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Hugo NINOU

Education

Oct. 2022 - Now **PhD at ENS-PSL**, *Learning dynamics in biologically plausible neural networks: theory and data-driven modeling. Under the supervision of Alex Cayco Gajic and Jonathan Kadmon. Recipient of a selective scholarship (CDSN).*

- Developed a biologically inspired optimization method and evaluated its efficiency relative to classic gradient descent through large-scale simulations on a local cluster.
- Conducted multimodal statistical analysis of high-dimensional electrophysiological brain recordings to investigate the role of cerebellar signals in motor preparatory activity during adaptation.

2021-2022 **M2 MVA (Mathematics, Vision and Learning)**, *Université Paris-Saclay*.

- *Classes:* Algorithms for speech and natural language processing; Computational statistics; Convex optimization and applications in machine learning; Information and Complexity; Modeling in neuroscience; Theoretical neuroscience; Topological data analysis for imaging and machine learning; Responsible machine learning.

2020-2021 **M2 ICFP : Theoretical physics track and École normale supérieure diploma (DENS)**.

- *Classes:* Machine Learning; Advanced topics in Markov-chain Monte Carlo; Advanced Statistical Physics and New Applications; Numerical Physics and Machine Learning; Complex systems : from physics to social sciences; Information, inference, networks : from statistical physics to big biological data; Biophysics; Quantum Field Theory; General Relativity.

2018-2019 **M1 ICFP and DENS**, *École normale supérieure de Paris*.

2017-2018 **Bachelor in physics and DENS**, *École normale supérieure de Paris*, admitted through competitive examination (rank 25/1137).

2014 - 2017 **Preparatory classes for the Grandes Ecoles, Physics and chemistry track**, *Lycée Aux Lazaristes, Lyon*.

Teaching experience

2024-2025 **Teaching assistant**, *Designed and delivered the tutorials for the course 'Mathematical tools for data science, machine learning, and statistical modeling' taught by Prof. Alex Cayco-Gajic.*

Publications

Sept. 2025 **Curl Descent: Non-Gradient Learning Dynamics with Sign-Diverse Plasticity**, *Hugo Ninou, Jonathan Kadmon, N. Alex Cayco-Gajic*, **Neurips 2025 Spotlight**.

March 2025 **Cerebellar output shapes cortical preparatory activity during motor adaptation**, *Sharon Israely*, Hugo Ninou*, Ori Rajchert, Lee Elmaleh, Ran Harel, Firas Mawase, Jonathan Kadmon, Yifat Prut*, *These authors contributed equally, **Nature Communications**.

Conferences and presentations

Oct. 2025 **Bernstein 2025**, *Poster 'Curl Descent: Non-Gradient Learning Dynamics with Sign-Diverse Plasticity'.*

July 2025 **OCNS 2025**, *Poster 'Curl Descent: Non-Gradient Learning Dynamics with Sign-Diverse Plasticity'.*

Apr. 2025 **ShineLab, University of Sydney**, *Talk on 'Cerebellar output shapes cortical preparatory activity during motor adaptation'.*

Jan. 2025 **Najafi Lab SYBECO journal club, Georgia Tech**, *Talk on 'Cerebellar output shapes cortical preparatory activity during motor adaptation'.*

March 2024 **COSYNE 2024**, *Poster 'Cerebellar output shapes cortical preparatory activity during motor adaptation'.*

Awards

NeurIPS 2025 Scholar Award.

Awarded a competitive PhD scholarship (CDSN) by the Ecole normale supérieure.

Research experience

May - Sept. 2022 **Hebrew University of Jerusalem**, *Analyzing neural dynamics in the cortico-cerebellar pathway of non-human primate brain during learning. Supervision by Jonathan Kadmon and Yifat Prut.*

- Data analysis on electrophysiological neural recordings.
- implementation of dimensionality reduction techniques (Targeted dimensionality reduction) for analysis of neural trajectories through adaptation in the motor cortex.

April 2021 - July 2021 **ENS-PSL**, *Inference of learning rules in biologically plausible recurrent neural networks. Supervised by Rémi Monasson.*

- Data analysis on calcic recordings of zebra fish whole-brain activity.
- Modeling this brain activity and its learning process based on a RNN model.

Dec. 2019 - May 2020 **LaDHyX, École Polytechnique - Capital Fund Management**, *Studying and modeling emergence phenomena in price heterogeneities. Supervised by Michael Benzaquen and Alan Kirman.*

- Data extraction and statistical analysis.
- Comparison between usual statistical physics model to fit the data and conception of an agent based model having phases associated to the different behaviours observed.

Aug. - Nov. 2019 **Canada France Hawaii Telescope**, *Development of a convolutional neural network for detecting parasite sources in the data harvested by the SITELLE spectrometer. Supervision by Simon Prunet and Laurie Rousseau-Nepton.*

- Making of training and testing sets through defect generation on clean images.
- Conception and training of a deep neural network for computer vision able to detect and label the different types of image defects.

Febr.-July 2019 **University of California San Diego**, *Synthesis of self-propelled swimmers and studying of emergence phenomena in their collective behaviour. Supervision by Jérémie Palacci.*

- Participation in developing an experimental setup together with exploring unknown phenomena.
- Developement of a synthesis protocol for self-propelled diffusio-phoretic swimmers able to resist high constraints.

2018-2019 **Lycée Michelet and Lycée Saint-Louis**, *Oral examiner (prépa PCSI and MP*).*

June 2018 **Institut Lumière Matière**, *Electro-cinetic flows in wetting films. Supervision by Anne-Laure Biance.*

- Making of an experimental setup enabling the measure of electro-cinetic flows in a wetting film.

Other

Feb. 2025 **Artificial Intelligence Action Summit, Paris**, *Took part in the PSL student assembly as a participant.*