Giulia **Zarpellon**

Operations Research · Data Science · Machine Learning

New York, NY

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Profile

I presently work as an **AI Scientist** at the Vector Institute, where I joined the group of Prof. Chris Maddison. In 2020, I completed a **Ph.D. in Applied Mathematics** at Polytechnique Montréal | CERC DS4DM, under the guidance of Prof. Andrea Lodi. My research explores the interplay of discrete optimization and statistical learning.

While my Bachelor's and Master's programs equipped me with strong foundations in Operations Research and the mathematics of **decision-making**, my Ph.D. training broadened my skills on the **computational aspects of OR practice and AI**. Specifically, my dissertation focused on applying machine learning tools to the algorithmic design of practical optimization frameworks like Mixed-Integer Programming.

I am passionate about **interrogating data** in search of both meaningful questions and actionable answers. Topics that challenge and motivate me everyday are sustainability and the issue of diversity gap in STEM: I believe data-driven approaches can provide powerful tools to model and analyze the world we live in, and I would love that my work could **make a difference for social good**!

Experience

Vector Institute, AI Scientist — 2021-present — *Toronto, Canada*
Postdoctoral research work at the intersection of AI and optimization, and support of graduate students' projects in the group of Prof. Chris Maddison (University of Toronto).
[Remote from New York, NY]

IBM Analytics – CPLEX Optimizer Developers Team, Research Intern — 2017-2018 — *Montréal, Canada*
One year collaboration with the IBM-CPLEX team to extend the research project on using a classifier to decide on the linearization of Mixed-Integer Quadratic Problems [C1], and work towards the practical implementation of a predictor in the solver [S1] (**deployed in CPLEX 12.10.0**).

Polytechnique Montréal, Teaching Assistant — 2017-2019 — *Montréal, Canada*
Graduate-level introduction to various concepts in Mixed-Integer Linear Programming (MILP): modeling of combinatorial optimization problems, methods for exponential formulations, computational aspects of MILP software. Classroom exercise sessions, grading and office hours to assist students.

Business Integration Partners, Consultant Intern — 2015 — *Milan, Italy*
Six months experience as Junior Consultant on directional-oriented projects for the client's IT-department.

Education

Polytechnique Montréal, Ph.D. in Applied Mathematics — GPA : 4.0/4.0 — 2015 - 2020 — *Montréal, Canada*

Advisor: Prof. Andrea Lodi
Thesis: "Machine learning algorithms in Mixed-Integer Programming"

Significant training: Implementation of Algorithms for Operations Research, Machine Learning, Applications of Game Theory, Operational Research Tools in Engineering

Affiliations: Department of Mathematics and Industrial Engineering | Canada Excellence Research Chair in Data Science for Real-time Decision-Making (DS4DM) | Group for Research in Decision Analysis (GERAD) | Interuniversity Research Center on Enterprise Networks, Logistics and Transportation (CIRRELT) | Mila

University of Padova, Master's Degree in Mathematics — 110/110 *cum laude* — 2012-2014 — *Padova, Italy*
Significant training: Integer Programming, Operations Research

Aarhus University, ERASMUS Program — GPA: 12.0/12.0 — 2013-2014 — *Aarhus, Denmark*
Significant training: Combinatorics, Multi-objective Optimization

University of Padova, Bachelor's Degree in Mathematics — 102/110 — 2009-2012 — *Padova, Italy*
Significant training: Linear Programming, Graph Theory

Skills

Technical

Optimization	SCIP Optimization Suite, IBM ILOG CPLEX Optimization Studio, Gurobi Optimizer
Programming	Python, Bash
Data, visualization, ML	Jupyter, pandas, matplotlib, scikit-learn, PyTorch
Modelling	AIMMS, AMPL, Matlab, Mathematica
Cluster computing	Slurm Workload Manager
Documents, markup	MS Office, LaTeX, Markdown

Soft

Writing and communicating research · Public speaking · Collaboration · Problem-solving · Troubleshooting

Languages

Italian (native) · English (fluent) · French (basic)

Publications

Authors are listed alphabetically, as is standard practice in Operations Research journals and conferences, with the only exception of [C3], in which authors are listed by relative contribution following the practice in Computer Science. I am the first author in all reported works.

Refereed papers

J1. A. Lodi, G. Zarpellon (2017) ***On learning and branching: a survey***. TOP 25, 207–236.

C1. P. Bonami, A. Lodi, G. Zarpellon (2018) ***Learning a classification of Mixed-Integer Quadratic Programming problems***. In: van Hoeve WJ. (eds) Integration of Constraint Programming, Artificial Intelligence, and Operations Research. *CPAIOR 2018*.

C2. M. Fischetti, A. Lodi, G. Zarpellon (2019) ***Learning MILP resolution outcomes before reaching time-limit***. In: Rousseau LM., Stergiou K. (eds) Integration of Constraint Programming, Artificial Intelligence, and Operations Research. *CPAIOR 2019*.

