Daniel Mimouni

PhD in Applied Mathematics & Machine Learning | Optimization & Robust Decision-Making
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Applied ML Researcher — Optimal Transport • Reinforcement Learning • Optimization

Experience

2022–2025   **PhD Researcher** – IFP Énergies Nouvelles (**IFPEN**), *Applied Math & Computer Science Dept.*
- **4 first-author publications** in top journals (e.g., *SIAM*)
- Developed **5 open-source libraries** actively used — high-performance ML algorithms
- Presented at **5 international conferences**
- A **patent** pending (IFPEN): OT-based RL/DRO optimization pipeline for industrial energy management
- Teaching Assistant: *Data Science* (Mines Paris, 2023–2024-2025)

May 2021–Oct. 2022   **Data Scientist** – **Île-de-France Mobilités (IDFM)** *Public authority managing transport for 12M inhabitants in Paris region (€11B budget)*

2021–2022   **Freelance Developer** –
- ML prototypes and automation tools

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 in Applied Mathematics** – **Mines Paris PSL**, *Centre de Mathématiques Appliquées (CMA) Multistage Stochastic Optimization: From Optimal Transport-Based Scenario Tree Reduction to Robust Optimization for Energy Management*
Funded by IFPEN.
- Advanced coursework at **MVA ENS Paris** (Ulm): *Optimal Transport* (Gabriel Peyré), *Reinforcement Learning*

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*)

Technical Skills

ML: PyTorch, generative modeling (GANs), Reinforcement Learning, OT-based ML
Optimization: Large-scale optimization, stochastic programming, operator splitting, Distributional Robust Optimization
Scientific Computing: Python, NumPy, Numba, CUDA, MPI, C/C++ (basics), Gurobi
Tools: Docker, Jupyter, Git

Languages

French: Native   **English:** Fluent (C2)   **German:** Proficient (B1)   **Hebrew:** Learning

Interests

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

Publications

Main themes: Computational Optimal Transport (Wasserstein barycenters, balanced/unbalanced constrained OT, nested distances), with applications to machine learning and stochastic optimization. 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 fast. Wasserstein barycenters are used in imaging, biomedical data alignment and model aggregation; the library is built to be domain-agnostic and scalable.

- 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**.
  Annals of Operations Research [Submitted].
  OT-based reduction method — using the nested distance (a generalization of the Wasserstein distance); achieves ×10 speed-ups on large scenario trees and improves stability in multistage stochastic models.

- Mimouni, D, Malisani, P., Zhu, J., de Oliveira, W. (2025). **A Comparative Study of Multi-Stage Stochastic Optimization Approaches for an Energy Management System**.
  IEEE Transactions on Control Systems Technology [Submitted]
  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.

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 other 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.

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 2023 & 2024** – Gaspard Monge Program Days (EDF/INRIA) *Boosting Scenario Tree Reduction via nested distance – Computing Balanced Barycenters*

- **CIROQUO 2023** – Poster: *Wasserstein Barycenter Computation*