Activity Report 2014

Section Partnerships and Cooperations

AMIB Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

A. Denise is involved in the NSD-NGD ANR project 2010-2014. Y. Ponty was involved in the MAGNUM ANR project (BLAN program, 12/2010–12/2014).

6.1.2. PEPS

Ch. Froidevaux was responsible at LRI for the CNRS-INSERM-INRIA PEPS grant *Identification of metabolic capabilities of fungi by comparative genomic* involving IGM, Paris-Sud and UMR GV, CNRS.

6.1.3. FRM

Fondation pour la Recherche Medicale – *Analyse Bio-informatique pour la recherche en Biologie* program

- Approche comparatives haut-débit pour la modelisation de l'architecture 3D des ARN à partir de données experimentales
- 2015–2018
- Y. Ponty, A. Denise
- B. Sargueil (Paris V – Experimental partner), J. Waldispuhl

6.2. European Initiatives

6.2.1. Collaborations in European Programs, except FP7 & H2020

ANR International program

- Fast and efficient sampling of structures in RNA folding landscapes
- RNALands (ANR-14-CE34-0011)
- 01/10/2014-30/09/2018
- Y. Ponty, A. Denise, M. Regnier
- EPI BONSAI/INRIA Inria Lille - Nord Europe, Vienna University (Austria)

6.3. International Initiatives

- Capes Biologie systémique du cancer (051/2013) porté par Sandro José de Souza (Univ. Federal do Rio Grande do Norte, Brésil)
- Sabine Peres
- 2014-2018

6.3.1. Inria Associate Teams

6.3.1.1. ITSNAP

Title: Intelligent Techniques for Structure of Nucleic Acids and Proteins

International Partner (Institution - Laboratory - Researcher):

Stanford University (ÉTATS-UNIS)

Duration: 2009 - 2014

See also: http://pages.saclay.inria.fr/julie.bernauer/EA_ITSNAP/

The ITSNAP Associated Team project is dedicated to the computational study of RNA 3D structure and interactions. By developing new molecular hierarchical models for knowledge-based and machine learning techniques, we can provide new insights on the biologically important structural features of RNA and its dynamics. This knowledge of RNA molecules is key in understanding and predicting the function of current and future therapeutic targets.

6.3.2. Inria International Partners

6.3.2.1. Declared Inria International Partners

Title: CARNAGE: Combinatorics of Assembly and RNA in GEnomes

International Partner (Institution - Laboratory - Researcher):

State Research Institute of Genetics and Selection of Industrial Microorganisms (Russia (Russian Federation)) - Bioinformatics laboratory - V. Makeev and Mireille Régnier

Duration: 2012- 2014

See also: https://team.inria.fr/amib/carnage

CARNAGE addresses two main issues on genomic sequences, by combinatorial methods.

Fast development of high throughput technologies has generated a new challenge for computational biology. The recently appeared competing technologies each promise dramatic breakthroughs in both biology and medicine. At the same time the main bottlenecks in applications are the computational analysis of experimental data. The sheer amount of this data as well as the throughput of the experimental dataflow represent a serious challenge to hardware and especially software. We aim at bridging some gaps between the new "next generation"sequencing technologies, and the current state of the art in computational techniques for whole genome comparison. Our focus is on combinatorial analysis for NGS data assembly, interspecies chromosomal comparison, and definition of standard pipelines for routine large scale comparison.

This project also addresses combinatorics of RNA and the prediction of RNA structures, with their possible interactions.

6.3.2.2. Informal International Partners

Polytechnique/UPSud and McGill/U. Montréal

Program: CFQCU

Title: Réseau franco-québecois de recherche sur l'ARN

Inria principal investigator: Jean-Marc Steyaert

International Partner (Institution - Laboratory - Researcher):

Mc Gill and Université de Montréal (Canada)

Computer Science Department

Jérôme Waldispühl

Duration: 2012 - 2014

Résumé : The partners have developped complementary expertise on RNA : bioinformatics, combinatorics and algorithms. machine learning, physics and genomics. Methodologies will be developed that combine theoretical simulations and new (high throughput) experimental data. A common high level training at Master and PhD level is organized.

6.3.3. Participation In other International Programs

Henry van den Bedem and J. Bernauer presented their work at the Inria BIS 2014 Workshop in Paris https://project.inria.fr/inria-siliconvalley/workshops/bis2014/.

6.4. International Research Visitors

6.4.1. Visits of International Scientists

      J. Holub

          Subject: Word automata

          Institution: Praha University (Czech Republic)

      E. Furletova

          Subject: word enumeration

          Institution: Institute of Mathematical Problems in Biology (Russia)

6.4.1.1. Internships

      Jan Lin Chan

          Subject: Exceptional words in *Archae* genomes

          Date: 01/06/2014 - 11/08/2014

          Institution: NUS (Singapour)

          Funding: INRIA

          Supervision: M. Régnier

      Damien Busatto-Gaston

          Subject: de Bruijn graphs and assembly

          Date: 01/06/2014 - 14/07/2014

          Institution: ENS-Lyon (France)

          Funding: INRIA

          Supervision: M. Régnier

      Robert Huang

          Subject: Repeats in genomic sequences

          Date: 01/06/2014 - 25/08/2014

          Institution: Berkeley (USA)

          Funding: ECOLE POLYTECHNIQUE

          Supervision: M. Régnier

      Hanlun Jiang

          Subject : conformational dynamics of the RNA-induced silencing complex

          Date: 01/06/2014 - 25/08/2014

          Institution: HKUST (Hong-Kong)

          Funding: MRE

          Supervision: J. Bernauer

      Stéphanie Kamgnia Wonkap

          Subject : Extraction de motifs dans les graphes de workflows scientifiques

          Date: 01/06/2014 - 30/06/2014

          Institution: Univ. Rennes

          Funding: INRIA

          Supervision: Ch. Froidevaux and S. Cohen-Boulakia

6.4.2. Visits to International Teams

6.4.2.1. Sabbatical programme

Julie Bernauer

Date: Feb 2014 - Jul 2014

Institution: Stanford University (USA)

6.4.2.2. Research stays abroad

Sarah Cohen-Boulakia

Date: Apr 2014

Institution: University of Pennsylvania (USA)

Date: Dec 2014

Institution: Humboldt University of Berlin (Germany)

Yann Ponty

Date: Sep 2013 - Sep 2015

Institution: Simon Fraser University (Canada)

Sabine Peres

Date: Dec 2014

Institution: Friedrich-Schiller-University Jena (Germany)

Alice Heliou

Date: Feb-Apr 2014

Institution: King's College (UK)

Date: December 2014

Institution: Vavilov Institute of General Genetics (Russia)

Amélie Heliou

Date: Mar-May 2014

Institution: Stanford University (USA)

Antoine Soulé

Date: Half-time 2014

Institution: McGill University (Canada)

AVIZ Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR FITOC: From Individual To Collaborative Visual Analytics

Participants: Petra Isenberg [correspondant], Jean-Daniel Fekete, Pierre Dragicevic, Wesley Willett.

The project addresses fundamental problems of technological infrastructure and the design of data representation and interaction to build a bridge between individual and team work for visual data analysis. In collaboration with the University of Magdeburg we have begun to tackle this challenge through the design of tangible widgets that help to bridge the gap between individual and collaborative information seeking.

8.1.2. ANR EASEA-Cloud

Participants: Evelyne Lutton [correspondant], Waldo Cancino, Hugo Gilbert, Pierre Collet.

The aim of the EASEA-CLOUD project is to exploit the massively parallel resources that are offered by clusters or a grid of modern GPU-equipped machines in order to find solutions to inverse problems whose evaluation function can be intrinsically sequential. Massive parallelization of generic sequential problems can be achieved by evolutionary computation, that can efficiently exploit the parallel evaluation of thousands of potential solutions (a population) for optimization or machine-learning purposes. The project consists in turning the existing EASEA (EAsy Specification of Evolutionary Algorithms, http://easea.unistra.fr/) research platform into an industrial-grade platform that could be exploited by running in "cloud" mode, on a large grid of computers (ISC-PIF/CREA is the current manager of the French National Grid). The necessary steps are to develop:

- a professional-grade API, development environment and human-computer interface for the existing academic EASEA platform,

- cloud-management tools (in order to launch an experiment on a grid of computers, monitor the experiment and bill the laboratories or companies that will be using EASEA-CLOUD for intensive computation,

- novel visualisation tools, in order to monitor an evolutionary run, potentially launched on several hundred heterogeneous GPU machines.

The consortium is made of thee partners: LSIIT/UDS (which is developing the EASEA platform), ISCPIR/CREA (for its experience in grid and cloud computing), AVIZ/Inria (for its experience in visualization tools for evolutionary computation) and two subcontractors: LogXLabs (a software development company in order to create industrial-grade code and interfaces) an BIOEMERGENCE-IMAGIF, the "valorisation" department of CNRS Gif s/Yvette. Valorisation will take place in strong collaboration with UNISTRA VALO, the valorisation structure of Université de Strasbourg. The project started on October 1st, 2012, for 2 years. AVIZ is in charge of developing new visualisation tools adapted to the monitoring of the optimization process.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CENDARI

Program: Infrastructures

Project acronym: **CENDARI**

Project title: Collaborative EuropeaN Digital/Archival Infrastructure

Duration: 01/2012 - 12/2015

Coordinator: Trinity College, Dublin (IE),

Other partners: Freie Universitaet Berlin (DE), Matematicki Institut Sanu u Beogradu (Serbia), University of Birmingham (UK), King's College London (UK), Georg-August-Universitaet Goettingen Stiftung Oeffentlichen Rechts (DE), Narodni Knihovna Ceske Republiky (Czech Republic), Societa Internazionale per lo Studio del Medioevo Latino-S.I.S.M.E.L. Associazione (IT), Fondazione Ezio Franceschini Onlus (IT), Ministerium fur Wissenschaft, Forschung und Kunst Baden-Wurttemberg (DE), Consortium of European Research Libraries (UK), Koninklijke Bibliotheek (NL), UNIVERSITA DEGLI STUDI DI CASSINO (IT).

Abstract:

The Collaborative EuropeaN Digital Archive Infrastructure (CENDARI) will provide and facilitate access to existing archives and resources in Europe for the study of medieval and modern European history through the development of an 'enquiry environment'. This environment will increase access to records of historic importance across the European Research Area, creating a powerful new platform for accessing and investigating historical data in a transnational fashion overcoming the national and institutional data silos that now exist. It will leverage the power of the European infrastructure for Digital Humanities (DARIAH) bringing these technical experts together with leading historians and existing research infrastructures (archives, libraries and individual digital projects) within a programme of technical research informed by cutting edge reflection on the impact of the digital age on scholarly practice.

The enquiry environment that is at the heart of this proposal will create new ways to discover meaning, a methodology not just of scale but of kind. It will create tools and workspaces that allow researchers to engage with large data sets via federated multilingual searches across heterogeneous resources while defining workflows enabling the creation of personalized research environments, shared research and teaching spaces, and annotation trails, amongst other features. This will be facilitated by multilingual authority lists of named entities (people, places, events) that will harness user involvement to add intelligence to the system. Moreover, it will develop new visual paradigms for the exploration of patterns generated by the system, from knowledge transfer and dissemination, to language usage and shifts, to the advancement and diffusion of ideas.

See more at http://cendari.eu/ and http://www.aviz.fr/Research/CENDARI.

8.2.2. Collaborations with Major European Organizations

Fraunhofer Institute, IGD (DE)
We are collaborating on visual analytics, setting up European projects and coordinating European initiatives on the subject.

University of Dresden, (DE)
We have been collaborating with Raimund Dachselt on stackable tangible devices for faceted browsing [55], [54].

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

AVIZ researchers collaborate with a number of international partners, including:

- Google, Mountain View, USA
- Microsoft Research, Redmond, USA
- New York University, USA
- University of Toronto, Canada
- University of Calgary, Canada
- University of British Columbia, Canada
- University of Kent, UK
- University of Konstanz, Germany
- University of Magdeburg, Germany

8.3.1.2. Informal International Partners

- Arizona State University, USA
- University of Vienna, Austria
- University of Groningen, the Netherlands
- University of Granada, Spain

8.3.2. Inria International Labs

- *Massive Data team*, Inria Chile.

8.3.3. Collaboration with Google

AVIZ collaborates with Google on several projects, related to the Google Research Grant and to evaluation methodology in information visualization.

8.3.4. Collaboration with Microsoft Research

AVIZ collaborates with several researchers from Microsoft Research Redmond, in particular on the topic of new interactions for information visualization and brain connectivity visualization.

8.3.5. Collaboration with New-York University

Jean-Daniel Fekete collaborates with Claudio Silva and Juliana Freire from NYU-Poly on the VisTrails workflow system for visual analytics (http://www.vistrails.org). Rémi Rampin, intern from the Univ. Paris-Sud Master in HCI, has spent one month at Orsay and 5 months at NYU-Poly to allow VisTrails to run Java-based applications and Toolkits. Rémi successfully connected the traditional Python-C implementation of VisTrails to the Java virtual machine using the JPype package. Jean-Daniel Fekete is now porting the Obvious Toolkit [47] in this environment to integrate all its components [50].

8.4. International Research Visitors

8.4.1. Visits to International Teams

8.4.1.1. Sabbatical programme

Jean-Daniel Fekete

Date: Jan 2015 - Dec 2015

Institution: University of New-York (USA)

COMETE Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Large-scale initiatives

Project acronym: CAPPRIS

Project title: Collaborative Action on the Protection of Privacy Rights in the Information Society

Duration: October 2011 - September 2015

URL: https://cappris.inria.fr/

Coordinator: Daniel Le Metayer, Inria Grenoble

Other partner institutions: The project involves four Inria research centers (Saclay, Saphia-Antipolis, Rennes and Grenoble), CNRS-LAAS, Eurecom and the university of Namur. Besides computer scientists, the consortium also includes experts in sociology and in law, thus covering the complementary areas of expertise required to reach the objectives.

Abstract: The goal of this project is to study the challenges related to privacy in the modern information society, trying to consider not only the technical, but also the social and legal ones, and to develop methods to enhance the privacy protection.

7.2. European Initiatives

7.2.1. FP7 & H2020 Projects

7.2.1.1. MEALS

Program: FP7-PEOPLE-2011-IRSES

Project acronym: MEALS

Project title: Mobility between Europe and Argentina applying Logic to Systems

Duration: October 2011 - September 2015

URL: http://www.meals-project.eu/

Coordinator: Holger Hermans, Saarland University, Germany

Coordinator for the Inria sites: Catuscia Palamidessi, Inria Saclay

Other partner institutions: Rheinisch-Westfälische Technische Hochschule Aachen, Germany. Technische Universität Dresden, Germany. Inria, France. Imperial College of Science, Technology and Medicine, UK, University of Leicester, UK. Technische Universiteit Eindhoven, NL. Universidad Nacional de Cordoba, AR. Universidad de Buenos Aires, AR. Instituto Tecnologico de Buenos Aires, AR. Universidad Nacional de Rio Cuarto, AR.

Abstract: In this project we focus on three aspects of formal methods: specification, verification, and synthesis. We consider the study of both qualitative behavior and quantitative behavior (extended with probabilistic information). We aim to study formal methods in all their aspects: foundations (their mathematical and logical basis), algorithmic advances (the conceptual basis for software tool support) and practical considerations (tool construction and case studies).

7.3. International Initiatives

7.3.1. Inria-MSR joint lab

7.3.1.1. Privacy-Friendly Services and Apps

Title: Privacy-Friendly Services and Applications

Inria principal investigator: Catuscia Palamidessi

International Partners:

Cedric Fournet, Microsoft Research Lab, Cambridge, UK

Andy Gordon, Microsoft Research Lab, Cambridge, UK

Duration: 2014 - 2016

URL: http://www.msr-inria.fr/projects/privacy-friendly-services-and-apps/

Abstract: This is a project sponsored by Microsoft Research Lab, on methods to preserve privacy in web services and location-based services.

7.3.2. Inria Associate Teams

7.3.2.1. PRINCESS

Title: Protecting privacy while preserving data access

Inria principal investigator: Catuscia Palamidessi

International Partners:

Geoffrey Smith, Florida International University (United States)

Andre Scedrov, University of Pennsylvania (United States)

Duration: 2013 - 2016

URL: http://www.lix.polytechnique.fr/comete/Projects/Princess/

Abstract: PRINCESS is an Inria associated team focusing on the protection of privacy and confidential information. In particular, we study the issues related to the leakage of confidential information through public observables.

We aim at developing a meaningful notion of measure in order to quantify the leakage of information, and to design mechanisms to limit the amount of leakage, without interfering too severely with the utility of the information that is meant to be disclosed.

The main topics currently investigated are quantitative information flow, where we are developing a decision-theoretic approach, and differential privacy, where we are developing an extension which lifts the basic notion of privacy meant for databases to arbitrary domains.

7.3.3. Inria International Partners

7.3.3.1. Informal International Partners

Moreno Falaschi, Professor, University of Siena, Italy

Mario Ferreira Alvim Junior, Assistant Professor, Federal University of Minas Gerais, Brazil

Annabelle Mciver, Associate Professor, Macquarie University, Australia

Charles Carroll Morgan, Professor, University of New South Wales, Australia

Carlos Olarte, Adjunct professor at Universidade Federal do Rio Grande do Norte, Brazil

Camilo Rueda, Professor, Universidad Javeriana Cali, Colombia

7.3.4. Participation In other International Programs

7.3.4.1. PACE

Program: ANR Blanc International

Project title: Beyond plain Processes: Analysis techniques, Coinduction and Expressiveness

Duration: January 2013 - December 2016

URL: http://perso.ens-lyon.fr/daniel.hirschkoff/pace/

Coordinator: Daniel Hirschkoff, Ecole Normale Supérieure de Lyon

Other PI's and partner institutions: Catuscia Palamidessi, Inria Saclay. Davide Sangiorgi, University of Bologna (Italy). Yuxi Fu, Shanghai Jiao Tong University (China).

Abstract: This project objective is to enrich and adapt these methods, techniques, and tools to much broader forms of interactive models, well beyond the realm of "traditional" processes.

7.3.4.2. LOCALI

Program: ANR Blanc International

Project title: Logical Approach to Novel Computational Paradigms

Duration: October 2011 - September 2015

URL: http://lcs.ios.ac.cn/~locali2013/

Coordinator: Gilles Dowek, Inria Rocquencourt

Other PI's and partner institutions: Catuscia Palamidessi, Inria Saclay. Thomas Erhard, Paris VII. Ying Jiang , Chinese Academy of Science in Beijin (China).

