Activity Report 2014

Section Contracts and Grants with Industry

ALGORILLE Project-Team　(section vide)

ALICE Project-Team (section vide)

BIGS Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

Start-up project by T. Bastogne:

- Industrial partner: CYBERnano (Contract Research Organization in NanoMedicine).

- Status: SAS created in July 2013.

- Comments: a research engineer has been hired by CYBERnano since November 2014 to develop and implement new algorithms devoted to biological signal processing.

CAMUS Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The CAMUS team is taking part of the NANO 2017 national research program and its sub-project PSAIC (Performance and Size Auto-tuning thru Iterative Compilation) with the company STMicroelectronics, starting January 2015. Luis Esteban Campostrini has been recruited as PhD student in this project. His work will focus on extending the Apollo framework to dynamic analysis providing useful feedbacks to users regarding code optimization opportunities, and to code generation for ARM Cortex platforms.

<p style="text-align: center; color: red;">**CARAMEL Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Training and Consulting with HTCS

Participants: Pierrick Gaudry, Emmanuel Thomé [contact].

The training and consulting activities begun in 2012 with the HTCS company have been pursued, and the existing contract has been renewed in identical form for 2013, 2014 and 2015.

CARTE Project-Team (section vide)

CASSIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Research Result Transfer

The BZ-Testing-Tools technology has been transfered to LEIRIOS Technologies, at the end of 2004. LEIRIOS changed its name into 2007 and is now called Smartesting. The partnership between the Cassis project and the R&D department of Smartesting, located at the TEMIS Scientific and Industrial area at Besançon, will be continued through (national and international) projects. F. Bouquet is scientific consultant of Smartesting.

7.2. Electronic Voting Systems

Participant: Véronique Cortier.

A collaboration agreement has been signed between Loria and Scytl, a Spanish company who is proposing solutions for the organization of on-line elections, including legally binding elections, in several countries. We have a collaboration with David Galindo (who joined Scytl in July 2014) on defining security properties for e-voting (privacy as well as verifiability properties) and designing e-voting schemes that meet all these properties. Further contracts may cover the analysis of the solutions developed at Scytl.

7.3. Analysis of Electrum Bitcoin Wallet

Participants: Michaël Rusinowitch, Mathieu Turuani.

Electrum has signed a 2-month contract with Cassis for verifying its electronic bitcoin wallet. The protocol model has been specified in Aslan language and covers then registration of new users, the confirmation phase, and the usage of the wallet by the clients. Many optimisations techniques had to be used to limit state explosion, and *CL-AtSe* has been extended to cover a class of security properties with negative constraints that appear in this model, and might be useful for other protocol analysis. *CL-AtSe* has been applied to several scenarios to verify the security properties, and a few modifications were suggested to Electrum designer.

COAST Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Grants with Industry

6.1.1. CIFRE Grant with Bonitasoft

Participants: François Charoy, Samir Youcef.

Bonitasoft is a leading software company in the domain of open source Business Process Management Systems. The objective of this grant is to help Bonitasoft to support effective elastic BPM operation in the Cloud by leveraging both the business knowledge, the process models and the execution history of process instances and correlate them with cloud resource consumption. Guillaume Rosinoski has been recruited as a PhD Student to work on this project. We will define models that will be validated based on a detailed analysis of existing use cases that we have started to collect from Bonitasoft and its clients.

CORIDA Team (section vide)

MADYNES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Inria-EDF Strategic action MS4SG

Participants: Yannick Presse, Benjamin Segault, Laurent Ciarletta [contact].

Vincent Chevrier (Maia team, LORIA) is a collaborator and correspondant for the MS4SG project. Benjamin Camus, Victorien Elvinger (Maia team, LORIA) are extrenal collaborators.

