RESEARCH CENTER

FIELD
Perception, Cognition and Interaction

Activity Report 2016

Section Partnerships and Cooperations

Edition: 2017-08-25

CEDAR Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- AIDE ("A New Database Service for Interactive Exploration on Big Data") is an ANR "Young Researcher" project led by Y. Diao, to start at the end of 2016.
- CBOD ("Cloud-Based Organizational Design") is a 4-year ANR started in 2014, coordinated by prof. Ahmed Bounfour from UPS. Its goal is to study and model the ways in which cloud computing impacts the behavior and operation of companies and organizations, with a particular focus on the cloud-based management of data, a crucial asset in many companies.
- ContentCheck (2015-2018) is an ANR project in collaboration with U. Rennes 1 (F. Goasdoué), INSA Lyon (P. Lamarre), the LIMSI lab from U. Paris Sud, and the Le Monde newspaper, in particular their fact-checking team Les Décodeurs. Its aim is to investigate content management models and tools for journalistic fact-checking.
- Datalyse is funded for 3.5 years as part of the *Investissement d'Avenir - Cloud & Big Data* national program. The project is led by the Grenoble company Eolas, a subsidiary of Business & Decision. It is a collaboration with LIG Grenoble, U. Lille 1, U. Montpellier, and Inria Rhône-Alpes aiming at building scalable and expressive tools for Big Data analytics. The project has ended in November 2016.

8.1.2. LabEx, IdEx

- Structured, Social and Semantic Search (S4) is a 3-year project started in October 2013, financed by the *LabEx (Laboratoire d'Excellence)*DIGICOSME. The project aims at developing a data model for rich structured content enriched with semantic annotations and authored in a distributed setting, as well as efficient algorithms for top-k search on such content. The project has ended in September 2016.
- CloudSelect is a three-years project started in October 2015. It is financed by the *Institut de la Société Numérique* (ISN) of the IDEX Paris-Saclay; it funds the PhD scholarship of S. Cebiric. The project is a collaboration with A. Bounfour from the economics department of Université Paris Sud. The project aims at exploring technical and business-oriented aspects of data mobility across clo ud services, and from the cloud to outside the cloud. Research contributing to this project is carried in collaboration with U. California in San Diego (UCSD) (see Section 3.1).

8.1.3. Others

- ODIN is a four-year project started in 2014, funded by the Direction Générale de l'Armement, between the SemSoft company, IRISA Rennes and Cedar. The project aims to develop a complete framework for analytics on Web data, in particular taking into account uncertainty, based on Semantic Web technologies such as RDF.
- Google Award I. Manolescu has received a Google Award in collaboration with X. Tannier from LIMSI/CNRS and Université de Paris-Sud. The award is given within a call specifically dedicated to computing tools for computational journalism. The project given the award focuses on "Event Thread Extraction for Viewpoint Analysis"; the project has finished at the end of 2016.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

The permanent members of the team participate to build a proposal called GDMA (Graph Data Management and Analytics, for an European Joint Doctorate within the Initial Training Network (ITN) chapter of Europe's H2020 program, with the University of Aalborg (Denmark), Université Libre de Bruxelles, Universitat Politecnica de Catalunya, and University of Ioannina (Greece). If successful the project would involve six PhD thesis co-supervised in Cedar and starting in 2018, three students mostly residing with us, and three abroad working with our partners from Aalborg and Brussels.

I. Manolescu has submitted a Marie-Curie proposal titled IDEAA (An interactive toolbox to help citizens understand and build a viewpoint on specific issues by monitoring, analysing, and interlinking public data from EU institutions) to host a junior researcher (Mirjana Mazuran from Politecnico di Milano) for two years.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

We continue collaborating with U. California in San Diego (UCSD) following the OAKSAD associated team (2013-2015), in particular in the Estocada project (Section 7.1).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Several international guests gave seminars in our group:

- L. Ach and M. Rezk (Rakuten)
- D. Calvanese (University of Bolzano)
- R. Cheng (Hong Kong University)
- M. Franklin (University of Berkeley)
- R. Kontchakov, S. Kikot, M. Zakharyaschev (Birbeck University College)
- Y. Papakonstantinou (University of California in San Diego)
- V. Vianu (University of California in San Diego)

8.4.1.1. Internships

- R. Alotaibi visited the team for two months working on scalable heterogeneous stores with D. Bursztyn and I. Manolescu.
- D. Lanti visited the team for five months, working on efficient semantic query answering with D. Bursztyn.

DAHU Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

Acronym: PRODAQ

Title: Proof systems for Data Queries

Coordinator: Sylvain Schmitz

Duration: January 2015 – September 2019

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

8.2. International Research Visitors

8.2.1. Visits of International Scientists

Victor Vianu, June 15 to September 15, UC San diego

EXMO Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR Lindicle

Program: ANR-Blanc international 2

Project acronym: LINDICLE

Project title: Linking data in cross-lingual environment

Duration: January 2013 - December 2016

Coordinator: Inria EXMO/Jérôme David

Participants: Jérôme Euzenat, Manuel Atencia Arcas, Jérôme David, Tatiana Lesnikova, Adam Sanchez Ayte, Armen Inants

Other partners: Tsinghua university (CN)

See also: http://lindicle.inrialpes.fr

Abstract: The LINDICLE project investigates multilingual data interlinking between French, English and Chinese data sources (see §6.2).

7.2. International Initiatives

7.2.1. Informal International Partners

EXMO (and other colleagues from Oxford, Trento, Mannheim, Linköping, Milano, Amsterdam, Galway and the Open university) organises yearly the Ontology alignment evaluation initiative (OAEI).

7.2.2. Participation in Other International Programs

Jérôme Euzenat is benefiting from a special visiting researcher grant from the Brazilian Ciência sem Fronteiras program on "Methodology and algorithms for ontology refinement and matching" (2015-2017). He is working with the team of Fernanda Baião and Kate Revoredo at the Universidade Federal do Estado do Rio de Janeiro (UNIRIO). Together, they investigate methods for evolving ontologies and alignments which involve users and agents. The goal of the project is to design methods and algorithms using theory revision to deal with knowledge evolution in a reliable manner and obtaining better quality alignments.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- Karima Akli (USTHB, Algiers) visited EXMO in September 2016, working on rough sets for link key extraction.
- Yan Zhang (U. Tsinghua) and Zhichun Wang (Beijing Normal University) visited EXMO in September 2016 in the framework of the Lindicle project, working cross-lingual data interlinking and query-driven ontology matching.

7.3.2. Research Stays Abroad

- Jérôme Euzenat visited the Universidade Federal do Estado do Rio de Janeiro (UNIRIO) for two months in March and November 2016 (see §7.2.2).

GRAPHIK Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ASPIQ

Participants: Jean-François Baget, Madalina Croitoru, Fabien Garreau, Marie-Laure Mugnier, Jérôme Fortin, Michel Leclère, Odile Papini, Swan Rocher.

ASPIQ (ASP technologIes for Querying large scale multisource heterogeneous web information), is an ANR white project that started in January 2013 (duration: 4 years, extended to July 2017). It involves partners from CRIL, LERIA and LSIS. The project coordinator is Odile Papini (LSIS). http://aspiq.lsis.org/

The main objective of this project is to propose:

- extensions of standard ASP for representing OWL2 tractable sublanguages;
- new operations for merging conflicting information in this extended ASP;
- the identification of subclasses of this extended ASP allowing for efficient query answering mechanisms;
- an implementation of a prototype reasoning system.
- *See Section 6.1 and 6.2 for this year's results.*

8.1.1.2. Pagoda

Participants: Meghyn Bienvenu, Jean-François Baget, Marie-Laure Mugnier, Swan Rocher, Federico Ulliana.

Pagoda (Practical Algorithms for Ontology-based Data Access) is an ANR JCJC (young researchers) project that started in Jan. 2013 (duration: 4 years, extended to August 2017). The project coordinator is Meghyn Bienvenu (initially in LRI, now member of GraphIK). It involves partners from the EPI LEO, the LIG, and the Anatomy Laboratory of Grenoble. http://pagoda.lri.fr/

The primary aim of this project is to address challenges brought by scalability and the handling of data inconsistencies by developing novel OBDA (Ontology Based Data Access) query answering algorithms and practical methods for handling inconsistent data.

- *See Section 6.1 and 6.2 for this year's results.*

8.1.1.3. Qualinca

Participants: Michel Leclère, Michel Chein, Madalina Croitoru, Rallou Thomopoulos, Alain Gutierrez, Swan Rocher, Clément Sipieter, Marie-Laure Mugnier.

Qualinca is an ANR Contint project that started in Apr. 2012 (duration: 4 years, extended to September 2016). The project coordinator is Michel Leclère (GraphIK). It involves partners from LRI, LIG, ABES and INA. http://www.lirmm.fr/qualinca/index8ece.html?q=en/en/home

The main objective is to elaborate mechanisms allowing to:

- evaluate the quality of an existing document base;
- maintain a given level of quality by controlling updating operations;
- increase the quality of a given base;
- develop generic methods that take into account the quality of a given base (for instance for searching documents or interconnecting bases).
- *See Section 6.3 for this year's results.*

8.1.1.4. Dur-Dur

Participants: Abdallah Arioua, Pierre Bisquert, Patrice Buche, Madalina Croitoru, Jérôme Fortin, Abdelraouf Hecham, Rallou Thomopoulos.

Dur-Dur (Innovations agronomiques, techniques et organisationnelles pour accroître la DURabilité de la filière blé DUR) is an ANR project that started in March 2014 (duration: 3 years). It is led by IATE Laboratory. http://umr-iate.cirad.fr/projets/dur-dur

The Dur-Dur project develops a systematic approach to investigate the questions related to the management of the nitrogen, energy and contaminants, to guarantee a global quality of products throughout the production and the processing chain. The knowledge representation task of Dur-Dur proposes to map the stakeholders' objectives into a multicriteria cartography, as well as possible means to reach them, and computes the compatibility / incompatibility of these objectives on the basis of argumentation methods. The research methods used are qualitative and based both on argumentation theory and on Social Multi- Criteria Evaluation (SMCE) theory. They will be extended and adapted to the needs of the project to provide a formal framework of assessment of the various orientations considered for the durum wheat chain.

- *See Section 6.2 for this year's results.*

8.1.2. Other projects

8.1.2.1. Pack4Fresh

Participants: Patrice Buche, Pierre Bisquert, Madalina Croitoru, Bruno Yun.

Pack4Fresh (Sept. 2015 - Sept. 2017) is a project selected in the framework of the GloFood INRA-CIRAD metaprogramme. The multi-year metaprogramme GloFoodS (Transitions to global food security) is dedicated to the investigation of pathways to worldwide food security in a context of competition for land and natural resources, and is jointly conducted by INRA and Cirad, the two leading French research institutions for agriculture. Involving research on crop yield and livestock systems, land use changes, food processing and waste, nutrition and governance, GloFoodS aims at articulating global modeling of food supply and demand, with local issues of production and access to food.

In this context, Pack4Fresh focuses on the big fragility of fresh foods which generates enormous post-harvest wastes, short shelf-life, and constitutes a major lock to their consumption and health benefit. This project aims at initiating an eco-design approach of the post-harvest phase of fresh foods working on the interdependency relation between environmental impact (1) positive for waste reduction, et (2) negative for technologies, which aims at reducing the waste, in order to minimize the ratio between those two parameters.

- *See Section 6.2 for this year's results.*

8.1.2.2. OBDA-KeyVal: Ontology-Based Data Access for NoSQL Databases

Participants: Federico Ulliana, Marie-Laure Mugnier.

OBDA-KeyVal is a one-year PEPS project (JCJC INS2I 2016, funded by CNRS-INS2I) dedicated to Ontology Based Data Access for NOSQL Databases. Its goal is to study the problem of answering ontology-mediated queries on top of non-relational databases, and more precisely Key-Value stores. These are a family of NOSQL databases dealing with data represented as nested-structures (JSON records), processed on distributed systems but also increasingly exchanged on the Web, slowly replacing XML and RDF formats. Key-value stores have been designed with performance and scalability in mind, and this opens the possibility to implement OBDA in a novel and efficient distributed setting. The work carried out in this project builds on our first results published at AAAI 2016 [39], see also Sect. 6.1 . We addressed both practical and theoretical aspects of OBDA for key-value stores. First, a prototype of the reasoning framework for key-value stores has been developed by master students (https://github.com/OBDA-KEYVAL/graal-keyval). Second, a novel first-order logic semantics for the setting (in contrast to the former operational semantics) has been defined and investigated from a decidability viewpoint. This still ongoing work is a necessary step towards bridging this setting with the relational OBDA.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. NoAW (No Agricultural Waste)

Participants: Patrice Buche, Pierre Bisquert, Madalina Croitoru, Nikolaos Karanikolas, Rallou Thomopoulos.

Website: http://cordis.europa.eu/project/rcn/203384_en.html

NoAW (No Agricultural Waste) is an H2020 european project led by INRA-IATE, started in Oct. 2016. Driven by a "near zero-waste" society requirement, the goal of NoAW project is to generate innovative efficient approaches to convert growing agricultural waste issues into eco-efficient bio-based products opportunities with direct benefits for both environment, economy and EU consumer. To achieve this goal, the NoAW concept relies on developing holistic life cycle thinking able to support environmentally responsible R&D innovations on agro-waste conversion at different TRLs, in the light of regional and seasonal specificities, not forgetting risks emerging from circular management of agro-wastes (e.g. contaminants accumulation).

GraphIK will contribute on two aspects. On one hand we will participate in the annotation effort of knowledge bases (using the @Web tool). On the other hand we will further investigate the interplay of argumentation with logically instantiated frameworks and its relation with social choice in the context of decision making.

8.2.2. Collaborations in European Programs, Except FP7 & H2020

8.2.2.1. COST FoodMC.

Participants: Madalina Croitoru, Rallou Thomopoulos.

Website: http://www6.inra.fr/foodmc

Rallou Thomopoulos is involved as Co-coordinator (together with Alberto Tonda and Kamal Kansou) in the European COST Action "FoodMC" (Mathematical and Computer Science Methods for Food Science and Industry) started in 2016. Both Madalina Croitoru and Rallou Thomopoulos are Members of the Management Committee, representing France.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

- University of Buenos Aires, Ricardo Rodriguez, since 2013. Work in progress.
- University of Aberdeen, Nir Oren, since 2010. Work in progress.
- Technical University of Dresden, Sebastian Rudolph, since 2012. [34], co-organizer for GKR@IJCAI 2017.
- University of Liverpool, Frank Wolter, since 2009. [11], [27]
- Sapienza University (Rome), Riccardo Rosati, since 2012. [28]
- University of Bremen, Carsten Lutz, since 2009. [27], [11]
- Technical University of Vienna, Magdalena Ortiz and Mantas Simkus, since 2010. Work in progress.
- Laval University (Quebec), Irène Abi-Zeid, since 2015, and Bernard Moulin, since 2012. [44], [38]
- University of Amsterdam, Ulle Endriss, since 2015. Work in progress.

8.3.2. Participation in Other International Programs

Patrice Buche is involved in the RDA AgriSemantics working group (https://www.rd-alliance.org/groups/agrisemantics-wg.html). The goal of the Agrisemantics WG is to gather community-based requirements and use cases for an infrastructure that supports appropriate use of semantics for data interoperability, with special focus on agriculture.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Nov. 2016 (1 week). Visit of Elena Botoeva (Univ. of Bolzano), Stanislav Kikot (London Univ.), Roman Kontchakov (London Univ.) Vladislav Rhyzhikov (Univ. of Bolzano), and Michael Zakharyaschev (London Univ.) to work on the complexity on ontology-mediated query answering with description logics and linear existential rules. Seminars: "Query Inseparability of Description Logic Knowledge Bases and TBoxes" by Elena Botoeva and "The Complexity of Ontology-Based Data Access with OWL 2 QL and Bounded Treewidth Queries" by Stanislav Kikot.
- Nov. 2016 (2 days). Visit of Sebastian Rudolph (TU Dresden) in the context of Swan Rocher's PhD defense. Seminar: "The Curse of Finiteness: Undecidability of Database-Inspired Reasoning Problems in Very Expressive Description Logics".
- Sept. 2016 (1 week) Visit of Ricardo Rodriguez (Univ. of Buenos Aires) to work on belief revision for inconsistent tolerant semantics.

8.4.2. Visits to International Teams

8.4.2.1. Research Stays Abroad

Pierre Bisquert was an invited researcher at the University of Amsterdam from May 2015 to Apr. 2016.

- In collaboration with Ulle Endriss (Institute for Logic, Language and Computation), he worked on the link between argumentation theory and social choice. The aim of this work was to study and understand how Arrow's Impossibility Theorem (stating that there is no democratic voting rule) could be avoided thanks to deliberation and argumentation. More precisely, the favored approach was to define a formal framework of the deliberation process predating a vote, and to establish conditions under which deliberation may help to output a democratic and collectively rational choice through the notion of preference structuration, i.e.,the changes in preferences that the agents may undergo after discussion.

Rallou Thomopoulos was invited at Laval University (Québec, Canada) for one year until July 2016. She worked on two projects dealing with decision support:

- An academic project conducted with the Computer Science Division of Laval University. It aimed at conceiving a systematic approach to assess several scenarios in agriculture, by combining a qualitative model based on argumentation and a quantitative simulation technique based on system dynamics.
- The second project was conducted both with a private partner and with the Operation and Decision Division of Laval University. It aimed to provide explanations for automatically-computed instructions, to improve human understanding of the situation. These instructions were the results of a commercial software used for real-time decision support for the flow management of a combined and sanitary wastewater system.

LACODAM Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. SePaDec: Declarative approaches for Sequential Pattern mining

Participants: Benjamin Negrevergne, Thomas Guyet, Ahmed Samet, Alexandre Termier.

The SEPADEC project is funded by the Region Bretagne. It aims at exploring the application of declarative pattern mining (more especially ASP) in the field of care pathway analysis. The first objective was to model knowledge from the data to enrich the raw data with medical expert knowledge and to develop a toolbox that smoothly integrates both expert knowledge and declarative pattern mining.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. #DigitAg: Digital agriculture

Participants: Alexandre Termier, Véronique Masson, Christine Largouët, Anne-Isabelle Graux.

#DigitAg is a "Convergence Institute" dedicated to the increasing importance of digital techniques in agriculture. Its goal is twofold: first, make innovative research on the use of digital techniques in agriculture in order to improve competitiveness, preserve environment, and offer correct living conditions to farmers. Second, through education prepare future farmers and agricultural policy makers to successfully exploit such technology.

While #DigitAg is based on Montpellier, Rennes is a satellite of the institute focused on cattle farming. Lacodam is involved in the "data mining" challenge of the institute, that A. Termier co-leads. He is also the representative of Inria in the steering comittee of the institute.

The interest for the team is to design novel methods to analyze and represent agricultural data, which are challenging because they are both heterogeneous and multi-scale (both spatial and temporal).

9.2.2. National Platforms

9.2.2.1. PEPS: Pharmaco-epidemiology for Health Products

Participants: Yann Dauxais, Thomas Guyet, Véronique Masson, René Quiniou, Alexandre Termier.

The PEPS project (Pharmaco-epidemiology des Produits de Santé) is funded by ANSM (national agency for health security). The project leader is E. Oger from the clinical investigation center CIC-1414 INSERM/CHU Rennes. The other partners located in Rennes are the Institute of Research and Technology (IRT) B<>Com, EHESP and the LTSI. The project started in january 2015 and is funded for 4 years.

The PEPS project has two parts: the clinical studies and a research program dedicated to the development of innovative tools for pharmaco-epidemiological studies with medico-administrative databases.

Our contribution to this project will be to propose pattern mining algorithm and reasoning techniques to analyse the typical care pathways of specific groups of insured patients.

9.3. International Initiatives

9.3.1. Inria International Partners

9.3.1.1. Informal International Partners

9.3.1.1.1. University of Calgary: Monitoring cattle in big herds with multiple sensors

Participant: René Quiniou.

The state of Alberta produces a significant part of the beef meat in Canada. Big farms feeds up around 40.000 bull calves in feedlots grouping 200-300 animals. Diseases such as Bovine Respiratory Diseases (BRD) are frequent and may propagate quickly in such conditions. So, it is important to detect as soon as possible when an animal is sick. We are collaborating with the Department of Production Animal Health, University of Calgary for designing monitoring systems able to generate early alarms when an animal is sick. Precisely, we are studying the properties of new sensors and their aptitude to provide relevant data for BRD detectors.

9.3.1.1.2. University of Potsdam: preferences in mining with ASP
Participant: Thomas Guyet.

The research group “knowledge processing and information systems" of the University of Potsdam, so called Potascco group, develops a collection of tools and programs for Answer Set Programming such as the clingo solver or the ASPRIN system, developed by J. Romero to handle preferences on ASP models. They have strong expertise in problem encoding with ASP. In addition to T. Schaub Inria position, we initiate some collaborations with other members of the Potascco group in order to strengthen our relationships.

9.4. International Research Visitors

9.4.1. Research Stays Abroad

Thomas Guyet spent a month (may 2016) in the team leaded by Prof. Torsten Schaub in the university of Potsdam.

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.

ORPAILLEUR Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Hydreos

Participant: Jean-François Mari.

Hydreos is a state organization –actually a so-called "Pôle de compétitivité"– aimed at evaluating the delivering and the quality of water (http://www.hydreos.fr/fr). Actually, data about water resources rely on many agronomic variables, including land use successions. The data to be analyzed are obtained by surveys or by satellite images and describe the land use at the level of the agricultural parcel. Then there is a search for detecting changes in land use and for correlating these changes to groundwater quality. Accordingly, one main challenge in our participation in Hydreos is to process and analyze space-time data for reaching a better understanding of the changes in the organization of a territory. The systems ARPEnTAge and CarottAge (see § 6.2.1) are used in this context, especially by agronomists of INRA (ASTER Mirecourt http://www6.nancy.inra.fr/sad-aster).

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. Hybride (2011-2016)

Participants: Adrien Coulet, Amedeo Napoli, Chedy Raïssi, My Thao Tang, Mohsen Sayed, Yannick Toussaint.

The Hybride research project (http://hybride.loria.fr/) aims at combining Natural Language Processing (NLP) and Knowledge Discovery in Databases (KDD) for text mining. A key idea is to design an interacting and convergent process where NLP methods are used for guiding text mining while KDD methods are used for guiding the analysis of textual documents. NLP methods are mainly based on text analysis and extraction of general and temporal information. KDD methods are based on pattern mining, e.g. patterns and sequences, formal concept analysis and graph mining. In this way, NLP methods applied to texts extract "textual information" that can be used by KDD methods as constraints for focusing the mining of textual data. By contrast, KDD methods extract patterns and sequences to be used for guiding information extraction from texts and text analysis. Experimental and validation parts associated with the Hybride project are provided by an application to the documentation of rare diseases in the context of Orphanet.

The partners of the Hybride consortium are the GREYC Caen laboratory (pattern mining, NLP, text mining), the MoDyCo Paris laboratory (NLP, linguistics), the INSERM Paris laboratory (Orphanet, ontology design), and the Orpailleur team at Inria NGE (FCA, knowledge representation, pattern mining, text mining). The Hybride project ended on 30th November 2016.

8.2.1.2. ISTEX (2014–2016)

Participant: Yannick Toussaint.

ISTEX is a so-called "Initiative d'excellence" managed by CNRS and DIST ("Direction de l'Information Scientifique et Technique"). ISTEX aims at giving to the research and teaching community an on-line access to scientific publications in all the domains (http://www.istex.fr/istex-excellence-initiative-of-scientific-and-technical-information/). Thus ISTEX requires a massive acquisition of documents such as journals, proceedings, corpus, databases...ISTEX-R is one research project within ISTEX in which the Orpailleur team is involved, with two other partners, namely ATILF laboratory and INIST Institute (both located in Nancy). ISTEX-R aims at developing new tools for querying full-text documentation, analyzing content and extracting information. A platform is under development to provide robust NLP tools for text processing, as well as methods in text mining and domain conceptualization.

8.2.1.3. PractiKPharma (2016–2020)

Participants: Adrien Coulet, Joël Legrand, Pierre Monnin, Amedeo Napoli, Malika Smaïl-Tabbone, Yannick Toussaint.

The ANR project PractiKPharma (http://practikpharma.loria.fr/) is interested in the validation of domain knowledge in pharmacogenomics. The originality of PractiKPharma is to use "Electronic Health Records" (EHRs) to constitute cohorts of patients, cohorts which are are then mined for validating extracted pharmacogenomics knowledge units after validation w.r.t. literature knowledge. This project involves two other labs, namely LIRMM at Montpellier and CRC Paris.

8.2.1.4. Termith (2014–2016)

Participant: Yannick Toussaint.

Termith (http://www.atilf.fr/ressources/termith/) is an ANR Project involving a series of laboratories, namely ATILF, INIST, Inria Nancy Grand Est, Inria Saclay, LIDILEM, and LINA. It aims at indexing documents belonging to different domain of Humanities. Thus, the project focuses on extracting candidate terms (information extraction) and on disambiguation.

In the Orpailleur team, we are mainly concerned by information extraction using Formal Concept Analysis techniques, but also pattern and sequence mining. The objective is to define contexts introducing terms, i.e. finding textual environments allowing a system to decide whether a textual element is actually a candidate term and its corresponding environment. This disambiguation process was described and published at LREC 2016 [35]. The Termith project ended in April 2016.

8.2.2. FUI POQEMON (2014-2016)

Participants: Chedy Raïssi, Mickaël Zehren.

The publication of transaction data, such as market basket data, medical records, and query logs, serves the public benefit. Mining such data allows the derivation of association rules that connect certain items to others with measurable confidence. Still, this type of data analysis poses a privacy threat; an adversary having partial information on a person's behavior may confidently associate that person to an item deemed to be sensitive. Ideally, an anonymization of such data should lead to an inference-proof version that prevents the association of individuals to sensitive items, while otherwise allowing truthful associations to be derived. The POQEMON project aims at developing new pattern mining methods and tools for supporting privacy preserving knowledge discovery from monitoring purposes on mobile phone networks. The main idea is to develop sound approaches that handle the tradeoff between privacy of data and the power of analysis. Original approaches to this problem were based on value perturbation, damaging data integrity. Recently, value generalization has been proposed as an alternative; still, approaches based on it have assumed either that all items are equally sensitive, or that some are sensitive and can be known to an adversary only by association, while others are non-sensitive and can be known directly. Yet in reality there is a distinction between sensitive and non-sensitive items, but an adversary may possess information on any of them. Most critically, no antecedent method aims at a clear inference-proof privacy guarantee. In this project, we integrated the ρ-uncertainty privacy concept that inherently safeguards against sensitive associations without constraining the nature of an adversary's knowledge and without falsifying data. The project integrates the ρ-uncertainty pattern mining approach with novel data visualization techniques.

The POQEMON research project (https://members.loria.fr/poqemon/) involves the following partners: Altran, DataPublica, GenyMobile, HEC, IP-Label, Next Interactive Media, Orange and Université Paris-Est Créteil, and Inria Nancy Grand Est.

8.2.3. CNRS PEPS and Mastodons projects

8.2.3.1. Mastodons HyQual (2016–2018)

Participants: Miguel Couceiro, Esther Galbrun, Dhouha Grissa, Amedeo Napoli, Chedy Raïssi, Justine Reynaud.

The HyQual project was proposed and initiated this year in the framework of the Mastodons CNRS Call about data quality in data mining (see http://www.cnrs.fr/mi/spip.php?article819&lang=fr). This project is interested in the mining of nutritional data for discovering predictive biomarkers of diabetes and metabolic syndrome in elder populations. The data mining methods which are considered here are hybrid, combining symbolic and numerical methods, and are applied to complex and noisy metabolic data [39]. In the HyQual project, we are mainly interested by the quality of the data at hand and the patterns that can be discovered. In particular, we check whether we can find possible definitions within the data (actually double implications) and redescriptions (under the form of different descriptions of the same data). In this way, we can study the definitional power of the data and as well the incompleteness of the data, leading to two original ways of considering data quality. The project involves researchers from the Orpailleur Team, with researchers from LIRIS Lyon, ICube Strasbourg, and INRA Clermont-Ferrand.

8.2.3.2. PEPS Confocal (2015–2016)

Participants: Adrien Coulet, Amedeo Napoli, Chedy Raïssi, Malika Smaïl-Tabbone.

The Confocal Project (see http://www.cnrs.fr/ins2i/spip.php?article1183) is interested in the design of new methods in bioinformatics for analyzing and classifying heterogeneous omics data w.r.t. biological domain knowledge. We are working on the adaption of FCA and pattern structures for discovering patterns and associations in gene data with the help of domain ontologies. One important objective of the project is to check whether such a line of research could be reused on so-called "discrete models in molecular biology".

8.2.3.3. PEPS Prefute (2015–2016)

Participants: Quentin Brabant, Adrien Coulet, Miguel Couceiro, Esther Galbrun, Amedeo Napoli, Chedy Raïssi, Justine Reynaud, Mohsen Sayed, Malika Smaïl-Tabbone, My Thao Tang, Yannick Toussaint.

The PEPS Prefute project is mainly interested in interaction and iteration in the knowledge discovery (KD) process. Usually the KD process is organized around three main steps which are (i) selection and preparation of the data, (ii) data mining, and (iii) interpretation of (selected) resulting patterns. An analyst, most of the time an expert of the data domain, is present for leading the KD process. Accordingly, the PEPS Prefute project is interested in the study of interactions between the analyst and the KD process, i.e. pushing constraints, preferences and domain knowledge, for guiding and improving the KD process. One possible way is to discover initial patterns acting as seeds for searching farther the pattern space w.r.t. this initial seeds possibly linked to preferences of the analyst. In this way, the interesting pattern space is much more concise and of much lower size.

Then, the importance of preferences and domain knowledge in interaction with KD, and as well, visualization tools, have to be improved for allowing work with large and complex datasets (see https://www.greyc.fr/fr/node/2207).

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. CrossCult (H2020 Project, 2016-2020)

Participants: Miguel Couceiro, Nyoman Juniarta, Amedeo Napoli, Chedy Raïssi.

CrossCult (http://www.crosscult.eu/) aims to make reflective history a reality in the European cultural context, by enabling the re-interpretation of European (hi)stories through cross-border interconnections among cultural digital resources, citizen viewpoints and physical venues. The project has two main goals. The first goal is to lower cultural EU barriers and create unique cross-border perspectives, by connecting existing digital historical resources and by creating new ones through the participation of the public. The second goal is to provide long-lasting experiences of social learning and entertainment that will help towards the better understanding and re-interpretation of European history. To achieve these goals, CrossCult will use cutting-edge technology to connect existing digital cultural assets and to combine them with interactive experiences that all together are intended to increase retention, stimulate reflection and help European citizens appreciate their past and present in a holistic manner. CrossCult will be implemented on 4 real-world flagship pilots involving a total of 8 sites across Europe.

The role of the Orpailleur Team (in conjunction with the Kiwi Team of LORIA) is mainly to work on the recommendation aspects, with a focus on defining an extended profile of the users and connecting these profiles with domain knowledge for leading the recommendation process [42].

The partners of the Orpailleur team in the CrossCult project are the following: Luxembourg Institute for Science and Technology and Centre Virtuel de la Connaissance sur l'Europe (Luxembourg, leader of the project), University College London (England), University of Malta (Malta), University of Peloponnese and Technological Educational Institute of Athens (Greece), Università degli Studi di Padova (Italy), University of Vigo (Spain), National Gallery (London, England), and GVAM Guìas Interactivas (Spain).

8.4. International Initiatives

8.4.1. Inria Associate Teams:SNOWFLAKE

8.4.1.1. SNOWFLAKE

Participants: Adrien Coulet, Joël Legrand, Pierre Monnin, Malika Smaïl-Tabbone.

Title: Knowledge Discovery from Linked Data and Clinical Notes

International Partner (Institution - Laboratory - Researcher):

Stanford (United States) - Department of Medicine, Stanford Center for Biomedical Informatics Research (BMIR) - Nigam Shah

Start year: 2014

Web site: http://snowflake.loria.fr/

Snowflake is an Inria Associate Team which started in 2014. It is aimed at facilitating the collaboration between researchers from the Inria Orpailleur team and the Stanford Center for Biomedical Informatics Research, Stanford University, USA. The main objective of Snowflake is to improve biomedical knowledge discovery by connecting Electronic Health Records (EHRs) with domain knowledge either in the form of ontologies or of Linked Open Data (LOD). Such a connection should help to complete domain knowledge w.r.t. EHRs. The initial focus of Snowflake is the identification and characterization of groups of patients w.r.t. (adverse) reactions to drugs. Identified features associated with such groups of patients could be used as predictors of over- or under-reactions to some drugs.