Abstract: This project aims at exploring the interplays between logic and sequential/distributed computation in formalisms like the lambda calculus and the π calculus. Going back to the fundamentals of the definitions of these calculi, the project plans to design new programming languages and proof systems via a logical approach.

7.3.4.3. MUSICAL

Program: CNPq Science Without Borders.

Project title: Music and Spatial Interaction with Constraints, Algebra and Logic: Foundations and Applications.

Duration: Oct 2014- Oct 2016

URL: http://cic.puj.edu.co/~caolarte/musical/Musical/Welcome.html

Coordinator: Elaine Pimentel, Universidade Federal do Rio Grande do Norte (Brazil),

Other PI's and partner institutions: Camilo Rueda, PUJ Cali (Colombia). Carlos Olarte, Universidade Federal do Rio Grande do Norte (Brazil). Frank Valencia, CNRS-LIX and Inria Saclay (France). Gerard Assayag, IRCAM (France).

Abstract: This multi-disciplinary project aims to develop and integrate tools from logic and concurrency theory for the design and analysis of reactive systems and to their application to musical processes and multimedia systems.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Mauricio Cano, Masters Student, Universidad Javeriana Cali, Colombia, Nov 2014

Moreno Falaschi, Professor, University of Siena, Italy, from July 2014 until Aug 2014

Mario Ferreira Alvim Junior, Assistant Professor, Federal University of Minas Gerais, Brazil, Dec 2014

Maurizio Gabbrielli, Professor, University of Bologna, Italy, from July 2014 until Aug 2014

Daniel Gebler, PhD student, Free University of Amsterdam, The Netherlands, Jun 2014

Justin Hsu, PhD student, University of Pennsylvania, USA, Nov 2014

Annabelle McIver, Associate Professor, Macquarie University, Australia, Dec 2014

Hernan Claudio Melgratti, Associate Professor, University of Buenos Aires, Argentina, Apr 2014

Carroll Morgan, Professor, University of New South Wales and NICTA, Australia, Dec 2014

Carlos Olarte, Adjunct professor at Universidade Federal do Rio Grande do Norte, Brazil, from June 2014 until Jul 2014

Camilo Rueda, Professor, Universidad Javeriana Cali, Colombia, from Nov 2014 to Nov 2014

Geoffrey Smith, Professor, Florida International University, USA, Dec 2014

7.4.1.1. Internships

7.4.1.1.1. Raphaelle Crubillé

Duration: From Mar 2014 until Jul 2014

Subject: Formal modelling of RFID distance bounding protocols

Institution: ENS Lyon

7.4.2. Visits to International Teams

Konstantinos Chatzikokolakis and Catuscia Palamidessi visited the team of Annabelle McIver and Carroll Morgan at Macquarie University, Australia, July 2014.

Frank Valencia visited the team of Camilo Rueda (AVISPA) at Pontifical Universidad Javeriana Cali, from July 2014 until July 2014

<div align="center">

COMMANDS Project-Team

</div>

8. Partnerships and Cooperations

8.1. Regional Initiatives

- F. Bonnans is coordinator of the ICODE project "Strategic crowds: analysis and simulation", with U. Limoges, Paris-Sud.
- F. Bonnans participates to two PGMO project: "Hydro-electric scheduling under uncertainty", with U. Auckland, "Perturbation analysis for deterministic and stochastic optimal control problems", with U. Limoges and TSE (Toulouse),
- P. Martinon participates to the OPTIBIO project, supported by FMJH-PGMO, devoted to "New challenges in the optimal control of bioprocesses", with U. Angers, Lille 1 / Limoges

8.2. National Initiatives

8.2.1. DGA

Participants: Olivier Bokanowski, Anna Désilles, Hasnaa Zidani.

This project is a collaboration in the framework of a 3-year (2012-2015) research program funded by DGA. The title of the project is "Problèmes de commande optimale pour des systèmes non-linéaires en présence d'incertitudes et sous contraintes de probabilité de succès".

8.2.2. ANR HJNet

Participants: Olivier Bokanowski, Zhiping Rao, Hasnaa Zidani.

The team is part of the collaborative project HJNet funded by the French National Research Agency (ANR-12-BS01-0008-01). It started in January 2013 and will end in December 2013. Website: http://hjnet.math.cnrs.fr

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. SADCO

Type: FP7

Defi: NC

Instrument: Initial Training Network

Objectif: NC

Duration: January 2011 - December 2014

Coordinator: Inria

Partner: Univ. of Louvain, Univ. Bayreuth, Univ. Porto, Univ. Rome - La Sapienza, ICL, Astrium-Eads, Astos solutions, Volkswagen, Univ. Padova, Univ. Pierre et Marie Curie.

Inria contact: Hasnaa Zidani

Abstract: Optimisation-based control systems concern the determination of control strategies for complex, dynamic systems, to optimise some measures of best performance. It has the potential for application to a wide range of fields, including aerospace, chemical processing, power systems control, transportation systems and resource economics. It is of special relevance today, because optimization provides a natural framework for determining control strategies, which are energy efficient and respect environmental constraints. The multi-partner initial training network SADCO aims at: Training young researchers and future scientific leaders in the field of control theory with emphasis on two major themes sensitivity of optimal strategies to changes in the optimal control problem specification, and deterministic controller design; Advancing the theory and developing new numerical methods; Conveying fundamental scientific contributions within European industrial sectors.

See: http://itn-sadco.inria.fr

8.4. International Initiatives

8.4.1. Inria International Labs

We are involved in the CIRIC team "Optimization and control of energy", jointly with U. de Chile at Santiago. This collaboration involved several visits of the team in Santiago: F. Bonnans (1 week), B. Heymann (2 months) and P. Martinon (2 weeks).

8.4.2. Inria Associate Teams

8.4.2.1. OCONET

Title: Optimization and control in network economics

International Partner:

> Universidad de Chile (CHILI)

Duration: 2012 - 2014.

See also: http://www.cmm.uchile.cl/EA_OCONET/

Limited resources in telecommunication, energy, gas and water supply networks, lead to multi-agent interactions that can be seen as games or economic equilibrium involving stochastic optimization and optimal control problems. Interaction occurs within a network, where decisions on what to produce, consume, trade or plan, are subject to constraints imposed by node and link capacities, risk, and uncertainty, e.g. the capacity of generators and transmission lines; capacity of pipeline in gas supply; switches and antennas in telecommunication. At the same time, nonlinear phenomena arise from price formation as a consequence of demand-supply equilibria or multi-unit auction processes in the case of energy and telecommunication. We will focus first in this project in electricity markets in which there are producers/consumers PCs, and an agent called ISO (Independent system operator) in charge of the management of the network. One major application we have in mind is the one of smart (electrical) grids, in view of the increased use of renewable energies, that is, a massive entry of wind, geothermal, solar in particular.

8.4.3. Inria International Partners

8.4.3.1. Informal International Partners

Collaboration with the CIFASIS lab of U. Rosario, Argentina (3 months visit of J. Gianatti).

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Andew Philpott, U. Auckland (NZ), 6 weeks. Research on stochastic optimization with F. Bonnans and F. Wahid.

8.5.1.1. Internships

- Justina Gianatti, Cifasis, U. Rosario (Argentina), 3 months. Research on stochastic control with F. Bonnans.

DAHU Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

Acronym: PRODAQ

Title: Proof systems for Data Queries

Coordinator: Sylvain Schmitz

Duration: January 2015 – September 2019

Abstract: The project aims at developing proof systems for data logics. It is at the interface between several research communities in database theory, infinite-state system verification and proof theory. The main thrust behind the project is the investigation of proof-theoretic tools for data logic, using in particular insights from substructural logics, and using counter systems as a means to obtain algorithms and complexity results.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Declared Inria International Partners

Victor Vianu, UC San Diego, USA. Chaire Inria depuis 2013.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Thomas Schwentick

  Subject: Automata methods for data processing

  Institution: Dortmund University, Dortmund, Germany.
- Sławomir Lasota

  Subject: Reasoning with data using sets with atoms

  Institution: Warsaw University, Warsaw, Poland.

<h2 style="text-align:center; color:red;">DEFI Project-Team</h2>

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- H. Haddar is the DEFI coordinator of the ANR: Modelization and numerical simulation of wave propagation in metamaterials (METAMATH), program MN, 2011-2015. This is a joint ANR with POEMS, Inria Scalay Ile de France project team (Coordinator, S. Fliss), DMIA, Département de Mathématiques de l'ISAE and IMATH, Laboratoire de Mathématiques de l'Université de Toulon. https://www.rocq.inria.fr/poems/metamath

- J.R. Li is the coordinator of the Inria partner of the project "Computational Imaging of the Aging Cerebral Microvasculature", funded by ANR Program "US-French Collaboration". French Partners (Coordinating partner CEA Neurospin): CEA Neurospin (Coordinator Luisa Ciobanu), Inria Saclay (Coordinator Jing-Rebecca Li). US Partner: Univ of Illinois, bioengineering department (Coordinator Brad Sutton). Duration: Sept 2013- Sept 2016.

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

Partner 1: University of Bremen, Department of Math. (Germany)

Joint PhD advising of T. Rienmuller, partly funded by French-German university. Correspondant: Armin Lechleiter.

Partner 2: University of Goettingen, Department of Math. (Germany)

Development of conformal mapping method to electrostatic inverse problems. Correspondant: Rainer Kress.

Partner 3: University of Genova, Department of Math. (Italy)

Development of qualitative methods in inverse scattering problems. Correspondant: Michele Piana.

8.3. International Initiatives

8.3.1. Inria International Labs

- H. Haddar is member and the Inria correspondant of EPIC, an Inria team of LIRIMA Afrique.

8.3.2. Inria International Partners

8.3.2.1. Declared Inria International Partners

Title: Qualitative Approaches to Scattering and Imaging (QUASI)

International Partner (Institution - Laboratory - Researcher):

University of Delaware, Department of Mathematical Sciences (USA)

Duration: since 2013

Abstract: We concentrate on the use of qualitative methods in acoustic and electromagnetic inverse scattering theory with applications to nondestructive evaluation of materials and medical imaging. In particular, we would like to address theoretical and numerical reconstruction techniques to solve the inverse scattering problems using either time harmonic or time dependent measurements of the scattered field. The main goal of research in this field is to not only detect but also identify geometric and physical properties of unknown objects in real time.

8.3.3. Participation In other International Programs

- Olivier Pantz is in charge of the french side of the PHC (Hubert Curien Project) *Sur l'étude de quelques problèmes d'équations aux dérivées partielles issus de la physique* (with H. Zorgati of the University of Tunis in charge for the Tunisian side).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

We had short visits (one week) of the following collaborators

- Fioralba Cakoni
- David Colton
- Drossos Gintides
- Ozgur Ozdemir
- Rainer Kress
- Armin Lechleiter
- Nicolas Chaulet

8.4.1.1. Internships

- Shixu Meng
- Jacob Rezac
- Irena de Teresa-Trueba
- Thi Minh Phuong Nguyen
- Afa Saaidi

8.4.1.2. Research stays abroad

- H. Haddar spent one month research visit to the University of Sfax in October 2014.

<p align="center" style="color:red">DISCO Project-Team</p>

8. Partnerships and Cooperations

8.1. Regional Initiatives

- DIGITEO Project (DIM LSC) ALMA3

  Project title: Mathematical Analysis of Acute Myeloid Leukemia (AML) and its treatments

  September 2014 - August 2017

  Coordinator: Catherine Bonnet

  Other partners: Inria Paris-Rocquencourt, France, L2S, France, UPMC, St Antoine Hospital Paris

  Abstract: this project follows the regional projects ALMA (2010-2014) and ALMA2 (2011-2013). Starting from the work of J. L. Avila Alonso's PhD thesis in ALMA the aim of this project is to provide a refined coupled model of healthy and cancer cell dynamics in AML whose (stability) analysis will enable evaluation of polychemiotherapies delivered in the case of AML which have a high level of Flt-3 duplication (Flt-3-ITD).

- DIGITEO Project (DIM LSC) MOISYR

  Project title: Monotonie, observaterus par intervalles et systèmes à retard.

  Dedember 2011- December 2014

  Coordinator: Frédéric Mazenc

  Other partners: L2S, France, Mines-ParisTech, France

  Abstract: MOISYR is concerned with the problem of extending the theory of monotone systems to the main families of continuous time systems with delay along with the application of this theory to the design of observers and interval observers. In particular, nonlinear systems with pointwise and distributed delays and stabilizable systems with delay in the input shall be considered. In a second step, we extend our result to discrete time systems and to a specific class of continuous/discrete systems calles Networked Control Systems.

8.2. National Initiatives

8.2.1. ANR

An ANR Blanc SIMI 3 *Multidimensional Systems: Digression On Stabilities* (MSDOS) has started at the beginning of 2014. Its main goal is to constructively study stabilities and stabilization problems of (nonlinear) multidimensional systems. For more details, see http://www.lias-lab.fr/perso/nimayeganefar/doku.php. Alban Quadrat is the local leader for Inria Saclay.

Guillaume Sandou is the head of the RISEGrid Institute. The Institute is dedicated to the study, modelling and simulation of smart electric distribution grids and their interactions with the whole electric power system. It is located in Supélec and gathers about 20 people (academic and industrial researchers, PhD students, post-doctoral researchers).

Frédéric Mazenc is member of the Conseil du Laboratoire of Laboratoire des Signaux et Systèmes (L2S).

Frédéric Mazenc is member of the commission scientifique du CRI Saclay- Ile-de-France.

8.3. European Initiatives

8.3.1. Collaborations in European Programs, except FP7 & H2020

Program: **GDRI (European research network founded by CNRS)**

Project acronym: DelSys

Project title: Delay Systems

Duration: 2011-2015

Coordinator: Silviu Iulian Niculescu

Other partners: GIPSA-Lab and LAAS France, Ancona University Italy, Czech Technical University in Prague Czech Republic, Kent University Great-Britain, KTH Stockholm Sweden and KU Leuven Belgium.

Abstract: the aim of this GDRI is to bring together the main European teams which work in the fiels of Delay systems. This network meets once a year.

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Program: **PHC Pessoa (Portugal)**

Project acronym: 28750QA

Project title: Robust Distributed Model Predictive Control of Medium- and Large- Scale Systems

Duration: 2013-2014

Coordinator: Cristina Stoica (French leader), Fernando Lobo Perreira (Portuguese leader)

Other partners: Sorin Olaru

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Program:**PHC Brancusi (Romania)**

Project acronym: 28705PF

Project title: Adaptive and predictive control of bioprocesses (modelling, identification and control of interconnected bioprocesses)

Duration: 2013-2014

Coordinator: Sihem Tebbani (French leader), Dan Selisteanu (Romanain leader)

Other partners: Sorin Olaru

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Program:**PHC Parrot**

Project acronym: CASCAC

Project title: Computer Algebra, Symbolic Computation, and Automatic Control

Duration: 2013 - 2014

Coordinator: Alban Quadrat (French leader), Maris Tõnso (Estonian leader)

Other partners: Institute of Cybernetics, University of Tallinn

Abstract: The CASCAC project is at the interfaces of control theory, computer algebra and software engineering. The goals of the project are: 1. Develop new theoretical results on nonlinear control systems defined by functional equations (e.g., ordinary differential equations, partial differential equations, differential time-delay equations, partial difference equations). 2. Implement them on dedicated softwares developed in the computer algebra system Mathematica. In particular, Mathematica versions of the OREMODULES and OREMORPHISMS packages will be developed. 3. Develop an interface between the C library BLAD (http://www.lifl.fr/~boulier/pmwiki/pmwiki.php?n=Main.BLAD) − dedicated to differential algebra techniques − and Mathematica. This interface will allow one to have access to differential elimination techniques in Mathematica and to use them in decision methods for nonlinear control theory. 4. Co-supervise the Master thesis of Kristina Halturina with Prof. Ülle Kotta on constructive aspects of differential flatness and its applications to control theory (e.g., tracking, motion planning).

———

Program:**PHC GALILEE 2014**

Project acronym: SeTASDelSys - 30188PK

Project title: Set theoretic analysis of switched and time delay systems with application to fault tolerant control systems

Duration: January 2014 - December 2014

Coordinator: Sorin Olaru (France), Stefano Miani (Italy)

Other partners: Dipartimento di Ingegneria Elettrica, Gestionale e Meccanica, Universita' degli Studi di Udine, Italy

Abstract: The present Galileo project intends to initiate a collaborative research relationship based on the common interest of the French and Italian teams in the set-theoretic analysis of switched and delay time dynamics. On a broad perspective, the results on these topics can be extended to different aspects of the control design (as fault tolerance, constraints handling or robustness with respect to communication uncertainties). The scientific objective is to address two main open problems : i) the construction of (positive) invariant sets for switched dynamical systems; ii) the definition of the appropriate concepts of set invariance for delay time systems and their algorithmic construction.

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Program: **PHC Rila (Bulgaria)**

Project acronym: 29401YJ

Project title: Robust Distributed Model Predictive Control of Medium- and Large- Scale Systems

Duration: 2013-2014

Coordinator: Sorin Olaru (French leader), Alexandra Grancharova (Bulgarian leader)

Other partners: Bulgarian Academy of Science

Abstract: The project intends to address the control design of large scale dynamical systems with an emphasis on distributed predictive control strategies. There are two points of view with respect to the control synthesis in this framework: a. avoid the use of a global prediction model in the receding horizon optimal control of the subsystems and privilege the use of a coordination level in the decision process; b. consider the distributed synthesis for a network of discrete-time constrained linear systems without central coordinator. In the present project we intend to contribute to both of these directions by: a. Prediction of the interactions in between subsystems in a decomposition-coordination scheme. This can be done by imposing a reduced set of constraints for the MPC problems at the lower levels. b. With respect to the MPC design in the absence of coordination one of the issues will be the definition of appropriate terminal sets, ensuring invariance properties or at least recursive feasibility for the global functioning. We will investigate the construction of terminal set for a stabilizing centralized MPC decomposable in the form of a cross product of sets in each subsystem state space. An interesting idea on this direction was presented recently by the participants in this project.

8.3.2. Collaborations with Major European Organizations

Partner 1: University of L'Aquila, Department of Electrical and Information Engineering (Italy)

Sujet : study of nonlinear systems with delay, (notably differential equations interconnected with difference equations) via Lyapunov-Krasovskii functionals.

