Activity Report 2012

Section Contracts and Grants with Industry

<div align="center">**ALGORILLE Project-Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- In 2012, SUPÉLEC had 2 contracts with Quartet Financial System about parallel and distributed applications processing flows of financial data (the first one on PC clusters, and the second on NUMA computing nodes). This industrial research collaboration is continuing in 2013.
- In 2012 SUPÉLEC has achieved an industrial contract with Thales Underwater Systems about parallelisation on GPU of sonar signal processing algorithms.
- In 2012 SUPÉLEC has achieved an industrial contract with CGGVeritas about the parallelization on GPU of seismic data decompression.
- In 2012 SUPÉLEC has started 2 contracts with EDF R&D about the development of co-simulators for electrical smart Grids, including control parallelism issues.

ALICE Project-Team (section vide)

BIGS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Start-up project by T. Bastogne:

Industrial partner: CyberBio (Biocybernetics for Cancerology & Nanomedicine).

Status: in incubation.

Comments: Cybernano is an incubating start-up specialized in nano-cancerology, which has received the "emergence" award in 2012 from the French Research ministry for the creation of start-up based on innovative technology. Cybernano proposes innovating products to reduce the cost and control the risk during the preclinical development of nanoparticles in oncology applications. The engineering approach used by this spin-off is strongly based on the use of suited mathematical models.

7.2. Bilateral Grants with Industry

CIFRE PhD grant supervised by P. Vallois:

Industrial partner: Caisse Mutuelle du Crédit Agricole.

Title: Claim reserving for insurance.

PhD thesis of M. Geoffray Nichil.

CALVI Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

We have started a collaboration with the SME (Small and Medium Enterprise) AxesSim on the development of Maxwell solvers. AxesSim is specialized on scientific software for airplane electromagnetic compatibility. For the moment, one CIFRE thesis is supported by DGA. Gary Cohen from Inria Rocquencourt is also involved in the project.

CAMUS Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Training and consulting with HTCS

Participants: Pierrick Gaudry, Emmanuel Thomé [contact].

We have a one-year contract with the HTCS company, for training and consulting activities, on topics related to our research. This contract is likely to be renewed in 2013.

CARTE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

We are currently working with the consortium "malware.lu".

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 or with a new transfer protocol. F. Bouquet is scientific consultant of Smartesting.

CORIDA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. FRAE (Fondation de Recherche pour l'Aéronautique et l'Espace)

In March 2010, Karim Ramdani obtained a 2 years funding from FRAE [3] to work on inverse problems in Aeronautics. The project involves two partners : Inria Nancy Grand-Est (7 participants, from which 5 members of CORIDA) and ONERA Toulouse (4 participants).

7.2. EADS Foundation

We obtained a four years grant (2010-2014) of 147000 euros from EADS foundation. This project aims to develop new efficient numerical methods to solve electromagnetic scattering problems. Part of this grant is used to support the Phd of I. Zangré supervised by X. Antoine and C. Geuzaine (University of Liège). Y. Saad (university of Minneapolis) is also involved in this project.

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[3] Fondation de Recherche pour l'Aéronautique et l'Espace : http://www.fnrae.org/

CORTEX Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

As part of our effort in Pervasive Computing research, we worked with Firelies RTLS, a French startup specialized in advanced geolocation services. The contract led to new routing schemes, QoS mand management protocols for Wireless Sensor Networks.

7.2. Bilateral Grants with Industry

We are active in the Alcatel Lucent/Bellabs Inria joint lab. This joint lab brings together research teams from Inria and Alcatel Lucent Bell Labs for addressing the key challenges of autonomous networking in three critical areas: semantic networking, high manageability and self-organized networks. Our activity is part of the joint initiative dedicated to high manageability, and focuses on security management aspects with the Alcatel-Lucent Bell Labs teams on network security. Our work in this joint lab concerns the automation of security management. It includes a first activity related to fuzzing, which includes the improvement of the KiF framework as well as the design of novel fuzzing models for Alcatel-Lucent specific protocols. A second activity of the joint lab aims at investigating to what extent risk management strategies can be applied to VoIP infrastructures. The objective is to design and experiment dynamic risk management methods and techniques for voice oriented critical services.

