Offer #2026-10502

Post-Doctoral Research Visit F/M Post-Doctoral Research Visit F/M Modern Grant-Free Access Techniques for Cellular Networks (AI and Experimentation)

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

Created in 2008, the Inria Saclay Center is located at the heart of the Paris-Saclay scientific and technological excellence cluster, which alone accounts for 15% of French research. Serving the development of the Université Paris-Saclay and the Institut Polytechnique de Paris, the Inria Saclay center employs 80 people in research support services and 500 scientists of 54 nationalities.

Benefiting from continuous growth, the center now has a total of 42 project-teams and two in the process of being created, including 21 jointly with the Institut Polytechnique de Paris, 16 with the Université Paris-Saclay, as well as 7 Inria EPs, including one in collaboration with Onera and one with the Pôle Universitaire Centre Val de Loire. These research teams are spread over more than ten sites.

Context

This post-doctoral position is part of the PEPR Future Networks, and its PERSEUS project. PERSEUS focuses on the technologies, processing and optimization of next-generation cellular cell-free networks. This includes the development of robust physical and MAC layers and the proofs of concept for the practical assessment of the performance of selected algorithms.

The position will be based at Inria Saclay, with expected collaboration with other sites and partners. The start and end dates are flexible, subject to administrative

constraints, and the contract is for 12 months.

Assignment

The proposed position will focus on the development of grant-free access techniques for IoT applications.

One common communication scenario in IoT applications is massive machine-type communications (mMTC), where a large number of devices transmit sporadic, small packets. In traditional cellular systems, each device is allocated orthogonal resources prior to uplink transmission via a grant mechanism. However, this allocation requires signaling on control channels, which can exceed the data payload size and lead to inefficient resource use. Consequently, grant-free methods [1] that eliminate or reduce control traffic are well suited for these scenarios. Removing coordination introduces non-orthogonality, resulting in the superposition of signals from some or all devices.

A recent family of random access protocols—sometimes called "modern random access"—aims to address and even exploit this phenomenon. The IRSA protocols (Irregular Repetition Slotted ALOHA) [2,3,4] use Successive Interference Cancellation (SIC) and represent one form of grant-free technique, but they can also operate with any packet transmission scheme. They are related to "Unsourced Random Access" [7]. Adapting these methods for grant-free mMTC in cellular networks is therefore of prime interest and the main objective of this position.

Main activities

The initial research direction in this post-doctoral position is to study variants of modern random access, incorporating realistic physical-layer features and methods (e.g., [5,6]), including cell-free systems.

Our main objectives are to enhance performance and practicality in cellular networks. IRSA-based protocols can operate with any modulation scheme, including existing transmission techniques, and do not necessarily require NOMA features such as advanced multi-user detection. However, they can benefit from NOMA methods that improve SIC, as well as ML methods to perform SIC itself (e.g. [9]).

We are particularly interested in improving the selection of transmission opportunities (e.g., using precomputed sequences), possibly constructed with machine learning techniques (as in [8]). We could also consider lightweight node synchronization to reduce signal superposition.
An important aspect is that we plan to do actual experiments on the CortexLab platform in INSA/Inria Lyon using available software. We envision the use of Sionna Research Kit (SRK).

References

[1] Muhammad Basit Shahab, Rana Abbas, Mahyar Shirvanimoghaddam, and Sarah J. Johnson. "Grant-free non-orthogonal multiple access for iot: A survey.IEEE Communications Surveys & Tutorials", 2020.
[2] Gianluigi Liva. "Graph-Based Analysis and Optimization of Contention Resolution Diversity Slotted ALOHA." IEEE Transactions on Communications, 59(2):477–487, 2011.
[3] Clazzer, Federico, Andrea Munari, Gianluigi Liva, Francisco Lazaro, Cedomir Stefanovic, and Petar Popovski. "From 5G to 6G: Has the time for modern random access come?." arXiv preprint arXiv:1903.03063 (2019).
[4] "Modern Random Access for Grant-Free Cellular Networks," C. Adjih, Tutorial, https://indo-french-seminar-6g.github.io/slides/Modern_Random_Access_for_Grant-Free_Cellular_Networks--Cedric-Adjih.pdf
[5] Saeed Alsabbagh, Cédric Adjih, Amine Adouane, and Nadjib Aitsaadi. "Optimization of Irregular Repetition Slotted ALOHA with Imperfect SIC in 5G CIoT". IEEE International Conference on Communications (ICC) 2025.
[6] Saeed Alsabbagh, Cédric Adjih, Amine Adouane, and Nadjib Aitsaadi "IRSA Under Capture Effect and Imperfect SIC: a de Analysis for Future Cellular IoT", PIMRC 2025, Sep. 2025
[7] G. Liva and Y. Polyanskiy, “Unsourced Multiple Access: A Coding Paradigm for Massive Random Access,” Proceedings of the IEEE, vol. 112, no. 9, pp. 1214–1229, Sep. 2024
[8] Iman Hmedoush, Pengwenlong Gu, Cedric Adjih, Paul Muhlethaler, Ahmed Serhrouchni, "DS-IRSA: A Deep Reinforcement Learning and Sensing Based IRSA" in IEEE Global Communications Conference - GLOBECOM 2023, Kuala Lumpour, Malaysia, December 04–08, 2023.
[9] N. Shlezinger, R. Fu, Y. C. Eldar, "DeepSIC: Deep Soft Interference Cancellation for Multiuser MIMO Detection,"" IEEE Transactions on Wireless Communications, vol. 20, no. 2, pp. 1349–1362, Feb. 2021.

Skills

- Ph. D. in Computer Science, Telecommunications, Electrical Engineering, or a related field.
- Excellent programming skills, specifically in Python and good knowledge of machine learning frameworks.
- Strong background in telecommunication, including communication theory, random access, (machine learning, or artificial intelligence applied to telecommunications).
- Experience in programming SDR (Software Defined Radio) is a plus.
- Some experience in Sionna is a plus.

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
- Social security coverage

Remuneration

2788€ gross per month

General Information

- **Theme/Domain :** Networks and Telecommunications
  System & Networks (BAP E)
- **Town/city :** Palaiseau
- **Inria Center :** Centre Inria de Saclay
- **Starting date :** 2027-01-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2026-11-30

Contacts

- **Inria Team :** TRIBE
- **Recruiter :**
  Adjih Cédric / Cedric.Adjih@inria.fr

About Inria

Inria, the French national institute for research in digital science and technology, supports the French government in national research and innovation strategies in the digital field, acting as Digital Programs Agency. Inria leads over 300 research and innovation projects with its 3,500 scientists, engineers, and support staff, in partnership with universities and the digital ecosystem (businesses, entrepreneurs, and public stakeholders). Together, we explore strategic fields such as artificial intelligence, cybersecurity, quantum computing, cloud technologies, digital transformation in healthcare, digital twins, and digital technologies for defence. We develop practical solutions such as software, tech startups, partnerships with national companies, and cutting-edge training programmes. Our goal is to drive scientific, technological, and industrial excellence to ensure France’s digital sovereignty.

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

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.