Partner 2: RWTH Aachen University, Germany

Mathematical systems theory, control theory, symbolic computation

Partner 3: Bilkent University, Turkey

Control of linear and nonlinear systems with delays, medical applications

Partner 4: Tel Aviv University, Israel

Stability analysis of nonlinear Partial Differential Equations

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- E. Acchab, University of El Jadida, Marocco, 01-15/11.
- M. Barakat, University of Kaiserslautern, Germany, 31/04-01/05.
- Y. Belikov, University of Tallinn, Estonia, 26-30/05.
- E. Fridman, University of Tel-Aviv, Israël, 22/09-22/10.
- U. Kotta, University of Tallinn, Estonia, 26-30/05.
- P. Laakkonen, University of Tampere, Finland, 09-17/06.
- G. Regensburger, RICAM, Linz, Austria, 06/03.
- D. Robertz, University of Plymouth, United Kingdom, 02-05/06.
- M. Tõnso, University of Tallinn, Estonia, 26-30/05, 17-21/11.
- Y. Yamamoto, University of Kyoto, Japan, 15-30/04.

National scientists who gave a talk at the seminar *Théorie Algébrique des Systèmes* (http://pages.saclay.inria.fr/alban.quadrat/Seminar.html): F. Boulier (University of Lille I, 27/05), Y. Bouzidi (Inria Nancy, VEGAS, 30/06), T. Cluzeau (University of Limoges, 19-20/11), J.-A. Weil (University of Limoges, 20/01, 03/02).

8.4.1.1. Internships

- Master thesis: W. Djema, *Etude de la stabilité d'un modèle de leucémie aiguë myéloblastique*, Ecole Nationale Polytechnique d'Alger (Algeria), 17/06/2014, C. Bonnet et F. Mazenc.
- Master thesis: K. Halturina, *Constructive study of differential flatness and its applications in control theory*, University of Tallinn (Estonia), grant of the French governement (3 months), 15/05/2014, Alban Quadrat.
- Master thesis: N. Ribard, *Etude constructive des théorèmes de Warfield sur l'équivalence des systèmes fonctionnels linéaires*, University of Versailles (France), 15/09/2014, Alban Quadrat.

8.4.2. Visits to International Teams

Alban Quadrat visited the department of mathematics of the University of SUNY Cortland, New York (USA), 09/2014.

8.5. International Initiatives

8.5.1. Inria International Partners

8.5.1.1. Informal International Partners

- UNICAMP, Sao Paulo, Brazil.

- Kyushu Institute of Technology, Iizuka, Fukuoka and University of Kyoto, Kyoto, Japan.

- Louisiana State University, Baton Rouge, USA.

GALEN Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Excellence Clusters

- Program: DIGITEO (Chair)

    Project acronym: SubSample

    Project title: Identification and prediction of Salient brain States through probabilistic structure learning towards fusion of imaging and genomic date

    Duration: 01/2012-12/2015

    Coordinator: ECP - FR

- Program: DIGITEO (OMTE)

    Project acronym: Curator

    Project title: Real-time 2D/3D Deformable Fusion Towards Computer Assisted Surgery

    Duration: 01/2013-01/2015

    Coordinator: ECP - FR

- Program: DIGITEO

    – Project acronym: SOPRANO

    – Project title: Structured Output Prediction on Large Scale Neuroscience Data

    – Duration: 3/2013-3/2016

    – Coordinator: Ecole Centrale Paris - FR

- Program: MEDICEN

    Project acronym: ADOC

    Project title: ADOC – Diagnostic peropératoire numérique en chirurgie du cancer

    Duration: 11/2011-09/2015

    Coordinator: LLTECH - FR

8.2. National Initiatives

8.2.1. ANR

- Program: ANR Blanc International

    Project acronym: ADAMANTIUS

    Project title: Automatic Detection And characterization of residual Masses in pAtients with lymphomas through fusioN of whole-body diffusion-weighTed mrI on 3T and 18F-flUorodeoxyglucoSe pet/ct

    Duration: 9/2012-8/2015

    Coordinator: CHU Henri Mondor - FR

- Program: ANR JCJC

    Project acronym: HICORE

    Project title: HIerarchical COmpositional REpresentations for Computer Vision

    Duration: 10/2010-9/2014

> Coordinator: ECP - FR

- Program: ANR JCJC

  > Project acronym: LearnCost
  > Project title: Learning Model Constraints for Structured Prediction
  > Duration: 2014-2018
  > Coordinator: Inria Saclay - FR

- Program: ITMOs Cancer & Technologies pour la santé d'Aviesan / INCa

  > Project acronym: CURATOR
  > Project title: Slice-to-Image Deformable Registration towards Image-based Surgery Navigation & Guidance
  > Duration: 12/2013-11/2015
  > Coordinator: ECP - FR

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. DIOCLES

> Type: FP7
> Instrument: European Research Council
> Duration: September 2011 - August 2016
> Coordinator: Nikos Paragios
> Partner: Ecole Centrale de Paris (FR)
> Inria contact: Nikos Paragios

8.3.1.2. MOBOT

> Type: FP7
> Defi: Cognitive Systems and Robotics
> Instrument: Specific Targeted Research Project
> Objectif: Cognitive Systems and Robotics
> Duration: February 2013 - January 2016
> Coordinator: Angelika Peer
> Partner: University of Bristol (UK)
> Inria contact: Iasonas Kokkinos

8.3.1.3. I-SUPPORT

> Type: H2020
> Defi: Cognitive Systems and Robotics
> Instrument: Specific Targeted Research Project
> Objectif: Cognitive Systems and Robotics
> Duration: March 2015 - February 2018
> Coordinator: Rafa Lopez
> Partner: Robotnik Automation (Spain)
> Inria contact: Iasonas Kokkinos

8.3.1.4. RECONFIG

> Type: FP7

Defi: Cognitive Systems and Robotics

Instrument: Specific Targeted Research Project

Objectif: Cognitive Systems and Robotics

Duration: February 2013 - January 2016

Coordinator: Dimos Dimarogonas

Partner: KTH (SE)

Inria contact: Iasonas Kokkinos

8.3.1.5. Strategie

Type: FP7

Instrument: Career Integration Grant

Duration: January 2014 - December 2017

Coordinator: Inria

Inria contact: Matthew Blaschko

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. SPLENDID

Title: Self-Paced Learning for Exploiting Noisy, Diverse or Incomplete Data

International Partner (Institution - Laboratory - Researcher):

Stanford University (ÉTATS-UNIS)

Duration: 2012 - 2014

See also: http://cvn.ecp.fr/personnel/pawan/research/splendid.html

The goal of the project is to develop methods for learning accurate probabilistic models using diverse (consisting of fully and weakly supervised samples), incomplete (consisting of partially labeled samples) and noisy (consisting of mislabeled samples) data. To this end, we will build on the intuitions gained from self-paced human learning, where a child is first taught simple concepts using simple examples, and gradually increasing the complexity of the concepts and the examples. In the context of machine learning, we aim to impart the learner with the ability to iteratively adapt the model complexity and process the training data in a meaningful order. The efficacy of the developed methods will be tested on several real world computer vision and medical imaging applications using large, inexpensively assembled datasets.

8.4.2. Inria International Partners

8.4.2.1. Informal International Partners

Europe

- Technical University of Munich (DE) – Collaborative research with the Chair for Computer Aided Medical Procedures& Augmented Reality at the department of Computer Science. Collaboration Topic: Graph-based methods for linear/deformable registration, segmentation, and tracking.
- University College London (UK) – Collaborative research with the Gatsby Computational Neuroscience Unit. Collaboration Topic: Kernel measures of dependence.
- University of Oxford (UK) – Collaborative research with the Visual Geometry Group of the Department of Engineering Science. Collaboration Topic: Structured prediction and parts-based models.
- University of Oulu (Finland) – Collaborative research with the Machine Vision Group at the department of Electrical Engineering. Collaboration Topic: Ranking based learning algorithms for cascaded object detection.

Americas

- University of California at Los Angeles (US) – Collaborative research with the UCLA Vision Lab and the UCLA Center for Cognition, Vision, and Learning Lab at the Departments of Computer Science and Statistics. Collaboration Topic: Action Recognition & Object Detection Parsing.

- University of Pensylvania (USA) – Collaborative research with the section of Biomedical Imaging of the Department of Radiology. Collaboration Topic: Graph-based methods for linear/deformable registration.

- StonyBrook University, Computer Science Department (USA) – Collaborative research with the image analysis lab in the context of the SubSample DIGITEO Chair. Collaboration Topic: Higher Order Graph-based methods in graph-matching, cocaine addiction analysis with sparse graph models, object detection and implicit 3D pose estimation

- Ecole Polytechnique de Montreal (CA) – Collaborative research with the Canada Research Chair in Medical Imaging and Assisted Interventions. Collaboration Topic: Higher Order Graph-based methods in Spine Imaging

- University of Colorado, Department of Computer Science (USA) - Research with the Autonomous Robotics & Perception Group. Collaboration topic: Large scale video segmentation using efficient approximations to a graph Laplacian.

Asia

- International Institute of Information Technology, Hyderabad (India) – Collaborative research with Center for Visual Information Technology. Collaboration Topic: Average precision with weak supervision and self-paced learning for deep convolutional neural networks.

8.5. International Research Visitors

8.5.1. *Visits of International Scientists*

- Professor Maragos, Petros: Technical University of Athens, GR (October 2014)

8.5.1.1. Internships

- Gastounioti, Aimilia: Technical University of Athens, GR (from February until June 2014)

- Trulls, Eduard: Universitat Politècnica de Catalunya, ES (from June until October 2014)

- Vedantam, Shanmukha Ramakrishna: Virginia Tech, USA (from June 2014 until August 2014)]

8.5.2. *Visits to International Teams*

- Ferrante, Enzo: Stanford University, USA (from June to September 2014)

8.5.2.1. Research stays abroad

- Boussaid, Haithem: University of Pennsylvania, USA (from June to September 2014)

- Togkas, Stavros: Oxford University, UK (from August to November 2014)

GECO Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

- Project *Stabilité des systèmes à excitation persistante*, Program MathIng, Labex LMH, 2013-2016. This project is about different stability properties for systems whose damping is intermittently activated. The coordinator is Mario Sigalotti. The other members are Yacine Chitour and Guilherme Mazanti.

- **Digitéo project 2012-061D SSyCoDyC.** SSyCoDyC (2013–2014) is financed by Digitéo in the framework of the DIM *Hybrid Systems and Sensing Systems*. It focuses on the application of techniques of hybrid systems to the analysis of retarded equations with time-varying delays. SSyCoDyC has financed the post-doc fellowship of Ihab Haidar and was coordinated by Paolo Mason and Mario Sigalotti.

- iCODE is the Institute for Control and Decision of the Idex Paris Saclay. It was launched in March 2014 for two years until June 2016. iCODE's aims are fostering research, spin-offs creation, training and diffusion of Control and Decision in Paris-Saclay. To those aims, iCODE has received a budget of 980Keuros, supported by *investissements d'avenir*. The scientific topics addressed by iCODE are organized in four research initiatives:

    - Control & Neuroscience
    - Large-scale systems & Smart grids
    - Behavioral Economics
    - White research initiative.

  iCODE is coordinated by Yacine Chitour (L2S-Univ. Paris Sud), associated member and collaborator of GECO. Mario Sigalotti is member of the Steering Committee.

7.2. European Initiatives

7.2.1. FP7 Projects

Program: ERC Starting Grant

Project acronym: GeCoMethods

Project title: Geometric Control Methods for the Heat and Schroedinger Equations

Duration: 1/5/2010 - 1/5/2015

Coordinator: Ugo Boscain

Abstract: The aim of this project is to study certain PDEs for which geometric control techniques open new horizons. More precisely we plan to exploit the relation between the sub-Riemannian distance and the properties of the kernel of the corresponding hypoelliptic heat equation and to study controllability properties of the Schroedinger equation.

All subjects studied in this project are applications-driven: the problem of controllability of the Schroedinger equation has direct applications in Laser spectroscopy and in Nuclear Magnetic Resonance; the problem of nonisotropic diffusion has applications in cognitive neuroscience (in particular for models of human vision).

Participants. Main collaborator: Mario Sigalotti. Other members of the team: Andrei Agrachev, Riccardo Adami, Thomas Chambrion, Grégoire Charlot, Yacine Chitour, Jean-Paul Gauthier, Frédéric Jean.

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. Informal International Partners

SISSA (Scuola Internazionale Superiore di Studi Avanzati), Trieste, Italy.

Sector of Functional Analysis and Applications, Geometric Control group. Coordinator: Andrei A. Agrachev.

We collaborate with the Geometric Control group at SISSA mainly on subjects related with sub-Riemannian geometry. Thanks partly to our collaboration, SISSA has established an official research partnership with École Polytechnique.

7.3.2. Participation In other International Programs

- Laboratoire Euro Maghrébin de Mathématiques et de leurs Interactions (LEM2I)
  http://www.lem2i.cnrs.fr/
- GDRE Control of Partial Differential Equations (CONEDP)
  http://www.ceremade.dauphine.fr/~glass/GDRE/

GEOMETRICA Project-Team

8. Partnerships and Cooperations

8.1. Technological Development Actions

8.1.1. ADT PH

Participants: Jean-Daniel Boissonnat, Frédéric Chazal, David Cohen-Steiner, Sonali Digambar Patil, Marc Glisse, Steve Oudot, Clément Maria, Mariette Yvinec.

- Title: Persistent Homology

- Coordinator: Mariette Yvinec (GEOMETRICA)

- Duration: 1 year renewable once, starting date December 2012. Renewed for 1 year from January 1st 2014 to December 31t 2014
- Others Partners: Inria team ABS, Gipsa Lab (UMR 5216, Grenoble, http://www.gipsa-lab.inpg.fr/)

- Abstract: Geometric Inference is a rapidly emerging field that aims to analyse the structural, geometric and topological, properties of point cloud data in high dimensional spaces. The goal of the ADT PH is to make available, a robust and comprehensive set of algorithmic tools resulting from recent advances in Geometric Inference. The software will include:

> tools to extract from the data sets, families of simplicial complexes,

> data structures to handle those simplicial complexes,

> algorithmic modules to compute the persistent homology of those complexes,

> applications to clustering, segmentation and analysis of scalar fields such as the energy landscape of macromolecular systems.

8.1.2. ADT OrbiCGAL

Participants: Aymeric Pellé, Monique Teillaud.

- Title: OrbiCGAL

- Coordinator: Monique Teillaud (GEOMETRICA)

- Duration: 1 year renewable once, starting date September 2013.
- Abstract: OrbiCGAL is a software project supported by Inria as a Technological Development Action (ADT). It is motivated by applications ranging from infinitely small (nano-structures) to infinitely large (astronomy), through material engineering, physics of condensed matter, solid chemistry, etc

The project consists in developing or improving software packages to compute triangulations and meshes in several types of non-Euclidean spaces: sphere, 3D closed flat manifolds, hyperbolic plane.

8.2. Regional Initiatives

8.2.1. Digiteo project TOPERA

Participants: Frédéric Chazal, Marc Glisse, Anaïs Vergne.

TOPERA is a project that aims at developing methods from Topological Data Analysis to study covering properties and quality of cellular networks. It also involves L. Decreusefond and P. Martins from Telecom Paris.

- Starting date: December 2013

- Duration: 18 months

8.3. National Initiatives

8.3.1. *ANR Présage*

Participants: Olivier Devillers, Marc Glisse, Ross Hemsley, Monique Teillaud, Rémy Thomasse.

- Acronym: Presage.

- Type: ANR blanc.

- Title: *méthodes PRobabilistes pour l'Éfficacité des Structures et Algorithmes GÉométriques*.

- Coordinator: Xavier Goaoc.

- Duration: 31 december 2011 - 31 december 2015.

- Other partners: Inria VEGAS team, University of Rouen.

- Abstract: This project brings together computational and probabilistic geometers to tackle new probabilistic geometry problems arising from the design and analysis of geometric algorithms and data structures. We focus on properties of discrete structures induced by or underlying random continuous geometric objects. This raises questions such as:

- What does a random geometric structure (convex hulls, tessellations, visibility regions...) look like?

- How to analyze and optimize the behavior of classical geometric algorithms on *usual* inputs?

- How can we generate randomly *interesting* discrete geometric structures?

- Year publications: [56], [33], [48], [52], [62], [61], [12]

8.3.2. *ANR TOPDATA*

Participants: Jean-Daniel Boissonnat, Frédéric Chazal, David Cohen-Steiner, Mariette Yvinec, Steve Oudot, Marc Glisse, Clément Levrard.

- Acronym : TopData.

- Title : Topological Data Analysis: Statistical Methods and Inference.

- Type : ANR blanc

- Coordinator : Frédéric Chazal (GEOMETRICA)

- Duration : 4 years starting October 2013.

- Others Partners: Département de Mathématiques (Université Paris Sud), Institut de Math́matiques (Université de Bourgogne), LPMA (Université Paris Diderot), LSTA (Université Pierre et Marie Curie)

- Abstract: TopData aims at designing new mathematical frameworks, models and algorithmic tools to infer and analyze the topological and geometric structure of data in different statistical settings. Its goal is to set up the mathematical and algorithmic foundations of Statistical Topological and Geometric Data Analysis and to provide robust and efficient tools to explore, infer and exploit the underlying geometric structure of various data.

Our conviction, at the root of this project, is that there is a real need to combine statistical and topological/geometric approaches in a common framework, in order to face the challenges raised by the inference and the study of topological and geometric properties of the wide variety of larger and larger available data. We are also convinced that these challenges need to be addressed both from the mathematical side and the algorithmic and application sides. Our project brings together in a unique way experts in Statistics, Geometric Inference and Computational Topology and Geometry. Our common objective is to design new theoretical frameworks and algorithmic tools and thus to contribute to the emergence of a new field at the crossroads of these domains. Beyond the purely scientific aspects we hope this project will help to give birth to an active interdisciplinary community. With these goals in mind we intend to promote, disseminate and make our tools available and useful for a broad audience, including people from other fields.

- See also: http://geometrica.saclay.inria.fr/collaborations/TopData/Home.html

8.4. European Initiatives

8.4.1. FP7 & H2020 Projects

8.4.1.1. GUDHI

Type: FP7

Instrument: ERC Advanced Grant

Duration: February 2014 - January 2019

Coordinator: Jean-Daniel Boissonnat

Inria contact: Jean-Daniel Boissonnat

Abstract: The central goal of this project is to settle the algorithmic foundations of geometry understanding in dimensions higher than 3. Geometry understanding encompasses a collection of tasks including the approximation and computer representation of geometric structures, and the inference of geometric or topological properties of sampled shapes.