MAGRIT Project-Team (section vide)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

Participants: Arsène Fansi Tchango, Olivier Buffet, Vincent Thomas, Alain Dutech.

Arsène Fansi Tchango has currently a CIFRE grant for his PhD "Multi-Camera Tracking in Partially Observable Environment". This CIFRE is the result of the collaboration between Thales THERESIS and Inria Nancy Grand-Est (Section 6.1.5).

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

6. Bilateral Contracts and Grants with Industry

6.1. Contract with IAEA

Anopheles arabiensis is the target of a sterile insect technique (SIT) program in Sudan. Success will depend in part upon reasonable estimates of the adult population in order to plan the sizes of releases. It is difficult to obtain good estimates of adult population sizes for this mosquito because of the low density of the populations and also because the temporal and spatial distribution of Anopheles arabiensis is very dynamic. We have developed a compartmental model capable of predicting the range of adult populations of Anopheles arabiensis in two study sites in the North of Sudan. We have provided a software that is "user friendly" and that is able to give an estimate of the whole male and female population for the two geographical areas. A screenshot of the soft user interface is presented in Figure 3 . This work is done in collaboration with Yves Dumont (AMAP, CIRAD).
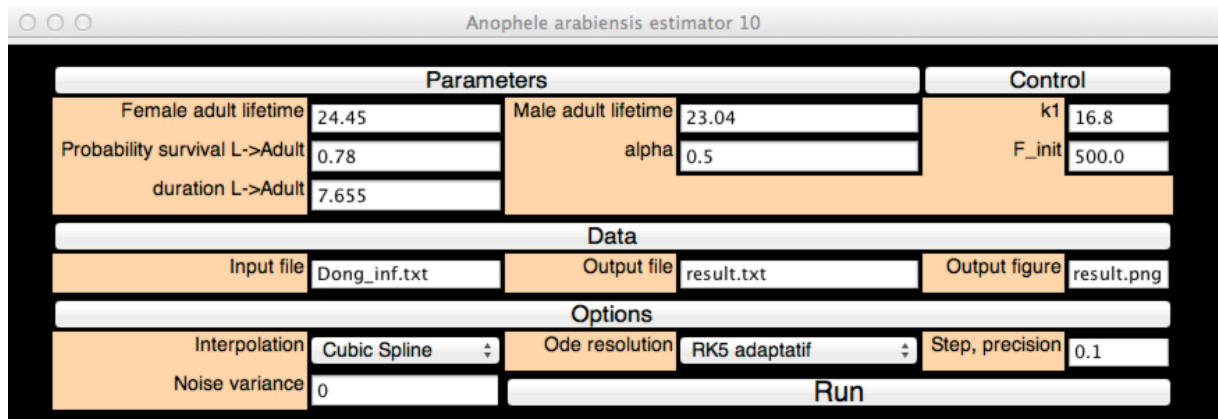

Figure 3. Anopheles estimator: screenshot of the soft user interface

ORPAILLEUR Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. The BioIntelligence Project

Participants: Mehwish Alam, Yasmine Assess, Aleksey Buzmakov, Adrien Coulet, Marie-Dominique Devignes, Amedeo Napoli [contact person], 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 running in the Orpailleur team. A first thesis is related to the study of possible combination of mining methods on biological data. The mining methods which are considered here are based on FCA and RCA, itemset and association rule extraction, and inductive logic programming. These methods have their own strengths and provide different special capabilities for extending domain ontologies. A particular attention will be paid to the integration of heterogeneous biological data and the management of a large volume of biological data while being guided by domain knowledge lying in ontologies (linking data and knowledge units). Practical experiments will be led on biological data (clinical trials data and cohort data) also in accordance with ontologies lying at the NCBO BioPortal.

