Liyuan Cao

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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

Postdoc Beijing International Center for Mathematical Research, Peking University 2021 - present
advisor: Zaiwen Wen
Funded by Boya Postdoctoral Fellowship and International Postdoctoral Exchange Fellowship.

Intern Robert Bosch LLC in Sunnyvale, CA, USA Summer 2019
Developed a method to automatically tune the hyperparameters in a machine learning task for Bosch's assisted vehicle brake system.

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

[1] 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*.)

[2] Liyuan Cao, Albert S Berahas, and Katya Scheinberg. First-and second-order high probability complexity bounds for trust-region methods with noisy oracles. *arXiv preprint arXiv:2205.03667*, 2022. (Accepted by *Mathematical Programming* in June 2023.)

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

[4] 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

[5] 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

[6] 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)

[7] 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
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

IMA journal of Numerical Analysis
INFORMS Journal on Computing
Journal of Optimization Theory and Applications
Machine Learning
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