See also https://project.inria.fr/gudhi/

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Pedro Machado Manhães de Castro (Universidade Federal de Pernambuco)

Arijit Ghosh (MPII, Saarbrucken), april, november-december

Antoine Vigneron (KAUST), may

Ramsay Dyer (Johann Bernouilli Institute, University of Groningen), octobre

Kira Vyatkina (Saint Petersburg Academic University), october

Vissarion Fisikopoulos (Université Libre de Bruxelles), november

GRACE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. PEPS PAIP

From late 2012 through 2013, D. Augot was heavily involved in the preparation of the *Institut de la société du numérique* (Digital Society Institute) proposal within IDEX Paris-Saclay. Led by N. Boujemaa, this proposal aims to be a catalyst for interdisciplinary research (involving computer scientists and researchers from the humanities) on societal challenges inherent to eLife/life digitization. The proposal has initial funding from the IDEX, and will hopefully be self-funding within three years. Two kick-off projects were defined: joint human & machine interaction, and privacy and digital identity.

Within IDEX Paris-Saclay, the PAIP (Pour une Approche Interdisciplinaire de la Privacy) project was proposed and accepted in September 2013, with a small budget (30 keuros) for all the partners of the privacy group.

D. Augot engaged in monthly brainstorming meetings with researchers from Inria Paris–Rocquencourt (project-team SMIS), Université Jean Monnet's ADIS and CERDI labs (A. Rallet, A. Bensamoun), and Télécom ParisTech (C. Levallois-Barth). Topics under discussion include terms of service of various cloud storage providers; SMIS's *TrustedCell* secure token initiative for helding private and secure personal data; privacy leaks; and measurements on smartphones.

A one-day conference was held in Paris in December 2014.

8.1.2. PEPS Aije-Bitcoin

Within the group PAIP (Pour une Approche Interdisciplinaire de la Privacy), D. Augot presented the cryptographic and peer-to-peer principles at the heart of the Bitcoin protocol (electronic signature, hash functions, and so on). Most of the information is publicly available: the history of all transactions, evolution of the source code, developers' mailing lists, and the Bitcoin exchange rate. It was recognized by the economists in our group that such an amount of data is very rare for an economic phenomenon, and it was decided to start research on the history of Bitcoin, to study the interplay between the development of protocol and the development of the economical phenomenon.

The project **Aije-Bitcoin** (analyse informatique, juridique et économique de Bitcoin) was accepted as interdisciplinary research for a PEPS (Projet exploratoire Premier Soutien) cofunded by the CNRS and Université de Paris-Saclay. This one-year preliminary program will enable the group to master the understanding of Bitcoin from various angles, allowing more advanced research in the following years.

8.1.3. IDEALCODES

Idealcodes is a two-year Digiteo research project, started in October 2014. The partners involved are the École Polytechnique (X) and the Université de Versailles–Saint-Quentin-en-Yvelines (Luca de Feo, UVSQ). It funds one two-year post-doc, J. Nielsen, working at the boundary between coding theory, cryptography, and computer algebra.

Idealcodes spans the three research areas of algebraic coding theory, cryptography, and computer algebra, by investigating the problem of lattice reduction (and root-finding). In algebraic coding theory this is found in Guruswami and Sudan's list decoding of algebraic geometry codes and Reed–Solomon codes. In cryptography, it is found in Coppersmith's method for finding small roots of integer equations. These topics were unified and generalised by H. Cohn and N. Heninger [36], by considering algebraic geometry codes and number field codes under the deep analogy between polynomials and integers. Sophisticated results in coding theory could be then carried over to cryptanalysis, and vice-versa. The generalized view raises problems of computing efficiently, which is one of the main research topics of Idealcodes.

8.2. National Initiatives

8.2.1. ANR

- CATREL (accepted June 2012, Kickoff December 14, 2012, Starting January 1st, 2013): "Cribles: Améliorations Théoriques et Résolution Effective du Logarithme" (Sieve Algorithms: Theoretical Advances and Effective Resolution of the Discrete Logarithm Problem). This project aims to make effective "attacks" on reduced-size instances of the discrete logarithm problem (DLP). This is a key ingredient for the assessment of the security of cryptosystems relying on the hardness of the DLP in finite fields, and for deciding on relevant key sizes.

8.2.2. DGA

- DIFMAT-3: this one-year project aims to find matrices with good diffusion properties over small finite fields, in the spirit of [17]. The principle is to find non-maximal matrices, but with better coefficients and implementation properties. The relevant cryptographic properties to be studied correspond to the weight distribution of the associated code. Since we use Algebraic-Geometry codes, much more powerful techniques can be used for computing these weight distribution, using and improving Duursma's ideas [37].

- Cybersecurity. Inria and DGA contracted for three PhD topics at the national level, one of them involving Grace. Grace started a new PhD, and hired P. Karpman. The topic of this PhD is complementary to the above DIFMAT-3: while DIFMAT-3 provides fundamental methods for dealing with AG codes, in application for diffusion layers in block ciphers, the topic here is to make concrete propositions of block ciphers using these matrices. P. Karpman is coadvised by T. Peyrin (Nanyang Technological University, Singapore), by P.-A. Fouque (Université de de Rennes), and D. Augot.

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

PQCRYPTO (Post-Quantum Cryptography) is a proposal which was submitted in 2014 by Tanja Langa (Tu/E), with Inria as a partner. We received in September 2014 the notification that it was accepted. Inria's Secret and Grace project-teams are part of this proposal, whose starting date is March 2015.

8.3.2. Collaborations in European Programs, except FP7 & H2020

Program: COST

Project acronym: COST 4175/11

Project title: Random Network Coding and Designs over GF(q) http://www.network-coding.eu/index.html

Duration: 04/2012 - 04/2016

Coordinator: Marcus Greferath

Other partners: Camilla Hollanti, Aalto University, Finland Simon R. Blackburn, Royal Holloway, University of London, UK Tuvi Etzion, Technion, Israel Ángeles Vázquez-Castro, Autonomous University of Barcelona, Spain Joachim Rosenthal, University of Zurich, Switzerland (Chairs of the five working groups).

Abstract: Random network coding emerged through an award-winning paper by R. Koetter and F. Kschischang in 2008 and has since then opened many new directions in networking, internet, wireless communication systems, and cloud computing. This COST Action will set up a European research network and establish network coding as a European core area in communication technology. Its aim is to bring together experts from pure and applied mathematics, computer science, and electrical engineering, who are working in the areas of discrete mathematics, coding theory, information theory, and related fields.

8.4. International Initiatives

8.4.1. Informal International Partners

- M. Bossert, Institute of Communications Engineering, Ulm Universität.
- S. Galbraith, Department of Mathematics, University of Auckland.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Ruud Pellikaan (Department of Mathematics and Computing Science Eindhoven University of Technology) visited us from April 24th to May 21st.

INFINE Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. *Equipex FIT*

Participants: Cedric Adjih, Emmanuel Baccelli, Ichrak Amdouni, Alaeddine Weslati, Vincent Ladeveze.

Partners: Inria (Lille, Sophia-Antipolis, Grenoble), INSA, UPMC, Institut Télécom Paris, Institut Télécom Evry, LSIIT Strasbourg.

FIT (Future Internet of Things) aims to develop an experimental facility, a federated and competitive infrastructure with international visibility and a broad panel of customers. It provides this facility with a set of complementary components that enable experimentation on innovative services for academic and industrial users. The project gives french internet stakeholders a means to experiment on mobile wireless communications at the network and application layers thereby accelerating the design of advanced networking technologies for the future internet. FIT was one of 52 winning projects from the first wave of the French Ministry of Higher Education and Research's "Équipements d'Excellence" (Equipex) research grant program, in 2011.

One component of the FIT platform is the sets of IoT-LAB testbeds (voir le site IoT-LAB). These were motivated by the observation that the world is moving towards an "Internet of Things", in which most communication over networks will be between objects rather than people.

The Infine team is now managing the FIT IoT-LAB site currently at Rocquencourt whose development has been started in 2010 (in the Hipercom team).

8.2. European Initiatives

8.2.1. *EU CHIST-ERA MACACO*

Participants: Aline Carneiro Viana, Emmanuel Baccelli, Eduardo Mucelli.

Program: EU CHIST-ERA, topic Context- and Content-Adaptive Communication Networks

Project acronym: MACACO

Project title: Mobile context-Adaptive CAching for COntent-centric networking

Duration: 2013-2016

Coordinator: Aline Carneiro Viana

Other partners: INPT-ENSEEIHT at University of Toulouse, University of Birmingham (UK), SUPSI (Switzerland), CNR (Italy) and Federal University of Minas Gerais (Brazil)

Abstract:

MACACO (Mobile context-Adaptive CAching for COntent-centric networking) is a 3-year CHIST-ERA European Project addressing the topic Context- and Content-Adaptive Communication Networks. It is funded by ANR in France, SNSF in Switzerland, and ESPRC in UK. It focus on data offloading mechanisms that take advantage of context and content information. Our intuition is that if it is possible to extract and forecast the behaviour of mobile network users in the threedimensional space of time, location and interest (i.e. 'what', 'when' and 'where' users are pulling data from the network), it is possible to derive efficient data offloading protocols. Such protocols would pre-fetch the identified data and cache it at the network edge at an earlier time, preferably when the mobile network is less charged, or offers better quality of service. This project has officially started in November 2013. The first annual report will be delivered before January 25, 2015.

8.2.2. Collaborations in European Programs, except FP7 & H2020

Participants: Emmanuel Baccelli, Cedric Adjih, Oliver Hahm.

Program: ANR/BMBF French-German partnership within CSOSG Framework

Project acronym: SAFEST

Project title: Social Area Framework for Early Security Triggers

Duration: 2012-2015

Coordinators: Emmanuel Baccelli (France), Jochen Schiller (Germany)

Other partners: Freie Universitat Berlin, Fraunhofer, Hamburg University, Sagem, Daviko, FOS

Abstract: Public spaces, such as airports, railway stations, or stadiums bring together large numbers of people on limited space to use security-sensitive infrastructure. These spaces pose two distinct challenges to public security: (a) detecting unauthorized intrusions and (b) monitoring large crowds in order to provide guidance in case of unexpected events (e.g., mass panic). To ensure the safety of the general public as well as individuals, we thus require a flexible and intelligent method for area surveillance. One example in which current monitoring systems proved to be dangerously inefficient is the Love Parade music festival in Duisburg, Germany, July 2010. Crowd control failed to provide guidance to a large crowd, resulting in a mass panic with 21 deaths and several hundred injured. In this particular case, overloaded communication infrastructure led to a lack of information about the density and the movement of the crowd, which in turn resulted in misjudgments on appropriate strategies to resolve the situation. This incident highlights the need for more sophisticated and reliable methods for area surveillance. The SAFEST project aims to analyse the social context of area surveillance and to develop a system that can fulfill this task, both in terms of technology as well as acceptance by the general public. The system will operate in distributed way, collect anonymised data, securely transfer this data to a central location for evaluation, and if necessary notify the operator and/or issue alerts directly to the general public. SAFEST addresses the following topics: (i) it proposes a solution for crisis management, addressing social, technical, and economic issues, (ii) it enhances the protection of the population against risks and dangers, including the evaluation of acceptance of said solution, and (iii) it addresses the protection of critical infrastructures by the means of a comprehensive technical solution.

8.3. International Initiatives

8.3.1. Participation In other International Programs

8.3.1.1. STIC AmSud UCOOL

Participants: Aline Carneiro Viana, Eduardo Mucelli.

Program: STIC AmSud

Project acronym: UCOOL

Project title: Understanding and predicting human demanded COntent and mObiLity

Duration: 2013-2015

Coordinator: Aline Carneiro Viana

Other partners: National Laboratory for Scientific Computing (Brazil), Facultad de Ingeniería, Universidad de Buenos Aires (Argentina), Universidad Tecnica Federico Santa Maria (Chile), Telecom Sud Paris, and Inria (with INFINE at Saclay and DANTE at Rhone-Alpes)

Abstract: The UCOOL (Understanding and predicting human demanded COntent and mObiLity, https://macaco.inria.fr/) project is granted by STIC-AmSUD, it is a 2-year project, and has officially started in January 2014. The main goal of this project is to define solutions for the identification and modelling of correlations between the user mobility – describing changes in the user positioning and the current environment he/she is in – and the traffic demand he/she generates.

8.3.1.2. STIC Asie URSA

Participant: Aline Carneiro Viana.

Program: STIC Asie

Project acronym: URSA

Project title: Urban Sensing for Ads Networks

Duration: 2012-2014

Coordinator: Stephane MAag (Telecom SudParis)

Other partners: Telecom SudParis, Inria, Fu Jen Catholic University (Taiwan), Institute for Infocomm Research (Singapore), and IFI (Vietnam).

Abstract: The URSA (Urban Sensing for Ads Networks, http://www-public.tem-tsp.eu/ maag/URSA/) project was granted by STIC-Asie. It was a 2-year project which has started in January 2013 and has just finished. URSA aims at defining an urban sensing network based on the mobility of users and the diffusion of advertisements by fixed elements.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Artur Ziviani, National Laboratory for Scientific Computing (LNCC), Brazil, October 2014.

José Ignacio Alvarez-Hamelin, Facultad de Ingeniería, Universidad de Buenos Aires, Argentina, October 2014.

Jorge Brea, GranData and Universidad de Buenos Aires, Argentina, October 2014.

Anelise Munaretto, Federal Technological University of the Parana (UTFPR), Brazil, October 2014.

Carlos Sarraute, GranData, Argentina, October 2014.

Don Towsley, University of Massachusetts - Amherst, USA, June 2014.

8.4.1.1. Internships

Lavanya Addepalli, Universidad Politecnica de Valencia, Spain, from Jun 2014 to Nov 2014.

8.4.2. Visits to International Teams

8.4.2.1. Research stays abroad

Emmanuel Baccelli has been visiting Freie Universitaet (FU) Berlin in 2014, within the context of the SAFEST project. The closer collaboration enabled by this stay allowed the initial development of the RIOT community http://www.riot-os.org, and the development of new activities around Information-centric networking in the Internet of Things. During his stay, Emmanuel Baccelli also taught a course on Computer Networking for graduate level. More details in the corresponding sections of this document.

IN-SITU Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

DigiPods - Remote Collaborative Interaction mong Heterogeneos Visualization Platforms, Région Île-de-France (2012-2015), Coordinator: Stéphane Huot. Partners: Digiteo/FCS Campus Paris-Saclay, Univ. Paris-Sud, Inria, CNRS, CEA, Telecom ParisTech.

The goal of DIGIPODS is to design new interactive equipments and devices for collaborative interaction in immersive and high-resolution visualization platforms, connected through a high-end telepresence infrastructure. Beyond the usual interactive devices of such platforms (motion capture, interactive surfaces, haptic devices, audio and video systems), all the platforms will be augmented with new devices to facilitate co-located or remote interaction and collaboration: telepresence robots and the Digicarts, a new kind of interaction devices specifically designed for these needs. These equipments will be used by researchers in Human-Computer Interaction to explore the visualization and manipulation of large datasets, interaction in virtual reality, remote collaboration among heterogeneous platforms; but also by researchers from other fields and by professionals in order to explore and manipulate their complex data.

DigiCarts - Post-doctoral fellow position funded by Digiteo, Coordinator: Stéphane Huot. Partners: Univ. Paris-Sud, Inria, CNRS, CEA, Telecom ParisTech.

Complements the DigiPods project with funding for a 18 months post-doctoral position focused on the design, implementation and evaluation of the Digicart devices.

DigiZoom - Funding by DIGICOSME Labex, Coordinator: Olivier Chapuis. Partners: U. Paris-Sud, Inria, Institut Mines-Telecom.

Design, modeling and empirical evaluation of multi-scale navigation techniques depending on the input channels and output characteristics of the devices, in particular their size, in single-user and collaborative contexts. This project funds a joint PhD student between InSitu and the VIA group at Institut Mines-Telecom.

MultiVis - Funding by DIGICOSME Labex, Coordinator: James Eagan (Institut Mines Telecom). Partners: U. Paris-Sud, Inria, Institut Mines-Telecom.

Design, evaluate, and implement novel interaction models to help users appropriate multiple computational surfaces in the sense-making process. Our initial approach is to operationalize and extend the instrumental interaction model to specifically accommodate the specific needs of the sense-making process for information visualization. This project funds a joint PhD student between the VIA group at Institut Mines-Telecom and InSitu.

7.2. National Initiatives

Digiscope - Collaborative Interaction with Complex Data and Computation (2011-2020) http://digiscope.fr. "Equipment of Excellence" project funded by the "Invesissements d'Avenir" program of the French government. 10 academic partners: FCS Paris-Saclay (coordinator), Université Paris-Sud, CNRS, CEA, Inria, Institut Telecom ParisTech, Ecole Centrale Paris, Université Versailles - Saint-Quentin, ENS Cachan, Maison de la Simulation. Overall budget: 22.5 Meuros, including 6.7 Meuros public funding from ANR. Michel Beaudouin-Lafon: coordinator and principal investigator for the whole project.

The goal of Digiscope is to create nine high-end interactive rooms interconnected by high-speed networks and audio-video facilities to study remote collaboration across interactive visualization environments. The equipment will be open to outside users and targets four main application areas: scientific discovery, product lifetime management, decision support for crisis management, and education and training. In Situ contributes the existing WILD room, a second room called WILDER funded by the project, and its expertise in the design and evaluation of advanced interaction techniques and the development of distributed software architectures for interactive systems.

MDGest - Interacting with Multi-Dimensional Gestures (2011-2014). InSitu is the only academic partner. Funded by the French National Research Agency (ANR), Programme JCJC (Junior researchers): 88 Keuros. Caroline Appert (coordinator) and Theophanis Tsandilas.

This project investigates new interactions for small devices equipped with a touchscreen. Complementing the standard point-and-click interaction paradigm, the MDGest project explores an alternative way of interacting with a user interface: tracing gestures with the finger. According to previous work, this form of interaction has several benefits, as it is faster and more natural for certain contexts of use. The originality of the approach lies in considering new gesture characteristics (dimensions) to avoid complex shapes that can be hard for users to memorize and activate. Dimensions of interest include drawing speed (local or global), movement direction, device orientation or inclination, and distinctive drawing patterns in a movement.

