Gabriele Iommazzo, PhD

Postdoctoral researcher in Mathematical Optimization

Location: Berlin, DE

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Research

My current research focuses on the design and analysis of algorithms for convex optimization, with a strong emphasis on high-dimensional problems and first-order methods. I recently studied the convergence properties of Frank–Wolfe methods when combined with nonsmooth optimization techniques to build inexact oracles, when applied to over product domains, and when used in penalty-based relaxation schemes. I have explored the computational performance of these algorithms in diverse contexts, with applications in quantum nonlocality, optimization over product domains and semidefinite programming. During my PhD, I worked on mixed-integer linear/nonlinear programming, in particular distance geometry on large graphs, and I studied the integration of machine learning predictors into combinatorial optimization problems.

Background

Postdoctoral Researcher Convex Optimization — *Zuse Institute Berlin, Germany* *May 2022–*

- Design and analysis of 1st order methods for convex optimization, particularly Frank-Wolfe. Convergence study in different settings such as polytopes in product domains, inexact oracles, barrier-based relaxation schemes, with applications in semidefinite programming, quantum nonlocality, convex feasibility problems, matrix completion.
- Developed a GNN-based column generation solver for vehicle routing problems.

Advisors: Sebastian Pokutta

PhD Computer Science — *École Polytechnique, France & Università di Pisa, Italy* (*joint*) *Oct 2017–Dec 2021*

- Machine learning driven mathematical programming, applications in power plant scheduling (unit commitment problems in the energy sector) and automatic parameter configuration of MILP solvers.
- Graph theory based mixed-integer nonlinear optimization for distance geometry, applications in large, graph-based, protein structure reconstruction problems

Advisors: Claudia D'Ambrosio, Antonio Frangioni, Leo Liberti

Research Intern — *CNRS LIX, École Polytechnique, France* *Mar 2017–Oct 2017*

Data-driven optimization

MSc Computer Science — *Università di Pisa, Italy* *Oct 2013–Oct 2017*

Topics: convex optimization, linear programming, numerical analysis, operations research, machine learning, data mining, databases, discrete mathematics, linear algebra, algorithms & data structure.
Grade: 110/110 Summa Cum Laude

Erasmus student exchange program — *Universidad de Zaragoza, Spain* *Sep 2011–Mar 2012*

BSc Business Administration and Management — *Università di Roma Tor Vergata, Italy* *Oct 2008–Apr 2013*

Topics: statistics, financial mathematics, microeconomics, macroeconomics, financial accounting, business economics.
Grade: 104/110

Grants, Sponsorships, Awards

2023–2024: **MISTI Seed Fund** ($9k) — "Learning-symbolic programming", in partnership with MIT, USA and Università di Pisa, Italy

2022–2024: **MATH+ Postdoctoral Member**, Berlin Mathematics Research Center

2022: **Premio Lorenzo Brunetta 2019–2021** (€2.5k) — awarded by the "Istituto Veneto di Scienze, Lettere ed Arti" to the best Ph.D. thesis in operations research obtained in the years 2019–2021

2021: **Research Fellowship** (€21k) — "Machine learning based approaches for the algorithm configuration problem", Università di Pisa, Italy

2017–2020: **PhD Fellowship** (€64k) — École Polytechnique, France

Professional service

Program Committee Member: 15th and 16th LION conference, 32nd EURO conference

Organizer: 2023 Thematic Einstein Semester on Mathematical Optimization and Machine Learning (workshop, conference), QOPT Workshop 2023

Reviewer: LION, CPAIOR; Journal of Global Optimization, Annals of Mathematics and Artificial Intelligence, Graphs and Combinatorics, Optimization Methods and Software, EURO Journal on Computational Optimization

Talks

Seminar Modern Methods in Applied Stochastics and Nonparametric Statistics: WIAS, Berlin, Germany, June 11, 2024: *"Linearly converging Frank–Wolfe over intersecting polytopes"*

QOPT Workshop 2023: ZIB, Berlin, Germany, May 3–June 02, 2023: *"A bird's eye on conditional gradient algorithms"*

Fifth Conference on Discrete Optimization and Machine Learning (**DOxML**): GRIPS, Tokyo, Japan, Aug 8–9, 2023: *"Cycle-based formulations in distance geometry"*

2022 European Conference on Operational Research (**EURO**): Aalto University, Espoo, Finland, Jul 3–6, 2022: *"Solver configuration by optimization and machine learning"*

Machine Learning NeEDS Mathematical Optimization **online seminar series**: held online, organized by IMUS, Sevilla, Spain and Copenhagen Business School, Copenhagen, Denmark, May 17, 2021: *"Optimize to learn to optimize: getting down and dirty"*

2020 Journée "Hors les Murs" du groupe Polyèdres et Optimisation Combinatoire: LAMSADE, Université Paris Dauphine, Paris, France, Dec 15, 2020: *"A cycle-based formulation for the Distance Geometry Problem"*

2020 Cologne-Twente Workshop on Graphs and Combinatorial Optimization (**CTW**): held online, Sep 14-16, 2020: *"A cycle-based formulation for the Distance Geometry Problem"*

2020 International Conference on Machine Learning, Optimization, and Data Science (**LOD**): Università di Siena, Siena, Italy, Jul 19-23, 2020: *"A learning-based mathematical programming formulation for the automatic configuration of optimization solvers"*

CRM/DIMACS Mixed Integer Nonlinear Optimization Workshop: Polytechnique de Montréal, Montréal, Canada, Oct 07-10, 2019: poster on *"Learning to configure mathematical programming solvers by mathematical programming"*

