Offre n°2025-09162

Post-Doctoral Research Visit F/M Adaptive Communication for Personalized Federated Learning

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : PhD or equivalent

Fonction : Post-Doctoral Research Visit

A propos du centre ou de la direction fonctionnelle

The Inria centre at Université Côte d'Azur includes 42 research teams and 9 support services. The centre's staff (about 500 people) is made up of scientists of di?erent 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 regiona 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.

Contexte et atouts du poste

Federated learning (FL) is a distributed machine learning approach that enables multiple clients to
collaboratively train a shared global model without exchanging their raw data, mitigating privacy
concerns and reducing communication costs. In standard FL, a single global model is learned by
aggregating locally trained updates from clients, assuming that all client data are drawn from a
similar distribution. However, in practice, client data are often highly heterogeneous—reflecting
diverse user behaviors and environments—which can lead to poor performance of the global model
on individual clients. Personalized federated learning (PFL) addresses this

challenge by adapting
the global training process to account for client-specific data characteristics.

The postdoc is funded by the Inria Challenge FedMalin on federated learning and will be based in the PREMEDICAL team.

Mission confiée

In this project, we will focus on two complementary thrusts: (1) designing metrics to quantify
statistical heterogeneity across client distributions; and (2) developing optimization and learning
algorithms that leverage these metrics to achieve provably effective personalized model training
under communication constraints.

Opportune Metrics for Statistical Heterogeneity

• Definition of Distributional Discrepancy Metrics: Develop novel measures that capture
both global and local differences in feature–label joint distributions, extending beyond
traditional divergence measures (e.g., Wasserstein, KL, MMD) to incorporate feature
relevance and task-specific losses.
• Weak-Communication Adaptation: Adapt metrics to settings with limited exchange of
summary statistics, ensuring that clients can compute and share compact heterogeneity
scores without revealing raw data.

2.2. Novel Learning Algorithms

• Personalized FL Algorithms with Optimal Client Selection: Design algorithms that use
heterogeneity-aware metrics to optimally select weighted subsets of clients for aggregation.
These methods aim to minimize gradient variance and reduce model bias by ensuring that
selected clients are both representative and informative. The approach will be grounded in
theoretical analysis and empirically validated in federated settings.
• Communication-Efficient Protocols: Integrate sampling schemes with quantization and
compression techniques to ensure compatibility with bandwidth constraints, analyzing trade-
offs between compression error and sampling-induced variance.

To evaluate the usefulness of the proposed techniques, we will work with synthetic data and open
benchmark datasets. The research will be made available in open access and we will seek to publish
the work in top machine learning venues.

Principales activités

- Develop and analyze new algorithms
- Run experiments on benchmark data
- Publish papers in top-tier machine learning venues

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 (after 6 months of employment) 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)

Rémunération

Gross Salary: 2788 € per month.

Informations générales

- **Thème/Domaine :** Optimization, machine learning and statistical methods
- **Ville :** Sophia Antipolis
- **Centre Inria :** Centre Inria d'Université Côte d'Azur
- **Date de prise de fonction souhaitée :** 2025-10-01
- **Durée de contrat :** 12 months
- **Date limite pour postuler :** 2025-08-31

Contacts

- **Équipe Inria :** PREMEDICAL
- **Recruteur :**
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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'e?orce 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. Collecting applications 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.