8.4.2. Participation in Other International Programs

8.4.2.1. A stay at NASA Frontier Development Lab

Participant: Chedy Raïssi.

In 2013, NASA presented the "Asteroid Grand Challenge", a White House supported initiative to supplement the NEO (Near-Earth Object) Program, with a mission: "Find all asteroid threats to human populations and to know what to do about them." There remain a number of unresolved gaps in this challenge, both in terms of discovery, characterization and eventual mitigation strategies, should a potentially hazardous asteroid (PHA) be discovered. By bringing new approaches in computer science, such as deep learning and data mining to tackle specific parts of the problem, solutions may be revealed that, combined with existing processes, significantly benefit the community as a whole.

In July 2016, Chedy Raïssi visited NASA Ames and SETI Institute as part of the Frontier Development Lab. He worked there on developing meaningful research opportunities, as well as support the work of the planetary defense community and show the potential of this kind of applied research methodology to deliver breakthrough of significant value. The work was over a period of six weeks, focusing on Delay-Doppler radar imaging. Delay-Doppler radar imaging is a powerful technique to characterize the trajectories, shapes, and spin states of near-Earth asteroids and has yielded detailed models of dozens of objects. Since the 1990s, Delay-Doppler data has been analyzed using the SHAPE software developed originally by Steven J. Ostro. SHAPE performs sequential single-parameter fitting, and requires considerable computation runtime and human intervention. Reconstructing asteroid shapes and spins from Delay-Doppler data is, like many inverse problems, computationally intensive and requires extensive human oversight of the shape modeling process. Chedy Raïssi has explored two new techniques to better automate Delay-Doppler shape modeling: Bayesian optimization and deep generative models.

8.4.2.2. Ciência Sem Fronteiras (2014–2016)

Participant: Amedeo Napoli.

Program "Ciência Sem Fronteiras" is a Brazilian research fellowship which provides a funding for the stay of a visiting French researcher in Brazil at Universidade Federal Pernambuco Recife for three years. The on-going project is called "Formal Concept Analysis as a Support for Knowledge Discovery" and is aimed at combining FCA methods with numerical clustering methods used by Brazilian colleagues. This project is supervised in Brazil by Professor Francisco de A.T. de Carvalho (CIn/UFPE).

The project aims at developing and comparing classification and clustering algorithms for complex data (especially interval and multi-valued data). Two families of algorithms are studied, namely "clustering algorithms" based on the use of a similarity or a distance for comparing the objects, and "classification algorithms in Formal Concept Analysis (FCA)" based on attribute sharing between objects. The objectives here are to combine the facilities of both families of algorithms for improving the potential of each family in dealing with more complex and voluminous datasets.

8.4.2.3. STIC AmSud: Autonomic Knowledge Discovery (AKD, 2015–2016)

Participants: Miguel Couceiro, Esther Galbrun, Amedeo Napoli, Chedy Raïssi.

This research project involves researchers with different specialties, from Brazil (Universidade Federal Rio Grande do Sul), from Chile (UFSM Santiago and Valparaiso), from Uruguay (Universidad de la Repùblica), and the Orpailleur Team. The project is interested in the design of solutions able to proactively understand the behavior of systems and networks in order to prevent vulnerable states. Accordingly, we aim at integrating knowledge discovery techniques within autonomic systems in order to provide intelligent self-configuration and self-protection mechanisms. The results of this project may not only benefit to end-users but also highly contribute to the scientific community by providing solid foundations for the development of more secure, scalable, and reliable management approaches.

8.4.2.4. LEA STRUCO

Participant: Jean-Sébastien Sereni.

LEA STRUCO is an "Associated International Laboratory" of CNRS between IÚUK, Prague, and LIAFA, Paris. It focuses on high-level study of fundamental combinatorial objects, with a particular emphasis on comprehending and disseminating the state-of-the-art theories and techniques developed. The obtained insights shall be applied to obtain new results on existing problems as well as to identify directions and questions for future work. Jean-Sébastien Sereni is the contact person for LEA STRUCO which was initiated when Jean-Sébastien was a member of LIAFA.

8.4.2.5. Research Collaboration with HSE Moscow

Participants: Miguel Couceiro, Adrien Coulet, Amedeo Napoli, Chedy Raïssi, Justine Reynaud.

An on-going collaboration involves the Orpailleur team and Sergei O. Kuznetsov at Higher School of Economics in Moscow (HSE). Amedeo Napoli visited HSE laboratory several times while Sergei O. Kuznetsov visited Inria Nancy Grand Est several times too. The collaboration is materialized by the joint supervision of students (such as for example the thesis of Aleksey Buzmakov defended at the end of 2015), and the the organization of scientific events, as in particular the workshop FCA4AI whose fifth edition was organized this year in August at ECAI 2016 (see http://www.fca4ai.hse.ru) [53]. A special session about Knowledge Discovery and Formal Concept Analysis will be supervised by Sergei O. Kuznetsov and Amedeo Napoli at the next ISMIS Conference in Warsaw (Poland) next June 2017 (http://ismis2017.ii.pw.edu.pl/s_kd_fca.php).

SMIS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR PerSoCloud (Jan. 2017 - Jan. 2020)

Partners: Orange Labs (coordinator), Inria-SMIS, Cozy Cloud, Univ. of Versailles.
SMIS funding: 170k€.

The objective of PerSoCloud is to design, implement and validate a fullfledged Privacy-by-Design Personal Cloud Sharing Platform. One of the major difficulties linked to the concept of personal cloud lies in organizing and enforcing the security of the data sharing while the data is no longer under the control of a central server. We identify three dimensions to this problem. Devices-sharing: assuming that the primary copy of user U1's personal data is hosted in a secure place, how to share and synchronize it with U1's multiple (mobile) devices without compromising security? Peers-sharing: how user U1 could exchange a subset of his-her data with an identified user U2 while providing to U1 tangible guarantees about the usage made by U2 of this data? Community-sharing: how user U1 could exchange a subset of his-her data with a large community of users and contribute to personal big data analytics while providing to U1 tangible guarantees about the preservation of his-her anonymity? In addition to tackling these three scientific and technical issues, a legal analysis will guarantee compliance of this platform with the security and privacy French and UE regulation, which firmly promotes the Privacy by Design principle, including the current reforms of personal data regulation.

8.1.2. ANR KISS (Dec. 2011 - Feb. 2016)

Partners: Inria-SMIS (coordinator), Inria-SECRET, LIRIS, Univ. of Versailles, CryptoExperts, Gemalto, Yvelines district.
SMIS funding: 230k€.

The idea promoted in KISS is to embed, in trusted devices, software components capable of acquiring, storing and managing securely various forms of personal data (e.g., salary forms, invoices, banking statements, geolocation data, depending on the applications). These software components form a Personal Data Server which can remain under the holder's control. The scientific challenges include: embedded data management issues tackling regular, streaming and spatio-temporal data (e.g., geolocation data), data provenance-based privacy models, crypto-protected distributed protocols to implement private communications and secure global computations.

8.1.3. PIA - PDP SECSi (May. 2016 - Dec. 2017)

Partners: Cozy Cloud (coordinator), Qwant, Inria-SMIS, FING.
SMIS funding: 149k€.

The objective of this PIA-PDP (Programme Investissement d'Avenir - Protection des Données Personnelles) SECSi project is to build a concrete Personal Cloud platform which can support a large scale deployment of Self Data services. Three major difficulties are identified and will be tackled in this project: (1) how to implement and enforce a fine control of the data flow when personal data are exploited by third party applications, (2) how to protect these same applications when processing is delegated to the personal cloud platform itself and (3) how to implement personalized search on the web without hurting user's privacy.

8.1.4. CAPPRIS Project-Lab (Dec. 2011 - Dec. 2016)

Inria Partners: PRIVATICS (coordinator), SMIS, PLANETE, CIDRE, COMETE.
External partners: Univ. of Namur, Eurecom, LAAS.
Funding: not associated to individual project-teams.

An Inria Project Lab (IPL) is a long-term multi-disciplinary project launched by Inria to sustain large scale risky research actions in line with its own strategic plan. CAPPRIS stands for "Collaborative Action on the Protection of Privacy Rights in the Information Society". The key issues that are addressed are: (1) the identification of existing and future threats to privacy, (2) the definition of formally grounded measures to assess and quantify privacy, (3) the definition of the fundamental principles underlying privacy by design and methods to apply them in concrete situations and (4) The integration of the social and legal dimensions. To assess the relevance and significance of the research results, they are confronted to three classes of case studies CAPPRIS partners are involved in: namely Online Social Networks, Location Based Services and Electronic Health Record Systems.

8.1.5. CityLab@Inria, Inria Project Lab (May 2014 -).

Inria Partners: CLIME, DICE, FUN, MIMOVE, MYRIADS, SMIS, URBANET, WILLOW.
External partners: UC Berkeley.
Funding: not associated to individual project teams.

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. SMIS contributes to Privacy-by-Design architectures for trusted smart objects so as to ensure privacy to citizens, which is critical for ensuring that urbanscale sensing contributes to social sustainability and does not become a threat. https://citylab.inria.fr/

8.1.6. VALDO (Valorisation et monétisation des données personnelles à l'ère du Big Data), Digital Society Institute (DSI) (May 2015 - Sept. 2016).

Partners: DANTE and SMIS (co-organizers), CERDI, RITM.
SMIS funding: 50K€.

The objective of this project is to study with a multidisciplinary approach (i.e., computer science, law and economics) the impact of putting a certain (e.g., monetary) value on personal data, over the behavior of individuals (that are the rightful owners of the data) and market companies (that make usage of the personal data) in terms of data protection practices and data usage.

TYREX Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

AGIR

Title: Data-CILE

Call: Appel à projet Grenoble Innovation Recherche (AGIR-Pole)

Duration: 2016-2018

Coordinator: Nabil Layaïda

Abstract: The goal of this project is to contribute to foundational and algorithmic challenges introduced by increasingly popular data-centric paradigms for programming on distributed architectures such as spark and the massive production of big linked open data. The focus of the project is on building robust and more efficient workflows of transformations of rich web data. We will investigate effective programming models and compilation techniques for producing specialised language runtimes. We will focus on high-level specifications of pipelines of data transformations and extraction for producing valuable knowledge from rich web data. We will study how to synthesise code which is correct and optimised for execution on distributed platforms. The overall expected outcome is to make the development of rich-data-intensive applications less error-prone and more efficient.

7.2. National Initiatives

7.2.1. Investissements d'avenir

Datalyse

Title: Entrepôt Intelligent pour Big Data hétérogènes. Investissements d'Avenir Développement de l'Economie Numérique.

Call: Cloud Computing, num 3 – Big Data.

Duration: May 2013 - November 2016

Coordinator: Business & Decision Eolas

Others partners: Groupement des Mousquetaires, Inria Saclay (OAK EPC), LIG (Hadas and Erods teams), LIRMM (Montpellier), LIFL (Lille).

See also: http://www.datalyse.fr/

Abstract: Project Datalyse aims at designing and deploying an infrastructure for big data storage, collection, certification, integration, categorisation, enrichment and sharing over very large heterogeneous data sets. It relies on an industrial platform, to be made available on the cloud, and focuses on three flagship applications, showcasing three uses of big data over different data sets:

- Data-Center Monitoring: The goal of this application is to provide features such as traceability, reporting, optimisation and analysis of abnormal behaviour regarding energy efficiency and security issues. The application will be built with an existing application called ScopeBR (Eolas) and will be deployed in two different green data centers, those of Eolas and GDF SUEZ.
- 'Territoire de données ouvertes et liées': This application aims at extracting and provisioning public open data collected from the city of Grenoble and its suburbs. The goal is to make public data available to third-party application developers and to federate local actors around a single platform.
- Real-time Business Intelligence for the management and processing of points of sale: this application will focus on real-time data analytics and will be deployed within 'Groupement des Mousquetaires' in support of their business intelligence platforms.

7.2.2. ANR

CLEAR

Title: Compilation of intermediate Languages into Efficient big dAta Runtimes

Call: Appel à projets générique 2016 défi 'Société de l'information et de la communication' – JCJC

Duration: October 2016 – September 2020

Coordinator: Pierre Genevès

See also: http://tyrex.inria.fr/clear

Abstract: This project addresses one fundamental challenge of our time: the construction of effective programming models and compilation techniques for the correct and efficient exploitation of big and linked data. We study high-level specifications of pipelines of data transformations and extraction for producing valuable knowledge from rich and heterogeneous data. We investigate how to synthesize code which is correct and optimized for execution on distributed infrastructures.

7.2.3. PERSYVAL-lab LabEx

Title: Mobile Augmented Reality Applications for Smart Cities

Call: Persyval Labex ('Laboratoire d'excellence').

Duration: 2014 – 2017

Coordinators: Pierre Genevès and Nabil Layaïda

Others partners: NeCS team at GIPSA-Lab laboratory.

Abstract: The goal of this project is to increase the relevance and reliability of augmented reality (AR) applications, through three main objectives:

1. Finding and developing appropriate representations for describing the physical world (3D maps, indoor buildings, ways...), integrated advanced media types (3D, 3D audio, precisely geo-tagged pictures with lat., long. and orientation, video...)
2. Integrating the different abstraction levels of these data streams (ranging from sensors data to high level rich content such as 3D maps) and bridging the gap with Open Linked Data (the semantic World). This includes opening the way to query the environment (filtering), and adapt AR browsers to users' capabilities (e.g. blind people). The objective here is to provide an open and scalable platform for mobile-based AR systems (just like the web represents).
3. Increasing the reliability and accuracy of localization technologies. Robust and high-accuracy localization technologies play a key role in AR applications. Combined with geographical data, they can also be used to identify user-activity patterns, such as walking, running or being in an elevator. The interpretation of sensor values, coupled with different walking models, allows one to ensure the continuity of the localization, both indoor and outdoor. However, dead reckoning based on Inertial Navigation Systems (INS) or Step-and-Heading Systems (SHS) is subject to cumulative errors due to many factors (sensor drift (accelerometers, gyroscopes, etc.), missed steps, bad estimation of the length of each stride, etc.). One objective is to reduce such errors by merging and mixing these approaches with various external signals such as GPS and Wi-Fi or relying on the analyses of user trajectories with the help of a structured map of the environment. Some filtering methods (Kalman Filter, observer, etc.) will be useful to achieve this task.

7.3. European Initiatives

7.3.1. Collaborations in European Programs, Except FP7 & H2020

Program: COST

Project acronym: BETTY

Project title: Behavioural Types for Reliable Large-Scale Software Systems

Duration: October 2012 – October 2016

Coordinator: Professor Simon Gay, University of Glasgow, UK

Other partners: Bosnia and Herzegovina, Croatia, Cyprus, Denmark, Estonia, fYR Macedonia, Germany, Greece, Ireland, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Sweden, United Kingdom

Abstract: Modern society is increasingly dependent on large-scale software systems that are distributed, collaborative and communication-centred. Correctness and reliability of such systems depend on compatibility between components and services that are newly developed or may already exist. The consequences of failure are severe, including security breaches and unavailability of essential services. Current software development technology is not well suited to producing these large-scale systems, because of the lack of high-level structuring abstractions for complex communication behaviour.

This Action will use behavioural type theory as the basis for new foundations, programming languages, and software development methods for communication-intensive distributed systems. Behavioural type theory encompasses concepts such as interfaces, communication protocols, contracts, and choreography. As a unifying structural principle it will transform the theory and practice of distributed software development.

The significance of behavioural types has been recognised world-wide during the last five years. European researchers are internationally leading. There is an urgent need for European co-ordination to avoid duplication of effort, facilitate interactions among research groups, and ensure that the field proceeds efficiently from academic research to industrial practice. This Action will provide the co-ordination layer and leverage the efforts of European researchers, to increase the competitiveness of the European software industry.

See also: http://behavioural-types.eu

7.4. International Research Visitors

7.4.1. Internships

Jakob Zietsch from Technische Universität München visited the team from March to July to work on geolocalization with smartphones based on fingerprinting.

WIMMICS Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. SPARKS Team (I3S)

Wimmics is member of the I3S SPARKS team (Scalable and Pervasive softwARe and Knowledge Systems). It is structured according to three axes: FORUM, ELK and S3.

9.1.1.1. SPARKS ELK Axis

Wimmics contributes to the SPARKS ELK research axis (Knwoledge Extraction and Learning). Andrea Tettamanzi is co-animator of this axis together with Frédéric Precioso (I3S).

9.1.1.2. SPARKS FORUM Axis

Wimmics contributes to the SPARKS FORUM research axis (FORmalizing with Users and Models). Catherine Faron-Zucker and Alain Giboin are co-animators of FORUM. This year, three seminars were organized: (1) Visualisation des données liées (Emilie Palagi, Erwan Demairy, Raphaël Boyer, Olivier Corby); (2) Agents BDI possibilistes (Célia Da Costa-Pereira, Serena Villata, Andrea Tettamanzi); (3) Adaptation Dynamique : des processus métiers à l'environnement opérationnel. Application à la continuité de services ambiants (Jean-Yves Tigli, Isabelle Mirbel).

9.1.1.3. SPARKS S3 Axis

Wimmics contributes to the SPARKS S3 research group (Scalable Software Systems). Olivier Corby, Fuqi Song and Erwan Demairy contribute with federated distributed query processing in Corese with Johan Montagnat and Abdoul Macina. Catherine Faron-Zucker and Franck Michel contribute on it with Johan Montagnat on heterogeneous databases federation.

9.1.1.4. SPARKS HCI Group

The HCI Group brings together researchers from the SPARKS team conducting or wishing to conduct research related to Human-Computer Interaction. The group specifically addresses the issues of how to conduct user experiments to evaluate the UIs of the software developed in GLC. The group establishes collaborations between researchers in the design and implementation of experiments. The HCI group is animated by Anne-Marie Dery (I3S).

9.1.1.5. MSHS Axis-2: ICT, Usage and Communities

Participants: Alain Giboin, Alexandre Monnin, Fabien Gandon, Emilie Palagi.

Axis-2 of the *Maison des Sciences Humaines et Sociales (MSHS) du Sud-Est (Nice)* aims to federate interdisciplinary research on the relationships between ICT, Practices and Communities. Wimmics is mainly involved in one of the Axis-2 groups-projects, "Artifacts and Coordination." This group-project studies the impact of cognitive technologies on the social and cognitive coordination between individuals in organizational and community contexts. Alain Giboin is member of the Axis-2 scientific committee and co-animator (with Lise Arena, GREDEG, until September 2016; and Evelyne Rouby, GREDEG, from October 2016) of the "Artifacts and Coordination" group-project. He is also co-animator (with Pierre Thérouanne (Lapcos), Lise Arena and Agnès Festré (GREDEG)) of the project "Acceptabilitity of digital devices: an interdisciplinary perspective". This group is animated by Alain Giboin, Alexandre Monnin, Fabien Gandon and Emilie Palagi.

9.1.2. TCP-IP + Blockchain UCA Idex Submission

Participant: Alexandre Monnin.

We submitted a project proposal around the "TCP-IP + Blockchain (Transdisciplinary Collaborative Plaform for Internet of things and Platformcooperativism)" platform, launched and coordinated by Alexandre Monnin inside the UCA Jedi Idex (Wimmics, LEAT, Aoste, Indes, I3S, GREDEG, LAPCOS, SKEMA, Sustainable Design School, Villa Arson, module D, club Cap EF, SCITIAM, Fabrique des Mobilités, Mnémotix, etc.). A host of projects were submitted inside this platform:

- ACCEPT by Lise Arena and Alain Giboin (Idex Academy 5)

- SMART by François Verdier (Idex Academy 1)

- Polisthelia by Alexandre Monnin (ANR, PCRI with Luxemburg)

- SMARTIOT by François Verdier (ANR project on Smart Contracts)

among which ValueModels submitted by Alexandre Monnin (Idex Academy 1) was accepted.

9.2. National Initiatives

9.2.1. NiceCampus Research Lab

Participant: Nhan Le Thanh.

NiceCampus Research Lab (from training to/and through research to a Joint International Laboratory) is a framework for cooperation for research training. This framework is proposed by the University of Nice Sophia Antipolis to support the 911 Vietnamese research training program that aims to support the development of Vietnamese universities. The NiceCampus Lab Project was a winner of the AUF Call for Proposals 2016-2017. In this context, the MIRE (Maison de l'innovation et de la recherche NiceCampus) was created at University of Da Nang (Vietnam).

9.2.2. DILPROSPECT

Participant: Andrea Tettamanzi.

We participated in the interdisciplinary DILPROSPECT CNRS Project, with researchers of many other research units, including the UMR 7300 ESPACE and INRA on the study of the interface between constructed and natural land on the French Riviera.

9.2.3. AZKAR

Participants: Alain Giboin, Thierry Bergeron, Michel Buffa, Catherine Faron-Zucker.

AZKAR is a two years French project funded by BPI (Banque Publique d'Investissement), focused on *Fast Control of Mobile Robots over the Internet*.

The project started in September 2014. The first step of the project has been the evaluation and benchmarking of video and data solutions over Internet, based on the WebRTC technology. The second step consists in implementing these solutions on a real mobile robot that has been deployed in museums or in homes for helping seniors in their daily tasks. Semantic Web technologies, have been used in the project for describing the services, the context of the application domain, the content transmitted, etc. We got a best demo award at ISWC this year, for a demo that shown a robot located in France that has been remote controlled from Kobe in Japan during the conference [32].

9.2.4. ANR WASABI

Participants: Michel Buffa, Elena Cabrio.

We will be project leader of this 42 month ANR project that starts in January 2017. Partners are IRCAM, Deezer, Radio France and a french startup named Parisson. WASABI aims to build the biggest song metadata semantic database, mixing audio and cultural content analysis. Client applications target music school, sound engineer schools, composers and musicians, journalists, radios and streaming services.

9.2.5. ANR LabCom SMILK

Participants: Elena Cabrio, Catherine Faron-Zucker, Fabien Gandon, Zide Meng, Oscar Rodríguez Rocha, Molka Tounsi.

SMILK (Social Media Intelligence and Linked Knowledge) is a joint laboratory (LabCom, 2013-2016) between the Wimmics team and the Research and Innovation unit of VISEO (Grenoble). Natural Language Processing, Linked Open Data and Social Networks as well as the links between them are at the core of this LabCom. The purpose of SMILK is both to develop research and technologies in order to retrieve, analyze, and reason on textual data coming from Web sources, and to make use of LOD, social networks structures and interaction in order to improve the analysis and understanding of textual resources. Topics covered by SMILK include: use of data and vocabularies published on the Web in order to search, analyze, disambiguate and structure textual knowledge in a smart way, but also to feed internal information sources; reasoning on the combination of internal and public data and schemes, query and presentation of data and inferences in natural formats.

9.2.6. Inria LabCom EduMICS

Participants: Catherine Faron-Zucker, Fabien Gandon, Chihabeddine Bouchenaki, Olivier Corby.

EduMICS (Educative Models Interactions Communities with Semantics) is a joint laboratory (LabCom, 2016-2018) between the Wimmics team and the Educlaver company. Adaptive Learning, Social Learning and Linked Open Data and links between them are at the core of this LabCom. The purpose of EduMICS is both to develop research and technologies with the ultimate goal to adapt educational progressions and pedagogical resource recommendation to learner profiles. Topics covered by EduMICS include: ontology-based modeling of educational resources; ontology-based integration of heterogenous data sources; ontology-based reasoning; semantic analysis of a social network of learners; pedagogical resource recommendation adpated to learner profiles.

9.2.7. Ministry of Culture: DBpedia.fr

Participants: Raphaël Boyer, Fabien Gandon.

This DBpedia.fr project proposes the creation of a French chapter of the DBpedia database. This project was the first project of the Semanticpedia convention signed by the Ministry of Culture, the Wikimedia foundation and Inria.

Web site: http://dbpedia.fr

9.2.8. Ministry of Culture: GT 6 for a convention between Inria and the Ministry of Culture

Participant: Fabien Gandon.

We supervised the working group GT6 Ministry of Culture on the creation of a research convention to foster research and development at the crossroad of culture and digital sciences. This convention signed between Inria and the Ministry of Culture the 12 December 2016 will provide a framework to support projects at the cross-road of the cultural domain and the digital sciences.

9.2.9. ANR OCKTOPUS

Participants: Fabien Gandon, Catherine Faron-Zucker, Zide Meng.

OCKTOPUS is an ANR project (2012-2016) which ended during this year. Its general objective was to increase the potential social and economic benefit of the large and quickly growing amounts of user-generated content, by transforming it into useful knowledge. We showed how it is possible to considerably improve upon existing generic Information Retrieval techniques by exploiting the specific structure of this content and of the online communities which produce it. Specifically, we focused on a multi-disciplinary approach in order to address the problem of finding relevant answers to questions within forums and question-answer sites. To create metrics and predictors of content quality and use them to improve the search experience of a user, we took advantage of:

- the experience of the CRG (the management research institute of Ecole Polytechnique and CNRS) to understand better the incentives of, and interactions between individuals who produce online content within large communities;
- the experience of the Wimmics research team to analyze the structural and temporal aspects of the complex typed social graphs found within these communities;
- the ability of Alcméon (a start-up developing a search application dedicated to user-generated content) to integrate and test the results of OCKTOPUS within a common demonstration framework, in order to assess their practical usefulness when applied to concrete large-scale datasets.

Partners: Alcméon, CRG, Inria Wimmics.

Web site: http://ocktopus.alcmeon.com

9.2.10. GDRI Zoomathia

Participants: Olivier Corby, Catherine Faron-Zucker, Alexandre Monnin, Andrea Tettamanzi.

Wimmics is partner of the International Research Group (GDRI) Zoomathia funded by two CNRS institutes: INEE and INSHS. It aims at studying transmission of zoological knowledge from Antiquity to Middle-Age through material resources (bio residues, artefacts), iconography and texts.

One of the goals of the project is to design a thesaurus and semantically annotate resources, capturing different types of knowledge: zoonyme, historical period, zoological speciality (ethology, anatomy, physiology, psychology, zootechnique, etc.), litterary genre or iconography.

We collaboratively work with MNHN and CEPAM researchers on the construction of a SKOS thesaurus of zoonyms and a SKOS thesaurus of animal specialties the automatic and on the automatic semantic categorization of text fragments. The ultimate goal is the exploitation of these semantic metadata to help historians in their studies of knowledge transmission through these texts.

Web site: http://www.cepam.cnrs.fr/zoomathia/

9.2.11. FUI PadDOC

Participants: Patrice Pena, Alain Giboin.

PadDOC goal is to contribute to accelerating the digital transition of citizen, local and regional authorities, administrations and enterprises, by : (1) developing an open standard and innovative software and hardware resources to facilitate nearby or distant administrative formalities and procedures; (2) improving the security of the holder's personal data by putting these data under the exclusive control of the holder; (3) by exploiting unmarked communicating supports (such as smartphones or tablets) for all chain actors. PadDOC partners are: Docapost BPO, Anyces, ABC SmartCard and the teams Rainbow, Media-Coding and Wimmics.Wimmics will contribute to: (1) the analysis, design and evaluation of the PadDOC security-oriented user interfaces; (2) the impact assessment of the chain of actors participating in the experiment to validate the viability of the PadDOC social system. The PadDOC project officially began in November 2014.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. MIREL RISE

Participants: Serena Villata, Elena Cabrio, Oscar Rodríguez Rocha, Raphaël Gazzotti, Fabien Gandon.

Program: Research and Innovation Staff Exchange (RISE) project, funding under Marie Skłodowska-Curie grant.

Project acronym: MIREL

Project title: MIning and REasoning with legal text

Duration: 2016-2019

Coordinator: Leendert van der Torre, University of Luxembourg

Other partners: University of Bologna (Italy), University of Torino (Italy), University of Huddersfield (UK), Inria (France), APIS (Bulgaria), Nomotika s.r.l. (Italy), DLVSystem s.r.l. (Italy), Zhejiang University (China), Research Organization of Information and Systems (Japan), University of Cape Town (South Africa), National University of La Plata (Argentina), National University of Córdoba (Argentina), Universidad Nacional del Sur in Bahía Blanca (Argentina), National ICT Australia Ltd (Australia), Stanford University (USA).

Abstract: The MIREL project will create an international and inter-sectorial network to define a formal framework and to develop tools for MIning and REasoning with Legal texts, with the aim of translating these legal texts into formal representations that can be used for querying norms, compliance checking, and decision support. MIREL addresses both conceptual challenges, such as the role of legal interpretation in mining and reasoning, and computational challenges, such as the handling of big legal data, and the complexity of regulatory compliance. It bridges the gap between the community working on legal ontologies and NLP parsers and the community working on reasoning methods and formal logic. Moreover, it is the first project of its kind to involve industrial partners in the future development of innovative products and services in legal reasoning and their deployment in the market. MIREL promotes mobility and staff exchange between SMEs to academies in order to create an inter-continental interdisciplinary consortium in Law and Artificial Intelligence areas including Natural Language Processing, Computational Ontologies, Argumentation, and Logic & Reasoning.

Web site: http://www.mirelproject.eu/

9.3.1.2. ALOOF CHIST-ERA

Participants: Valerio Basile, Elena Cabrio, Fabien Gandon.

ALOOF (Autonomous Learning of the Meaning of Objects) is a European project (CHIST-ERA 2015-2018) to enable robots to use the ever-growing amount of knowledge available on the Web, by learning from there about the meaning of previously unseen objects, expressed in a form that makes them applicable when acting in situated environments. Partners include: University of Rome La Sapienza (Italy), University of Birmingham (United Kingdom), Technische Universität Wien (Austria), Inria Sophia Antipolis Méditerranée (France).

Web site: https://project.inria.fr/aloof/

9.4. International Initiatives

9.4.1. MoReWAIS

Participants: Papa Fary Diallo, Mahamadou Toure, Olivier Corby, Isabelle Mirbel, Fabien Gandon.

Title: Mobile Read Write Access and Intermittent to Semantic Web

International Partner (Institution - Laboratory - Researcher):

UGB (Senegal) - LANI - Moussa Lo, Seydina Ndiaye

Start year: 2016

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

MoReWAIS proposes to explore the specificities (advantages and constraints) of mobile knowledge sharing. The mobile application targeted in MoReWAIS must allow communities and their users to enrich and access more easily the knowledge base using the user's context with its richness (e.g. location, other users close-by) and addressing its limitations (e.g. intermittent access, limited resources).

We will design and develop algorithms, methods and tools for mobile devices allowing users to:

- co-construct locally and on the road the Semantic Web of Data RDF triple stores representing the sociocultural shared knowledge.
- Access and visualize in context relevant data from the knowledge platform. This requires a complete rethinking of RDF storage and SPARQL querying in a mobile and unreliable network environment. This will also require dedicated interaction design to ease and encourage access and contribution.

9.4.2. SEEMPAD

Title: Social Exchanges and Emotions in Mediated Polemics - Analysis and Data

International Partner (Institution - Laboratory - Researcher):

University of Montréal (Canada) - Higher Educational Research ON tutoring systems (Heron) - Claude Frasson

Start year: 2014

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

Generating, annotating and analyzing a dataset that documents a debate. We aim at synchronizing several dimensions: social links (intensity, alliances, etc.); interactions happening (who talks to whom); textual content of the exchanged messages; social-based semantic relations among the arguments; emotions, polarity, opinions detected from the text; emotions, physical state detected from sensors.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

9.5.1.1. Internships

Hatim Aouzal

Date: May – September

Institution: MIAGE UNS & EMSI Casablanca, Morocco

Title: Intelligent System for Mobile Robot Museum Visit.

Supervisor: Michel Buffa

Lautaro Petaccio

Date: July – December

Institution: Universidad de Buenos Aires (Argentina)

Title: Design and development of a Fact-Checking Framework Based on Argumentation Theory and Natural Language Processing Techniques.

Supervisors: Elena Cabrio, Serena Villata

Konstantina Poulida

Date: until January

Institution: University of Patras, Computer Engineering and Informatics Department

Title: Semantic Categorization of Segments of Ancient and Mediaeval Zoological Texts

Supervisors: Catherine Faron-Zucker, Andrea Tettamanzi

Avijit Shah

Date: September – December

Institution: NITK, National Institute of Technology Karnataka, Surathkal (India).

Title: Bootstrapping the Construction of a Knowledge Base of Objects

Supervisors: Valerio Basile and Elena Cabrio

9.5.2. Visits to International Teams

9.5.2.1. Research Stays Abroad

Tuan Anh Pham

Date: October 2016 to July 2017.

Erasmus Mundus Scholarship Exchange at University of Danang, Vietnam for 7 months to deploy the result of the PhD in a common project with UNS.

Serena Villata

Date: February-March.

Visit of the Nomotika startup in Turin, Italia, for two months as a secondment of the MIREL H2020 Project.

