Activity Report 2016

Section Partnerships and Cooperations

<h1 style="text-align:center; color:red">BONSAI Project-Team</h1>

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

- ANR ASTER: ASTER is a national project that aims at developing algorithms and software for analyzing third-generation sequencing data, and more specifically RNA sequencing. BONSAI is the principal investigator in this ANR. Other partners are Erable (LBBE in Lyon) and two sequencing and analysis platforms that have been very active in the MinION Access Program (Genoscope and Institut Pasteur de Lille).

- PIA France Génomique: National funding from "Investissements d'Avenir" (call *Infrastructures en Biologie-Santé*). France Génomique is a shared infrastructure, whose goal is to support sequencing, genotyping and associated computational analysis, and increases French capacities in genome and bioinformatics data analysis. It gathers 9 sequencing and 8 bioinformatics platforms. Within this consortium, we are responsible for the workpackage devoted to the computational analysis of sRNA-seq data, in coordination with the bioinformatics platform of Génopole Toulouse-Midi-Pyrénées.

9.1.2. ADT

- ADT Vidjil (2015–2017): The purpose of this ADT is to strengthen Vidjil development and to ensure a better diffusion of the software by easing its installation, administration and usability. This will enable the software to be well suited for a daily clinical use. The software is already used in test on our own web server (more than 5,000 samples processed by now). Vidjil is now used in a routine practice by three French hospitals and one German hospital. By the end of the ADT, we expect this number to increase and the software to be directly installed inside some hospitals.

9.2. European Initiatives

9.2.1. Collaborations in European Programs, Except FP7 & H2020

International ANR RNAlands (2014-2017): National funding from the French Agency Research (call *International call*). Our objective is the fast and efficient sampling of structures in RNA Folding Landscapes. The project gathers three partners: Amib from Inria Saclay, the Theoretical Biochemistry Group from Universität Wien and BONSAI.

Interreg Va (France-Wallonie-Vlaanderen) : Portfolio "SmartBioControl", including 5 constitutive projects and 25 partners working together towards sustainable agriculture.

9.3. International Initiatives

9.3.1. Inria Associate Teams Not Involved in an Inria International Labs

9.3.1.1. CG-ALCODE

Title: Comparative Genomics for the analysis of gene structure evolution: ALternative CODing in Eukaryote genes through alternative splicing, transcription, and translation.

International Partner (Institution - Laboratory - Researcher):

Université du Québec À Montréal (Canada) - Laboratoire de combinatoire et d'informatique mathématique (LaCIM) - Anne Bergeron

From 2014 to 2017

The aim of this Associated Team is the development of comparative genomics models and methods for the analysis of eukaryote genes structure evolution. Our goal is to answer very important questions arising from recent discoveries on the major role played by alternative transcription, splicing, and translation, in the functional diversification of eukaryote genes. Two working meeting took place in 2016. S. Blanquart and J.-S. Varré met A. Bergeron and K. Swenson in Montpellier, from 13th to 15th of April. J.-S. Varré and K. Swenson met A. Bergeron in Montréal, from 8th to 19th of November.

9.3.2. Inria International Partners

9.3.2.1. Informal International Partners

- *Astrid Lindgrens Hospital, Stockholm University:* Collaboration with Anna Nilsson and Shanie Saghafian-Hedengren on RNA sequencing of stromal cells.
- *Childhood Leukaemia Investigation Prague (CLIP), Department of Pediatric Hematology/Oncology, 2nd Faculty of Medicine, Charles University, Prague, Czech Republic:* Collaboration with Michaela Kotrová and Eva Fronkova on leukemia diagnosis and follow-up.
- *CWI Amsterdam:* Collaboration with Alexander Schoenhuth and Jasmijn Baaijens on succinct data structures and algorithms for the assembly of viral quasispecies.
- *Department of Statitics, North Carolina State University:* Collaboration with Donald E. K. Martin on spaced seeds coverage.
- *Département des Sciences de la Vie, Faculté des Sciences de Liège:* Collaboration with Denis Beaurain on nonribosomal peptides.
- *Gembloux Agro-Bio Tech, Université de Liège:* Collaboration with Philippe Jacques on nonribosomal peptides.
- *Institut für Biophysik und physikalische Biochemie, University of Regensburg:* Collaboration with Rainer Merkl on ancestral sequence inference and synthesis.
- *Institute of Biosciences and Bioresources, Bari:* Collaboration with Nunzia Scotti on the assembly of plant mitochondrial genomes.
- *Makova lab, The Pennsylvania State University:* Collaboration with Kateryna Makova and Samarth Rangavittal on the assembly of the gorilla Y chromosome, and visualisation of assembly graphs.
- *Medvedev lab, The Pennsylvania State University:* Collaboration with Paul Medvedev on algorithms for constructing de Bruijn graphs.
- *Novo Nordisk Foundation Center for Biosustainability, Technical University of Denmark:* Collaboration with Tilmann Weber on nonribosomal peptides.
- *Proteome Informatics Group, Swiss Institute of Bioinformatics:* Collaboration with Frédérique Lisacek on nonribosomal peptides.
- *School of Social and Community Medicine, University of Bristol:* Collaboration with Marc Duez, John Moppett and Stephanie Wakeman on leukemia diagnosis follow-up.
- *Theoretical Biochemistry Group, Universität Wien:* Collaboration with Andrea Tanzer and Ronny Lorenz on RNA folding and RNA kinetics.

9.3.3. Participation in Other International Programs

- Participation in the EuroClonality-NGS consortium. This consortium aims at standardizing the study of immune repertoire, clonality and minimal residual disease in leukemia at the european level. We are part of the bioinformatics workgroup led by Nikos Darzentas (CEITEC, Brno, Czech Republic).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Dr. Alexander Schoenhuth (group leader, *CWI Amsterdam*) and Jasmijn Baaijens (PhD student, *CWI Amsterdam*).

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. Inserm

Olivier Goury was hired as a postdoctoral researcher by the "Réhabilitation chirurgicale mini-invasive et robotisée de l'audition" to collaborate with the DEFROST team on the simulation of Cochlear Implant surgery. The contract stopped since Olivier has been recruited as a Research scientist. The collaboration with Inserm will be continued with the hiring of Piyush Jain as an engineer.

9.1.2. ANR

- **Sorcery** The goal of this project was to work on the modeling, simulation and control of soft surgical robot with a particular focus in cochlear implantology. A very good consortium was built around the project that went to phase 2 in the ANR project. Unfortunately, the project has not been funded.

- **IDeaS**, Image-Driven Simulation, Jeremie Dequidt, Magrit, MIMESIS and Nancy Hospital, 42 months,: this is a project targeted at per-operative guidance for interventional radiology procedures. Our main goal is to provide effective solutions for the two main drawbacks of interventional radiology procedures, namely: reduce radiation exposure and provide a fully 3D and interactive visual feedback during the procedure. To do so, our project relies on an original combination of computer vision algorithms and interactive physics-based medical simulation.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

Program: FET Open

Project acronym: RoboSoft

Project title: Coordination Action for Soft Robotics

Duration: 2014-2016

Coordinator: Cecilia Laschi (Scuola Superiore Sant'Anna)

9.3. International Initiatives

9.3.1. Declared Inria International Partners

We have a collaboration with King's College (Profs Kaspar Althoefer and Hongbin Liu) on soft hydraulic robots with the support of the program North European associate team of the center Inria Lille North Europe (2014-2016)

We have started a collaboration with the Université Libre de Bruxelles (Profs Denis Terwagne, Serge Massar, Marc Haelterman and Guillaume Tillema) on the use of soft robot simulation to build control strategies based on artificial intelligence algorithms (2016-2018)

9.3.2. Informal International Partners

This section includes some recent collaboration. We have initiated research work with Prof. Bordas at the University of Luxembourg on Model reduction with contacts. We are also working with Adrien Escande and with Prof. Yoshida, at AIST Japan, on the simulation of deformable objects in contact and with Prof Miguel Otaduy at URJC Madrid on human hand grasping and manipulation (Conference paper in 2014 and journal paper in 2015).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Ugo Chouinard was a research intern in the Defrost team from September to December 2016. He is a PhD candidate in mechanical engineering at Polytechique Montréal (Canada) and obtained the Mitacs-Globalink Research Award that allowed him to join our team for a few months. He investigated the effect of design change on the compliance of deformable manipulators. The result of his research will help to better understand and design soft robotic manipulators. Indeed, with the research he carried out, it will be easier to design robots that meet the design specifications. Furthermore, his internship might lead to further collaboration with Polytechnique Montréal for the design of soft robotics systems.

- Alejandro Rodriguez Aguilera from the University of Granada, stayed from March to June 2016. His works on GPU computing allowed him to develop a parallelized hydraulics systems simulation and integrate it into the SOFA Framework.

9.4.1.1. Internships

- Valentin Owczarek was a research intern in the Defrost team from March to September 2016. He worked on using genetics algorithm to generate task specific soft-robot designs.

- During the internship of Piyush Jain (India) from April 2016 to September 2016, it was observed that it is possible to create the concept of self-contained pneumatic actuation for soft robots without the need for an external pneumatic supply.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

- CPER "data" (2015-2020): co-leader of a workpackage "Research infrastructures". The objective is to support research related to data science including high performance computing for combinatorial optimization using the Grid'5000 grid infrastructure.
- ELSAT (2015-2019) of CPER (Contrat Plan Etat Région) : transversal research action "Planning and scheduling of maintenance logistics in transportation".

9.2. National Initiatives

9.2.1. ANR

- ANR project Modèles Numériques "NumBBO - Analysis, Improvement and Evaluation of Numerical Blackbox Optimizers" (2012-2016) in collaboration with Inria Saclay, TAO team, Ecole des Mines de St. Etienne, CROCUS team, and TU Dortmund University, Germany (2012-2016).
- ANR project TECSAN (Technologies pour la Santé) "ClinMine - Optimisation de la prise en Charge des Patients à l'Hôpital", in collaboration with University Lille 1, Université Lille 2, Inria, CHRU Lille, CHICL, Alicante (7 partners) (2014-2017) - Coordinator -
- Bilateral ANR/RGC France/Hong Kong PRCI "Big Multiobjective Optimization" (2016-2021) in collaboration with City University of Hong Kong.
- PGMO project "Towards a Complexity Theory for Black-Box Optimization", together with Carola Doerr (CNRS, LIP6), Benjamin Doerr (Ecole Polytechnique), Anne Auger, Nikolaus Hansen (both Inria Saclay), Timo Koetzing (University of Jena, Germany), Johannes Lengler (ETH Zurich, Switzerland), and Jonathan Rowe (The University of Birmingham, UK), (2014-2016)
- PGMO project "Demand side management in smart grids", together with EDF, (2015-2017).

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

Program: H2020

Project acronym: SYNERGY

Project title: Synergy for Smart Multi-Objective Optimisation

Duration: 02 2016 - 01 2019

Coordinator: Jožef Stefan Institute (JSI), Ljubljana, Slovenia

Other partners: University of Lille (France), Cologne University of Applied Sciences (Germany)

Abstract: Many real-world application areas, such as advanced manufacturing, involve optimisation of several, often time-consuming and conflicting objectives. For example, they require the maximisation of the product quality while minimising the production cost, and rely on demanding numerical simulations in order to assess the objectives. These, so-called multi-objective optimisation problems can be solved more efficiently if parallelisation is used to execute the simulations simultaneously and if the simulations are partly replaced by accurate surrogate models.

9.3.2. Collaborations with Major European Organizations

University of Luxembourg: (Luxembourg)

Energy aware scheduling in Cloud computing systems

University of Oviedo: (Spain)

Optimization under uncertainty for fuzzy flow shop scheduling

University of Elche and University of Murcia: (Spain)

Matheuristics for DEA

9.4. International Initiatives

9.4.1. Inria International Labs

- LIRIMA Afrique: Equipe associér avec l'EMI (Ecole Mohammadia d'Ingénieurs), Morocco

9.4.2. Inria Associate Teams Not Involved in an Inria International Labs

9.4.2.1. MOHA

Title: Mixed Multi-objective Optimization using Hybrid Algorithms: Application to smart grids

International Partner (Institution - Laboratory - Researcher):

Ecole Mohammadia d'Ingénieurs (Morocco) - LERMA (Laboratoire d'Etudes et de Recherches en Mathématiques Appliquées) - Rachid Ellaia

Start year: 2016

See also: https://ocm.univ-lille1.fr/ talbi/momh

The key challenge of this project is to propose new optimization models and new hybrid algorithms to the demand side management of smart grids in a context of uncertainty and in the presence of several conflicting objectives.

Those complex optimization problems are also characterized by the presence of both continuous and discrete variables. We need to design new efficient optimization algorithms combining state of the art exact and metaheuristic algorithms from the global optimization and combinatorial optimization communities

9.4.2.2. s3-bbo

Title: Threefold Scalability in Any-objective Black-Box Optimization (s3-bbo)

International Partner (Institution - Laboratory - Researcher):

Shinshu University, Japan

Duration: 2015-2017

See also: http://francejapan.gforge.inria.fr/doku.php?id=associateteam

The main scientific goals of this collaboration is to theoretically derive, analyze, design, and develop scalable evolutionary and other stochastic local search algorithms for large-scale optimization considering three different axes of scalability: (i) decision space, (ii) objective space, and (iii) availability of distributed and parallel computing resources. This research will allow us to design, control, predict, analyze and optimize parameters of recent complex, large-scale, and computationally expensive systems, providing the basic support for problem solution and decision-making in a variety of real world applications. For single-objective continuous optimization, we want to theoretically derive variants of the state-of-the-art CMA-ES with linear time and space complexity scalings with respect to the number of variables. We will exploit the information geometry framework to derive updates using parametrization of the underlying family of probability distribution involving a linear number of components. The challenges are related to finding good representations that are theoretically tractable and meaningful. For the design of robust algorithms, implementing the derived updates, we plan to follow the same approach as for the design of CMA-ES. For multi- and many-objective optimization, we will start by characterizing and defining new metrics and methodologies to analyze scalability in the objective space and in terms of computational resources. The first challenge is to

accurately measure the impact of adding objectives on the search behavior and on the performance of evolutionary multi- and many- objective optimization (EMyO) algorithms. The second challenge is to investigate the new opportunities offered by large-scale computing platforms to design new effective algorithms for EMyO optimization. To this end, we plan to follow a feature-based performance analysis of EMyO algorithms, to design new algorithms using decomposition-based approaches, and to investigate their mapping to a practical parallel and distributed setting.

9.4.3. Inria International Partners

9.4.3.1. Declared Inria International Partners

- Memorandum of Understanding between Shinshu University (Japan) and Inria, signed on March 2014

9.4.3.2. Informal International Partners

- University of Coimbra, Portugal
- University of Manchester, U.K.
- Collaboration with Université de Mons (UMONS). The collaboration consists mainly in the joint supervision of the Ph.D thesis of Jan Gmys started in 2014.

9.4.4. Participation in Other International Programs

- JSPS-MEXT project on Evolutionary multi-objective optimization, landscape analysis, and search performance, with Shinshu University, Japan (2013—2016)

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Hernan Aguirre, Shinshu University, Japan
- Fabio Daolio, University of Stirling, U.K.
- Luis Paquete, University of Coimbra, Portugal
- Kiyoshi Tanaka, Shinshu University, Japan
- Saúl Zapotecas-Martínez, Shinshu University, Japan
- Qingfu Zhang, City University, Hong Kong
- Dr. Myriam Delgado (Federal University of Technology of Paraná, Brazil), 1 week, April 2016
- Prof. Fred Glover (University of Colorado, USA), 1 month, Nov 2016
- Dr Lakhdar Loukil from Université d'Oran, Algeria (January 18-22, 2016).

