

Mathis Hardion

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 mhardion

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

Interests

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

Education

- 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.
- 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

- 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

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

2021 (2 months)	Education Intern <i>Learning Robots (Gif-sur-Yvette, France)</i> 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 AlphAI robot and software (Python).
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Computer skills

Proficient: Python (pytorch, matplotlib, numpy, pandas, scipy, sklearn, cvxpy, etc.), L^AT_EX, Git
Intermediate: R, C++, Java

Languages

French: Native
English: Proficient (C1)
German: Intermediate (B2)