Zikai Xiong

MIT Operations Research Center
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EDUCATION

Massachusetts Institute of Technology, Cambridge, MA (expected) June 2025
Ph.D. in Operations Research
GPA: 5.0/5.0
Advisor: Prof. Robert M. Freund

Fudan University, Shanghai, China May 2020
B.S. in Mathematics and Applied Mathematics

RESEARCH INTERESTS

Huge-scale linear programming, first-order methods for optimization, with applications in statistical learning, machine learning, deep learning, transportation, and fairness.

PUBLICATIONS

Publications and working papers in optimization:

- **Zikai Xiong** and Robert Freund, "Improving the Geometry of (Conic) Linear Optimization Problems for the Primal-Dual Hybrid Gradient Method," in preparation.
- **Zikai Xiong** and Robert Freund, "Computational Guarantees for Restarted PDHG for LP based on 'Limiting Error Ratios' and LP Sharpness," submitted.
- **Zikai Xiong** and Robert Freund, "On the Relation Between LP Sharpness and Limiting Error Ratio in Linear Programs and the Complexity Implication of the Restarted PDHG," technical report.
- **Zikai Xiong,** Niccolo Dalmasso, Vamsi Potluru, Tucker Balch, Manuela Veloso, "Fair Wasserstein Coresets," submitted. https://arxiv.org/abs/2311.05436
- **Zikai Xiong,** Niccolo Dalmasso, Alan Mishler, Vamsi Potluru, Tucker Balch, Manuela Veloso, "FairWASP: Fast and Optimal Fair Wasserstein Pre-processing," submitted. https://arxiv.org/abs/2311.00109
- **Zikai Xiong** and Robert Freund, "Using Taylor-Approximated Gradients to Improve the Frank-Wolfe Method for Empirical Risk Minimization," under revision in SIAM Journal on Optimization. https://zikaixiong.github.io/FWERM.pdf
- Dongdong Ge, Chengwenjian Wang, **Zikai Xiong**, and Yinyu Ye (alphabetical order), "From an Interior Point to a Corner Point: Smart Crossover," under revision in INFORMS Journal on Computing. https://arxiv.org/abs/2102.09420
- Dongdong Ge, Haoyue Wang, **Zikai Xiong**, and Yinyu Ye (alphabetical order), "Interior-Point Methods Strike Back: Solving the Wasserstein Barycenter Problem." *NeurIPS 2019*, 6894-6905, 2019. https://proceedings.neurips.cc/paper/2019/hash/0937fb5864ed06ffb59ae5f9b5ed67a9-Abstract.html

- **Zikai Xiong**, Renjie Xu, Yanwei Xu, and Yimin Wei, "Low-Rank Traffic Matrix Completion with Marginal Information." *Journal of Computational and Applied Mathematics* 410(3):114219, 2022. https://doi.org/10.1016/j.cam.2022.114219

Other:

- Zhengqi Gao, Fan-Keng Sun, Mingran Yang, Sucheng Ren, **Zikai Xiong**, et al. "Learning from Multiple Annotator Noisy Labels via Sample-wise Label Fusion." *ECCV 2022*. https://arxiv.org/abs/2207.11327
- **Zikai Xiong**, Jiacheng Guo and Bo Jiang, "Effect of Hidden-City Ticketing in Revenue Management," in preparation.

WORK EXPERIENCE

Research Intern, J.P.Morgan Chase AI Research 2023 Summer

- Developed a preprocessing method on datasets to improve fairness for downstream models, via proposing a fast algorithm on the huge-scale linear programming subproblem
- Developed a data distillation algorithm that distills the knowledge of large models and ensures the fairness for downstream models

Research Assistant, MIT 2020 – Present

Operations Research Center

Supervisor: Robert M. Freund (MIT)

- Studied the condition numbers for first-order methods (such as primal-dual hybrid gradient method) for general huge-scale linear programming problems, aimed at deriving practical enhancements on huge-scale linear programming methods
- Developed new algorithms for improving the geometry of (conic) linear programming problems, to improve the convergence rates of first-order methods on them, in theory and practice
- Developed new stochastic Frank-Wolfe methods for solving empirical risk minimization problems, yielding reduced dependence on sample size and demonstrating robust performance in real-world applications.

Research Assistant, Shanghai University of Finance and Economics (SUFE) 2018 - 2022

Research Institute for Interdisciplinary Sciences (RIIS)

Supervisors: Yinyu Ye (Stanford), Dongdong Ge (SUFE)

- Developed new crossover methods for linear programming (LP), now in a new commercial LP solver that won first place in Hans Mittelmann benchmark of barrier LP solvers.
- Developed a matrix-based interior-point method to solve the large-scale linear programming problems in Wasserstein barycenter problems.
- Studied the effects of hidden-city ticketing practices on airline revenues.

PRESENTATIONS

- "Improving the Geometry of (Conic) Linear Optimization Problems for the Primal-Dual Hybrid Gradient Method (PDHG)," Workshop on Modern Continuous Optimization, Cambridge, 2023; INFORMS Annual Meeting, Phoenix, 2023
- "Geometric Condition Measures in the Primal-Dual Hybrid Gradient Method for Linear Programming," SIAM Conference on Optimization (OP23), Seattle, 2023; Operations Research Center, Cambridge, 2023; SUFE, Shanghai, 2023
- "Using Taylor-Approximated Gradients to Improve the Frank-Wolfe Method for Empirical Risk

Minimization," ICCOPT, Bethlehem, 2022; and MIT Operations Research Center, Cambridge, 2022; and INFORMS Annual Meeting, Indianapolis, 2022

- "From an inner point to a corner point: Smart Crossover," INFORMS Annual Meeting, Indianapolis, 2022
- "Interior-Point Methods Strike Back: Solving the Wasserstein Barycenter Problem," INFORMS Annual Meeting, Seattle, 2019; and Shanghai University of Finance and Economics, 2019

PROFESSIONAL SERVICE

Reviewer:

Journal: *SIAM Journal on Optimization (SIOPT)*

Conference: *ICML 2021/2022*; *NeurIPS 2022*

HONORS & AWARDS

First Place, MIT OR Center Common Experience Presentation Competition 2021

SIAM Travel Award 2021

Fudan Graduation Star 2020

The highest award of Fudan University, for only 10 graduates every year

Outstanding Graduate of Shanghai City 2020

Fudan Outstanding Student Pacesetter Award 2019

The highest annual award of Fudan University, for only 10 undergraduate students

National Scholarship 2018

The highest annual scholarship for top students (1%)

OTHER

Teaching Assistant:

Massachusetts Institute of Technology graduate courses:

- 15.081 Introduction to Mathematical Programming Fall 2023
- 15.081 Introduction to Mathematical Programming Fall 2022
- 15.077 Statistical Machine Learning and Data Science Summer 2022
- 15.071 The Analytics Edge Spring 2022

Shanghai University of Finance and Economics graduate courses:

- International Summer Courses (Stochastic Modeling; From Machine Learning to Decision-making: Bandit Learning and Reinforcement Learning; Stochastic Process and Financial Risk Analysis) Summer 2019

Programming languages: Julia, Python, MATLAB, R, C++

Hobbies: Hiking, Kayaking, Skiing