9.5.1.1. Internships

- Oliver Cuate, CINVESTAV, Mexico
- Miyako Sagawa, Shinshu University, Japan

9.5.2. Visits to International Teams

9.5.2.1. Sabbatical programme

- E-G. Talbi has a one-year sabbatical program for 2016 and 2017.

9.5.2.2. Research Stays Abroad

- E-G. Talbi: University of Florida, USA, 1 month, 2016.
- E-G. Talbi: University of Colorado, USA, 1 month, 2016.

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

7. Partnerships and Cooperations

7.1. International Initiatives

7.1.1. Inria International Partners

7.1.1.1. Informal International Partners

In 2016 we have continued our strong and long-term collaboration with Prof. Dorel Lucanu's group Univ. Iasi as witnessed by the co-authored publications (3 journals and 1 conference). Vlad Rusu serves as "external advisor for PhD students" in Prof. Lucanu's group. In 2016 we have also had notable interactions with Prof. José Meseguer (Univ. Illinois at Urbana Champaign, USA), which consisted in sharing ideas and mutual reading and commenting advanced drafts prior to submission in journals/conferences.

FUN Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Tracaverre

Participants: Nathalie Mitton [correspondant], Gabriele Sabatino.

Title: Tracaverre

Type: FUI

Duration: November 2012 - Dec 2016

Coordinator: Saver Glass

Others partners: Inria FUN IEMN Courbon Camus La Grande Marque LIRIS DISP

Tracaverre studies the use of RFID for traceability of prestigious bottles. Tracaverre has yielded to the implementation of the T-Scan software.

9.1.2. StoreConnect

Participants: Nathalie Mitton [correspondant], Valeria Loscri.

Title: StoreConnect

Type: FUI

Duration: September 2016 - October 2018

Coordinator: NEOSENSYS

Others partners: Inria FUN, SPIRALS and STARS, TeVolys, Ubudu, Smile, STIME, Leroy Merlin

The aim of StoreConnect is to provide French large retailers with efficient and powerful tools in the in-store customer interaction.

9.1.3. PIPA

Participants: Nathalie Mitton [correspondant], Farouk Mezghani, Cristina Cano Bastidas.

Title: Partager de l'Info PArtout à bas coût

Type: Chercheur citoyen

Duration: Dec 2015 - Dec 2017

Coordinator: Inria FUN

Others partners: SpotTrotter

PIPA project aims to provide an innovative low cost solution to share information in places where communication infrastructure are lacking, insuffisant or not adapted, going beyond technical, economical or political limitations.

9.2. National Initiatives

9.2.1. Inria Project Lab

9.2.1.1. CityLab@Inria
Participants: Valeria Loscri, Abdoul Aziz Mbacke, Nathalie Mitton [correspondant].

- Title: CityLab@Inria
- Type: IPL
- Duration: 2015 - 2019
- Coordinator: Valerie Issarny
- CityLab@Inria studies ICT solutions toward smart cities that promote both social and environmental sustainability. A strong emphasis of the Lab is on the undertaking of a multi-disciplinary research program through the integration of relevant scientific and technology studies, from sensing up to analytics and advanced applications, so as to actually enact the foreseen smart city Systems of Systems. Obviously, running urban-scale experiments is a central concern of the Lab, so that we are able to confront proposed approaches to actual settings. The Lab's research leverages relevant effort within Inria project-teams that is further revisited as well as integrated to meet the challenges of smart cities. Research themes span: energy-efficient wireless communication protocols, urban-scale social and physical sensing, privacy by design, cloud-based urban data management, data assimilation, visual analysis, and urban system software engineering. In addition, CityLab Inria research builds upon collaborative effort at the International level, and especially collaboration in the context of the Inria SiliconValley program. This project has yield to the set up of a full course on Smart Cities via a MOOC.

9.2.2. ADT

9.2.2.1. RFunID
Participants: Clement Fumey, Nathalie Mitton [correspondant], Julien Vandaele.

Duration: September 2015 - August 2017

Coordinator: Inria FUN

The purpose of this project is to deploy a large scale experimental RFID platform that enables remote programmation of RFID scenario on heterogeneous devices.

9.2.2.2. ARUNTA
Participants: Emilio Compagnone, Valeria Loscri [correspondant], Julien Vandaele.

Title: Arduino-based Robots for Ubiquitous Network (ARUNTA)

Type: ADT

Duration: September 2014 - August 2016

Coordinator: Inria FUN

Abstract: This ADT focuses on the use of Arduino, an open-source electronics prototyping platform, really flexible and easy-to-use [1] to allow a fleet of robots to perform specific tasks. The goal of the ADT is to make experiments on Arduino-based robotic platforms, by implementing two robot cooperation algorithms that have been already tested through simulation tools. In order to extend the users' community and to allow more people to benefit from this research on robot cooperation, this ADT will output a tutorial and a test-bed will be developed. Moreover, the final project will be shared with the Arduino community and every interested user.

9.2.3. Equipements d'Excellence

9.2.3.1. FIT

Participants: Nathalie Mitton [correspondant], Julien Vandaele.

Title: Future Internet of Things

Type: EquipEx

Duration: March 2010 - December 2019

Coordinator: UPMC

See also: http://fit-equipex.fr/

Abstract: 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 will provide this facility with a set of complementary components that enable experimentation on innovative services for academic and industrial users. The project will give 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 is one of 52 winning projects from the first wave of the French Ministry of Higher Education and Research's "Equipements d'Excellence" (Equipex) research grant program. Coordinated by Professor Serge Fdida of UPMC Sorbonne Universités and running over a nine-year period, the project will benefit from a 5.8 million euro grant from the French government. This project has yield to several publications in 2016: [44], [43].

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. VITAL

Participants: Salvatore Guzzo Bonifacio, Valeria Loscri, Nathalie Mitton [correspondant], Riccardo Petrolo.

Title: Virtualized programmable InTerfAces for innovative cost-effective IoT depLoyments in smart cities

Programm: FP7

Duration: September 2013 - December 2016

Coordinator: National University of Ireland Galway (NUIG)

Partners:

> Research and Education Laboratory in Information Technologies (Greece)
>
> Atos Spain (Spain)
>
> Camden Town Center (United Kingdom)
>
> Images & Co (United Kingdom)
>
> Istanbul Metropolitan Municipality (Turkey)
>
> Istanbul Teknik Universitesi (Turkey)
>
> National University of Ireland, Galway (Ireland)
>
> Santer Reply Spa (Italy)
>
> Singularlogic Anonymi Etairia Pliroforiakon Sistimaton Kai Efarmogon Pliroforikis (Greece)

Inria contact: Nathalie Mitton

Internet-of-Things (IoT) applications are currently based on multiple architectures, standards and platforms, which have led to a highly fragmented IoT landscape. This fragmentation is evident in the area of smart cities, which typically comprise several technological silos (i.e. IoT systems that have been developed and deployed independently). Nowadays there is a pressing need to remove these silos in order to allow cities to share data across systems and coordinate processes across domains, thereby essentially improving sustainability and quality of life. In response to this need, VITAL will realize a radical shift in the development, deployment and operation of IoT applications, through introducing an abstract virtualized digital layer that will operate across multiple IoT architectures, platforms and business contexts. Specifically, VITAL will provide platform and business context agnostic access to Internet-Connected-Objects (ICO). Moreover, it will research virtualized filtering, complex event processing (CEP) and business process management mechanisms, which will be operational over a variety of IoT architectures/ecosystems. The mechanisms will compromise the diverse characteristics of the underlying ecosystems, thereby boosting interoperability at the technical and business levels. VITAL will also provide development and governance tools, which will leverage the project's interfaces for virtualized access to ICOs.VITAL will allow solution providers to (re)use a wider range of data steams, thereby increasing the scope of potential applications. It will also enable a more connected/integrated approach to smart city applications development, which will be validated in realistic deployments in London and Istanbul. The partners will contribute and adapt a host of readily available urban infrastructures, IoT platforms and novel IoT applications, which will ease the accomplishment of the project's goals based on an optimal value for EC money. Publications in 2016 in the framework of this project are: [21], [44], [43], [42].

9.3.1.2. VESSEDIA

Participant: Simon Duquennoy [correspondant].

Title: VERIFICATION ENGINEERING OF SAFETY AND SECURITY CRITICAL DYNAMIC INDUSTRIAL APPLICATIONS

Programm: H2020

Duration: January 2017 - Dec. 2019

TECHNIKON FORSCHUNGS UND PLANUNGSGESELLSCHAFT MBH (TEC) The VESSEDIA project will bring safety and security to many new software applications and devices. In the fast evolving world we live in, the Internet has brought many benefits to individuals, organisations and industries. With the capabilities offered now (such as IPv6) to connect billions of devices and therefore humans together, the Internet brings new threats to the software developers and VESSEDIA will allow connected applications to be safe and secure. VESSEDIA proposes to enhance and scale up modern software analysis tools, namely the mostly open-source Frama-C Analysis platform, to allow developers to benefit rapidly from them when developing connected applications. At the forefront of connected applications is the IoT, whose growth is exponential and whose security risks are real (for instance in hacked smart phones). VESSEDIA will take this domain as a target for demonstrating the benefits of using our tools on connected applications. VESSEDIA will tackle this challenge by 1) developing a methodology that allows to adopt and use source code analysis tools efficiently and produce similar benefits than already achieved for highly-critical applications (i.e. an exhaustive analysis and extraction of faults), 2) enhancing the Frama-C toolbox to enable efficient and fast implementation, 3) demonstrating the new toolbox capabilities on typical IoT (Internet of Things) applications including an IoT Operating System (Contiki), 4) developing a standardisation plan for generalizing the use of the toolbox, 5) contributing to the Common Criteria certification process, and 6) defining a label "Verified in Europe" for validating software products with European technologies such as Frama-C.

9.4. International Initiatives

9.4.1. Inria International Labs

9.4.1.1. PREDNET

Participants: Simon Duquennoy, Nathalie Mitton [correspondant], Viktor Toldov, Julien Vandaele.

Title: Predator network

Type: LIRIMA with Stellenbosch University, South Africa

Duration: January 2013 - December 2016

See also: https://iww.inria.fr/prednet/en/

Abstract: PREDNET (PREDator adhoc NETwork) proposes to do research on the most suitable topology and subsequent deployment of a wireless sensor network for sparsely populated outlying rural and wilderness areas, for effective monitoring and protection of resources and ecosystems. This collaboration gave birth to joint project submission, joint conference organization and several publications, among them for 2016 [47], [48], [48], [49].

9.4.2. Inria Associate Teams Not Involved in an Inria International Labs

9.4.2.1. DepIoT
Participants: Simon Duquennoy [correspondant], Nathalie Mitton.

Title: DepIoT: Coexistence and Security for Dependable Internet of Things

Type: North-European Inria Associate Team with SICS, Sweden

Duration: Sept 2016 - August 2018

Abstract: In order to foster the adoption of IoT technologies, dependability must be guaranteed. We will tackle this challenge by ensuring operation even in the presence of other networks sharing the same frequency band (coexistence) and by enabling a secure communication.

9.4.3. Inria International Partners

9.4.3.1. Declared Inria International Partners

Université Mediterranea di Reggio Calabria (UNIC) (Italy) Objective of this collaboration is the design of an innovative architecture that enables autonomic and decentralized fruition of the services offered by the network of smart objects in many heterogeneous and dynamic environments, in a way that is independent of the network topology, reliable and flexible. The result is an 'ecosystem' of objects, self-organized and self-sustained, capable of making data and services available to the users wherever and whenever required, thus supporting the fruition of an 'augmented' reality thanks to a new environmental and social awareness. This collaboration has allowed students and researchers exchanges and joint publications, among them for 2016: [20], [19].

9.4.3.2. Informal International Partners
Southern University, China

The purpose of this collaboration is to study the green (or energy-efficient) communication problem in vehicular ad hoc networks (VANETs) and the application of vehicular network communication in green transportation. In this framework, Nathalie Mitton visited the Nanjing University. It gave birth to joint project submission, joint conference organization (UIC 2016) and joint publications, one in 2016 [27].

Arun Sen from Arizona State University, USA

The purpose of this collaboration is to study the joint scheduling and trajectory of RFID readers in a mobile environment. In this framework, Arun Sen visited the FUN team for 6 months in 2015 and in July 2016. It gave birth to joint project submission, joint conference submission and joint publications, among them in 2016 [30], [29].

Anna-Maria Vegni from Roma Tre University, Italy

The purpose of this collaboration is to study alternative communication paradigms and investigate their limitations and different effects on performances. In this framework, joint publications have been obtained, among them in 2016 [51], [26], [53], [50], [46], [40], [16], [55], [15], [45], [25].

9.4.3.3. PhD co-supervision
Participants: Nathalie Mitton [correspondant], Mouna Masmoudi.

Since January 2013, Nathalie Mitton co-supervises Mouna Rekik as a PhD student with Pr Zied Chtourou from Université de Sfax, Tunisia. Her topic is about swarm intelligence based multi-path geographic routing for wireless sensor and actuator networks.

This work has led to the following publications in 2016: [23]. Mouna defended her PhD on July 26th 2016.

Since 2014, Simon Duquennoy co-supervised Anwar Hithnawi as a PhD student with Pr Friedemann Mattern from ETH Zurich, Sweden. Her research is on low-power wireless systems coexistence, and mitigation of cross-technology inteference. This work has led to the following publications in 2016: [39]. Anwar defended her PhD on November 8, 2016.

9.4.4. Participation in Other International Programs

9.4.4.1. CROMO

Participants: Valeria Loscri, Nathalie Mitton [correspondant], Riccardo Petrolo, Abdoul Aziz Mbacke.

Title: Crowd Data In the mobile cloud

Duration: January 2015 - December 2019

CroMo (Crowd Data In the mobile cloud) is a submission to the CAPES-COFECUB project call lead by Inria from the French side and University of Rio de Janeiro from Brazilian Side. Other partner institutions are Université Pierre et Marie Curie and Université de la Rochelle.

Mobile cloud computing is an emerging paradigm to improve the quality of mobile applications by transferring part of the computational tasks to the resource-rich cloud. The multitude data sources combined with the known difficulties of wireless communications represent an important issue for mobile cloud computing. Therefore, the additional computational power added by the cloud has to deal with the constraints of the wireless medium. One could imagine a situation where different sensors collect data and require intensive computation. This data must be transmitted at high rates before becoming stale. In this case, the network becomes the main bottleneck, not the processing power or storage size. To circumvent this issue, different strategies can be envisioned. As usual alternatives, wireless data rates must be increased or the amount of data sent to the cloud must be reduced. CROMO tackles challenges from all these three components of the mobile clouds (data generation, collect and processing) to then integrate them as a whole enhanced mobile cloud with improved network performances in terms of delay, energy consumption, availability, and reliability.

In this context, joint exchanges and crossed visits have been done (Aziz went to Rio, Dianne went to Lille). The project yield to several publications such as [35], [36], [37].

9.5. International Research Visitors

9.5.1. Visits of International Scientists

9.5.1.1. Senior researchers

Several researchers have visited our group in 2016, mainly from our partner universities but not only:

- Zied Chtourou, Univ. Sfax, Tunisia, July 2016
- Arun Sen, Arizona State University, USA, July 2016
- Ahmet Sekercioglu, Monash University, Australia, July 2016
- Riaan Wolhuter, Univ. Stellenbosch, South Africa, July 2016
- Anwar Hithnawi, ETH Zurich, Switzerland, March 2016
- Hossein Shafagh, ETH Zurich, Switzerland, March 2016
- Cédric Chauvenet from ERDF, May 2016

9.5.1.2. Internships

Other students have visited us from our partner universities in the framework of the joint project we run together. This is the case for William Pretorius (2 months) who came from Stellenbosch university, South Africa, in the framework of the PredNET program and Rahul Vyas from IIIT Allahabad, India (2 months).