DRAO – Adrien Bousseau (Inria, Sophia Antipolis) submitted a successful ANR grant with InSitu members Theophanis Tsandilas and Wendy Mackay, and Prof. Maneesh Agrawala (Berkeley).

The goal of the project is to create interactive graphics tools to support sketching. The kickoff meeting was held in Nov. 2012 and included interviews with designers from Toyota.

7.3. European Initiatives

7.3.1. CREATIV

Type: IDEAS
Instrument: ERC Advanced Grant
Duration: June 2013 - May 2018
Coordinator: Wendy Mackay
Partner: Inria (France)
Inria contact: Wendy Mackay
Abstract: CREATIV explores how the concept of co-adaptation can revolutionize the design and use of interactive software. Co-adaptation is the parallel phenomenon in which users both adapt their behavior to the system's constraints, learning its power and idiosyncrasies, and appropriate the system for their own needs, often using it in ways unintended by the system designer. The initial goal of the CREATIV project is to fundamentally improve the learning and expressive capabilities of advanced users of creative software, offering significantly enhanced methods for expressing and exploring their ideas. The ultimate goal is to radically transform interactive systems for everyone by creating a powerful and flexible partnership between human users and interactive technology.

7.3.2. Social Privacy

Type: PEOPLE
Instrument: Marie Curie International Outgoing Fellowships for Career Development
Duration: September 2012 - August 2015
Coordinator: Wendy Mackay
Partner: Inria (France) and Massachusets Institute of Technology (USA)
Inria contact: Ilaria Liccardi
Abstract: Although users' right to privacy has long been protected, the rapid adoption of social media has surpassed society's ability to effectively regulate it. Today's users lack informed consent: they must make all-or-nothing decisions about on-line privacy regardless of context. The Social Privacy project will first diagnose the problem, exploring privacy issues associated with social media at the level of the individual, the enterprise and society, and then generate effective solutions, from providing users with technical safeguards and informed consent, to establishing corporate guidelines for protecting privacy, to developing and testing recommendations for public policy.

7.3.3. Collaborations in European Programs, except FP7 & H2020

EIT ICT Labs Master School, European Institute of Technology. Coordinator: M. Beaudouin-Lafon. Partners: KTH (Sweden), U. Paris-Sud (France), U. Aalto (Finland), Technical University Berlin (Germany), Technical University Delft (Netherlands), U. College London (UK), U. Trento (Italy).

InSitu participates in the Human-Computer Interaction and Design (HCID) major of the EIT ICT Labs European Master School. Paris-Sud is one the sites for the first year of this Master Program, and host one of the specialties for second-year students. Students in this program receive a double degree after studying in two countries. https://www.dep-informatique.u-psud.fr/en/formation/lmd/M1_HCID.

7.3.4. Collaborations with Major European Organizations

VCoRE - Next-Generation Visual Computing Platform (ADT Inria, 2011-2014), Coordinator for InSitu: Stéphane Huot. Partners: Inria (Grenoble, Lille, Rennes, Saclay, Sophia Antipolis), IGD Fraunhofer Institute.

Collaboration between Inria and IGD Fraunhofer Institute for the specification and development of a software framework dedicated to mixed/augmented/virtual reality and advanced visualization platforms (distributed computer graphics, simulation and interaction).

7.4. International Initiatives

7.4.1. Inria International Labs

7.4.1.1. Massive Data

A former member of InSitu, Emmanuel Pietriga, has spent two years at the Inria Chile/CIRIC lab as head of the Massive Data team. The team focuses on the design, development and empirical evaluation of novel interactive visualization techniques that help users understand and manipulate massive amounts of data on different types of platforms: mobile devices, workstations, control rooms (ALMA radio-telescope), ultra-high-resolution wall-sized displays such as ANDES, the lab's wall-sized display similar to InSitu's WILD and WILDER rooms. During his stay, he continued to collaborate with InSitu members.

- ALMA: http://almaobservatory.org
- ANDES: http://www.inria.cl/?page_id=2727&lang=en

7.4.2. Inria Associate Teams

7.4.2.1. MIDWAY

Title: Musical Interaction Design Workbench And technologY

International Partner:

McGill University & CIRMMT, Montréal (CA), Marcelo Wanderley

Duration: 2014 -

See also: http://insitu.lri.fr/MIDWAY

The MIDWAY associated team involves two partners: the InSitu group, and the Input Devices and Music Interaction Laboratory (IDMIL) from the Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT) – McGill University. Our goal is to design and implement MIDWAY, a musical interaction design workbench, to facilitate the exploration and design of new interactive technologies for both musical creation and performance. Each laboratory has extensive experience developing new interactive technologies and studying interactive phenomena from complementary points of view. The two groups share multiple, complementary research interests that the MIDWAY joint team will help them to explore together: In|Situ|'s experience working with composers to develop novel tools, toolkits and interaction models will complement IDMIL/CIRMMT's knowledge and experience designing new musical instruments and their studies of the musical creative process. Both partners have organized workshops to initiate and to plan the research program for the upcoming months (joint developments, publication and visits/exchanges).

7.4.3. Inria International Partners

7.4.3.1. Informal International Partners

- Stu Card and Sara Goldhaber-Fiebert, Stanford University, on improving the use of emergency manuals in operating rooms.

- Wendy Ju, Stanford University, and Steven Dow, Carnegie Mellon University, on the issues of Research Through Design.
- James Hollan, U.C. San Diego, on video analysis tools.
- Bjorn Hartmann, U.C. Berkeley, on multi-surface interaction.
- Shumin Zhai, Google Mountain View, on gesture-based interaction.
- Clemens Klokmose, University of Aarhus (Denmark), on ubiquitous instrumental interaction.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

- Marcelo Wanderlay, Professor at McGill University, Canada, May 2014.
- Shumin Zhai, Senior Staff Research Scientist at Google, USA, July 2014.
- Chat Wacharamanotham, Ph.D. candidate at RWTH Aachen, Germany, June 2014.

7.5.1.1. Internships

- Ignacio Avellino Martinez, Master Student from Univ. Trento and Univ. Aachen, was an intern at InSitu from Apr 2014 until Sep 2014 to work on telepresence systems for large interactive spaces. He was then granted an Inria CORDI grant pursue a Ph.D. at InSitu.

<p align="center" style="color:red">**M3DISIM Team**</p>

7. Partnerships and Cooperations

7.1. Regional Initiatives

The team is part of the Mechanics and Living Systems Initiative (Opération Mécanique et Systèmes du Vivant), a joint operation – focused on biomechanical modeling – between the LadHyx and LMS labs (CNRS and Ecole Polytechnique), and Inria-M3DISIM.

7.2. European Initiatives

7.2.1. FP7 & H2020 Projects

7.2.1.1. VPH-Share

Type: FP7

Defi: Towards sustainable and personalised healthcare

Instrument: Integrated Project

Objectif: Virtual Physiological Human

Duration: March 2011 - February 2015

Coordinator: Univ. Sheffield (UK)

Other partners: Cyfronet (Cracow), University College London, Istituto Ortopedico Rizzoli (Bologna), NHS, IBM Israel, Univ. Auckland, Agència d'Informació, Avaluació i Qualitat en Salut (Barcelona), Biocomputing Competence Centre (Milano), Universitat Pompeu Fabra (Barcelona), Philips Research, TUE (Eindhoven), Sheffield Teaching Hospitals, Atos Origin (Madrid), the Open University (UK), Univ. Vienna, King's College London, Empirica (Bonn), Fundació Clínic (Barcelona), Univ. Amsterdam

See also: http://vph-share.org/

Abstract: VPH-Share aims at developing the organisational fabric (the infostructure) and integrating the optimised services to expose and share data and knowledge, to jointly develop multiscale models for the composition of new VPH workflows, and to facilitate collaborations within the VPH community. Within this project, the M3DISIM team is in charge of developing some high-performance data assimilation software tools.

7.2.1.2. VP2HF

Type: FP7

Defi: ICT for Health, Ageing Well, Inclusion and Governance

Instrument: Specific Targeted Research Project

Objectif: Virtual Physiological Human

Duration: October 2013 - September 2016

Coordinator: King's College London (UK)

See also: http://vp2hf.eu/

Abstract: Heart failure (HF) is one of the major health issues in Europe affecting 6 million patients and growing substantially because of the aging population and improving survival following myocardial infarction. The poor short to medium term prognosis of these patients means that treatments such as cardiac re-synchronisation therapy and mitral valve repair can have substantial impact. However, these therapies are ineffective in up to 50% of the treated patients and involve significant morbidity and substantial cost. The primary aim of VP2HF is to bring together image and data processing tools with statistical and integrated biophysical models mainly developed in previous VPH projects, into a single clinical workflow to improve therapy selection and treatment optimisation in HF.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

7.3.1.1. Internships

Alexendre Laurin [Simon Fraser Univ., Canada] Sébastien Imperiale [correspondant] Philippe Moireau Dominique Chapelle

In the context of an ongoing collaboration between the Aerospace Physiology lab (Simon Fraser University, Vancouver, Canada) and Inria (M3DISIM and Reo teams), Alexandre Laurin (PhD student) has been awarded some funding for a 2 months internship in the M3DISIM team, with the objective of initiating the modelling of seismocardiography (SCG) measurements. SCG consists in measuring displacements of the sternum and ribs generated by a heart beat using accelerometers placed on the thorax. In this context, linear elastodynamics equations are applicable to account for the transient propagation of motion from the heart to the sternum via the highly heterogeneous underlying materials (cartilage and bone). Specific care has been taken to solve the aforementioned equation in a realistic 3D geometry including the complete thoracic cage. Fully coupled simulations (beating heart with thorax deformation) are planned at the final stage of this modelling work in 2015.

Maxplus Project-Team

8. Partnerships and Cooperations

8.1. Actions nationales/National Initiatives

8.1.1. ANR

- Participation de Cormac Walsh au projet ANR FINSLER (Géométrie de Finsler et applications).
- Projet ANR CAFEIN (Combinaison d'approches formelles pour l'étude d'invariants numériques), responsable P.L. Garoche. Partenaires : ONERA, CEA LIST, ENSTA Paristech, Inria Saclay (Maxplus, Toccata, Parkas), Université de Perpignan, Prover, Rockwell Collins France.
- Projet ANR MALTHY (Méthodes ALgébriques pour la vérification de modèles Temporisés et HYbrides), responsable T. Dang. Partenaires : Verimag, CEA LIST, Inria Rennes, Inria Saclay, VISEO/Object Direct.
- Projet ANR DEMOCRITE ("DEmonstrateur d'un MOteur de Couverture des Risques sur un TErritoire), responsable Emmanuel Lapébie (CEA). Partenaires : CEA-GRAMAT, BSPP, Inria Saclay (Maxplus), Institut PPRIME - UPR3346 (CNRS, Univ. Poitiers, ISAE-ENSMA), IPSIS, SYSTEL, ARMINES-E.M. Alès-ISR, CERDACC (Univ. de Haute-Alsace).

8.1.2. Programme Gaspard Monge pour l'Optimisation

- Projet intitulé "Méthodes tropicales pour l'optimisation", responsable X. Allamigeon, faisant intervenir M. Akian, P. Benchimol, S. Gaubert, R. Katz, et Z. Qu.
- Participation de Marianne Akian et Stéphane Gaubert au projet "STORY: Stochastic and Robust Optimization Network and Teaching", responsables: Laurent El Ghaoui (UC Berkeley) et Michel De Lara(CERMICS).

8.1.3. iCODE (Institut pour le Contrôle et la Décision de l'Idex Paris-Saclay)

Projet "blanc" intitulé "Stabilité et stabilisation des systèmes commutés" (Oct. 2014-fin 2015), faisant intervenir M. Akian, X. Allamigeon, S. Gaubert, et des membres de EPI Geco, L2S, LIX, LSV (ENS Cachan), UVSQ.

8.2. Actions internationales/International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

Collaborations régulières dans le cadre des programmes internationaux ci-dessous, ainsi qu'avec:

- Ricardo Katz (Conicet et Cifasis, Argentine);
- Alexander Guterman (Moscow State University);
- Françoise Tisseur (Université de Manchester) qui participe à l'encadrement de la thèse d'Andrea Marchesini.

8.2.2. Participation In other International Programs

- La thèse de Pascal Benchimol est financée par une bourse Monge/DGA prévoyant des visites régulières du doctorant dans l'équipe de Michael Joswig (TU Berlin).

8.3. Accueils de chercheurs étrangers/International Research Visitors

8.3.1. Chercheurs étrangers/Visits of International Scientists

- Ricardo Katz (Conicet, Rosario, Argentine), 2 mois entre Septembre et Novembre, financé par Digitéo et PGMO.
- Alexander Guterman (Université d'état de Moscou), 3 jours en Mars, 5 jours en Septembre.
- Visites d'un jour de Francisco Santos, Thorsten Theobald et Michael Joswig (autour de la thèse de Pascal Benchimol).
- Visite de Thomas Hansen, une semaine, Octobre 2014.

8.3.2. Séjours à l'étranger/Visits to International Teams

8.3.2.1. Research stays abroad

- A. Marchesini, visite à l'Université de Manchester, 22-25 avril 2014 et participation a NEP14.
- X. Allamigeon, visite à TU Berlin, 28–30 Avril 2014.
- S. Gaubert, visite à TU Berlin, 28–30 Avril 2014.
- S. Gaubert, visite au CIFASIS, Rosario, Argentina, 8-15 Juin 2014.

MEXICO Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. DIM/LSC TECSTES - 2011-052D

In this DIGITEO project (No. 6024), Hernán Ponce de Léon, Delphine Longuet (ParisSud) and Stefan Haar cooperate on the subject of conformance testing for concurrent systems, using Event Structures. The project started on September 1, 2011 and has ended on August 31, 2014.

8.2. IRT

8.2.1. SystemX

Participants: Simon Theissing, Stefan Haar.

We participate in the project MIC on multi-modal transport systems with in the IRT *System X*, with academic partners UPMC, IFSTTAR and CEA, and several industrial partners including Alstom (project leader), COSMO and Renault. MIC is scheduled to be completed late in 2016.

8.3. National Initiatives

8.3.1. ANR project IMPRO

Participants: Thomas Chatain, Stefan Haar, Serge Haddad.

The Project ANR **ImpRo** ANR-2010-BLAN-0317 involves *IRCCyN* (Nantes), *IRISA* (Rennes), *LIP6*(Paris), *LSV* (Cachan), *LIAFA* (Paris) and *LIF* (Marseille). It addresses issues related to the practical implementation of formal models for the design of communication-enabled systems: such models abstract away from many complex features or limitations of the execution environment. The modeling of *time*, in particular, is usually idealized, with infinitely precise clocks, instantaneous tests or mode communications, etc. Our objective is thus to study to what extent the practical implementation of these models preserves their good properties. We aim at a generic mathematical framework to reason about and measure implementability, and then study the possibility to integrate implementability constraints in the models. A particular focus is on the combination of several sources of perturbation such as resource allocation, the distributed architecture of applications, etc. We also study implementability through control and diagnosis techniques, and apply the developed methods to a case study based on the AUTOSAR architecture, a standard in the automotive industry.

8.4. European Initiatives

8.4.1. FP7 & H2020 Projects

8.4.1.1. Hycon2

Type: FP7 COOPERATION

Defi: Engineering of Networked Monitoring and Control Systems

Instrument: Network of Excellence

Objectif: Engineering of Networked Monitoring and Control systems

Duration: September 2010 - August 2014

Coordinator: CNRS

Partners: ETH Zürich, TU Berlin, TU Delft and many others.

Inria contact: C. Canudas de Wit

Abstract: Hycon2 aims at stimulating and establishing a long-term integration in the strategic field of control of complex, large-scale, and networked dynamical systems. It focuses in particular on the domains of ground and aerospace transportation, electrical power networks, process industries, and biological and medical systems.

8.5. International Initiatives

8.5.1. Inria International Partners

8.5.1.1. Informal International Partners

1. The CMI (Chennai Mathematical Institute) is a long-standing partner of our team. The project *Île de France/Inde* in the *ARCUS* program from 2008 to 2011 has allowed several exchange visits between Cachan and Chennai, organizations of ACTS workshops with french and indian researchers in Chennai, internships in Cachan, and two theses in *co-tutelle* (Akshay Sundararaman, defended in 2010) and Aiswarya Cyriac (thesis in progress).

   Currently, Paul Gastin is co-head (with Madhavan Mukund) of the CNRS International Associated Laboratory (LIA) INFORMEL (INdo-French FORmal Methods Lab, http://projects.lsv.ens-cachan.fr/informel/), see below.

2. We have been exchanging visits for several years between *MExICo* and the DISCO team (Lucia Pomello and Luca Bernardinello) at University Milano-Bicocca, Italy.

3. Exchanges are frequent with Rolf Hennicker from LMU and Javier Esparza at TUM, both in Munich, Germany.

4. With the computer science and electrical engineering departments at Newcastle University, UK (Maciej Koutny, Alex Yakovlev, Victor Khomenko and Andrey Mokhov), with visits in both directions.

8.5.2. Participation In Other International Programs (non-Inria)

8.5.2.1. EGIDE: TAMTV

Since October 2013, Benedikt Bollig has been the French coordinator of the EGIDE-Procope project TAMTV (2013/2014), which is a collaboration with LIAFA (Paris) and the University of Ilmenau (Germany).

8.5.2.2. LIA INFORMEL

The Indo-French Formal Methods Lab is an International Associated Laboratory (LIA) fostering the scientific collaboration between India and France in the domain of formal methods and applications to the verification of complex systems. Our research focuses on theoretical foundations of games, automata, and logics, three important tools in formal methods. We study applications to the verification of safety-critical systems, with an emphasis on quantitative aspects (time, cost, energy, etc.), concurrency, control, and security protocols. The Laboratory was founded in 2012 by a consortium of researchers from the French Centre for Scientific Research (CNRS), Ecole Normale Supérieure de Cachan (ENS Cachan), Université Bordeaux 1, the Institute of Mathematical Sciences Chennai (IMSc), the Chennai Mathematical Institute (CMI), and the Indian Institute of Science Bangalore (IISc). It is directed by Paul Gastin (ENS Cachan, MExICo team) and Madhavan Mukund (CMI). The LIA has been scientifically extremely active and productive since its creation. The LIA has supported numerous scientific exchanges and joint research papers, see http://projects.lsv.ens-cachan.fr/informel/

8.6. International Research Visitors

8.6.1. Visits of International Scientists

- Maciej Koutny from Newcastle University came as an invited Profeessor (for ENS Cachan) from February 10 to 14 and from March 3 to 7, 2014.

