Xiaopeng Li

(+1) 3322488122 | (+86) 15679140148 • xl3040@columbia.edu

285 Saint Nicholas Ave., New York, NY 10027, USA

Education

Columbia University   New York City, NY

M.S./PhD in Operations Research GPA: 4.02/4.30   Sept 2020 – present

➢ Core Courses:
  ⬧ IEOR 6613 E Optimization I, IEOR 6614 E Optimization II
  ⬧ IEOR 6711 E Stochastic Modeling I, IEOR 6712 E Stochastic Modeling II
➢ Elective Courses:
  ⬧ EEOR 4650 E Convex Optimization for Electrical Engineering, EEOR 6616 E Convex Optimization
  ⬧ CSOR 4231 W Analysis of Algorithms I
  ⬧ IEOR 8100 E High-dimensional Probability with Applications, IEOR 8100 E Optimization in Machine Learning
  ⬧ APMA 6301 E Analytic Methods for PDE
  ⬧ MATH 6151 GR Analysis & Probability I, MATH 6153 GR Probability II
  ⬧ STAT 6201 GR Theoretical Statistics I

The Chinese University of Hong Kong, Shenzhen (CUHK(SZ))   Shenzhen, China

B.S. in Applied Mathematics. GPA: 3.88/4.00   Sept 2016 – May 2020

➢ Core Courses:
  ⬧ Mathematical Analysis I & II, Elementary Real Analysis, Real Analysis, Complex Analysis, Functional Analysis
  ⬧ Advanced Linear Algebra, Abstract Algebra
  ⬧ Optimization I & II, Stochastic Processes, Probability Theory, Stochastic Differential Equation
  ⬧ Ordinary Differential Equations, Partial Differential Equation, Numerical Analysis
  ⬧ Graph Theory, Differential Geometry, Introduction to Geometry and Topology
  ⬧ Data Structures, Fundamentals of Machine Learning

University of California - Berkeley   Berkeley, CA

International Student Visiting Program. GPA: 4.00/4.00   June – Aug 2017

➢ Core Courses: Linear Algebra and Differential Equations; Introduction to Neuroscience

Research Experience

Global Convergence of Momentum Method for Tame Functions March 2022 – Dec 2022

Graduate Researcher, Columbia University   ***Supervisor: Prof. Cedric Josz***

➢ Proved that gradient method with constant stepsize and constant momentum converges to a critical point for every initial point when the objective function is bounded below, definable on some o-minimal structure, has locally Lipschitz continuous gradient and bounded to its gradient dynamics.
➢ Proved that that gradient method with constant stepsize and constant momentum avoids strict saddle point and its convergence rate in terms of the minimum of gradient norm is $o(1/k)$.

Certifying the Absence of Spurious Local Minima at Infinity   July 2021 – Feb 2022
Graduate Researcher, Columbia University   *Supervisor: Prof. Cedric Josz*
➢ Proposed a new concept "local minima at infinity" to study the landscape of noncoercive functions at infinity based on the observation that optimization algorithm may not converge to global minima even if there are no local minima.
➢ Provided a new theory on certifying the absence of such local minima at infinity and applied the theory to study unconstrained optimization problems widely used in machine learning, e.g., linear neural network, matrix recovery, and robust matrix factorization.

(Sub)Gradient Dynamics for Tame Functions   Feb 2021 – June 2021
Graduate Researcher, Columbia University   *Supervisor: Prof. Cedric Josz*
➢ Proved the existence of solutions to (sub)gradient dynamics for any locally Lipschitz continuous lower bounded function.
➢ Proved the boundedness of solutions for the (sub)gradient dynamics of deep linear neural network, one-dimensional deep neural network with sigmoid activation function, matrix recovery (under RIP) and nonsmooth matrix factorization (rank one).

Global Convergence of Consensus ADMM for QCQP Problem   Mar 2019 – May 2020
Undergraduate Researcher, CUHK(SZ)   *Supervisor: Prof. Zhi-Quan Luo*
➢ Proposed a variant of the consensus ADMM algorithm (parameterized dual stepsize) to obtain a higher probability of convergence for the general non-convex QCQP problem.
➢ Conducted rigorous proof concerning the continuity of Lagrange multiplier with respect to the input point for projection onto a single inequality quadratic constraint.
➢ Derived a new proof of global convergence of modified consensus ADMM for convex QCQP problems and a rigorous proof of convergence to KKT points for non-convex QCQP problems given that the iterates converge.

Publications

➢ Josz, C., & Li, X. (2023). Certifying the absence of spurious local minima at infinity. arXiv preprint arXiv:2303.03536.

Teaching Experience

Teaching Assistant   **Columbia University**
➢ Had experience being a teaching assistant for IEOR E 3404 Simulation. For each course, responsibilities included
     ⬥ Delivering recitation session to teach practice questions each week.
     ⬥ Holding office hours (1 hour/week) to answer questions from students.
     ⬥ Grading midterm and final exams of students.

Undergraduate Student Teaching Fellows   **CUHK(SZ)**
➢ Had rich experience being a teaching assistant using English as the working language for Elementary Real Analysis, Ordinary Differential Equations and Mathematical Analysis I & II. For each course, responsibilities included

- ⬧ Delivering tutorial session(s) (40 students/session) to teach practice questions in English each week.
- ⬧ Holding consultation sessions (2 hours/week) to answer questions from students.

Course Projects

A Review on Stochastic Gradient Langevin Dynamics   March – April 2021
- ➢ Did some literature review on various kinds of stochastic gradient Langevin dynamics-based algorithms and their convergence analysis.
- ➢ Classified them into different categories according to whether the problems are convex or not, the choice of stepsize and temperature parameter, metrics of convergence, and asymptotic or nonasymptotic error bounds.

Honors & Awards

- ➢ Academic Performance Scholarship (CUHK(SZ), Class B for 2017, Class C for 2018, Class A for 2019)
- ➢ Dean's List (CUHK(SZ), 2017, 2018 & 2019)
- ➢ Undergraduate Research Award (CUHK(SZ), 2018 & 2019)
- ➢ Second Prize in China Undergraduate Mathematical Contest in Modeling (China, 2018)
- ➢ Second Prize in National College Students Mathematical Competition (China, 2018)

Skills

- ➢ **Computer Skills**: C++, Python, MATLAB, R, Lingo, LaTeX
- ➢ **Language Skills**: Chinese (Native); English (Fluent, TOEFL: 108); French (Beginner)
- ➢ **GRE**: General (V160, Q170, AW 3.5); Mathematics (Percentile: 89%)
- ➢ **Interests**: Teaching Mathematics Courses, General Medicine, Modern Chinese History