Daniel Mimouni

PhD in Applied Mathematics & Computer Science – Optimization, Optimal Transport
dan-mim.github.io | github.com/dan-mim | daniel.mimouni@gmail.com

Applied researcher in Optimization bridging theory and implementation in ML applications

PhD Research

Through my objective of solving optimization problems under uncertainty in energy management, I explore, leverage, and enhance techniques in **optimal transport**, **machine learning** (mostly **RL**), **convex optimization**, and **stochastic optimization algorithms**.

We have thoroughly worked on the **Wasserstein barycenter** problem and proposed several **extensions** to the original formulation. We developed state-of-the-art algorithms to solve these problems and established rigorous mathematical guarantees for each of them.
Additionally, we tackled **dimension reduction** in the context of the nested distance—a generalization of the Wasserstein distance—to enable the application of classic methods to large-scale multistage problems.
Finally, we investigated the integration of reinforcement learning and stochastic optimization in **a real-world industrial setting**.
All of my research is supported by **open-source codes**, and the applied contributions have been incorporated into **industrial softwares**.

Experience

2022–2025 **PhD Researcher** – IFP Énergies Nouvelles (**IFPEN**), *Applied Math Dept.*

May 2021–Oct. 2022 **Data Scientist** – Île-de-France Mobilités (**IDFM**)
Public authority overseeing transportation and mobility in the Paris region
- Designed predictive models to assess long-term impacts of future transport infrastructure on complex datasets (14M records/day)

2021–2022 **Freelance Developer** –
- Built machine learning packages and automated web workflows (Selenium) for startups and industrials.

Oct. 2020–Apr. 2021 **Engineering Intern** – **Vinci** Construction Grands Projets, *Research & Development Dept.*
- Performed numerical integration optimizations of Finite Element Equations (FEA).

May 2020–Oct. 2020 **Research Intern** – Imperial College London, *Dept. of Nonlinear Structures*
Master's thesis under the supervision of Prof. Ahmer Wadee
- Studied cost-effective bridge implementation using nonlinear constrained optimization (FEA).

Education

2022–2025 **PhD Candidate** – **Mines Paris PSL**, *Centre de Mathématiques Appliquées (CMA)*
Applied Mathematics
"Scenario tree reduction and operator method for the stochastic optimization of energetic systems", under the supervision of Welington de Oliveira, Paul Malisani & Jiamin Zhu
PhD defense scheduled in Oct. 2025, PhD Committee: Prof. Franck Iutzler, Prof. Alois Pichler
- Teaching assistant: Data Science course – Centre for Computational Biology (MINES Paris)
- MVA coursework at ENS Paris (Ulm) — relevant coursework: Optimal Transport with Gabriel Peyré

2019–2020 **MSc** – **Imperial College London**
- Graduated with Distinction (highest honor in the cohort)

2017–2021 **Diplôme d'Ingénieur (MSc Equivalent)** – **Centrale Lyon**
Applied Mathematics

2015–2017 **Preparatory classes for Grandes Ecoles** – **Henri IV & Louis Le Grand**
(MPSI and PSI)*

Publications

Reproducible code for all articles is available at dan-mim.github.io.

Journal Articles

- Mimouni, D., Malisani, P., Zhu, J., de Oliveira, W. (2024). **Computing Wasserstein Barycenters via Operator Splitting: the Method of Averaged Marginals**. *SIAM Journal on Mathematics of Data Science (SIMODS)*. DOI:10.1137/23M1584228
  New algorithm for computing exact Wasserstein barycenters — for both free and fixed support — in balanced and unbalanced settings using a Douglas-Rachford splitting approach.
- Mimouni, D., de Oliveira, W., Sempere, G. M. (2025). **On the Computation of Constrained Wasserstein Barycenters**. *Pacific Journal of Optimization*, special issue in honor of R. T. Rockafellar. [In press]
  Extention of MAM to tackle barycenter computations when convex and non-convex constraints are added to the barycenter.
- Mimouni, D., Malisani, P., Zhu, J., de Oliveira, W. (2024). **Scenario Tree Reduction via Wasserstein Barycenters**. *Submitted to Annals of Operations Research.*
  A boosted version of the Kovacevic & Pichler's algorithm to reduce large scenario trees using the nested distance (a generalization of the Wasserstein distance).

Preprint for IEEE Transactions on Control Systems Technology

- Mimouni, D., Malisani, P., Zhu, J., de Oliveira, W. **A Comparative Study of Multi-Stage Stochastic Optimization Approaches for an Energy Management System**.
  RL vs stochastic optimization to EMS - an industrial application case.

Patent

- **Robust Energy Management System** (in preparation) RL and DRO-based pipeline for multi-stage energy management for IFPEN.

Selected Talks and Conferences

- **ICSP 2025** – Int. Conference on Stochastic Programming *How Optimal Transport can sharpen multi-stage decisions: Boosting scenario tree algorithms*
- **ICCOPT 2025** – Int. Conf. on Continuous Optimization *Optimization framework for Energy Management Systems: RL vs Stochastic Programming*
- **ISMP 2024** – Int. Symposium on **Mathematical Programming** *Computing Wasserstein Barycenters via Operator Splitting*
- **EUROPT 2024** – *New Approach to Optimal Transport problems* (with W. de Oliveira)
- **PGMO 2024 / 2023** – Gaspard Monge Program Days (EDF/INRIA) *Boosting Scenario Tree Reduction – Computing Balanced Barycenters*
- **CIROQUO 2023** – Poster: *Wasserstein Barycenter Computation*

Open-Source Software

- **Wasserstein Barycenters – MAM** Python package of the MAM algorithm for exact computation of Wasserstein barycenter (WB) via operator splitting (SIMODS 2024).
- **Constrained Barycenters** Solvers for barycenter problems under convex and non-convex constraints. Also visit **the mam-GAN project** for industrial applications.
- **Nested Tree Reduction** Efficient implementation of the nested Wasserstein-based reduction method. 10× speed-up of the boosted proposed version over classic Kovacevic and Pichler's baseline.
- **EMS-RL-DRO** RL and DRO-based solver for multi-stage energy management. Already industrially deployed in IFPEN's EMS-Lab.

Languages

French: Native **English:** Fluent (C2) **German:** Proficient (B2) **Hebrew:** Learning

Interests

Chess (Elo 1575), **Piano** (10y), **Football** (team captain), **Judo** (10y in competition), **Magic** (performed shows)