Raphaël Barboni

PhD candidate

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Education

2022 – 2025 **PhD candidate**, *École Normale Supérieure – PSL, Department of Mathematics*, Paris
"Convergence and implicit bias of deep Residual Neural Networks", supervised by **G. Peyré** and **F.-X. Vialard**

2018–2022 **"Élève fonctionnaire stagiaire"**, *École Normale Supérieure – PSL*, Paris, France
Department of Mathematics (DMA)

2020–2021 **M.Sc. Mathematics for Machine Learning and Data Science (MVA)**, *ÉNS Paris-Saclay*, with honors
Thesis: *"Convergence properties of Gradient Descent in the training of Deep Residual Networks"* (supervised by **G. Peyré** and **F-X. Vialard**)

2018–2019 **Bachelor degree in mathematics**, *École Normale Supérieure – PSL*, Paris, with honors
Thesis: *"Mean curvature flow, an introduction to geometrical flows"* (supervised by T. Ozuch)

Teaching

Since 2021 **Teaching assistant**, *Paris Science Lettres (PSL)*, Paris
"Cycle Pluridisciplinaire d'Études Supérieure" (CPES), undergrad.

2018–2022 **Preparation for oral exams**, *Lycée Henri IV*, Paris

Publications

Published

R. B., Gabriel Peyré, and François-Xavier Vialard. "Understanding the training of infinitely deep and wide resnets with conditional optimal transport". In: *Communications on Pure and Applied Mathematics* (2025).

R. B., Gabriel Peyré, and François-Xavier Vialard. "On global convergence of ResNets: From finite to infinite width using linear parameterization". In: *Advances in Neural Information Processing Systems* 35 (2022).

Preprints

R. B., Gabriel Peyré, and François-Xavier Vialard. "Ultra-fast feature learning for the training of two-layer neural networks in the two-timescale regime". In: *arXiv preprint arXiv:2504.18208* (2025).

Internships

2022 **Statistical to computational gaps in Tensor PCA**, *ETH, Mathematic Department*, Zürich, supervised by **A. Bandeira**

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

2020 **Hydrodynamical models for red tides phenomena in Quellón's bay**, *Center for Mathematical Modeling (CMM) - CNRS*, Santiago, Chile, supervised by **C. Conca**

Skills

Programming

Python	Scientific computing and machine learning
Github	Developing open source code

Languages

French	Native language
English	Professional skills

Conferences

Oral presentation

- IWOTA (International Workshop on Operator Theory), July 2025, Twente, Netherlands,
- SIGMA (Signal-Image-Geometry-Modeling-Approximation), June 2024, Luminy, France,
- PDE Methods in Machine Learning (Birs event), June 2024, Granada, Spain.

Poster presentation

- Physics of AI algorithms, January 2025, Les Houches, France,
- Learning and Optimization in Luminy, June 2024, Luminy, France,
- Workshop on Optimal Transport, from Theory to Applications, March 2024, Berlin, Germany,
- Conference on Neural Information Processing Systems (Neurips), November 2022, New Orleans, USA,
- International Conference on Curves and Surfaces, June 2022, Arcachon, France.