The MS4SG (multi-simulation for smart grids) project is granted as a strategic action between Inria and EDF. It is a joint work between the Madynes and MAIA teams from Inria-NGE and EDF R&D. The aim of the project is to provide primitives based on AA4MM in order to enable the multi-modeling and the multi-simulation of smart-grids. They can be seen as a combination of at least 3 layers: the power grid, the network used to collect information and control the system and an Information System. As these domains can influence each other, smart-grids can be considered as a kind of complex system and we are faced with multi-modeling and multi-simulation issues. Models in these simulators (and therefore simulators) are heterogeneous (at least equation based and event based models).

The idea behind MS4SG is to use simulation to help develop and evaluate future smart grids architectures, novel supervision techniques and to eventually control these systems. Instead of building a "super simulator", our approach is stemming from our AA4MM work, and consists in integrating simulators (and models) coming from at least the three aforementioned initial different domains: electrical networks, communication networks and information systems.

7.1.2. Alerion, project

Participants: Laurent Ciarletta, Maxence Ho, Yael Kolasa, Martin Thiriau, Emmanuel Nataf [contact].

Alerion is an e-falconry startup created by a member of Madynes. Its goal is to provide novel solutions and services "for, using and eventually against" UxV (Unmanned Air ... Vehicle). The concept is to enhance existing system and design new ones by combining well designed components seen as Cyber Physical bricks.

As part of its national grant by the "Concours national d'aide à la création d'entreprises de technologies innovantes" (for the emerging category in 2013), Alerion is funding a Proof of Concept project to help in developing and validating the requirements of a couple of basic components related to functionalities such as safety mechanisms and sensor data collection.

Alerion has also actively supported the UAV Challenge team that participated to the "Outback Joe Challenge". .

<div align="center" style="color:red">**MAGRIT Project-Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The partnership with GE Healthcare started in 1993. In the past few years, it bore on the supervision of CIFRE PhD fellows on the topic of using a multi-modal framework and augmented reality in interventional neuroradiology. A new PhD thesis -Charlotte Delmas- started in April 2013 with the aim to perform 3D reconstruction of tools in interventional neuroradiology. Our goal is to help clinical gesture by providing the plysician with a better understanding of the relative positions of the tools and of the pathology.

MAIA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Inria-EDF Strategic action MS4SG

Participants: Vincent Chevrier, Julien Vaubourg, Victorien Elvinger.

Laurent Ciarletta, Yannick Presse and Benjamin Segault (Madynes team, LORIA) are external collaborators.

The MS4SG (multi-simulation for smart grids) project is granted as a strategic action between Inria and EDF. This project is joint between Madynes and MAIA team from Inria-NGE and EDF R&D.

Smart-grids are electric supply grids endowed with smart capabilities because of the use of information and communication technologies. This perspective of smart grids corresponds to new challenges and it is needed to re-think the way electricity is supplied to customers and the power supply network regulated.

The simulation approach can be taken to envisage the supervision and regulation of these systems. Such an approach implies to integrate simulators coming from different domains: electrical networks, communication networks and information systems. As these domains can influence each other, smart-grids can be considered as a kind of complex system and we are faced with multi-modeling and multi-simulation issues: models in these simulators (and therefore simulators softwares) are heterogeneous (at least equation based and event based models), the softwares used are existing ones, etc.

The aim of the project is to provide primitives based on AA4MM in order to enable the multi-modeling and the multi-simulation of smart-grids.

MASAIE Project-Team (section vide)

<p align="center" style="color:red">MULTISPEECH Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Besides the contracts listed below, for which MULTISPEECH is officially part of, E. Vincent was involved through his former team (PANAMA) in another 30-month bilateral research contract with Studio MAIA.

7.1.1. MAIA

Company: Studio MAIA

Duration: September 2014 - August 2015

Supported by: Bpifrance

Abstract: A pre-study contract was signed to investigate speech processing tools that could eventually be transferred as plugins for audio mixing software. Prosody modification, noise reduction, and voice conversion are of special interest.

7.1.2. Venatech

Company: Venathec SAS

Other partners: ACOEM Group, GE Intelligent Platforms (contracted directly with Venathec)

Duration: June 2014 - August 2017

Supported by: Bpifrance

Abstract: The project aims to design a real-time control system for wind farms that will maximize energy production while limiting sound nuisance. This will leverage our know-how on audio source separation and uncertainty modeling and propagation.