9.5.2. Visits to International Teams

- Riccardo Petrolo visited Ericsson group in Finland in April 2016.
- Nathalie Mitton visited Southeast university in Nanjing, China in June 2016.
- Simon Duquennoy visited SICS in Sweden in September 2016 and May 2016.
- Aziz Mbacke visited UFRJ in Brazil in November 2016.

<div align="center">

INOCS Team

</div>

8. Partnerships and Cooperations

8.1. Regional Initiatives

The ELSAT research program addresses the issues involved in sustainable transportation and mobility. Within ELSAT, INOCS is involved on two projects devoted to hybrid optimization methods in logistics and to city logistics in collaboration with LAMIH (University of Valenciennes), LGI2A (University of Artois) and LEOST (IFSTTAR). ELSAT is supported by the CPER 2015-2020 (State-Region Contract).

8.2. National Initiatives

8.2.1. ANR

ANR project PI-Commodality "Co-modal freight transportation chains: an approach based on physical internet" in collaboration with CGS-ARMINES (Paris), LAAS (Toulouse), DHL (2016 - 2018). The PI-co-modality project aims to design new sustainable logistic services between preset origins and destinations. It is based on innovative approaches both in terms of: 1) Logistics and transportation services : by considering the PI-internet approach, specifically: mesh logistics and transportation networks based on available capacities, by designing consistent integrated co-modal chains; 2)Methodology : by addressing the underlying problems according to two approaches: centralized and decentralized, by proposing news realistic models relevant for practitioner taking into account the consistency, by developing state-of-the-art decision making algorithms.

8.2.2. National Initiatives (Belgium)

Combinatorial Optimization: Meta-heuristics and Exact Methods (2012-2017, coordinator: Bernard Fortz (GOM-ULB/INOCS-Inria). Inter-university Attraction Pole funded by the Belgian Federal Science Policy Office. Study and modeling of combinatorial optimization problems; Advancements in algorithmic techniques; Implementation of solution methods for large-scale, practically relevant problems.

8.3. European Initiatives

8.3.1. Collaborations in European Programs, Except FP7 & H2020

Program: COST

Project acronym: TD1207

Project title: Mathematical Optimization in the Decision Support Systems for Efficient and Robust Energy Networks

Duration: 04/2014 - 04/2017

Coordinator: Thorsten Koch (ZIB, Germany)

INOCS partners: Bernard Fortz, Martine Labbé

Abstract: Energy Production and Distribution (EP&D) is among the biggest challenges of our time, since energy is a scarce resource whose efficient production and fair distribution is associated with many technical, economical, political and ethical issues like environmental protection and people health. EP&D networks have rapidly increased their size and complexity, e.g. with the introduction and interconnection of markets within the EU. Thus, there is an increasing need of systems supporting the operational, regulatory and design decisions through a highly inter-disciplinary approach, where experts of all the concerned fields contribute to the definition of appropriate mathematical models. This is particularly challenging because these models require the simultaneous use of many different mathematical optimization tools and the verification by experts of the underlying engineering and financial issues. The COST framework is instrumental for this Action to be able to coordinate the inter-disciplinary efforts of scientists and industrial players at the European level.

Program: JPI Urban Europe
Project acronym: e4-share
Project title: Models for Ecological, Economical, Efficient, Electric Car-Sharing
Duration: 10/2014 - 09/2017
Coordinator: Markus Leitner (University of Vienna, Austria)
Other partners:

- Austrian Institute of Technology, Austria
- Université Libre de Bruxelles (INOCS), Belgium
- University of Bologna, Italy
- tbw research GesmbH, Austria

Abstract: Car-sharing systems and the usage of electric cars become increasingly popular among urban citizens. Thus, providing vast opportunities to meet today's challenges in terms of environmental objectives, sustainability and living quality. Our society needs to manage a transformation process that ultimately shall lead to fewer emissions and less energy consumption while increasing the quality of public space available. In e4-share, the team will lay the foundations for efficient and economically viable electric car-sharing systems by studying and solving the optimization problems arising in their design and operations. A main goal is to derive generic methods and strategies for optimized planning and operating in particular for flexible variants which best meet preferences of customers but impose nontrivial challenges to operators. This project will develop novel, exact and heuristic, numerical methods for finding suitable solutions to the optimization problems arising at the various planning levels as well as new, innovative approaches considering these levels simultaneously.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Informal International Partners

- Department of Statistics and Operations Research, University of Vienna, Austria.
- Centre for Quantitative Methods and Operations Management, HEC-Liège, Belgique.
- Interuniversity Centre on Entreprise Networks, Transportation and Logistics, Montreal, Canada.
- Instituto Sistemas Complejos de Ingeniería (ISCI), Santiago, Chile.
- The Centre for Business Analytics, University College Dublin, Ireland.
- Department of Electrical, Electronic, and Information Engineering, University of Bologna, Italy.
- Department of Mathematics, University of Aveiro, Portugal.
- Department of Statistics and Operations Research, University of Lisbon, Portugal.
- Instituto de Matemáticas, University of Seville.
- Dipartimento di Matematica, Universita degli studi di Padova.

8.4.2. Participation in Other International Programs

- STIC Algérie, University of Oran, Algeria.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Yasemin Arda Da Silveira, HEC-École de gestion de l'Université de Liège, Visiting Scientist from Oct 2016 until Nov 2016
- Bernard Gendron, Université de Montréal, Visiting Scientist from Oct 2016 to Dec 2016
- Juan Alejandro Gomez Herrera, Ecole Polytechnique de Montréal, Visiting Scientist Oct 2016
- Daniele Vigo, Université de Bologne, Visiting Scientist, Dec 2016.

LINKS Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

Links participates in the CPER DATA (2015-19)

8.2. National Initiatives

ANR Aggreg (2014-19): Aggregated Queries.

- Particpants: J. Niehren [correspondent], P. Bourhis, A. Lemay, A. Boiret
- The coordinator is J. Niehren and the parteners are the University Paris 7 (A. Durand) including members of the Inria project DAHU (L. Ségoufin), the University of Marseille (N. Creignou) and University of Caen (E. Grandjean).
- Objective: the main goal of the Aggreg project is to develop efficient algorithms and to study the complexity of answering aggregate queries for databases and data streams of various kinds.

ANR Colis (2015-20): Correctness of Linux Scripts.

- Participants: J. Niehren [correspondent], A. Lemay, S. Tison, A. Boiret, V. Hugot.
- The coordinator is R. Treinen from the University of Paris 7 and the other partner is the Tocata project of Inria Saclay (C. Marché).
- Objective: This project aims at verifying the correctness of transformations on data trees defined by shell scripts for Linux software installation. The data trees here are the instance of the file system which are changed by installation scripts.

ANR DataCert (2015-20):

- Participants: I. Boneva [correspondent], S. Tison, J. Lozano.
- Partners: The coordinator is E. Contejean from the University of Paris Sud and the other partner is the University of Lyon.
- Objective: the main goals of the Datacert project are to provide deep specification in Coq of algorithms for data integration and exchange and of algorithms for enforcing security policies, as well as to design data integration methods for data models beyond the relational data model.

ANR Headwork (2016-21):

- Participants: P. Bourhis [correspondant], J. Niehren, M. Sakho.
- Scientific partners: The coordinateur is D. Gross-Amblard from the Druid Team (Rennes 1). Other partners include the Dahu team (Inria Saclay) and Sumo (Inria Bretagne)
- Industrial partners: Spipoll, and Foulefactory.
- Objective: The main object is to develop data-centric workflows for programming crowd sourcing systems in flexible declarative manner. The problem of crowd sourcing systems is to fill a database with knowledge gathered by thousands or more human participants. A particular focus is to be put on the aspects of data uncertainty and for the representation of user expertise.

ANR Delta (2016-21):

- Participants: P. Bourhis [correspondent], D. Gallois.

- Partners: The coordinator is M. Zeitoun from LaBRI, other partners are LIF (Marseille) and IRIF (Paris-Diderot).
- Objective: Delta is focused on the study of logic, transducers and automata. In particular, it aims at extending classical framework to handle input/output, quantities and data.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

AMSud project "Foundations of Graph Databases" (2015-16)

Partners: Chili (C. Riveros), Buenos Aires (Figueira), Bordeaux (G. Puppis).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Domagoj Vrgoc, DCC PUC Chile, From Aug 2016 Until Sep 2016

8.4.2. Visits to International Teams

8.4.2.1. Research Stays Abroad

Slawek Staworko, University of Edinburgh, 2014-16.

MAGNET Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

Participation to the *Data Advanced data science and technologies* project (CPER Data). This project, leaded by DAVID SIMPLOT-RYL, is organized following three axes: internet of things, data science, high performance computing. MAGNET is involved in the data science axis to develop machine learning algorithms for big data, structured data and heterogeneous data.

9.2. National Initiatives

9.2.1. ANR Pamela (2016-2020)

Participants: MARC TOMMASI [correspondent], AURÉLIEN BELLET, RÉMI GILLERON, FABIO VITALE

The Pamela project aims at developing machine learning theories and algorithms in order to learn local and personalized models from data distributed over networked infrastructures. Our project seeks to provide first answers to modern information systems built by interconnecting many personal devices holding private user data in the search of personalized suggestions and recommendations. More precisely, we will focus on learning in a collaborative way with the help of neighbors in a network. We aim to lay the first blocks of a scientific foundation for these new types of systems, in effect moving from graphs of data to graphs of data and learned models. We argue that this shift is necessary in order to address the new constraints arising from the decentralization of information that is inherent to the emergence of big data. We will in particular focus on the question of learning under communication and privacy constraints. A significant asset of the project is the quality of its industrial partners, Snips and Mediego, who bring in their expertise in privacy protection and distributed computing as well as use cases and datasets. They will contribute to translate this fundamental research effort into concrete outcomes by developing personalized and privacy-aware assistants able to provide contextualized recommendations on small devices and smartphones. https://project.inria.fr/pamela/.

9.2.2. ANR JCJC GRASP (2016-2020)

Participants: PASCAL DENIS [correspondent], AURÉLIEN BELLET, RÉMI GILLERON, MIKAELA KELLER, MARC TOMMASI

The GRASP project aims at designing new graph-based Machine Learning algorithms that are better tailored to Natural Language Processing structured output problems. Focusing on semi-supervised learning scenarios, we will extend current graph-based learning approaches along two main directions: (i) the use of structured outputs during inference, and (ii) a graph construction mechanism that is more dependent on the task objective and more closely related to label inference. Combined, these two research strands will provide an important step towards delivering more adaptive (to new domains and languages), more accurate, and ultimately more useful language technologies. We will target semantic and pragmatic tasks such as coreference resolution, temporal chronology prediction, and discourse parsing for which proper Machine Learning solutions are still lacking. https://project.inria.fr/grasp/.

9.2.3. ANR-NFS REM (2016-2020)

With colleagues from the linguistics departments at Lille 3 and Neuchâtel (Switzerland), PASCAL DENIS is a member of another ANR project (REM), funded through the bilateral ANR-NFS Scheme. This project, co-headed by I. Depreatere (Lille 3) and M. Hilpert (Neufchâtel), proposes to reconsider the analysis of English modal constructions from a multidisciplinary perspective, combining insights from theoretical, psycho-linguistic, and computational approaches.

9.2.4. EFL (2010-2020)

PASCAL DENIS is an associate member of the Laboratoire d'Excellence *Empirical Foundations of Linguistics* (EFL), http://www.labex-efl.org/.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

ERC-PoC 713626 SOM "Statistical modeling for Optimization Mobility": This project aims at bringing to practice results from the project ERC-StG 240186 MiGraNT in the domain of mobility and mobile devices. In particular, a proof of concept will be made of graph mining approaches to learn predictive models and/or recommendation systems from collections of data distributed over a large number of devices (cars, smartphones, ...) while caring about privacy-friendliness.

9.3.2. Collaborations in European Programs, Except FP7 & H2020

9.3.2.1. Sci-GENERATION (2013-2017)

Program: COST

Project acronym: Sci-GENERATION

Project title: Next Generation of Young Scientist: Towards a Contemporary Spirit of R&I.

Duration: 2013-2017

Coordinator: JAN RAMON is an MC member for belgium and a core group member

Other partners: More information on http://scigeneration.eu/en/participants.html

Abstract: Sci-Generation is a COST targeted network that addresses the challenges faced by next generation of researchers in Europe. We aim to improve the visibility, inclusion and success of excellent young researchers and research teams in European science and policy-making. We study and deliberate how changes in research funding opportunities and career perspectives can facilitate these improvements. We wish to promote new and emergent research topics, methods and management organisations. We are developing recommendations for EU science policy that will foster transformations at national and regional levels to promote scientific excellence and to establish a true European research area. (See http://scigeneration.eu).

9.3.2.2. TextLink (2014-2018)

Program: COST Action

Project acronym: TextLink

Project title: Structuring Discourse in Multilingual Europe

Duration: Apr. 2014 - Apr. 2018

Coordinator: Prof. Liesbeth Degand, Université Catholique de Louvain, Belgium. PASCAL DENIS is member of the Tools group.

Other partners: 26 EU countries and 3 international partner countries (Argentina, Brazil, Canada)

Abstract: Effective discourse in any language is characterized by clear relations between sentences and coherent structure. But languages vary in how relations and structure are signaled. While monolingual dictionaries and grammars can characterize the words and sentences of a language and bilingual dictionaries can do the same between languages, there is nothing similar for discourse. For discourse, however, discourse-annotated corpora are becoming available in individual languages. The Action will facilitate European multilingualism by (1) identifying and creating a portal into such resources within Europe - including annotation tools, search tools, and discourse-annotated corpora; (2) delineating the dimensions and properties of discourse annotation across corpora; (3) organizing these properties into a sharable taxonomy; (4) encouraging the use of this taxonomy in subsequent discourse annotation and in cross-lingual search and studies of devices that relate and

structure discourse; and (5) promoting use of the portal, its resources and sharable taxonomy. With partners from across Europe, TextLink will unify numerous but scattered linguistic resources on discourse structure. With its resources searchable by form and/or meaning and a source of valuable correspondences, TextLink will enhance the experience and performance of human translators, lexicographers, language technology and language learners alike.

9.3.2.3. STAC (2011-2016)

Program: ERC Advanced Grant

Project acronym: STAC

Project title: Strategic conversation

Duration: Sep. 2011 - Aug. 2016

Coordinator: Nicholas Asher, CNRS, Université Paul Sabatier, IRIT (France)

Other partners: School of Informatics, Edinburgh University; Heriot Watt University, Edinburgh; Inria (PASCAL DENIS)

Abstract: STAC is a five year interdisciplinary project that aims to develop a new, formal and robust model of conversation, drawing from ideas in linguistics, philosophy, computer science and economics. The project brings a state of the art, linguistic theory of discourse interpretation together with a sophisticated view of agent interaction and strategic decision making, taking advantage of work on game theory.

9.4. International Initiatives

9.4.1. Inria Associate Teams Not Involved in an Inria International Labs

9.4.1.1. RSS

Program: Inria North-European Labs

Project title: Rankings and Similarities in Signed graphs

Duration: late 2015 to late 2017

Partners: Aristides Gionis (Data Mining Group, Aalto University, Finland) and Mark Herbster (Centre for Computational Statistics and Machine Learning, University College London, UK)

Abstract: The project focuses on predictive analysis of networked data represented as signed graphs, where connections can carry either a positive or a negative semantic. The goal of this associate team is to devise novel formal methods and machine learning algorithms towards link classification and link ranking in signed graphs and assess their performance in both theoretical and practical terms.

