

Raphaël Barboni

PhD candidate

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Education

- Since 2022 **PhD candidate**, *ÉNS Ulm – PSL, Département of Mathematics*, Paris.
“Convergence and implicit bias of deep Residual Neural Networks”, under supervision of G. Peyré and F-X. Vialard
- 2018 – 2022 **Research apprentice (“Élève fonctionnaire stagiaire”)**, *ÉNS Ulm*, Paris, France.
Department of Mathematics (DMA)
- 2020–2021 **M.Sc. Mathematics for Machine Learning and Data Science (MVA)**, *ÉNS Paris-Saclay*, with honors.
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*.
 - **Industrial workshop** : optimization with cardinality constraints for the adjustment of electricity production,
 - **Workshop** : “Spectral theory in quantum mechanics” (E.Séré).
- 2018–2019 **Bachelor degree in mathematics**, *ÉNS Ulm & Sorbonne Université*, Paris, 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, ...)
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

- Since 2021 **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

Barboni, Raphaël, Gabriel Peyré, and François-Xavier Vialard (2021). *Global convergence of ResNets: From finite to infinite width using linear parameterization*. Accepted to Neurips. URL: <https://arxiv.org/abs/2112.05531>.

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