NEUROSYS Team (section vide)

ORPAILLEUR Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. The BioIntelligence Project

Participants: Mehwish Alam, Aleksey Buzmakov, Melisachew Chekol, Adrien Coulet, Marie-Dominique Devignes, Amedeo Napoli [contact person], Nicolas Pépin-Hermann, Malika Smaïl-Tabbone.

The objective of the "BioIntelligence" project is to design an integrated framework for the discovery and the development of new biological products. This framework takes into account all phases of the development of a product, from molecular to industrial aspects, and is intended to be used in life science industry (pharmacy, medicine, cosmetics, etc.). The framework has to propose various tools and activities such as: (1) a platform for searching and analyzing biological information (heterogeneous data, documents, knowledge sources, etc.), (2) knowledge-based models and process for simulation and biology in silico, (3) the management of all activities related to the discovery of new products in collaboration with the industrial laboratories (collaborative work, industrial process management, quality, certification). The "BioIntelligence" project is led by "Dassault Systèmes" and involves industrial partners such as Sanofi Aventis, Laboratoires Pierre Fabre, Ipsen, Servier, Bayer Crops, and two academics, Inserm and Inria. An annual meeting of the project usually takes place in Sophia-Antipolis at the beginning of July.

Two theses related to "BioIntelligence" are currently in preparation within the Orpailleur team. A first thesis is related to the mining of complex biological data using FCA and RCA techniques [47], [48], [49]. The objective is to take advantage of Linked Open Data in biology for helping the biologist for querying and navigating complex data. There are needs to integrate data and knowledge from several web biological resources. At present, some experiments are conducted on designing practical interfaces based on sophisticated visualization tools for allowing human agents to have an easy and quick access to interesting patterns .

A second thesis is based on an extension of FCA involving Pattern Structures on complex data such as sequences and graphs [107]. The idea is to extend the formalism of pattern structures to these complex data for being able to classify complex structures such as patient trajectories or molecular structures. The classification results (e.g. concept lattices) are expected to help practitioners in information retrieval tasks and specific problem solving. In addition, a theoretical and practical work was conducted on the evaluation of interest measures for selecting the best concepts to be analyzed by a human agent in a concept lattice, and especially the stability measure in FCA. This led to a series of original and pioneering experiments on this probably underestimated research subject [20], [54], [53].

7.2. The Quaero Project

Participants: Victor Codocedo [contact person], Ioanna Lykourentzou, Amedeo Napoli.

The Quaero project (http://www.quaero.org) is a program aimed at promoting research and industrial innovation on technologies for automatic analysis and classification of multimedia and multilingual documents (the project ended at the beginning of 2014). The partners collaborate on research and the realization of advanced demonstrators and prototypes of innovating applications and services for access and usage of multimedia information, such as spoken language, images, video and music.

In this framework, the Orpailleur team worked on information retrieval, document annotation and recommendation. The objective was to define methods and algorithms for achieving these complex tasks, based on KDDK techniques and especially the FCA technology.

Part of the thesis of Victor Codocedo was prepared in this context, focusing on information retrieval guided by domain knowledge, recommendation and classification of documents w.r.t. sets of annotations using FCA and pattern structures [2] [58], [22].

PAREO Project-Team (section vide)

SEMAGRAMME Project-Team (section vide)

<p style="text-align:center">**SHACRA Project-Team**</p>

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

InSimo is a startup we created in January 2013, after two years of thinking, maturation and incubation. Its founding members are all former or actual team members of SHACRA: Jeremie Allard, Juan Pablo de la Plata Alcalde and Pierre Jean Bensoussan have joined the operation team, while Stéphane Cotin and Christian Duriez serve as scientific advisors. The business model of the company is based on the SOFA platform and its community to transfer state-of-the-art simulation technologies into commercially-supported software components that medical simulator vendors can integrate into their products. The goal is to foster the creation of a new generation of medical simulators, highly realistic, faster to develop, allowing a broader commercial offer and novel uses. InSimo participated to the 2012 OSEO / MESR national innovative technology company creation competition (Emergence category) and was selected as the best project in the Alsace region as well as one of the three projects highlighted at the national level. InSimo also won the HelpMeSee contract (in partnership with Moog and SenseGraphics) and entered in February 2013 into a 3-year development phase to build a first batch of 100 MSICS simulators.