C3. G. Zarpellon, J. Jo, A. Lodi and Y. Bengio (2021) ***Parameterizing branch-and-bound search trees to learn branching policies***. Proceedings of the AAAI Conference on Artificial Intelligence, 35(5), 3931-3939.

Submitted

S1. P. Bonami, A. Lodi and G. Zarpellon (2020) ***A classifier to decide on the linearization of Mixed-Integer Quadratic Problems in CPLEX***. (Extension of [C1]) *Online preprint*. Submitted to *Operations Research.*

Scholarships and awards

2019 **Excellence CIRRELT Award**, Doctoral Redaction Grants

2017 **GERAD Doctoral Fellowship**, "Conference Fees" Competition

2017 **Honorable Mention Prize**, Poster Competition, The 2017 Mixed Integer Programming Workshop *Montréal, Canada*

Selected talks and posters

- Toronto AI Safety Reading Group, *Verification of neural networks: a primer.* June 4, 2021.
- AAAI 2021, *Parameterizing Branch-and-Bound search trees to learn branching policies.* February 2-9, 2021.
- Montréal Machine Learning and Optimization (MTL MLOpt) Seminar, *Machine learning algorithms in Mixed-Integer Programming.* June 26, 2020.
- SCIP Online Workshop 2020, *Parameterizing Branch-and-Bound search trees to learn branching policies.* June 4, 2020.
- INFORMS Annual Meeting 2019, *Reward-driven branching policies.* October 20-23, 2019, Seattle, WA, USA.
- The 2019 Mixed Integer Programming Workshop, Poster *Reward-driven branching policies* (G. Zarpellon, J. Jo, A. Lodi and Y. Bengio) July 15-18, 2019, Boston, MA, USA.
- CPAIOR 2019, *Learning MILP resolution outcomes before reaching time-limit.* June 4-7, 2019, Thessaloniki, Greece.
- INFORMS Annual Meeting 2018, *A temporal architecture for Branch and Bound.* November 4-7, 2018, Phoenix, AZ, USA.
- ISMP 2018, *Learning MILP resolution outcomes before reaching time-limit.* July 1-6, 2018, Bordeaux, France.
- CPAIOR 2018, *Learning a classification of Mixed-Integer Quadratic Programming Problems.* June 26-29, 2018, Delft, The Netherlands.
- IBM T.J. Watson Center, *Deciding whether to linearize MIQPs: a learning approach.* February 8-9, 2018, Yorktown Heights, NY, USA.
- The Aussois Combinatorial Optimization Workshop, *Learning a classification of Mixed-Integer Quadratic Programming problems.* January 7-12, 2018, Aussois, France.

- Seminar "Un chercheur du GERAD vous parle!", *Learning a classification of Mixed-Integer Quadratic Programming problems.* November 14, 2017, Montréal, Canada.
- 15th EUROPT Workshop on Advances in Continuous Optimization, *Learning a classification of Mixed-Integer Quadratic Programming problems.* July 12-14, 2017, Montréal, Canada.
- The 2017 Mixed Integer Programming Workshop, Poster *Learning a classification of Mixed-Integer Quadratic Programming problems* (P. Bonami, A. Lodi, G. Zarpellon) June 19-22, 2017, Montréal, Canada. **Awarded *Honorable Mention***.
- CERC DS4DM Internal Seminar, *Towards learned branching decisions.* March 24, 2016, Montréal, Canada.

Workshops and teaching

Recent Advances in Integrating Machine Learning and Combinatorial Optimization

AAAI 2021

Tutorial Presenter

- Overview of recent advances in the application of ML to combinatorial optimization, with special focus on Mixed-Integer Programming and the Branch-and-Bound framework.

Machine Learning for Combinatorial Optimization

IJCAI 2020

Tutorial Organizer

- Tutorial for newcomers in the field at the intersection of ML and combinatorial optimization, to showcase the landscape of this research space using examples from the literature.

MTH6404 - Integer Programming

Polytechnique Montréal

Teaching Assistant — *Fall 2017, 2018, 2019*

- Graduate-level introduction to various concepts in Mixed-Integer Linear Programming (MILP): modeling of combinatorial optimization problems, methods for exponential formulations, computational aspects of MILP software. Classroom exercise sessions, grading and office hours to assist students.

Intern Project Tutoring

Polytechnique Montréal

Co-tutor — *April - July 2017*

- Tutoring of intern graduate student at CERC DS4DM, on the project "Exploiting variability at the root node of a branch-and-cut system".

Service

Reviewer

Mathematical Programming Computation
Computers & Operations Research
INFORMS Journal on Computing
Operations Research
CPAIOR - Integration of Constraint Programming, Artificial Intelligence, and Operations Research
AAAI - Association for the Advancement of Artificial Intelligence

Community

- *Girls Who Code Club* organizer at Polytechnique Montréal (Winter 2020)