



**Offer #2024-08531**

## **Post-Doctoral Research Visit F/M Postdoc in Neural Networks and Computational Neuroscience**

**Contract type :** Fixed-term contract

**Level of qualifications required :** PhD or equivalent

**Fonction :** Post-Doctoral Research Visit

### **About the research centre or Inria department**

The Inria center at Université Côte d'Azur includes 42 research teams and 9 support services. The center's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

### **Context**

We are looking for a postdoc to join the [Interdisciplinary Institutes for Artificial Intelligence 3IA Côte d'Azur](#), in the beautiful 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](#).

## Assignment

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](mailto: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.

## **Main activities**

To be discussed with the supervisor at the time of the candidate's skills assessment and agreement on the main project that will be pursued.

## **Skills**

Technical skills and level required :

Languages :

Relational skills :

Other valued appreciated :

## **Benefits package**

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Contribution to mutual insurance (subject to conditions)

## **Remuneration**

Gross Salary : 2788 € per month.

## General Information

- **Theme/Domain** : Optimization, machine learning and statistical methods  
Scientific computing (BAP E)
- **Town/city** : Sophia Antipolis
- **Inria Center** : [Centre Inria d'Université Côte d'Azur](#)
- **Starting date** : 2025-09-01
- **Duration of contract** : 2 years
- **Deadline to apply** : 2025-03-31

## Contacts

- **Inria Team** : [COATI](#)
- **Recruiter** :  
Natale Emanuele / [emanuele.natale@inria.fr](mailto:emanuele.natale@inria.fr)

## About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

## The keys to success

There you can provide a "broad outline" of the collaborator you are looking for what you consider to be necessary and sufficient, and which may combine :

- tastes and appetencies,
- area of excellence,
- personality or character traits,
- cross-disciplinary knowledge and expertise...

This section enables the more formal list of skills to be completed and 'lightened' (reduced) :

- "Essential qualities in order to fulfil this assignment are feeling at ease in an environment of scientific dynamics and wanting to learn and listen."
- " Passionate about innovation, with expertise in Ruby on Rails development and strong influencing skills. A thesis in the field of \*\*\*\* is a real asset."

**Warning** : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

## Instruction to apply

Applications must be submitted online on the Inria website. Collecting applications by other channels is not guaranteed.

### **Defence Security :**

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

### **Recruitment Policy :**

As part of its diversity policy, all Inria positions are accessible to people with disabilities.