Raphaël Barboni

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Positions

2025 – now	**Postdoctoral fellow**, *Bocconi University, Institute for Data Science and Analytics (BIDSA)*, Milan mentored by **G. Zanella**.

Education

2022 – 2025	**PhD**, *École Normale Supérieure – PSL, Department of Mathematics*, Paris **Thesis**: "Training deep neural networks: mathematical models and convergence results", supervised by **G. Peyré** and **F.-X. Vialard**.
2018 – 2022	**Élève fonctionnaire**, *École Normale Supérieure – PSL, Department of Mathematics*, Paris
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.

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)*, 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**

Teaching

2021 – 2025	**Teaching assistant**, *Paris Science Lettres (PSL)*, Paris "Cycle Pluridisciplinaire d'Études Supérieure" (CPES).
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).

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.