Mathieu Lerouge

Researcher in Operations Research | Optimization Scientist

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I am an applied researcher in Operations Research, currently leveraging my expertise as an Optimization Scientist at DecisionBrain. I hold a Ph.D. in Computer Science from CentraleSupélec - Université Paris-Saclay, where my research focused on designing and generating user-centered explanations for optimization systems applied to Workforce Scheduling and Routing Problems. Most recently, I completed a post-doctoral fellowship at the Università di Bologna, where I developed a ML-guided MILP re-optimization method for real-time adjustments. My core research interests include combinatorial optimization, Machine Learning, explainable AI, and the design of ethical decision support systems.

Education

PhD in Operations Research & Explainable Artificial Intelligence

Dec 2020 - Dec 2023

Laboratoire MICS - Ecole CentraleSupélec - Université Paris Saclay - Gif-sur-Yvette, France

Title: "Designing approaches for generating user-centered explanations about solutions of Workforce Scheduling and Routing Problems."

Directors: Céline Gicquel, Vincent Mousseau, Wassila Ouerdane.

Collaboration with: DecisionBrain and IBM within joint public-private AI project called AIDA.

Abstract: "Combinatorial optimization is used for modeling real-world situations as mathematical problems with well-defined objectives and constraints (*e.g.* workforce management). In order to solve these problems, optimization systems, like solvers or optimization software, are developed by experts. However, usually, the end-users of these systems are not experts in optimization. They often view their systems as black boxes whose reasoning is inaccessible and they may experience trust issues. Thus, we propose to address these issues by designing approaches for generating user-centered explanations about the solutions obtained from optimization systems. More specifically, this work focus on generating explanations in the case of an NP-hard optimization problem: the Workforce Scheduling and Routing Problem. This work is mostly in line with recent concerns about designing explanations for recommendations in autonomous systems. With the recent era of explainable Artificial Intelligence, explanability has gained significant interest."

MS (2nd year) in Operations Research

Sep 2019 - Nov 2020

Conservatoire National des Arts et Métiers - Paris, France

Additional year of MS that I did in order to specialize in Operations Research. Core courses include mathematical programming, metaheuristics, constraint programming, stochastic optimization, graph theory, complexity theory. Supplementary courses in machine learning and reinforcement learning. Did several group and individual projects using Python, Julia, C++, CPLEX, Git, Latex.

"Diplôme d'ingénieur" in Computer Science & Engineering

Sep 2015 - Aug 2019

Ecole Nationale des Ponts et Chaussées - Champs-sur-Marne, France

Three-year curriculum to get a "Diplôme d'ingénieur" (equivalent to a MS of Engineering) in one of the five best "Grandes Ecoles d'ingénieurs" in France. Double major in Computer Science & Structural Engineering. Courses include continuous optimization, introduction to operations research, advanced programming, statistics, introduction to machine learning and computer vision. Did several group and individual projects using Python, C++, Javascript, HTML, Git, Latex.

"Classes préparatoires" in Maths, Physics & Computer Science

Sep 2013 - Aug 2015

Lycée Hoche - Versailles, France

Two-year post-secondary curriculum (equivalent to three years of BS) in one of the five best schools preparing students for attending highly challenging contests to join "Grandes Ecoles d'ingénieurs". Courses include pure mathematics (general and linear algebra, mathematical analysis), physics and computer science (graph theory, automata theory, computational complexity) with Python.

Digital skills

Programming languages

Python (Advanced)

C++ (Advanced)

Java (Intermediate)

Julia (Intermediate)

Javascript (Beginner)

HTML (Beginner)

Solvers

Gurobi (Advanced)

CPLEX (Intermediate)

Documenting

Git (Intermediate)

LaTeX (Advanced)

Languages

French (Native)

English (C1-C2)

Italian (C1)

Spanish (B1-B2)

Soft skills

Curiosity, autonomy, team-working, empathy, communication

Hobbies

Crafts (drawing, painting)

Cooking

Sport, Dance

Tutoring

Work experience

Optimization Scientist
Jan 2026 - Present

DecisionBrain - Bologna, Italy

Modeling operational problems and implementing mathematical optimization solutions to meet clients' specific needs.

Post-doctoral research fellow
Jan 2024 - Dec 2025

Università di Bologna - Bologna, Italy

Supervisors: Andrea Lodi, Enrico Malaguti, Michele Monaci, Filippo Focacci.

Title: "Machine-Learning-aided reoptimization methods for real-time adjustments and human interaction".

