





Shuvomoy Das Gupta

CONTACT	 Apt. 528, 70 Pacific Street, Cambridge, MA 02139  https://shuvomoy.github.io/  sdgupta@mit.edu  (857) 999-6308
CITIZENSHIP	Canada
EDUCATION	Massachusetts Institute of Technology 2019 – 2024 (expected) Ph.D. in Operations Research THESIS: A Unified Methodology for Constructing Optimal Optimization Algorithms 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 THESIS: Optimization Models for Energy-efficient Railway Timetables ADVISOR: Prof. Lacra Pavel
RESEARCH INTERESTS	My primary research interest is developing methodologies that construct the <i>provably fastest</i> algorithms for optimization problems arising in machine learning, business analytics, and data science. My methodologies have led to the discovery of optimal algorithms in several practically relevant setups. I am also interested in application-driven areas involving energy, sustainability, and transportation systems. Through industry collaboration, my research on energy-optimal timetable design for sustainable metro railway networks has been implemented in the largest installed base of communication-based train control systems worldwide.
WORK EXPERIENCE	Thales Canada Inc., Toronto, Canada 2016–2018 <i>Researcher, Research & Technology Department</i> Worked on large-scale, real-time, and embedded optimization in autonomous transportation systems.
SELECTED PUBLISHED PAPERS	[1] Branch-and-Bound Performance Estimation Programming: A Unified Methodology for Constructing Optimal Optimization Methods (<i>job market paper</i>) with Prof. Bart P.G. Van Parys and Prof. Ernest K. Ryu Published in <i>Mathematical Programming</i> , 2023 PDF: https://arxiv.org/pdf/2203.07305.pdf [2] A Two-Step Linear Programming Model for Energy-Efficient Timetables in Metro Railway Networks with Prof. Lacra Pavel and J. Kevin Tobin Published in <i>Transportation Research Part B: Methodological</i> , 2016 PDF: https://arxiv.org/pdf/1506.08243.pdf

PAPERS
UNDER
REVIEW

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

with Prof. Lacro Pavel

Published in *Journal of Global Optimization*, 2019

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

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

with Prof. Lacro Pavel and J. Kevin Tobin

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

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

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

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

Under review in *Mathematical Programming*

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

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

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

Under review in *Manufacturing & Service Operations Management*

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

[7] **Exterior-Point Optimization for Sparse and Low-Rank Optimization**

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

Under review in *Journal of Optimization Theory and Applications*

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

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

with Uijeong Jang and Prof. Ernest K. Ryu

Under review in *Mathematical Programming*

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

TEACHING

Danforth Math and Reading Center, Toronto, Canada

2012-2014

Science Teacher at an after school program. Taught and tutored immigrant high school students mathematics and physics.

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	<i>Design and Analysis of First-Order Methods via Nonconvex QCQP Frameworks</i>	
	One of just four invited “long talks” at the 1 st Workshop on Performance Estimation, UCLouvain, Belgium	2023
	<i>BnB-PEP: A Unified Methodology for Constructing Optimal Optimization Methods</i>	
	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
	<i>Energy-Optimal Timetable Design for Sustainable Metro Railway Networks</i>	
	INFORMS Annual Meeting, Phoenix, AZ	2023
SERVICE	33rd Annual POMS Conference, Orlando, FL	2023
	2023 MIT Energy Initiative Annual Research Conference	2023
	<i>Exterior-Point Optimization for Sparse and Low-Rank Optimization</i>	
	INFORMS Annual Meeting (virtual)	2020
	<i>On Convergence of Heuristics Based on Douglas-Rachford Splitting and ADMM to Minimize Convex Functions over Nonconvex Sets</i>	
	56th Allerton Conference on Communication, Control, and Computing, Monticello, IL	2018
	<i>Multi-Player Minimum Cost Flow Problems with Nonconvex Costs and Integer Flows</i>	
	55th IEEE Conference on Decision and Control, Las Vegas, NV	2018
	Reviewer for <i>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</i>	
	Session Chair, INFORMS Annual Meeting	2023
SOFTWARE	Session Chair, INFORMS Annual Meeting	2022
	[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 <i>Quanta Magazine</i> 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 <i>Nautilus Quarterly Magazine</i> and in the Chinese magazine <i>Heart of the Machine</i> . URL: https://www.quantamagazine.org/risky-giant-steps-can-solve-optimization-problems-faster-20230811/	
REFERENCES	Robert M. Freund Professor Sloan School of Management Massachusetts Institute of Technology Room 567, Building 62 100 Main Street Cambridge, MA 02142, USA ✉ rfreund@mit.edu ☎ (612) 624-0624	David Simchi-Levi Professor Institute for Data, Systems, and Society Massachusetts Institute of Technology Room 459, Building 17 76 Vassar Street Cambridge, MA 02142, USA ✉ dslevi@mit.edu ☎ (617) 253-6160
	Bart P.G. Van Parys Assistant Professor Sloan School of Management Massachusetts Institute of Technology Room 569, Building 62 100 Main Street Cambridge, MA 02142, USA ✉ vanparys@mit.edu ☎ (617) 253-6697	J. Kevin Tobin Chief Researcher Research & Technology Thales Canada Inc. Room 4114 105 Moatfield Drive Toronto, ON, M3B 04A, Canada ✉ Kevin.Tobin@thalesgroup.com ☎ (647) 274-5101