

# Nicolas Zucchet

PHD STUDENT · ETH ZÜRICH

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## Education

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### PhD student

ETH ZÜRICH

Zürich, Switzerland

09/2021 - now

- Doctoral student in artificial intelligence and computational neuroscience in the lab of Prof. Dr. Angelika Steger, jointly supervised by Dr. João Sacramento.

### Visiting student

UNIVERSITY OF BERN

Bern, Switzerland

05/2021 - 08/2021

- Probabilistic methods for continual learning, hosted by Prof. Dr. Jean-Pascal Pfister.

### Computer science MSc

ETH ZÜRICH

Zürich, Switzerland

09/2019 - 04/2021

- Theoretical foundations of artificial intelligence (optimization, neuroscience, machine learning).
- Master thesis: “Equilibrium propagation for bilevel optimization”, supervised by Dr. João Sacramento.

### Ingénieur polytechnicien (MSc)

ÉCOLE POLYTECHNIQUE

Palaiseau, France

09/2016 - 08/2019

- Multidisciplinary education (applied mathematics, computer science, economics), specialization in deep learning and computer vision during the last two semesters.

### Classe préparatoire aux grandes écoles (MPI\*)

LYCÉE HOCHÉ

Versailles, France

09/2014 - 08/2016

- Intensive training for competitive entrance exams to french Grandes Écoles (fundamental mathematics, computer science, physics).

## Professional experience

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### Research internship

PROPHESÉE

Paris, France

05/2019 - 08/2019

- Deep learning algorithms for event-based cameras in autonomous cars.

### Software developer intern

AMADEUS

Sophia-Antipolis, France

06/2019 - 08/2019

- Design and development of continuous integration tools.

## Publications

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### PREPRINTS

- [2] Uncovering mesa-optimization algorithms in Transformers, J. von Oswald\*, E. Niklasson\*, M. Schlegel\*, S. Kobayashi, **N. Zucchet**, N. Scherrer, N. Miller, M. Sandler, B. Agüera y Arcas, M. Vladymyrov, R. Pascanu and J. Sacramento.
- [1] Gated RNNs discover attention, **N. Zucchet**\*, S. Kobayashi\*, Y. Akram\*, J. von Oswald, M. Larcher, A. Steger†, J. Sacramento†.

### CONFERENCE AND JOURNAL PAPERS

- [5] Online learning of long-range dependencies. **N. Zucchet**\*, R. Meier\*, S. Schug\*, A. Mujika and J. Sacramento. 37<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS), 2023.
- [4] The least-control principle for local learning at equilibrium. A. Meulemans\*, **N. Zucchet**\*, S. Kobayashi\*, J. von Oswald and J. Sacramento. 36<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS), 2022.

- [3] A contrastive rule for meta-learning. **N. Zucchet\***, S. Schug\*, J. von Oswald\*, D. Zhao and J. Sacramento. 36<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS), 2022.
- [2] Beyond backpropagation: Bilevel optimization through implicit differentiation and equilibrium propagation. **N. Zucchet** and J. Sacramento. Neural Computation 34 (12), 2022.
- [1] Learning where to learn: Gradient sparsity in meta and continual learning. J. von Oswald\*, D. Zhao\*, S. Kobayashi, S. Schug, M. Caccia, **N. Zucchet** and J. Sacramento. 35<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS), 2021.

## WORKSHOP PAPERS

- [1] Random initialisations performing above chance and how to find them. F. Benzing, S. Schug, R. Meier, J. von Oswald, Y. Akram, **N. Zucchet**, L. Aitchison<sup>†</sup>, A. Steger<sup>†</sup>. OPT2022: 14th Annual Workshop on Optimization for Machine Learning (NeurIPS), 2022.

## Talks

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- Jan. 2024 **Online learning of long-range dependencies**, Swiss Computational Neuroscience Retreat.
- Feb. 2023 **The least-control principle for local learning at equilibrium**, Swiss Computational Neuroscience Retreat.
- Nov. 2022 **The least-control principle for local learning at equilibrium**, Jean-Rémi King's Brain & AI group at Meta AI.
- July 2022 **Biologically plausible bilevel optimization**, Rafal Bogacz's group at Oxford.
- June 2022 **Bilevel optimization in neural networks**, MLSS<sup>N</sup> 2022 lecture with J. Sacramento, A. Meulemans and S. Schug.
- Feb. 2022 **A contrastive rule for meta-learning**, Swiss Computational Neuroscience Retreat.

## Teaching experience

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- 2022-23 **Algorithms lab**, Teaching assistant (Master's course).
- 2022-24 **Algorithms and probability**, Teaching assistant (Bachelor's course).
- 2021 **Randomized algorithms**, Teaching assistant (Master's course).
- 2016-17 **High-school mathematics**, Full-time tutoring of high school students from deprived neighborhoods.

## Mentoring

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- 2023 **Kevin Lopez**, Master thesis, ETH Zürich (co-supervised with J. Sacramento).
- 2023 **Yanick Schimpf**, Bachelor thesis, ETH Zürich.
- 2022-23 **Qianqian Feng**, Research project, ETH Zürich (co-supervised with J. Sacramento).
- 2022 **Anja Surina**, Master thesis, ETH Zürich (co-supervised with J. Sacramento and S. Schug).

## Community service

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- 2023 **ICML**, Reviewer.
- 2023 **ICLR**, Reviewer.
- 2023 **NeurIPS**, Reviewer.

## Awards

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- 2022 **Scholar award**, NeurIPS.