



Offer #2023-06134

Post-Doctoral Research Visit F/M Federated Learning under Energy Limit

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Level of experience : Recently graduated

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

This post-doctoral position will be supported by the Fed-MALIN project.

Fed-MALIN addresses a number of challenges that arise when Federated Learning (FL) is deployed over the Internet, including privacy, fairness, energy consumption, personalisation, and location/time dependencies.

Fed-MALIN will also contribute to the development of open-source tools for FL and will use them for concrete applications in medicine and crowdsensing.

The position is part of a collaboration between two teams of Inria Lille: Spirals (Self-adaptation for distributed services and large software systems Magnet (Machine Learning in Information Networks).

Assignment

The context of this project is Federated Learning (FL) where devices have an a priori and known budget for energy consumption. The exact energy consumption of devices is unknown, but can be evaluated by local measurements reported by middleware toolkits, like PowerAPI (<http://powerapi.org>). The aim is to design and implement online strategies in FL algorithms that are adaptive to the constraints of the energy limit and to the consequences of these constraints. You will study the impact of budgeted limits and energy consumption approximation on the client and the server side. In particular, devices can adapt the amount of information sent to the server and reduce the computational cost of gradients (using, for instance, quantization or sampling data or parameters).

On the server side, it is therefore necessary to mitigate the induced biases due to the unavailability of the devices, the heterogeneity of the collected gradients. These strategies are driven by local information in the first place, but need to be tuned in a collaborative way.

Main activities

The post-doctoral research activity includes several key steps:

- Study (local) energy consumption measurement. This includes the quality and robustness of PowerAPI measurements, the impact of quantization, model sizes, batch sizes, loss function in classical gradient descent-descent algorithms. Model predictions for energy consumption could also be studied and evaluated;
- Study and manage the impact of heterogeneity of gradients at the server level on the convergence and the accuracy in (standard) aggregation steps. Possible strategies to mitigate the induced bias could also depend on auxiliary knowledge communicated by the clients;
- Devise new collaborative approaches for adaptive consumption of the budget across FL iterations.

Skills

PhD in computer science, machine learning, or software engineering/distributed computing.
Strong programming skills in Python/Pytorch.
Prior experience in Federated Learning will be an asset.

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

Gross monthly salary (before taxes) : 2788€

General Information

- **Theme/Domain** : Optimization, machine learning and statistical methods
Scientific computing (BAP E)
- **Town/city** : Villeneuve d'Ascq
- **Inria Center** : [Centre Inria de l'Université de Lille](#)
- **Starting date** : 2023-10-01
- **Duration of contract** : 2 years
- **Deadline to apply** : 2024-04-30

Contacts

- **Inria Team** : [MAGNET](#)
- **Recruiter** :
Tommasi Marc / Marc.Tommasi@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

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.