MATTEO SAPONATI

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My goal is to develop innovative learning algorithms for Neuromorphic devices, lead cutting-edge research on the interpretability of Foundation Models, and contribute to the evolution of Deep Learning. I conduct my research using analytical and numerical tools, within a multidisciplinary approach getting inspiration from Physics, Theoretical Neuroscience, and Statistical Learning Theory.

Work experience

Oct 2023 - present **Postdoctoral Researcher**
Institute of Neuroinformatics, ETH/UZH, Zurich (CH)

- Design novel learning algorithms for Neuromorphic computing.
- Lead scientific projects on mechanistic interpretability of Deep Neural Networks (DNNs), Transformer models, and Recurrent Neural Networks (RNNs).
- Supervise master students from the University of Zürich (UZH) and ETH Zürich.

Sep 2019 - Sep 2023 **Ph.D. Candidate**
Ernst Strüngmann Institute for Neuroscience, Max-Planck Institute for Brain Research, Frankfurt Am Main (DE)

- Design and implement learning algorithms for Spiking Neural Networks (SNNs), with applications in Machine Learning and Computational Neuroscience.
- Publish scientific articles and present at international conferences.
- Employ state-of-the-art ML frameworks (PyTorch, Tensorflow).

Mar 2019 - Aug 2019 **Assistant Research Scientist**
Institute des Neurosciences des Systemes Aix-Marseille University, Marseille (FR)

Jul 2018 - Aug 2018 **Research Intern**
Barcelona Biomedical Research Park, Barcelona (ESP)

Education

May 2020 - Nov 2023 **Ph.D. in Neurophysics**
Highest Honors (top 5%) - Donders Centre for Neuroscience, Radboud University (NL)

Sep 2016 - Oct 2018 **M.Sc. in Physics**
110/110 - Department of Physics, University of Pisa (IT)

Sep 2011 - Jun 2016 **B.Sc. in Physics**
94/110 - Department of Physics, University of Pisa (IT)

Research

Saponati, **M.**, & Vinck, M. (2023a, August 27). *Inhibitory feedback enables predictive learning of multiple sequences in neural networks*. https://doi.org/10.1101/2023.08.26.554928

Saponati, **M.**, & Vinck, M. (2023b). Sequence anticipation and spike-timing-dependent plasticity emerge from a predictive learning rule. *Nature Communications*, *14*(1), 4985. https://doi.org/10.1038/s41467-023-40651-w

Saponati, **M.**, Garcia-Ojalvo, J., Cataldo, E., & Mazzoni, A. (2022). Thalamocortical Spectral Transmission Relies on Balanced Input Strengths. *Brain Topography*, *35*(1), 4–18. https://doi.org/10.1007/s10548-021-00851-3

Spyropoulos, G., **Saponati**, **M.**, Dowdall, J. R., Schölvinck, M. L., Bosman, C. A., Lima, B., Peter, A., Onorato, I., Klon-Lipok, J., Roese, R., Neuenschwander, S., Fries, P., & Vinck, M. (2022). Spontaneous variability in gamma dynamics described by a damped harmonic oscillator driven by noise. *Nature Communications*, *13*(1), 2019. https://doi.org/10.1038/s41467-022-29674-x

Saponati, **M.**, Garcia-Ojalvo, J., Cataldo, E., & Mazzoni, A. (2019). Integrate-and-fire network model of activity propagation from thalamus to cortex. *Biosystems*, *183*, 103978. https://doi.org/10.1016/j.biosystems.2019.103978

Grants and Awards

Jan 2024 - Jan 2026	**ETH Fellowship - 235200 CHF** ETH Zurich Postdoctoral Fellowship programme (Zürich, CH)
Mar 2023	**Cosyne Presenters Travel Grant - 1000 USD** Cosyne Conference 2023 (Montreal, CA)
Sep 2019 - Sep 2023	**PhD Research Fellowship - 35000 EUR** (estimate) International Max Planck Research School (IMPRS) for Neural Circuits, MPI for Brain Research, Frankfurt am Main (DE)
Jul 2018 - Aug 2018	**Erasmus+ Grant - 700 EUR** Erasmus program (EU)

Conference presentations and proceedings

2023 **Cosyne Conference (Montreal, CA)**
Poster: ”A predictive plasticity rule entails the anticipation of multiple spike sequences”

2022 **SfN, Society for Neuroscience Meeting (San Diego, USA)**
Poster: ”A predictive plasticity rule explains the anticipation of spike patterns at the single neuron level and the emergence of spike-timing-dependent plasticity mechanisms”

2022 **Bernstein Conference (Berlin, DE)**
Poster: ”V1 classical receptive field response is shaped by the spatio-temporal properties of the input”

2021 **Neuromatch Conference (online)**
Poster: ”Sequence anticipation and STDP emerge from a predictive learning rule”

Skills

Language Skills	Italian (Mother tongue), English (Fluent), Portuguese (Intermediate)
Coding Skills	Python, PyTorch, Matlab, C++, LaTex, Adobe Illustrator, Music production DAWs
Research Skills	Mathematical Modelling, Data Analysis, Critical Thinking, Teamwork, Public Speaking, Problem Solving