Description: In industrial and operational contexts, optimal solutions to combinatorial optimization problems often become infeasible due to unpredictable disruptions, such as machine breakdowns. Re-solving the underlying Mixed-Integer Linear Programming (MILP) models from scratch is computationally prohibitive for real-time reactions, while simple repair heuristics typically yield poor-quality results. Furthermore, practical adjustments require operational stability, meaning the new plan should not deviate excessively from the original one. This post-doctoral research addresses these challenges by developing a novel "learning-to-reoptimize" framework. Specifically, we design a fix-and-reoptimize strategy aided by a Graph Neural Network (GNN). Given a feature graph encoding the information about the disruption and the solution before disruption, the GNN predicts the likelihood that specific binary decision variables need to be modified. This drastically reduces the MILP search space by identifying a significant subset of decision variables to hard-fix while reoptimizing the rest. Applied to the Lot Sizing Problem (LSP), numerical experiments demonstrate that this graph-based approach successfully generalizes across varying instance sizes and consistently yields good-quality solutions within short time limits.

Short-term international research visitor
Jun 2023 - Jul 2023

Freie Universität Berlin - Berlin, Germany

Experienced working in another research laboratory, abroad, as part of a one-month visit. Explored research problems at the intersection between the explainability of optimization problems and social Vehicle Routing Problems.

Teaching assistant
Dec 2020 - Mar 2024

Ecole CentraleSupélec - Université Paris Saclay - Gif-sur-Yvette, France

Taught courses to undergraduate students about algorithmic & complexity and coding group project (involving use of Python and Git) as well as courses to graduate students about operations research & decision aid (invloving use of Python and Gurobi).

Intern in Operations Research (MS internship)
Jun 2020 - Nov 2020

SNCF Innovation & Recherche - Saint-Denis, France

Developed a method for solving a Dial-A-Ride Problem, in dynamic and stochastic environment. Reviewed literature about variants of Vehicle Routing Problems. Implemented a multiple scenario approach based on Local Search in Java. Wrote a MS thesis.

Intern in Architectural Design Optimization (MS internship)
Feb 2019 - Aug 2019

Laboratoire Navier - Ecole Nationale des Ponts et Chaussées - Champs-sur-Marne, France

Programmed geometric optimization algorithms using C#. Contributed to a collective scientific paper. Took part in an international conference and contest (IASS 2019). Wrote a MS thesis.

Intern in Structural Engineering (gap year internship)
Jul 2017 - Jul 2018

Thornton Tomasetti Inc - Washington DC, USA

Modeled and designed building structures for various projects. Programmed tools in Python.

Publications in journals

"**Learning to reoptimize: a GNN-aided fix-and-optimize approach and an application to the Lot Sizing problem**", Mathieu Lerouge, Andrea Lodi, Enrico Malaguti, Michele Monaci, Filippo Focacci, Working Paper.

Modeling and generating user-centered contrastive explanations for the Workforce Scheduling and Routing Problem2024Mathieu Lerouge, Céline Gicquel, Vincent Mousseau, Wassila OuerdaneITOR

Conferences with proceedings

Received **Best Paper Award Honorable** for "**Counterfactual Explanations for Workforce Scheduling and Routing Problems**", Mathieu Lerouge, Céline Gicquel, Vincent Mousseau, Wassila Ouerdane, Proceedings of the 12th International Conference on Operations Research and Enterprise Systems (ICORES), 2023.

Presentation "**Generating counterfactual explanations for the Workforce Scheduling and Routine Problem**", at international conference ICORES, in Lisbon (Portugal), from February 19 to 21, 2023.

Conferences without proceedings

Presentation "**A GNN-aided fix-and-reoptimize approach for the Lot Sizing Problem**", at French congress ROADEF, in Tours (France), from February 24 to 26, 2026.

Presentation "**ML-guided MILP reoptimization applied to Lot Sizing Problem**", at French congress ROADEF, in Paris (France), from February 26 to 28, 2025.

Presentation "**Generating various types of explanations for optimization system end-users, application to the Workforce Scheduling and Routine Problem**", at French congress ROADEF, in Rennes (France), from February 20 to 23, 2023.

Presentation "**Designing methods for explaning solutions stemming from optimization systems, application to the Workforce Scheduling and Routine Problem**", at French congress ROADEF, in Lyon (France), from February 23 to 25, 2023.

Other presentations

Presentation "**Challenges of designing explanation tools for optimization systems**", at French seminar organized by AFIA on the topic "Trustworthy AI: responsability, robustness, transparency", in Paris (France), October 7, 2021.

References available upon request.