

PhD position and postdoc position:
Automatic inference of software transformation rules for
automatically back and forward porting legacy infrastructure
software

Julia Lawall
Inria/LIP6/Whisper Team
Julia.Lawall@lip6.fr

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1 Context

Large, real-world software must continually change, to keep up with evolving requirements, fix bugs, and improve performance, maintainability, and security. For example, a new release of the Linux kernel appears every 2-3 months, with each release resulting from 10-13K patches. This rate of change can pose difficulties for clients, whose code cannot always evolve at the same rate. For example, the current version of Android is based on a Linux kernel version first released in 2013. This situation leads to the need for backporting, where services developed for more modern kernel versions are transformed to be compatible with an older one. Ultimately, there is often a need for forward porting of client-specific code, when relying on a old kernel version is no longer viable. The goal of the ITrans project is to provide automated solutions to address these problems. This project is a collaboration between Julia Lawall and Gilles Muller at Inria/LIP6, and David Lo and Lingxiao Jiang at Singapore Management University. The project is funded by an ANR PRCI grant.

2 Project

The project will focus on back porting and forward porting of Linux device drivers. The key technology to be developed in the project is an approach to inferring transformation rules from a collection of relevant examples. To address the problems of back porting and forward porting, it will furthermore be necessary to identify the code fragments in the source version that are not compatible with the target version, and to select examples from the Linux kernel change history illustrating how to modify these code fragments. This work will build on previous work in the Whisper team on the Coccinelle [1] program matching and transformation engine, that has been extensively applied to the Linux kernel, and the Prequel patch query system for finding change examples [3]. The PhD student will be responsible for the assessment of the state of the art, the development of the change rule inference algorithm, and the evaluation of the approach, while the postdoc will be responsible for automating the collection of the required examples from which to infer change rules.

3 Positions available

The PhD position is available for 36 months, starting March 1, 2017. The position requires a master's degree by the starting date. The postdoc position is available for 15 months. The starting date is flexible. The position requires a PhD degree by the starting date. The positions will be located in Paris.

This project will also have two positions open in Singapore at Singapore Management University: one research fellow (postdoc) for 18 months and one research assistant (engineer) for 21 months. Contact David LO <davidlo@smu.edu.sg> for more information.

4 Background required

The project sits at the intersection between systems, programming languages, and software engineering. An applicant should demonstrate a strong background in programming languages, specifically practical aspects of program analysis, and should have some background in at least one of the other areas (multiple courses at the masters level with high grades and ideally some project work in the area). Familiarity with data mining, machine learning, and graph algorithms would also be helpful.

To effectively build on the infrastructure already developed in the Whisper group, most of the programming required for the project will be done in OCaml [2]. The applicant need not already know OCaml, but will be expected to learn it quickly at the beginning of the project.

The application area of the project is large-scale open source development. Previous experience in contributing to open source software, or other forms of large-scale software development would be appreciated, but is not essential.

Knowledge of French is not required.

5 Application process

Please send a CV, transcripts for the bachelor and master's degrees, and a detailed letter of motivation to Julia.Lawall@lip6.fr. The CV should contain links to any published papers. The letter of motivation should describe the applicant's background in the areas of the project, reason for interest in the project, and future plans. The application should be accompanied by 2-3 letters of recommendation, sent directly to the above address. Applications will be considered as they are received.

References

- [1] Coccinelle. <http://coccinelle.lip6.fr/>.
- [2] OCaml. <http://ocaml.org>.
- [3] Prequel. <http://prequel-pql.gforge.inria.fr/>.