Topic: This secondment was in the context of WP2, and more specifically it addressed Task 2.2 (Develop NLP systems for mining named entities and concepts, in order to populate the ontology). Serena Villata worked in the past on the topic of ontology-based information extraction from licensing information applying machine learning techniques. The results of her work have been exploited to define the two tools called NLL2RDF [0] and Licentia [0].

During this secondment, she studied together with the Nomotika personnel how to generalize the approach proposed in NLL2RDF and Licentia in such a way that this kind of processing is applicable to legal texts in general, and not only to licenses. More precisely, the collaboration has been concentrated on the investigation of the following open issues: (i) find and refine (if needed) existing computational ontologies for normative reasoning, and (ii) mine legal texts to extract the main deontic components (i.e., obligations, permissions, and prohibitions) and returning a machine-readable semantic representation of such information extracted from the texts exploiting a distributional semantics approach where the meaning of a word is represented by the set of contexts in which it occurs in texts. The collaboration is still ongoing and results are expected soon (i.e., publications).

[0] http://www.airpedia.org/nll2rdf/
[0] http://licentia.inria.fr/

ZENITH Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Labex NUMEV, Montpellier

URL: http://www.lirmm.fr/numev

We participate in the Laboratory of Excellence (labex) NUMEV (Digital and Hardware Solutions, Modelling for the Environment and Life Sciences) headed by University of Montpellier in partnership with CNRS, and Inria. NUMEV seeks to harmonize the approaches of hard sciences and life and environmental sciences in order to pave the way for an emerging interdisciplinary group with an international profile. The project is decomposed in four complementary research themes: Modeling, Algorithms and computation, Scientific data (processing, integration, security), Model-Systems and measurements. Florent Masseglia co-heads the theme on scientific data.

9.1.2. Institute of Computational Biology (IBC), Montpellier

URL: http://www.ibc-montpellier.fr

IBC is a 5 year project (2012-2017) with a funding of 2Meuros by the MENRT (PIA program) to develop innovative methods and software to integrate and analyze biological data at large scale in health, agronomy and environment. Patrick Valduriez heads the workpackage on integration of biological data and knowledge.

9.2. National Initiatives

9.2.1. PIA (Projets Investissements d'Avenir

9.2.1.1. PIA Floris'Tic (2015-2018), 430Keuro.

Participants: Julien Champ, Alexis Joly.

Floris'tic aims at promoting the scientific and technical culture of plant sciences through innovative pedagogic methods, including participatory initiatives and the use of IT tools such as the one built within the Pl@ntNet project. A. Joly heads the work package on the development of the IT tools. This is a joint project with the AMAP laboratory, the TelaBotanica social network and the Agropolis foundation.

9.2.2. Others

9.2.2.1. CIFRE INA/Inria (2013-2016), 100Keuros

Participants: Alexis Joly, Valentin Leveau, Patrick Valduriez.

This contract with INA allows funding a 3-years PhD (Valentin Leveau). This PhD addresses research challenges related to large-scale supervised content-based retrieval in distributed environments.

9.2.2.2. INRA/Inria PhD program, 100Keuros

Participant: Alexis Joly.

This contract between INRA and Inria allows funding a 3-years PhD student (Christophe Botella). The addressed challenge is the large-scale analysis of Pl@ntNet data with the objective to model species distribution (a big data approach to species distribution modeling). The PhD student is supervised by Alexis Joly with François Munoz (ecologist, IRD) and Pascal Monestiez (statistician, INRA).

9.3. European Initiatives

9.3.1. FP7 Projects

9.3.1.1. CoherentPaaS

Participants: Carlyna Bondiombouy, Boyan Kolev, Oleksandra Levchenko, Patrick Valduriez.

Project title: A Coherent and Rich Platform as a Service with a Common Programming Model
Instrument: Integrated Project
Duration: 2013 - 2016
Total funding: 5 Meuros (Zenith: 500Keuros)
Coordinator: U. Madrid, Spain
Partner: FORTH (Greece), ICCS (Greece), INESC (Portugal) and the companies MonetDB (Netherlands), QuartetFS (France), Sparsity (Spain), Neurocom (Greece), Portugal Telecom (Portugal).
Inria contact: Patrick Valduriez

CoherentPaaS has been developing a PaaS that incorporates a rich and diverse set of cloud data management technologies, including NoSQL data stores, such as key-value data stores and graph databases, SQL data stores, such as in-memory and column-oriented databases, hybrid systems, such as SQL engines on top on key-value data stores, and complex event processing data management systems. It uses a common query language to unify the programming models of all systems under a single paradigm and provides holistic coherence across data stores using a scalable, transactional management system. CoherentPaaS will dramatically reduce the effort required to build and the quality of the resulting cloud applications using multiple cloud data management technologies via a single query language, a uniform programming model, and ACID-based global transactional semantics. CoherentPaaS will design and build a working prototype and will validate the proposed technology with real-life use cases. In this project, Zenith is in charge of designing the CloudMdsQL language and implementing its compiler/optimizer and query engine.

9.3.1.2. HPC4E

Participants: Reza Akbarinia, Florent Masseglia, Esther Pacitti, Patrick Valduriez.

Project title: High Performance Computing for Energy
Instrument: H2020
Duration: 2015 - 2017
Total funding: 2 Meuros
Coordinator: Barcelona Supercomputing Center (BSC), Spain
Partner: Europe: Inria, Lancaster University, Centro de Investigaciones Energéticas Medioambientales y Tecnológicas, Repsol S.A., Iberdrola Renovables Energía S.A., Total S.A. Brazil: COPPE/Universidade Federal de Rio de Janeiro, LNCC, Instituto Tecnológico de Aeronáutica (ITA), Universidade Federal do Rio Grande do Sul, Universidade Federal de Pernambuco, Petrobras.
Inria contact: Patrick Valduriez

The main objective is to develop high performance simulation tools that can help the energy industry to respond future energy demands and also to carbon-related environmental issues using HPC systems. The project also aims at improving the usage of energy using HPC tools by acting at many levels of the energy chain for different energy sources. Another objective is to improve the cooperation between energy industries from EU and Brazil. The project includes relevant energy industral partners from Brazil (Petrobras) and EU (Repsol and Total as O&G industries), which benefit from the project's results. A last objective is to improve the cooperation between the leading research centres in EU and Brazil in HPC applied to energy. This includes sharing supercomputing infrastructures between Brazil and EU. In this project, Zenith is working on Big Data management and analysis of numerical simulations.

9.3.1.3. CloudDBAppliance

Participants: Reza Akbarinia, Boyan Kolev, Florent Masseglia, Esther Pacitti, Patrick Valduriez.

Project title: CloudDBAppliance

Instrument: H2020
Duration: 2016 - 2019
Total funding: 5 Meuros (Zenith: 500Keuros)
Coordinator: Bull/Atos, France
Partner: Europe: Inria Zenith, U. Madrid, INESC and the companies LeanXcale, QuartetFS, Nordea, BTO, H3G, IKEA, CloudBiz, and Singular Logic.
Inria contact: Florent Masseglia, Patrick Valduriez

The project aims at producing a European Cloud Database Appliance for providing a Database as a Service able to match the predictable performance, robustness and trustworthiness of on premise architectures such as those based on mainframes. The cloud database appliance features: (1) a scalable operational database able to process high update workloads such as the ones processed by banks or telcos, combined with a fast analytical engine able to answer analytical queries in an online manner; (2) an operational Hadoop data lake that integrates an operational database with Hadoop, so operational data is stored in Hadoop that will cover the needs from companies on big data; (3) a cloud hardware appliance leveraging the next generation of hardware to be produced by Bull, the main European hardware provider. This hardware is a scale-up hardware similar to the one of mainframes but with a more modern architecture. Both the operational database and the in-memory analytics engine will be optimized to fully exploit this hardware and deliver predictable performance. Additionally, CloudDBAppliance will tolerate catastrophic cloud data centres failures (e.g. a fire or natural disaster) providing data redundancy across cloud data centres. In this project, Zenith is in charge of designing and implementing the components for analytics and parallel query processing.

9.4. International Initiatives

9.4.1. MUSIC

Title: MUltiSite Cloud (MUSIC) data management
Inria principal investigator: Esther Pacitti
International Partner):

Laboratorio Nacional de Computaçao Cientifica, Petropolis (Brazil) - Fabio Porto

Universidade Federal do Rio de Janeiro (Brazil) - Alvaro Coutinho and Marta Mattoso

Universidade Federal Fluminense, Niteroi (Brazil) - Daniel Oliveira

Centro Federal de Educa cao Tecnologica, Rio de Janeiro (Brazil) - Eduardo Ogasawara

Duration: 2014 - 2016
See also: https://team.inria.fr/zenith/projects/international-projects/music/

By centralizing all data in a large-scale data center, the cloud significantly simplifies the task of system administration. But for scientific data, where different organizations may have their own data centers, a distributed (multisite) cloud model where each site is visible from outside, is needed. The main objective of this research and scientific collaboration is to develop a multisite cloud architecture for managing and analyzing scientific data, including support for heterogeneous data; distributed scientific workflows, and complex big data analysis. The resulting architecture will enable scalable data management infrastructures that can be used to host a variety of scientific applications that benefit from computing, storage, and networking resources that span multiple data centers.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

We have regular scientific relationships with research laboratories in

- North America: Univ. of Waterloo (Tamer Özsu), UCSB Santa Barbara (Divy Agrawal and Amr El Abbadi)
- Asia: National Univ. of Singapore (Beng Chin Ooi, Stéphane Bressan), Wonkwang University, Korea (Kwangjin Park)
- Europe: Univ. of Madrid (Ricardo Jiménez-Periz), UPC Barcelona (Josep Lluis Larriba Pey), HES-SO (Henning Müller), University of Catania (Concetto Spampinatto), The Open University (Stefan Rüger)
- North Africa: Univ. of Tunis (Sadok Ben-Yahia)
- Australia: Australian National University (Peter Christen)
- Central America: Technologico de Costa-Rica (Erick Mata, former director of the US initiative Encyclopedia of Life)

9.4.3. Participation In other International Programs

We are involved in LifeCLEF lab, a self-organized research platform whose main mission is to promote research, innovation, and development of computer-assisted identification of living organisms. It was initiated by Alexis Joly in 2014 in collaboration with several European colleagues: Henning Müller (CH), Robert B Fisher (UK), Andreas Rauber (AU), Concetto Spampinato (IT), Hervé Glotin (FR). Each year, LifeCLEF releases large-scale experimental data covering tens of thousands of species (plants images, birds audio recordings and fish sub-marine videos). About 100-150 research groups register each year to get access to it and tens of them submit reports describing their conducted research (published in CEUR-WS proceedings). Results are then synthesized and further analyzed in joint research papers.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Marta Mattoso (UFRJ, Brazil) gave a seminar on “‘Exploratory Analysis of Raw Data Files through Dataflows” in march.

Jose Mario Carranza Rojas (PhD student, Technologico de Costa-Rica) spent two days per week in the team in the context of a 4 months internship at the Montpellier research lab AMAP in the context of the Floris’Tic project).

ALICE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

CPER (2014-2020) 50 k€. Sylvain Lefebvre coordinates a work package for the CPER 2014-2020. It involves several members of ALICE as well as laboratories within the Nancy area (Institut Jean Lamour, LRGP, ERPI). Our goal is to consider the interaction between software and material in the additive manufacturing process, with a focus on filament-based printers.

PIC (2015-2017) 150 k€. The PIC project (Polymères Innovants Composites) is a collaboration between Inria, Institut Jean Lamour and Ateliers Cini, funded by Région Lorraine. The goal is to develop a new additive manufaturing process using filament of composite materials with applications in mechanical engineering and the medical domain. Our goal in the project is to provide novel ways to deposit the filament that is better suited to the considered materials and improves the quality of the final parts.

8.2. National Initiatives

8.2.1. ANR BECASIM (2013 – 2016)

890 k€. X. Antoine heads the second partner, which includes Bruno Lévy. Budget for Nancy: 170 k€ of which 100 k€ are for IECL (team CORIDA). This project is managed by Inria. Becasim is a thematic "Numerical Models" ANR project granted by the French Agence Nationale de la Recherche for years 2013-2016. The acronym Becasim is related to Bose-Einstein Condensates: Advanced SIMulation Deterministic and Stochastic Computational Models, HPC Implementation, Simulation of Experiments. The members of the ANR Project Becasim belong to 10 different laboratories.

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. SHAPEFORGE

Title: ShapeForge: By-Example Synthesis for Fabrication

Programm: FP7

Duration: December 2012 - November 2017

Coordinator: Inria

Inria contact: Sylvain Lefebvre

Despite the advances in fabrication technologies such as 3D printing, we still lack the software allowing for anyone to easily manipulate and create useful objects. Not many people possess the required skills and time to create elegant designs that conform to precise technical specifications. 'By–example' shape synthesis methods are promising to address this problem: New shapes are automatically synthesized by assembling parts cutout of examples. The underlying assumption is that if parts are stitched along similar areas, the result will be similar in terms of its low–level representation: Any small spatial neighborhood in the output matches a neighborhood in the input. However, these approaches offer little control over the global organization of the synthesized shapes, which is randomized. The ShapeForge challenge is to automatically produce new objects visually similar to a set of examples, while ensuring that the generated objects can enforce a specific purpose, such as supporting weight distributed in space, affording for seating space or allowing for light to go through. These properties are crucial for someone designing furniture, lamps, containers, stairs and many of the common objects surrounding us. The originality of our approach is to cast a new

view on the problem of 'by–example' shape synthesis, formulating it as the joint optimization of 'by–example' objectives, semantic descriptions of the content, as well as structural and fabrication objectives. Throughout the project, we will consider the full creation pipeline, from modeling to the actual fabrication of objects on a 3D printer. We will test our results on printed parts, verifying that they can be fabricated and exhibit the requested structural properties in terms of stability and resistance.

8.4. International Initiatives

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

8.4.1.1. PREPRINT3D

Title: Model Preparation for 3D Printing

International Partner (Institution - Laboratory - Researcher):

University of Hong Kong, Computer science department, with Li-Yi Wei and Wenping Wang

Start year: 2014

We seek to develop novel ways to prepare objects for 3D printing which better take into account limitations of the fabrication processes as well as real-world properties such as the mechanical strength of the printed object. This is especially important when targeting an audience which is not familiar with the intricacies of industrial design. We target complex, intricate shapes such as models of vegetation and highly detailed meshes, as well as models with thin walls such as architectural models. Our methods will modify the object geometry and topology while remaining as close as possible to its initial appearance.

8.4.2. Inria International Partners

8.4.2.1. Informal International Partners

We have on-going collaborations with Marc Alexa (TU Berlin) regarding slicing algorithms for additive manufacturing and Niloy Mitra (University College London) on minimal wastage design of furniture.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

8.5.1.1. Internships

Denis Salem (CESI-EXIA), 6-months intern started in September 2016, working on point distributions along surfaces using GPU algorithms. Théo Poisson (CESI-EXIA) was an intern from February to May 2016, working on quality testing and improvements to our software IceSL. Yuexin Ma, PhD student with Wenping Wang (HKU), 1 month visit in the context of the PrePrint3D associated team.

AVIZ Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR FITOC: From Individual To Collaborative Visual Analytics

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

The goal of this project is to help bringing collaboration to existing individual visual data analysis work. It is situated in the domain of information visualization, a subdomain of computer science, but views and tries to support data analysis as a social process. The work is motivated by the fact that a large amount of data analysis work is conducted by individuals in isolated tool, such as Excel, R, SPSS, Tableau, and others. Synthesis and sharing of the results then happens in another set of tools such as notes, email, or office documents. The research is situated in the domain of visualization which has a long tradition of building tools and techniques for individual data analysis. Currently there are technological innovations under way to help people analyze data together, but there is still a disconnect between the two modes of data analysis (collaborative and individual). In this project, we want to find ways in which information can best be used and shared visually while transitioning between individual and collaborative data analysis activities.

The project ended in July, 2016.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CENDARI

Title: Collaborative EuropeaN Digital/Archival Infrastructure

Programm: FP7

Duration: February 2012 - January 2016

Coordinator: Trinity College - Dublin

Partners:

Consortium of European Research Libraries (United Kingdom)

Koninklijke Bibliotheek (Netherlands)

Fondazione Ezio Franceschini Onlus (Italy)

Freie Universitaet Berlin (Germany)

King's College London (United Kingdom)

"matematicki Institutnu, Beograd" (Serbia)

Narodni Knihovna Ceske Republiky (Czech Republic)

Societa Internazionale Per Lo Studio Del Medioevo Latino-S.I.S.M.E.L.Associazione (Italy)

The Provost, Fellows, Foundation Scholars & The Other Members of Board of The College of The Holy & Undivided Trinity of Queen Elizabeth Near Dublin (Ireland)

Georg-August-Universitaet Goettingen Stiftung Oeffentlichen Rechts (Germany)

The University of Birmingham (United Kingdom)

Universitaet Stuttgart (Germany)

Universita Degli Studi di Cassino E Del Lazio Meridionale (Italy)

Inria contact: L. Romary

'The Collaborative EuropeaN Digital Archive Infrastructure (CENDARI) will provide and facilitate access to existing archives and resources in Europe for the study of medieval and modern European history through the development of an 'enquiry environment'. This environment will increase access to records of historic importance across the European Research Area, creating a powerful new platform for accessing and investigating historical data in a transnational fashion overcoming the national and institutional data silos that now exist. It will leverage the power of the European infrastructure for Digital Humanities (DARIAH) bringing these technical experts together with leading historians and existing research infrastructures (archives, libraries and individual digital projects) within a programme of technical research informed by cutting edge reflection on the impact of the digital age on scholarly practice. The enquiry environment that is at the heart of this proposal will create new ways to discover meaning, a methodology not just of scale but of kind. It will create tools and workspaces that allow researchers to engage with large data sets via federated multilingual searches across heterogeneous resources while defining workflows enabling the creation of personalized research environments, shared research and teaching spaces, and annotation trails, amongst other features. This will be facilitated by multilingual authority lists of named entities (people, places, events) that will harness user involvement to add intelligence to the system. Moreover, it will develop new visual paradigms for the exploration of patterns generated by the system, from knowledge transfer and dissemination, to language usage and shifts, to the advancement and diffusion of ideas.'

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

- Univ. of Konstanz, Jean-Daniel Fekete collaborates with Michael Behrischon network exploration based on matrices [4], [3].
- NYU, Jean-Daniel Fekete collaborates with Enrico Bertini and his students on multidimensional visualization and exploration [23]/
- Microsoft Research Redmond, Jean-Daniel Fekete collaborates with Nathalie Henry-Riche on the visualization of dynamic networks (see 6.3).
- Stanford University. Mathieu Le Goc, Jean-Daniel Fekete and Pierre Dragicevic collaborate with Sean Follmer on Swarm User Interfaces and the design of the Zooids (section 7.1).
- Univ of Calgary. Pierre Dragicevic collaborates with Wesley Willett on situated data visualization.
- Univ of Washington, Univ Chicago and Univ Zurich. Pierre Dragicevic collaborates with Matthew Kay, Steve Haroz and Chat Wacharamanotham on transparent statistical reporting.
- Microsoft Research, Redmond, University of Waterloo, University of Calgary. Petra Isenberg and Tobias Isenberg collaborate with Bongshin Lee, Mark Hancock, Diane Watson, and Sheelagh Carpendale on touch vs. mouse interaction
- Microsoft Research, Redmond. Petra Isenberg collaborates with Bongshin Lee on mobile visualization research.
- Univ. of Vienna, Austria: Petra Isenberg and Tobias Isenberg collaborate with Torsten Möller and Michael Sedlmair on visualization practices and evaluation of visualization.
- Univ. of Maryland, Baltimore County, USA: Petra Isenberg and Tobias Isenberg collaborate with Jian Chen on visualization practices and evaluation of visualization.
- Georgia Tech, USA: Petra Isenberg and Tobias Isenberg collaborate with John Stasko on visualization practices.
- Univ. Groningen, the Netherlands: Petra Isenberg and Tobias Isenberg collaborate with Lingyun Yu and Konstantinos Efstathiou on context-aware 3D selection.

- Univ. of Granada, Spain: Tobias Isenberg collaborates with Domingo Martín on non-photorealistic rendering.
- Techn. Univ. of Vienna, Austria: Tobias Isenberg collaborates with Ivan Viola on illustrative visualization.
- Univ. of Bergen, Norway: Tobias Isenberg collaborates with Stefan Bruckner on interactive visualization.
- Univ. of Ulm, Germany: Tobias Isenberg collaborates with Timo Ropinski on interactive visualization.
- Worms Univ. of Appl. Sciences, Germany: Tobias Isenberg collaborates with Alexander Wiebel on interactive visualization.
- Univ. Koblenz-Landau, Germany: Tobias Isenberg collaborates with Kai Lawonn on illustrative visualization.
- Univ. Magdeburg, Germany: Tobias Isenberg collaborates with Bernhard Preim on illustrative visualization.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

- Sriram Karthik Badam, PhD, Univ. of Maryland, from Jun 2016 until Sep 2016
- Yanhong Wu, PhD, Hong-Kong Univ. of Science and Technology, from May to Sep. 2016

EX-SITU Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. MultiVis – Novel Interaction Models for Multi-surface Visualization

Type: Ph.D. grant

Funding: DigiCosme Labex

Duration: 2014-2017

Coordinator: James Eagan (Institut Mines Telecom)

Partners: Univ. Paris-Sud, Inria, CNRS, Institut Mines-Telecom

Inria contact: Michel Beaudouin-Lafon

Abstract: The goal of this project is to design, evaluate, and implement novel interaction models that help users appropriate multiple computational surfaces in the sense-making process. Our initial approach is to operationalize and extend the instrumental interaction model to specifically accommodate the specific needs of the sense-making process for information visualization. This project funds Marc-Emmanuel Perrin, a joint PhD student between the VIA group at Institut Mines-Telecom and ExSitu.

9.1.2. MoveIT – Modeling the Speed/Accuracy Trade-Off of Human Aimed Movement with the Tools of Information Theory

Type: Ph.D. grant

Funding: DigiCosme Labex

Duration: 2015-2018

Coordinator: Olivier Rioul (Institut Mines Telecom)

Partners: Univ. Paris-Sud, Inria, CNRS, Institut Mines-Telecom

Inria contact: Michel Beaudouin-Lafon

Abstract: The goal of this project is to conduct fundamental studies of aimed movements based on information theory. The project studies the interaction phenomena involved in pointing, in order to discover novel, more effective pointing techniques. This project funds Wanyu Liu, a joint Ph.D. student between the COMELEC and VIA groups at Institut Mines Telecom and ExSitu.

9.1.3. SensoMotorCVE – Sensor-motor Interface for Collaborative Virtual Environments with Heterogeneous Devices: Application to Industrial Design

Type: Ph.D. grant

Funding: DigiCosme Labex

Duration: 2014-2017

Coordinator: Patrick Bourdot (LIMSI-CNRS)

Partners: Univ. Paris-Sud, Inria, CNRS

Inria contact: Cédric Fleury

Abstract: In the context of collaborative virtual environments, the goal of this project is to develop a sensorimotor interface model for CAD data manipulation that supports heterogeneous interactive systems such as wall-sized displays or immersive virtual reality rooms. This project funds Yujiro Okuya, a joint Ph.D. student between the VENISE group at LIMSI and ExSitu.

9.1.4. La Grande Vitrine des Choses

Type: Art-science grant

Funding: IDEX Paris-Saclay

Duration: 2015-2016

Coordinators: Michel Beaudouin-Lafon & Wendy Mackay

Partners: Univ. Paris-Sud, Inria, CNRS, Theater group $n + 1$

Abstract: Art-science project funded by "La Diagonale Paris-Saclay" to create, in collaboration with the theather group "n+1", an interactive store front in the form of an advent calendar, where users must discover which gestures to perform in order make an animated character open the next window. This installation raises the question of who is controlling whom: Participants think that their gestures directly control the character, but the system actually uses shaping techniques from experimental psychology that encourage users to make successive approximations to the correct gesture. The installation was demonstrated at the Fête de la Science in October, 2016, and was shown during the month of December, 2016 in the Evry shopping mall, next to the Agora Theater. It will also be shown in the Curiositas festival in Gif-sur-Yvette in May, 2017.

9.2. National Initiatives

9.2.1. Investissements d'Avenir

9.2.1.1. Digiscope - Collaborative Interaction with Complex Data and Computation

Type: EQUIPEX (Equipement d'Excellence)

Duration: 2011-2020

Coordinator: Michel Beaudouin-Lafon

Partners: FCS Paris-Saclay (coordinator), Université Paris-Sud, CNRS, CEA, Inria, Institut Mines-Telecom, Ecole Centrale Paris, Université Versailles - Saint-Quentin, ENS Cachan, Maison de la Simulation

Overall budget: 22.5 Meuros, including 6.7 Meuros public funding from ANR

Abstract: The goal of the project is to create ten high-end interactive rooms interconnected by high-speed networks and audio-video facilities to support remote collaboration across interactive visualization environments. The equipment will be open to outside users and targets four main application areas: scientific discovery, product lifetime management, decision support for crisis management, and education and training. Digiscope includes the existing WILD room, and funded the WILDER room. ExSitu contributes its expertise in the design and evaluation of advanced interaction techniques and the development of distributed software architectures for interactive systems. At the end of 2016, all ten rooms are operational, and the telepresence network is being deployed.

9.2.2. Institut Universitaire de France

9.2.2.1. The Instrumental Paradigm

Type: IUF senior fellowship

Duration: 2011-2016

Principal investigator: Michel Beaudouin-Lafon

Abstract: Tools or instruments are a natural way to interact with the real world, and can serve as a powerful metaphor to interact with on-line information. An instrument reifies interaction: it turns an interaction into a meaningful object for users, designers and developers. We envision a future where large, monolithic and closed applications are replaced by a rich ecology of instruments and information containers that can interoperate, giving users the power to shape their own environments. Our work on multisurface interaction [2] and Webstrates [5] illustrate this approach.

9.3. European Initiatives

9.3.1. European Research Council (ERC)

9.3.1.1. Creating Human-Computer Partnerships

Program: ERC Advanced Grant

Project acronym: CREATIV

Project title: Creating Human-Computer Partnerships

Duration: mois année début - mois année fin

Coordinator: Wendy Mackay

Abstract: CREATIV explores how the concept of co-adaptation can revolutionize the design and use of interactive software. Co-adaptation is the parallel phenomenon in which users both adapt their behavior to the system's constraints, learning its power and idiosyncrasies, and appropriate the system for their own needs, often using it in ways unintended by the system designer. A key insight in designing for co-adaptation is that we can encapsulate interactions and treat them as first class objects, called interaction instruments This lets us focus on the specific characteristics of how human users express their intentions, both learning from and controlling the system. By making instruments co-adaptive, we can radically change how people use interactive systems, providing incrementally learnable paths that offer users greater expressive power and mastery of their technology. The initial goal of the CREATIV project is to fundamentally improve the learning and expressive capabilities of advanced users of creative software, offering significantly enhanced methods for expressing and exploring their ideas. The ultimate goal is to radically transform interactive systems for everyone by creating a powerful and flexible partnership between human users and interactive technology.

9.3.1.2. Unified Principles of Interaction

Program: ERC Advanced Grant

Project acronym: ONE

Project title: Unified Principles of Interaction

Duration: October 2016 - September 2020

Coordinator: Michel Beaudouin-Lafon

Abstract: The goal of ONE is to fundamentally re-think the basic principles and conceptual model of interactive systems to empower users by letting them appropriate their digital environment. The project addresses this challenge through three interleaved strands: empirical studies to better understand interaction in both the physical and digital worlds, theoretical work to create a conceptual model of interaction and interactive systems, and prototype development to test these principles and concepts in the lab and in the field. Drawing inspiration from physics, biology and psychology, the conceptual model combines *substrates* to manage digital information at various levels of abstraction and representation, *instruments* to manipulate substrates, and *environments* to organize substrates and instruments into digital workspaces.

9.4. International Initiatives

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

9.4.1.1. DECibel

Title: Discover, Express, Create – Interaction Technologies For Creative Collaboration

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical and Computer Engineering, Center for Magnetic Resonance Research - Bjoern Hartmann

Start year: 2016

The DECibel associated team includes Inria's ExSitu and the CITRIS Connected Communities Initiative (CCI) at UC Berkeley. ExSitu explores extreme interaction, working with creative professionals and scientists who push the limits of technology to develop novel interactive technologies that offer new strategies for creative exploration. ExSitu's research activities include: developing underlying theory (co-adaptive instruments and substrates), conducting empirical studies (participatory design with creative professionals), and implementing interactive systems (creativity support tools). The CITRIS Connected Communities Initiative investigates collaborative discovery and design through new technologies that enhance education, creative work, and public engagement. It develops interactive tools, techniques and materials for the rapid design and prototyping of novel interactive products, expertise sharing among designers, and citizen science investigations. DECibel will combine the strengths of these two groups to to investigate novel tools and technologies that support Discovery, Expressivity, and Creativity.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Joanna McGrenere, Professor at University of British Columbia, Vancouver, Canada, visited ExSitu for her entire sabbatical, from September, 2015 to July, 2016.
- Jim Hollan, Professor at University of California at San Diego (UCSD), visited from April to June, 2016.

GRAPHDECO Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ANR DRAO

Participant: Adrien Bousseau.

https://www-sop.inria.fr/members/Adrien.Bousseau/drao/

The ANR DRAO is a young researcher project coordinated by Adrien Bousseau, in collaboration with the InSitu project team at Inria Saclay - Ile de France (W. Mackay and T. Tsandilas) and the MANAO project team (P. Barla and G. Guennebaud) and POTIOC project team (M. Hachet) at Inria Bordeaux - Sud Ouest. The goal of this collaboration is to develop novel drawing tools for amateurs as well as for expert designers and illustrators, combining expertise in Computer Graphics (REVES and MANAO) and Human-Computer Interaction (InSitu, POTIOC). This ANR project funds the PhD of Emmanuel Iarussi.

While the ANR DRAO ended in 2015, it has resulted in a publication at ACM Conference on Human Factors in Computing Systems (CHI) 2016 [9]. Adrien Bousseau received an ANR Young Researcher Award for coordinating this project.

8.1.1.2. ANR SEMAPOLIS

Participants: George Drettakis, Abdelaziz Djelouah, Theo Thonat.

This ANR project started in October 2013. The goal is to use semantic information to improve urban reconstruction and rendering. The consortium is led by ENPC (R. Marlet) and includes the Inria Willow team and the GREY-C laboratory on image processing. Our contribution will be in the rendering of urban models, in particular using image-based rendering algorithms.

This year, the ANR SEMAPOLIS resulted in five publications on multi-view segmentation [10], multi-view inpainting [13], image-based rendering of cars [12] and interiors [6], and procedural modeling of buildings [8]. Two of these projects rely on a deep learning method from the ENPC group to identify semantic object categories in images (e.g., cars, people etc.) [13], [12]. In [12] we also collaborated with the ENPC group to use a deep learning method to allow the use of rendered images to identify objects in photographs. These collaborations have been extremely fruitful for our group, and have opened the way to several new collaborations with ENPC.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CR-PLAY – Capture Reconstruct Play

http://www.cr-play.eu

Type: COOPERATION (ICT)

Instrument: Specific Targeted Research Project

Objectif: Creativity

Duration: November 2013 - October 2016

Coordinator: Testaluna SA (IT)

Partner: TU Darmstadt (DE), UC London (UK), U. Patras (GR), Miniclip UK, Cursor Oy (FI)

Inria contact: George Drettakis

Abstract: The goal of this project is to use image- and video-based rendering and relighting techniques in the context of games and in particular mobile or casual games. The computer graphics and vision partners (UCL, TUD) are leaders in their fields, and have developed algorithms allowing easy capture of scenes using images and video, and reconstruction using vision algorithms. UCL and Inria have developed image- and video-based rendering algorithms which can be useful for games. These tools need to be perfected, reducing artifacts and difficulty of use so that they can be useful and productive for games companies. For evaluation, the HCI lab of the University of Patras will provide cutting-edge methodologies to make the resulting systems useable. The consortium is led by the games company Testaluna, based in Genova Italy. Other industrial partners include Cursor Oy (a regional group of games companies in Finland, which is a leader in Europe in Casual games) and Miniclip, which is one of the major players in the online game market.

This year we had four results related to CR-PLAY on multi-view segmentation [10], multi-view inpainting [13], image-based rendering of cars [12] and indoors [6]. The work on indoors rendering was led by the CR-PLAY partner UCL. The CR-PLAY project ended in October, and was successfully evaluated in November. The project has resulted in a number of technological developments related to the Ph.D. work of R. Ortiz-Cayon and T. Thonat, as well as the postdoc of A. Djelouah which will be the object of a market study in the goal of a technology transfer.

