

# Mathis Hardion

[✉ mathis.hardion@telecom-paris.fr](mailto:mathis.hardion@telecom-paris.fr)  
[🌐 mhardion.github.io](https://github.com/mhardion)  
[🌐 Mathis Hardion](https://www.linkedin.com/in/Mathis-Hardion)  
[🌐 mhardion](https://github.com/mhardion)

After my last year of master's degree in mathematical data science, I am seeking a PhD position to pursue my research in Entropic Optimal Transport and Gradient Flows.

## Interests

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Optimal Transport, Gradient Flows in Metric Spaces, Machine Learning & Statistics, MCMC methods, Optimization, Topological and Geometric Data Analysis

## Education

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- 2023 - 2024 **Master MVA (Mathematics, Vision, Learning)**  
*École Normale Supérieure de Paris-Saclay (Gif-sur-Yvette, France)*  
Research-oriented degree in data science through a mathematical lens, wide spectrum of courses followed in the above domains of interest.  
Thesis: Gradient Flows in the Geometry of the Sinkhorn Divergence ([report](#), [defense slides](#)).  
Supervisor: Hugo Lavenant (Bocconi University).
- 2020 - 2024 **MSc in Applied Mathematics**  
*Télécom Paris (Palaiseau, France)*  
Specialization in Stochastic Modelling and Numerical Analysis, Signal Processing and Machine Learning, 4.0 CGPA
- 2018 - 2020 **Classe Préparatoire au Grandes Écoles (MPSI, MP\*)**  
*Lycée Carnot (Dijon, France)*  
Intensive two-year program giving rigorous training in preparation for national competitive exams allowing entry into top French graduate schools. Specialization in Mathematics, Physics and Computer Science.

## Research experience

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- 2024 **Research Intern**  
(6 months) *Bocconi University (Milan, Italy)*  
Gradient Flows in the Geometry of the Sinkhorn Divergence: derivation of the differential equation corresponding to the gradient flow of a potential energy, its main properties and long-time behavior, numerical implementation and comparison with the Wasserstein case. Entropic Optimal Transport, Gradient Flows, Functional Analysis, Riemannian Geometry, RKHS, Numerical Optimization & Visualization (Python).
- 2023 **Front Office Support**  
(2 months) *Axpo Solutions AG (Brussels, Belgium)*  
Constrained algorithmic financial optimization of multi-asset heat, power and CO2 production schedules for greenhouses. Applied research, Mathematical modelling, Numerical optimization (python, LP/MILP, Simulated annealing, Evolutionary algorithm), FTP communication, Predictive price curve evaluation and comparison.

## Research projects

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Some of my academic reports and presentations made during my MSc can be found in the "[Research](#)" section of my website, including the following:

### Reports:

- [Neural Optimal Transport](#)
- [Variational Learning of Inducing Variables in Sparse Gaussian Processes](#)
- [Generalized Sliced Distances for Probability Distributions](#)
- [Sparse representation of multivariate extremes with applications to anomaly detection](#)
- [Mean Curvature Motion of Point Cloud Varifolds](#)

### Presentations:

- [Riemannian Manifold Hamiltonian Monte Carlo](#)
- [FibeRed: Fiberwise Dimensionality Reduction of Topologically Complex Data with Vector Bundles](#)

## Other work experience

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2021      **Education Intern**  
(2 months)    *Learning Robots (Gif-sur-Yvette, France)*

Design and improvement of high-school and post-secondary level practical sessions and videos teaching artificial intelligence algorithms and ethics through robots. Development of new features for the AlphaAI robot and software (Python).

## Computer skills

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Proficient: Python (pytorch, matplotlib, numpy, pandas, scipy, sklearn, cvxpy, etc.), L<sup>A</sup>T<sub>E</sub>X, Git

Intermediate: R, C++, Java

## Languages

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**French:** Native

**English:** Proficient (C1)

**German:** Intermediate (B2)