- From May 12 to June 3rd, K. Narayan Kumar from CMI Chennai, India, visited to work with C. Aiswarya and Paul Gastin on controllers for distributed systems.

- From June 1 to 10, 2014, S. Akshay from IIT Bombay visited MExICo to work with Paul Gastin, on split-width techniques for timed systems.

- Stanislav Böhm from the Technical University of Ostrava visited the group from 7 october to 7 december 2014.

8.6.2. Internships hosted by MExICo

Athanasiou Konstantinos - Athanasios

  Date: Apr 2014 - Aug 2014

  Institution: National University of Athens, Greece

Jana Schubert

  Date: 30 Sept 2013 - 28 February 2014

  Institution: Universität Dresden, Germany

Akshay Kumar

  Date: May 10 to July 22, 2014

  Institution: IIT Khanpur

8.6.3. Visits to International Teams

8.6.3.1. Shorter Visits

- Paul Gastin visited S. Akshay at IIT Bombay twice, first January 11-17 to work on probabilistic timed systems , and then from December 7 to 19 to work on timed pushdown systems and to deliver an invited talk at FSTTCS in Delhi.

- Stefan Haar visited the PAIS lab at Higher School of Economics in Moscow from Sept. 15 to 23.

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

7. Partnerships and Cooperations

7.1. Regional Initiatives

DW4RDF is a Digiteo project joint between Inria and U. Paris Sud, focused on analytic platforms for RDF data. The project has ended in October 2014, it has lasted three years, and it was coordinated by François Goasdoué. The project has provided the framework for the PhD of Alexandra Roatis [10], [28], [4], [28], [2].
S4 (Social, Structured and Semantic Search) is a Digicosme project joint between Inria and U. Paris Sud, focused on developing novel models and algorithms for user-centric search in a social context where complex documents are authored and endowed with rich semantics. The project provides the framework for the PhD of Raphael Bonaque [19].

7.2. National Initiatives

7.2.1. ANR

Apprentissage Adaptatif pour le Crowdsourcing Intelligent et l'Accès à l'Information (ALICIA) is a 4-year project, started in February 2014, supported by the ANR CONTINT call. The project is coordinated by Bogdan Cautis, with Nicole Bidoit, and Ioana Manolescu. Its goal is to study models, techniques, and the practical deployment of adaptive learning techniques in user-centric applications, such as social networks and crowdsourcing.
Cloud-Based Organizational Design (CBOD) is a 4-year ANR started in 2014, coordinated by prof. Ahmed Bounfour from UNIV. PARIS-SUD. Its goal is to study and model the ways in which cloud computing impacts the behavior and operation of companies and organizations, with a particular focus on the cloud-based management of data, a crucial asset in many companies.
Datalyse is funded for 3.5 years as part of the *Investissement d'Avenir - Cloud & Big Data* national program. The project is led by the Grenoble company Eolas, a subsidiary of Business & Decision. It is a collaboration with LIG Grenoble, U. Lille 1, U. Montpellier, and Inria Rhône-Alpes aiming at building scalable and expressive tools for Big Data analytics.

7.2.2. LabEx, IdEx

Structured, Social and Semantic Search is a 3-year project started in October 2013, financed by the *LabEx (Laboratoire d'Excellence)*DIGICOSME. The project aims at developing a data model for rich structured content enriched with semantic annotations and authored in a distributed setting, as well as efficient algorithms for top-k search on such content.
BizModel4Cloud is a one-year (2014) interdisciplinary research project funded under a *Projet Exploratoire Premier Soutien (PEPS)* call joint between the CNRS and the IdEx Paris Saclay. It reunites the same partners as the ANR CBOD project of which it is an initial, short version.

7.2.3. Others

ODIN is a four-year project started in 2014, funded by the Direction Générale de l'Armement, between the SemSoft company, IRISA Rennes and Inria Saclay (OAK). The project aims to develop a complete framework for analytics on Web data, in particular taking into account uncertainty, based on Semantic Web technologies such as RDF.

7.3. European Initiatives

7.3.1. Collaborations in European Programs, except FP7 & H2020

Program: COST

Project acronym: Keystone

Project title: Semantic keyword-based search on structured data sources

Duration: Oct 2013 – Oct 2018

Coordinator: Francesco Guerra (U. Modena, Italy)

Other partners: The project involves 24 countries, see http://www.cost.eu/domains_actions/ict/Actions/IC1302?parties

Abstract: To build efficient and expressive keyword search tools, the action "semantic KEYword-based Search on sTructured data sOurcEs" (KEYSTONE) proposes to draw upon competencies from several disciplines, such as semantic data management, the semantic web, information retrieval, artificial intelligence, machine learning, user interaction, service science, service design, and natural language processing.

7.4. International Initiatives

7.4.1. Inria Associate Teams

7.4.1.1. OAKSAD

Title: Languages and techniques for efficient large-scale Web data management

International Partner (Institution - Laboratory - Researcher):

University of California, San Diego (ÉTATS-UNIS)

Duration: 2013 - 2015

See also: https://team.inria.fr/oak/oaksad/

Data on the Web is increasingly large and complex. The ways to process and share it have also evolved, from the classical scenario where users connect to a database, to today's complex processes whereas data is jointly produced on the Web, disseminated through streams, corroborated and enriched through annotations, and exploited through complex business processes, or workflows. The OAK and San Diego teams work together to devise expressive languages, efficient techniques and scalable platforms for such applications. The main areas on which our interest is shared are: semantic Web annotations; large-scale distributed data sharing; monitoring and verification of automated data processing workflows in the cloud.

7.4.2. Inria International Partners

7.4.2.1. Informal International Partners

We have started discussions with the University of Tsukuba (Japan) and prepare a future submission of an associate team with them, on topics related to efficient techniques for querying distributed heterogeneous data sources.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

- Yannis Velegrakis (U. Trento) visited the team in December 2014 and gave a seminar on recommender systems.
- Konstantinos Karanasos (Microsoft Research) visited the team in November 2014 and gave a seminar on dynamic query optimization in large-scale data processing platforms.
- Tamer Ozsu (U. Waterloo) visited the team in October 2014 and gave a seminar on distributed RDF data management.
- Alin Deutsch (UCSD) visited the team in October 2014 as part of our OAKSADjoint work.
- Dan Olteanu (Oxford U.) visited the team in October 2014 and gave a seminar on modern Datalog evaluation engines.
- Julien Leblay (Oxford U.) visited the team in May 2014 and gave a seminar on querying the deep web.
- Laurent Daynès (Oracle) visited the team in February 2014 and gave a seminar on optimization techniques for evaluating arithmetic expressions in Oracle.

7.5.1.1. Internships

- Sejla Cebiric (M2 intern), from University of Sarajevo, Bosnia (March - August 2014)
- Elham Akbari Azirani (M2 intern), from University of Teheran, Iran (April - September 2014)

7.5.2. Visits to International Teams

7.5.2.1. Research stays abroad

Bogdan Cautis visited Yahoo Labs Barcelona, in July, on the account of ongoing collaborations in as-you-type search and query recommendation in social media. He also visited the University of Singapore for one week in April (Stephane Bressan's team).

PARIETAL Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. iConnectom project

Participants: Bertrand Thirion [Correspondant], Gaël Varoquaux, Elvis Dohmatob.

This is a Digiteo project (2014-2017).

Mapping brain functional connectivity from functional Magnetic Resonance Imaging (MRI) data has become a very active field of research. However, analysis tools are limited and many important tasks, such as the empirical definition of brain networks, remain difficult due to the lack of a good framework for the statistical modeling of these networks. We propose to develop population models of anatomical and functional connectivity data to improve the alignment of subjects brain structures of interest while inferring an average template of these structures. Based on this essential contribution, we will design new statistical inference procedures to compare the functional connections between conditions or populations and improve the sensitivity of connectivity analysis performed on noisy data. Finally, we will test and validate the methods on multiple datasets and distribute them to the brain imaging community.

8.1.2. SUBSAMPLE Digiteo chair

Participants: Bertrand Thirion [Correspondant], Gaël Varoquaux, Alexandre Abraham.

Parietal is associated with this Digiteo Chair by Dimitris Samaras, in which we will address the probabilistic structure learning of salient brain states (PhD of Alexandre Abraham, 2012-2015).

Cognitive tasks systematically involve several brain regions, and exploratory approaches are generally necessary given the lack of knowledge of the complex mechanisms that are observed. The goal of the project is to understand the neurobiological mechanisms that are involved in complex neuro-psychological disorders. A crucial and poorly understood component in this regard refers to the interaction patterns between different regions in the brain. In this project we will develop machine learning methods to capture and study complex functional network characteristics. We hypothesize that these characteristics not only offer insights into brain function but also can be used as concise features that can be used instead of the full dataset for tasks like classification of healthy versus diseased populations or for clustering subjects that might exhibit similarities in brain function. In general, the amount of correlation between distant brain regions may be a more reliable feature than the region-based signals to discriminate between two populations e.g. in schizophrenia. For such exploratory methods to be successful, close interaction with neuroscientists is necessary, as the salience of the features depends on the population and the observed effects of psychopathology. For this aim we propose to develop a number of important methodological advances in the context of prediction of treatment outcomes for drug addicted populations, e.g. for relapse prediction.

8.1.3. Medilearn/braincodes Inria-MSR project

Participants: Bertrand Thirion [Correspondant], Gaël Varoquaux, Andrés Hoyos Idrobo.

Neuroimaging is accumulating large functional MRI datasets that display –among artefacts and noise– brain activation patterns giving access to a meaningful representation of brain spatial organization. This ongoing accumulation is intensified via new large-scale international initiatives such as the *Human Connectome Project* (www.humanconnectomeproject.org). but also to existing open repositories of functional neuroimaging datasets (https://openfmri.org/) or http://www.fmridc.org/. These datasets represent a very significant resource for the community, but require new analytic approaches in order to be fully exploited. The MediLearn/BrainCodes project strives to provide a synthetic picture of the brain substrate of human cognition and its pathologies. In practice, this can be achieved by learning from large-scale datasets a brain atlas that summarizes adequately these functional activation maps drawing from a large number of protocols and subjects. Once learned, such an atlas is extremely useful to understand the large-scale functional organization of the brain: it is a tool for understanding *brain segregation*, the different encoding of many cognitive parameters into different brain regions, as well as *brain integration*, *i.e.* how remote brain regions co-activate across subjects and experiments.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. BrainPedia project
Participants: Bertrand Thirion [Correspondant], Gaël Varoquaux, Yannick Schwartz, Virgile Fritsch.

BrainPedia is an ANR JCJC (2011-2015) which addresses the following question: Neuroimaging produces huge amounts of complex data that are used to better understand the relations between brain structure and function. While the acquisition and analysis of this data is getting standardized in some aspects, the neuroimaging community is still largely missing appropriate tools to store and organize the knowledge related to the data. Taking advantage of common coordinate systems to represent the results of group studies, coordinate-based meta-analysis approaches associated with repositories of neuroimaging publications provide a crude solution to this problem, that does not yield reliable outputs and looses most of the data-related information. In this project, we propose to tackle the problem in a statistically rigorous framework, thus providing usable information to drive neuroscientific knowledge and questions.

8.2.1.2. IRMgroup project
Participants: Bertrand Thirion [Correspondant], Alexandre Gramfort, Michael Eickenberg.

This is a joint project with Polytechnique/CMAP http://www.cmap.polytechnique.fr/: Stéphanie Allassonnière and Stéphane Mallat (2010-2014).

Much of the visual cortex is organized into visual field maps, which means that nearby neurons have receptive fields at nearby locations in the image. The introduction of functional magnetic resonance imaging (fMRI) has made it possible to identify visual field maps in human cortex, the most important one being the medial occipital cortex (V1,V2,V3). It is also possible to relate directly the activity of simple cells to an fMRI activation pattern and Parietal developed some of the most effective methods. However, the simple cell model is not sufficient to account for high-level information on visual scenes, which requires the introduction of specific semantic features. While the brain regions related to semantic information processing are now well understood, little is known on the flow of visual information processing between the primary visual cortex and the specialized regions in the infero-temporal cortex. A central issue is to better understand the behavior of intermediate cortex layers.

Our proposition is to use our mathematical approach to formulate explicitly some generative model of information processing, such as those that characterize complex cells in the visual cortex, and then to identify the brain substrate of the corresponding processing units from fMRI data. While fMRI resolution is still too coarse for a very detailed mapping of detailed cortical functional organization, we conjecture that some of the functional mechanisms that characterize biological vision processes can be captured through fMRI; in parallel we will push the fMRI resolution to increase our chance to obtain a detailed mapping of visual cortical regions.

8.2.1.3. Niconnect project

Participants: Bertrand Thirion, Gaël Varoquaux [Correspondant], Alexandre Abraham.

- **Context:** The NiConnect project (2012-2016) arises from an increasing need of medical imaging tools to diagnose efficiently brain pathologies, such as neuro-degenerative and psychiatric diseases or lesions related to stroke. Brain imaging provides a non-invasive and widespread probe of various features of brain organization, that are then used to make an accurate diagnosis, assess brain rehabilitation, or make a prognostic on the chance of recovery of a patient. Among different measures extracted from brain imaging, functional connectivity is particularly attractive, as it readily probes the integrity of brain networks, considered as providing the most complete view on brain functional organization.

- **Challenges:** To turn methods research into popular tool widely usable by non specialists, the NiConnect project puts specific emphasis on producing high-quality open-source software. NiConnect addresses the many data analysis tasks that extract relevant information from resting-state fMRI datasets. Specifically, the scientific difficulties are *i)* conducting proper validation of the models and tools, and *ii)* providing statistically controlled information to neuroscientists or medical doctors. More importantly, these procedures should be robust enough to perform analysis on limited quality data, as acquiring data on diseased populations is challenging and artifacts can hardly be controlled in clinical settings.

- **Outcome of the project:** In the scope of computer science and statistics, NiConnect pushes forward algorithms and statistical models for brain functional connectivity. In particular, we are investigating structured and multi-task graphical models to learn high-dimensional multi-subject brain connectivity models, as well as spatially-informed sparse decompositions for segmenting structures from brain imaging. With regards to neuroimaging methods development, NiConnect provides systematic comparisons and evaluations of connectivity biomarkers and a software library embedding best-performing state-of-the-art approaches. Finally, with regards to medical applications, the NiConnect project also plays a support role in on going medical studies and clinical trials on neurodegenerative diseases.

- **Consortium**
  - Parietal Inria research team: applied mathematics and computer science to model the brain from MRI
  - LIF INSERM research team: medical image data analysis and modeling for clinical applications
  - CATI center: medical image processing center for large scale brain imaging studies
  - Henri-Mondor hospital neurosurgery and neuroradiology: clinical teams conducting research on treatments for neurodegenerative diseases, in particular Huntington and Parkinson diseases
  - Logilab: consulting in scientific computing

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. HBP

Type: FP7

Defi: Future and Emerging Technologies

Instrument: Collaborative Project with Coordination and Support Action

Objectif: FET Flagships

Duration: October 2013 - March 2016

Coordinator: Henry Markram (EPFL, Switzerland)

Partners: 86 partners, https://www.humanbrainproject.eu/fr/discover/the-community/partners

Inria contact: Olivier Faugeras

Abstract:

Understanding the human brain is one of the greatest challenges facing 21st century science. If we can rise to the challenge, we can gain profound insights into what makes us human, develop new treatments for brain disease and build revolutionary new computing technologies. Today, for the first time, modern ICT has brought these goals within sight.

Convergence of ICT and Biology The convergence between biology and ICT has reached a point at which it can turn the goal of understanding the human brain into a reality. This realization motivates the Human Brain Project – an EU Flagship initiative in which over 80 partners will work together to realize a new "ICT-accelerated" vision for brain research and its applications.

One of the major obstacles to understanding the human brain is the fragmentation of brain research and the data it produces. Our most urgent need is thus a concerted international effort that uses emerging emerging ICT technologies to integrate this data in a unified picture of the brain as a single multi-level system.

Research Areas The HBP will make fundamental contributions to neuroscience, to medicine and to future computing technology.

In *neuroscience*, the project will use neuroinformatics and brain simulation to collect and integrate experimental data, identifying and filling gaps in our knowledge, and prioritizing future experiments.

In *medicine*, the HBP will use medical informatics to identify biological signatures of brain disease, allowing diagnosis at an early stage, before the disease has done irreversible damage, and enabling personalized treatment, adapted to the needs of individual patients. Better diagnosis, combined with disease and drug simulation, will accelerate the discovery of new treatments, drastically lowering the cost of drug discovery.

In *computing*, new techniques of interactive supercomputing, driven by the needs of brain simulation, will impact a vast range of industries. Devices and systems, modeled after the brain, will overcome fundamental limits on the energy-efficiency, reliability and programmability of current technologies, clearing the road for systems with brain-like intelligence.

The Future of Brain Research

Applying ICT to brain research and its applications promises huge economic and social benefits. But to realize these benefits, the technology needs to be made accessible to scientists – in the form of research platforms they can use for basic and clinical research, drug discovery and technology development. As a foundation for this effort, the HBP will build an integrated system of ICT-based research platforms, building and operating the platforms will require a clear vision, strong, flexible leadership, long-term investment in research and engineering, and a strategy that leverages the diversity and strength of European research. It will also require continuous dialogue with civil society, creating consensus and ensuring the project has a strong grounding in ethical standards.

The Human Brain Project will last ten years and will consist of a ramp-up phase (2013-2016) followed by an operational phase (2016-2023). Bertrand Thirion is responsible for the 2.1.1 task, *Anatomo-functional mapping of the human brain*.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Gaspar Pizarro made a three months internship (January-March 2014), funded by Inria Chile and Conycit. His research topic was *Improving the fit of functional MRI data through the use of sparse linear models.*.

8.4.1.2. Other visitors

Danilo Bzdok (Forschungszentrum Jülich, institue of neuroscience and medicine) visited Parietal several months in 2014 (February-March, then September-), to develop collaborations on the use of machine learning techniques to model behavioral variables and find data-driven characterization of brain diseases.