9.4.1.2. LEGO

Title: LEarning GOod representations for natural language processing

International Partner (Institution - Laboratory - Researcher): University of California, Los Angeles (United States) - TEDS: Research group Theoretical and Empirical Data Science - Fei Sha

Start year: 2016

See also: https://team.inria.fr/lego/

Abstract: LEGO lies in the intersection of Machine Learning and Natural Language Processing (NLP). Its goal is to address the following challenges: what are the right representations for structured data and how to learn them automatically, and how to apply such representations to complex and structured prediction tasks in NLP? In recent years, continuous vectorial embeddings learned from massive unannotated corpora have been increasingly popular, but they remain far too limited to capture the complexity of text data as they are task-agnostic and fall short of modeling complex structures in languages. LEGO strongly relies on the complementary expertise of the two partners in areas such as representation/similarity learning, structured prediction, graph-based learning, and statistical NLP to offer a novel alternative to existing techniques. Specifically, we will

investigate the following three research directions: (a) optimize the embeddings based on annotations so as to minimize structured prediction errors, (b) generate embeddings from rich language contexts represented as graphs, and (c) automatically adapt the context graph to the task/dataset of interest by learning a similarity between nodes to appropriately weigh the edges of the graph. By exploring these complementary research strands, we intend to push the state-of-the-art in several core NLP problems, such as dependency parsing, coreference resolution and discourse parsing.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

We invited Soravit Changpinyo (University of Southern California) in October, collaborating with MATHIEU DEHOUCK, PASCAL DENIS and AURÉLIEN BELLET on multi-task learning and transfer of word embeddings.

JAN RAMON collaborated with WILHELMIINA HAMALAINEN, who visited the magnet lab for 2 weeks. In particular, they worked on multiple hypothesis tests for regression and discretization problems.

MARK HERBSTER from University College London was invited for one week in January and collaborated with FABIO VITALE and MARC TOMMASI on machine learning and similarity prediction in graphs.

Several international researchers have also been invited to give a talk at the MAGNET seminar:

- TIM VANDERCRUYS (Toulouse): "Modeling Meaning with Latent Factorization Models" (April)
- SORAVIT CHANGPINYO (University of Southern California): "Synthesized Classifiers for Zero-Shot Learning" (October)
- THOMAS KIPF (University of Amsterdam): "Deep Learning on Graphs with Graph Convolutional Networks" (December)

9.5.1.1. Local Workshops

- FABIO VITALE organized the workshop Graph-based Learning and Graph Mining.
- PASCAL DENIS organized the Workshop on Argumentation Mining.

9.5.2. Visits to International Teams

In March, April and May FABIO VITALE visited the Department of Computer Science of the University of Milan, collaborating with Prof. NICOLÒ CESA-BIANCHI and Prof. CLAUDIO GENTILE.

In July, AURÉLIEN BELLET and PASCAL DENIS visited the Department of Computer Science of the University of California (Los Angeles), collaborating with Prof FEI SHA.

In September, MATHIEU DEHOUCK visited the Department of Computer Science of the University of California (Los Angeles), collaborating with Prof FEI SHA.

Since September, FABIO VITALE is working at the department of computer science of Aalto University, Helsinki (Finland), in the DMG group (http://research.ics.aalto.fi/dmg/index.shtml) led by Prof. ARISTIDES GIONIS.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR BECASIM

G. Dujardin is a member of the ANR BECASIM project (http://becasim.math.cnrs.fr/). This ANR project gathers mathematicians with theoretical and numerical backgrounds together with engineers. The objective is to develop numerical methods to accurately simulate the behavior of Bose-Einstein condensates.

> Title: Simulation numérique avancée pour les condensats de Bose-Einstein.
>
> Type: Modèles Numériques - 2012
>
> ANR reference: ANR-12-MONU-0007
>
> Coordinator: Ionut DANAILA, Université de Rouen.
>
> Duration: January 2013 - December 2017.
>
> Partners: Université Lille 1, UPMC, Ecole des Ponts ParisTech, Inria-Nancy Grand-Est, Université Montpellier 2, Université Toulouse 3.

8.1.2. ANR EDNHS

M. Simon is a member of the ANR EDNHS project.

> Title: Diffusion de l'énergie dans des système hamiltoniens bruités.
>
> Type: Défi de tous les savoirs (DS10) 2014.
>
> ANR reference: ANR-14-CE25-0011.
>
> Coordinator: Cédric Bernardin, Université de Rennes.
>
> Duration: October 2014 - October 2019.

8.1.3. Labex CEMPI

> Title: Centre Européen pour les Mathématiques, la Physique et leurs interactions
>
> Coordinator: Stephan De Bièvre.
>
> Duration: January 2012 - December 2019.
>
> Partners: Laboratoire Paul Painlevé and Laser physics department (PhLAM), Université Lille 1.

The "Laboratoire d'Excellence" Centre Européen pour les Mathématiques, la Physique et leurs interactions (CEMPI), a project of the Laboratoire de Mathématiques Paul Painlevé and the Laboratoire de Physique des Lasers, Atomes et Molécules (PhLAM), was created in the context of the "Programme d'Investissements d'Avenir" in February 2012.

The association Painlevé-PhLAM creates in Lille a research unit for fundamental and applied research and for training and technological development that covers a wide spectrum of knowledge stretching from pure and applied mathematics to experimental and applied physics.

One of the three focus areas of CEMPI research is the interface between mathematics and physics. This focus area encompasses three themes. The first is concerned with key problems of a mathematical, physical and technological nature coming from the study of complex behaviour in cold atoms physics and non-linear optics, in particular fibre optics. The two other themes deal with fields of mathematics such as algebraic geometry, modular forms, operator algebras, harmonic analysis and quantum groups that have promising interactions with several branches of theoretical physics.

8.1.4. PEPS "Jeunes Chercheurs"

M. Simon obtained a CNRS grant "PEPS Jeunes Chercheurs" for a project in collaboration with Oriane Blondel (Université Lyon 1), Clément Erignoux (IMPA, Rio de Janeiro) and Makiko Sasada (Tokyo University)

8.1.5. MIS

Incentive Grant for Scientific Research (MIS) of the Fonds National de la Recherche Scientifique (Belgium)

Title: Patterns, Phase Transitions, 4NLS & BIon.

Coordinator: D. Bonheure.

Duration: January 2014 - December 2016.

Partner: Université libre de Bruxelles.

8.1.6. PDR

Research Project (PDR) of the Fonds National de la Recherche Scientifique (Belgium).

D. Bonheure is co-investigator of this PDR.

Title: Asymptotic properties of semilinear systems.

Coordinator: Christophe Troestler (UMons).

Duration: July 2014 - June 2018.

Partner: Université de Mons, Université catholique de Louvain, Université libre de Bruxelles.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. QUANTHOM

Title: Quantitative methods in stochastic homogenization

Programm: FP7

Duration: February 2014 - January 2019

Coordinator: Université Libre de Bruxelles (Belgium)

Partner: Inria

Inria contact: A. Gloria

'This proposal deals with the development of quantitative tools in stochastic homogenization, and their applications to materials science. Three main challenges will be addressed. First, a complete quantitative theory of stochastic homogenization of linear elliptic equations will be developed starting from results I recently obtained on the subject combining tools originally introduced for statistical physics, such as spectral gap and logarithmic Sobolev inequalities, with elliptic regularity theory. The ultimate goal is to prove a central limit theorem for solutions to elliptic PDEs with random coefficients. The second challenge consists in developing an adaptive multiscale numerical method for diffusion in inhomogeneous media. Many powerful numerical methods were introduced in the last few years, and analyzed in the case of periodic coefficients. Relying on my recent results on quantitative stochastic homogenization, I have made a sharp numerical analysis of these methods, and introduced more efficient variants, so that the three academic examples of periodic, quasi-periodic, and random stationary diffusion coefficients can be dealt with efficiently. The emphasis of this challenge is put on the adaptivity with respect to the local structure of the diffusion coefficients, in order to deal with more complex examples of interest to practitioners. The last and larger objective is to make a rigorous connection between the continuum theory of nonlinear elastic materials and polymer-chain physics through stochastic homogenization of nonlinear problems and random graphs. Analytic and numerical preliminary results show the potential of this approach. I plan to derive explicit constitutive laws for rubber from polymer chain properties, using the insight of the first two challenges. This requires a good understanding of polymer physics in addition to qualitative and quantitative stochastic homogenization.'

8.2.2. Collaborations with Major European Organizations

Max Planck Institute for Mathematics in the Sciences (Germany)

Long-term collaboration with F. Otto on the development of a quantitative theory of stochastic homogenization of linear elliptic systems.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

Milton Jara, Professor Adjunto, IMPA, Rio de Janeiro (Brazil), was an invited professor at Université Lille 1 funded by the LabeX CEMPI.

8.3.1.1. Internships

Pierre Mennuni, MA2 Université Lille 1, Internship, 3 months

8.3.1.2. Research Stays Abroad

M. Simon spent one month at Universidade Federal Fluminense (Niteroi, Brazil) in march 2016, sponsored by the "Réseau France-Brésil", as a guest of Freddy Hernandez.

S. De Bièvre visited C. Mejia-Monasterio at the Technical University of Madrid in June 2016.

MINT Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. StimTac, 2015-2017

Participants: Frédéric Giraud [correspondant], Patricia Plénacoste, Laurent Grisoni, Michel Amberg, Nicolas Bremmard.

The aim of this project is to create the first digital book, enhanced with haptic feedback, in order to anticipate the integration of this technology into everyday products. This project adresses technological issues, like programming haptic content in a multimedia software, and design issues to understand how the haptic feedback is perceived by the users.

Stimtac is a book, and could thus be presented to non-specialists users and to a wide public during presentations, demos and foru. The scenario and the illustrations were made by Dominique Maes, a belgium artist, who did the digital book "bleu de toi" among other things. The Public Library of Lille is a partner of this project and allows us to meet the public.
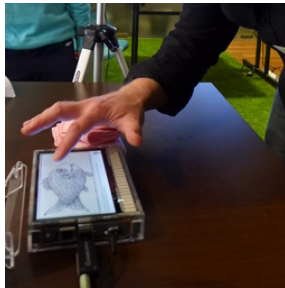
(a)   (b)

Figure 4. Demo session at "La nuit des Bibliothèques (Lille, October 2016), and a page of Stimtac; the ellipse highlights the tactile feedback on E-Vita.

This project has been granted 8Keuros from IRCICA.

8.2. National Initiatives

8.2.1. Touchit (13th FUI, May 2012-2015)

Participants: Michel Amberg, Frédéric Giraud, Betty Lemaire-Semail [correspondant].

The purpose of this project is twofold. It aims at designing and implementing hardware solutions for tactile feedback based on programmable friction. It also aims at developing the knowledge and software tools required to use these new technologies for human-computer interaction. Grant for MINT is balanced on 272 keuro handled at University for L2EP, and 220 Keuros for Inria.

Partners: STMicroelectronics, CEA/LETI, Orange Labs, CNRS, EASii IC, MENAPIC and ALPHAUI.

Competitive clusters involved: Minalogic, Cap Digital and MAUD.

8.2.2. Equipex IRDIVE (ANR project 2012-2020)

3 Meuros project, co-funded by ERDF for the developpement of a pluri-disciplinary project on ICT-based tools for understanding human perception of visual contents. Laurent Grisoni is member of the lead group of this project, and animates an axis devoted to art-sciences and technologies collaborations.

8.2.3. MAUVE CPER ("Contrat de Plan État-Région") 2016-2020 project

Funds: 4 Meuros (validated at national level, funded by Region), and 1 Meuro additional funding provided by ERDF.
Subject: ICT tools for mediation and access to knowledge.
Lead: University of Lille, University of Artois. Laurent Grisoni is co-lead of this project.

8.2.4. Projet FUI HID: lead Holusion (2016-2018)

Participants: Laurent Grisoni [correspondant], Samuel Degrande, Fabrice Aubert.

290 Keuros for MINT. Funding for two 18 months contracts and 24 months of post-doc.
Subject: rationalized process for industrial use of holographic displays.
MINT contribution: anamorphic software tools for holographics displays, and study of interactive aspects, including collaborative activities. This project has been prematurily stopped by french government.

8.2.5. InriaRT

Participants: Laurent Grisoni [correspondant], Samuel Degrande, Francesco de Comité.

Art/science Inria internal network gathering projects interested in collaborating with artists.
Inria teams involved: MuTANT (paris), Imagine (grenoble), Flowers, Potioc (Bordeaux), Hybrid, MimeTic (Rennes). This initiative shall take advantage of an agreement between Inria and french ministry of culture, signed early december 2016.

8.2.6. MATRICE (sept 2015-sept. 2017

Participant: Laurent Grisoni [correspondant].

This regional project, funded by ERDF, led by lille school of architecture, aims at understanding in which way 3D printing may be interesting for the building economy. partners: école d'architecture de Lille, Inria, ecole centrale de lille, télécome Lille 1, Ecole des mines de douai.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

- INESC-ID: collaboration with Joaquim Jorge (Talaria paper, published at ISS'16)
- Collaboration with Mrad UofT (paper published, harvesting energy)

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Dr. Luke Dahl (University of Virginia) for the BOEUF project
- Masaya Takasaki and Masayuki Hara (University of Saitama, Japan) 22nd of january
- Masaya Takasaki has also been visiting Professor at University lille1 (April, 18th - April 30th)

8.4.1.1. Internships

visiting PhD student from University of Chile: Orlando Errazo (nov 2015-jan 2016). One publication currently on submission.

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Mjolnir/UCLIC associate team (Inria Lille, 2015-2017)

Participants: Sylvain Malacria [correspondent], Nicolas Roussel.

The goal of this project is the design and implementation of novel cross-device systems and interaction techniques that minimize the cost of divided attention. Of particular interest are notification systems on smart watches and in distributed computing systems. More precisely, we design cross-device activity and notifications monitor that will intercept external (e.g. new e-mail) and internal (e.g. a video editing software completed an export) notifications and distribute them to the device users are currently wearing/interacting with in order to minimize notification redundancy.

Partner: University College London Interaction Centre (United Kingdom).

9.2. National Initiatives

9.2.1. Turbotouch (ANR, 2014-2018)

Participants: Géry Casiez [correspondent], Nicolas Roussel, Thomas Pietrzak.

Touch-based interactions with computing systems are greatly affected by two interrelated factors: the transfer functions applied on finger movements, and latency. This project aims at transforming the design of touch transfer functions from black art to science to support high-performance interactions. We are working on the precise characterization of the functions used and the latency observed in current touch systems. We are developing a testbed environment to support multidisciplinary research on touch transfer functions and will use this testbed to design latency reduction and compensation techniques, and new transfer functions.

Partners: Inria Lille's NON-A team and the "Perceptual-motor behavior group" from the Institute of Movement Sciences.

Web site: http://mjolnir.lille.inria.fr/turbotouch/

Related publications: [20], [35], [19], [34], [37], [42]

9.2.2. ParkEvolution (Carnot Inria - Carnot STAR, 2015-2017)

Participants: Géry Casiez [correspondent], Sébastien Poulmane.

This project studies the fine motor control of patients with Parkinson disease in an ecological environment, at home, without the presence of experimenters. Through longitudinal studies, we collect raw information from pointing devices to create a large database of pointing behavior data. From the analysis of this big dataset, the project aims at inferring the individual's disease progression and influence of treatments.

Partners: the "Perceptual-motor behavior group" from the Institute of Movement Sciences and Hôpital de la Timone.

Web site: http://parkevolution.org/

9.2.3. BCI-LIFT (Inria Project Lab, 2015-2019)

Participants: Géry Casiez, Nicolas Roussel [correspondent].

