Offre n°2024-07508

PhD Position F/M Goal-Oriented Communications for Federated Learning

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 300 people in 16 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre / INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Contexte et atouts du poste

This PhD position is supported by the Nokia-Inria Federated Learning Challenge, and will be hosted within the MARACAS team in the CITI Laboratory (a joint laboratory between Inria and INSA-Lyon). The position will be supervised by Dr Malcolm Egan and Prof. Jean-Marie Gorce (MARACAS) and Dr Alberto Conte and Marie-Line Alberia Morel (Networks Systems and Security Research, Nokia Bell Labs).

MARACAS is a research group consisting of approximately 15 people within Inria and INSA Lyon, this includes 6 PhD students, 2 postdocs, and 2 research engineers. The focus of MARACAS is in the theory, algorithms, and experimentation for communication systems, developing and applying methods in information theory, statistical signal processing and machine learning. The PhD position will complement existing projects on stochastic optimization and federated learning currently being carried out within MARACAS.

Mission confiée

The focus of the Inria-Nokia Federated Learning Challenge project is the development of federated and decentralized learning architectures and algorithms for future generation wireless communication systems. Federated learning systems support model estimation without providing the data stored in the clients directly to the server. Instead, the clients estimate local models and exchange the local model parameters or associated (sub)gradients with the server. This can dramatically reduce the amount of communication required and provide increased privacy. With the recent dramatic advances in the foundations of federated learning, the time is now ripe to investigate applications in emerging 6G wireless communication systems.

In the work carried out in this PhD position, we will ask two key questions:

(i) What is the impact of constraints imposed by realistic wireless communication links on state-of-the-art federated learning methods?

(ii) How can massive multiple access communications (e.g., coding, resource allocation, and signal processing) be optimized for state-of-the-art federated learning algorithms?

To address the first question, we will investigate the impact of wireless communications on the convergence of state-of-the-art federated learning algorithms. For the second question, new resource allocation, compression and coding schemes will be developed to optimize tradeoffs between reliability of communications (e.g., error-rates) and compression of federated learning updates.

Principales activités

The candidate will carry out research on federated learning algorithms in collaboration with members of the MARACAS Inria and Networks Systems and Security Research (Nokia Bell Labs). This includes participation in local seminars as well as in summer schools and international conferences. The

candidate will also have the opportunity to do limited teaching within INSA Lyon.

Main activities:

- Analyze convergence of state-of-the-art federated learning methods in the presence of realistic limitations arising from emerging 6G wireless communication systems.
- Develop new coding, resource allocation, and compression schemes to mitigate the impact of errors arising from wireless communications.

Compétences

Technical skills:

- Background in optimization theory, probability theory/statistics, and wireless communications;
- Ideally exposure to stochastic optimization algorithms and the corresponding convergence theory;
- proficiency in python and ideally experience with machine learning packages.

The candidate must have a high level of spoken and written English.

Avantages

- 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 (90 days / year) 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
- Complementary health insurance under conditions

Rémunération

1st and 2nd year: 2 100 euros gross salary /month

3rd year: 2 190 euros gross salary / month

Informations générales

- **Thème/Domaine :** Networks and Telecommunications
  System & Networks (BAP E)
- **Ville :** Villeurbanne
- **Centre Inria :** Centre Inria de Lyon
- **Date de prise de fonction souhaitée :**2024-09-01
- **Durée de contrat :**3 years
- **Date limite pour postuler :**2024-05-12

Contacts

- **Équipe Inria :** MARACAS
- **Directeur de thèse :**
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Applications must be submitted online on the Inria website.

Processing of applications sent by other channels is not guaranteed.

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.