2018-00626 - post-doctoral fellowship on a domain specific language for crowd-sourcing systems specified by Guarded Attribute Grammars (SUMO)

Level of qualifications required : PhD or equivalent
Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

The Inria Rennes - Bretagne Atlantique Centre is one of Inria's eight centres and has more than thirty research teams. The Inria Center is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Team presentation:

The SUMO team proposes to combine formal methods approaches with concurrency theory, in order to address the modeling, analysis and management of large distributed or modular systems exhibiting quantitative aspects. Large distributed softwares and systems are indeed calling for quantitative models involving time, probabilities, costs, and combinations of them. As many problems in this setting become untractable or even undecidable, we are interested in the design of efficient approximation techniques, for example borrowed from electrical engineering approaches to the management of large stochastic systems. A strong point of SUMO is to gather skills from formal methods, discrete event systems, concurrency theory, and electrical engineering. Several application fields are covered: telecommunication networks management, modeling and verification of web services, control issues in large data centers, plus more opportunistic applications in the field of embedded systems or biological pathways.

Context

The Guarded Attribute Grammar (GAG) model developed in SUMO team is centered around services which are tasks with input and output parameters. A task is resolved by breaking it into smaller tasks, resolving these subtasks and combining their results to produce the required output. The breaking down of tasks to smaller tasks is modelled as rewriting rules using the productions of an attribute grammar. The inherited and synthesized attributes of the grammar respectively model the input and input parameters of tasks, while the semantics rules are used to enforce data-flow between a task and its subtasks, and between sibling tasks. Several such decomposition can exist for the same task, each suitable for a specific way of carrying it out. Constraints on the input parameters of tasks are used to restrict the applicability of a rule in a given configuration. These constraints are guards that are evaluated against the effective input values, an operation that filters applicable rules for each pending tasks. Enacting a GAG model is done lazily, that is, a rule is enabled if and when its guard becomes satisfied. Finally, tasks on the right-hand side of a rule for which there exist no (local) rules are considered as call to external services. Semantic rules may also have side effects, for instance, computing values using math operators, running data storage and retrieval queries against a database to respectively save synthesized values and populate inherited attributes, sending and receiving messages, etc.

The Active Workspaces based on Guarded Attribute Grammars (AW/GAG) is a declarative model for the specification of distributed collaborative user-centered and data-driven processes. The idea behind the model is to have independent user-workspaces communicating asynchronously by exchanges of services. Each user workspace (described by a specific GAG) contains the specification of the services the user offers, their enacted instances and references to services offered by other users.

We have developed a domain specific language, embedded in Haskell, (AW/GAG-DSL) that includes a GAG execution engine, a workspace graphical interface and a middleware in charge of communication between workspaces, user administration and task assignment.

We're working on this with

- The startup OpenAgora (https://www.open-agora.com/fr) on collective decision-making systems;
- DRUID team, in the frame of ANR Headwork, on workflow models for crowd-sourcing applications;
- Milan University and the JRC in Ispra on the formalisation of debates (in the broad sense):

General Information

- Theme/Domain : Proofs and Verification
- Town/city : Rennes
- Inria Center : CRI Rennes - Bretagne Atlantique
- Starting date : 2018-11-01
- Duration of contract : 1 year, 2 months
- Deadline to apply : 2018-05-31

Contacts

- Inria Team : SUMO
- Recruiter : Badouel Eric / eric.badouel@inria.fr

About Inria

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Conditions for application

Thank you to send us these documents by applying online:

- updated CV
- cover letter
- letters of recommendation eventually
- degree transcripts

More information : eric.badouel@inria.fr

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
parliamentary, citizens, experts, etc.) and the management of related documents;
- CESPA (Centre d'épidémiologie et de santé publique des armées, Marseille) on health crisis management systems.

Travel related to this project will be covered within the limits of the scale in force.

**Assignment**

With the help of Eric Badouel, the recruited person will develop the AW/GAG-DSL for crowd-sourcing applications and conduct experiments with our partners. The study will focus on the middleware part of the AW/GAG-DSL.

From a formal perspective, we are seeking mechanisms to produce knowledge from information transmitted by crowd participants given that this information is imprecise, uncertain and most often than not contradictory (presence of conflicts). Emphasis will be placed on point of view extraction (using clustering techniques), amendment management and consensus building mechanisms.

These mechanisms will be implemented in the AW/GAG-DSL and then used to specify and experiment collaborative systems in the context of two case studies. The first, which follows Robert Nsaibirni's thesis on the development of an early detection system for epidemics (in partnership with CESPA), will focus on health crisis management systems. The second, in collaboration with the University of Milan and the JRC of Ispra, will focus on the formalization of debates and the management of associated documents.

**Main activities**

Main activities of the recruited person are thus:

- Design mechanisms for merging data produced by a pool of users.
- Design clustering algorithms to identify the various points of view and related conflicts that occur in a debate as well as amendment and negotiation mechanisms in consensus building.
- Contribute to the development of the AW/GAG domain specific language to incorporate these mechanisms in order to make it usable in a crowd-sourcing context.
- Develop case studies in collaboration with our partners
- Write reports and submit research articles.

**Skills**

The proposed post-doctoral fellowship requires a taste and competencies both for formal models (attribute grammars, Dempster-Shaffer Theory of evidence ...), algorithmics and programmation (in Haskell), and experimentation on real world issues.

**Benefits package**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Sports facilities

**Remuneration**

Gross salary: 2653 euros