The goal of this large-scale initiative is to design a new generation of non-invasive Brain-Computer Interfaces (BCI) that are easier to appropriate, more efficient, and suited for a larger number of people.

Partners: Inria's ATHENA, NEUROSYS, POTIOC, HYBRID & DEMAR teams, *Centre de Recherche en Neurosciences de Lyon* (INSERM) and INSA Rouen.

Web site: https://bci-lift.inria.fr/

Related publications: [38], [15], [14], [41]

9.3. European Initiatives

9.3.1. *Happiness (H2020-ICT-2014-1/ICT-03-2014/RIA, 2015-2018)*

Participants: Christian Frisson, Julien Decaudin, Thomas Pietrzak [correspondent], Nicolas Roussel.

The main objective of this project is to develop and evaluate new types of haptic actuators printed on advanced Thin, Organic and Large Area Electronics (TOLAE) technologies for use in car dashboards. These actuators are embedded in plastic molded dashboard parts. The expected outcome is a marketable solution for haptic feedback on curved interactive surfaces.

Partners: CEA (coordinator), Inria Rennes' HYBRID team, Arkema, Bosch, Glasgow University, ISD, Walter Pack, Fundacion Gaiker.

Web site: http://happiness-project.eu/

Related publication: [29]

9.4. International Initiatives

9.4.1. *MIDWAY (Inria associate team, 2014-2016)*

Participants: Fanny Chevalier, Stéphane Huot [correspondent], Justin Mathew.

The goal of the project is the design and implementation of a musical interaction design workbench to facilitate the exploration and definition of new interactive technologies for both musical creation and performance.

Partner: Inria Saclay's EXSITU team and the Input Devices and Music Interaction Laboratory (IDMIL) from the Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT) at McGill University, Canada.

Web site: http://insitu.lri.fr/MIDWAY/

Related publication: [43]

9.5. International Research Visitors

9.5.1. *Visits of International Scientists*

Visiting scholars:
- Marcelo Wanderley, Professor at McGill University, Canada (3 one week visits in April, October & December)
- Edward Lank, Associate Professor at the University of Waterloo, Canada (since September)
- Daniel Wigdor, Associate Professor at the University of Toronto, Canada (April 2016)
- Baptiste Caramiaux, Post-Doctoral researcher at McGill University, Canada, & IRCAM (December)

Internships:
- Filipe Calegario, PhD student at McGill University, Canada (January)
- Nicholas Fellion, Master's student at Carleton University, Canada (from January to April)
- Aakar Gupta, PhD student at the University of Toronto, Canada (from June to September)
- Hrim Mehta, PhD student at the Ontario Institute of Technology, Canada (from May to August)
- Anastasia Kuzminykh, PhD student at the University of Waterloo, Canada (from October to December)

<center>**MODAL Project-Team**</center>

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. *L'impact de l'évolution de l'état émotionnel et cognitif ressenti sur la reprise de l'activité de femmes atteintes d'un cancer du sein (Protocole FACEBROK)*
Participant: Sophie Dabo.

> Partners: LAPCOS (EA 7278), UMR 9193 SCALab, LEM UMR 9221 LEM, Modal-Inria, EA CRDP

9.1.2. *Main partners of bilille*
Participant: Guillemette Marot.

bilille, the bioinformatics platform of Lille officially gathers from Nov. 2015 a few bioinformaticians, biostatisticians and bioanalysts from the following teams:

> EA2694 (Univ. Lille 2, CHRU, Inria)
>
> FRABIO, FR3688 (Univ. Lille 1,CNRS)
>
> CBP / GFS (Univ. Lille 2, CHRU)
>
> TAG (Univ. Lille 2, CNRS, INSERM, Institut Pasteur de Lille)
>
> U1167 (Univ. Lille 2, CHRU, INSERM et Institut Pasteur de Lille)
>
> U1011 (Univ. Lille 2, INSERM)
>
> UMR8198 (Univ. Lille 1, CNRS)
>
> LIGAN PM (Univ. Lille 2, CNRS)
>
> BONSAI (Inria, Univ. Lille 1, CNRS)

Those teams are thus the main partners of MODAL concerning biostatistics for bioinformatics. Guillemette Marot is the leader of the platform and works in close collaboration with the following people for the leadership of the scientific strategy related to the platform:

> H. Touzet, BONSAI (deputy head of bilille)
>
> P. Touzet, UMR8198 (deputy head of bilille)
>
> V. Chouraki, U1167
>
> M. Figeac, CBP / GFS
>
> D. Hot, TAG
>
> V. Leclère, Insitut Charles Viollette
>
> M. Lensink, UGSF

9.1.3. *New collaborations of the year linked to bilille, the bioinformatics and bioanalysis platform*
Participants: Guillemette Marot, Samuel Blanck.

Guillemette Marot has supervised the data analysis part or support in biostatistics tools testing for the following research projects involving Samuel Blanck or engineers from bilille (only the names of the principal investigators of the project are given even if several partners are sometimes involved in the project):

> U 1011, H. Duez, circadiomics project
>
> CIIL, J.C. Sirard, Flagnew project
>
> JPARC, M.H. David, biostatistics related to DNAse-seq

9.1.4. Collaboration linked to SIRIC Oncolille

Participants: Sophie Dabo, Guillemette Marot.

During the 'Plan Cancer 2' period, eight SIRICs ('Site de Recherche Intégrée sur le Cancer') were created in France, including the SIRIC ONCOLille (Link). More recently, the SFR Cancer has been created and Sophie Dabo-Niang is a member of the board that aims to create an Interdisciplinary Cancer Research Institute in Lille, based on ONCOLille. Guillemette Marot is still involved in several collaborations linked to cancer, through the projects analysed by the bilille platform.

9.2. National Initiatives

9.2.1. Programme of Investments for the Future (PIA)

Bilille is a member of two PIA "Infrastructures en biologie-santé":

> France Génomique https://www.france-genomique.org/spip/?lang=en
>
> IFB (French Institute of Bioinformatics) https://www.france-bioinformatique.fr/en

As leader of the platform, Guillemette Marot is thus involved in these networks.

9.2.2. Working groups

Sophie Dabo-Niang belongs to the following working groups.

- STAFAV (STatistiques pour l'Afrique Francophone et Applications au Vivant)
- ERCIM Working Group on computational and Methodological Statistics, Nonparametric Statistics Team
- Ameriska

Benjamin Guedj belongs to the following working groups (GdR) of CNRS: ISIS (local referee for Inria Lille - Nord Europe), MaDICS, MASCOT-NUM (local referee for Inria Lille - Nord Europe).

Guillemette Marot belongs to the StatOmique working group.

9.2.3. ANR

Participant: Cristian Preda.

> ClinMine Project-2014-2017
>
> ANR project (ANR TECSAN - Technologie de la santé)
>
> Main coordinator of the project: Clarisse Dhaenens, CRIStAL, USTL
>
> 7 partners - EA 1046 (Maladie d'Alzheimer et pathologies vasculaires, Faculté de Médecine, Lille), EA 2694 (Centre d'Etudes et de Recherche en Informatique Médicale - Faculté de Médecine, Lille), MODAL (Inria LNE), Alicante (Entreprise), CHRU de Montpelier, GHICL (Groupe Hospitalier de l'Institut Catholique de Lille), CRIStAL, USTL

9.2.4. Other initiatives

Serge Iovleff is the head of the project CloHe granted in 2016 by the Mastodons CNRS challenge "Big data and data quality". The project is axed on the design of classification and clustering algorithms for mixed data with missing values with applications to high spatial resolution multispectral satellite image time-series. Website.

9.3. European Initiatives

9.3.1. European Research Council

Benjamin Guedj has participated in the 2017 Starting call of the European Research Council (ERC), by submitting a project (called BEAGLE, standing for PAC-Bayesian Agnostic Learning) in October 2016.

9.3.2. Collaborations with Major European Organizations

> EMS (European Mathematical Society), Sophie Dabo-Niang
>
> Nominated (November 2016) as member of EMS-CDC (Committee of Developing counties)
>
> CIMPA (International Center of Pure and Applied Mathematics), Sophie Dabo-Niang
>
> Nominated (June 2016) as member

9.4. International Initiatives

9.4.1. Inria International Labs

Sophie Dabo-Niang is a member of SIMERGE, a LIRIMA project-team started in January 2015. It includes researchers from Mistis (Inria Grenoble - Rhône-Alpes, France), LERSTAD (Laboratoire d'Etudes et de Recherches en Statistiques et Développement, Université Gaston Berger, Sénégal), IRD (Institut de Recherche pour le Développement, Unité de Recherche sur les Maladies Infectieuses et Tropicales Emergentes, Dakar, Sénégal) and LEM lab (Lille Economie et Management, Université Lille 1, 2, 3, Modal, Inria Lille Nord-Europe, France).

9.4.2. Inria Associate Teams Not Involved in an Inria International Labs

Benjamin Guedj and Christophe Biernacki began a two years collaboration as "Equipes associées nord-européennes" with the Irish team "INSIGHT". The Centre for Data Analytics INSIGHT is about the size of Inria Lille - Nord Europe and is the main Irish research facility in Statistics and Machine Learning. It is focused on the next generation of machine learning (ML) and statistics (Stat) algorithms that can operate on large-scale, dynamic data. Nial Friel is the leader of the ML/Stat axis of INSIGHT, Brendan Murphy is a professor. The topic of this project is to manage statistical models inflation by the means of model clustering.

9.4.2.1. Informal International Partners

> Benjamin Guedj regularly collaborates with Olivier Wintenberger from Københavns Universitet (KU, Denmark).
>
> Benjamin Guedj regularly collaborates with Sylvain Robbiano from University College London (UCL, UK).

9.5. International Research Visitors

9.5.1. Visits of International Scientists

9.5.1.1. Internships

> Rohit Uttam Bhagwat
>> Date: June 2016 - July 2016
>> Institution: Indian Institute of Science Education and Research, Kolkata (India)
>> Supervisor: Vincent Vandewalle
>
> Siddharth Sharma Siddharth
>> Date: Nov 2015 - May 2016
>> Institution: LNM Institute of Information Technology (India)
>> Supervisor: Guillemette Marot
>
> Miguel Assuncao
>> Date: September 2016 - February 2017
>> Institution: University of Lille
>> Supervisor: Christophe Biernacki and Vincent Kubicki
>
> Ghazouani Yannis

Date: Oct 2015 - Sept 2016

Institution: École Centrale Lille - VEKIA

Supervisor: Alain Celisse

Hamza Tajmouati

Date: Oct 2015 - Sept 2016

Institution: École Centrale Lille

Supervisor: Alain Celisse

Astha Gupta

Date: May 2016 - Jul 2016

Institution: BITS Pilani (India)

Supervisor: Benjamin Guedj

Bhargav Srinivasa Desikan

Date: Aug 2016 - Jul 2017

Institution: BITS Pilani (India)

Supervisor: Benjamin Guedj

9.5.2. Visits to International Teams

9.5.2.1. Research Stays Abroad

Sophie Dabo-Niang has visited AIMS-Senegal (African Institute of Mathematical Sciences) and SIMERGE (Inria International Lab of University Gaston-Berger, Senegal) from July to mid-August, 2016.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

- Project ARCIR ESTIREZ "Estimation distribuée de systèmes dynamiques en réseaux", coordinators: D. Efimov, M. Petreczky, 2013-2017.
- CPER DATA 2016-2020 (involved in two projects: "FIT" related to the wireless robots and sensors network and "DATA", related to platform). FIT includes our robotic activity and DATA corresponds to our computation need in fluid mechanics as well as possible security issues in the ControlHub development platform.
- ELSAT20202 (Ecomobilité, Logistique, Sécurité, Adaptabilité dans les Transports) is a Regional consortium gathering aeronautics (ONERA), micro/nano technologies (IEMN), control sciences (Non-A) and fluid mechanics (LAMIH, LML) and working on technologies and methods for the active control of separated flows.

9.2. National Initiatives

- ANR project Finite4SoS (Finite time control and estimation for Systems of Systems), coordinator: W. Perruquetti, 2015-2020.
- ANR project WaQMoS (Coastal waters quality surveillance using bivalve mollusk-based sensors), coordinator: D. Efimov, 2015-2019.
- ANR project TurboTouch (High-performance touch interactions), coordinator: G. Casiez (MJOL-NIR team, Inria), 2014-2018.
- ANR project ROCC-SYS (Robust Control of Cyber-Physical Systems), coordinator: L. Hetel (CNRS, EC de Lille), 2013-2018.
- ANR project MSDOS (Multidimentional System: Digression on Stability), coordinator: Nima Yeganefar (Poitiers University), 2014-2018.
- We are also involved in several technical groups of the GDR MACS (CNRS, "Modélisation, Analyse de Conduite des Systèmes dynamiques", see http://www.univ-valenciennes.fr/GDR-MACS), in particular: Technical Groups "Identification", "Time Delay Systems", "Hybrid Systems", "Complex Systems, Biological Systems and Automatic Control," and "Control in Electrical Engineering".
- Model-free control: collaborations with the startup ALIEN SAS (created by C. Join and M. Fliess).

9.3. European Initiatives

9.3.1. Collaborations with Major European Organizations

Partner 1: KULeuven, labo 1 (Belgium)
Supervisor: W. Michiels
Partner 2: TU/Eindhoven, labo 1 (The Netherlands)
Supervisor: H. Nijmeijer
Partner 3: Centrale Lille, labo 1 (France)
Supervisor: J.-P. Richard

H2020 project UCoCoS ("Understanding and Controlling of Complex Systems", 2016-2020) is a European Joint Doctorate aiming at creating a framework for complex systems, and at defining a common language, common methods, tools and software for the complexity scientist. It strongly relies on a control theory point of view. Six ESR (early stage researchers) perform a cutting-edge project, strongly relying on the complementary expertise of the 3 academic beneficiaries and benefiting from training by 4 non-academic partners from different sectors. ESR1: Analytical and numerical bifurcation analysis of delay-coupled systems; ESR2: Estimation in complex systems; ESR3: Grip on partial synchronization in delay-coupled networks; ESR4: Reduced modelling of large-scale networks ; ESR5: Network design for decentralized control ; ESR6: Networks with event triggered computing. Non-A is firstly invested on ESR 2 (Haik Silm), 4 (Quentin Voortman), 5 (Deesh Dileep), 6 (Jijju Thomas).

9.4. International Initiatives

9.4.1. Inria Associate Teams Not Involved in an Inria International Labs

HoTSMoCE "Homogeneity Tools for Sliding Mode Control and Estimation", project with UNAM (Mexico), supervisor: D. Efimov, 2015-2018.

9.4.2. Inria International Partners

9.4.2.1. Declared Inria International Partners

Arie Levant, Tel Aviv University, Israel (Invited Professor, 4 months, 2015-2016).

9.4.2.2. Informal International Partners

- Emilia Fridman, Tel Aviv University, Israel
- Leonid Fridman, UNAM, Mexico
- Jaime Moreno, UNAM, Mexico
- Johannes Schiffer, Leeds University, UK
- ITMO University, Saint-Petersburg, Russia
- Eva Zerz, Aachen University, Germany

9.4.3. Participation in Other International Programs

- "Robust and Reliable Control of Aerial Syste"', Beihang University, China, 2016, in charge: G. Zheng
- PHC Amadeus "Computer Algebra and Functional Equations", 2016-2017, with the University of Limoges (XLIM) and the University of Linz (Austria).

