

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

Group seminar: University of Vienna, Vienna, Austria, May 24, 2025: *"Polytope conditioning matters: a linear convergence study of Frank-Wolfe over product domains"*, invited by Yura Malitsky

MOP Research Seminar: Universität des Saarlandes (online), April 10, 2025: *"Polytope conditioning matters: a linear convergence study of Frank-Wolfe over product domains"*, invited by Peter Ochs

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"*

Group seminar: Zuse Institute Berlin, Berlin, Germany, June 22, 2022: *"Algorithm configuration through machine learning and mathematical programming"*, invited by Thorsten Koch

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"*, invited by Andrea Lodi

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"*

Group seminar: DIAG, Università di Roma La Sapienza, Roma, Italy, May 17, 2019: *"Algorithm configuration by learning and optimization"*, invited by Laura Palagi

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

○ Feb 2023: MIT Sloan School, Cambridge, MA. Research visit, invited by Prof. Dimitris Bertsimas

- Oct–Nov 2019: CRM/DIMACS, Polytechnique de Montréal, Canada, “Mixed Integer Nonlinear Optimization” thematic month. 1 seminar, invited by Prof. Andrea Lodi

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, KN-IME), machine learning (PyTorch, Sklearn)

Deployment: Git, Jupyter

Typesetting: L^AT_EX, 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. *Frank-Wolfe on Product Polytopes: conditioning and Linear Convergence*

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]