8.4.2. Visits to International Teams

8.4.2.1. Research stays abroad

As part of the SubSample Digiteo chair, Alexandre Abraham spent six months in the USA at Stony Brook University and Nathan Klein Institute.

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

7. Partnerships and Cooperations

7.1. European Initiatives

7.1.1. FP7 & H2020 Projects

Title: ProofCert: Broad Spectrum Proof Certificates

Duration: January 2012 - December 2016
Type: IDEAS
Instrument: ERC Advanced Grant
Coordinator: Dale Miller

Abstract: There is little hope that the world will know secure software if we cannot make greater strides in the practice of formal methods: hardware and software devices with errors are routinely turned against their users. The ProofCert proposal aims at building a foundation that will allow a broad spectrum of formal methods—ranging from automatic model checkers to interactive theorem provers—to work together to establish formal properties of computer systems. This project starts with a wonderful gift to us from decades of work by logicians and proof theorist: their efforts on logic and proof has given us a *universally accepted* means of communicating proofs between people and computer systems. Logic can be used to state desirable security and correctness properties of software and hardware systems and proofs are uncontroversial evidence that statements are, in fact, true. The current state-of-the-art of formal methods used in academics and industry shows, however, that the notion of logic and proof is severely fractured: there is little or no communication between any two such systems. Thus any efforts on computer system correctness is needlessly repeated many time in the many different systems: sometimes this work is even redone when a given prover is upgraded. In ProofCert, we will build on the bedrock of decades of research into logic and proof theory the notion of *proof certificates*. Such certificates will allow for a complete reshaping of the way that formal methods are employed. Given the infrastructure and tools envisioned in this proposal, the world of formal methods will become as dynamic and responsive as the world of computer viruses and hackers has become.

7.2. International Initiatives

Members of the team have applied for the following three international projects. All three are still pending, the final results are not currently know.

1. A generic ANR proposal for collaboration between several French sites and the University of Bologna.
2. A proposal to ANR and JCJC (Japan).
3. A proposal to the Ministry of Education, Singapore for collaboration with the Nanyang Technological University.

7.3. International Research Visitors

- Chuck Liang (Professor from Hofstra University, NY, USA) visited for three weeks 26 May – 20 June 2014 and for another week starting 15 December.
- Gopalan Nadathur (Professor from the University of Minnesota) visited 2 - 11 July.
- Mary Southern (PhD candidate at the University of Minnesota, USA), May – Aug 2014 Internship supervised by K. Chaudhuri.
- Yuting Wang (PhD candidate at the University of Minnesota, USA), May – Aug 2014

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

8. Partnerships and Cooperations

8.1. National Initiatives - ANR

- ANR project *PROCOMEDIA: Propagation d'ondes en milieux complexes*
  Partners: ESPCI, Laboratoire d'Acoutique de l'Université du Maine, Departamento de Fisica de la Universidad de Chile.
  Start : 04/01/2011, End : 03/30/2014. Administrator : CNRS. Coordinator for POEMS : Jean-François Mercier.

- ANR project *METAMATH: modélisation mathématique et numérique pour la propagation des ondes en présence de métamatériaux.* Partners: EPI DEFI (Inria Saclay), IMATH-Université de Toulon, LJLL-Paris 6 University.
  Start : 12/01/2011, End : 11/30/2016. Administrator : Inria. Coordinator : Sonia Fliss.

- ANR project *CHROME: Chauffage , réflectométrie et Ondes pour les plasmas magnétiques*
  Partners: Université Pierre et Marie Curie (Paris 6), Université de Lorraine
  Start : 10/01/2012, End : 10/01/2015 Administrator : Inria Coordinator for POEMS: Eliane Bécache

- ANR project *SODDA: Diagnostic de défauts non francs dans les réseaux de câbles*
  Partners: CEA LIST, ESYCOM, LGEP (Supelec)
  Start : 10/01/2012, End : 10/01/2015 Administrator : Inria Coordinator for Poems: Patrick Joly

- ANR project *RAFFINE: Robustesse, Automatisation et Fiabilité des Formulations INtégrales en propagation d'ondes : Estimateurs a posteriori et adaptivité*
  Partners: EADS, IMACS, ONERA, Thales
  Start : January 2013. End : december 2016. Administrator : Inria. Coordinator: Marc Bonnet.

- ANR project *ARAMIS: Analyse de méthodes asymptotiques robustes pour la simulation numérique en mécaniques*
  Partners: Université de Pau, Université technologique de Compiègne
  Start : january 2013. End : december 2016. Administrator : Université de Pau. Participant for POEMS: Marc Bonnet

8.2. European Initiatives - FP7 & H2020 Projects

8.2.1. SIMPOSIUM

Type: FP7

Defi: ICT for the Enterprise and Manufacturing

Instrument: Integrated Project

Objectif: PPP FoF: Digital factories: Manufactoring design and product lifecycle management

Duration: September 2011 - August 2014

Coordinator: Steve MAHAUT, CEA/LIST

Inria contact: P. Joly, E. Lunéville

Abstract: Gathering together industrial companies, research centres and universities, the purpose of the SIMPOSIUM project is the integration in a unique platform of interoperable Non Destructive Evaluation simulation tools, to make possible virtual testing of parts at the early stages of manufacturing and design. The role of POEMS team is to develop a new finite element library (XLiFE++) with specific tools dedicated to propagation in waveguides. The library is now available and simulations of propagation in composite (anistropic elastic medium) waveguide have been done and compared to simulations provided by CIVA platform.

8.2.2. BATWOMAN

Type: FP7 Marie Curie

Objectif: Basic Acoustics Training - & Workprogram On Methodologies for Acoustics - Network

Duration: September 2013 - August 2017

Coordinator: Martin Wifling, VIRTUAL VEHICLE (AT)

Inria contact: P. Joly

Abstract: The BATWOMAN ITN aims at structuring research training in basic and advanced acoustics and setting up a work program on methodologies for acoustics for skills development in a highly diverse research field offering multiple career options.

8.3. International Initiatives

8.3.1. Inria International Partners

Wilkins Aquino (Duke University)

George Biros (University of Texas, Austin)

Fioralba Cakoni (University of Delaware)

Eric Chung (Chinese University of Hong Kong)

Dan Givoli (Technion - Israel Institute of Technology)

Nabil Gmati (Ecole Nationale d'Ingénieurs de Tunis)

Bojan Guzina (University of Minnesota)

Manfred Kaltenbacher (Technische Universitat Wien)

Sergei Nazarov (Saint-Petersburg University)

Jeronimo Rodriguez (University of Santiago de Compostela)

Kersten Schmidt (Technische Universitat Berlin)

Chrysoula Tsogka (University of Crete)

Ricardo Weder (Universidad Nacional Autonoma, Mexico)

Wensheng Zhang (Institute of Computational Mathematics, Beijing)

8.3.2. Participation In other International Programs

Groupement De Recherche Européen : GDRE-US

This European Research Network (GDRE) entitled *Wave Propagation in Complex Media for Quantitative and Non Destructive Evaluation* aims at giving opportunities for interactions between researchers on the occasion of informal meetings, workshops and colloquia, alternatively in France and in the UK. It linked groups of academics and researchers in Ultrasonic Wave Phenomena with each other, and with industrial research centres and companies. The teams involved focused particularly on the theoretical end of the research spectrum, and include mathematicians, physicists and engineers.

8.3.3. Visits of International Scientists

Ricardo Weder, Institute of Applied Mathematics and Systems, Universidad Nacional Autonoma, Mexico (June 2014).

Wensheng Zhang, Institute of Computational Mathematics, Beijing (September 2014).

Eric Chung, Department of Mathematics, Chinese University of Hong Kong (November 2014).

Shravan Veerapaneni, Department of Mathematics, University of Michigan (December 2014).

8.3.4. Visits to International Teams

Gary Cohen visited Prof. Wensheng Zhang at LSEC, Institute of Computational Mathematics, Chinese Academy of Sciences (CAS) in Beijing January 5-13.

Gary Cohen visited Dr. Eric Chung at Department of Mathematics in The Chinese University of Hong Kong (CUHK). They continued their collaboration on staggered discontinuous Galerkin methods and started a collaboration on mortar elements for hybrid meshes for the Maxwell's system.

POPIX Team

8. Partnerships and Cooperations

8.1. European Initiatives

8.1.1. FP7 & H2020 Projects

The Drug Disease Model Resources (DDMoRe) consortium will build and maintain a universally applicable, open source, model-based framework, intended as the gold standard for future collaborative drug and disease modeling and simulation.

The DDMoRe project is supported by the Innovative Medicines Initiative (IMI), a large-scale public-private partnership between the European Union and the pharmaceutical industry association EFPIA.

Marc Lavielle is leader of WP6: "New tools for Model Based Drug Development".

DDMoRe website: http://www.ddmore.eu

Duration: 2010 - 2015

Project members: Uppsala Universitet, Sweden; University of Navarra, Spain; Universiteit Leiden, Netherlands; Université Paris Diderot, France; Universita degli Studi di Pavia, Italy; UCB Pharma , Belgium; Simcyp, UK; Pfizer, UK; Optimata , Israel; Novo Nordisk , Denmark; Novartis, Switzerland; Merck Serono, Switzerland; Takeda, Switzerland; Mango Business Solutions , UK; Lixoft, France; Interface Europe, Belgium; Institut de Recherches Internationales Servier, France; Inria, France; GlaxoSmithKline Research and Development, UK; Freie Universitat Berlin, Germany; F. Hoffmann - La Roche , Switzerland; EMBL - European Bioinformatics Institute, UK; Eli Lilly , UK; Cyprotex Discovery, UK; Consiglio Nazionale delle Ricerche, Italy; AstraZeneca, Sweden.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

POPIX has a collaboration with the Faculty of Pharmacy of Manchester University (UK). Marc Lavielle is invited every year to give a one day course about mixed effects models and the MONOLIX software.

POPIX has a collaboration with the Faculty of Pharmacy of Buffalo university (USA). Marc Lavielle is invited every year to give a 2 days course about mixed effects models and the MONOLIX software.

8.2.2. Participation In other International Programs

Indo French Centre for the promotion of advanced research (CEFIPRA): Marc Lavielle was invited to participate to the the IFCAM Workshop in Statistics and Mathematical Biology, in Bangalore (August 2014).

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

7. Partnerships and Cooperations

7.1. Regional Initiatives

- **CALIFHA project (DIM Digiteo 2011)**: CALculations of Incompressible Fluid flows on Heterogeneous Architectures. Funding for a PhD student. Collaboration with LIMSI/CNRS. Participants: Marc Baboulin (Principal Investigator), Joel Falcou, Yann Fraigneau (LIMSI), Laura Grigori, Olivier Le Maître (LIMSI), Laurent Martin Witkowski (LIMSI)

7.2. National Initiatives

- **EDF**: Contract with EDF on improving performance and designing algorithms of iterative solvers on parallel machines with accelerators (Marc Baboulin). This contract enables to hire a postdoc researcher in October 2014.
  Participants: Marc Baboulin, Amal Khabou.
- **Lal/In2P3/CERN** The collaboration with CERN and LAL/IN2P3 + LRI focuses on LHCb and Atlas tracker code optimization. Those experiments must analyze results in realtime (10ms for analyzing particle trajectography). Early results show that these tracking algorithms can run in real time on SIMD multicore General Purpose Processor and on Xeon-Phi.
  Participant: Lionel Lacassagne.
- **Inserm** Contract with Paris X / INSERM U669 (Christophe Genolini) in the R++ project. R++ is an open source effort to modernize and increase performance of the R language used by scientists to develop statistical analysis tools. Funding for one research engineer has been received to support this project.
  Participant: Joël Falcou.
- **followup of the ANR Cosinus project PetaQCD - Towards PetaFlops for Lattice Quantum ChromoDynamics** Collaboration with Lal (Orsay), LPT (Orsay), LABRI (Bordeaux). About the design of architecture, software tools and algorithms for Lattice Quantum Chromodynamics.
  Participants: Christine Eisenbeis, Michael Kruse, Konstantin Petrov.

7.3. European Initiatives

7.3.1. ITEA

Program: ITEA

Project acronym: MANY

Project title: Many-core Programming and Resource Management for High-Performance Embedded Systems

Duration: 09/2011 - 08/2014

Coordinator: XDIN

Other partners: France: Thales Communications and Security, CAPS Entreprise, Telecom SudParis; Spain: UAB; Sweden: XDIN; Korea: ETRI, TestMidas, SevenCore; Netherlands: Vector Fabrics, ST-Ericsson, TU Eindhoven; Belgium: UMONS.

Abstract: Adapting Industry for the for the disruptive landing of many-core processors in Embedded Systems in order to provide scalable, reusable and very fast sofware development.

Participants: Lénaïc Bagnères, Cédric Bastoul, Taj Muhammad Khan.

7.4. International Initiatives

7.4.1. Inria Associate Teams

Participants: Marc Baboulin, Jack Dongarra.

R-LAS is an Inria associate team with University of Tennessee,(https://www.lri.fr/~baboulin/r-las.html), 2014-2017.

This project is proposed in the context of developing a class of fast algorithms based on randomization for numerical linear algebra solvers. The funding was used in 2014 to cover exchange visits for researchers and PhD students from Inria and University of Tennessee.

7.4.1.1. Informal International Partners

- **Lawrence Berkeley National Laboratory** - USA: collaboration of Marc Baboulin with Sherry Li on application of randomization techniques to the solution of large sparse linear systems using direct methods (joint publications and co-organizations of mini-symposia for SIAM conferences).
- **Old Dominion University** - USA: Collaboration with Pr. Masha Sosonkina on locality optimization for numerical linear algebra solvers (joint publication) and preconditioned Krylov subspace methods (PhD thesis of Aygül Jamal, starting in October 2014).
- **Louisiana State University** - USA: collaboration of Joel Falcou with the STELLAR team in the framework of the HPX project (Hartmut Kaiser). It is mainly related to the design and implementation of a C++ asynchronous runtime system. In this framework, the STELLAR team hosted 2 PhD students of the Postale team for extended visits in 2013 and 2014.
- **Texas A&M University** - USA: collaboration of Joel Falcou with the PARASOL team in the framework of the STAPL project (Lawrence Rauchwerger). It is mainly related to the applicability of parallel skeletons inside STAPL on large scale parallel machines.
- **University of Illinois at Urbanna Champaign** (UIUC) - USA, in the context of the Inria Joint Laboratory for Petascale computing. Since 2011, we have initiated collaborations with researchers from UIUC (Wen-mei Hwu, Karl Rupp) in the area of numerical software.
- **University of Manchester**: collaboration with Professors Nick Higham and Françoise Tisseur on random orthogonal matrices and fault-tolerant linear algebra algorithms (Amal Khabou).
- **University of California - Irvine**: collaboration of Christine Eisenbeis with Professor Jean-Luc Gaudiot on Application Characterization for Modern Multicore Architectures

7.4.2. Participation In other International Programs

Stic AmSud: BioCloud-EEAmSud **Participants:** Christine Eisenbeis, Alessandro Ferreira Leite, Claude Tadonki.

BioCloud-EEAmSud is a cooperation project integrated by Brazil, Chile and France following the 2012 STIC-AmSud call. Partners in Brazil are Universidade de Brasilia, Universidade Federal Fluminense, and EMBRAPA-Genetic Resources and Biotechnology (CENARGEN), through the support of the Coordination of Improvement of Senior Staff of the Ministry of Education in Brazil (CAPES). In Chile, the main partner is Universidad de Santiago de Chile, through the support of the National Commission for Scientific and Technological Research of Chile (CONICYT). In France, the institutions involved are Mines ParisTech (CRI) and Inria-Saclay, through the support of the Ministry of Foreign and European Affairs (MAEE). The international project coordinator is Pr. Maria Emília Machado Telles Walter (UnB). Alessandro Ferreira Leite' thesis work is a joint University of Brazilia - université Paris-Sud 11 thesis and is partially supported by BioCloud-EEAmSud. Maria Emilia Machado Telles Walter and Alba Cristian de Melo visited Grand-Large in 2013, as well as Taina Rajol.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

- Masha Sosokina (Professor, Old Dominion University, USA), June 10-13, 2014.
- Tingxing Tim Dong (PhD student, University of Tennessee, USA), August 25-26, 2014.
- Anthony Danalis (University of Tennessee, USA), December 15-16, 2014.
- Tetsuya Sakurai (University of Tsukuba, Japan), December 15-16, 2014.
- Jose Roman (University of Valencia, Spain), December 15-16, 2014.
- Jean-Luc Gaudiot, UCLA, Irvine, March 3rd, September 4th, November 24th, 2014.

REGULARITY Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

Regularity has strong collaborations with Nantes University (Anne Philippe) [40] and Rennes University (Ronan Le Guével) [42].

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

- Regularity collaborates with St Andrews University (Prof. Kenneth Falconer) on the study of multistable processes.
- Regularity collaborates with Acadia University (Prof. Franklin Mendivil) on the study of fractal strings, certain fractals sets, and the study of the regularization dimension.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

Pr. Franklin Mendivil, from Acadia University was invited for one month in the team.

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

Pascal Massart is co-organizing a working group at ENS (Ulm) on Statistical Learning.

Christine Keribin is animating the bimensual rendez-vous SFdS "methods and Software".

Gilles Celeux and Christine Keribin has started a collaboration with the Pharmacoepidemiology and Infectious Diseases (PhEMI, INSERM).

8.2. National Initiatives

8.2.1. ANR

SELECT is participating to the ANR MixStatSeq.

8.3. International Initiatives

Gilles Celeux is one of the co-organizers of the international Working Group on Model-Based Clustering. This year this workshop took place in Dublin (Ireland).

Yves Rozenholc has been invited at the Department of Statistics of the University of Haifa for three weeks, at the Department of Mathematics of Eindhoven University for one week and at the Institut of statistic, biostatistic and actuarial sciences of the catholic University of Louvain.

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

Project **Coquelicot**, funded jointly by the Fondation de Coopération Scientifique "Campus Paris-Saclay" and Digiteo.
Goal: Create a new Coq library for real numbers of mathematics.
Leader: S. Boldo (INRIA Saclay, Toccata). Participant: A. Mahboubi.
Website: http://coquelicot.saclay.inria.fr/.

8.2. National Initiatives

8.2.1. ANR

ParalITP (ANR-11-INSE-001).
Goal: Improve the performances and the ergonomics of interactive provers by taking advantage of modern, parallel hardware.
Leader: B. Wolff (University of Orsay, Paris Paris-Sud). Participants: A. Mahboubi, C. Tankink, E. Tassi.
Website: http://paral-itp.lri.fr/.