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Leonid Fridman, UNAM, Mexico, 10/07/2016-22/07/2016, "Stability analysis of a sliding-mode control algorithm of second order with time delays".
- Emilia Fridman, Tel Aviv University, Israel, 27/06/2016-11/07/2016, "Design of interval observers for distributed-parameters systems".
- Jaime Alberto Moreno Pérez, UNAM, Mexico, 27/06/2016-08/07/2016, "Recursive design of Lyapunov functions for finite-time stable systems".
- Tonametl Sanchez Ramirez, UNAM, Mexico, 24/10/2016-18/11/2016, "Homogeneity for discrete-time systems".
- Juan Gustavo Rueda Escobedo, UNAM, Mexico, 24/10/2016-18/11/2016, "Finite-time and fixed-time identification of parameters".
- Konstantin Zimenko, ITMO, Russia, 26/09/2016-28/10/2016, "Delay independent stabilization via implicit Lyapunov function approach".
- Damiano Rotondo, NTNU, Norway, 17/10/2016-21/10/2016, "Fault detection for LPV systems using interval observers".

9.5.1.1. Internships

- Paul Lesur, "Robust control of blimp", 05-07/2016 , supervisor: G. Zheng
- Baihui Du, "Robust control of fast dynamical systems", 05-07/2016, supervisor: G. Zheng

9.5.2. Visits to International Teams

G. Zheng visited Beihang University (China) for two weeks in July 2016.

9.5.2.1. Explorer programme

COSY (under evaluation) Real-time Control of Synthetic microbial communities. While some precursory work has appeared in recent years, the control of microbial communities remains largely unexplored. This proposal aims at exploiting the potential of state-of-art biological modelling, control techniques, synthetic biology and experimental equipment to achieve a paradigm shift in control of microbial communities. Lead by E. Cinquemani as a collaboration of 4 Inria teams IBIS, BIOCORE, COMMANDS, Non-A), the Inria Exploratory Action INBIO and external partners BIOP (CNRS), MaIAge (INRA), and YoukLAB (TU Delft).

9.5.2.2. Research Stays Abroad

G. Zheng held a visiting professor position in Nanjing University of Science and Technology (China) for two months stay in August 2016.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

The PhD program of Ahmed Aït Hammou Oulhaj is partially supported (50%) by the Region Nord-Pas-de-Calais.

9.2. National Initiatives

9.2.1. ANR

C. Cancès is the coordinator of the ANR GEOPOR project. (https://www.ljll.math.upmc.fr/cances/ANR-GEOPOR/). This project aims to study realistic models for complex porous media flows from a variational point of view, and to take advantage of this new approach to design and analyze some efficient numerical methods.

> Title: Approche géométrique pour les écoulements en milieux poreux : théorie et numérique.
>
> Type: Jeunes Chercheuses Jeunes Chercheurs SIMI 1- 2013
>
> ANR Reference: ANR-13-JS01-0007-01
>
> Coordinator: Clément Cancès, Inria Lille - Nord Europe.
>
> Duration: January 2014 – June 2017

I. Lacroix is the local coordinator at Université Lille 1 of the ANR BECASIM project (http://becasim.math.cnrs.fr/). This ANR project gathers mathematicians with theoretical and numerical backgrounds together with engineers. The objective is to develop numerical methods to accurately simulate the behavior of Bose-Einstein condensates.

> Title: Simulation numérique avancée pour les condensats de Bose-Einstein.
>
> Type: Modèles Numériques - 2012
>
> ANR reference: ANR-12-MONU-0007
>
> Coordinator: Ionut DANAILA, Université de Rouen.
>
> Duration: January 2013 - November 2017.

C. Chainais-Hillairet is a member of the ANR MOONRISE project (http://moonrise.math.cnrs.fr/). The MOONRISE project aims at exploring modeling, mathematical and numerical issues originating from the presence of high oscillations in nonlinear PDEs mainly from the physics of nanotechnologies and from the physics of plasmas.

> Title: Modèles, Oscillations et schémas numériques.
>
> Type: Fondements du numérique (DS0705) - 2014
>
> ANR reference: ANR-14-CE23-0007
>
> Coordinator: Florian MEHATS, Université de Rennes 1.
>
> Duration: October 2014 - September 2019.

B. Merlet is a member of the ANR GEOMETRYA project

(https://www.ljll.math.upmc.fr/lemenant/GEOMETRYA/) The GEOMETRYA project addresses several problems within the framework of geometric measure theory, from both theoretical and numerical viewpoints. Most of these problems are derived from the modeling of physical phenomenons. The main topics are: the Geometric Measure Theory in singular metric spaces, the Plateau problem, the Mumford-Shah functional, irrigation and branched transport problems, the Willmore energy.

Title: Théorie gémométrique de la mesure et applications

Type: Blanc SIMI 1 - 2012

ANR reference: ANR-12-BS01-0014

Coordinator: Hervé Pajot, Université Joseph Fourier (Grenoble).

Duration: january 2013 - december 2016.

9.2.2. Labex CEMPI

Title: Centre Européen pour les Mathématiques, la Physique et leurs interactions

Coordinator: Stephan De Bièvre.

Duration: January 2012 - December 2019.

Partners: Laboratoire Paul Painlevé and Laser physics department (PhLAM), Université Lille 1.

The "Laboratoire d'Excellence" Centre Européen pour les Mathématiques, la Physique et leurs interactions (CEMPI), a project of the Laboratoire de Mathématiques Paul Painlevé and the Laboratoire de Physique des Lasers, Atomes et Molécules (PhLAM), was created in the context of the "Programme d'Investissements d'Avenir" in February 2012.

The association Painlevé-PhLAM creates in Lille a research unit for fundamental and applied research and for training and technological development that covers a wide spectrum of knowledge stretching from pure and applied mathematics to experimental and applied physics.

One of the three focus areas of CEMPI research is the interface between mathematics and physics. This focus area encompasses three themes. The first is concerned with key problems of a mathematical, physical and technological nature coming from the study of complex behavior in cold atoms physics and non-linear optics, in particular fibre optics. The two other themes deal with fields of mathematics such as algebraic geometry, modular forms, operator algebras, harmonic analysis and quantum groups that have promising interactions with several branches of theoretical physics.

9.3. International Research Visitors

9.3.1. Visits of International Scientists

Alexis Vasseur (UT Austin, Texas) was invited in Lille in June 2016 thanks to a support of the Labex CEMPI.

We have a long time collaboration with Ansgar Jüngel's team from TU Wien. In 2016, we hosted 2 PhD students advised by A. Jüngel : Anita Gerstenmayer for a first one month and a second one week research stays, Polina Shpartko for a one week research stay.

Kyle Talbot, a PhD student advised by Jérôme Droniou at Monash University (Melbourne, Australia), and Ward Melis, a PhD student supervised by Giovanni Samaey (KU Leuven, Belgium), spent both one week in our team.

9.3.2. Visits to International Teams

Claire Chainais-Hillairet and Ingrid Lacroix-Violet visited Ansgar Jüngel in Vienna (May 17-20, 2016). Claire Chainais-Hillairet visited Jürgen Fuhrmann, Patricio Farrell and Nella Rotundo at WIAS (Berlin) to work on numerical schemes for semiconductor devices models. Clément Cancès visited Léonard Monsaingeon in Lisbon (Feb. 29 to March 4, 2016) Clément Cancès and Flore Nabet visited Daniel Matthes in Munich (June 6-8).

RMOD Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

Participants: Anne Etien, Nicolas Anquetil, Olivier Auverlot, Stéphane Ducasse. From Sept 2016 to Dec. 2018.

Lille Nord Europe European Associated Team with the PreCISE research center of Pr. A. Cleve from Namur University (Belgium).

This project aims to study the co-evolution between database structure and programs and to propose recommendations to perform required changes on cascade. These programs are either internal to the schema as functions or triggers or external as applications written in Java or Php built on top of the DB. Our intuition is that software engineering techniques can be efficient for such issues. This project also aims to unify the abstract representation of the DB and its relationships with the internal or external program.

9.2. European Initiatives

9.2.1. *Collaborations with Major European Organizations*

Marco Naddéo is a PhD student co-supervised by Damien Cassou, Stéphane Ducasse and Viviana Bono from University of Turin (Italy).

9.3. International Initiatives

9.3.1. *Inria International Labs*

Inria Chile
Associate Team involved in the International Lab:

9.3.1.1. PLOMO2

Title: Infrastructure for a new generation of development tools

International Partner (Institution - Laboratory - Researcher):

Universidad de Chile (Chile) - Computer Science Department, PLEIAD laboratory (DCC) - Alexander Bergel

Start year: 2014

See also: http://pleiad.cl/research/plomo2

Performing effective software development and maintenance are best achieved with effective tool support. Provided by a variety of tools, each one presenting a specific kinds of information supporting the task at hand. With Plomo2, we want to invent a new generation tools to navigate and profile programs by combining dynamic information with visualization to improve the development environment.

9.3.2. *Inria Associate Teams Not Involved in an Inria International Labs*

9.3.2.1. Informal International Partners

We are working with the Uqbar team from different argentinian universities. We hired three of the people: Nicolas Passerini(engineer), Esteban Lorenzano (engineer) and Pablo Tesone (PhD).

We are starting to work with Dr. Robert Pergl from the University of Prague.

9.3.3. Participation in Other International Programs

9.3.3.1. STIC AmSud projects

We were involved in two STIC AmSud projects:

Participants: Damien Cassou [correspondant], Gustavo Santos [RMoD], Martin Dias [RMoD], David Röthlisberger [UDP - Universidad Diego Portales, Santiago, Chile], Marcelo Almeida Maia [UFU - Federal University of Uberlândia, Brasil], Romain Robbes [Departamento de Ciencias de la Computación (DCC), Universidad de Chile, Santiago, Chile], Martin Monperrus [Spirals]. Project Partners: Inria RMOD, Inria Spirals, DCC Universidad de Chile, Universidad Diego Portale Chile, Federal University of Uberlândia, Brasil.

This project aims at facilitating the usage of frameworks and application programming interfaces (APIs) by mining software repositories. Our intuition is that mining reveals how existing projects instantiate these frameworks. By locating concrete framework instantiations in existing projects, we can recommend to developers the concrete procedures for how to use a particular framework for a particular task in a new system. Our project also tackles the challenge of adapting existing systems to new versions of a framework or API by seeking repositories for how other systems adapted to such changes. We plan to integrate recommendations of how to instantiate a framework and adapt to changes directly in the development environment. Those points taken together, considerably distinguish our approach from existing research in the area of framework engineering.

Thanks to this project, a PhD student of Federal University of Uberlândia in Brasil (Klérisson Vinícius Ribeiro da Paixão) did a six months internship in RMod, and prof. Marcelo Almeida Maia (from the same university) visited us for one week.

Participants: Nicolas Anquetil [correspondant], Anne Etien [RMoD], Gustavo Santos [RMoD], Marco Tulio Valente [UFMG - Federal University of Minas Gerais, Brazil], Alexander Bergel [Departamento de Ciencias de la Computación (DCC), Universidad de Chile, Santiago, Chile], Project Partners: Inria RMOD, DCC Universidad de Chile, Federal University of Minas Gerais, Brazil.

The goals of the collaboration is to provide tools to help software engineer restructure a large software system in an iterative and incremental way with input from both expert architect and advanced tool. The tools consist of: extraction of a model from source code, manipulation of the model to experiment with possible restructuring, architecture evaluation tool, recommendation tool to help the software engineers to define the new structure, and tool to back port the modification to the source code.

Pr. Marco Tulio Valente of Federal University of Minas Gerais (Brazil)visited RMod for one week.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Prof. Serge Demeyer, 2 days
- Prof. Marcelo Almeida Maia, 1 week, November 2016;
- Prof. Alain Plantec, 5 days, November 2016;
- Prof. Alexandre Bergel, 1 week, December 2016;
- Prof. Marco Tulio Valente, 1 week, December 2016;
- Eliot Miranda, Cadence,1 week, August 2016;
- Dr. Andrei Chis, 3 days, Decembrer 2016.

9.4.1.1. Internships

- Klérisson Vinícius Ribeiro da Paixão, Federal University of Uberlândia, Uberlândia (MG), Brazil, from September, 2015 to July, 2016;
- Lionel Akue, University of Lomé, Togo, from Oct 2016 to Nov 2016
- Julien Delplanque, University of Mons, Belgium, from September 2016 to December 2016.

9.4.2. Visits to International Teams

The whole RMod team spent two days in January at the Vrije Universiteit Brussel (Belgium) to discuss with the Software Languages Lab team: Coen De Roover, Elisa Gonzalez Boix, and their students.

Stéphane Ducasse and Damien Cassou visited Dr. Robert Pergl's team at Czech Technical University in Prague, one week in April.

9.4.2.1. Research Stays Abroad

Marcus Denker: Visit PLEIAD DCC University of Chile, Santiago de Chile 04/12-21/12. Visit in the context of the Inria Associated Team PLOMO2.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR BoB

Participant: Michal Valko.

- *Title*: Bayesian statistics for expensive models and tall data
- *Type*: National Research Agency
- *Coordinator*: CNRS (R. Bardenet)
- *Duration*: 2016-2020
- *Abstract*:

  Bayesian methods are a popular class of statistical algorithms for updating scientific beliefs. They turn data into decisions and models, taking into account uncertainty about models and their parameters. This makes Bayesian methods popular among applied scientists such as biologists, physicists, or engineers. However, at the heart of Bayesian analysis lie 1) repeated sweeps over the full dataset considered, and 2) repeated evaluations of the model that describes the observed physical process. The current trends to large-scale data collection and complex models thus raises two main issues. Experiments, observations, and numerical simulations in many areas of science nowadays generate terabytes of data, as does the LHC in particle physics for instance. Simultaneously, knowledge creation is becoming more and more data-driven, which requires new paradigms addressing how data are captured, processed, discovered, exchanged, distributed, and analyzed. For statistical algorithms to scale up, reaching a given performance must require as few iterations and as little access to data as possible. It is not only experimental measurements that are growing at a rapid pace. Cell biologists tend to have scarce data but large-scale models of tens of nonlinear differential equations to describe complex dynamics. In such settings, evaluating the model once requires numerically solving a large system of differential equations, which may take minutes for some tens of differential equations on today's hardware. Iterative statistical processing that requires a million sequential runs of the model is thus out of the question. In this project, we tackle the fundamental cost-accuracy trade-off for Bayesian methods, in order to produce generic inference algorithms that scale favourably with the number of measurements in an experiment and the number of runs of a statistical model. We propose a collection of objectives with different risk-reward trade-offs to tackle these two goals. In particular, for experiments with large numbers of measurements, we further develop existing subsampling-based Monte Carlo methods, while developing a novel decision theory framework that includes data constraints. For expensive models, we build an ambitious programme around Monte Carlo methods that leverage determinantal processes, a rich class of probabilistic tools that lead to accurate inference with limited model evaluations. In short, using innovative techniques such as subsampling-based Monte Carlo and determinantal point processes, we propose in this project to push the boundaries of the applicability of Bayesian inference.

9.1.2. ANR Badass

Participants: Odalric Maillard, Emilie Kaufmann.

