

# Raphaël Barboni

Postdoctoral fellow, Bocconi University

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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 **Ph.D. in Mathematics, 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 **B.Sc. 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).

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## 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.