Offer #2025-09170

PhD Position F/M Signal and attack detection infrastructure based on heterogeneous antennas in wireless networks

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria University of Lille centre, created in 2008, employs 360 people including 305 scientists in 15 research teams. Recognised for its strong involvement in the socio-economic development of the Hauts-De-France region, the Inria University of Lille centre pursues a close relationship with large companies and SMEs. By promoting synergies between researchers and industrialists, Inria participates in the transfer of skills and expertise in digital technologies and provides access to the best European and international research for the benefit of innovation and companies, particularly in the region.For more than 10 years, the Inria University of Lille centre has been located at the heart of Lille's university and scientific ecosystem, as well as at the heart of Frenchtech, with a technology showroom based on Avenue de Bretagne in Lille, on the EuraTechnologies site of economic excellence dedicated to information and communication technologies (ICT)

Context

The PhD student will be co-supervised by Valeria Loscri (FUN Team) and Nicolas Battaglini (Université Paris Cité)

The Inria FUN research group investigates solutions to enhance programmability, adaptability and reachability of FUN (Future Ubiquitous Networks) composed of RFID, wireless sensor and robot networks. Limited resources, and high mobility evolving in distrusted environments characterize the objects that compose FUN. They communicate in a wireless way. To be operational and efficient, such networks have to follow some self-organizing rules. Indeed, components of FUN have to be able in a distributed and energy-efficient way to discover the network, self-deploy, communicate, self- structure in spite of their hardware constraints while adapting the environment in which adapting the environment in which they

evolve. For additional information on the FUN research group, please see
http://team.inria.fr/fun/

Assignment

The main objectives of the thesis can be summarized as follows:

1) Design and development of a surveillance infrastructure based on heterogeneous nodes, including thin and flexible planar antennas made of conductive nanomaterials.

2) Characterization of an environment based on infrastructure nodes, in both passive and active scenarios.

3) Collection and processing of data/signals and development of machine learning approaches for device and communication technology identification, real-time demodulation, and tracking [alla-acsac24][bou21].

4) Ability to jam target devices while minimizing the impact on neighboring devices.

[alla-acsac24] Ildi Alla, Selma Yahia, Valeria Loscri, Hossien Eldeeb. Robust Device Authentication in Multi-Node Networks: ML-Assisted Hybrid PLA Exploiting Hardware Impairments. Annual Computer SecurityApplications Conference (ACSAC), Dec 2024, Waikiki, Hawaii, USA, United States. hal-0472749

[bou21] Emilie Bout, Valeria Loscri, Antoine Gallais. How Machine Learning changes the nature of cyber-attacks on IoT networks: A survey. Communications Surveys and Tutorials, IEEE Communications Society, Institute of Electrical and Electronics Engineers, 2021. hal-03390359

Main activities

To achieve the objectives of this thesis, we plan to select a candidate with a background in signal processing. The following tasks are planned:

[M0-M6] Review of the literature on approaches for device detection, localization, and identification;

[M3-M10] Design of flexible antennas and selection of reprogrammable cards for indoor and outdoor applications. Initial tests for initial data collection in controlled environments.

[M9-M24] Design of algorithms for environmental characterization in the "passive" and "active" cases, and indoor/outdoor. Development of detection, geolocation, and environmental characterization algorithms based on machine learning approaches. Analysis of key characteristics and parameters for the construction phase of the monitoring infrastructure.

Design of algorithms for the detection and identification of devices and their occupancy in the transmission spectrum. Development of anti-jamming solutions.

[M24-M30] Experimentation and validation of detection approaches in real-world scenarios based on reprogrammable cards and flexible antennas.

Testing and validation of identification of anti-jamming devices and solutions.

[M30-36] Finalization of activities, thesis writing, and defense.

Skills

Skills

Technical skills and level required :Programming skills on C++, Python and Matlab

Languages : English or French

Relational skills :Capacity to work in team

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

2 200 € gross monthly salary

General Information

- **Theme/Domain :** Networks and Telecommunications
  System & Networks (BAP E)
- **Town/city :** Villeneuve d'Ascq

- **Inria Center :** Centre Inria de l'Université de Lille
- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-08-21

Contacts

- **Inria Team :** FUN
- **PhD Supervisor :**
  Loscri Valeria / Valeria.Loscri@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.

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

Please send your CV and cover letter

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.