- *Title*:
- *Type*: National Research Agency
- *Coordinator*: Inria Lille (O. Maillard)
- *Duration*: 2016-2020

- *Abstract*: Motivated by the fact that a number of modern applications of sequential decision making require developing strategies that are especially robust to change in the stationarity of the signal, and in order to anticipate and impact the next generation of applications of the field, the BADASS project intends to push theory and application of MAB to the next level by incorporating non-stationary observations while retaining near optimality against the best not necessarily constant decision strategy. Since a non-stationary process typically decomposes into chunks associated with some possibly hidden variables (states), each corresponding to a stationary process, handling non-stationarity crucially requires exploiting the (possibly hidden) structure of the decision problem. For the same reason, a MAB for which arms can be arbitrary non-stationary processes is powerful enough to capture MDPs and even partially observable MDPs as special cases, and it is thus important to jointly address the issue of non-stationarity together with that of structure. In order to advance these two nested challenges from a solid theoretical standpoint, we intend to focus on the following objectives: *(i)* To broaden the range of optimal strategies for stationary MABs: current strategies are only known to be provably optimal in a limited range of scenarios for which the class of distribution (structure) is perfectly known; also, recent heuristics possibly adaptive to the class need to be further analyzed. *(ii)* To strengthen the literature on pure sequential prediction (focusing on a single arm) for non-stationary signals via the construction of adaptive confidence sets and a novel measure of complexity: traditional approaches consider a worst-case scenario and are thus overly conservative and non-adaptive to simpler signals. *(iii)* To embed the low-rank matrix completion and spectral methods in the context of reinforcement learning, and further study models of structured environments: promising heuristics in the context of e.g. contextual MABs or Predictive State Representations require stronger theoretical guarantees.

  This project will result in the development of a novel generation of strategies to handle non-stationarity and structure that will be evaluated in a number of test beds and validated by a rigorous theoretical analysis. Beyond the significant advancement of the state of the art in MAB and RL theory and the mathematical value of the program, this JCJC BADASS is expected to strategically impact societal and industrial applications, ranging from personalized health-care and e-learning to computational sustainability or rain-adaptive river-bank management to cite a few.

9.1.3. ANR ExTra-Learn

Participants: Alessandro Lazaric, Jérémie Mary, Rémi Munos, Michal Valko.

- *Title*: Extraction and Transfer of Knowledge in Reinforcement Learning
- *Type*: National Research Agency (ANR-9011)
- *Coordinator*: Inria Lille (A. Lazaric)
- *Duration*: 2014-2018
- *Abstract*: ExTra-Learn is directly motivated by the evidence that one of the key features that allows humans to accomplish complicated tasks is their ability of building knowledge from past experience and transfer it while learning new tasks. We believe that integrating transfer of learning in machine learning algorithms will dramatically improve their learning performance and enable them to solve complex tasks. We identify in the reinforcement learning (RL) framework the most suitable candidate for this integration. RL formalizes the problem of learning an optimal control policy from the experience directly collected from an unknown environment. Nonetheless, practical limitations of current algorithms encouraged research to focus on how to integrate prior knowledge into the learning process. Although this improves the performance of RL algorithms, it dramatically reduces their autonomy. In this project we pursue a paradigm shift from designing RL algorithms incorporating prior knowledge, to methods able to incrementally discover, construct, and transfer "prior" knowledge in a fully automatic way. More in detail, three main elements of RL algorithms would significantly benefit from transfer of knowledge. *(i)* For every new task, RL algorithms need exploring the environment for a long time, and this corresponds to slow learning processes for large environments. Transfer learning would enable RL algorithms to dramatically reduce the exploration

of each new task by exploiting its resemblance with tasks solved in the past. *(ii)* RL algorithms evaluate the quality of a policy by computing its state-value function. Whenever the number of states is too large, approximation is needed. Since approximation may cause instability, designing suitable approximation schemes is particularly critical. While this is currently done by a domain expert, we propose to perform this step automatically by constructing features that incrementally adapt to the tasks encountered over time. This would significantly reduce human supervision and increase the accuracy and stability of RL algorithms across different tasks. *(iii)* In order to deal with complex environments, hierarchical RL solutions have been proposed, where state representations and policies are organized over a hierarchy of subtasks. This requires a careful definition of the hierarchy, which, if not properly constructed, may lead to very poor learning performance. The ambitious goal of transfer learning is to automatically construct a hierarchy of skills, which can be effectively reused over a wide range of similar tasks.

- *Activity Report*: Research in ExTra-Learn continued in investigating how knowledge can be transferred into reinforcement learning algorithms to improve their performance. Pierre-Victor Chaumier did a 4 months internship in SequeL studying how to perform transfer neural networks across different games in the Atari platform. Unfortunately, the preliminary results we obtained were not very positive. We investigated different transfer models, from basic transfer of a fully trained network, to co-train over multiple games and retrain with initialization from a previous network. In most of the cases, the improvement from transfer was rather limited and in some cases even negative transfer effects appeared. This seems to be intrinsic in the neural network architecture which tends to overfit on one single task and it poorly generlizes over alternative tasks. Another activity was related to the study of macro-actions in RL. We proved for the first time under which conditions macro-actions can actually improve the learning speed of an RL exploration-exploitation algorithm. This is the first step towards the automatic identification and construction of useful macro-actions across multiple tasks.

9.1.4. ANR KEHATH

Participant: Olivier Pietquin.

- *Acronym*: KEHATH
- *Title*: Advanced Quality Methods for Post-Edition of Machine Translation
- *Type*: ANR
- *Coordinator*: Lingua & Machina
- *Duration*: 2014-2017
- *Other partners*: Univ. Lille 1, Laboratoire d'Informatique de Grenoble (LIG)
- *Abstract*: The translation community has seen a major change over the last five years. Thanks to progress in the training of statistical machine translation engines on corpora of existing translations, machine translation has become good enough so that it has become advantageous for translators to post-edit machine outputs rather than translate from scratch. However, current enhancement of machine translation (MT) systems from human post-edition (PE) are rather basic: the post-edited output is added to the training corpus and the translation model and language model are re-trained, with no clear view of how much has been improved and how much is left to be improved. Moreover, the final PE result is the only feedback used: available technologies do not take advantages of logged sequences of post-edition actions, which inform on the cognitive processes of the post-editor. The KEHATH project intends to address these issues in two ways. Firstly, we will optimise advanced machine learning techniques in the MT+PE loop. Our goal is to boost the impact of PE, that is, reach the same performance with less PE or better performance with the same amount of PE. In other words, we want to improve machine translation learning curves. For this purpose, active learning and reinforcement learning techniques will be proposed and evaluated. Along with this, we will have to face challenges such as MT systems heterogeneity (statistical and/or rule-based), and ML scalability so as to improve domain-specific MT. Secondly, since quality prediction (QP) on MT outputs is

crucial for translation project managers, we will implement and evaluate in real-world conditions several confidence estimation and error detection techniques previously developed at a laboratory scale. A shared concern will be to work on continuous domain-specific data flows to improve both MT and the performance of indicators for quality prediction. The overall goal of the KEHATH project is straightforward: gain additional machine translation performance as fast as possible in each and every new industrial translation project, so that post-edition time and cost is drastically reduced. Basic research is the best way to reach this goal, for an industrial impact that is powerful and immediate.

9.1.5. ANR MaRDi

Participants: Olivier Pietquin, Bilal Piot.

- *Acronym*: MaRDi
- *Title*: Man-Robot Dialogue
- *Type*: ANR
- *Coordinator*: Univ. Lille 1 (Olivier Pietquin)
- *Duration*: 2012-2016
- *Other partners*: Laboratoire d'Informatique d'Avignon (LIA), CNRS - LAAS (Toulouse), Acapela group (Toulouse)
- *Abstract*: In the MaRDi project, we study the interaction between humans and machines as a situated problem in which human users and machines share the same environment. Especially, we investigate how the physical environment of robots interacting with humans can be used to improve the performance of spoken interaction which is known to be imperfect and sensible to noise. To achieve this objectif, we study three main problems. First, how to interactively build a multimodal representation of the current dialogue context from perception and proprioception signals. Second, how to automatically learn a strategy of interaction using methods such as reinforcement learning. Third, how to provide expressive feedbacks to users about how the machine is confident about its behaviour and to reflect its current state (also the physical state).

9.1.6. National Partners

- CentraleSupélec
  - J.Perolat, B.Piot and O.Pietquin worked with M.Geist on Stochastic Games. it led to a conference publication in ICML 2016.
- Inria Nancy - Grand Est
  - J.Perolat, B.Piot and O.Pietquin worked with Bruno Scherrer on Stochastic Games. It led to a conference publication in AISTATS 2016 [47] and ICML 2016.
- Institut de Mathématiques de Toulouse
  - É. Kaufmann had publications at COLT, ALT and NIPS with Aurélie Garivier.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

Program: H2020

Project acronym: BabyRobot

Project title: Child-Robot Communication and Collaboration

Duration: 01/2016 - 12/2018

Coordinator: Alexandros Potamianos (Athena Research and Innovation Center in Information Communication and Knowledge Technologies, Greece)

Other partners: Institute of Communication and Computer Systems (Greece), The University of Hertfordshire Higher Education Corporation (UK), Universitaet Bielefeld (Germany), Kunlgliga Tekniska Hoegskolan (Sweden), Blue Ocean Robotics ApS (Denmark), Univ. Lille (France), Furhat Robotics AB (Sweden)

Abstract: The crowning achievement of human communication is our unique ability to share intentionality, create and execute on joint plans. Using this paradigm we model human-robot communication as a three step process: sharing attention, establishing common ground and forming shared goals. Prerequisites for successful communication are being able to decode the cognitive state of people around us (mindreading) and building trust. Our main goal is to create robots that analyze and track human behavior over time in the context of their surroundings (situational) using audio-visual monitoring in order to establish common ground and mind-reading capabilities. On BabyRobot we focus on the typically developing and autistic spectrum children user population. Children have unique communication skills, are quick and adaptive learners, eager to embrace new robotic technologies. This is especially relevant for special eduation where the development of social skills is delayed or never fully develops without intervention or therapy. Thus our second goal is to define, implement and evaluate child-robot interaction application scenarios for developing specific socio-affective, communication and collaboration skills in typically developing and autistic spectrum children. We will support not supplant the therapist or educator, working hand-inhand to create a low risk environment for learning and cognitive development. Breakthroughs in core robotic technologies are needed to support this research mainly in the areas of motion planning and control in constrained spaces, gestural kinematics, sensorimotor learning and adaptation. Our third goal is to push beyond the state-of-the-art in core robotic technologies to support natural human-robot interaction and collaboration for edutainment and healthcare applications. Creating robots that can establish communication protocols and form collaboration plans on the fly will have impact beyond the application scenarios investigated here.

9.2.2. Collaborations in European Programs, Except FP7 & H2020

Program: CHIST-ERA

Project acronym: IGLU

Project title: Interactively Grounded Language Understanding

Duration: 11/2015 - 10/2018

Coordinator: Jean Rouat (Université de Sherbrooke, Canada)

Other partners: UMONS (Belgique), Inria (France), Univ-Lille (France), KTH (sweden), Universidad de Zaragoza (Spain)

Abstract: Language is an ability that develops in young children through joint interaction with their caretakers and their physical environment. At this level, human language understanding could be referred as interpreting and expressing semantic concepts (e.g. objects, actions and relations) through what can be perceived (or inferred) from current context in the environment. Previous work in the field of artificial intelligence has failed to address the acquisition of such perceptually-grounded knowledge in virtual agents (avatars), mainly because of the lack of physical embodiment (ability to interact physically) and dialogue, communication skills (ability to interact verbally). We believe that robotic agents are more appropriate for this task, and that interaction is a so important aspect of human language learning and understanding that pragmatic knowledge (identifying or conveying intention) must be present to complement semantic knowledge. Through a developmental approach where knowledge grows in complexity while driven by multimodal experience and language interaction with a human, we propose an agent that will incorporate models of dialogues, human emotions and intentions as part of its decision-making process. This will lead anticipation and reaction not only based on its internal state (own goal and intention, perception of the environment), but also on the perceived state and intention of the human interactant. This will be possible through the development of advanced machine learning methods (combining developmental, deep and reinforcement

learning) to handle large-scale multimodal inputs, besides leveraging state-of-the-art technological components involved in a language-based dialog system available within the consortium. Evaluations of learned skills and knowledge will be performed using an integrated architecture in a culinary use-case, and novel databases enabling research in grounded human language understanding will be released.

9.3. International Initiatives

9.3.1. Inria Associate Teams Not Involved in an Inria International Labs

9.3.1.1. EduBand

Title: Educational Bandits

International Partner (Institution - Laboratory - Researcher):

Carnegie Mellon University (United States) - Department of Computer Science, Theory of computation lab - Emma Brunskill

Start year: 2015

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

Education can transform an individual's capacity and the opportunities available to him. The proposed collaboration will build on and develop novel machine learning approaches towards enhancing (human) learning. Massive open online classes (MOOCs) are enabling many more people to access education, but mostly operate using status quo teaching methods. Even more important than access is the opportunity for online software to radically improve the efficiency, engagement and effectiveness of education. Existing intelligent tutoring systems (ITSs) have had some promising successes, but mostly rely on learning sciences research to construct hand-built strategies for automated teaching. Online systems make it possible to actively collect substantial amount of data about how people learn, and offer a huge opportunity to substantially accelerate progress in improving education. An essential aspect of teaching is providing the right learning experience for the student, but it is often unknown a priori exactly how this should be achieved. This challenge can often be cast as an instance of decision-making under uncertainty. In particular, prior work by Brunskill and colleagues demonstrated that reinforcement learning (RL) and multi-arm bandit (MAB) can be very effective approaches to solve the problem of automated teaching. The proposed collaboration is thus intended to explore the potential interactions of the fields of online education and RL and MAB. On the one hand, we will define novel RL and MAB settings and problems in online education. On the other hand, we will investigate how solutions developed in RL and MAB could be integrated in ITS and MOOCs and improve their effectiveness.

9.3.2. Inria International Partners

9.3.2.1. With CWI

Title: Learning theory

"North-European Associate Team"

Centrum Wiskunde & Informatica (CWI), Amsterdam (NL) - Peter Grünwald

Duration: 2016 - 2018

Start year: 2016

ABSTRACT: The aim is to develop the theory of learning for sequential decision making under uncertainty problems.

In 2016, this collaboration involved D. Ryabko, É. Kaufmann, J. Ridgway, M. Valko, A. Lazaric, O. Maillard. A post-doc funded by Inria has been recruited in Fall 2016.

This collaboration aims at developing through the Inria International Laboratory with CWI.

9.3.2.2. With University of Leoben

Title: The multi-armed bandit problem

International Partner (Institution - Laboratory - Researcher):

University of Leoben (Austria) - Peter Auer

Duration: 2016 - 2016

Start year: 2016

ABSTRACT: Study of the multi-armed bandit problem.

9.3.2.3. Informal International Partners

- University of California Irvine (USA)

  Anima Anandkumar *Collaborator*

  A. Lazaric collaborates with A. Anandkumar on the use of spectral methods for reinforcement learning.

- University of Lancaster (UK)

  Borja Balle *Collaborator*

  O-A. Maillard collaborates with B. Balle on concentration inequalities for Hankel matrices.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

9.4.1.1. Internships

- Cricia Zilda Felicio Paixao, University Uberlandia, Brasil, Sep. 2015-Jul. 2016, working on recommendation systems in collaboration with Philippe Preux

- Maryam Aziz, Northeastern University, May-Aug. 2016, working on multi-armed bandits for clinical trials in collaboration with Emilie Kaufmann

- Kamyar Azizzadenesheli, University of California at Irvine, Aug-Oct. 2016, working on latent variable models for reinforcement learning in collaboration with Alessandro Lazaric

- Pierre-Victor Chaumier, Ecole Polytechnique, Jan-Jun. 2016, working on transfer learning in collaboration with Alessandro Lazaric

- Firas Jarboui, ENSTA ParisTech, France, May-July.@ 2016, working on Human-AI co-operation, in collaboration with Christos Dimitrakakis.

9.4.2. Visits to International Teams

9.4.2.1. Research Stays Abroad

- Christos Dimitrakakis visited SEAS, Harvard University, USA in the context of a Swedish/EU project "Market Mechanisms for Multiple Minds", and the future of life institute project "Mechanism Design for Multiple AIs", May-June, September-December 2016.

