Ruben Ohana

Flatiron Research Fellow, Flatiron Institute. PhD in Machine Learning from École Normale Supérieure.

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Positions

Flatiron Research Fellow - Flatiron Institute (Simons Foundation) *New York City, USA*

Collaborators: Robert Gower, Michael Eickenberg *Oct. 2022 - Current*

Current project: new efficient optimization methods for deep learning.

Education

PhD internship - Criteo AI Lab *Paris, France*

Supervisors: Liva Ralaivola, Alain Rakotomamonjy *Dec. 2021 - March 2022*

- Theoretical and experimental study of Sliced Optimal Transport [1].
- Development of Complex-to-real random features for tensor sketches [9].

PhD in Machine Learning - École Normale Supérieure *Paris, France*

Supervisors: Florent Krzakala (ex-ENS, EPFL), Alessandro Rudi (Inria), Laurent Daudet (LightOn) *Oct. 2019 - Sept. 2022*

Axis of Research:

- Machine learning for chaotic time-series [6].
- Improving Adversarial Robustness of Neural Networks [4,5].
- Differential Privacy [2].
- Optical Computing [3,5,8, P1].
- Alternative training methods to backpropagation [2,4,5,6].
- (Optical) Random features and kernel methods [7,8,9].
- Sliced Optimal Transport [1].

MSc (Master 2) in Mathematics (Statistics & Machine Learning) *Paris, France*

Sorbonne Université *2018 - 2019*

MSc (Master 2) in Physics (Condensed Matter & Quantum Physics) *Paris, France*

École Normale Supérieure, Sorbonne Université *2017 - 2018*

***Diplôme d'ingénieur* (major: Physics, minors: Biology & Chemistry)** *Paris, France*

École Supérieure de Physique et de Chimie Industrielles (ESPCI ParisTech) *2014 - 2018*

Internships

LPENS, Ecole Normale Supérieure *Paris, France*

Approximation of Kernels at the speed of light using the OPU of LightOn (PI: Florent Krzakala) *May 2019 - Nov. 2019*

- **Corresponding Publication: [8]**

LIP6, Sorbonne Université *Paris, France*

Contextuality for quantum information networks (PI: Damian Markham) *April 2018 - June 2018*

- **Corresponding Publication: [10]**

MIT LIGO laboratory, Massachusetts Institute of Technology (MIT) *Cambridge, USA*

Noise characterization of the ytterbium-doped fiber laser for ligo (PI: Peter Fritschel) *May 2017 - July 2017*

- Implementation of the whole optical set-up for noise characterization of the laser.
- Characterization of the frequency noise, relative intensity noise, polarization noise of the laser - data analysis.

Quantum Solid State Physics Group, NTT Basic Research Laboratories *Atsugi, Japan*

Quantum Spin Hall Effect in InAs/(In)GaSb double quantum wells (PI: Hiroshi Irie) *July 2016 - December 2016*

- **Corresponding Publication: [11]**

Publications

[1] *Shedding a PAC-Bayesian Light on Adaptive Sliced-Wasserstein Distances.* **R. Ohana***, Kimia Nadjahi*, Alain Rakotomamonjy, Liva Ralaivola, **arXiv.**

[2] *Photonic Differential Privacy with Direct Feedback Alignment.* **R. Ohana***, H. Ruiz*, J. Launay*, A. Cappelli, I. Poli, L. Ralaivola, A. Rakotomamonjy, **arXiv,** NeurIPS 2021.

[3] *Photonic co-processors in HPC: using LightOn OPUs for Randomized Numerical Linear Algebra.* D. Hesslow, A. Cappelli, I. Carron, L. Daudet, R. Lafargue, K. Müller, **R. Ohana,** G. Pariente, I. Poli, **arXiv.**

[4] *Adversarial Robustness by Design through Analog Computing and Synthetic Gradients.* A. Cappelli*, **R. Ohana***, J. Launay, L. Meunier, I. Poli, F. Krzakala, **arXiv,** ICASSP 2022.

[5] *ROPUST: Improving Robustness through Fine-tuning with Photonic Processors and Synthetic Gradients.* Alessandro Cappelli, Julien Launay, Laurent Meunier, **Ruben Ohana,** Iacopo Poli, **arXiv.**

[6] *The dynamics of learning with feedback alignment.* M. Refinetti, S. d'Ascoli, **R. Ohana**, S. Goldt, **arXiv,** ICML 2021.

[7] *Reservoir Computing meets Recurrent Kernels and Structupurple Transforms.* **R. Ohana***, J. Dong*, M. Rafayelyan, F. Krzakala, **arXiv,** Oral Presentation at NeurIPS 2020.

[8] *Kernel computations from large-scale random features obtained by Optical Processing Units.* **R. Ohana**., J. Wacker, J. Dong, S. Marmin, F. Krzakala, M. Filippone, L. Daudet, **arXiv,** ICASSP 2020.

[9] *Complex-to-Real Random Features for Polynomial Kernels.* Jonas Wacker, **Ruben Ohana,** Maurizio Filippone, **arXiv,**

[10] *Experimental Approach to Demonstrating Contextuality for Qudits.* A. Sohbi, **R. Ohana**, I. Zaquine, E. Diamanti, D. Markham, **arXiv,** Physical Review A.

[11] *Impact of epitaxial strain on the topological-nontopological phase diagram and semimetallic behavior of InAs/GaSb composite quantum wells.* H. Irie, T. Akiho, F. Couedo, **R. Ohana**, K. Suzuki, K. Onomitsu, K. Muraki, **arXiv,** Physical Review B.

Patent [P1]: *Method and System for machine learning using optical data* I. Poli, J. Launay, K. Müller, G. Pariente, I. Carron, L. Daudet, **R. Ohana,** D. Hesslow. 2021, **US Patent.**

Reviewer in International conferences: ALT 2020, NeurIPS 2021-2022, Nature Communications, JMLR, ICML 2022-2023.

Education Projects

ENGIE Challenge Data (rank: 33/185) Predict wind power production from wind turbine operational data (supervised learning). Data preprocessing, feature engineering and model selection.

Scientific Team Project (ESPCI, 18 months) Assembly of an electrospray and study of the nano-drops on a liquid (water or oil) collector, as well as the different modes of the spray. Video of the project available **here**.

Languages/Computer Science

English Fluent.
French Mother tongue.
Computer skills **Python, Pytorch**, Jax and Matlab.

Extracurricular Activity

Association President of the Langevinium (1 year), the laboratory for students of the ESPCI: implementation of a superconductive train self-propelled by liquid nitrogen, showing of many scientific experiments at the *Collège de France* and the *Grand Palais*.

Music Harp (11 years of practice, *Diplôme de fin d'études du Conservatoire de Rueil-Malmaison*, 1st Medal), music theory.

Teaching Private tutoring (mathematics, quantum physics, chemistry, music theory) to students from various levels.