8.2.1.2. EMOTIVE

Type: COOPERATION (ICT)

Instrument: Reseach Innovation Action

Objectif: Virtual Heritage

Duration: November 2016 - October 2019

Coordinator: EXUS SA (UK)

Partner: Diginext (FR), ATHENA (GR), Noho (IRL), U Glasgow (UK), U York (UK)

Inria contact: George Drettakis

Abstract: Storytelling applies to nearly everything we do. Everybody uses stories, from educators to marketers and from politicians to journalists to inform, persuade, entertain, motivate or inspire. In the cultural heritage sector, however, narrative tends to be used narrowly, as a method to communicate to the public the findings and research conducted by the domain experts of a cultural site or collection. The principal objective of the EMOTIVE project is to research, design, develop and evaluate methods and tools that can support the cultural and creative industries in creating Virtual Museums which draw on the power of 'emotive storytelling'. This means storytelling that can engage visitors, trigger their emotions, connect them to other people around the world, and enhance their understanding, imagination and, ultimately, their experience of cultural sites and content. EMOTIVE will do this by providing the means to authors of cultural products to create high-quality, interactive, personalized digital stories.

GRAPHDECO will contribute by developing novel image-based rendering techniques to help museum curators and archeologists provide more engaging experiences.

8.3. International Initiatives

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

8.3.1.1. CRISP2

Title: Creating and Rendering Images based on the Study of Perception

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical Engineering and Computer Science Department (EECS) - Maneesh Agrawala

Start year: 2014

See also: http://www-sop.inria.fr/reves/crisp/

The CRISP collaboration aims at developing novel techniques to create and manipulate effective numerical imagery. We adopt a multidisciplinary approach, focusing on understanding how people create and perceive images, on developing new rendering algorithms based on this understanding, and on building interactive tools that enable users to efficiently produce the images they have in mind. The participants of CRISP share complementary expertise in computer graphics, human computer interaction and human visual perception. In 2016, the CRISP collaboration supported the postdoc of George Koulieris, who spent 6 months at UC Berkeley and is now at Inria. Johanna Delanoy also spent 2 weeks at UC Berkeley to collaborate with Alexei Efros.

8.3.2. Inria International Partners

8.3.2.1. Informal International Partners

Canada. A. Bousseau collaborates regularly with the University of Toronto (K. Singh) and the University of British Columbia (A. Sheffer).

India. A. Bousseau collaborates with Vinay Namboodiri from IIT Kanpur and hosted several of his students for internships (Rahul Arora and Srinivasa Rao Gadhamchetty).

UK. G. Drettakis collaborates with UCL in the context of the CR-PLAY projects, resulting in a publication on indoor image-based rendering [6].

United States. We regularly collaborate with Adobe Research. Most recently, G. Drettakis worked with Eli Shechtman and Sylvain Paris on multi-view inpainting [13]. We also collaborate with Daniel Aliaga from Purdue University on sketch-based procedural modeling [8].

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Martin Banks (UC Berkeley) visited our group for two weeks in the context of the Associate Team CRISP (Sec. 8.3.1.1). We also hosted Philip Isola, Richard Zhang and Alexei Efros (UC Berkeley) for two days, also in the context of CRISP. Several international researchers made short visits and talks: Elena Garces (University of Zaragoza), Yulia Gryditskaya (MPI), Jan Jermyn (Durham University) , Christian Lessig (Otto-von-Guericke Universitat Magdeburg), Marc Stamminger (Erlangen University). Finally, we hosted Frédo Durand from MIT (10 months) and Eugene Fiume from university of Toronto (6 months) for their sabbatical.

8.4.1.1. Internships

Sai Praveen Bangaru and Srinivasa Rao Gadhamchetty were master interns from IIT Madras and IIT Kampur respectively.

8.4.2. Visits to International Teams

8.4.2.1. Research Stays Abroad

George Koulieris spent 6 months at UC Berkeley (Feb. 1 - Jul. 31) to work with Martin S. Banks in the context of the CRISP Inria associate team. Johanna Delanoy also visited UC Berkeley for two weeks to work with Alexei Efros.

HYBRID Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Labex Cominlabs SUNSET

Participants: Bruno Arnaldi, Guillaume Claude, Gautier Picard, Valérie Gouranton [contact].

SUNSET is a 4-year Labex Cominlabs project (2016-2020). SUNSET partners are MediCIS-LTSI (coordinator), Hybrid, Hycomes (IRISA/Inria), and CHU Rennes. SUNSET aims at developing an innovative training software suite based on immersive and collaborative virtual reality technology for training and evaluating non-technical skills. This approach will be implemented and evaluated in the context of training neurosurgical scrub nurses. We will notably integrate methods and systems developed in the S3PM project (see bellow). By relying on Human Factors approaches, the project also addresses training and evaluation of interpersonal skills. Whereas the developed technologies and approaches will be generic and adaptable to any surgical specialty, the project will evaluate the developed system within training sessions performed with scrub nurses. We ambition to propose novel approaches for surgical non-technical skill learning and assessment, and to install the developed training factory at the University Hospital of Rennes, and evaluate it with real-scale user studies.

9.1.2. Labex Cominlabs S3PM

Participants: Bruno Arnaldi, Guillaume Claude, Valérie Gouranton [contact].

S3PM ("Synthesis and Simulation of Surgical Process Models") is a 4-year Labex Cominlabs project (2013-2017). S3PM partners are MediCIS-LTSI (coordinator), Hybrid, Hycomes (IRISA/Inria), and CHU Rennes. The objective of S3PM is to propose a solution for the computation of surgical procedural knowledge models from recordings of individual procedures, and their execution. The goal of the Hybrid team is to propose and use new models for collaborative and interactive virtual environments for procedural training. The Hybrid team also works on the creation of a surgical training application in virtual reality, exposing the different contributions. Ar

9.1.3. Labex Cominlabs HEMISFER

Participants: Anatole Lécuyer [contact], Marsel Mano, Lorraine Perronnet.

HEMISFER is a 4-year project (2013-2017) funded by Labex CominLabs. It involves 4 Inria/IRISA teams (Hybrid, Visages (lead), Panama, Athena) and 2 medical centers: the Rennes Psychiatric Hospital (CHGR) and the Reeducation Department of Rennes Hospital (CHU Pontchaillou). The goal of HEMISFER is to make full use of neurofeedback paradigm in the context of rehabilitation and psychiatric disorders. The major breakthrough will come from the use of a coupling model associating functional and metabolic information from Magnetic Resonance Imaging (fMRI) to Electro-encephalography (EEG) to “enhance” the neurofeedback protocol. Clinical applications concern motor, neurological and psychiatric disorders (stroke, attention-deficit disorder, treatment-resistant mood disorders, etc).

9.1.4. Labex Cominlabs SABRE

Participants: Anatole Lécuyer [contact], Jussi Tapio Lindgren, Nataliya Kos’Myna.

SABRE is a 3-year project (2014-2017) funded by Labex CominLabs. It involves 1 Inria/IRISA team (Hybrid) and 2 groups from TELECOM BREST engineering school. The goal of SABRE is to improve computational functionnalities and power of current real-time EEG processing pipelines. The project will investigate innovative EEG solution methods empowered and speeded-up by ad-hoc, transistor-level, implementations of their key algorithmic operations. A completely new family of fully-hardware-integrated, new computational EEG imaging methods will be developed that are expected to speed up the imaging process of an EEG device of several orders of magnitude in real case scenarios.

9.1.5. IRT b<>com

Participants: Bruno Arnaldi [contact], Valérie Gouranton, Maud Marchal.

b<>com is a French Institute of Research and Technology (IRT). The main goal of this IRT is to fasten the development and marketing of tools, products and services in the field of digital technologies. Our team has collaborated with b<>com within two 3-year projects: ImData (on "Immersive Interaction") and GestChir (on "Augmented Healthcare") which both ended in 2016. A new 3-year project "NeedleWare" (on "Augmented Healthcare") has been started on October 2016.

9.1.6. CNPAO Project

Participants: Valérie Gouranton [contact], Jean-Baptiste Barreau, Ronan Gaugne.

CNPAO ("Conservatoire Numérique du Patrimoine Archéologique de l'Ouest") is an on-going research project partially funded by the Université Européenne de Bretagne (UEB) and Université de Rennes 1. It involves IRISA/Hybrid and CReAAH. The main objectives are: (i) a sustainable and centralized archiving of 2D/3D data produced by the archaeological community, (ii) a free access to metadata, (iii) a secure access to data for the different actors involved in scientific projects, and (iv) the support and advice for these actors in the 3D data production and exploration through the latest digital technologies, modeling tools and virtual reality systems.
This work was done in collaboration with Quentin Petit (SED Inria Rennes).

9.1.7. Imag'In CNRS IRMA

Participants: Bruno Arnaldi, Jean-Baptiste Barreau, Ronan Gaugne, Valérie Gouranton [contact].

The IRMA project is an Imag'In project funded by CNRS which aims at developping innovative methodologies for research in the field of cultural heritage based on the combination of medical imaging technologies and interactive 3D technologies (virtual reality, augmented reality, haptics, additive manufacturing). It relies on close collaborations with the National Institute of Preventive Archaeological Research (Inrap), the Research Center Archaeology, and History Archéosciences (CReAAH UMR 6566) and the company Image ET. The developed tools are intended for cultural heritage professionals such as museums, curators, restorers, and archaeologists. We focus on a large number of archeological artefacts of different nature, and various time periods (Paleolithic, Mesolithic, and Iron Age Medieval) from all over France. We can notably mention the oldest human bones found in Brittany (clavicle Beg Er Vil), a funeral urn from Trebeurden (22), or a Bronze Cauldron from a burial of the Merovingian necropolis "Crassés Saint-Dizier" (51). This project involves a strong collaboration with Théophane Nicolas (Inrap/UMR Trajectoires), Quentin Petit (SED Inria Rennes), and Grégor Marchand (CNRS/UMR CReAAH).

9.2. National Initiatives

9.2.1. ANR MANDARIN

Participants: Adrien Girard, Anatole Lécuyer, Maud Marchal [contact].

MANDARIN ("MANipulation Dextre hAptique pour opéRations INdustrielles en RV") was a 4-year ANR project (2012-2016). MANDARIN partners were CEA-List (coordinator), Inria/Hybrid, UTC, Haption and Renault. It aimed at designing new hardware and software solutions to achieve natural and intuitive mono and bi-manual dextrous interactions, suitable for virtual environments. The objective of Hybrid in MANDARIN was to design novel multimodal 3D interaction techniques and metaphors allowing to deal with haptic gloves limitations (portability, under-actuation) and to assist the user in virtual reality applications requiring dexterous manipulation. The results were evaluated with a representative industrial application: the bi-manual manipulation of complex rigid objects and cables bundles.

9.2.2. ANR HOMO-TEXTILUS

Participants: Anatole Lécuyer [contact], Maud Marchal.

HOMO-TEXTILUS was a 4-year ANR project (2012-2016). Partners of the project were : Inria/Hybrid, CHART, LIP6, TOMORROW LAND, RCP and potential end-user is Hussein Chalayan fashion designer. The objective of HOMO TEXTILUS was to study what could be the next generation of smart and augmented clothes, and their influence and potential impact on behavior and habits of their users. The project was strongly oriented towards human science, with both user studies and sociological studies. The involvement of Hybrid team in the project consisted in studying the design of next-gen prototypes of clothes embedding novel kinds of sensors and actuators. These prototypes were used and tested in various experiments.

9.2.3. FUI Previz

Participants: Bruno Arnaldi [contact], Valérie Gouranton [contact].

Previz was a 3-year project (2013-2016) funded by the competitive cluster "Images et Réseaux". Previz involved 4 Academic partners (Hybrid/INSA Rennes, ENS Louis-Lumière, LIRIS, Gipsa-Lab) and 9 Industrial partners (Technicolor, Ubisoft, SolidAnim, loumasystem, Polymorph). Previz aimed at proposing new previsualization tools for movie directors. The goal of Hybrid in Previz was to introduce new interactions between real and virtual actors so that the actor's actions, no matter his/her real or virtual nature, impact both the real and the virtual environment. The project ended up with a new production pipeline in order to automatically adapt and synchronize the visual effects (VFX), in space and time, to the real performance of an actor.

9.2.4. Ilab CertiViBE

Participants: Anatole Lécuyer [contact], Jussi Tapio Lindgren, Charles Garraud, Jérôme Chabrol.

CertiViBE is a 2-year "Inria Innovation Lab" (2015-2017) funded by Inria for supporting the development of OpenViBE software, and notably its evolution in order to enable and fasten the medical transfer and the medical certification of products based on OpenViBE. This joint lab involves two partners: Hybrid and Mensia Technologies startup company. The project aims at setting up a quality environment, and developping a novel version of the software wich should comply with medical certification rules.

9.2.5. IPL BCI-LIFT

Participants: Anatole Lécuyer [contact], Jussi Tapio Lindgren [contact], Andéol Evain, Lorraine Perronnet, Nataliya Kos'Myna.

BCI-LIFT is a 4-year "Inria Project Lab" initiative (2015-2019) funded by Inria for supporting a national research effort on Brain-Computer Interfaces. This joint lab involves sevearl Inria teams: Hybrid, Potioc, Athena, Neurosys, Mjolnir, Demar; as well as external partners: INSERM-Lyon, and INSA Rouen. This project aims at improving several aspects of Brain-Computer Interfaces : learning and adaptation of BCI systems, user interfaces and feedback, training protocols, etc.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. HAPPINESS

Title: HAptic Printed Patterned INtErfaces for Sensitive Surface

Programm: H2020

Duration: January 2015 - December 2017

Coordinator: CEA

Partners:

Arkema France (France)

Robert Bosch (Germany)

Commissariat A L'Energie Atomique et Aux Energies Alternatives (France)

Fundacion Gaiker (Spain)

Integrated Systems Development S.A. (Greece)

University of Glasgow (United Kingdom)

Walter Pak SL (Spain)

Inria contact: Nicolas Roussel and Anatole Lécuyer

The Automotive HMI (Human Machine Interface) will soon undergo dramatic changes, with large plastic dashboards moving from the 'push-buttons' era to the 'tactile' era. User demand for aesthetically pleasing and seamless interfaces is ever increasing, with touch sensitive interfaces now commonplace. However, these touch interfaces come at the cost of haptic feedback, which raises concerns regarding the safety of eyeless interaction during driving. The HAPPINESS project intends to address these concerns through technological solutions, introducing new capabilities for haptic feedback on these interfaces. The main goal of the HAPPINESS project is to develop a smart conformable surface able to offer different tactile sensations via the development of a Haptic Thin and Organic Large Area Electronic technology (TOLAE), integrating sensing and feedback capabilities, focusing on user requirements and ergonomic designs. To this aim, by gathering all the value chain actors (materials, technology manufacturing, OEM integrator) for application within the automotive market, the HAPPINESS project will offer a new haptic Human-Machine Interface technology, integrating touch sensing and disruptive feedback capabilities directly into an automotive dashboard. Based on the consortium skills, the HAPPINESS project will demonstrate the integration of Electro-Active Polymers (EAP) in a matrix of mechanical actuators on plastic foils. The objectives are to fabricate these actuators with large area and cost effective printing technologies and to integrate them through plastic molding injection into a small-scale dashboard prototype. We will design, implement and evaluate new approaches to Human-Computer Interaction on a fully functional prototype that combines in packaging both sensors and actuator foils, driven by custom electronics, and accessible to end-users via software libraries, allowing for the reproduction of common and accepted sensations such as Roughness, Vibration and Relief. In this project, the role of Hybrid team is to design user studies on tactile perception, and study innovative usages of the technologies developed in HAPPINESS.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

Michael Pereira (EPFL, Switzerland) visited Hybrid for a collaboration on Brain-Computer Interfaces and sports in January 2016.

9.4.2. Visits to International Teams

Ferran Argelaguet visited the Virtual Reality Lab (Pr. Bernd Frohlich) at the Bauhaus University at Weimar (Germany) in October/November 2016.

ILDA Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

ScaleGest. Surface Gestures for Advanced Graphical Interfaces: Which Gesture for What. (2014-2017) Funded by Digiteo. In collaboration with Telecom ParisTech: **109Keuros**. Participants: Caroline Appert (PI), Rafael Morales Gonzalez, Emmanuel Pietriga.

The project aims at designing gesture-based interaction for expert users who navigate and manipulate large datasets. In the context of advanced graphical applications, the number of gestures should be large-enough to cover the set of controls (*i.e.*, commands and parameter settings) but remain simple-enough to avoid exceeding human abilities. Making gesture-based interaction scale with graphical applications' growing complexity can be achieved only by understanding the foundational aspects of this input modality. This project is about characterizing and structuring both the space of application controls and the space of surface gestures in order to establish guidelines for appropriate control-gesture mappings. It is also about the definition of a sound and systematic evaluation methodology that will serve as a reference benchmark for evaluating these mappings. The resulting control-gesture mappings are demonstrated in the specific application domains of cartography and astronomy.

9.2. National Initiatives

9.2.1. ANR

MapMuxing - Multi-dimensional Map Multiplexing. (2014-2018) Funded by the French National Research Agency (ANR). In collaboration with IGN (Institut National de l'Information Géographique et Forestière): **208Keuros**/499Keuros. Participants: Emmanuel Pietriga (PI), Caroline Appert, Olivier Chapuis, María-Jesús Lobo. http://mapmuxing.ign.fr

The project explores novel ways of combining different maps and data layers into a single cartographic representation, and investigates novel interaction techniques for navigating in it. The project aims at going beyond the traditional pan & zoom and overview+detail interface schemes, and at designing and evaluating novel cartographic visualizations that rely on high-quality generalization, *i.e.*, the simplification of geographic data to make it legible at a given map scale, and symbol specification.

9.2.2. Collaborations with other French Research Organizations

CorTextViz. (2015-2016) Funded by INRA (Institut National de la Recherche Agronomique). In collaboration with project-team Aviz at Inria Saclay (Jean-Daniel Fekete) and INRA (Jean-Philippe Cointet, Guy Riba). Interactive visualization of medium-scale multi-level networks, supporting data storytelling on wall displays. Participants: André Spritzer, Emmanuel Pietriga (PI), Anastasia Bezerianos.

9.3. European Initiatives

9.3.1. Collaborations with Major European Organizations

- European Southern Obseervatory (ESO)
- ALMA Operations Monitoring and Control - design and implementation of state-of-the-art interactive visualization components for the operations monitoring and control software that runs the ALMA radio-observatory in Chile.
- Deutsches Elektronen-Synchrotron (DESY)

- Scientific collaboration on the design and implementation of user interfaces for array operations monitoring and control for the Cherenkov Telescope Array (CTA) project [24], to be built in the Canary Islands (Spain) and in the Atacama desert (Chile).

9.4. International Initiatives

9.4.1. Inria International Labs

Inria Chile / CIRIC. From 2012 to 2015, Emmanuel Pietriga was the scientific leader of the Massive Data team at Inria Chile, working on projects in collaboration with the ALMA radio-telescope and the Millenium Institute of Astrophysics [15]. He is now scientific advisor to Inria Chile's visualization lab.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

- University of Konstanz: Daniel Keim and Johannes Fuchs on mapping out the design space for visualization glyphs [14]. Participants: Anastasia Bezerianos.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Shumin Zhai, Google, June 2016
- Iftach Sadeh, DESY/CTA Observatory, April 2016

9.5.1.1. Internships

- María Grazia Prato, Inria Chile, April 2016

IMAGINE Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. ARC6 PoTAsse (2015 - 2018)

Participants: Pablo Coves, Jean-Claude Léon, Damien Rohmer.

We received a doctoral grant (AdR) from the ARC6 program to generate functional CAD assemblies from scanned data (*PoTAsse*: POint clouds To ASSEmblies) as a collaboration between Imagine team (LJK/Inria) and Geomod team (LIRIS). Our PhD student Pablo Coves is advised by Jean-Claude Léon and Damien Rohmer at Imagine, Raphaëlle Chaine and Julie Digne in Geomod team.

7.2. National Initiatives

7.2.1. FUI Collodi (October 2013 - October 2016)

Participants: Francois Faure, Romain Testylier.

This 3-year contract with two industrial partners: TeamTo and Mercenaries Engineering (software for production rendering), was a follow-up and a generalization of Dynam'it. The goal was to propose an integrated software for the animation and final rendering of high-quality movies, as an alternative to the ever-ageing Maya. It included dynamics similarly to Dynam'it This contract, started in October, funded 2 engineers for 3 years.

This project will be pursued within the new FUI Collodi 2 between 2017 - 2018.

7.3. European Initiatives

7.3.1. ERC Grant Expressive

Title: EXPloring REsponsive Shapes for Seamless desIgn of Virtual Environments.

Programm: ERC Advanced Grant

Duration: 04/2012 - 03/2017

Inria contact: Marie-Paule Cani

To make expressive and creative design possible in virtual environments, the goal is to totally move away from conventional 3D techniques, where sophisticated interfaces are used to edit the degrees of freedom of pre-existing geometric or physical models: this paradigm has failed, since even trained digital artists still create on traditional media and only use the computer to reproduce already designed content. To allow creative design in virtual environments, from early draft to progressive refinement and finalization of an idea, both interaction tools and models for shape and motion need to be revisited from a user-centred perspective. The challenge is to develop reactive 3D shapes – a new paradigm for high-level, animated 3D content – that will take form, refine, move and deform based on user intent, expressed through intuitive interaction gestures inserted in a user-knowledge context. Anchored in Computer Graphics, this work reaches the frontier of other domains, from Geometry, Conceptual Design and Simulation to Human Computer Interaction.

7.3.2. PIPER

Title: Position and Personalize Advanced Human Body Models for Injury Prediction

Programm: FP7

Duration: November 2013 - April 2017

Inria contact: F. Faure

In passive safety, human variability is currently difficult to account for using crash test dummies and regulatory procedures. However, vulnerable populations such as children and elderly need to be considered in the design of safety systems in order to further reduce the fatalities by protecting all users and not only so called averages. Based on the finite element method, advanced Human Body Models for injury prediction have the potential to represent the population variability and to provide more accurate injury predictions than alternatives using global injury criteria. However, these advanced HBM are underutilized in industrial R&D. Reasons include difficulties to position the models – which are typically only available in one posture – in actual vehicle environments, and the lack of model families to represent the population variability (which reduces their interest when compared to dummies). The main objective of the project will be to develop new tools to position and personalize these advanced HBM. Specifications will be agreed upon with future industrial users, and an extensive evaluation in actual applications will take place during the project. The tools will be made available by using an Open Source exploitation strategy and extensive dissemination driven by the industrial partners.Proven approaches will be combined with innovative solutions transferred from computer graphics, statistical shape and ergonomics modeling. The consortium will be balanced between industrial users (with seven European car manufacturers represented), academic users involved in injury bio-mechanics, and partners with different expertise with strong potential for transfer of knowledge. By facilitating the generation of population and subject-specific HBM and their usage in production environments, the tools will enable new applications in industrial R&D for the design of restraint systems as well as new research applications.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- Jean-Charles Bazin (ETH Zurich): The convergence space of visual computing.
- Ariel Shamir (Interdisciplinary Center, Israel): Creating visual stories.
- Eugene Fiume (Univ. Toronto, Canada): Procedural Speech Synchronization for Facial Animation.
- Rahul Narain (Univ. Minnesota, USA): Adaptivity and Optimization for Physics-Based Animation.
- Christian Jacquemin (Univ. Paris Sud): Arts and science: examples in computer graphics and image processing, and critical analysis.
- James Gain (Univ. Cape Town, South Africa): Parallel, Realistic and Controllable Terrain Synthesis.
- Nils Thuerey (Technical Univ. of Munich, Germany): Data-driven Fluid Simulation.
- Bernhard Thomaszewski (Disney Research Zurich, ETH Zurich, Switzerland): Computational Design Tools for the Age of Digital Fabrication.

MANAO Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Carer xD: "Caractérisation et restitution du réel xD"

Currently, the characterization and display of the real world are limited to techniques focusing on a subset of the necessary physical phenomena. A lot of work has been done to acquire geometric properties. However, the acquisition of a geometry on an object with complex reflection property or dynamic behavior is still a challenge. Similarly, the characterization of a material is limited to a uniform object for complex material or a diffuse material when one is interested in its spatial variations.

To reach full interaction between real and virtual worlds (augmented reality, mixed reality), it is necessary to acquire the real world in all its aspects (spatial, spectral, temporal) and to return it as in all these dimensions. To achieve this goal, a number of theoretical and practical tools will be developed around the development of mixed reality solutions and the development of some theoretical framework that supports the entire project.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. "Young Researcher" RichShape (2014-2018)

MANAO
Leader G. Guennebaud
This project aims at the development of novel representations for the efficient rendering and manipulation of highly detailed shapes in a multi-resolution context.

9.2.1.2. ALTA (2011-2016)

MAVERICK, REVES
Leader N. Holzschuch (MAVERICK)
The project ALTA aims at analyzing the light transport equations and at using the resulting representations and algorithms for more efficient computation. We target lighting simulations, either off-line, high-quality simulations or interactive simulations.

9.2.1.3. ISAR (2014-2017)

POTIOC, MANAO, LIG-CNRS-UJF, Diotasoft
Leader M. Hachet (POTIOC)
The ISAR project focuses on the design, implementation and evaluation of new interaction paradigms for spatial augmented reality, and to systematically explore the design space.

9.2.1.4. MATERIALS (2015-2019)

MAVERICK, LP2N-CNRS (MANAO), Musée d'Ethnographie de Bordeaux, OCÉ-Print
Leader N. Holzschuch (MAVERICK)
Local Leader R. Pacanowski (LP2N-CNRS)

Museums are operating under conflicting constraints: they have to preserve the artifacts they are storing, while making them available to the public and to researchers. Cultural artifacts are so fragile that simply exposing them to light degrades them. 3D scanning, combined with virtual reality and 3D printing has been used for the preservation and study of sculptures. The approach is limited: it acquires the geometry and the color, but not complex material properties. Current 3D printers are also limited in the range of colors they can reproduce. Our goal in this project is to address the entire chain of material acquisition and restitution. Our idea is to scan complex cultural artifacts, such as silk cloths, capturing all the geometry of their materials at the microscopic level, then reproduce them for study by public and researchers. Reproduction can be either done through 2.5D printing or virtual reality displays.

9.2.1.5. FOLD-Dyn (2016-2020)

IRIT, IMAGINE, MANAO, TeamTo, Mercenaries
Leader L. Barthe (IRIT)
Local Leader G. Guennebaud (Inria)
The FOLD-Dyn project proposes the study of new theoretical approaches for the effective generation of virtual characters deformations, when they are animated. These deformations are two-folds: character skin deformations (skinning) and garment simulations. We propose to explore the possibilities offered by a novel theoretical way of addressing character deformations: the implicit skinning. This method jointly uses meshes and volumetric scalar functions. By improving the theoretical properties of scalar functions, the study of their joint use with meshes, and the introduction of a new approach and its formalism - called multi-layer 3D scalar functions - we aim at finding effective solutions allowing production studios to easily integrate in their pipeline plausible character deformations together with garment simulations.

9.2.2. Competitivity Clusters

9.2.2.1. LabEx CPU

IMB (UPR 5251), LABRI (UMR 5800), Inria (CENTRE BORDEAUX SUD-OUEST), I2M (NEW UMR FROM 2011), IMS (UMR 5218), CEA/DAM
Some members of *MANAO* participate in the local initiative CPU. As it includes many thematics, from fluid mechanics computation to structure safety but also management of timetable, safety of networks and protocols, management of energy consumption, etc., numerical technology can impact a whole industrial sector. In order to address problems in the domain of certification or qualification, we want to develop numerical sciences at such a level that it can be used as a certification tool.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. PRISM

Title: Perceptual Representation of Illumination, Shape and Material
Programm: FP7
Duration: January 2013 - December 2016
Coordinator: JUSTUS-LIEBIG-UNIVERSITAET GIESSEN
Partners:

Justus-Liebig-Universitaet Giessen (Germany)
Katholieke Universiteit Leuven (Belgium)
Next Limit Sl (Spain)
Technische Universiteit Delft (Netherlands)
the Chancellor, Masters and Scholars of The University of Cambridge (United Kingdom)
Bilkent Üniversitesi (Turkey)
Universite Paris Descartes (France)

The University of Birmingham (United Kingdom)

Local Leader: Pascal Barla

Visual perception provides us with a richly detailed representation of the surrounding world, enabling us to make subtle judgements of 1) 3D shape, 2) the material properties of objects, and 3) the flow of illumination within a scene. Together, these three factors determine the intensity of a surface in the image. Estimating scene properties is crucial for guiding action and making decisions like whether food is edible. Visual 'look and feel' also plays a key role in industrial design, computer graphics and other industries. Despite this, little is known about how we visually estimate the physical properties of objects and illumination. Previous research has mainly focussed on one or two of the three causal factors independently, and from the viewpoint of a specific discipline. By contrast, in PRISM we take an integrative approach, to understand how the brain creates a richly detailed representation of the world by looking at how all three factors interact simultaneously. PRISM is radically interdisciplinary, uniting experts from psychology, neuroscience, computer science and physics to understand both the analysis and synthesis of shape, shading and materials. PRISM is intersectoral by uniting researchers from seven leading Universities and two industrial partners, enabling impact in basic research, technology and the creative industries. Through research projects, cross-discipline visits, and structured Course Modules delivered through local and network-wide training events, we will endow PRISM fellows with an unusually broad overview and the cross-sector skills they need to become future leaders in European research and development. Thus, by delivering early-career training embedded in a cutting-edge research programme, we aim to 1) springboard the next generation of interdisciplinary researchers on perceptual representations of 3D scenes and 2) cement long-term collaborations between sectors to enhance European perception research and its applications.

9.4. International Initiatives

9.4.1. International Partners

9.4.1.1. Rainbow Particle Imaging Velocimetry

Partner : KAUST - King Abdullah University of Science & Technology

We propose a new approach for snapshot imaging of time-resolved, non-stationary 3D fluid flows, which we term Rainbow Particle Imaging Velocimetry (RainbowPIV). Using only a single camera, RainbowPIV will be able to track a dense set of particles advected in the flow. This is achieved by illuminating the flow volume with a stack of monochromatic light planes at different wavelengths (a "rainbow"). Particles are tracked in 3D by both following their 2D spatial position and their change in color, depending on which light plane they traverse.

RainbowPIV will provide dense measurements of 3D velocity vectors, thus obtaining a dense 3D representation of a 3D velocity field. This will allow us to accurately image and understand many new types of flow, including turbulent flows within complex 3D geometries and particle trajectories, with limited optical access. After the initial exploration stage covered in this proposal, RainbowPIV could find many applications in science and engineering, for example to help understand combustion processes or flow through catalytic converters, between turbine blades, and inside inlet manifolds.

MAVERICK Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR BLANC: ALTA

Participants: Nicolas Holzschuch [contact], Cyril Soler.

We are funded by the ANR research program "Blanc" for a joint research project with two other Inria research teams, REVES in Sophia-Antipolis and Manao in Bordeaux. The goal of this project is studying light transport operators for global illumination, both in terms of frequency analysis and dimensional analysis. The grant started in October 2011, for 54 months.

8.1.2. ANR CONTINT: Galaxy/veRTIGE

Participants: Jean-Dominique Gascuel, Nicolas Holzschuch, Fabrice Neyret [contact].

RTIGE stands for Real-Time and Interactive Galaxy for Edutainment. This is an ANR CONTINT (Contents and Interactions) research program, for a joint research project with the EVASION Inria project-team, the GEPI and LERMA research teams at Paris Observatory, and the RSA Cosmos company. The goal of this project is to simulate the quality multi-spectral real-time exploration of the Galaxy with Hubble-like images, based on simulation data, statistical data coming from observation, star catalogs, and procedural amplification for stars and dust clouds distributions. RSA-Cosmos aims at integrating the results in digital planetariums (See Figures 16 and 17). The grant started in December 2010, for 60 months.

8.1.3. ANR CONTINT: MAPSTYLE

Participants: Joëlle Thollot [contact], Hugo Loi.

The MAPSTYLE project aims at exploring the possibilities offered by cartography and expressive rendering to propose original and new cartographic representations. Through this project, we target two types of needs. On the one hand, mapping agencies produce series paper maps with some renderings that are still derived from drawings made by hand 50 years ago: for example, rocky areas in the series TOP25 (to 1/25000) of the French Institut Géographique National (IGN). The rendering of these rocky areas must be automated and its effectiveness retained to meet the requirements of hikers safety. On the other hand, Internet mapping tools allow any user to become a cartographer. However, they provide default styles that cannot be changed (GeoPortal, Google Maps) or they are editable but without any assistance or expertise (CloudMade). In such cases, as in the case of mobile applications, we identify the need to offer users means to design map styles more personalised and more attractive to meet their expectations (decision-making, recreation, etc.) and their tastes. The grant started on October 2012, for 48 months.

