Liyuan Cao

Email: caoliyuan@nju.edu.cn
Website: https://liyuancao.github.io
WeChat: Liyuan_Cao
DOB: August, 1992

School of Mathematics, Nanjing University
West Building of Gulou Campus
22 Hankou Road
Nanjing, China 210093

EDUCATION

Doctor of Philosophy in Industrial Engineering   2016 - 2021
    Department of Industrial and Systems Engineering, Lehigh University
    advisor: Katya Scheinberg

Master of Engineering in Industrial Engineering   2014 - 2016
    Department of Industrial and Systems Engineering, Lehigh University

Bachelor of Engineering in Mechanical Engineering   2010 - 2014
    College of Mechanical & Electrical Engineering, Nanjing University of Aeronautics & Astronautics

EMPLOYMENT

Assistant Professor School of Mathematics, Nanjing University   2024 - present

Postdoc Beijing International Center for Mathematical Research, Peking University   2021 - 2024
    advisor: Zaiwen Wen
    Sept 2021 - May 2022 Funded by Boya Postdoctoral Fellowship;
    May 2022 - May 2024 Funded by International Postdoctoral Exchange Fellowship.

Intern Robert Bosch LLC in Sunnyvale, CA, USA   Summer 2019
    Participated in an assisted braking system design project. Developed a method based on derivative-free optimization to automatically tune the hyperparameters in a machine learning task, improving the model's ability to decide when to brake.

Givens Fellow Argonne National Laboratory   Summer 2018
    Worked on derivative-free multi-objective optimization.

Teaching/Research Assistant Lehigh University   2016 - 2021

Intern Huakuo Auto&Eng Co., LTD in Shanghai, China   Summer 2016

PUBLICATIONS & PREPRINTS

Google Scholar Link: https://scholar.google.com/citations?user=zYJRGroAAAAJ

[1] Yiming Chen, Yuan Zhang, **Liyuan Cao**, Kun Yuan, and Zaiwen Wen. Enhancing zeroth-order fine-tuning for language models with low-rank structure. 2024. (Submitted to *2025 International Conference on Learning Representations*)

[2] Yiming Chen, **Liyuan Cao**, Kun Yuan, and Zaiwen Wen. Sharper convergence guarantees for federated learning with partial model personalization. 2024. (Submitted to *Journal of Computational Mathematics*)

[3] **Liyuan Cao**, Zaiwen Wen, and Ya-xiang Yuan. The error in multivariate linear extrapolation with applications to derivative-free optimization. 2023. (Submitted to *IMA Journal of Numerical Analysis.*)

[4] **Liyuan Cao**, Albert S Berahas, and Katya Scheinberg. First-and second-order high probability complexity bounds for trust-region methods with noisy oracles. *Mathematical Programming*, 207(1):55–106, 2024.

[5] **Liyuan Cao**. *Model-Based Derivative-Free Optimization Methods and Analysis of Stochastic Nonlinear Optimization.* PhD thesis, Lehigh University, 2021

[6] Albert S Berahas, **Liyuan Cao**, Krzysztof Choromanski, and Katya Scheinberg. A theoretical and empirical comparison of gradient approximations in derivative-free optimization. *Foundations of Computational Mathematics*, 22(2):507–560, 2022

[7] Albert S Berahas, **Liyuan Cao**, and Katya Scheinberg. Global convergence rate analysis of a generic line search algorithm with noise. *SIAM Journal on Optimization*, 31(2):1489–1518, 2021

[8] Albert S Berahas, **Liyuan Cao**, Krzysztof Choromanski, and Katya Scheinberg. Linear interpolation gives better gradients than gaussian smoothing in derivative-free optimization. *arXiv preprint arXiv:1905.13043*, 2019 (Technical Report, Lehigh University)

[9] Fenlan Wang and **Liyuan Cao**. A new algorithm for quadratic integer programming problems with cardinality constraint. *Japan Journal of Industrial and Applied Mathematics*, 37(2):449–460, 2020

TEACHING

Teaching Assistant Lehigh University   2016 - 2021
Production and Inventory Control (ISE 251), Product Quality (ISE 332), Introduction to Machine Learning (ISE 364), Introduction to Mathematical Optimization (ISE 406), Optimization Models and Applications (ISE426), Optimization in Machine Learning (ISE444), Optimization Algorithms and Software (ISE 455)

TECHNICAL TALKS

Approximation Error of Linear Interpolation
2nd Derivative-Free Optimization Symposium (DFOS24), Padova, Italy, June 2024
SIAM Conference on Optimization (OP23), Seattle, Washington, USA, June 2023

General Derivative-Free Optimization
SICIAM/CSIAM Zeroth-Order Optimization Workshop, Shenzhen, Guangdong, China, May 2023

The Application of Derivative-Free Optimization in Medical Science
Tuberculosis seminar 江苏省结核病防治技术发展研讨会, Nanjing, Jiangsu, China, August 2022 (hosted by 江苏省防痨协会)

High Probability Complexity Bounds for Trust-Region Methods with Noisy Oracles
Invited Talk by Chinese Academy of Science SIAM Student Chapter, Beijing, China, April 2023
ORSC2022-2023, Changsha, Hunan, China, April 2023
INFORMS Annual Meeting (virtual), Anaheim, CA, USA, October 2021

Complexity Analysis of Gradient Descent with Line Search under Noise
  ShanghaiTech University, Shanghai, China, October 2021

Adapting Derivative-Free Methods for Hyperparameter Tuning Problems
  INFORMS Annual Meeting (virtual), National Harbor, MD, USA, November 2020

Poisedness in Derivative-Free Optimization
  OptML group meeting, Lehigh University, February 2020

Introduction to Computer Vision
  OptML workshop, Lehigh University, September 2019

Gradient Approximation Methods in Derivative-Free Optimization
  MOPTA Conference, Bethlehem, PA, USA, August 2021
  INFORMS Annual Meeting, Seattle, WA, USA, October 2019
  MOPTA Conference, Bethlehem, PA, USA, August 2019
  ICCOPT Conference, Berlin, Germany, August 2019
  INFORMS Annual Meeting, Phoenix, AZ, USA, November 2018

Software

DFO-TR a practical derivative-free trust-region method designed to solve unconstrained black-box optimization problems, available in Python 3 and Matlab, link: `https://github.com/LiyuanCao/DFOTR`

Services

Professional Community Services
  President, Lehigh University INFORMS Student Chapter, 2019-2020
  Treasurer, Lehigh University INFORMS Student Chapter, 2018-2019

Conference Organization
  Session Chair, INFORMS Annual Meeting 2021: Derivative Free Optimization Algorithms and Applications

Journal Paper Review
  Journal of Scientific Computing
  IMA Journal of Numerical Analysis
  INFORMS Journal on Computing
  Journal of Optimization Theory and Applications
  Machine Learning
  Mathematical Programming
  Mathematical Programming Computation
  SIAM Journal on Optimization

Conference Paper Review
  AAAI Conference on Artificial Intelligence 2023
  The Platform for Advanced Scientific Computing (PASC) Conference 2019