**PhD Position F/M LLM-based Development of Sustainable Software Service**

*Le descriptif de l’offre ci-dessous est en Anglais*

**Type de contrat : CDD**

**Niveau de diplôme exigé : Bac + 5 ou équivalent**

**Fonction : Doctorant**

**A propos du centre ou de la direction fonctionnelle**

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).

**Contexte et atouts du poste**

Spirals is an Inria research team in the domain of distributed systems and software engineering. Spirals aims at introducing more automation in the adaptation mechanisms of software systems, in particular, transitioning from adaptive systems to self-adaptive systems. Spirals creates the future techniques for building self-healing and self-optimizing software systems.

We are offering a 3-year PhD position in the field of towards complex, self-adaptive software systems.

**Mission confiée**

With the emergence of Large Language Models (LLMs), code recommenders embedded in Integrated Development Environments (IDEs) have evolved into advanced code assistants that leverage a corpus of popular code snippets, like Open Source Software (OSS) repositories, to guide the development of more and more online cloud services. These code assistants are now widely adopted by development teams and software companies thanks to the success of popular services and plugins, like GitHub Copilot. While the underlying generative models have demonstrated human-competitive capabilities to produce energy-efficient algorithms for simple problems, they fail to produce acceptable solutions for more advanced challenges, likely less prominent in training datasets [2]. This lack of diversity and expertise in code assistants may, therefore, fail to guide developers toward delivering more sustainable software services at scale. Instead, it could reinforce popular beliefs and bias [5], hence contributing to rebound effects by increasing the delivery of resource-intensive services. This is all the more damaging as the research community is investing intense efforts into assessing the energy efficiency of ICT, by studying the various levers that influence the environmental footprint of a software service in production [1]. Therefore, influencing the generation process of code assistants in an explainable manner emerges as a critical challenge for the research community in software engineering [5].

In the context of this PhD thesis, we aim to study and promote a virtuous workflow to address the intrinsic complexity of modern software services and to reason across all the layers required to develop and operate these services.

**Principales activités**

We can structure the activities to be addressed as part of this PhD thesis as follows:

1. Study the integration of domain-specific expertise in code assistants. This challenge intends to leverage and extend appropriate state-of-the-art approaches, such as Retrieval-Augmented Generation (RAG), or knowledge distillation, to derive expert models that favor assessed solutions in their recommendations. To do so, we intend to study alternative knowledge representations to identify the most actionable insights to be adopted in this process.

2. Study the integration of agent peers in code assistants. This challenge intends to leverage execution metrics monitored during test or production phases by PowerAPI [4] to learn about energy-efficient constructions [3]. By analyzing source code and execution trace diffs, we aim to extract code snippets that reduce the energy consumption of software and use this runtime knowledge to guide the generation of new code, or the refactoring of legacy systems.
3. Study the configuration of sustainable services with code assistants. This challenge intends to study how LLMs can be leveraged to guide the design, development, and deployment of configurable and sustainable software services.

References

Compétences
- Technical skills: Master's degree in IT
- Languages: French, English
- Interpersonal skills: teamwork, autonomy, taking initiative

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 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

Informations générales
- Thème/Domaine : Systèmes distribués et intergiciels
- Ingénierie logicielle (BAP E)
- Ville : Villeneuve d'Ascq
- Centre Inria : Centre Inria de l'Université de Lille
- Date de prise de fonction souhaitée : 2024-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2024-08-18

Contacts
- Équipe Inria : SPIRALS
- Directeur de thèse : Quinton Clément / clement.quinton@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'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

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Consignes pour postuler
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 :
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