8.1.4. ANR: Materials

Participants: Nicolas Holzschuch [contact], Romain Vergne.

Participants: Nicolas Holzschuch [contact], Romain Vergne. We are funded by the ANR for a joint research project on acquisition and restitution of micro-facet based materials. This project is in cooperation with Océ Print Logic technologies, the Museum of Ethnography at the University of Bordeaux and the Manao team at Inria Bordeaux. The grant started in October 2015, for 48 months.

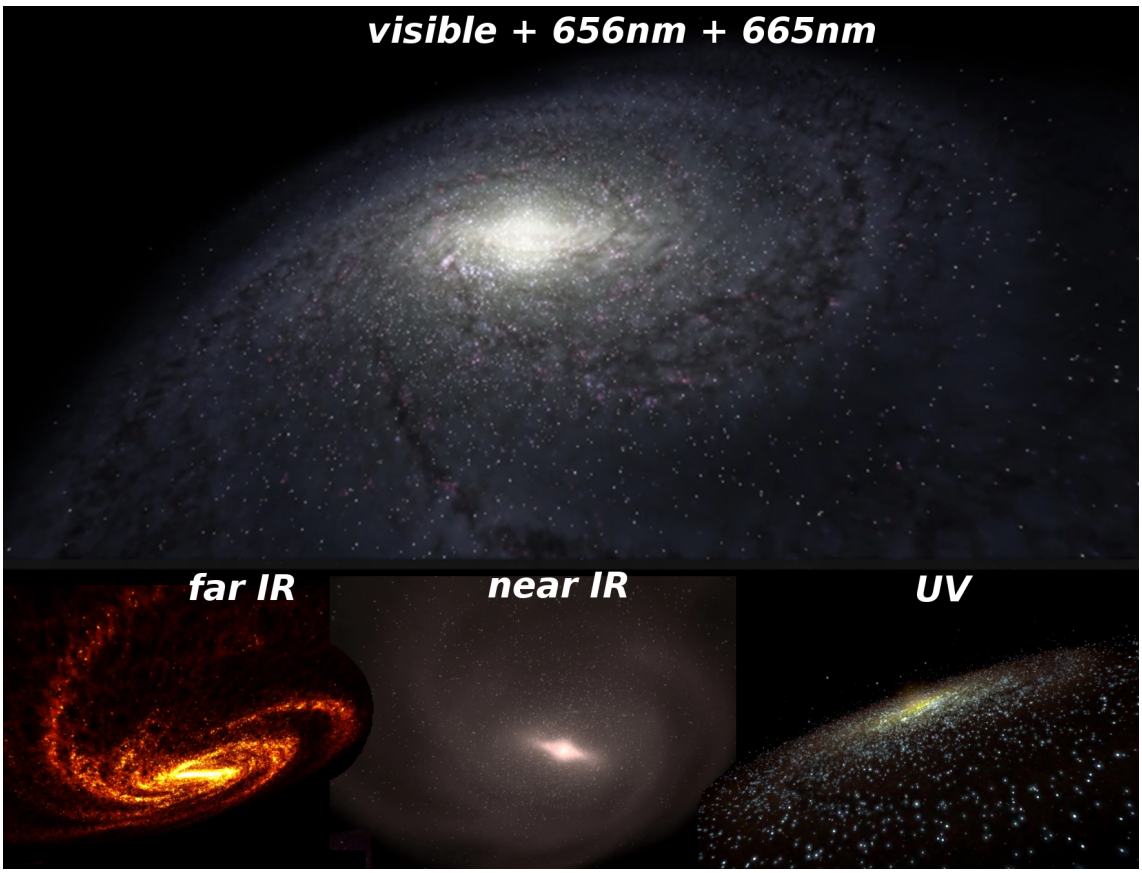


Figure 16. The interactive virtual galaxy integrated in the RSA Cosmos virtual planetarium Sky Explorer, rendered in real-time simulating various Hubble filters in the visible and invisible ranges.

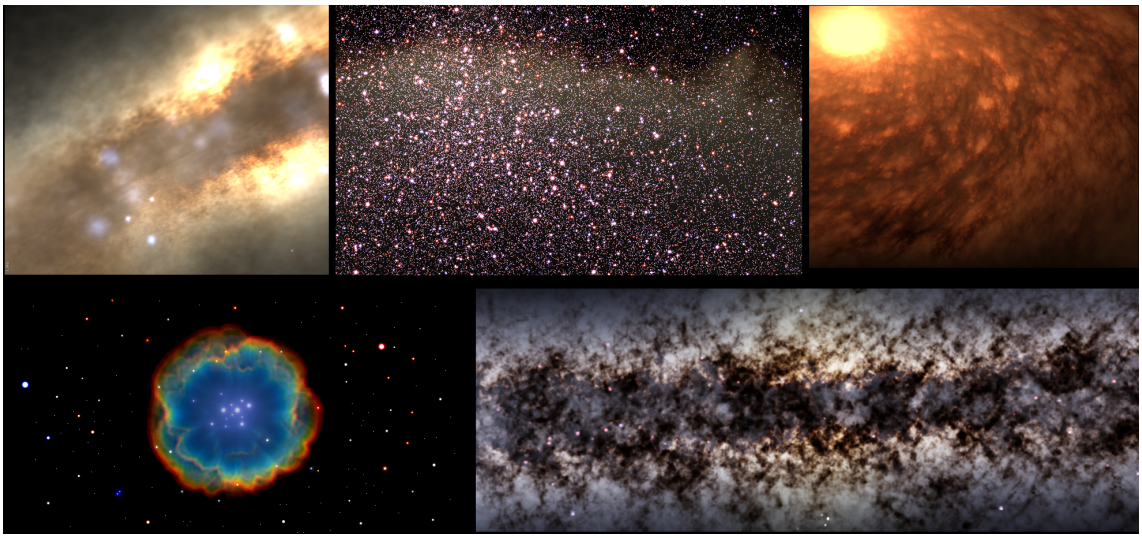


Figure 17. Some detailed views inside the galaxy using the experimental model GigaVoxels-veRTIGE.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Declared Inria International Partners

Title: "MAIS": Mathematical Analysis of Image Synthesis

International Partner (Institution - Laboratory - Researcher):

University of Montreal (Canada) - Département d'Informatique et Recherche Opérationnelle - Derek Nowrouzezahrai

Duration: 2015 - 2019

Start year: 2015

See also: http://diro.umontreal.ca/accueil/

8.2.1.2. Informal International Partners

We have frequent exchanges and on-going collaborations with Cyril Crassin from nVIDIA-Research, and Eric Heitz, Laurent Belcour and Jonathan Dupuy from Unity-Research.

Maverick is part of the GPU Research Center labeled by nVIDIA at Inria Grenoble. Team contact: Fabrice NEYRET.

8.2.2. Participation in Other International Programs

8.2.2.1. Indo-French Center of Applied Mathematics

Topology-driven Visualization of Scientific Data

Title: Topology-driven Visualization of Scientific Data

International Partner (Institution - Laboratory - Researcher):

IISc Bangalore (India) - Deptartment of Science and Automation - Vijay Natarajan

Duration: Sept 2016 - Sept 2017

One of the greatest scientific challenges of the 21st century is how to master, organize, and extract useful knowledge from the overwhelming flow of information made available by today's data acquisition systems and computing resources. Visualization is the premium means of taking up this challenge. Topological analysis has recently emerged as a powerful class of methods for visualizing data. From the input data, these methods derive combinatorial structures capturing the essential features of the data. The goal of this project is to design new topological structures, study their properties, and develop efficient algorithms to compute them. In order to solve this challenge, we will combine our expertise in Topology for the Indian partner and in Geometric Modeling for the French partner. We plan to develop new geometric models that accurately and intuitively depict the topological combinatorial structures.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

8.3.1.1. Internships

Nucha Girijanandan

Date: June 2016 - Jul 2016

Institution: IIS (India) - Deptartment of Science and Automation

Nucha worked on the project "Topology Driven Visualisation of Scientific Data", along with G-P. Bonneau.

Santiago Montesdeoca

Date: Oct 1st - Dec 31 2016

MAGIC - Nanyang Technological University, Singapore.

Santiago is doing research in watercolor rendering of 3D animation and environments, developing new stylization approaches and enforcing direct stylization frameworks in expressive rendering. His research interests include expressive/non-photorealistic rendering, computer animation, real-time rendering and image processing.

8.3.2. Visits to International Teams

8.3.2.1. Sabbatical programme

Soler Cyril

Date: Aug 2015 - Jul 2016

Institution: Université de Montréal (Canada)

During his stay in Montreal, C.Soler has worked in Collaboration with D.Nowrouzezahrai and P.Poulin (U.of Montreal) and Guillaume Lavoué (Université Lyon-I), on two projects associated to material appearance capture and characterisation. At the time of writing these two projects are actively followed by all partners and publications will be submitted to ACM Transaction on Graphics within a few months. C.Soler has also presented his work in the seminar of the DIRO in October 2015.

8.3.2.2. Research Stays Abroad

Fabrice Neyret

Date: Nov 2015 - Mar 2016

Institution: WETA Digital (New-Zeland)

The content of this collaboration is covered by a NDA.

MIMETIC Project-Team

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

9.1.1.1. Cineviz

Participants: Marc Christie [contact], Christophe Lino, Hui-Yin Wu.

Cineviz is a 3-year ANR LabCom project (2016-2019). Amount: 300kE. Parnters: SolidAnim, UR1.

The project is a bilateral collaboration with the SolidAnim company. The objective is to jointly progress on the design and implementation of novel tools for the preproduction in the film industry. The project will address the challenges related to (i) proposing expressive framing tools, (ii) integrating the technical aspects of shooting (how to place the cameras, lights, green sets) directly at the design stage), and (iii) novel interaction metaphors for designing and controlling the staging of lights in preproduction, using an example-based approach.

9.1.1.2. Cinecitta

Participants: Marc Christie [contact], Christophe Lino, Hui-Yin Wu.

Cinecitta is a 3.5 year ANR young researcher project lead by Marc Christie (ANR JCJC 2012-2016). Amount: 208kE.

The main objective of Cinecitta was to propose and evaluate a novel workflow which mixes user interaction using motion-tracked cameras and automated computation aspects for interactive virtual cinematography that will better support user creativity. We designed a novel cinematographic workflow that features a dynamic collaboration of a creative human filmmaker with an automated virtual camera planner. The process enhances the quality and utility of the automated planner's suggestions by adapting and reacting to the creative choices made by the filmmaker. This required three advances in the field. First, the ability to generate relevant viewpoint suggestions following classical cinematic conventions. The formalization of these conventions in a computationally efficient and expressive model is a challenging task in order to select and propose the user with a relevant subset of viewpoints among millions of possibilities. Second, the ability to analyze data from real movies in order to formalize some elements of cinematographic style and genre. Third, the integration of motion-tracked cameras in the workflow. Motion-tracked cameras represent a great potential for cinematographic content creation. However given that tracking spaces are of limited size, there is a need to provide novel interaction metaphors to ease the process of content creation with tracked cameras. Finally we gathered feedback on our prototype by involving professionals (during dedicated workshops) and numerous interactions with the Louis Lumière Film School.

9.1.1.3. Entracte

Participants: Charles Pontonnier [contact], Georges Dumont, Franck Multon, Pierre Plantard, Ana Lucia Cruz Ruiz, Antoine Muller, Anthony Sorel, Nicolas Bideau, Richard Kulpa.

The ANR project ENTRACTE is a collaboration between the Gepetto team in LAAS, Toulouse (head of the project) and the Inria/MimeTIC team. The project started in November 2013 and will end in August 2017. The purpose of the ENTRACTE project is to address the action planning problem, crucial for robots as well as for virtual human avatars, in analyzing human motion at a biomechanical level and in defining from this analysis bio-inspired motor control laws and bio-inspired paradigms for action planning. The project is launched since november 2013 and Ana Lucia Cruz Ruiz, who has been recruited as a PhD student since this date, just defended her thesis on muscle-based control based on synergies.

9.1.2. National scientific collaborations

9.1.2.1. Cavaletic

Participant: Franck Multon.

The Cavaletic collaborative project is leaded by University Bretagne Sud and also involves University Rennes2 (CREAD Lab.). It has been funded by the National IFCE (Institut Français du Cheval et de l'Equitation) in order to develop and evaluate technological assistance in horse riding learning, thanks to a user-centered approach. MimeTIC is involved in measuring expert and non-expert horse riders' motions in standardized situations in order to develop metrics to measure riders' performance. It will be used to develop a technological system embedded on users to evaluate their performance and provide them with real-time feedback to correct potential errors.

9.1.2.2. FFT

Participants: Richard Kulpa, Benoit Bideau, Pierre Touzard.

An exclusive contract has been signed between the M2S laboratory and the French Federation of Tennis for three years. The goal is to perform biomechanical analyses of 3D tennis serves on a population of 40 players of the Pôle France. The objective is to determine the link between injuries and biomechanical constraints on joints and muscles depending on the age and gender of the players. At the end, the goal is to evaluate their load training.

9.1.2.3. gDGA

Participants: Antonio Mucherino, Ludovic Hoyet, Franck Multon.

gDGA (generalization of the Distance Geometry and its Applications) is a INS2I/CNRS PEPS project involving local and national partners. Distance geometry can nowadays be seen as a classical problem in operational research, having a wide range of applications. The main aim of this interdisciplinary project is to extend the definition and the range of applicability of distance geometry. In particular, our main interest is on dynamical problems, motivated by a certain number of applications of interest, including interaction motion adaptation, the simulation of crowd behaviours, and the conception of modern recommender systems. The classical application of distance geometry arising in the biological field is also taken into consideration. The necessity of a strong computational power for the considered applications motivates the need of implementing our algorithms in environments capable of exploiting the resources on GPU cards.

9.1.2.4. IRMA

Participants: Ronan Gaugne [contact], Georges Dumont.

The IRMA project is an Imag'In project funded by CNRS which aims at developping innovative methodologies for research in the field of cultural heritage based on the combination of medical imaging technologies and interactive 3D technologies (virtual reality, augmented reality, haptics, additive manufacturing). It relies on close collaborations with the National Institute of Preventive Archaeological Research (Inrap), the Research Center Archaeology, and History Archéosciences (CReAAH UMR 6566) and the company Image ET. The developed tools are intended for cultural heritage professionals such as museums, curators, restorers, and archaeologists. We focus on a large number of archeological artefacts of different nature, and various time periods (Paleolithic, Mesolithic, and Iron Age Medieval) from all over France. We can notably mention the oldest human bones found in Brittany (clavicle Beg Er Vil), a funeral urn from Trebeurden (22), or a Bronze Cauldron from a burial of the Merovingian necropolis "Crassés Saint-Dizier" (51). This project involves a strong collaboration with members of the team Hybrid (Valérie Gouranton, Bruno Arnaldi and Jean-Baptiste Barreau), Théophane Nicolas (Inrap/UMR Trajectoires), Quentin Petit (SED Inria Rennes), and Grégor Marchand (CNRS/UMR CReAAH).

9.1.3. ADT: Immerstar

Participants: Franck Multon, Georges Dumont, Ronan Gaugne.

The ADT-Immerstar is driven by the SED and aims at developing new tools and facilities for the scientific community in order to develop demos and use the two immersive rooms in Rennes: Immersia and Immermove. The engineer (Quentin Petit, SED) has the responsibility of homogenizing the software modules and development facilities in each platform, of installing new upgrades and of developping collaborative applications between the two sites.

9.1.4. PRE

Participants: Franck Multon, Ludovic Hoyet.

The Inria PRE entitled "Smart sensors and novel motion representation breakthrough for human performance analysis" aims at designing a new description for human motion in order to automatically capture, measure and transfer the intrinsic constraints of human motion. Current approaches consist in manually editing the constraints associated with a motion, to use classical skeleton representation with joint angles based on direct or indirect measurements, and then perform inverse kinematics to fulfill these constraints. We aim at designing a new representation to simplify this process pipeline and make it automatic, together with relevant motion sensors that could provide enough information to automatically extract these intrinsic constraints. To this end, this project has been jointly proposed with the Inria CAIRN team, which develops sensors based on joint orientations and distances between sensors. We aim at extending this type of device to measure new types of information that would help to simplify the above mentionned pipeline. Zhiguang Liu started to work as a research fellow on this project since November 2016, working in collaboration with CAIRN. We also involved Hubert Shum from Northumbria University to link this project with our long-term collaboration on this type of problems.

9.2. International Initiatives

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

9.2.1.1. FORMOSA

Title: Fostering Research on Models for Storytelling Applications

International Partner (Institution - Laboratory - Researcher):

NCCU (Taiwan) - Intelligent Media Lab (IML) - Tsai-Yen Li

Start year: 2016

See also: http://www.irisa.fr/mimetic/GENS/mchristi/EA-FORMOSA/

Interactive Storytelling is a new media which allows users to alter the content and outcome of narratives through role-playing and specific actions. With the quality, the availability and reasonable costs of display technologies and 3D interaction devices on one side, and the accessibility of 3D content creation tools on the other, this media is taking a significant share in entertainment (as demonstrated by the success of cinematographic games such as Heavy Rain or Beyond: two souls). These advances push us to re-think the way narratives are traditionally structured, explore new interactive modalities and provide new interactive cinematographic experiences. As a sequel of the first associate team FORMOSA 1, we propose to address new challenges pertained to interactive storytelling such as the use of temporal structures in narratives, interaction modalities and their impact in terms of immersion, and the adaptation of cinematographic real data to 3D environments. To achieve these objectives, the associate team will rely on the complementary skills of its partners and on the co-supervision of students.

9.2.1.2. RE-SIMS

Title: REal data against crowd SImulation algorithMS

International Partner (Institution - Laboratory - Researcher):

University of North Carolina at Chapel Hill (United States) - GAMMA Research Group (GAMMA) - Ming LIN

Start year: 2015

See also: http://www.irisa.fr/mimetic/GENS/jpettre/EASIMS/easims.html

RE-SIMS aims at gathering the best international research teams working on crowd simulation to allow significant progresses on the level of realism achieved by crowd simulators. To this end, RE-SIMS aims at improving methods for capturing crowd motion data that describe real crowd behaviors, as well as by improving data assimilation techniques.

In this renewal, RE-SIMS extends the previous SIMS partnership and follows a multidiciplinary direction.

9.2.2. Informal Inria International Partners

Dr. Edouard Auvinet, Imperial College London, UK (collaboration with Franck Multon, visited the team for a wekk in November)

Dr. Douglas S. Gonçalves, Federal University of Santa Catarina, Florianópolis, Brazil (collaboration with Antonio Mucherino, visited the team in December)

Prof. Carlile Lavor, UNICAMP, Campinas, São Paulo, Brazil (collaboration with Antonio Mucherino)

Dr. Rachel McDonnell, Trinity College Dublin, Ireland (collaboration with Ludovic Hoyet, joint paper submission)

Prof. Carol O'Sullivan, Trinity College Dublin, Ireland (collaboration with Ludovic Hoyet, visited the team for a week in June)

Dr. Huber Shum, Northumbria University, Newcastle, UK (collaboration with Franck Multon and Ludovic Hoyet, with joint papers and supervision, visited the team in November)

9.3. International Research Visitors

9.3.1. Visits of International Scientists

Dr. Edouard Auvinet, Imperial College London, UK (one week in November)

Dr. Douglas S. Gonçalves, Federal University of Santa Catarina, Florianópolis, Brazil (one week in December)

Prof. Carol O'Sullivan, Trinity College Dublin, Ireland (one week in June)

Dr. Hubert Shum, Northumbria University, Newcastle, UK (joint supervision, visit for two days in November)

9.3.1.1. Internships

Yihun Shen, Northumbria University, Newcastle, UK (PhD supervisor: Dr. Hubert Shum), 4-month internship on Rennes Metropole incoming mobility funding (Sept. to Dec. 2016).

MINT Project-Team

8. Partnerships and Cooperations

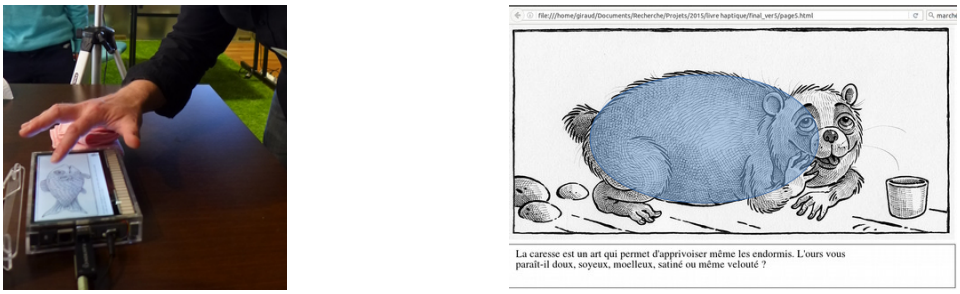
8.1. Regional Initiatives

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.

Mjolnir Team

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)

POTIOC Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

HOBIT: Hybrid Optical Bench for Innovative Teaching:

Duration: 2015-2017

Funding: Idex CPU & LAPHIA, and Inria ADT

Partners: Université de Bordeaux (IUT mesures physiques) & Université de Lorraine

The goal of the Hobit project (Hybrid Optical Bench for Innovative Teaching) is to design a hybrid optical bench that benefits from both the physical and the virtual worlds to enhance teaching and training in the field of optics and photonics (See Section 7.1).

website: https://project.inria.fr/hobit

OpenStreetMap

Collaboration with Marina Duféal (Assistant Professor in Geography at PASSAGES, UMR 5319, Univ. Bordeaux Montaigne) and Vincent Bergeot (Num&Lib) regarding contribution to OpenStreetMap. We have jointly organized a cartopartie for “Fête de la Science2016” at Inria Bordeaux.

9.2. National Initiatives

eTAC: Tangible and Augmented Interfaces for Collaborative Learning:

Funding: EFRAN

Duration: 2017-2021

Coordinator: Université de Lorraine

Local coordinator: Martin Hachet

Partners: Université de Lorraine, Inria, ESPE, Canopé, OpenEdge,

the e-TAC project proposes to investigate the potential of technologies ”beyond the mouse” in order to promote collaborative learning in a school context. In particular, we will explore augmented reality and tangible interfaces, which supports active learning and favors social interaction.

ANR Rebel:

Duration: 2016-2019

Coordinator: Fabien Lotte

Funding: ANR Jeune Chercheur Jeune Chercheuse Project

Partners: Disabilities and Nervous Systems Laboratory Bordeaux

Brain-Computer Interfaces (BCI) are communication systems that enable their users to send commands to computers through brain activity only. While BCI are very promising for assistive technologies or human-computer interaction (HCI), they are barely used outside laboratories, due to a poor reliability. Designing a BCI requires 1) its user to learn to produce distinct brain activity patterns and 2) the machine to recognize these patterns using signal processing. Most research efforts focused on signal processing. However, BCI user training is as essential but is only scarcely studied and based on heuristics that do not satisfy human learning principles. Thus, currently poor BCI reliability is probably due to suboptimal user training. Thus, we propose to create a new generation of BCI that apply human learning principles in their design to ensure the users can learn high quality control skills, hence making BCI reliable. This could change HCI as BCI have promised but failed to do so far.

ANR Project ISAR:

Duration: 2014-2017
Coordinator: Martin Hachet
Partners: LIG-CNRS (Grenoble), Diotasoft (Paris)
Acronym: Interaction en Réalité Augmentée Spatiale / Interacting with Spatial Augmented Reality
The ISAR project (Interaction with Spatial Augmented Reality) focuses on the design, implementation, and evaluation of new paradigms to improve interaction with the digital world when digital content is directly projected onto physical objects. It opens new perspectives for exciting tomorrow's applications, beyond traditional screen-based applications.
website: https://team.inria.fr/potioc/scientific-subjects/papart/

Inria ADT Artik:

Duration: 2014-2016
Coordinator: Jérémy Laviole & Martin Hachet
The Artik projet is focused on the development of Papart (Paper Augmented Reality Toolkit). Papart is a toolkit that enables projector/cameras (ProCam) and depth camera to work together to create interactive surfaces. It works with comsumer-available hardware and enables tabletop interactions, although high-end cameras and projectors are also well supported. Here are the major advances of the developments of 2015: The hardware is now managed with a dedicated application, each Papart application is now hardware agnostic. Extrinsic calibration of projector / color and depth cameras can be done with any application running, the calibration processing is now below 2 minutes. The touch detection can be tweaked to fit any suface: it has been tested on a table, wall, and floor with respectively finger, hand, and foot interaction. This project relies on open source software, we also maintain the support of Maven distribution for the Processing project.
website: https://project.inria.fr/papart/

Inria ADT OpenViBE-X:

Duration: 2014-2016
Partners: Inria teams Hybrid and Athena
Coordinator: Maureen Clerc (Inria Sophia Antipolis)
This is the follow-up project of OpenViBE-NT
website: http://openvibe.inria.fr

Inria Project Lab BCI-LIFT:

Duration: 2015-2018
Partners: Inria team Athena (Inria Sophia-Antipolis), Inria team Hybrid (Inria Rennes), Inria team Neurosys (Inria Nancy), LITIS (Université de Rouen), Inria team DEMAR (Inria Sophia-Antipolis), Inria team MINT (Inria Lille), DyCOG (INSERM Lyon)
Coordinator: Maureen Clerc (Inria Sophia Antipolis)
The aim is to reach a next generation of non-invasive Brain-Computer Interfaces (BCI), more specifically BCI that are easier to appropriate, more efficient, and suit a larger number of people. With this concern of usability as our driving objective, we will build non-invasive systems that benefit from advanced signal processing and machine learning methods, from smart interface design, and where the user immediately receives supportive feedback. What drives this project is the concern that a substantial proportion of human participants is currently categorized "BCI-illiterate" because of their apparent inability to communicate through BCI. Through this project we aim at making it easier for people to learn to use the BCI, by implementing appropriate machine learning methods and developping user training scenarios.
website: http://bci-lift.inria.fr/

Helios:

Duration: 2015-2016

Partners: Université de Lorraine

Funding: SATT Nancy Grand Est

Coordinator: Stéphanie Fleck (Université de Lorraine)

The Helios project aims to provide a methodology and innovative media for the improvement of learning of basic astronomical phenomena for school groups (8-11 years). As part of this project, Potioc has focused on the development of the final application for augmented reality based and 3D manipulation, for providing a high-fidelity prototype.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

Program: ERC Starting Grant

Project acronym: BrainConquest

Project title: Boosting Brain-Computer Communication with High Quality User Training

Duration: 2017-2021

Coordinator: Fabien Lotte

Abstract: Brain-Computer Interfaces (BCIs) are communication systems that enable users to send commands to computers through brain signals only, by measuring and processing these signals. Making computer control possible without any physical activity, BCIs have promised to revolutionize many application areas, notably assistive technologies, e.g., for wheelchair control, and man-machine interaction. Despite this promising potential, BCIs are still barely used outside laboratories, due to their current poor reliability. For instance, BCIs only using two imagined hand movements as mental commands decode, on average, less than 80A BCI should be considered a co-adaptive communication system: its users learn to encode commands in their brain signals (with mental imagery) that the machine learns to decode using signal processing. Most research efforts so far have been dedicated to decoding the commands. However, BCI control is a skill that users have to learn too. Unfortunately how BCI users learn to encode the commands is essential but is barely studied, i.e., fundamental knowledge about how users learn BCI control is lacking. Moreover standard training approaches are only based on heuristics, without satisfying human learning principles. Thus, poor BCI reliability is probably largely due to highly suboptimal user training. In order to obtain a truly reliable BCI we need to completely redefine user training approaches. To do so, I propose to study and statistically model how users learn to encode BCI commands. Then, based on human learning principles and this model, I propose to create a new generation of BCIs which ensure that users learn how to successfully encode commands with high signal-to-noise ratio in their brain signals, hence making BCIs dramatically more reliable. Such a reliable BCI could positively change man-machine interaction as BCIs have promised but failed to do so far.

9.3.2. Collaborations in European Programs, Except FP7 & H2020

Program: ERASMUS+

Project acronym: VISTE

Project title: Empowering spatial thinking of students with visual impairment

Duration: 2016-2019

Coordinator: National Technical University of Athens (Greece)

Other partners: Intrasoft International SA (Greece), Casa Corpolui Didatic Cluj (Romania), Liceul Special pentru Deficienti de Vedere Cluj-Napoca (Romania), Eidiko Dimotiko Sxolio Tiflon Kallitheas (Greece)

Abstract: VISTE addresses inclusion and diversity through an innovative, integrated approach for enhancing spatial thinking focusing on the unique needs of students with blindness or visual impairment. However, since spatial thinking is a critical competence for all students, the VISTE framework and associated resources and tools will focus on cultivating this competence through collaborative learning of spatial concepts and skills both for sighted and visually impaired students to foster inclusion within mainstream education. The VISTE project will introduce innovative educational practices for empowering students with blindness or visual impairment with spatial skills through specially designed educational scenarios and learning activities as well as through a spatial augmented reality prototype to support collaborative learning of spatial skills both for sighted and visually impaired students.

9.4. International Initiatives

9.4.1. Inria International Partners

9.4.1.1. Informal International Partners

Prof. James Landay and Dr. Jessica Cauchard at the Stanford HCI Group (USA) on interaction with maps projected from drones

Prof. Niels Henze (University Stuttgart,Germany) and Prof. Katrin Wolf (Hamburg University of Applied Science, Germany) on mobile applications for visually impaired people

Prof. Pierre Dillenbourg (EPFL, Switzerland) on HCI for Education

9.4.2. Participation in Other International Programs

DGA-DSTL Project with UK, “Assessing and Optimising Human-Machine Symbiosis through Neural signals for Big Data Analytics”, 2014-2018

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Andreas Meinel, University of Freiburg, Germany, Apr. and Dec. 2016

Katrin Wolf, University of Art and Design, Berlin, Germany, Jul. 2016

9.5.2. Visits to International Teams

9.5.2.1. Research Stays Abroad

Fabien Lotte - Visting scientist At RIKEN Brain Science Institute, Cichocki’s advanced Brain Signal Processing Laboratory, Wakoshi, Japan, October-November 2016

Camille Jeunet - Uniersity of Sussex (Brigthon - UK) 01/11/2015 - 30/01/2016

Camille Jeunet - UQAM (Montréal - CA) 10/06/2016 - 10/07/2016

TITANE Project-Team

9. Partnerships and Cooperations

9.1. European Initiatives

9.1.1. FP7 & H2020 Projects

9.1.1.1. TITANIUM - Software Components for Robust Geometry Processing

Type: IDEAS

Instrument: ERC Proof of concept

Duration: 18 months

Coordinator: Pierre Alliez

Inria contact: Pierre Alliez

Abstract: The TITANIUM project aims to develop a software demonstrator for geometry processing and 3D urban modeling, in order to facilitate the pre-commercialization of novel software components for the Computational Geometry Algorithms Library. The demonstrator will include novel approaches resulting from the ERC-funded IRON project (Robust Geometry Processing, StG-2010-257474), which are illustrated by publications presented at premier conferences in our field and a patent submitted in 2015. The expected outcomes of TITANIUM will be versatile methods for 3D reconstruction and simplification of data gathered from geometric measurements, as well as related methods specifically tailored to urban modeling. These methods represent a significant step forward by offering unrivaled levels of robustness, and automated generation of levels of detail that are semantically meaningful. The acronym TITANIUM, a robust and lightweight material, conveys our wish to streamline the geometric modeling pipeline through robust algorithms and lightweight representations. This Proof of Concept project will also implement the steps required for pre-commercialization. In view of this goal, we have included an industrial partner, GeometryFactory, a spinoff from Inria. We have already established preliminary contacts in the fields of metrology and geographic information systems. These contacts will provide real-world industrial case studies.

9.2. International Initiatives

9.2.1. Inria International Partners

9.2.1.1. Declared Inria International Partners

We have a long standing collaboration with Prof. Mathieu Desbrun from Caltech.

9.2.1.2. Informal International Partners

We collaborate with researchers from RWTH Aachen.

9.3. International Research Visitors

9.3.1. Visits of International Scientists

Prof. Mathieu Desbrun visited us for 3 months between August and November, within the framework of the Inria international chair.

9.3.1.1. Internships

Chunlin Xiao (University of Nice Sophia-Antipolis and University of L'Aquila): large-scale remote sensing image segmentation and classification.

ALPAGE Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. LabEx EFL (Empirical Foundations of Linguistics) (2011 – 2021)

Participants: Laurence Danlos, Benoît Sagot, Marie-Hélène Candito, Benoît Crabbé, Pierre Magistry, Djamé Seddah, Maximin Coavoux, Éric Villemonte de La Clergerie.