FastRelax (ANR-14-CE25-0018).
Goal: Develop computer-aided proofs of numerical values, with certified and reasonably tight error bounds, without sacrificing efficiency.
Leader: B. Salvy (Inria, ÉNS Lyon). Participants: A. Mahboubi, Th. Sibut-Pinote.
Website: http://fastrelax.gforge.inria.fr/.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

Claudio Sacerdoti Coen (associate professor at the University of Bologna) has been visiting three times a week during 2014. During his stays he collaborated with Enrico Tassi and Dale Miller (team Parsifal) on the design and implementation of a λ-Prolog-inspired programming language well suited to express type-inference algorithms and their extensions.

Fabian Immler (PhD candidate, TUM, Munich, Germany) is working on the formal certification of properties of differential systems, using the Isabelle proof assistant. He visited us for three days in December.

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

- **TIMCO (Technology for In Memory Computing applications)** FUI Project – 2012-2015 (432 kEuros)
  Coordinator: Bull SA
  Participants: Cécile GERMAIN(WP Algorithm adaptation: the paradigm shif coordinator)

- **ROM - Réduction de modèles et optmisisation multiphysiques** – 2014 (73 kEuros).
  Coordinator: IRT System X
  Participants: Marc Schoneuaer, François Gonard (PhD)

- **ISN** – 2013-2016 (105 kEuros).
  Related to Thomas Schmitt's PhD - A Collaborative Filtering Approach to Matching Job Openings and Job Seekers
  Participants: Michèle Sebag, Thomas Schmitt

- **AutoML - An empirical approach to Machine Learning** – 2014-2017 (104 kEuros).
  Related to Sourava Mishra's PhD.
  Participants: Michèle Sebag, Balazs Kégl, Sourava Mishra

8.2. National Initiatives

- **SIMINOLE** – 2010-2014 (1180kEuros, 250kEuros for TAO). Large-scale simulation-based probabilistic inference, optimization, and discriminative learning with applications in experimental physics, ANR project, Coordinator B. Kégl (CNRS LAL).

  Participants: Balázs Kégl, Nikolaus Hansen, Emmanuel Benazera, Michèle Sebag, Cécile Germain-Renaud

- **NUMBBO** – 2012-2016 (290kEuros for TAO). Analysis, Improvement and Evaluation of Numerical Blackbox Optimizers, ANR project, Coordinator Anne Auger, Inria. Other partners: Dolphin, Inria Lille, Ecole des Mines de Saint-Etienne, TU Dortmund
  Participants: Anne Auger, Nikolaus Hansen, Marc Schoenauer, Ouassim Ait ElHara

- **LOGIMA** – 2012-2016 (136kEuros for TAO). Logics, structural representations, mathematical morphology and uncertainty for semantic interpretation of images and videos, ANR project, Coordinator Céline Hudelot, MAS-ECP. Other partners: TAO , LTCI-Telecom ParisTech
  Local coordinator: Jamal Atif

- **ACTEUR** – 2014-2018 (236kEuros). Cognitive agent development for urban simulations, ANR project, Coordinator P. Taillandier (IDEES, Univ Rouen).

  Participants: Philippe Caillou

8.2.1. Other

- **POST** – 2014-2018 (1,220 MEuros, including 500 kEuros for a 'private' cluster). Platform for the optimization and simulation of trans-continental grids
  ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie)
  Coordinator: ARTELYS
  Participants: Olivier Teytaud, Marie-Liesse Cauwet, Jérémie Decock, Sandra Cecilia Astete Morales, David L. Saint-Pierre, J. Decock

- **E-LUCID** 2014-2017 (194 kEuros)
  Coordinator: Thales Communications & Security S.A.S
  Participants: Marc Schoenauer, Cyril Furtlehner

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. CitInES

Type: FP7

Defi: ICT for a low carbon economy

Instrument: Specific Targeted Research Project

Objectif: ICT systems for energy efficiency

Duration: October 2011 - March 2014

Coordinator: Artelys

Partners: Artelys (SME, France), Inria (Tao), AIT (Austria), Tupras (4 refineries, Turkey), Cesena (City, Italy), Ervet (Italy), Inesc-Porto (Portugal), Armines (France), Bologna (City, Italy)

Inria contact: Olivier Teytaud

Abstract: Design of a decision support tool for sustainable, reliable and cost-effective energy strategies in cities and industrial complexes

8.3.1.2. EGI-Inspire

Type: FP7

Defi: e-Infrastructure

Instrument: CP-CSA

Objectif: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe

Duration: May 2010 - April 2014

Coordinator: EGI.eu foundation

Partner: Université Paris XI (France)

Inria contact: Cécile Germain-Renaud

Abstract: To support European science and innovation, a longer lasting operational model is now needed - both for coordinating the infrastructure itself and for delivering integrated services that cross national borders.The EGI-InSPIRE project will support the transition from a project-based system to a sustainable pan-European e-Infrastructure.

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. INDEMA

Title: Intelligent Decision Making Mechanisms with Hidden Information, and Application to El ectricity Generation

International Partner (Institution - Laboratory - Researcher):

NUTN (TAIWAN)

Duration: 2012 - 2014

See also: http://www.lri.fr/~teytaud/indema.html

The objective of the project is three-fold:

- Objective 1: Designing consistent iterative realistic algorithms for partially observable 1-player or 2-player games.
  - Consistent algorithms (provably, asymptotically optimal in the computation time).
  - Iterative a.k.a. anytime algorithms, improving its results as the computational time allowed increases and requiring little time to yield a decent answer. Most algorithms which survive decades are iterative.
  - Realistic algorithms, i.e. suited to real-world settings.

- Objective 2: Impressive visible applications, e.g. applications in games or puzzles, such as Minesweeper (on which we believe that much progress is still possible), Chinese Dark Chess, Kriegspiel, Phantom-Go, or card games. Games and puzzles offer nice frameworks to assess and make our research highly visible.

- Objective 3: Big industrial applications. Having both mathematics and visible realizations in games and industrial applications might be considered as too ambitious. Yet, our strategy is to tackle e.g. the field of energy generation because: i) it is close from our past activities (thus reducing the warm-up time), yet with a new challenge, partial observability; ii) in real applications, many problems are simplified so that they boil down to fully observable problems, (e.g. through including tricks in the solvers); iii) our former achievements facilitate our contact with industry. Formally, we assume that mathematical analysis can be done on this (objective 1); that it will provide big results in games (objective 2) where many main programs are based on non-consistent algorithms; that these results will translate to real-world application.
  Our roadmap is:
  - Check on simple versions of energy production problems whether the fully observable approximation holds true. We guess that in many cases it does not; the next point is to assess the loss of performance incurred;
  - Experiment our algorithms on real industrial problems, considering both Taiwan-centered and Europe-Centered electricity generation problems in order to widen the scope of the analysis, enforcing the applicability of the approach.

8.4.2. Inria International Partners

8.4.2.1. Declared Inria International Partners

- Shinshu University (Professor Akimoto, Professor Tanaka, Professor Aguire). Partnership officialized via MOU signature between Inria and Shinshu University. Joint project funded by the Japanese governement.

- Dortmund University through the funded ANR project NumBBO.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Holger Hoos, Professor, Dept of Computer Science, University of British Columbia, from Oct. 1. to Dec. 31., funded by Microsoft-Inria Joint Lab.
- Daria La Rocca, PhD student at University Roma 3, Italy, from Oct. 2013 until Oct. 2014
- Luigi Malago, Post-Doc at University Shinshu, Japan, since Sept. 2014 (see Section 8.4.2.1).

8.5.2. Visits to International Teams

8.5.2.1. Research stays abroad

- Olivier Teytaud, National University of Tainan and Dong Hwa University in Hualien, Taiwan (6 months).
- Jialin Liu, National University of Tainan and Dong Hwa University in Hualien, Taiwan (6 months).

- Marie-Liesse Cauwet, National University of Tainan and Dong Hwa University in Hualien, Taiwan (3 months).

- Constance Deperrois, National University of Tainan and Dong Hwa University in Hualien, Taiwan (1 month).

- Baptiste Roziere, National University of Tainan and Dong Hwa University in Hualien, Taiwan (2 months).

- Sandra Cecilia Astete Morales, National University of Tainan and Dong Hwa University in Hualien, Taiwan (1 month).

- Vincent Berthier, National University of Tainan and Dong Hwa University in Hualien, Taiwan (4 months).

- David L. Saint-Pierre, National University of Tainan and Dong Hwa University in Hualien, Taiwan (4 months).

TOCCATA Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. *Coquelicot*

Participants: Sylvie Boldo [contact], Catherine Lelay, Guillaume Melquiond.

Coquelicot is a 3-year Digiteo project that started in September 2011. http://coquelicot.saclay.inria.fr/. S. Boldo is the principal investigator of this project.

The Coquelicot project aims at creating a modern formalization of the real numbers in *Coq*, with a focus on practicality [101], [65], [100],[19]. This is sorely needed to ease the verification of numerical applications, especially those involving advanced mathematics.

Partners: team SpecFun from LIX (Palaiseau), University Paris 13

8.1.2. *ELFIC*

Participants: Sylvie Boldo [contact], Claude Marché, Guillaume Melquiond.

ELFIC is a working group of the Digicosme Labex. S. Boldo is the principal investigator.

Project ELFIC focuses on proving the correctness of the FELiScE (Finite Elements for Life Sciences and Engineering) C++ library which implements the finite element method for approximating solutions to partial differential equations. Finite elements are at the core of numerous simulation programs used in industry. The formal verification of this library will greatly increase confidence in all the programs that rely on it. Verification methods developed in this project will be a breakthrough for the finite element method, but more generally for the reliability of critical software relying on intricate numerical algorithms.

Partners: Inria team Pomdapi; Ecole Polytechnique, LIX; CEA LIST; Université Paris 13, LIPN; UTC, LMAC (Compiègne).

8.2. National Initiatives

8.2.1. *ANR Ajacs*

Participant: Arthur Charguéraud [contact].

The AJACS research project is funded by the programme "Société de l'information et de la communication" of the ANR, for a period of 42 months, starting on October 1st, 2014.

The goal of the AJACS project is to provide strong security and privacy guarantees on the client side for web application scripts implemented in JavaScript, the most widely used language for the Web. The proposal is to prove correct analyses for JavaScript programs, in particular information flow analyses that guarantee no secret information is leaked to malicious parties. The definition of sub-languages of JavaScript, with certified compilation techniques targeting them, will allow deriving more precise analyses. Another aspect of the proposal is the design and certification of security and privacy enforcement mechanisms for web applications, including the APIs used to program real-world applications. On the Toccata side, the focus will be on the formalization of secure subsets of JavaScript, and on the mechanization of proofs of translations from high-level languages into JavaScript.

Partners: team Celtique (Inria Rennes - Bretagne Atlantique), team Prosecco (Inria Paris - Rocquencourt), team Indes (Inria Sophia Antipolis - Méditerranée), and Imperial College (London).

8.2.2. *ANR FastRelax*

Participants: Sylvie Boldo [contact], Guillaume Melquiond.

This is a research project funded by the programme "Ingénierie Numérique & Sécurité" of the ANR. It is funded for a period of 48 months and it has started on October 1st, 2014. http://fastrelax.gforge.inria.fr/

Our aim is to develop computer-aided proofs of numerical values, with certified and reasonably tight error bounds, without sacrificing efficiency. Applications to zero-finding, numerical quadrature or global optimization can all benefit from using our results as building blocks. We expect our work to initiate a "fast and reliable" trend in the symbolic-numeric community. This will be achieved by developing interactions between our fields, designing and implementing prototype libraries and applying our results to concrete problems originating in optimal control theory.

Partners: team ARIC (Inria Grenoble Rhône-Alpes), team MARELLE (Inria Sophia Antipolis - Méditerranée), team SPECFUN (Inria Saclay - Île-de-France), Université Paris 6, and LAAS (Toulouse).

8.2.3. ANR Soprano

Participants: Sylvain Conchon [contact], Évelyne Contejean, Guillaume Melquiond.

The Soprano research project is funded by the programme "Sciences et technologies logicielles" of the ANR, for a period of 42 months, starting on October 1st, 2014.

The SOPRANO project aims at preparing the next generation of verification-oriented solvers by gathering experts from academia and industry. We will design a new framework for the cooperation of solvers, focused on model generation and borrowing principles from SMT (current standard) and CP (well-known in optimization). Our main scientific and technical objectives are the following. The first objective is to design a new collaboration framework for solvers, centered around synthesis rather than satisfiability and allowing cooperation beyond that of Nelson-Oppen while still providing minimal interfaces with theoretical guarantees. The second objective is to design new decision procedures for industry-relevant and hard-to-solve theories. The third objective is to implement these results in a new open-source platform. The fourth objective is to ensure industrial-adequacy of the techniques and tools developed through periodical evaluations from the industrial partners.

Partners: team DIVERSE (Inria Rennes - Bretagne Atlantique), Adacore, CEA List, Université Paris-Sud, and OCamlPro.

8.2.4. ANR CAFEIN

Participant: Sylvain Conchon [contact].

The CAFEIN research project is funded by the programme "Ingénierie Numérique & Sécurité" of the ANR, for a period of 3 years, starting on February 1st, 2013. https://cavale.enseeiht.fr/CAFEIN/.

This project addresses the formal verification of functional properties at specification level, for safety critical reactive systems. In particular, we focus on command and control systems interacting with a physical environment, specified using the synchronous language Lustre.

A first goal of the project is to improve the level of automation of formal verification, by adapting and combining existing verification techniques such as SMT-based temporal induction, and abstract interpretation for invariant discovery. A second goal is to study how knowledge of the mathematical theory of hybrid command and control systems can help the analysis at the controller's specification level. Third, the project addresses the issue of implementing real valued specifications in Lustre using floating-point arithmetic.

Partners: ONERA, CEA List, ENSTA, teams Maxplus (Inria Saclay - Île-de-France), team Parkas (Inria Paris - Rocquencourt), Perpignan University, Prover Technology, Rockwell Collins.

8.2.5. ANR BWare

Participants: Sylvain Conchon [contact], Évelyne Contejean, Jean-Christophe Filliâtre, Andrei Paskevich, Claude Marché.

The BWare research project is funded by the programme "Ingénierie Numérique & Sécurité" of the ANR, a period of 4 years, starting on September 1st, 2012. http://bware.lri.fr.

BWare is an industrial research project that aims to provide a mechanized framework to support the automated verification of proof obligations coming from the development of industrial applications using the B method and requiring high guarantee of confidence. The methodology used in this project consists in building a generic platform of verification relying on different theorem provers, such as first-order provers and SMT solvers. The variety of these theorem provers aims at allowing a wide panel of proof obligations to be automatically verified by the platform. The major part of the verification tools used in BWare have already been involved in some experiments, which have consisted in verifying proof obligations or proof rules coming from industrial applications [109]. This therefore should be a driving factor to reduce the risks of the project, which can then focus on the design of several extensions of the verification tools to deal with a larger amount of proof obligations.

The partners are: Cedric laboratory at CNAM (CPR Team, project leader); teams Gallium and Deducteam (Inria Paris - Rocquencourt) ; Mitsubishi Electric R&D Centre Europe, ClearSy (the company which develops and maintains *Atelier B*), and the start-up OCamlPro.

8.2.6. ANR Verasco

Participants: Guillaume Melquiond [contact], Sylvie Boldo, Arthur Charguéraud, Claude Marché.

The Versaco research project is funded by the programme "Ingénierie Numérique & Sécurité" of the ANR, for a period of 4 years, starting on January 1st, 2012. Project website: http://verasco.imag.fr.

The main goal of the project is to investigate the formal verification of static analyzers and of compilers, two families of tools that play a crucial role in the development and validation of critical embedded software. More precisely, the project aims at developing a generic static analyzer based on abstract interpretation for the C language, along with a number of advanced abstract domains and domain combination operators, and prove the soundness of this analyzer using the *Coq* proof assistant. Likewise, it will keep working on the CompCert C formally-verified compiler, the first realistic C compiler that has been mechanically proved to be free of miscompilation, and carry it to the point where it could be used in the critical software industry.

Partners: teams Gallium and Abstraction (Inria Paris - Rocquencourt), Airbus avionics and simulation (Toulouse), IRISA (Rennes), Verimag (Grenoble).

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

Project acronym: ERC Deepsea

Project title: Parallel dynamic computations

Duration: Jun. 2013 - Jun. 2018

Coordinator: Umut A. Acar

Other partners: Carnegie Mellon University

Abstract:

The objective of this project is to develop abstractions, algorithms and languages for parallelism and dynamic parallelism with applications to problems on large data sets. Umut A. Acar (affiliated to Carnegie Mellon University and Inria Paris - Rocquencourt) is the principal investigator of this ERC-funded project. The other main researchers involved are Mike Rainey (Inria, Gallium team), who is full-time on the project, and Arthur Charguéraud (Inria, Toccata team), who works 40% of his time to the project. Project website: http://deepsea.inria.fr/.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Declared Inria International Partners

S. Conchon, A. Mebsout and F. Zaïdi (VALS group, LRI) collaborate with S. Krstic and A. Goel (Intel Strategic Cad Labs in Hillsboro, OR, USA), in particular around the development of the SMT-based model checker Cubicle (see above). This collaboration is partly supported by an academic grant by Intel.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- P. Roux (ISAE, Onera) visited for 7 months in order to collaborate with S. Boldo and G. Melquiond on the topic of formal verification of numerical algorithms.

- Bas Spitters visited for 3 months from April to June funded by a Digiteo grant. He worked with C. Paulin on the extension of the ALEA library to continuous structures and the use of "lower reals" (monotonic sequences of rationals). He also worked on adapting the Corn and Math-classes libraries to the new Coq release. During that time he published a final version of a paper presented at the Workshop on Quantum Physics and Logic in 2012 [119].

- Andrew Tolmach is a visiting researcher from Portland State University, on a one-year Digiteo Chair. His research project will initiate a new research effort to develop principles, techniques, and tools for large-scale proof engineering. It is focused on the Coq proof assistant and is designed to take advantage of the deep pool of expertise available in the Paris area (at Paris-Sud, LIX, Inria, etc.) concerning both the use and development of Coq. Initial results are expected to include: a precise description of requirements for large proof management; sample prototype tools addressing one or more of these requirements; and a technical survey of relevant proof representation options.