A second thesis is based on an extension of FCA involving Pattern Structures on Graphs. The idea is to be able to extend the formalism of pattern structures to graphs and to apply the resulting framework on molecular structures. In this way, it will be possible to classify molecular structures and reactions by their content. This will help practitioners in information retrieval tasks involving molecular structures or the search for particular reactions. In addition, an experiment was also carried out in the combination of supervised (distance-based clustering) and unsupervised learning (FCA) methods for the prediction of the configuration of inhibitors of the c-Met protein (which is very active in cancer).

In addition, a forthcoming thesis will be in concern with ontology re-engineering in the domain of biology. The objective is consider the content of the BioPortal ontologies (http://bioportal.bioontology.org/) and to design formal contexts and associated concept lattices which will become supports for ontological schemes. Moreover, this ontological schema will be completed thanks to external resources such as Wikipedia and domain knowledge as well. The global idea is to get definitions and thus classification capabilities for atomic or primitive concepts.

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 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 participates in the task called "Formal Representation of Knowledge for Guiding Recommendation", whose objectives are to define methods and algorithms for building a "discovery engine" guided by domain knowledge and able to recommend a user some content to visualize. Such a discovery engine has to extend capabilities of usual recommender systems with a number of capabilities, e.g. to select among a huge amount of items (e.g. movie, video, music) those which are of interest for a user according to a given profile. In addition, the discovery engine should take into account contextual information that can be of interest such as news, space location, moment of the day, actual weather and weather forecast, etc. This contextual information changes within time and extracted information has to be continuously updated. Finally, the system has be able to justify or explain the recommendations.

A thesis takes place in the context of the Quaero project. At the moment, document annotation is especially studied for enhancing recommendation but also information retrieval. Information retrieval guided by domain knowledge can be used for selecting resources of interest for these two tasks. Then knowledge discovery based on Formal Concept Analysis can be used for extracting patterns of interest w.r.t. the context and for enriching the domain and contextual knowledge base.

Finally, the discovery process has to be able to act as a classifier and as an inference engine at the same time for reasoning and classifying elements for recommendation and retrieval.

PAREO Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Introduction

Our policy in terms of technological and industrial partnership consists in favoring contracts that quite precisely fit our scientific objectives. We are involved in an ANR project about audiovisual speech synthesis, another about acoustic-to-articulatory inversion of speech (ARTIS), another about the processing of articulatory data (DOCVACIM) and in a national evaluation campaign of automatic speech recognition systems (ETAPE). We also coordinated until January 2009 the 6th PCRD project ASPI about acoustic-to-articulatory inversion of speech, and the Rapsodis ARC until october 2009.

In addition, we are involved in several regional projects.

7.2. Regional Actions

7.2.1. CPER MISN TALC

The team is involved in the Contrat Plan Etat-Région (CPER) contract. The CPER MISN TALC, for which Christophe Cerisara is co-responsible, with Claire Gardent, have the objective to leverage collaborations between regional academic and private partners in the domain of Natural Language Processing and Knowledge engineering. The TALC action involves about 12 research teams and 40 researchers for a budget of about 240,000 euros per year.

In addition to the co-management of this project, our team is also involved in scientific collaborative operations about text-to-speech alignement, in collaboration with the ATILF laboratory. Automatic alignement procedures are available, and a first version of speech data prosodic structuration has been developed.

7.3. National Contracts

7.3.1. ADT JSnoori

JSnoori ADT (2011-2012) is dedicated to porting main functions of WinSnoori in Java and the integration of new facilities targeting language learning. The main objective is to offer functions enabling the development of feedback for foreign language learning and more precisely the mastery of prosody.

This year the architecture has been changed to comply to the MVC (Model View Controller) model. This makes the management of interactions easier and this clearly separates speech processing algorithms from interactions. In addition forced alignment facilities and phonetic edition tools have been integrated for French and English. They enable the segmentation of sentences uttered by learners, and the annotation with international phonetic alphabet (IPS).