Linguistics and related disciplines addressing language have achieved much progress in the last two decades but improved interdisciplinary communication and interaction can significantly boost this positive trend. The LabEx (excellency cluster) EFL (Empirical Foundations of Linguistics), launched in 2011 and headed by Jacqueline Vaissière, opens new perspectives by adopting an integrative approach. It groups together some of the French leading research teams in theoretical and applied linguistics, in computational linguistics, and in psycholinguistics. Through collaborations with prestigious multidisciplinary institutions (CSLI, MIT, Max Planck Institute, SOAS...) the project aims at contributing to the creation of a Paris School of Linguistics, a novel and innovative interdisciplinary site where dialog among the language sciences can be fostered, with a special focus on empirical foundations and experimental methods and a valuable expertise on technology transfer and applications.

Alpage is a very active member of the LabEx EFL together with other linguistic teams we have been increasingly collaborating with: LLF (University Paris 7 & CNRS) for formal linguistics, LIPN (University Paris 13 & CNRS) for NLP, LPNCog (University Paris 5 & CNRS) LSCP (ENS, EHESS & CNRS) for psycholinguistics, MII (University Paris 4 & CNRS) for Iranian and Indian studies. Alpage resources and tools have already proven relevant for research at the junction of all these areas of linguistics, both before the start of the LabEx EFL and within several EFL "scientific operations". Moreover, the LabEx provides Alpage with opportunities for collaborating with new teams, e.g., on language resource development and empirical studies in collaboration with descriptive linguists.

The LabEx EFL's scientific activities are spread accross 7 autonomous scientific "strands". In 2016,Benoît Sagot, Marie Candito and Benoît Crabbé were respectively deputy-head of strand 6 on "Language Resources", strand 5 on "Computational semantic analysis" and strand 2 on "Experimental grammar from a cross-linguistic perspective". Several project members are in charge of research operations within these 3 strands.

8.1.2. ANR

8.1.2.1. ANR project Profiterole (2017 - 2020)

Participants: Benoît Crabbé, Éric Villemonte de La Clergerie, Benoît Sagot.

PROFITEROLE is a 4-year ANR research project led by Sophie Prévost (LATTICE) that involves computational linguists and specialists of Medieval French from LATTICE (Univ. Paris 3, CNRS, ENS), ALPAGE and ICAR (Univ. Lyon, ENS).

PROFITEROLE has three closely correlated main goals that fall within the fields of linguistics and Natural Language Processing (NLP): (1) formal and computational modeling phonological, morphological and syntactic aspects of the diachronic evolution of French; (2) targeting the development of a methodology to explore and annotate heterogeneous linguistic data while providing automatic analysers for various stages of the French language; (3) expanding linguistic resources for French, by building a large annotated corpus (1 million words) of Medieval French (9th-15th centuries) and morphological lexicons (plus NLP tools) covering several stages of French. Alpage members will essentially be involved on the computational and formal modeling aspects of the project and on the design of automated processing tools for lexicon and syntax.

8.1.2.2. ANR project PARSITI (2016 - 2020)

Participants: Marie-Hélène Candito, Djamé Seddah [principal investigator], Benoît Crabbé, Éric Villemonte de La Clergerie, Benoît Sagot.

Exploiting multilingual user-generated content (UGC), for applications such as information extraction, text mining or summarization, and facilitate their access to a wider audience implies a qualitative step-ahead in Natural Language Understanding. This is because UGC differs from better-studied edited data in many ways, including by non-canonical syntax, highly contextualised nature and rich lexical variability. The ParSiTi ANR project focuses on three critical aspects: (1) Robust Parsing Technologies, (2) Accurate Machine Translation Engines and (3) Context-aware Methods, all backed by State-of-the-Art Morphological Analysers and Normalization tools. To showcase the different models and algorithms designed during the project, a Machine Translation System will be developed that will be able to translate UGC between French, Arabic and English.

8.1.2.3. ANR project PARSEME-FR (2016 - 2019)

Participants: Marie-Hélène Candito, Mathieu Constant [principal investigator], Benoît Crabbé, Laurence Danlos, Éric Villemonte de La Clergerie, Djamé Seddah.

PARSEME-FR is a 4-year ANR research project headed by Mathieu Constant (LIGM, Université Paris-Est Marne-la-Vallée, currently in “délégation” at Alpage). PARSEME-FR partners are LIGM, Alpage, LI (Université de Tours), LIF (Aix-Marseille Université) and LIFO (Université d’Orléans). This project aims at improving linguistic representativeness, precision and computational efficiency of Natural Language Processing (NLP) applications, notably parsing. The project focuses on the major bottleneck of these applications: Multi-Word Expressions (MWEs), i.e. groups of words with a certain degree of idiomaticity such as “hot dog”, “to kick the bucket”, “San Francisco 49ers” or "to take a haircut". In particular, it aims at investigating the syntactic and semantic representation of MWEs in language resources, the integration of MWE analysis in (deep) syntactic parsing and its links to semantic processing. Expected deliverables include enhanced language resources (lexicons, grammars and annotated corpora) for French, MWE-aware (deep) parsers and tools linking predicted MWEs to knowledge bases. This proposal is a spin-off of the European IC1207 COST action PARSEME on the same topic.

Alpage is participating mainly to two tasks: (i) the production of an evaluation corpus annotated with MWE and (ii) the production of MWE-aware statistical parsers, both for surface syntax and deep syntax. MWE recognition can be viewed as part of a more ambitious task of recovering the semantic units of a sentence. Combining it to deep syntactic parsing will provide a further step towards semantic parsing.

8.1.2.4. ANR project SoSweet (2015 - 2019)

Participants: Djamé Seddah, Marie-Hélène Candito, Benoît Sagot, Éric Villemonte de La Clergerie, Benoît Crabbé.

Led by Jean-Phillipe Magué (ENS Lyon), the SoSweet project focuses on the synchronic variation and the diachronic evolution of the variety of French language used on Twitter. Its goal is to provide a state-of-the-art socio-linguistic description of half a billion tweets collected over 5 years.

Alpage, specialized in natural language processing, takes care of the linguistics enrichment part, which provides the other partners with normalized and structurally enriched forms of text. Alpage is also responsible of providing distributional analysis of our corpus, by the means of various forms of word clustering in order to define sociolinguistic variants in the tweets.

8.1.2.5. ANR project ASFALDA (2012 – 2016)

Participants: Marie-Hélène Candito [principal investigator], Marianne Djemaa, Benoît Sagot, Éric Villemonte de La Clergerie, Laurence Danlos.

Alpage is principal investigator team for the ANR project ASFALDA, lead by Marie Candito. The other partners are the Laboratoire d’Informatique Fondamentale de Marseille (LIF), the CEA-List, the MELODI team (IRIT, Toulouse), the Laboratoire de Linguistique Formelle (LLF, Paris Diderot) and the Ant’inno society.

The project aims to provide both a French corpus with semantic annotations and automatic tools for shallow semantic analysis, using machine learning techniques to train analyzers on this corpus. The target semantic annotations are structured following the FrameNet framework [54] and can be characterized roughly as an explicitation of "who does what when and where", that abstracts away from word order / syntactic variation, and to some of the lexical variation found in natural language.

The project relies on an existing standard for semantic annotation of predicates and roles (FrameNet), and on existing previous effort of linguistic annotation for French (the French Treebank). The original FrameNet project provides a structured set of prototypical situations, called frames, along with a semantic characterization of the participants of these situations (called *roles*). We propose to take advantage of this semantic database, which has proved largely portable across languages, to build a French FrameNet, meaning both a lexicon listing which French lexemes can express which frames, and an annotated corpus in which occurrences of frames and roles played by participants are made explicit. The addition of semantic annotations to the French Treebank, which already contains morphological and syntactic annotations, will boost its usefulness both for linguistic studies and for machine-learning-based Natural Language Processing applications for French, such as content semantic annotation, text mining or information extraction.

To cope with the intrinsic coverage difficulty of such a project, we adopt a hybrid strategy to obtain both exhaustive annotation for some specific selected concepts (commercial transaction, communication, causality, sentiment and emotion, time), and exhaustive annotation for some highly frequent verbs. Pre-annotation of roles will be tested, using linking information between deep grammatical functions and semantic roles.

The project is structured as follows:

- Task 1 concerns the delimitation of the focused FrameNet substructure, and its coherence verification, in order to make the resulting structure more easily usable for inference and for automatic enrichment (with compatibility with the original model);
- Task 2 concerns all the lexical aspects: which lexemes can express the selected frames, how they map to external resources, and how their semantic argument can be syntactically expressed, an information usable for automatic pre-annotation on the corpus;
- Task 3 is devoted to the manual annotation of corpus occurrences (we target 20000 annotated occurrences);
- In Task 4 we will design a semantic analyzer, able to automatically make explicit the semantic annotation (frames and roles) on new sentences, using machine learning on the annotated corpus;
- Task 5 consists in testing the integration of the semantic analysis in an industrial search engine, and to measure its usefulness in terms of user satisfaction.

The scientific key aspects of the project are:

- an emphasis on the diversity of ways to express the same frame, including expression (such as discourse connectors) that cross sentence boundaries;
- an emphasis on semi-supervised techniques for semantic analysis, to generalize over the available annotated data.

8.1.2.6. ANR project Polymnie (2012-2016)

Participants: Laurence Danlos, Éric Villemonte de La Clergerie, Timothée Bernard.

Polymnie is an ANR research project headed by Sylvain Podogolla (Sémagramme, Inria Lorraine) with Melodi (INRIT, CNRS), Signes (LABRI, CNRS) and Alpage as partners. This project relies on the grammatical framework of Abstract Categorial Grammars (ACG). A feature of this formalism is to provide the same mathematical perspective both on the surface forms and on the more abstract forms the latter correspond to. ACG allows for the encoding of a large variety of grammatical formalisms, in particular Tree Adjoining grammars (TAG).

The role of Alpage in this project is to develop sentential or discursive grammars written in TAG and to participate in their conversion in ACG. Results were first achieved in 2014 concerning text generation: GTAG formalism created by Laurence Danlos in the 90's has been rewritten in ACG [64], [65], [66]. As regards discursive analysis, D-STAG formalism created by Laurence Danlos in the 00's has also been rewritten in ACG in 2015 [67] (see also [27]).

8.1.3. Other national initiatives

8.1.3.1. "RAPID" project VerDI (2016 – 2019)

Participants: Benoît Sagot, Héctor Martínez Alonso.

The ANR "RAPID" project VerDI focuses on the automatic identification of information dissimulation on the Internet and on social networks. Such dissimulations can be produced by omiting crucial pieces of information within documents or during written online discussions, by hiding them within a massive information flow, or using other techniques. VerDI aims at extending an existing journalistic fact-checking tool developed by Trooclick, the company that leads the project.

8.1.3.2. FUI project COMBI (2014-2016)

Participant: Laurence Danlos.

COMBI is is an "FUI 16" project. It started in February 2014 for a two year duration. It groups 5 industrial partners (Temis, Isthma, Kwaga, Yseop and Qunb) and Alpage. Temis and Istma work on data mining from texts and big data. Kwaga works on the interpretation and inferences that can be drawn from the data retrieved in the analysis module. Alpage and Qunb work, under the supervision of Yseop, on the production of respectively texts and graphics describing the results of the interpretation module. Currently, COMBI aims at creating the full chain for a user case concerning the weekly activity of an on-line service.

Alpage works on text generation, with the adaptation of TextElaborator, a generation system developed in the 10's by WatchAssistance and based on G-TAG. Alpage also works on the opportunity to describe pieces of information by texts, graphics or both.

8.1.3.3. Institut de Linguistique Française and Consortium CORLI within the TGIR Huma-Num

Participants: Benoît Sagot, Stéphane Riou, Djamé Seddah.

Huma-Num is a TGIR (Very Large Research Infrastructure) dedicated to digital humanities. Among Huma-Num initiatives are a dozen of consortia, which bring together most members of various research communities. Among them is the CORLI consortium (following, among other, the *Corpus Écrits* consortium in which previously participating), which is dedicated, among other topics, to all aspects related to written corpora, from NLP to corpus development, corpus specification, standardization, and others. All types of written corpora are covered (French, other languages, contemprorary language, medieval language, specialized text, non-standard text, etc.). The consortium CORLI is managed by the Institut de Linguistique Française, a CNRS federation of which Alpage is a member since June 2013, under the supervision of Franck Neveu.

Alpage is involved in various projects within this consortium, and especially in the development of corpora for CMC texts (blogs, forum posts, SMSs, textchat...) and shallow corpus annotation, especially with MElt, and in the development of a preliminary version of the future Corpus de Référence du Français (French Reference Corpus).

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. H2020 PARTHENOS

Participants: Laurent Romary, Luca Foppiano, Mohamed Khemakhem, Marie Puren, Charles Riondet, Dorian Seillier.

This EU project Parthenos of the H2020 INFRADEV program aims et strengthening the cohesion of research in the broad sector of Linguistic Studies, Humanities, Cultural Heritage, History, Archaeology and related fields through a thematic cluster of European Research Infrastructures, integrating initiatives, e-infrastructures and other world-class infrastructures, and building bridges between different, although tightly interrelated, fields. Within this project started in May 2015, Alpage has the leadership over the work package dedicated to the promotion and development of standards in the humanities.

In 2015, Laurent Romary and Charles Riondet have identified digital humanities use cases where standards play a central role and specified an architecture for organising standards related information (specification, software, bibliography, reference material, experts) at the service of scholars in the humanities.

8.2.1.2. H2020 EHRI

Participants: Laurent Romary, Luca Foppiano, Charles Riondet.

The EHRI 2 (European Holocaust Research Infrastructure), also in the INFRADEV program of H2020, seeks to transform archival research on the Holocaust, by providing methods and tools to integrate and provide access to a wide variety of archival content. The project has started in June 2015 and will led us to work on both standards for the representation of archival content and develop data mining components for archival textual data.

In 2015, we have focused on the identification of available data sources resulting from the first phase of the project in the previous years and compile specifications for the description of authorities according to the EAC (Encoded Archival Context) standard.

8.2.1.3. H2020 Iperion

Participants: Laurent Romary, Luca Foppiano, Marie Puren.

The H2020 Iperion project aims at coordinating infrastructural activities in the cultural heritage domain. Our team has a small participation in relation to the definition of data management and representation issues. This will directly contribute to increase our experience in curating the kind of heterogeneous linguistic data that we gathered over the years.

In 2015, we have designed a questionnaire for all data producers in the project in order to gather feedback on their existing practices (data flows, licences, formats) concerning the creation, management and dissemination of cultural heritage data. On this basis, we have produced a first version of the data management plan for the project.

8.2.2. Collaborations in European Programs, Except FP7 & H2020

Program: IC1207 COST

Project acronym: PARSEME

Project title: PARSing and Multi-word Expressions

Duration: March 2013 - March 2017

Coordinator: Agata Savary

Other partners: interdisciplinary experts (linguists, computational linguists, computer scientists, psycholinguists, and industrials) from 30 countries

Abstract: The aim of this project is to improve linguistic representativeness, precision and computational efficiency of Natural Language Processing (NLP) applications, focusing on the major bottleneck of these applications: Multi-Word Expressions (MWEs), i.e., sequences of words with unpredictable properties such as "to count somebody in" or "to take a haircut". A breakthrough in their modelling and processing is targeted, as the result of a coordinated effort of multidisciplinary experts working on fourteen different languages.

Program: ISCH COST Action IS1312

Project acronym: TextLink

Project title: Structuring Discourse in Multilingual Europe

Duration: April 2014 - April 2018

Coordinator: Liesbeth Degand

Other partners: experts in computational linguistics and discourse from 24 countries

France MC members: Laurence Danlos and Philippe Muller (IRIT)

Abstract: This action will facilitate European multilingualism by (1) identifying and creating a portal into discourse-level resources within Europe - including annotation tools, search tools, and discourse-annotated corpora; (2) delineating the dimensions and properties of discourse annotation across corpora; (3) organising 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.

Program: **ISCH COST Action IS1305**

Project acronym: ENeL

Project title: European Network of e-Lexicography

Duration: October 2013 - October 2017

Coordinator: Prof Martin EVERAERT (NL)

Other partners: interdisciplinary experts (linguists, computational linguists, computer scientists, lexicographers, and industrials) from 31 countries

Abstract: The proposed Action aims to establish a European network of lexicographers in order to deal with the following issues: give easier access to scholarly dictionaries, establish a systematic exchange of expertise on common standards and solutions, develop a common approach to e-lexicography that forms the basis for a new type of lexicography that fully embraces the pan-European nature of much of the vocabularies of the languages spoken in Europe

MULTISPEECH Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. COREXp

Project acronym: COREXp

Project title: Acquisition, Processing and Analysis of a Corpus for the Synthesis of Expressive Audiovisual Speech

Duration: December 2014 - December 2016

Coordinator: Slim Ouni

Cofunded by Inria and Région Lorraine

Abstract: The main objective of this project was the acquisition of a bimodal corpus of a considerable size (several thousand sentences) to study the expressiveness and emotions during speech (for example, how to decode facial expressions that are merged with speech signals). The main purpose was to acquire, process and analyze the corpus and to study the expressiveness; the results will be used for the expressive audiovisual speech synthesis system.

9.1.2. CPER LCHN

Project acronym: CPER LCHN

Project title: CPER "Langues, Connaissances et Humanités Numériques"

Duration: 2015-2020

Coordinator: Bruno Guillaume (LORIA) & Alain Polguère (ATILF)

Abstract: The main goal of the project is related to experimental platforms for supporting research activities in the domain of languages, knowledge and numeric humanities engineering.

MULTISPEECH contributes to automatic speech recognition, speech-text alignment and prosody aspects.

9.1.3. CPER IT2MP

Project acronym: CPER IT2MP

Project title: CPER "Innovation Technologique Modélisation et Médecine Personalisée"

Duration: 2015-2020

Coordinator: Faiez Zannad (Inserm-CHU-UL)

Abstract: The goal of the project is to develop innovative technologies for health, and tools and strategies for personalized medicine.

MULTISPEECH will investigate acoustic monitoring using an array of microphones.

9.1.4. SATT Dynalips

Project title: Control of the movements of the lips in the context of facial animation for an intelligible lipsync.

Duration: May 2016 - December 2017

Coordinator: Slim Ouni

Abstract: We propose in this project the development of tools of lipsync which from recorded speech will provide realistic mechanisms of animating the lips. These tools will be available to be integrated into existing 3D animation software and existing game engines. One objective is that these lipsync tools fit easily into the production pipeline in the field of 3D animation and video games. The goal of this maturation is to propose a product ready to be exploited in the industry whether by the creation of a start-up or by the distribution of licenses.

9.2. National Initiatives

9.2.1. EQUIPEX ORTOLANG

Project acronym: ORTOLANG [0]

Project title: Open Resources and TOols for LANGuage

Duration: September 2012 - December 2016 (phase I)

Coordinator: Jean-Marie Pierrel, ATILF (Nancy)

Other partners: LPL (Aix en Provence), LORIA (Nancy), Modyco (Paris), LLL (Orléans), INIST (Nancy)

Abstract: The aim of ORTOLANG was to propose a network infrastructure offering a repository of language data (corpora, lexicons, dictionaries, etc.) and tools and their treatment that are readily available and well-documented. This will enable a real mutualization of analysis research, of modeling and automatic treatment of the French language. This will also facilitate the use and transfer of resources and tools set up within public laboratories towards industrial partners, in particular towards SME which often cannot develop such resources and tools for language treatment due to the costs of their realization. Moreover, this will promote the French language and local languages of France by sharing knowledge which has been acquired by public laboratories.

Several teams of the LORIA laboratory contribute to this Equipex, mainly with respect to providing tools for speech and language processing. MULTISPEECH contributes with text-speech alignment and speech visualization tools.

9.2.2. E-FRAN METAL

Project acronym: E-FRAN METAL

Project title: Modèles Et Traces au service de l'Apprentissage des Langues

Duration: October 2016 - September 2020

Coordinator: Anne Boyer (LORIA)

Other partners: Interpsy, LISEC, ESPE de Lorraine, D@NTE (Univ. Versailles Saint Quentin), Sailendra SAS, ITOP Education, Rectorat.

Abstract: METAL aims at improving the learning of languages (both written and oral components) through the development of new tools and the analysis of numeric traces associated with students' learning, in order to adapt to the needs and rythm of each learner.

Multispeech is concerned by oral language learning aspects.

[0] http://www.ortolang.fr

9.2.3. PIA2 ISITE LUE

Project acronym: ISITE LUE

Project title: Lorraine Université d'Excellence

Duration: starting in 2016

Coordinator: Univ. Lorraine

Abstract: The initiative aims at developing and densifying the initial perimeter of excellence, within the scope of the social and economic challenges, so as to build an original model for a leading global engineering university, with a strong emphasis on technological research and education through research. For this, we have designed LUE as an "engine" for the development of excellence, by stimulating an original dialogue between knowledge fields.

MULTISPEECH is mainly concerned with challenge number 6: "Knowledge engineering", i.e., engineering applied to the field of knowledge and language, which represent our immaterial wealth while being a critical factor for the consistency of future choices. In 2016, this project has funded a new PhD thesis.

9.2.4. ANR ContNomina

Project acronym: ContNomina

Project title: Exploitation of context for proper names recognition in diachronic audio documents

Duration: February 2013 - March 2017

Coordinator: Irina Illina

Other partners: LIA, Synalp

Abstract: The ContNomina project focuses on the problem of proper names in automatic audio processing systems by exploiting in the most efficient way the context of the processed documents. To do this, the project addresses the statistical modeling of contexts and of relationships between contexts and proper names; the contextualization of the recognition module (through the dynamic adjustment of the lexicon and of the language model in order to make them more accurate and certainly more relevant in terms of lexical coverage, particularly with respect to proper names); and the detection of proper names (on the one hand, in text documents for building lists of proper names, and on the other hand, in the output of the recognition system to identify spoken proper names in the audio/video data).

9.2.5. ANR ORFEO

Project acronym: ORFEO [0]

Project title: Outils et Ressources pour le Français Écrit et Oral

Duration: February 2013 - February 2016

Coordinator: Jeanne-Marie DEBAISIEUX (Université Paris 3)

Other partners: ATILF, CLLE-ERSS, ICAR, LIF, LORIA, LATTICE, MoDyCo

Abstract: The main objective of the ORFEO project is the constitution of a corpus for the study of contemporary French.

In this project, we were concerned by the automatic speech-text alignment at the word and phoneme levels for audio files from several corpora gathered by the project. These corpora orthographically transcribed with Transcriber contain mainly spontaneous speech, recorded under various conditions with a large SNR range and a lot of overlapping speech and anonymised speech segments. For the forced speech-text alignment phase, we applied our 2-step methodology (the first step uses a detailed acoustic model for finding the pronunciation variants; then, in the second step a more compact model is used to provide more temporally accurate boundaries).

[0] http://www.agence-nationale-recherche.fr/en/anr-funded-project/?tx_lwmsuivibilan_pi2[CODE]=ANR-12-CORP-0005

9.2.6. ANR-DFG IFCASL

Project acronym: IFCASL

Project title: Individualized feedback in computer-assisted spoken language learning

Duration: March 2013 - December 2016

Coordinator: Jürgen Trouvain (Saarland University)

Other partners: Saarland University (COLI department)

Abstract: The main objective of IFCASL is to investigate learning of oral French by German speakers, and oral German by French speakers at the phonetic level.

A French-German learner corpus was designed and recorded. French speakers were recorded in Nancy, whereas German speakers were recorded in Saarbrücken. An automatic speech-text alignment process was applied on all the data. Then, the French speech data (native and non-native) were manually checked and annotated in France, and the German speech data (native and non-native) were manually checked and annotated in Germany. The corpora are currently used for analyzing non-native pronunciations, and studying feedback procedures.

9.2.7. ANR DYCI2

Project acronym: DYCI2 [0]

Project title: Creative Dynamics of Improvised Interaction

Duration: March 2015 - February 2018

Coordinator: Ircam (Paris)

Other partners: Inria (Nancy), University of La Rochelle

Abstract: The goal of this project is to design a music improvisation system which will be able to listen to the other musicians, improvise in their style, and modify its improvisation according to their feedback in real time.

9.2.8. ANR JCJC KAMoulox

Project acronym: KAMoulox

Project title: Kernel additive modelling for the unmixing of large audio archives

Duration: January 2016 - January 2019

Coordinator: Antoine Liutkus

Abstract: Develop the theoretical and applied tools required to embed audio denoising and separation tools in web-based audio archives. The applicative scenario is to deal with large audio archives, and more precisely with the notorious "Archives du CNRS — Musée de l'homme", gathering about 50,000 recordings dating back to the early 1900s.

9.2.9. ANR ArtSpeech

Project acronym: ArtSpeech

Project title: Synthèse articulatoire phonétique

Duration: October 2015 - March 2019

Coordinator: Yves Laprie

Other partners: Gipsa-Lab (Grenoble), IADI (Nancy), LPP (Paris)

[0] http://repmus.ircam.fr/dyci2/

Abstract: The objective is to synthesize speech from text via the numerical simulation of the human speech production processes, i.e. the articulatory, aerodynamic and acoustic aspects. Corpus based approaches have taken a hegemonic place in text to speech synthesis. They exploit very good acoustic quality speech databases while covering a high number of expressions and of phonetic contexts. This is sufficient to produce intelligible speech. However, these approaches face almost insurmountable obstacles as soon as parameters intimately related to the physical process of speech production have to be modified. On the contrary, an approach which rests on the simulation of the physical speech production process makes explicitly use of source parameters, anatomy and geometry of the vocal tract, and of a temporal supervision strategy. It thus offers direct control on the nature of the synthetic speech.

Measurements of glottis opening during the production of fricatives via EPGG (ElectroPhotoGlottoGraphy), the design of acoustic experiments with a replica of the vocal tract and the design of dynamic acquisition with MRI were the main activities of this first year.

9.2.10. FUI RAPSODIE

Project acronym: RAPSODIE

Project title: Automatic Speech Recognition for Hard of Hearing or Handicapped People

Duration: March 2012 - February 2016

Coordinator: eRocca (Mieussy, Haute-Savoie)

Other partners: CEA (Grenoble), Inria (Nancy), CASTORAMA (France)

Abstract: The goal of the project was to realize a portable device to help a hard-of-hearing person to communicate with other people. To achieve this goal the portable device needs to access a speech recognition system, adapted to this task. Another application of the device is environment vocal control for handicapped persons.

In this project, MULTISPEECH was involved in optimizing the speech recognition models for the envisaged task, and in finding the best way of presenting the speech recognition results in order to maximize the communication efficiency between the hard-of-hearing person and the speaking person.

9.2.11. FUI VoiceHome

Project acronym: VoiceHome

Duration: February 2015 - July 2017

Coordinator: onMobile

Other partners: Orange, Delta Dore, Technicolor Connected Home, eSoftThings, Inria (Nancy), IRISA, LOUSTIC

Abstract: The goal of this project is to design a robust voice control system for smart home and multimedia applications. We are responsible for the robust automatic speech recognition brick.

9.2.12. ADT Plavis

Project acronym: Plavis

Project title: Platform for acquisition and audiovisual speech synthesis

Duration: January 2015 - December 2016

Coordinator: Vincent Colotte

Abstract: The objective of this project was to develop a platform acquisition and audiovisual synthesis system (3D animation of the face synchronously with audio). The main purpose was to build a comprehensive platform for acquisition and processing of audiovisual corpus (selection, acquisition and acoustic processing, 3D visual processing and linguistic processing). The acquisition was performed using a motion-capture system (Kinect-like), a Vicon system, and an electromagnetic articulography (EMA) system.

9.2.13. LORIA exploratory project

Project title: Acquisition and processing of multimodal corpus in the context of interactive human communication

Duration: June 2015 - May 2016

Coordinator: Slim Ouni

Abstract: The aim of this project was the study of the various mechanisms involved in multimodal human communication that can be oral, visual, gestural and tactile. This project focused on the identification and acquisition of a very large corpus of multimodal data from multiple information sources and acquired in the context of interaction and communication between two people or more.

9.2.14. SYNABE

Project acronym: SYNABE

Project title: Articulatory data synchronization for studying stuttering

Duration: January 2016 - December 2016

Coordinator: Fabrice Hirsch (Praxiling, UMR 5267, Montpellier)

Other partners: S. Ouni

Funding: CNRS DEFI Instrumentation aux limites

Abstract: The objective of this project is to use simultaneously three hardware allowing having information on the subglottic (respiratory belt), glottic (electroglottograph) and supraglottic (articulograph) levels during the production of the speech in order to know the timing of the gestures during speech. This system will be used to study the motor coordination between the three levels mentioned in the stuttering and normo-fluent words. We will propose a new typology of normal and pathological disfluencies.

Our main contribution concerned the articulatory data acquisition using the articulograph AG501.

9.3. European Initiatives

9.3.1. Collaborations with Major European Organizations

Jon Barker: University of Sheffield (UK)

Robust speech recognition [11], [55]

9.4. International Initiatives

9.4.1. Inria International Partners

9.4.1.1. Informal International Partners

Jonathan Le Roux, Shinji Watanabe, John R. Hershey: Mitsubishi Electric Research Labs (MERL, Boston, USA)

Robust speech recognition [11], [55]

Dayana Ribas Gonzalez, Ramón J. Calvo: CENATAV (Habana, Cuba)

Robust speaker recognition [42]

9.4.2. Participation in Other International Programs

9.4.2.1. STIC-AmSud - multimodal communication corpus

STIC-AmSud: MCC - Multimodal Communication Corpus. A collaboration: Argentina, Chile and France (01/2015-12/2016)

Project acronym: MCC

Project title: Multimodal Communication Corpus

Duration: January 2015 - December 2016

International Coordinator: S. Ouni

National Coordinators: Nancy Hitschfeld (Depto. de Ciencias de la Computación (DCC), Universidad de Chile) - Chile; and, Juan Carlos Gomez (Centro Internacional Franco Argentino de Ciencias de la Información y de Sistemas (CIFASIS), UNR, CONICET) - Argentina

Abstract: The project aims to collect a multimodal speech corpus containing synchronized audio-visual data recorded from talking individuals. The corpus will incorporate several communication modes which appear in the communication among humans, such as the acoustic signal, facial movements and body gestures during speech. During 2016, a complete corpus of 8 speakers (4 French and 4 Spanish) has been acquired and processed. The corpus will be distributed using the Ortolang platform.

9.4.2.2. PHC UTIQUE - HMM-based Arabic speech synthesis

PHC UTIQUE - HMM-based Arabic speech synthesis, with ENIT (Engineer school at Tunis-Tunisia)

Duration: 2015 - 2018.

Coordinators: Vincent Colotte (France) and Noureddine Ellouze (Tunisia).

Abstract: Development of an HMM-based speech synthesis system for the Arabic language. This includes the development of an Arabic speech corpus, the selection of linguistic features relevant to Arabic HMM-based speech synthesis, as well as improving the quality of the speech signal generated by the system.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Sebastian Gonzales Mora

Date: Jan 2016

Faculty de Cs. Físicas y Matemáticas, University of Chile

Benjamin Martinez Elizalde

Date: May 2016 - Aug 2016

Institution: Carnegie Mellon University (USA)

Dayana Ribas Gonzalez

Date: Sep 2016 - Dec 2016

Institution: CENATAV (Cuba)

Ziteng Wang

Date: Sep 2016 - Sep 2017

Institution: Institute of Acoustics, Chinese Academy of Sciences (China)

PANAMA Project-Team

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. Labex Comin Labs projects

ComInLabs is a Laboratoire d'Excellence funded by the PIA (Programme Investissements d'Avenir) in the broad area of telecommunications.

9.1.1.1. HEMISFER

Participant: Rémi Gribonval.

Acronym: HYBRID (Hybrid Eeg-MrI and Simultaneous neuro-feedback for brain Rehabilitation)

http://www.hemisfer.cominlabs.ueb.eu/

Research axis: 3.1

ComInLabs partners : EPI VISAGES; EPI HYBRID; EPI PANAMA

External partners : EA 4712 team from University of Rennes I; EPI ATHENA, Sophia-Antipolis;

Coordinator: Christian Barillot, EPI VISAGES

Description: The goal of HEMISFER is to make full use of neurofeedback paradigm in the context of rehabilitation and psychiatric disorders. The major breakthrough will come from the use of a coupling model associating functional and metabolic information from Magnetic Resonance Imaging (fMRI) to Electro-encephalography (EEG) to "enhance" the neurofeedback protocol. We propose to combine advanced instrumental devices (Hybrid EEG and MRI platforms), with new man-machine interface paradigms (Brain computer interface and serious gaming) and new computational models (source separation, sparse representations and machine learning) to provide novel therapeutic and neuro-rehabilitation paradigms in some of the major neurological and psychiatric disorders of the developmental and the aging brain (stroke, attention-deficit disorder, language disorders, treatment-resistant mood disorders, Ã¢ÂÂ¦).

