Call for Postdocs in Neural Networks and Computational Neuroscience

2025

We are looking for a postdoc to join the Interdisciplinary Institutes for Artificial Intelligence 3IA Côte d'Azur, in the beatiful French Riviera, to work with 3IA Chair Emanuele Natale on problems at the interface of machine learning and computational neuroscience.

The candidate will be part of the COATI joint team between INRIA d'Université Côte d'Azur and the I3S Laboratory.

Project

The candidate should have a PhD in computer science, mathematics, physics, or related fields, with a passion for programming. A desire to contribute to the development of open-source software within the context of the agreed project will be appreciated. The use of the Julia programming language is preferred, which has been used by E. Natale's group since 2020, contributing to the developlment of projects such as GraphNeuralNetworks.jl and WorldDynamics.jl.

Depending on the candidate's interests, the research topic will be tailored to one of the following directions:

- **Sparsity and Structure in Neural Networks**. We are interested in understanding the role of topology in artificial neural networks at a fundamental level. To this end, we have investigated the Strong Lottery Ticket Hypothesis [NFG+24, dCDN23, dCDG+23, dNV22], which states that random neural networks can be pruned to approximate a large class of functions without changing the initial weights. We are also interested in Neural Combinatorial Optimization, where we investigate the use of graph neural networks to solve graph and combinatorial problems, such as approximating centrality measures or performing network alignment.
- **Computational Neuroscience**. We are interested in developing new tools to understand the nervous system and to explore theories behind neural phenomena. As for developing new tools, we have been working on network alignment algorithms [FCC+21] and network statistical models [RDN24], and we are currently working on GNN-based alignment algorithms to compare connectomes across different species. As for the theoretical side, we are interested in various fundamental questions, including

—but not limited to— models of evolution of the brain connectivity structure.

For inquiries on possible research topics, please send an email to emanuele.natale@univ-cotedazur.fr.

Salary

The duration of the position is 2 years, with a monthly gross salary around 3120€ according to experience. Candidates will also be encouraged to apply for competitive fellowships such as the Université Côte d'Azur Excellence Fellowship (monthly gross salary 3520€ with operating budget of 5,000 euros). Candidates wishing to start in 2026 will be invited to apply for a Marie Skłodowska-Curie fellowship (gross salary araound 5900€ + generous family and mobility allowance).

Contacts

To apply, please send an email to emanuele.natale@univ-cotedazur.fr.

References

[dCDG+23] Arthur Carvalho Walraven da Cunha, Francesco D'Amore, Frédéric Giroire, Hicham Lesfari, Emanuele Natale, and Laurent Viennot. Revisiting the random subset sum problem. In Inge Li Gørtz, Martin Farach-Colton, Simon J. Puglisi, and Grzegorz Herman, editors, *31st Annual European Symposium on Algorithms, ESA 2023, September 4-6, 2023, Amsterdam, The Netherlands*, volume 274 of *LIPIcs*, pages 37:1–37:11. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2023.

[dCDN23] Arthur da Cunha, Francesco D'Amore, and Natale, Emanuele. Polynomially Over-Parameterized Convolutional Neural Networks Contain Structured Strong Winning Lottery Tickets. In *Thirty-Seventh Conference on Neural Information Processing Systems*, November 2023.

[dNV22] Arthur da Cunha, Natale, Emanuele, and Laurent Viennot. Proving the Strong Lottery Ticket Hypothesis for Convolutional Neural Networks. In *ICLR 2022 - 10th International Conference on Learning Representations*, Virtual, France, April 2022.

[FCC+21] Matteo Frigo, Emilio Cruciani, David Coudert, Rachid Deriche, Natale, Emanuele, and Samuel Deslauriers-Gauthier. Network Alignment and Similarity Reveal Atlas-Based Topological Differences in Structural Connectomes. *Network Neuroscience*, 5(3):711–733, September 2021.

[NFG+24] Natale, Emanuele, Davide Ferre', Giordano Giambartolomei, Frédéric Giroire, and Frederik Mallmann-Trenn. On the Sparsity of the Strong Lottery Ticket Hypothesis. In *The Thirty-eighth Annual Conference on Neural Information Processing Systems*, September 2024.

[RDN24] Aurora Rossi, Samuel Deslauriers-Gauthier, and Natale, Emanuele. On Null Models for Temporal Small-Worldness in Brain Dynamics. *Network Neuroscience (Cambridge, Mass.)*, 8(2):377–394, 2024.