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# Raphaël Barboni

## Education

Since 2018 **Research apprentice (Élève fonctionnaire stagiaire)**, *ÉNS Ulm*, Paris, France.
Department of Mathematics and their Applications (DMA)

2020–2021 **M.Sc. Mathematics for Machine Learning and Data Science (MVA)**, *ÉNS Paris-Saclay*, with honors.
- 1st Semester : Computational optimal transport, Stochastic Differential Equations, Numerical imaging, Dynamical systems and stochastic models in neuroscience, Medical image analysis,
- 2nd Semester : Random matrix theory, Sparse representation theory, Geometry in the space of shapes, Inverse problems in imaging, PDEs for image analysis,
- **Master thesis** : *"Convergence properties of Gradient Descent in the training of Deep Residual Networks"* (supervised by G. Peyré and F-X. Vialard).

2019–2020 **First year of Master degree in mathematics**, *ÉNS Ulm*.
- 1st Semester : Stochastic processes and Markov chains, Elliptic PDEs, Dynamical systems and ergodic theory,
- 2nd Semester : Stochastic calculus, Optimal transport and applications in kinetic theory,
- **Industrial workshop** : optimization with cardinality constraints for the daily adjustment of electricity production,
- **Workshop** : *"Spectral theory in quantum mechanics"* (E.Séré).

2018–2019 **Sorbonne Université's Bachelor degree in mathematics**, *ÉNS Ulm*, with honors.
- **Bachelor thesis**, *"Mean curvature flow, an introduction to geometrical flows"* (supervised by T. Ozuch),
- **Workshop** : *"Riemannian geometry in the space of shapes"* (J. Feydy).

2016–2018 **Scientific preparation for competitive exams**, *Lycée Henri IV*, Paris.
Mathematics, Physics, Computer science (MPSI-MP*)

## Skills

### Computer

| | |
|---|---|
| Programming | Python, ML libraries (Pytorch, Scikit-learn, ...) |
| Operating System | Linux |

### Languages

| | |
|---|---|
| French | Mother tongue |
| English, German | Professional skills (B2) |

## Professional experiences

### Research internships

2022 **Statistical to computational gaps in Tensor PCA**, *ETH, Mathematic Department*, Zürich, supervised by A.Bandeira.
Theoretical guarantees for polynomial time algorithms in Tensor PCA.

2021 **Convergence and Implicit biases in training Deep Residual Networks**, *ÉNS DMA - CNRS*, Paris, supervised by G.Peyré and F-X.Vialard.
Convergence properties of Gradient Descent in the training of Deep Residual Networks.

2020 **Hydrodynamical models for red tides phenomena in Quellón's bay**, *Center for Mathematical Modeling (CMM) - CNRS*, Santiago, Chile, supervised by C.Conca.
Numerical models for Navier-Stokes equations. Interrupted due to the Covid pandemic.

### Teaching

2021–2022 **Teaching assistant**, *Lycée Henri IV*, Paris.
"Cycle Pluridisciplinaire d'Études Supérieure" (CPES), Bachelor level

2018–2022 **Preparation for competitive exams**, *Lycée Henri IV*, Paris.
Questioning students on mathematical exercises ("colles")

## Publications

### Preprints

R. Barboni, G. Peyré, and F.-X. Vialard, *Global convergence of ResNets: From finite to infinite width using linear parameterization*. `https://hal.archives-ouvertes.fr/hal-03473699`, Dec. 2021. preprint.

## Community life

2019–2021 **Confer'ENS Ulm**.
Students' forum, canvassing speakers, preparing interviews

2019 **Member of the ÉNS Students' Office**.
Scheduling artistic events, organizing associative events

## Hobbies

Track & Field I do Pole Vault, my personal best is 4.20m.

Mountain sports Hiking, climbing, skiing and traveling

Guitar Spanish and South-american music