Contribution of PANAMA: PANAMA, in close cooperation with the VISAGES team, contributes to a coupling model between EEG and fMRI considered as a joint inverse problem addressed with sparse regularization. By combining both modalities, one expects to achieve a good reconstruction both in time and space. This new imaging technique will then be used for improving neurofeedback paradigms in the context of rehabilitation and psychiatric disorders, which is the final purpose of the HEMISFER project.

9.1.1.2. TEPN

Participant: Rémi Gribonval.

Acronym: TEPN (Toward Energy Proportional Networks)

http://www.tepn.cominlabs.ueb.eu/

Research axis: 3.1

ComInLabs partners : IRISA OCIF - Telecom Bretagne; IETR SCN; IETR SCEE; EPI PANAMA

Coordinator: Nicolas Montavont, IRISA OCIF - Telecom Bretagne

Description: As in almost all areas of engineering in the past several decades, the design of computer and network systems has been aimed at delivering maximal performance without regarding to the energy efficiency or the percentage of resource utilization. The only places where this tendency was questioned were battery-operated devices (such as laptops and smartphones) for which the users accept limited (but reasonable) performance in exchange for longer use periods. Even though the end users make such decisions on a daily basis by checking their own devices, they have no way of minimizing their energy footprint (or conversely, optimize the network resource usage) in the supporting infrastructure. Thus, the current way of dimensioning and operating the infrastructure supporting the user services, such as cellular networks and data centers, is to dimension for peak usage. The problem with this approach is that usage is rarely at its peak. The overprovisioned systems are also aimed at delivering maximal performance, with energy efficiency being considered as something desired, but non-essential. This project aims at making the network energy consumption proportional to the actual charge of this network (in terms of number of served users, or requested bandwidth). An energy proportional network can be designed by taking intelligent decisions (based on various constraints and metrics) into the network such as switching on and off network components in order to adapt the energy consumption to the user needs. This concept can be summarized under the general term of Green Cognitive Network Approach.

Contribution of PANAMA: PANAMA, in close cooperation with the SCEE team at IETR (thesis of Marwa Chafii), focuses on the design of new waveforms for multi carrier systems with reduced Peak to Average Power Ratio (PAPR).

9.1.2. ANR INVATE project with IRT b<>com France

Participants: Rémi Gribonval, Nancy Bertin, Mohamed Hafsati.

Thesis on 3D audio scene decomposition for interactive navigation

Duration: 3 years (2016-2019)

Research axis: 3.2.2

Partners: IRT b<>com, Inria-Rennes, IRISA

Funding: ANR INVATE project (PIA)

The objective of this thesis is to develop tools to analyze audio scenes in order to identify, locate, and extract the sources present in the scene to re-spatialize them according to the user head orientation and the movement of the user in the targeted virtual scene.

9.1.3. OSEO-FUI: voiceHome

Participants: Nancy Bertin, Frédéric Bimbot, Romain Lebarbenchon, Ewen Camberlein.

Duration: 3 years (2015-2017)

Research axis: 3.2

Partners: onMobile, Delta Dore, eSoftThings, Orange, Technicolor, LOUSTIC, Inria Nancy

Coordinator: onMobile

Description: The goal of the project is to design and implement a multi-channel voice interface for smart home and multimedia (set-top-box) appliances.

Contributions of PANAMA are focused on (i) audio activity monitoring and wake-up word detection and (ii) audio source localization and separation. In both cases, the issue of energy frugality is central and strongly constrains the available resources. We expect from this cooperation to make progress towards operational low-resource audio source separation schemes and we intend to investigate compressive sensing for the characterization of audio and voice activity.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. ERC-StG: PLEASE (Projections, Learning, and Sparsity for Efficient Data Processing)

Participants: Rémi Gribonval, Srdan Kitic, Luc Le Magoarou, Nancy Bertin, Nicolas Keriven, Yann Traonmilin, Gilles Puy, Adrien Leman, Nicolas Bellot.

Duration: January 2012 - December 2016

Research axis: 3.1

Principal investigator: Rémi Gribonval

Program: ERC Starting Grant

Project acronym: PLEASE

Project title: Projections, Learning and Sparsity for Efficient data processing

Abstract: The Please ERC is focused on the extension of the sparse representation paradigm towards that of sparse modeling, with the challenge of establishing, strengthening and clarifying connections between sparse representations and machine learning

Web site: https://team.inria.fr/panama/projects/please/

9.3. International Initiatives

9.3.1. Inria International Partners

9.3.1.1. Informal International Partners

PANAMA has strong recurrent collaborations with the LTS2 lab at EPFL, the Center for Digital Music at Queen Mary University of London, the Institute for Digital Communications at the University of Edimburgh, and the Institute for Mathematics of the Postdam University.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Pierre Vandergheynst, in June-July, Professor of Signal and Image Processing, EPFL (Chaire Internationale Inria)
- Gilles Blanchard, in September, Professor, University of Potsdam
- Laurent Jacques, in October, Professor, Catholic University of Louvain
- Mike Davies, in November, Professor, University of Edimburgh

SEMAGRAMME Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Projets Région

7.1.1.1. SLAM

Participants: Maxime Amblard [coordinator], Philippe de Groote, Sylvain Pogodalla.

Schizophrenia is well-known among mental illnesses for the strength of the thought disorders it involves, and for their widespread and spectacular manifestations: from deviant social behavior to delusion, not to speak about affective and sensitive distortions. It aims at exploring a specific manifestation, namely disorders in conversational speech. This is an interdisciplinary research, both empirical and theoretical from several domains, namely psychology, philosophy, linguistic and computer science.

The first transcriptions of pathological interviews are analyses. The management chain was implemented for disfluences and POS. Moreover, we have focused on implementing the treatment of lexicography issues and proposed an interface for SDRT-annotations. This year, we have developed a new interaction with the Centre Médical d'Aix-en-Provence in order to collect new interviews. The protocol started at the very end of the year. Moreover we have started the reimplementation of the tool SLAMtk.

The SLAM project was supported by the MSH–Lorraine, USR 3261, the region Grand-Est and the University of Lorraine. We organise the fourth workshop (In)Coherence of Discourse which gather linguists, psychologists and computer scientists in march 2017 : http://discours.loria.fr.

7.1.2. CPER

7.1.2.1. ITL-DI-Oeil

Participant: Maxime Amblard.

Interrelation troubles du langage, discours et processus oculomoteurs

This project is part of another research project about eye-tracking of schizophrenics. It is really close to the SLAM project. One of the main issue is how to collect the data. In order to simplify this clue, the two projects share the same corpus. SLAM is concerned by the transcription of the interviews whereas ITL-DI-Oeil analyses the eye-tracking records.

7.2. National Initiatives

7.2.1. ANR

7.2.1.1. Polymnie: Parsing and synthesis with abstract categorial grammars. From lexicon to discourse

Participants: Maxime Amblard, Philippe de Groote, Aleksandre Maskharashvili, Sylvain Pogodalla [coordinator].

POLYMNIE[0] is a research project funded by the French national research agency (ANR) from September 2012 to February 2016. It relies on the grammatical framework of Abstract Categorial Grammars (ACG). A feature of this formalism is to provide the same mathematical perspective both on the surface forms and on the more abstract forms the latter correspond to. As a consequence:

- ACG allows for the encoding of a large variety of grammatical formalisms such as context-free grammars, Tree Adjoining grammars (TAG), etc.
- ACG defines two languages: an abstract language for the abstract forms, and an object language for the surface forms.

[0] http://semagramme.loria.fr/doku.php?id=projects:polymnie

Importantly, the notions of object language and abstract language are relative to each other. If we can naturally see surface forms as strings for instance and abstract forms as the associated syntactic trees, we can also consider to associate this abstract form to a first order logical formula as surface (object) form. This property is central in our project as it offers a unified approach to text analysis and text generation, in particular considering the underlying algorithms and their complexity.

ACG definition uses type-theory and lambda-calculus. From this point of view, they smoothly integrate formal semantics models issuing from Montague's proposal. Theories that extend to the discourse level such as Discourse Representation Theory (DRT) and Dynamic Predicate Logic (DPL) were not initially formulated using lambda-calculus. But such formulations have been proposed. In particular, a formulation based on continuation semantics allows them to be expressed quite naturally in the ACG architecture. Dynamic effects of discourse, in particular those related to anaphora resolution or rhetorical relation inference, have then to be expressed by lexical semantics or computed from the syntactic rules as studied in the Inria Collaborative Research Project (ARC) CAuLD [0].

It has been shown that the discourse structure of texts plays a key role in their understanding. This is the case for both human readers and automatic processing systems. For instance, it can enhance text transformation systems such as the ones performing automatic summarization.

POLYMNIE focuses on studying and implementing the modeling of sentences and discourses in a compositional paradigm that takes into account their dynamics and their structures, both in parsing and in generation. To that end, we rely on the ACG framework. The kind of processing we are interested in relates to the automatic construction of summaries or to text simplification. This has to be considered in the limits of the modeling of the linguistic processes (as opposed to inferential processes for instance) these tasks involve.

Partners:

- Sémagramme people,
- Alpage (Paris 7 university & Inria Paris-Rocquencourt): Laurence Danlos (local coordinator), C. Braud, C. Roze, Éric Villemonte de la Clergerie,
- MELODI (IRIT, CNRS): Stergos Afantenos, Nicholas Asher (local coordinator), Juliette Conrath, Philippe Muller,
- Signes (LaBRI, CNRS): Jérôme Kirman, Richard Moot, Christian Retoré (local coordinator), Sylvain Salvati, Noémie-Fleur Sandillon-Rezer.

The project has been presented during the *journés du numérique de l'ANR* [23]. A demonstration of the ACGtk software has been given during the TALN conference 2016 [22].

7.2.2. DGLFLF (Délégation générale à la langue française et aux langues de France)

7.2.2.1. ZombiLingo

Participants: Bruno Guillaume [coordinator], Nicolas Lefebvre.

The goal of the ZombiLingo project is to develop an online GWAP (Game With A Purpose) to help the construction of linguistic resources. See 6.3.1 for more information.

[0] https://members.loria.fr/SPogodalla/files/cauld

CHROMA Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Projet AAP ARC6 (2015-18)

Participants: Olivier Simonin, Anne Spalanzani, Fabrice Valois [Insa de Lyon, Inria Urbanet].

Regional project (Rhône-Alpes) "Mobilité au sein de flottes de robots sous contrainte de maintien de la connectivité" ARC6, 2015-2018. Leader : O. Simonin.

This project funds the PhD thesis of Mihai-Ioan Popescu, who started on november 2015, and co-advized by O. Simonin, A. Spalanzani and F. Valois. The project involves also the Pole de compétitivité "Via Meca".

9.1.2. Projet AAP ARC6 (2016-19)

Participants: Gérard Bailly [CNRS, GIPSA Lab. Grenoble], Olivier Simonin, Anne Spalanzani.

Regional project (Rhône-Alpes) "TENSIVE Robots de TEléprésence : Navigation Sociale et Interaction VErbale immersives" ARC6, 2016-2019. Leader : G. Bailly.

This project funds the PhD thesis of Remi Cambuzat who started on october 2016, and co-advized by G. Bailly (Dir.), O. Simonin and A. Spalanzani.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. ANR "VIMAD" (2015-17)

The VIMAD project aims at developing a robust and reliable perception system, only based on visual and inertial measurements, to enhance the navigation capabilities of fully autonomous micro aerial drones. It also aims at acquiring a deep theoretical comprehension of the problem of fusing visual and inertial measurements, by investigating its observability properties in challenging scenarios.

The activities related to this project, followed the work-plan (first year). They regarded the usage of our closed-form solution (recently published on the journal of computer vision, [70]) in the framework of micro aerial navigation in order to:

1. automatically perform state initialization;
2. improve the data matching process.

Additionally, the activities of VIMAD regarded the investigation of an unsolved problem in control theory, which is the unknown input observability problem in the nonlinear case, and its applications to the visual-inertial structure from motion problem.

See section 7.3.1 for a description of the results obtained during this first year of the project.

9.2.1.2. ANR "Valet" (2016-18)

The ANR VALET project proposes a novel approach for solving car-sharing vehicles redistribution problem using vehicle platoons guided by professional drivers. An optimal routing algorithm is in charge of defining platoons drivers' routes to the parking areas where the followers are parked in a complete automated mode. The consortium is made of 2 academic partners : Inria (RITS, Chroma, Prima) and Ircyyn Ecole Centrale de Nantes and the AKKA company.

In the VALET project we will propose a novel approach for solving car-sharing vehicles redistribution problem using vehicle platoons guided by professional drivers, retrieving vehicles parked randomly on the urban parking network by users. The phD student (Pavan Vashista) recruited in this project will focus on integrating models of human behaviors (pedestrian and/or drivers), proxemics (human management of space) and traffic rules to evaluate and communicate a risk to pedestrians that may encounter the trajectory of the VALET vehicle. His PhD thesis has started on february 2016 and is co-supervized by D. Vaufreydaz (Inria/PervasiveInteraction).

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. "ENABLE" Ecsel Project

ENABLE-S3 means "European Initiative to Enable Validation for Highly Automated Safe and Secure Systems". It is a H2020 Ecsel project.

ENABLE-S3 is *industry-driven* and therefore aims to foster the leading role of the European industry. This is also reflected in its *use case driven approach*. The main technical objectives are extracted from the use cases defined by the industrial partners, in order to validate the success of the developed methods and tools.

Recent scientific publications from the automotive domain predict that more than 100 Mio km of road driving is required for the thorough validation of a fully automated vehicle. Only if this extensive test is done, it is statistically proven that the automated vehicle is as safe as a manually driven car. Taking further into account the high number of vehicle variants and software versions, one can easily understand that *new validation approaches* are required to validate new Electronics, Components and Systems (ECS) for automated vehicles within a reasonable time period at reasonable costs. The same characteristic hold for other transportation domains such as aeronautics, maritime or rail.

The ENABLE-S3 project will provide European industry with leading-edge technologies that *support the development of reliable, safe and secure functions for highly automated and/or autonomously operating systems* by enabling the *validation and verification at reduced time and costs*.

Enables-S3 is a large European consortium, involving a French consortium leaded by Valeo, and including Thales, Renault and Inria. The project will start in March-April 2016 and will have a duration of 3 years.

9.3.2. Collaborations with Major European Organizations

- Autonomous System laboratory: ETHZ, Zurich (Switzerland)

  Subject: Vision and IMU data Fusion for 3D navigation in GPS denied environment.
- Robotics and Perception Group: University of Zurich (Switzerland)

  Subject: Vision and IMU data Fusion for 3D navigation in GPS denied environment.
- Karlsruhe Institut fur Technologie (KIT, Germany)

  Subject: Autonomous Driving (student exchanges and common project).
- Vislab Parma (Italy)

  Subject: Embedded Perception & Autonomous Driving (visits, projects submissions, and book chapter in the new edition of the Handbook of Robotics).
- University of Babes-Bolyai, Cluj-Napoca, Romania.

  Subject: Multi-robot patrolling and Machine Learning (Visit and PHC "DRONEM" 2017-18 obtained in December 2016).
- Department of Electrical & Computer Engineering: University of Thrace, Xanthi (GREECE)

  Subject: 3D coverage based on Stochastic Optimization algorithms
- Universidade de Aveiro (Portugal)

  Subject: Leader following. co-direction of P. Stein phD.

- Centro De Automatica y Robotica, UPM-CSIC, Madrid (Spain)
  Subject: Target interception.
- Bonn-Rhein-Sieg University of Applied Sciences (Germany)
  Subject: Using Semantic Information for Robot Navigation.
- Social Robotics Laboratory, Freiburg (Germany)
  Subject: Human behavior understanding.
- BlueBotics: BlueBotics Company, Lausanne (Switzerland)
  Subject: Implementation of self-calibration strategies for wheeled robots and SLAM algorithms for industrial purposes.

9.4. International Initiatives

9.4.1. Inria International Labs

- iCeiRA [0] international robotics laboratory led by Prof Ren Luo from NTU (Taiwan). Christian Laugier (Inria) and Raja Chatila (UPMC & CNRS) have actively participated to the starting of this laboratory in 2012 and are external Principal Investigators.
  Subject: Human centered robotics.

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

9.4.2.1. SAMPEN

Title: self adaptive mobile perception and navigation

International Partner (Institution - Laboratory - Researcher):

Start year: 2014

See also: http://emotion.inrialpes.fr/people/spalanzani/HomeSAMPEN.html

The associate team project is a Robotic project. The aim of the project is to propose a self-adaptive system of perception combined with a system of autonomous navigation. Usually, systems of perception rely on a set of specific sensors and a calibration is done in a specific environment. We propose to develop some methods to make perception systems adaptive to the environmental context and to the set of sensors used. This perception, that can be embedded on the mobile robot as well as on home structures (wall, ceiling, floor), will be helpful to localize agents (people, robot) present in the scene. Moreover, it will give information to better understand social scenes. All information will be used by the navigation system to move with a behavior that fit the context.

9.4.3. Inria International Partners

9.4.3.1. Informal International Partners

- UC Berkeley & Stanford University (CA, USA)
  Subject: Autonomous Driving (postdoc in the scope of Inria@SV, common publications and patent).
- Massachussetts Institute of Technology (MIT), Cambridge, MA (USA)
  Subject: Decentralized Control of Markov Decision Processes.

9.4.4. Participation in Other International Programs

- IEEE Robotics and Automation. Christian Laugier is member of several IEEE committees, in particular: IROS Steering committee, co-chair of Technical Committee on Autonomous Ground vehicles and Intelligent Transport Systems, Steering committee and Senior Editor of IEEE Transactions on Intelligent Vehicles. Olivier Simonin is member of the TC on Multi-Robot Systems (MRS).
  Subject: International Robotics Research Supporting.

[0] International Center of Excellence in Intelligent Robotics and Automation Research.

DEFROST Team

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.

FLOWERS Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Poppy Education

Poppy Education

Program: Feder - Région Aquitaine

Duration: January 2014 - December 2017

Coordinator: PY Oudeyer, Inria Flowers

Partners: Inria Flowers

Funding: 1 million euros (co-funded by Feder/EU Commission, Region Aquitaine and Inria)

Poppy Education aims to create, evaluate and disseminate pedagogical kits “turnkey solutions” complete, open-source and low cost, for teaching computer science and robotics. It is designed to help young people to take ownership with concepts and technologies of the digital world, and provide the tools they need to allow them to become actors of this world, with a considerable socio-economic potential. It is carried out in collaboration with teachers and several official french structures (French National Education/Rectorat, Highschools, engineering schools, ...). It targets secondary education and higher education, scientific literacy centers, Fablabs.

Poppy robotic platform used in the project is free hardware and software, printed in 3D, and is intended primarily for:

- learning of computer science and robotics,
- introduction to digital manufacturing (3D printing ...)
- initiation to the integration of IT in physical objects in humanoid robotics, mechatronics.
- artistic activities.

Educational sectors covered by the project are mainly: Enseignement d’exploration ICN en seconde, enseignement ISN en terminale S et bientôt en 1ère , filière STI2D, MPS seconde. Web: http://www.poppy-project.org/education .

9.1.2. ENSAM

The orientation of a (high school) student, choosing a career, is often based on an imagined representation of a discipline, sector of activity or training. Moreover, higher education is sometimes for a college student or a student a self centered universe, with inaccessible teaching methodologies and level of competence.

The Arts and Métiers campus at Bordeaux-Talence in partnership with Inria contributes with its educational and scientific expertise to the development of new teaching methods and tools. The objective is to develop teaching sequences based on a project approach relying on an attractive multidisciplinary technological system: the humanoid Inria Poppy robot. These teaching sequences will be built and tailored to different levels of training, from high schools to Engineer schools.

The new formation "Bachelor of Technology", started in September 2014 at Ensam Bordeaux, is resolutely turned towards a project based pedagogy, outlining concepts from concrete situations. The humanoid Inria Poppy robot offers an open platform capable of providing an unifying thread for the different subjects covered during the 3-years of the Bachelor formation: mechanics, manufacturing (3D printing), electrical, mechatronics, computer sciences, design...

For the 1st and 2nd year of the ENSAM Engineer cursus, the Poppy robot is now used to support the teaching and to conduct further investigation.

9.1.3. KidLearn and Region Aquitaine

A Conseil Régional d'Aquitaine Project (KidLearn, 2015-) began, coordinated by Manuel Lopes entitled KidLearn. Will fund 50% of a 3 years PhD student.

We propose here a research project that aims at elaborating algorithms and software systems to help humans learn efficiently, at school, at home or at work, by adapting and personalizing sequences of learning activities to the particularities of each individual student. This project leverages recent innovative algorithmic models of human learning (curiosity in particular, developed as a result of ERC European project of the Flowers team), and combines it with state-of-the-art optimization algorithms and an original integration with existing expert knowledge (human teachers). Given a knowledge domain and a set of possible learning activities, it will be able to propose the right activity at the right time to maximize learning progress. It can be applied to many learning situations and potential users: children learning basic knowledge in schools and with the support of their teachers, older kids using educational software at home, of adults needing to acquire new skills through professional training ("formation professionnelle"). Because it combines innovations in computational sciences (machine learning and optimization) with theories of human cognition (theories of human learning and of education), this project is also implementing a strong cross-fertilization between technology and human sciences (SHS).

9.1.4. Comacina Capsule Creative Art/Science project and Idex/Univ. Bordeaux

The artist community is a rich source of inspiration and can provide new perspectives to scientific and technological questions. This complementarity is a great opportunity that we want to enforce in the Poppy project by making the robot accessible to non-robotic-expert users. The Comacina project, in collaboration with the Flowers team and supported by funding from Idex/Univ. Bordeaux, explored the role of movements and light in expressing emotions. This project was implemented through several residencies during the year, and several performances at various cultural places in Aquitaine, including at Pole Evasion in Ambares-et-Lagrave. a report is available at https://flowers.inria.fr/RencontreAutourDuGeste.pdf . It benefitted from funding from the Art/Science Idex call for project.

9.2. National Initiatives

PY Oudeyer and M Lopes collaborated with Aymar de Rugy, Daniel Cattaert and Florent Paclet (INCIA, CNRS/Univ. Bordeaux) about the design of myoelectric robotic prostheses based on the Poppy platform, and on the design of algorithms for co-adaptation learning between the human user and the prosthesis. This was funded by a PEPS CNRS grant.

D. Roy is the Inria leader of project "Ecole du code" http://www.ecoleducode.net/ which provides teachers and animators formations and learning games to initiate young people to computer science and robotics.

D. Roy is member of the Class'code team (Inria is member of the consortium of this project) https://pixees.fr/classcode/accueil/. Class'code is a blended formation for teachers and animators who aim to initate young people to computer science and robotics. D. Roy has in charge the robotics module of the project.

D. Roy is member of the organization of computer science exhibition in "Palais de la découverte" which will begin on 2017 September for three years. He participates for robotics part.

D. Roy is member of the Scratch Conference (Bordeaux, 2017 July) organization team.

D. Roy is member of the team "Education en Scène" which organize educational activities with robotics in Bordeaux Digital City (2017 July).

D. Roy is member of "CRIC" Project, about Robotics in Vocational Schools, with Canope Ile de France, Lutin Userlab (Cité des SCiences), CNAM.

D. Roy is project leader of Thymio Simulator for Classcode project. Specifications and coordination of work.

D. Roy is project leader of Thymio Scratch and Thymio Snap! development, with D. Sherman. Inria, EPFL and Mobsya collaboration.

Around Robotics for education, many collaborations were put in place. With the LSRO Laboratory from EPFL (Lausanne) and others collaborations with French National Education/Rectorat d'Aquitaine, with Canopé Educational Network, with ESPE (teacher's school) Aquitaine, ESPE Martinique, ESPE Poitiers, National Directorate of Digital Education, Fondation "La Main à la Pâte", Maison for Science in Bordeaux University, Orange Fondation.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. 3rd HAND

Title: Semi-Autonomous 3rd Hand

Programm: FP7

Duration: October 2013 - September 2017

Coordinator: Inria

Partners:

Technische Universität Darmstadt (Germany)

Universität Innsbruck (Austria)

Universität Stuttgart (Germany)

Inria contact: Manuel Lopes

Robots have been essential for keeping industrial manufacturing in Europe. Most factories have large numbers of robots in a fixed setup and few programs that produce the exact same product hundreds of thousands times. The only common interaction between the robot and the human worker has become the so-called 'emergency stop button'. As a result, re-programming robots for new or personalized products has become a key bottleneck for keeping manufacturing jobs in Europe. The core requirement to date has been the production in large numbers or at a high price.Robot-based small series production requires a major breakthrough in robotics: the development of a new class of semi-autonomous robots that can decrease this cost substantially. Such robots need to be aware of the human worker, alleviating him from the monotonous repetitive tasks while keeping him in the loop where his intelligence makes a substantial difference.In this project, we pursue this breakthrough by developing a semi-autonomous robot assistant that acts as a third hand of a human worker. It will be straightforward to instruct even by an untrained layman worker, allow for efficient knowledge transfer between tasks and enable a effective collaboration between a human worker with a robot third hand. The main contributions of this project will be the scientific principles of semi-autonomous human-robot collaboration, a new semi-autonomous robotic system that is able to: i) learn cooperative tasks from demonstration; ii) learn from instruction; and iii) transfer knowledge between tasks and environments. We will demonstrate its efficiency in the collaborative assembly of an IKEA-like shelf where the robot acts as a semiautonomous 3rd-Hand .

9.3.1.2. DREAM

Title: Deferred Restructuring of Experience in Autonomous Machines

Programm: H2020

Duration: January 2015 - December 2018

Coordinator: UPMC

Partners:

Armines (ENSTA ParisTech)

Queen Mary University London (England)

University of A Coruna (Spain)

Vrije University Amsterdam (Holland)

Contact: David Filliat

Abstract: A holy grail in robotics and artificial intelligence is to design a machine that can accumulate adaptations on developmental time scales of months and years. From infancy through adult- hood, such a system must continually consolidate and bootstrap its knowledge, to ensure that the learned knowledge and skills are compositional, and organized into meaningful hierarchies. Consolidation of previous experience and knowledge appears to be one of the main purposes of sleep and dreams for humans, that serve to tidy the brain by removing excess information, to recombine concepts to improve information processing, and to consolidate memory. Our approach – Deferred Restructuring of Experience in Autonomous Machines (DREAM) – incorporates sleep and dream-like processes within a cognitive architecture. This enables an individual robot or groups of robots to consolidate their experience into more useful and generic formats, thus improving their future ability to learn and adapt. DREAM relies on Evo- lutionary Neurodynamic ensemble methods (Fernando et al, 2012 Frontiers in Comp Neuro; Bellas et al., IEEE-TAMD, 2010) as a unifying principle for discovery, optimization, re- structuring and consolidation of knowledge. This new paradigm will make the robot more autonomous in its acquisition, organization and use of knowledge and skills just as long as they comply with the satisfaction of pre-established basic motivations. DREAM will enable robots to cope with the complexity of being an information-processing entity in domains that are open-ended both in terms of space and time. It paves the way for a new generation of robots whose existence and purpose goes far beyond the mere execution of dull tasks. http://www.robotsthatdream.eu

9.3.2. Collaborations in European Programs, except FP7 & H2020

9.3.2.1. IGLU

Title: Interactive Grounded Language Understanding (IGLU)

Programm: CHIST-ERA

Duration: October 2015 - September 2018

Coordinator: University of Sherbrooke, Canada

Partners:

University of Sherbrooke, Canada

Inria Bordeaux, France

University of Mons, Belgium

KTH Royal Institute of Technology, Sweden

University of Zaragoza, Spain

University of Lille 1 , France

University of Montreal, Canada

Inria contact: Manuel Lopes

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. IGLU will gather an interdisciplinary consortium composed of committed and experienced researchers in machine learning, neurosciences and cognitive sciences, developmental robotics, speech and language technologies, and multimodal/multimedia signal processing. We expect to have key impacts in the development of more interactive and adaptable systems sharing our environment in everyday life. http://iglu-chistera.github.io/

9.4. International Initiatives

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

9.4.1.1. NEUROCURIOSITY

Title: NeuroCuriosity

International Partner (Institution - Laboratory - Researcher):

Columbia Neuroscience (United States) - ___DEPARTMENT???___ - JACQUELINE GOTTLIEB

Start year: 2016

See also: https://flowers.inria.fr/neurocuriosity

Curiosity can be understood as a family of mechanisms that evolved to allow agents to maximize their knowledge of the useful properties of the world. In this project we will study how different internal drives of an animal, e.g. for novelty, for action, for liking, are combined to generate the rich variety of behaviors found in nature. We will approach such challenge by studying monkeys, children and by developing new computational tools.

9.4.1.2. Informal International Partners

Benjamin Clement and Manuel Lopes just begin a collaboration with Joseph Jay Williams (Harvard University), Douglas Selent and Neil Heffernan (Worcester Polytechnic Institute) to use Kidlearn algorithm and contextual multi-armed bandit to recommend explanation on ASSISTments online tutoring system. Joseph Jay Williams and Neil Heffernan used multi-armed bandit algorithm on ASSISTments platform [179] to provide efficient explanation, and new we are looking to use new algorithm to provide a more personal and relevant feedback.

Pierre-Yves Oudeyer and Didier Roy have create a collaboration with LSRO EPFL and Pr Francesco Mondada, about Robotics and education. The two teams co-organize the annual conference "Robotics and Education"in Bordeaux. Didier Roy teaches "Robotics and Education" in EPFL several times a year.

Didier Roy has created a collaboration with HEP VAud (Teachers High School) and Bernard Baumberger and Morgane Chevalier, about Robotics and education. SCientific discussions and shared professional training.

9.4.2. Participation in Other International Programs

David Filliat participates in the ITEA3 DANGUN project with Renault S.A.S. in france and partners in Korea. The purpose of the DANGUN project is to develop a Traffic Jam Pilot function with autonomous capabilities using low-cost automotive components operating in France and Korea. By incorporating low-cost advanced sensors and simplifying the vehicle designs as well as testing in different scenarios (France & Korea), a solution that is the result of technical cooperation between both countries should lead to more affordable propositions to respond to client needs in the fast moving market of intelligent mobility.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Lauriane Rat-Fisher, IAST, Toulouse (November 23-25th)
- Fumihide Tanaka, ISI Lab, University of Tokyo, Japan (November 9th)
- Romain Brette, Institut de la Vision, Paris (February, 12th)
- Tony Belpaeme, Univ. Plymouth, UK (January)
- Tobjorn Dahl, Univ. Plymouth, UK (January)
- Jens Moenig, SAP Research, Germany (June)
- Stéphane Magnegnat, ETH Zurich, Switzerland (June)
- Francesco Mondada, EPFL, Lausanne, Switzerland Jjune)

9.5.1.1. Internships

- Yasmin Ansari, The Biorobotics Institute, Scuola Superiore S. Anna, Pontedera, Italy (January to May, 2016)

HEPHAISTOS Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

- CPER project MADORSON for the assistance to elderly people (with the STARS project)
- we have submitted several projects to the local IDEX without success but we are preparing several projects for the next year

9.2. National Initiatives

9.2.1. FHU

- the team has been involved for the FHU *INOVPAIN : Innovative Solutions in Refractory Chronic Pain* that has been labeled in December

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. RAPP

Type: COOPERATION

Instrument: Specific Targeted Research Project

Objective: Robotic Applications for Delivering Smart User Empowering Applications

Duration: December 2013-December 2016

Coordinator: CERTH/ITI

Partner: CERTH/ITI(Greece), Inria, WUT (Poland), ORTELIO (UK), ORMYLIA (Greece), INGEMA (Spain)

Inria contact: David Daney, Jean-Pierre Merlet, Manuel Serrano

Abstract: our societies are affected by a dramatic demographic change, in the near future elderly and people requiring support in their daily life will increase and caregivers will not be enough to assist and support them. Socially interactive robots can help to confront this situation not only by physically assisting people but also functioning as a companion. The increasing sales figures of robots are pointing that we are in front of a trend break for robotics. To lower the cost for developers and to increase their interest on developing robotic applications, the RAPP introduces the idea of robots as platforms. RAPP (Robotic Applications for Delivering Smart User Empowering Applications) will provide a software platform in order to support the creation and delivery of robotics applications (RAPPs) targeted to people at risk of exclusion, especially older people. The open-source software platform will provide an API that contains the functionalities for implementing RAPPs and accessing the robot's sensors and actuators using higher level commands, by adding a middleware stack with added functionalities suitable for different kinds of robots. RAPP will expand the computational and storage capabilities of robots and enable machine learning operations, distributed data collection and processing, and knowledge sharing among robots in order to provide personalized applications based on adaptation to individuals. The use of a common API will assist developers is creating improved applications for different types of robots that target to people with different needs, capabilities and expectations, while at the same time respect their privacy and autonomy, thus the proposed RAPP Store will have a profound effect in the robotic application market. The results of RAPP will be evaluated through the development and benchmarking of social assistive RAPPs, which exploit the innovative features (RAPP API, RAPP Store, knowledge reuse, etc.) introduced by the proposed paradigm.