6.2. Bilateral Grants with Industry

The collaboration is set with INSERM - UMR-S 867 (minimal invasive and robotized otological surgery) Faculté de Médecine Paris Diderot Paris 7 and with the company Collin SA (Bagneux, France) which is developing some activities in the domain of the head and neck (surgical robot such as RobOtol, middle ear implants, surgical instruments, surgical navigation, ...). The objective of this project is to obtain a simulation tool applied to the ear surgery for both training and planning of conventional and robotized middle ear surgery. In addition, the aim of this work is to provide a tool able to explore, develop and assess new robotized procedures using a tele-operated device called RobOtol. Guillaume Kazmitcheff is doing his PhD in the context of this collaboration: he is paid by a CIFRE contract with Collin, he is mainly working with the INSERM team but the design of the simulation is done in collaboration with our group and he is enrolled in the university of Lille 1.

TONUS Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

We are participating to a project with company AxesSim in Strasbourg. The objective is to help to the development of a commercial software for the numerical simulation of electromagnetic phenomena. The applications are directed towards antenna design and electromagnetic compatibility. This project is partly supported by DGA through "RAPID" (régime d'appui à l'innovation duale) funds. The CIFRE PhD of Thomas Strub is part of this project. Another CIFRE PhD will start in AxesSim on the same kind of subjects in March 2015.

<p style="text-align:center; color:red;">**TOSCA Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- TOSCA Nancy had a bilateral contract coordinated by M. Deaconu with the SME Alphability on financial risk measures with applications in portfolio management. This collaboration will be continued in 2015.

- M. Deaconu is involved in a bilateral contract with Venathec. She is supervising, with E. Vincent (EPI PAROLE), the Ph.D. Thesis of B. Dumortier on the acoustic control of wind farms noise.

7.2. Bilateral Grants with Industry

- TOSCA Sophia is involved in a Cifre convention with Koris International. M. Bossy supervises M. Bonelli's Ph.D. thesis.

7.2.1. Promotion of Mathematics in the industry

- M. Deaconu was invited to give a talk at the Workshop *Modélisation et Simulation Numérique - Applications, Enjeux, Besoins, Interactions Laboratoires/Entreprises*, on November 25 in Nancy.

- D. Talay continued to serve as the Vice-President of the Fondation d'Entreprise Natixis which aims to contribute to develop research in quantitative finance. He also serves as a member of the Scientific Committee of the Foundation.

- D. Talay continued to serve as a member of the Scientific Committee of the AMIES National Agency aimed to promote interactions between Mathematics and Industry.

VEGAS Project-Team (section vide)

VERIDIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Project Funded by the Airbus Foundation

Participants: Jingshu Chen, Marie Duflot-Kremer, Pascal Fontaine, Stephan Merz.

This two-year project (2013/2014) funds our work on the analysis of real-time Java programs described in section 6.3 , and in particular 12 months of the salary of Jingshu Chen as a post-doctoral researcher. It is complemented by funds granted by Région Lorraine.

7.2. ADN4SE Project

Participant: Stephan Merz.

Joint work with Damien Doligez of Inria Paris Rocquencourt and Jael Kriener and Tomer Libal at the Joint MSR-Inria Centre.

The ADN4SE project started in 2013 within *Programme d'Investissements d'Avenir: Briques Génériques du Logiciel Embarqué* and is coordinated for Inria by the Gallium team in Rocquencourt. The objective of this project is to develop and commercialize the PharOS real-time micro-kernel operating system. In cooperation with researchers at CEA List, we are contributing to the project by verifying key properties (in particular, determinism) of a high-level model of the system written in TLA^{+}.