

# Daniel Mimouni



PhD in Applied Mathematics & Machine Learning

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*Applied ML Researcher — Optimal Transport • Optimization • Reinforcement Learning*

## 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** in preparation (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

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*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](https://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 fast and scalable computation of exact Wasserstein barycenters. 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]  
Extension 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  $\times 10$  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

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- **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.  $10\times$  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

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- **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*