprint arXiv:2010.04199*, 2020.

[7] Y. Chen and W. Li, "Optimal transport natural gradient for statistical manifolds with continuous sample space", *Information Geometry*, vol. 3, no. 1, pp. 1–32, 2020.

[8] Y. Chen, Y. Sun, and W. Yin, "Run-and-inspect method for nonconvex optimization and global optimality bounds for r-local minimizers", *Mathematical Programming*, vol. 176, no. 1-2, pp. 39–67, 2019.

[9] J. Chen, Y. Chen, H. Wu, and D. Yang, "The quadratic wasserstein metric for earthquake location", *Journal of Computational Physics*, vol. 373, pp. 188–209, 2018.

All alphabetical order & Corresponding author: [3], [4], [6], [7]

Referee Services

- Reviewer for SIAM Journal on Control and Optimization
- Reviewer for SIAM on Numerical Analysis
- Reviewer for Research in the Mathematical Sciences
- Reviewer for 4th International Conference, GSI 2019, Toulouse, France, August 27–29, 2019, Proceedings.

Conferences and Seminars

- SIAM Uncertainty Quantification (UQ22) Minisymposium on New Developments in Gaussian Processes, Atlanta, Georgia, April 12-15, 2022
  - Talk: Solving PDEs via Gaussian Processes
- Second Symposium on Machine Learning and Dynamical Systems, Fields Institute, Toronto, Sept. 21-25, 2020
  - Gave talk: Consistency of Hiearchical Parameter Learning: Empirical Bayesian and Kernel Flow Approaches
- Bernoulli-IMS One World Symposium 2020
  - Gave talk: Consistency of Hiearchical Parameter Learning: Empirical Bayesian and Kernel Flow Approaches
- Oberwolfach Seminar: Beyond Numerical Homogenization, June 9-15, 2019
- Machine Learning for Multiscale Model Reduction Workshop, Harvard University, March 27-29, 2019
- Mathematical Model and Computation of Nonlinear Problems, Tsinghua Sanya International Mathematics Forum, January 15-19, 2018
- Youth Forum in the 15th Annual Meeting of CSIAM, Qingdao, China, Oct 2017
  - Gave talk: The quadratic Wasserstein metric for Earthquake Location

Teaching

- **Teaching Assistant** for graduate-level courses at Caltech 2020-2021
  ACM 109: Mathematical Modeling,2020
  ACM 117: Probability and Stochastic Processes, 2020
  ACM 118: Stochastic Processes and Regression, 2021
  ACM 109: Mathematical Modeling, 2021

Scholarships and Awards

Graduate:

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

Undergraduate: multiple top scholarships

- Tsinghua Xuetang Mathematics Program, Department of Mathematical Sciences 2015–2018
- Outstanding Undergraduate, Tsinghua and Beijing 2018

- Baosteel Scholarship, Baosteel Corporation 2017
- Scholarship in Memory of the "12.9" Student Movement, Tsinghua 2016
- Qualcomm Scholarship, Qualcomm Corporation 2016
- Scholarship in Memory of Prof. Ou Li (Mathematics) 2016
- National Scholarship, Ministry of Education of China 2015

Computer Skills

- **MATLAB:** proficient
- **LaTeX:** proficient
- **Python:** proficient
- **Julia:** intermediate

Languages

- **English:** fluent
- **Chinese:** native