Preliminary versions of diagnosis and feedback of prosody have been incorporated for English (see 6.1.6.1).

7.3.2. ANR ARTIS

This contract started in January 2009 in collaboration with LTCI (Paris), Gipsa-Lab (Grenoble) and IRIT (Toulouse). Its main purpose is the acoustic-to-articulatory inversion of speech signals. Unlike the European project ASPI the approach followed in our group will focus on the use of standard spectra input data, i.e. cepstral vectors. The objective of the project is to develop a demonstrator enabling inversion of speech signals in the domain of second language learning.

This year the work has focused on the development of the inversion from cepstral data as input. We particularly worked on the comparison of cepstral vectors calculated on natural speech and those obtained via the articulatory to acoustic mapping. Bilinear frequency warping was combined with affine adaptation of cepstral coefficients. These two adaptation strategies enable a very good recovery of vocal tract shapes from natural speech. The second topic studied is the access to the codebook. Two pruning strategies, a simple one using the spectral peak corresponding to F2 and a more elaborated one exploiting lax dynamic programming applied on spectral peaks enable a very efficient access to the articulatory codebook used for inversion.

7.3.3. ANR ViSAC

This ANR Jeunes Chercheurs started in 2009, in collaboration with Magrit group. The main purpose of ViSAC (Acoustic-Visual Speech Synthesis by Bimodal Unit Concatenation) is to propose a new approach of a text-to-acoustic-visual speech synthesis which is able to animate a 3D talking head and to provide the associated acoustic speech. The major originality of this work is to consider the speech signal as bimodal (composed of two channels acoustic and visual) "viewed" from either facet visual or acoustic. The key advantage is to guarantee that the redundancy of two facets of speech, acknowledged as determining perceptive factor, is preserved.

Currently, we designed a complete system of the text to acoustic-visual speech synthesis based on a relatively small corpus. The system is using bimodal diphones (an acoustic component and a visual one) and it is using unit selection techniques. Although the database for the synthesis is small, however the first results seem to be very promising. The developed system can be used with a larger corpus. We are trying to acquire/analyze an 1-2 hours of audiovisual speech.

Currently, we are mainly evaluating the system using both subjective and objective perceptual evaluation.

7.4. International Contracts

7.4.1. CMCU - Tunis University

This cooperation involves the LSTS (Laboratoire des systèmes et Traitement du Signal) of Tunis University headed by Prof. Noureddine Ellouze and Kais Ouni. This new project involves the investigation of automatic formant tracking, the modelling of peripheral auditory system and more generally speech analysis and parameterization that could be exploited in automatic speech recognition.

7.4.2. The Oesovox Project 2009-2011: 4 international groups associated...

It is possible for laryngectomees to learn a substitution voice: the esophageal voice. This voice is far from being natural. It is characterized by a weak intensity, a background noise that bothers listening, and a low pitch frequency. A device that would convert an esophageal voice to a natural voice would be very useful for laryngectomees because it would be possible for them to communicate more easily. Such natural voice restitution techniques would ideally be implemented in a portable device. In order to answer the Inria Euromed 3+3 Mediterranean 2006 call, the Inria Parole group (Joseph Di Martino, LORIA senior researcher, Laurent Pierron, Inria engineer and Pierre Tricot, Associated Professor at ENSEM) associated with the following partners:

- **Spain**: Begoña Garcia Zapirain, Deusto University (Bilbao-Spain), Telecommunication Department, PAS-"ESOIMPROVE" research group.
- **Tunisia**: Sofia Ben Jebara, TECHTRA research group, SUP'COM, Tunis.
- **Morocco**: El Hassane Ibn-Elhaj, SIGNAL research group, INPT, Rabat.

This project named LARYNX has been subsidized by the Inria Euromed program during the years 2006-2008. Our results have been presented during the Inria 2008 Euromed colloquium (Sophia Antipolis, 9-10 October 2008). During this international meeting, The French Inria institute decided to renew our project with the new name "OESOVOX". This new project will be subsidized during the years 2009-2011.

