Offre n°2024-08436

PhD Position F/M Machine Learning based Program Recognition

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

In the context of the Inria exploratory action *ProgReco* between Inria Lyon and Université Côte d'Azur, we are hiring a PhD student *in co-advising between ENS de Lyon and université Côte d'Azur*.
The PhD student could be registered either at université Côte d'Azur or at ENS de Lyon.

Mission confiée

The overall objective is to design a static analysis able to *recognize automatically a program* by leveraging *machine learning*; and its application to *automatic program optimization*. The research includes the implementation of the solution and the experimental validation required for the related publications.

Principales activités

The main steps of the research include the following points:

1. ***Find a relevant program representation.*** A program might be directly modeled by a *graph*. We seek to keep syntactic elements while encoding the semantics (computation) by keeping relevant data- and control-flow informations. SSA form and its variants might be a good starting.
2. ***Choose a learning model.*** Once the right representation is found, an appropriate *learning model* must be selected. *Graph neural networks* and *gated-graph sequence neural networks* were already used successfully in static analysis and might be a good starting point to investigate.
3. ***Generating a training set.*** Several variants of a program should be generated while being sufficiently uniform to avoid overfitting. Compiler transformations as well as polyhedral code generation techniques will be investigated.
4. ***Application to program optimization.*** Once an algorithm is recognized, it might be substituted by a better version, available for instance in a performance library. Many challenges must be addressed. First, our classifier does only *predictions*. Hence *exact equivalence* must be checked. Second, recognized kernels might overlap. Hence, some high-level selection must be applied. These questions will be addressed while trying to be as general as possible.

In addition to these research activities, the PhD student could have teaching activities at university or ENS de Lyon.

Compétences

The applicant must hold a master in computer science or an engineering degree. He/she is expected to have a strong background in theoretical computer science (compilers, advanced programming, machine learning, graphs). On the implementation side, the applicant is expected to be skilled in C++.

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 :** Architecture, Languages and Compilation
  Information system (BAP E)
- **Ville :** Villeurbanne
- **Centre Inria :** Centre Inria de Lyon
- **Date de prise de fonction souhaitée :** 2025-09-01
- **Durée de contrat :** 3 years
- **Date limite pour postuler :** 2025-06-30

Contacts

- **Équipe Inria :** CASH
- **Directeur de thèse :**
  Alias Christophe / christophe.alias@inria.fr

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.

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.