

Shuvomoy Das Gupta

CONTACT	 500 W 120th St # 315, New York, NY 10027, USA  https://shuvomoy.github.io/  sd3871@columbia.edu
CITIZENSHIP	Canada
RESEARCH INTERESTS	Optimization, Game Theory, Transportation
CURRENT POSITION	Columbia University, New York, NY, USA 2024–Present <i>Postdoctoral Research Scientist, Department of Industrial Engineering and Operations Research</i> Working on designing optimal algorithms for large-scale game solving.
INDUSTRY EXPERIENCE	Thales Canada Inc., Toronto, Canada 2016–2018 <i>Researcher, Research & Technology Department</i> Worked on real-time embedded optimization and sensor fusion algorithms in autonomous transportation systems.
EDUCATION	Massachusetts Institute of Technology 2019 – 2024 Ph.D. in Operations Research GPA: 5.0/5.0 THESIS: Advances in Computer-Assisted Design and Analysis of First-Order Optimization Methods and Related Problems ADVISORS: Prof. Robert M. Freund and Prof. Bart P.G. Van Parys University of Toronto 2016 Master of Applied Science in Electrical and Computer Engineering GPA: 4.0/4.0 THESIS: Optimization Models for Energy-Efficient Railway Timetables ADVISOR: Prof. Lacra Pavel
AWARDS AND HONORS	Winner, Informatics Computing Society Student Paper Award 2024 Honorable Mention, George Nicholson Student Paper Competition 2024 Honorable Mention, MIT Operations Research Center Best Student Paper Award 2024
SELECTED PUBLISHED PAPERS	[1] Branch-and-Bound Performance Estimation Programming: A Unified Methodology for Constructing Optimal Optimization Methods with Prof. Bart P.G. Van Parys and Prof. Ernest K. Ryu Published in <i>Mathematical Programming</i> , 2024 PDF: https://arxiv.org/pdf/2203.07305.pdf

[2] Nonlinear Conjugate Gradient Methods: Worst-Case Convergence Rates via Computer-Assisted Analyses

with Prof. Robert M. Freund, Prof. Andy Sun, and Prof. Adrien Taylor

Published in *Mathematical Programming*, 2024

PDF: <https://arxiv.org/pdf/2301.01530.pdf>

[3] Exterior-Point Optimization for Sparse and Low-Rank Optimization

with Prof. Bartolomeo Stellato and Prof. Bart P.G. Van Parys

Published in *the Journal of Optimization Theory and Applications*, 2024

PDF: <https://arxiv.org/pdf/2011.04552.pdf>

[4] On Seeking Efficient Pareto Optimal Points in Multi-Player Minimum Cost Flow Problems with Application to Transportation Systems

with Prof. Laca Pavel

Published in *the Journal of Global Optimization*, 2019

PDF: <https://arxiv.org/pdf/1805.11750.pdf>

[5] A Two-Step Linear Programming Model for Energy-Efficient Timetables in Metro Railway Networks

with Prof. Laca Pavel and J. Kevin Tobin

Published in *Transportation Research Part B: Methodological*, 2016

PDF: <https://arxiv.org/pdf/1506.08243.pdf>

[6] An Optimization Model to Utilize Regenerative Braking Energy in a Railway Network

with Prof. Laca Pavel and J. Kevin Tobin

Published in *the Proceedings of American Control Conference*, 2015

PDF: <https://tinyurl.com/ACCRegenOpt>

PAPERS
UNDER
REVIEW

[7] Energy-Optimal Timetable Design for Sustainable Metro Railway Networks

with Prof. Bart P.G. Van Parys and J. Kevin Tobin

R&R in *Transportation Research Part B: Methodological*

PDF: <https://arxiv.org/pdf/2309.05489.pdf>

[8] Computer-Assisted Design of Accelerated Composite Optimization Methods: OptISTA

with Uijeong Jang and Prof. Ernest K. Ryu

Major revision in *Mathematical Programming*

PDF: <https://arxiv.org/pdf/2305.15704.pdf>

TEACHING

6.7220: Nonlinear Optimization

Spring 2023

Teaching Assistant. This is MIT's main doctoral course in optimization.

RATING: 6.9/7.0

15.S60: Computing in Optimization and Statistics

Winter 2022, Winter 2023

Instructor. I taught the ORC's required three-hour module on advanced methods in computational optimization.

RATING: 6.9/7

15.S08: Optimization of Energy Systems

Spring 2022

Teaching Assistant. This is a graduate course in power systems modeling and optimization.
 RATING: 6.0/7.0

TALKS

Design and Analysis of First-Order Methods via Nonconvex QCQP Frameworks
 One of just four invited “long talks” at the 1st Workshop on Performance Estimation, UCLouvain, Belgium 2023

BnB-PEP: A Unified Methodology for Constructing Optimal Optimization Methods
 INFORMS Annual Meeting, Phoenix, AZ 2023
 SIAM Conference on Optimization (OP23), Seattle, Washington 2023
 UTOrg Seminar, University of Toronto, Toronto, Canada 2023
 International Conference on Continuous Optimization, Bethlehem, PA 2022
 MIT Data Science Lab Seminar 2022

Energy-Optimal Timetable Design for Sustainable Metro Railway Networks
 INFORMS Annual Meeting, Phoenix, AZ 2023
 33rd Annual POMS Conference, Orlando, FL 2023
 2023 MIT Energy Initiative Annual Research Conference 2023

Exterior-Point Optimization for Sparse and Low-Rank Optimization
 INFORMS Annual Meeting (virtual) 2020

On Convergence of Heuristics Based on Douglas-Rachford Splitting and ADMM to Minimize Convex Functions over Nonconvex Sets
 56th Allerton Conference on Communication, Control, and Computing, Monticello, IL 2018

Multi-Player Minimum Cost Flow Problems with Nonconvex Costs and Integer Flows
 55th IEEE Conference on Decision and Control, Las Vegas, NV 2018

SERVICE

Reviewer for *Mathematical Programming, Transportation Research Part B: Methodological, IEEE Transactions on Control of Network Systems, American Control Conference, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Automatic Control*

Session Chair, INFORMS Annual Meeting 2023

Session Chair, INFORMS Annual Meeting 2022

SOFTWARE

[1] BnB-PEP

Computes optimal first-order algorithms for different convex and nonconvex setups

LINK: <https://github.com/Shuvomoy/BnB-PEP-code>

[2] NCG-PEP

Computes worst-case convergence rates of nonlinear conjugate gradient methods

LINK: <https://github.com/Shuvomoy/NCG-PEP-code>

[3] NExOS

Implements the Nonconvex Exterior-point Optimization Solver (NExOS) algorithm for solving low-rank and sparse optimization problems

LINK: <https://github.com/Shuvomoy/NExOS.jl>

LANGUAGES

Fluent in

English, Bengali, Hindi, Urdu

Proficient in

Julia, C, C++, MATLAB, Mathematica

OTHER

I enjoy playing cricket, reading novels, cooking, and blogging at <https://shuvomoy.github.io/blogs/>.

MEDIA COVERAGE

“Risky Giant Steps Can Solve Optimization Problems Faster” August, 2023
by Allison Parshall in *Quanta Magazine*

I was interviewed and quoted in the article along with my paper [1] being cited as the main inspiration for the discovery of long step gradient descent by Prof. Ben Grimmer. Also publicized in the *Nautilus Quarterly Magazine* and in the Chinese magazine *Heart of the Machine*.

URL: <https://www.quantamagazine.org/risky-giant-steps-can-solve-optimization-problems-faster-20230811/>