- Christos Dimitrakakis visited ETHZ, Switzerland, in the context of the Swiss SNSF project "Differential Privacy and Approximate Decision Making", July-September 2016.

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SPIRALS Project-Team

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9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. *Région Nord-Pas De Calais*

9.1.1.1. Citizen Awareness and Contribution to Air Quality Monitoring

Participants: Daniel Romero Acero, Romain Rouvoy [correspondant], Lionel Seinturier.

This is a 3-year project in the context of the so-called "Chercheur citoyen" program that started in 2015. The partners are LISIC/Université Côte d'Opale (leader), ATMO Nord-Pas De Calais, Association Bâtisseurs d'Economie Solidaire. This project targets the distributed monitoring of air quality with crowd-sensing solutions obtained via sensors connected to smart devices. We aim at inciting citizens to perform their own measures, and to obtain thanks to GPS geo-localisation a large-scale database and a dynamic fine-grained cartography of air quality. This project takes advantage of the APISENSE® crowdsensing platform (see Section 6.1).

9.1.2. *Inria Lille - Nord Europe*

9.1.2.1. ADT Spoon3R

Participants: Gérard Paligot, Martin Monperrus [correspondant].

ADT Spoon3R (2014–16) is a technology development initiative supported by the Inria Lille - Nord Europe Center that aims at supporting the development of the SPOON software library. (see Section 6.4) Spoon3R aims at extending SPOON with the features defined in the context of our research activities on automated software repair.

9.1.2.2. ADT LibRepair

Participants: Benjamin Danglot, Martin Monperrus [correspondant], Simon Urli.

ADT LibRepair (2016–18) is a technology development initiative supported by the Inria Lille - Nord Europe Center that aims at supporting the development of an integrated library of automated software repair algorithms and techniques. This ADT builds on our results about with the Astor, Nopol and NpeFix that have been obtained in the context of the defended PhD theses of Matias Martinez [66] and Benoit Cornu [57].

9.1.2.3. North European Lab LLEX

Participants: Martin Monperrus [correspondant], Lionel Seinturier.

North European Lab LLEX (2015–17) is an international initiative supported by the Inria Lille - Nord Europe Center that takes place in the context of a collaboration between Inria and University College London. LLEX deals with research on automatic diagnosis and repair of software bugs. Automatic software repair is the process of fixing software bugs automatically An automatic software repair system fixes software bugs with no human intervention. The goal of automatic software repair is to save maintenance costs and to enable systems to be more resilient to bugs and unexpected situations. This research may dramatically improve the quality of software systems. The objective of the partnership is to work on the automated diagnosis of exceptions with a focus on null pointer exceptions.

9.1.2.4. LEDA

Participant: Philippe Merle [correspondant].

LEDA (2013–16) Laboratoire d'Expérimentation et de Démonstrations Ambiantes is a demonstration space allocated by the Inria Lille - Nord Europe Center whose goal is to show the scientific results of the Spirals team in the domains of distributed systems, adaptable middleware, software product lines, green computing, and ambiant computing. These results are illustrated around the scenario of a mock digital home.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. ANR BottleNet
Participants: Romain Rouvoy [correspondant], Walter Rudametkin Ivey, Lionel Seinturier.

BottleNet is a 48-month project funded by ANR that started on October 2015. The objective of BottleNet is to deliver methods, algorithms, and software systems to measure Internet Quality of Experience (QoE) and diagnose the root cause of poor Internet QoE. Our goal calls for tools that run directly at users' devices. We plan to collect network and application performance metrics directly at users' devices and correlate it with user perception to model Internet QoE, and to correlate measurements across users and devices to diagnose poor Internet QoE. This data-driven approach is essential to address the challenging problem of modeling user perception and of diagnosing sources of bottlenecks in complex Internet services. BottleNet will lead to new solutions to assist users, network and service operators as well as regulators in understanding Internet QoE and the sources of performance bottleneck.

9.2.1.2. ANR SATAS
Participants: Philippe Merle [correspondant], Romain Rouvoy, Lionel Seinturier.

SATAS is a 48-month project funded by ANR that started on October 2015. SATAS aims to advance the state of the art in massively parallel SAT solving with a particular eye to the applications driving progress in the field. The final goal of the project is to be able to provide a "pay as you go" interface to SAT solving services, with a particular focus on its power consumption. This project will extend the reach of SAT solving technologies, daily used in many critical and industrial applications, to new application areas, which were previously considered too hard, and lower the cost of deploying massively parallel SAT solvers on the cloud.

9.2.2. Competitivity Clusters

9.2.2.1. FUI StoreConnect
Participants: Julien Duribreux, Romain Rouvoy, Lionel Seinturier [correspondant], Antoine Veuiller.

StoreConnect is a 24-month project funded by FUI and labelized by the PICOM (Pôle des Industries du COMmerce) competitivity cluster which has started in September 2016. The partners are Neosensys (leader), Tevolys, Ubudu, Smile, STIME, Leroy Merlin, Insiteo, Inria Spirals, Inria Fun, Inria Stars. The goal of the project is to define a modular multi-sensors middleware platform for indoor geolocation.

9.2.3. Programme Investissement d'Avenir (PIA)

9.2.3.1. PIA Datalyse
Participants: Romain Rouvoy, Lionel Seinturier [correspondant], Bo Zhang.

Datalyse is a 42-month project of the Programme Investissement d'Avenir Cloud Computing 3rd call for projects. The project started in May 2013. The partners are Eolas (leader), Business & Decision, Groupement des Mousquetaires, Université Grenoble 1, Université Lille 1, Inria, Université Montpellier 2. The project aims at defining an elastic cloud computing infrastructure for processing big volumes of data. The originality of the project is to consider jointly data generated by users and by the infrastructure, and to correlate data at these two levels.

9.2.3.2. PIA OCCIware
Participants: Romain Rouvoy, Philippe Merle [correspondant], Lionel Seinturier.

OCCIware is a 36-month project of the Programme Investissement d'Avenir Cloud Computing and Big Data 4th call for projects. The project started in December 2014. The partners are Open Wide (leader), ActiveEon SA, CSRT, Institut Mines-Télécom/Télécom SudParis, Inria, Linagora GSO, Obeo, OW2 Consortium, Pôle Numérique, and Université Joseph Fourier - Grenoble. The project aims at defining a formal framework for managing every digital resources in the clouds, based on *Open Cloud Computing Interface* (OCCI) recommendations from *Open Grid Forum* (OGF).

9.2.4. Inria National Initiatives

9.2.4.1. Inria ADT Focus CrowdLab
Participants: Julien Duribreux, María Gómez Lacruz, Romain Rouvoy [correspondant], Antoine Veuiller.

The purpose of the ADT Focus CrowdLab (2014–2016) is to strengthen the technological part of the Metroscope consortium and to promote the APISENSE® crowd-sensing platform (see Section 6.1) as a reference platform fo gathering mobile data within the scientific community. The CrowdLab project focuses on three stringent goals: (1) consolidating the current technological solutions, (2) technical and logistical support of the research activities initiated in different scientific domains, and (3) the improvement of security and anonymity of collected data. In addition to the Metroscope consortium, the Inria research teams participating of the ADT Focus CrowdLab project are: Spirals (coordinator), Madynes, Diana, Muse.

9.2.4.2. Inria IPL BetterNet
Participants: Lakhdar Meftah, Romain Rouvoy [correspondant].

BetterNet (2016–19) aims at building and delivering a scientific and technical collaborative observatory to measure and improve the Internet service access as perceived by users. In this Inria Project Lab, we will propose new original user-centered measurement methods, which will associate social sciences to better understand Internet usage and the quality of services and networks. Our observatory can be defined as a vantage point, where: (1) tools, models and algorithms/heuristics will be provided to collect data, (2) acquired data will be analyzed, and shared appropriately with scientists, stakeholders and civil society, (3) and new value-added services will be proposed to end-users. IPL BetterNet is lead by Isabelle Chrisment (Inria Madynes), with the participation of the Diana, Dionysos, Inria Chile, Muse, and Spirals Inria project-teams.

9.2.5. Others

9.2.5.1. CNRS INS2I JCJC FPDefendor
Participant: Walter Rudametkin Ivey [correspondant].

FPDefendor is a 12-month project funded by the CNRS INS2I institute. The JCJC program targets young researchers. Walter Rudametkin is the recipient of such a grant. The project aims at better understanding browser fingerprinting, its risks to privacy, and to provide measures to detect it and effective countermeasures to mitigate it. The proposal brings together software engineering, security and privacy, and formal verification to propose a platform that uses dynamic reconfiguration as a means to evade fingerprint tracking.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

Program: FP7 ICT.

Project acronym: PaaSage.

Project title: Model Based Cloud Platform Upperware.

Duration: October 2012–September 2016.

Coordinator: ERCIM.

Other partners: ERCIM (Fr), SINTEF (No), STFC (UK), U. of Stuttgart (De), Inria (Fr), CETIC (Be), FORTH (El), Be.Wan (Be), EVRY Solutions (No), SysFera (Fr), Flexiant (UK), Lufthansa Systems AG (De), Gesellschaft fur wissenschaftliche Datenverarbeitung mbh Gottingen (De), Automotive Simulation Center Stuttgart (De).

Abstract: Cloud computing is a popular and over-hyped concept in ICT. The concept of infinitely scalable elastic resources changing without complex systems administration and paying only for resources used is attractive. These benefits are not immediately realizable. Within organisation benefits are realizable at considerable cost. IaaS (*Infrastructure-as-a-Service*) public Clouds have different interfaces and conditions of use thus for an organisation to "scale out" requires considerable investment using skilled technical staff. The business need is to allow organisations to "scale out" from their private Cloud to public Clouds without a technical chasm between. This cannot easily be achieved. Aligned with the EU strategic direction of an open market for services, SOA (*Service-Oriented architecture*) offers a way to virtualize across heterogeneous public Clouds and organizational private Clouds. It opens a market for European SMEs to provide services to be utilized (and paid for) by business applications and for all organisations to benefit from a catalogue of services that can be used across the environment. PaaSage will deliver an open and integrated platform, to support both deployment and design of Cloud applications, together with an accompanying methodology that allows model-based development, configuration, optimisation, and deployment of existing and new applications independently of the existing underlying Cloud infrastructures. Specifically it will deliver an IDE (*Integrated Development Environment*) incorporating modules for design time and execution time optimisation of applications specified in the Cloud Modeling Language (Cloud ML), execution-level mappers and interfaces and a metadata database.
Participants: Laurence Duchien, Daniel Romero Acero, Romain Rouvoy, Lionel Seinturier [correspondant].

Program: FP7 FET.
Project acronym: DIVERSIFY.
Project title: More software diversity. More adaptivity in CAS.
Duration: 36 months (2013–16).
Coordinator: Inria.
Other partners: SINTEF (Norway), Trinity College Dublin (Ireland), University of Rennes 1 (France).
Abstract: DIVERSIFY explores diversity as the foundation for a novel software design principle and increased adaptive capacities in CASs (*Collective Adaptive Systems*). Higher levels of diversity in the system provide a pool of software solutions that can eventually be used to adapt to unforeseen situations at design time. The scientific development of DIVERSIFY is based on a strong analogy with ecological systems, biodiversity, and evolutionary ecology. DIVERSIFY brings together researchers from the domains of software-intensive distributed systems and ecology in order to translate ecological concepts and processes into software design principles.
Participants: Martin Monperrus [correspondant].

Program: H2020 ICT-10-2016.
Project acronym: STAMP.
Project title: Software Testing Amplification.
Duration: 36 months (2016–19).
Coordinator: Inria.
Other partners: ActiveEon (France), Atos (Spain), Engineering (Italy), OW2 (France), SINTEF (Norway), TellU (Norway), TU Delft (The Netherlands), XWiki (France).
Abstract: By leveraging advanced research in automatic test generation, STAMP aims at pushing automation in DevOps one step further through innovative methods of test amplification. It will reuse existing assets (test cases, API descriptions, dependency models), in order to generate more test cases and test configurations each time the application is updated. Acting at all steps of development cycle, STAMP techniques aim at reducing the number and cost of regression bugs at unit level, configuration level and production stage.
Participants: Benjamin Danglot, Martin Monperrus [correspondant].

Program: H2020 JU Shift2Rail.

Project acronym: X2Rail-1.

Project title: Start-up activities for Advanced Signalling and Automation System.

Duration: 36 months (2016–19).

Coordinator: Siemens.

Other partners: 19 partners, among others Bombardier, Siemens, Thales, IRT Railenium.

Abstract: Our contribution to the project is focused on adaptive communication middleware for cyber-physical railway systems.

Participants: Lionel Seinturier [correspondant].

9.3.2. Collaborations in European Programs, Except FP7 & H2020

Program: EUREKA Celtic-Plus.

Project acronym: SENDATE.

Project title: SEcure Networking for a DATa Center Cloud in Europe.

Duration: 36 months (2016–19).

Coordinator: Nokia.

Other partners: 50+ partners in Finland, France, Germany, Norway, and Sweden. Selected partners involved: Nokia, Orange.

Abstract: The project addresses the convergence of telecommunication networks and IT in the context of distributed data centers. We are involved in the TANDEM subproject that targets the infrastructure of such a distributed system. More specifically, we are studying new approaches in terms of software engineering and component-based solutions for enabling this convergence of network and IT.

Participants: Lionel Seinturier [correspondant].

9.4. International Initiatives

9.4.1. Inria Associate Teams Not Involved in an Inria International Labs

9.4.1.1. SOMCA

Title: Self-Optimization of Service Oriented Architectures for Mobile and Cloud Applications

International Partner (Institution - Laboratory - Researcher):

Université du Québec À Montréal (Canada) - LATECE - Naouel MOHA

Start year: 2014

See also: http://sofa.uqam.ca/somca.php

The long-term goal of this research program is to propose a novel and innovative methodology embodied in an software platform, to support the runtime detection and correction of anti-patterns in large-scale service-oriented distributed systems in order to continuously optimize their quality of service. One originality of this program lies in the dynamic nature of the service-oriented environments and the application on emerging frameworks for embedded and distributed systems (e.g., Android/iOS for mobile devices, PaaS/SaaS for Cloud environments), and in particular mobile systems interacting with remote services hosted on the Cloud.

9.4.2. Participation in Other International Programs

9.4.2.1. STIC AmSud - Project MineAPI
Participants: María Gómez Lacruz, Martin Monperrus [correspondant], Vincenzo Musco, Gérard Paligot, Romain Rouvoy.

MineAPI is a STIC AmSud project (2015–16) between with University Diego Portales, Santiago, Chile, and Federal University of Uberlândia, Brazil. The coordinator on the French side is Damien Cassou from Inria Rmod. The project aims at facilitating the usage of frameworks and application programming interfaces (APIs) by mining software repositories. Our intuition is that mining reveals how existing projects instantiate these frameworks. By locating concrete framework instantiations in existing projects, we can recommend to developers the concrete procedures for how to use a particular framework for a particular task in a new system. Our project also tackles the challenge of adapting existing systems to new versions of a framework or API by seeking repositories for how other systems adapted to such changes.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Prof. Marcelo Maia, from the Federal University of Uberlândia, Brazil, visited us for 1 week in November 2016 in the context of the MineAPI project.

Fernanda Madeiral Delfim, PhD Student from the Federal University of Uberlândia, Brazil, started a 6-month visit in December 2016 in the context of the MineAPI project.

Mohamed Berkane, associate professor at the University Constantine 2, Algeria, visited us for 1 month in October 2016.

9.5.1.1. Research Stays Abroad

María Gómez spent 4 months from January to April 2016 at Universität Hamburg in the research group of Prof. Walid Maalej.