2019 Mixed Integer Programming Workshop (**MIP**): MIT, Boston, Jul 15-18, 2019: poster on *"Algorithmic Configuration by Learning and Optimization"*

2019 Cologne Twente Workshop (**CTW**): University of Twente, Enschede, Netherlands, Jul 1-3, 2019: *"Algorithmic configuration by learning and optimization"*

1st EUROYoung Workshop, **IMUS**: Sevilla, Spain, May 02-03, 2019: *"Optimization over trained machine learning predictors"*

2018 Cologne Twente Workshop (**CTW**): CNAM, Paris, France, Jun 18-20, 2018: *"Optimization over trained machine learning predictors"*

2017 Data Science Summer School (**DS3**): École Polytechnique, Paris, France, Aug 28 to Sep 1, 2017: poster on *"Combining ML and Mathematical Optimization to tackle automatic parameter tuning on HUC problems"*

Visiting terms and invited seminars

- Feb 2023: **MIT Sloan School**, Cambridge, MA. Research visit, invited by Prof. Dimitris Bertsimas
- Jun 2022: **ZIB**, Germany. 1 seminar, invited by Prof. Thorsten Koch
- Oct–Nov 2019: **CRM/DIMACS, Polytechnique de Montréal**, Canada, "Mixed Integer Nonlinear Optimization" thematic month. 1 seminar, invited by Prof. Andrea Lodi
- May 2019: **DIAG, Università La Sapienza**, Italy. 1 seminar, invited by Prof. Laura Palagi

Teaching experience

Apr–Jun 2018: **Big Data with C++ (INF442)** — teaching assistant (32h), École Polytechnique, France

Supervision

Internships and seminars

2023, 2 months: L. H. Huber — *Seminar on Discrete Optimization and Machine Learning*, TU Berlin, Germany. Topic: differentiable optimization in neural networks and Lagrangian duality

2022, 2 months: M. Aïdli, B. Liang, E. Vercesi, A. Zhang — *GRIPS research internship program*, organized by IPAM, USA, FU Berlin and ZIB, Germany. Topic: artificial intelligence for optimization solver configuration

B.Sc. and MS.c. dissertations

2024, 7 months: Silvia Calabretta, Università di Pisa — *B.Sc. dissertation*. Topic: "Improvement of Frank-Wolfe Methods via Bundle-inspired Directions"

Computer Science skills

Coding: **Julia** (2y), **Python** (4y), AMPL (1y); bash, SQL, C++, Matlab

Software: optimization solvers (CPLEX, Gurobi, GLPK, SCIP, Baron, Bonmin, Ipopt), platforms (Azure, KNIME), machine learning (PyTorch, Sklearn)

Deployment: Git, Jupyter

Typesetting: LaTeX, Microsoft Office

Languages

Italian (native), **English** (proficient), **French** (proficient), Spanish (elementary), German (rudimentary)

Working Papers

With F. Criado, D. Martínez-Rubio, E. Wirth and S. Pokutta. ***Linear Rates for the Convex Feasibility Problem through Frank-Wolfe***

Publications

Preprints

P. Dvurechensky, G. Iommazzo, S. Shtern and M. Staudigl (2025). ***A conditional gradient homotopy method with applications to Semidefinite Programming*** (submitted to journal) [ArXiv]

Conference proceedings

G. Iommazzo, C. D'Ambrosio, A. Frangioni and L. Liberti (2021), ***A Learning-based Mathematical Programming Formulation for the Automatic Configuration of Optimization solvers***. In: Nicosia, G., et al. Machine Learning, Optimization, and Data Science. **LOD 2020**. Lecture Notes in Computer Science, vol 12565. Springer, Cham. [DOI][ArXiv]

L. Liberti, G. Iommazzo, C. Lavor and N. Maculan (2020), ***A Cycle-based Formulation for the Distance Geometry Problem***. In: Gentile, C., Stecca, G., Ventura, P. (eds) Graphs and Combinatorial Optimization: from Theory to Applications. **CTW 2020**. AIRO Springer Series, vol 5. Springer, Cham. [DOI][link]

G. Iommazzo, C. D'Ambrosio, A. Frangioni, L. Liberti (2020), ***Learning to Configure Mathematical Programming Solvers by Mathematical Programming***. In: Kotsireas, I., Pardalos, P. (eds) Learning and Intelligent Optimization. **LION 2020**. Lecture Notes in Computer Science, vol 12096. Springer, Cham. [DOI][ArXiv]

International journals

S. Designolle, G. Iommazzo, M. Besançon, S. Knebel, P. Gelß, S. Pokutta (2023), ***Improved Local Models and New Bell Inequalities via Frank–Wolfe Algorithms***. In **Phys. Rev. Research** 5, 043059, 6 p. American Physical Society [DOI][ArXiv]

L. Liberti, G. Iommazzo, C. Lavor, N. Maculan (2023), ***Cycle-based Formulations in Distance Geometry***. **Open**

Journal of Mathematical Optimization, Volume 4, article no. 1, 16 p. [DOI][ArXiv]

Book chapters

G. Iommazzo, C. D'Ambrosio, A. Frangioni, L. Liberti (2023), ***The Algorithm Configuration Problem***, In: Pardalos, P.M., Prokopyev, O.A. (eds) **Encyclopedia of Optimization**. Springer, Cham. [DOI][ArXiv]

PhD Thesis

[Iom21]: G. Iommazzo (2021), *Algorithmic Configuration by Learning and Optimization*. [link]

Last updated on: April 2, 2025