In the framework of the European COADVISE-FP7 program, two PhD students have assigned to the Euromed 3+3 Oesovox project. These students are, Miss Fadoua Bahja from INPT-Rabat (Morocco) whose PhD thesis title is "Detection of F0 in real-time for audio: application to pathological voices" and Mr. Ammar Werghi from SUP'COM-Tunis (Tunisia) whose PhD thesis title is "Voice conversion techniques applied to pathological voice repair". The activity reports of these two students for the year 2009 is described in 6.1.5 .

SCORE Team (section vide)

SEMAGRAMME Team (section vide)

<p style="text-align:center;color:red;font-weight:bold">SHACRA Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. HelpMeSee and Sensegraphics

The swedish company Sensegraphics and the NGO HelpMeSee have signed for 2 contracts for technology transfer. The contract focus on the design of a simulator to treat cataract surgery using the MSICS (Manual small incision cataract surgery) technique.

7.1.2. Digital Trainers

The company Digital Trainers has signed a two year contract and a two year license with our group for the transfer of our suture simulation technology. The contract aims at improving the simulation by using an adaptive model for the suture thread and continuous constraints for the interaction with the soft tissues. Haptic feedback will also be investigated.

7.1.3. Collin

We have started a collaboration with INSERM - UMR-S 867 (minimal invasive and robotized otological surgery) Faculté de Médecine Paris Diderot Paris 7 and with the company Collin which is developing some activities in the domain of the head and neck (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 middle ear surgery. 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.

TOSCA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- TOSCA Nancy had a bilateral contract with the SME Alphability on the evaluation of the Value at Risk with applications in portfolio management. This collaboration will be continued in 2013.

TRIO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Ph.D. thesis under CIFRE collaboration with PSA

Participants: Aurélien Monot, Nicolas Navet, Françoise Simonot-Lion

The complexity of electronic embedded systems in cars is continuously growing. Hence, mastering the temporal behavior of such systems is paramount in order to ensure the safety and comfort of the passengers. As a consequence, the verification of end-to-end real-time constraints is a major challenge during the design phase of a car. The AUTOSAR software architecture drives us to address the verification of end-to-end real-time constraints as two independent scheduling problems respectively for electronic control units and communication buses.

First, we introduce an approach, which optimizes the utilization of controllers scheduling numerous software components that is compatible with the upcoming multicore architectures. We describe fast and efficient algorithms in order to balance the periodic load over time on multicore controllers by adapting and improving an existing approach used for the CAN networks. We provide theoretical result on the efficiency of the algorithms in some specific cases. Moreover, we describe how to use these algorithms in conjunction with other tasks scheduled on the controller [12], [8].

The remaining part of this research work addresses the problem of obtaining the response time distributions of the messages sent on a CAN network. First, we present a simulation approach based on the modelisation of clock drifts on the communicating nodes connected on the CAN network. We show that we obtain similar results with a single simulation using our approach in comparison with the legacy approach consisting in numerous short simulation runs without clock drifts. Then, we present an analytical approach in order to compute the response time distributions of the CAN frames. We introduce several approximation parameters to cope with the very high computational complexity of this approach while limiting the loss of accuracy. Finally, we compare experimentally the simulation and analytical approaches in order to discuss the relative advantages of each of the two approaches [20], [8].

VEGAS Project-Team (section vide)

<p style="text-align:center;color:red;font-weight:bold;">VERIDIS Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Tools and Methodologies for Formal Specifications and for Proofs

Participants: Stephan Merz, Hernán-Pablo Vanzetto.

We participate in the project on Tools and Methodologies for Formal Specifications and for Proofs at the MSR-Inria Joint Centre. The objective of the project is to develop a proof environment for verifying distributed algorithms in TLA$^+$ (see also sections 5.2 and 6.1). In particular, the project funds the PhD thesis of Hernán Vanzetto.