MATTEO SAPONATI

Research Scientist

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About me

I am a Research Scientist with several years of experience developing cutting-edge algorithms for Machine Learning and Neuromorphic Computing. I am passionate about understanding the principles of learning in brains and machines, designing novel intelligent devices, and contributing to the evolution of Artificial Intelligence. I conduct my research using analytical and numerical tools, with a multidisciplinary approach getting inspiration from Physics, Neuroscience, and Machine Learning.

Experience

Postdoctoral Researcher

2023 - ongoing

Institute of Neuroinformatics, ETH/UZH, Zurich (CH)

- Design and test advanced learning algorithms for Neuromorphic devices and edge computing.
- Lead scientific projects on mechanistic interpretability of Deep Neural Networks (DNNs), Transformer models, and Recurrent Neural Networks (RNNs).
- Supervise students (B.Sc., M.Sc., and Ph.D.) from ETH Zürich, University of Zürich, and ZHAW Center for Artificial Intelligence.
- Publish scientific articles and present research at international conferences.

Research Associate (PhD)

2019 - 2023

Max-Planck Institute for Brain Research and Ernst Strüngmann Institute, Frankfurt Am Main (DE)

- Design learning algorithms for Spiking Neural Networks (SNNs), with applications in Machine Learning and Computational Neuroscience.

- Publish scientific articles and present research at international conferences (3 scientific articles, 6 presentations).

- Employ state-of-the-art ML frameworks (PyTorch, Tensorflow).

Assistant Research Scientist

2019

Institute des Neurosciences des Systemes Aix-Marseille University, Marseille (FR)

Research Intern

2018

Barcelona Biomedical Research Park, Barcelona (ESP)

Education

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

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

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

Skills

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

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 Postdoctoral Fellowship**
ETH Zurich Postdoctoral Fellowship programme (Zürich, CH)

Mar 2023 **Cosyne Presenters Travel Grant**
Cosyne Conference 2023 (Montreal, CA)

Sep 2019 - Sep 2023 **IMPRS Research Fellowship**
International Max Planck Research School (IMPRS) for Neural Circuits, MPI for Brain Research, Frankfurt am Main (DE)

Jul 2018 - Aug 2018 **Erasmus+ Grant**
Erasmus program (EU)