Offer #2024-08436

PhD Position F/M Machine Learning based Program Recognition

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 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.

Context

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.

Assignment

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.

Main activities

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.

Skills

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++.

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 (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

Remuneration

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

3rd year: 2 190 euros gross salary / month

General Information

- **Theme/Domain :** Architecture, Languages and Compilation
  Information system (BAP E)
- **Town/city :** Villeurbanne
- **Inria Center :** Centre Inria de Lyon
- **Starting date :** 2025-09-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-06-30

Contacts

- **Inria Team :** CASH
- **PhD Supervisor :**
  Alias Christophe / christophe.alias@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

Applications must be submitted online on the Inria website.

Processing of applications sent by other channels is not guaranteed.

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.