9.4. International Initiatives

9.4.1. Informal International Partners

We have numerous international collaborations but we mention here only the one with activities that go beyond joint theoretical or experimental works:

- University of Bologna: 2 joint PhD student, publications
- University Innsbruck: joint conference organization
- Fraunhofer IPA, Stuttgart: joint conference organization
- Duisburg-Essen University: joint conference organization
- University of New-Brunswick: 1 joint PhD student
- University Laval, Québec: joint book
- University of Tokyo: joint conference organization
- Tianjin University, China: joint book

9.5. International Research Visitors

9.5.1. Visits of International Scientists

We have received for an extended stay our joint PhD student J. Pickard from University of New Brunswick together with his canadian supervisor J.A Carretero. We have received the Associate Professor Martin Pfurner from Innsbruck University for an extended stay and and Cuong Trinh Duc, PhD student from University Genova while several other scientists from other domains have visited our robotics flat.

LAGADIC Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. ARED NavRob

Participants: Suman Raj Bista, Paolo Robuffo Giordano, François Chaumette.

no Inria Rennes 8033, duration: 36 months.

This project funded by the Brittany council ended in October 2016. It supported in part Suman Raj Bista's Ph.D. about visual navigation (see Section 7.4.1).

9.1.2. ARED DeSweep

Participants: Lesley-Ann Duflot, Alexandre Krupa.

no Inria Rennes 8033, duration: 36 months.

This project funded by the Brittany council started in October 2014. It supports in part Lesley-Ann Duflot's Ph.D. about visual servoing based on the shearlet transform (see Section 7.3.3).

9.1.3. ARED Locoflot

Participants: Ide Flore Kenmogne Fokam, Vincent Drevelle, Eric Marchand.

no Inria Rennes 9944, duration: 36 months.

This project funded by the Brittany council started in October 2015. It supports in part Ide Flore Kenmogne Fokam's Ph.D. about cooperative localization in multi-robot fleets using interval analysis (see Section 7.5.3).

9.1.4. ARED Mod4Nav

Participants: Aline Baudry, Marie Babel.

no INSA Rennes 2016/01, duration: 36 months.

This project funded by the Brittany council started in October 2016. It supports in part Aline Baudry's Ph.D. about wheelchair modeling.

9.1.5. "Equipement mi-lourd Rennes Métropole"

Participant: Paolo Robuffo Giordano.

no CNRS Rennes 14C0481, duration: 36 months.

A grant from "Rennes Métropole" has been obtained in June 2014 and supports the activities related to the use of drones (quadrotor UAVs). The platform described in Section 6.9.5 has been purchased in part thanks to this grant.

9.1.6. IRT Jules Verne Mascot

Participant: François Chaumette.

no Inria Rennes 10361, duration: 36 months.

This project started in October 2015. It is managed by IRT Jules Verne in Nantes and realized in cooperation with IRCCyN, Airbus, Renault, Faurecia and Alsthom. Its goal is to perform screwing for various industrial applications.

9.1.7. IRT b<>com NeedleWare

Participants: Hadrien Gurnel, Alexandre Krupa.

no Inria Rennes 9072, duration: 36 months.

This project started in October 2016. It supports Hadrien Gurnel's Ph.D. about the study of a shared control strategy fusing haptic and ultrasound visual control for assisting manual steering of needles for biopsies or therapy purposes in a synergetic way.

9.2. National Initiatives

9.2.1. France Life Imaging WP3-FLI ANFEET

Participant: Alexandre Krupa.

duration: 24 months.

This project started in January 2016. Its objective is to initiate collaborative research with the ICube laboratory (Strasbourg) on the control and supervision of flexible endoscopes in the digestive tube using ultrasound images.

9.2.2. ANR Contint Visioland

Participants: Noël Mériaux, Patrick Rives, François Chaumette.

no Inria Rennes 8304, duration: 48 months.

This project started in November 2013. It is composed of a consortium managed by Onera in Toulouse with Airbus, Spikenet Technology, IRCCyN, and Lagadic. Its aim is to develop vision-based localization and navigation techniques for autonomous landing on a runway (see Section 7.1.3).

9.2.3. ANR Contint Entracte

Participant: Julien Pettré.

no Inria Rennes 8013, duration: 42 months.

This project started in November 2013. It is realized in collaboration with the Gepetto group at Laas, Toulouse, and the Mimetic group at Irisa and Inria Rennes Bretagne Atlantique. It addresses the problem of motion planning for anthropomorphic systems, and more generally, the problem of manipulation path planning. ENTRACTE proposes to study in parallel both the mathematical foundation of artificial motion and the neurocognitive structures used by humans to quickly solve motion problems.

9.2.4. ANR JCJC Percolation

Participant: Julien Pettré.

no Inria Rennes 7991, duration: 42 months.

The ANR "Jeune Chercheur" Percolation project started on January 2014. It aims at designing perception-based crowd simulation algorithms. We develop agents which are capable of perceiving their virtual environment through virtual sensors, and which are able to navigate in it, as well as to interact with the other agents.

9.2.5. ANR JCJC SenseFly

Participants: Thomas Bellavoir, Muhammad Usman, Riccardo Spica, Paolo Robuffo Giordano.

no Irisa CNRS 50476, duration: 36 months.

The ANR "Jeune Chercheur" SenseFly project started in August 2015. Its goal is to advance the state-of-the-art in multi-UAV in the design and implementation of fully decentralized and sensor-based group behaviors by only resorting to onboard sensing (mainly cameras and IMU) and local communication (e.g., Bluetooth communication, wireless networks). Topics such as individual flight control, formation control robust against sensor limitations (e.g., limited field of view, occlusions), distributed estimation of relative positions/bearings from local sensing, maintenance of architectural properties of a multi-UAV formation will be touched by the project. Part of the platforms described in Section 6.9.5 has been purchased thanks to this grant.

9.2.6. ANR PLaTINUM

Participants: Eduardo Fernandez Moral, Vincent Drevelle, Patrick Rives.

no Inria Sophia 10204, duration: 42 months.

This project started in November 2015. It is composed of a consortium managed by Litis in Rouen with IGN Matis (Paris), Le2i (Le Creusot) and Lagadic group. It aims at proposing novel solutions to robust long-term mapping of urban environments.

9.2.7. BPI Romeo 2

Participants: Giovanni Claudio, Nicolas Cazy, Suman Raj Bista, Fabien Spindler, François Chaumette.

no Inria Rennes 7114, duration: 60 months.

This project started in November 2012. It is composed of a large consortium managed by Softbank Robotics (ex Aldebaran Robotics) with Laas in Toulouse, Isir in Paris, Lirmm in Montpellier, Inria groups Lagadic, Bipop (Pierre-Brice Wieber), Flowers (Pierre-Yves Oudeyer), and many other partners. It aims at developing advanced control and perception functionalities to a humanoid robot. In this project, we are in charge of visual manipulation and navigation with Romeo and Pepper. It supports in part Suman Raj Bista's Ph.D. about visual navigation (see Section 7.4.1), as well as Nicolas Cazy's Ph.D. about model-based predictive control for visual servoing (see Section 7.2.4).

9.2.8. Equipex Robotex

Participants: Fabien Spindler, François Chaumette.

no Inria Rennes 6388, duration: 9 years.

Lagadic is one of the 15 French academic partners involved in the Equipex Robotex network thats started in February 2011. It is devoted to get and manage significative equipment in the main robotics labs in France. In the scope of this project, we have got the humanoid robot Romeo (see Section 6.9.4).

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. FP7 Space RemoveDEBRIS

Participants: Aurélien Yol, Eric Marchand, François Chaumette.

Instrument: Specific Targeted Research Project

Duration: October 2013 - September 2017

Coordinator: University of Surrey (United Kingdom)

Partners: Surrey Satellite Technology (United Kingdom), Airbus (Toulouse, France and Bremen, Germany), Isis (Delft, The Netherlands), CSEM (Neuchâtel, Switzerland), Stellenbosch University (South Africa).

Inria contact: François Chaumette

Abstract: The goal of this project is to validate model-based tracking algorithms on images acquired during an actual space debris removal mission (see Section 7.1.2).

9.3.1.2. H2020 Comanoid

Participants: Don Joven Agravante, Giovanni Claudio, Souriya Trinh, Fabien Spindler, François Chaumette.

Title: Multi-contact Collaborative Humanoids in Aircraft Manufacturing

Programm: H2020

Duration: January 2015 - December 2018

Coordinator: CNRS (Lirmm)

Partners: Airbus Group (France), DLR (Germany), Università Degli Studi di Roma La Sapienza (Italy), CNRS (I3S)

Inria contact: Francois Chaumette

COMANOID investigates the deployment of robotic solutions in well-identified Airbus airliner assembly operations that are laborious or tedious for human workers and for which access is impossible for wheeled or rail-ported robotic platforms. As a solution to these constraints a humanoid robot is proposed to achieve the described tasks in real-use cases provided by Airbus Group. At a first glance, a humanoid robotic solution appears extremely risky, since the operations to be conducted are in highly constrained aircraft cavities with non-uniform (cargo) structures. Furthermore, these tight spaces are to be shared with human workers. Recent developments, however, in multi-contact planning and control suggest that this is a much more plausible solution than current alternatives such as a manipulator mounted on multi-legged base. Indeed, if humanoid robots can efficiently exploit their surroundings in order to support themselves during motion and manipulation, they can ensure balance and stability, move in non-gaited (acyclic) ways through narrow passages, and also increase operational forces by creating closed-kinematic chains. Bipedal robots are well suited to narrow environments specifically because they are able to perform manipulation using only small support areas. Moreover, the stability benefits of multi-legged robots that have larger support areas are largely lost when the manipulator must be brought close, or even beyond, the support borders. COMANOID aims at assessing clearly how far the state-of-the-art stands from such novel technologies. In particular the project focuses on implementing a real-world humanoid robotics solution using the best of research and innovation. The main challenge will be to integrate current scientific and technological advances including multi-contact planning and control; advanced visual-haptic servoing; perception and localization; human-robot safety and the operational efficiency of cobotics solutions in airliner manufacturing.

9.3.1.3. H2020 Romans

Participants: Nicolò Pedemonte, Firas Abi Farraj, Fabien Spindler, François Chaumette, Paolo Robuffo Giordano.

Title: Robotic Manipulation for Nuclear Sort and Segregation

Programm: H2020

Duration: May 2015 - April 2018

Coordinator: University of Birmingham

Partners: NLL (UK), CEA (France), Univ. Darmstadt (Germany)

CNRS contact: Paolo Robuffo Giordano

The RoMaNS (Robotic Manipulation for Nuclear Sort and Segregation) project will advance the state of the art in mixed autonomy for tele-manipulation, to solve a challenging and safety-critical "sort and segregate" industrial problem, driven by urgent market and societal needs. Cleaning up the past half century of nuclear waste, in the UK alone (mostly at the Sellafield site), represents the largest environmental remediation project in the whole of Europe. Most EU countries face related challenges. Nuclear waste must be "sorted and segregated", so that low-level waste is placed in low-level storage containers, rather than occupying extremely expensive and resource intensive high-level storage containers and facilities. Many older nuclear sites (>60 years in UK) contain large

numbers of legacy storage containers, some of which have contents of mixed contamination levels, and sometimes unknown contents. Several million of these legacy waste containers must now be cut open, investigated, and their contents sorted. This can only be done remotely using robots, because of the high levels of radioactive material. Current state-of-the-art practice in the industry, consists of simple tele-operation (e.g. by joystick or teach-pendant). Such an approach is not viable in the long-term, because it is prohibitively slow for processing the vast quantity of material required. The project will: 1) Develop novel hardware and software solutions for advanced bi-lateral master-slave tele-operation. 2) Develop advanced autonomy methods for highly adaptive automatic grasping and manipulation actions. 3) Combine autonomy and tele-operation methods using state-of-the-art understanding of mixed initiative planning, variable autonomy and shared control approaches. 4) Deliver a TRL 6 demonstration in an industrial plant-representative environment at the UK National Nuclear Lab Workington test facility.

9.3.2. Collaborations with European Partners

Participants: Fabien Spindler, Alexandre Krupa, François Chaumette.

Project acronym: i-Process

Project title: Innovative and Flexible Food Processing Technology in Norway

Duration: January 2016 - December 2019

Coordinator: Sintef (Norway)

Other partners: Nofima, Univ. of Stavanger, NMBU, NTNU (Norway), DTU (Denmark), KU Leuven (Belgium), and about 10 Norwegian companies.

Abstract: This project is granted by the Norwegian Government. Its main objective is to develop novel concepts and methods for flexible and sustainable food processing in Norway. In the scope of this project, the Lagadic group is involved for visual tracking and visual servoing of generic and potentially deformable objects. Prof. Pal Johan from the Norwegian University of Life Sciences (NMBU), and Ekrem Misimi from Sintef spent a short visit in June and October respectively.

9.4. International Initiatives

9.4.1. Inria Associate Teams

9.4.1.1. SIMS

Title: Realistic and Efficient Simulation of Complex Systems

International Partners:

University of North Carolina at Chapel Hill (USA) - GAMMA Group - Ming C. Lin, Dinesh Manocha

University of Minnesota (USA) - Motion Lab - Stephen Guy

Brown University (USA) - VenLab - William Warren

Start year: 2012

See http://people.rennes.inria.fr/Julien.Pettre/EASIMS/easims.html

The general goal of SIMS is to make significant progress toward realistic and efficient simulation of highly complex systems, which raise combinatory explosive problems. This proposal is focused on human motion and interaction, and covers 3 active topics with wide application range:

1. Crowd simulation: virtual human interacting with other virtual humans,
2. Autonomous virtual humans interacting with their environment,
3. Physical simulation: real humans interacting with virtual environments.

SIMS is orthogonally structured by transversal questions: the evaluation of the level of realism reached by a simulation (which is a problem by itself in the considered topics), considering complex systems at various scales (micro, meso and macroscopic ones), and facing combinatory explosion of simulation algorithms.

9.4.1.2. ISI4NAVE

Title: Innovative Sensors and adapted Interfaces for assistive NAVigation and pathology Evaluation
International Partner:

University College London (United Kingdom) - Aspire CREATe - Tom Carlson

Start year: 2016
See http://www.irisa.fr/lagadic/team/MarieBabel/ISI4NAVE/ISI4NAVE.html
The global ageing population, along with disability compensation constitute major challenging societal and economic issues. In particular, achieving autonomy remains a fundamental need that contributes to the individual's wellness and well-being. In this context, innovative and smart technologies are designed to achieve independence while matching user's individual needs and desires.

Hence, designing a robotic assistive solution related to wheelchair navigation remains of major importance as soon as it compensates partial incapacities. This project will then address the following two issues. First, the idea is to design an indoor / outdoor efficient obstacle avoidance system that respects the user intention, and does not alter user perception. This involves embedding innovative sensors to tackle the outdoor wheelchair navigation problem. The second objective is to take advantage of the proposed assistive tool to enhance the user Quality of Experience by means of biofeedback. Indeed, adapted interfaces should improve the understanding of people that suffer from cognitive and/or visual impairments.

The originality of the project is to continuously integrate medical validation as well as clinical trials during the scientific research work in order to match user needs and acceptation.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

- Alexandre Krupa has a collaboration with Prof. Nassir Navab from the Technical University of Munich concerning the joint supervision of Pierre Chatelain's Ph.D. (see Section 7.3.2).

9.4.3. Participation in International Programs

The Lagadic group is one of the few external partners of the Australian Center for Robotic Vision (see http://roboticvision.org). It groups QUT in Brisbane, ANU in Canberra, Monash University and Adelaide University. In the scope of this project, Peter Corke and Ben Upcroft spent a short visit in May 2016 while Jurgen Leitner spent a 1-month visit in October 2016.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Nicolas Alt, senior researcher at Technical University of Munich (TUM) was a visiting scientist at Sophia Antipolis from Jan until Feb 2016. He worked on visuo-haptic environment perception.
- Alejandro Perez Yus, Ph.D. student at Universidad de Zaragoza, spent a 3-month visit in Sophia Antipolis from Sep until Nov 2016. He worked on the calibration of multi-camera RGB-D systems.
- Prof. Denis Wolf, associate professor at Univ. Sao Paulo, Brasil, spends a sabbatical year in Sophia Antipolis from Jul 2016 to Aug 2017. He works on semantic learning applied to intelligent vehicles.
- Nicola Battilani, Ph.D. student at University of Modena and Reggio Emilia, spent a 6-month visit in Rennes from May until Oct 2016. He worked on shared control algorithms for optimal 3D reconstruction from vision.
- Prof. Volkan Isler from University of Minnesota, Phillip Schmidt, Ph.D. student from DLR, Prof. Ivan Petrovic from Univ. of Zagreb, Prof. Purang Abolmaesumi from Univ. of British Columbia, Prof. Nassir Navab from Technical University of Munich, and Prof. Russ Taylor from John Hopkins University spent a short visit in the group in 2016.

LARSEN Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Project PsyPhINe: Cogitamus ergo sumus

Participant: Amine Boumaza.

This project is financed for two years by the MSH Lorraine (USR3261) gathering researchers from the following institutes: , InterPsy (EA 4432), APEMAC, EPSaM (EA4360), Archives Henri-Poincaré (UMR7117), Inria Bordeaux Sud-Ouest, Loria (UMR7503). Refer to sec. 7.1.1 for further information.

8.1.2. AME Satelor

Participants: François Charpillet, Xuan Son Nguyen, Thomas Moinel, Mélanie Lelaure.

Economic mobilisation agency in Lorraine has launched a new project Satelor providing it with 2.5 million Euros of funding over 3 years, out of an estimated total of 4.7 million. The leader of the project is Pharmagest-Diatelic. Pharmagest, in Nancy, is the French leader in computer systems for pharmacies, with a 43.5 % share of the market, 9,800 clients and more than 700 employees. Recently, the Pharmagest Group expanded its activities into e-health and the development of telemedicine applications. The Satelor project will accompany the partners of the project in developing services for maintaining safely elderly people with loss of autonomy at home or people with a chronic illness. Larsen team will play an important role for bringing some research results such as:

- developing a low cost environmental sensor for monitoring the daily activities of elderly people at home
- developing a low cost sensor for fall detection
- developing a low cost companion robot able to interact with people and monitoring their activities while detecting emergency situations.
- developing a general toolbox for data-fusion: Bayesian approach.

8.2. National Initiatives

8.2.1. PIA LAR Living Assistant Robot

Participants: François Charpillet, Abdallah Dib.

Partners : Crédit Agricole, Diatelic, Robosoft
The LAR project has the objective to design an assistant robot to improve the autonomy and quality of life for elderly and fragile persons. The project started at the beginning of 2015. The role of the Larsen Team is to develop a simultaneous localisation and mapping algorithm using a RGB-D camera. The main issue is to develop an algorithm able to deal with a dynamic environment. Another issue is for the robot to be able to behave with acceptable social skills.

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. RESIBOTS

Title: Robots with animal-like resilience

Programm: H2020

Type: ERC

Duration: May 2015 - April 2020

Coordinator: Inria

Inria contact: Jean Baptiste Mouret

Despite over 50 years of research in robotics, most existing robots are far from being as resilient as the simplest animals: they are fragile machines that easily stop functioning in difficult conditions. The goal of this proposal is to radically change this situation by providing the algorithmic foundations for low-cost robots that can autonomously recover from unforeseen damage in a few minutes. The current approach to fault tolerance is inherited from safety-critical systems (e.g. spaceships or nuclear plants). It is inappropriate for low-cost autonomous robots because it relies on diagnostic procedures, which require expensive proprioceptive sensors and contingency plans, which cannot cover all the possible situations that an autonomous robot can encounter. It is here contended that trial-and-error learning algorithms provide an alternate approach that does not require diagnostic or pre-defined contingency plans. In this project, we will develop and study a novel family of such learning algorithms that make it possible for autonomous robots to quickly discover compensatory behaviors. We will thus shed a new light on one of the most fundamental questions of robotics: how can a robot be as adaptive as an animal? The techniques developed in this project will substantially increase the lifespan of robots without increasing their cost, and will open new research avenues for adaptive machines.

8.3.1.2. CoDyCo

Participants: Serena Ivaldi, Valerio Modugno, Oriane Dermy.

Title: Whole-body Compliant Dynamical Contacts in Cognitive Humanoids

Program: FP7

Instrument: STREP

Objective: Cognitive Systems and Robotics (b)

Duration: March 2013 - February 2017 (4 years)

Coordinator: Francesco Nori (Italian Institute of Technology)

Partners: TU Darmstadt (Germany), Université Pierre et Marie Curie (France), Josef Stefan Institue (Slovenia), University of Birmingham (UK)

Inria contact: Serena Ivaldi

Abstract: The aim of CoDyCo is to advance the current control and cognitive understanding of robust, goal-directed whole-body motion interaction with multiple contacts. CoDyCo will go beyond traditional approaches by: (1) proposing methodologies for performing coordinated interaction tasks with complex systems; (2) combining planning and compliance to deal with predictable and unpredictable events and contacts; (3) validating theoretical advances in real-world interaction scenarios. First, CoDyCo will advance the state-of-the-art in the way robots coordinate physical interaction and physical mobility. Traditional industrial applications involve robots with limited mobility. Consequently, interaction (e.g., manipulation) has been treated separately from whole-body posture (e.g., balancing), assuming the robot firmly connected to the ground. Foreseen applications involve robots with augmented autonomy and physical mobility. Within this novel context, physical interaction influences stability and balance. To allow robots to surpass barriers between interaction

and posture control, CoDyCo will be grounded in principles governing whole-body coordination with contact dynamics. Second, CoDyCo will go beyond traditional approaches in dealing with all perceptual and motor aspects of physical interaction, unpredictability included. Recent developments in compliant actuation and touch sensing allow safe and robust physical interaction from unexpected contact including humans. The next advancement for cognitive robots, however, is the ability not only to cope with unpredictable contact, but also to exploit predictable contact in ways that will assist in goal achievement. Third, the achievement of the project objectives will be validated in real-world scenarios with the iCub humanoid robot engaged in whole-body goal-directed tasks. The evaluations will show the iCub exploiting rigid supportive contacts, learning to compensate for compliant contacts, and utilizing assistive physical interaction.

8.4. International Initiatives

8.4.1. Participation in Other International Programs

Serena Ivaldi, in collaboration with Prof. Dana Kulic of University of Waterloo, obtained a MITACS-Inria grant for the master student Jamie Waugh for the project “learning gait models”.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Francesco Nori, researcher at the Italian Institute of Technology, and coordinator of the European Project CoDyCo (where we are partners), visited our team for one month. During this visit, we wrote together a proposal for a H2020 project that was submitted in April 2016 and was subsequently accepted: the project, AnDy, will start in January 2017.
- John Rieffel, Associate Professor at Union College (NY, USA), visited our team for a month. During his visit, we used Bayesian optimization to learn gaits for a soft tensegrity robot. A paper has been submitted.

8.5.1.1. Internships

- Jamie Waugh, master student of University of Waterloo, visited our team for 3 months (from September to December) thanks to a MITACS-Inria grant.

PERVASIVE INTERACTION Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR Project Involved

Participants: Amr Alyafi, Patrick Reignier.

Other Partners: UMR G-SCOP, UMR LIG (Persuasive Interaction, IIHM), CEA Liten, PACTE, Vesta Systems and Elithis.

Dates: Jan 2015 to Dec 2018

The ANR project Involved focuses on bringing solutions to building actors for upcoming challenges in energy management in residential buildings. The project explores a user centric energy management system, where user needs and tacit knowledge drive the search of solutions. These are calculated using a flexible energy model of the living areas. The system is personified by energy consultants with which building actors such as building owners, building managers, technical operators but also occupants, can interact with in order to co-define energy strategies, benefiting of both assets: tacit knowledge of human actors, and measurement with computation capabilities of calculators. Putting actors in the loop, i.e. making energy not only visible but also controllable is the needed step before large deployment of energy management solutions. It is proposed to develop interactive energy consultants for all the actors, which are energy management aided systems embedding models in order to support the decision making processes. MIRROR (interactive monitoring), WHAT-IF (interactive quantitative simulation), EXPLAIN (interactive qualitative simulation), SUGGEST-AND-ADJUST (interactive management) and RECOMMEND (interactive diagnosis) functionalities will be developed.

8.1.2. ANR Project CEEGE: Chess Expertise from Eye Gaze and Emotion

Participants: James Crowley, Dominique Vaufreydaz, Rafaellea Balzarini

Other Partners: Dept of NeuroCognition, CITEN, Bielefeld University

Dates: Jan 2016 to Dec 2019

CEEGE is a multidisciplinary scientific research project conducted by the Inria PRIMA team in cooperation with the Dept of Cognitive Neuroscience at the University of Bielefeld. The primary impacts will be improved scientific understanding in the disciplines of Computer Science and Cognitive NeuroScience. The aim of this project is to experimentally evaluate and compare current theories for mental modelling for problem solving and attention, as well as to refine and evaluate techniques for observing the physiological reactions of humans to situation that inspire pleasure, displeasure, arousal, dominance and fear.

In this project, we will observe the visual attention, physiological responses and mental states of subject with different levels of expertise solving classic chess problems, and participating in chess matches. We will observe chess players using eye-tracking, sustained and instantaneous face-expressions (micro-expressions), skin conductivity, blood flow (BVP), respiration, posture and other information extracted from audio-visual recordings and sensor readings of players. We will use the recorded information to estimate the mental constructs with which the players understand the game situation. Information from visual attention as well as physiological reactions will be used to determine and model the degree to which a player understands the game situation in terms of abstract configurations of chess pieces. This will provide a structured environment that we will use for experimental evaluation of current theories of mental modeling and emotional response during problem solving and social interaction.

The project is organized in three phases. During the first phase, we will observe individual players of different levels of chess expertise solving known chess problems. We will correlate scan-path from eye tracking and other information about visual attention to established configurations of pieces and known solutions to chess problems. This will allow us to construct a labeled corpus of chess play that can be used to evaluate competing techniques for estimating mental models and physiological responses. In a second phase, we will observe the attention and face expressions of pairs of players of different levels of chess ability during game play. In particular, we will seek to annotate and segment recordings with respect to the difficulty of the game situation as well as situations that elicit particularly strong physiological reactions. In the final phase, we will use these recordings to evaluate the effectiveness of competing techniques for mental modeling and observation of emotions in terms of their abilities to predict the chess abilities of players, game outcomes and individual moves and player self reports. Results of our work will be published in scientific conferences and journals concerned with cognitive science and cognitive neuroscience as well as computer vision, multimodal interaction, affective computing and pervasive computing. Possible applications include construction of systems that can monitor the cognitive abilities and emotional reactions of users of interactive systems to provide assistance that is appropriate but not excessive, companion systems that can aid with active healthy ageing, and tutoring systems that can assist users in developing skills in a variety of domains including chess.

8.2. European Initiatives

8.2.1. ICT FET Bambi (FET Open FP7-ICT-2013-C)

Participants: Emmanuel Mazer, Marvin Faix

Partners: Hebrew University of Jerusalem, Probayes, Universit$\surd$© de Liege, Instituto de Sistemas e Robotica (Portugal),CNRS (LIG,ISIR,IEF,UMIPhi)

Dates January 2014 to December 2016

FET Open BAMBI explores a theory and a hardware implementation of probabilistic computation inspired by biochemical cell signalling. The project studies probabilistic computation following three axes: algebra, biology, and hardware. In each case, we will develop a bottom-up hierarchical approach starting from the elementary components, and study how to combine them to build more complex systems. It proposes a Bayesian Gate operating on probability distributions on binary variables as the building blocks of our probabilistic algebra. These Bayesian gates can be seen as a generalization of logical operators in Boolean algebra. The consortium interprets elementary cell signalling pathways as biological implementation of these probabilistic gates. In turn, the key features of biochemical processes give new insights for new probabilistic hardware implementation. They associate conventional electronics and novel stochastic nano-devices to build the required hardware elements. Combining these will lead to new artificial information processing systems, which could, in the future, outperform classical computers in tasks involving a direct interaction with the physical world. For this purpose, this project associates research in Bayesian probability theory, molecular biology, nanophysics, computer science and electronics.

RITS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. COCOVEA

Title: Coopération Conducteur-Véhicule Automatisé

Instrument: ANR

Duration: November 2013 - April 2017

Coordinator: Jean-Christophe Popieul (LAMIH - University of Valenciennes)

Partners: LAMIH, IFSTTAR, Inria, University of Caen, COMETE, PSA, CONTINENTAL, VALEO, AKKA Technologies, SPIROPS

Inria contact: Fawzi Nashashibi

Abstract: CoCoVeA project aims at demonstrating the need to integrate from the design of the system, the problem of interaction with the driver in resolving the problems of sharing the driving process and the degree of freedom, authority, level of automation, prioritizing information and managing the operation of the various systems. This approach requires the ability to know at any moment the state of the driver, the driving situation in which he finds himself, the operating limits of the various assistance systems and from these data, a decision regarding activation or not the arbitration system and the level of response.

8.1.1.2. VALET

Title: Redistribution automatique d'une flotte de véhicules en partage et valet de parking

Instrument: ANR

Duration: January 2016 - December 2018

Coordinator: Fawzi Nashashibi

Partners: Inria, Ecole Centrale de Nantes (IRCCyN), AKKA Technologies

Inria contact: Fawzi Nashashibi

Abstract: The VALET project proposes a novel approach for solving car-sharing vehicles redistribution problem using vehicle platoons guided by professional drivers. An optimal routing algorithm is in charge of defining platoons drivers' routes to the parking areas where the followers are parked in a complete automated mode. The main idea of VALET is to retrieve vehicles parked randomly on the urban parking network by users. These parking spaces may be in electric charging stations, parking for car sharing vehicles or in regular parking places. Once the vehicles are collected and guided in a platooning mode, the objective is then to guide them to their allocated parking area or to their respective parking lots. Then each vehicle is assigned a parking place into which it has to park in an automated mode.

8.1.2. FUI

8.1.2.1. Sinetic

Title: Système Intégré Numérique pour les Transports Intelligents Coopératifs

Instrument: FUI

Duration: December 2014 - May 2017

Coordinator: Thomas Nguyen (Oktal)

Partners: Oktal, ALL4TEC, CIVITEC, Dynalogic, Inria, EURECOM, Renault, Armines, IFSTTAR, VEDECOM

Inria contact: Jean-Marc Lasgouttes

Abstract: The purpose of the project SINETIC is to create a complete simulation environment for designing cooperative intelligent transport systems with two levels of granularity: the system level, integrating all the components of the system (vehicles, infrastructure management centers, etc.) and its realities (terrain, traffic, etc.) and the component-level, modeling the characteristics and behavior of the individual components (vehicles, sensors, communications and positioning systems, etc.) on limited geographical areas, but described in detail.

8.1.2.2. PAC V2X

Title: Perception augmentée par coopération véhicule avec l'infrastructure routière

Instrument: FUI

Duration: September 2016 - August 2019

Coordinator: SIGNATURE Group (SVMS)

Partners: DigiMobee, LOGIROAD, MABEN PRODUCTS, SANEF, SVMS, VICI, Inria, VEDECOM

Inria contact: Raoul de Charette

Abstract: The objective of the project is to integrate two technologies currently being deployed in order to significantly increase the time for an automated vehicle to evolve autonomously on European road networks. It is the integration of technologies for the detection of fixed and mobile objects such as radars, lidars, cameras ... etc. And local telecommunication technologies for the development of ad hoc local networks as used in cooperative systems.

8.1.3. Competitivity Clusters

RITS team is a very active partner in the competitivity clusters, especially MOV'EO and System@tic. We are involved in several technical committees like the DAS SUR of MOV'EO for example.
RITS is also the main Inria contributor in the VEDECOM institute (IEED). VEDECOM is financing the PhD theses of Mr. Fernando Garrido Carpio and Mr. Zayed Alsayed.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CityMobil2

Type: COOPERATION (TRANSPORTS)

Instrument: Large-scale integrating project

Objectif: NC

Duration: September 2012 - August 2016

Coordinator: University of Rome La Sapienza, CTL (Italy)

Partners: Inria (France), DLR (Germany), GEA Chanard (Switzerland), POLIS (Belgium), ERT (Belgium), EPFL (Switzerland),...(45 partners!)

Inria contact: Fawzi Nashashibi

Abstract: The CityMobil2 goal is to address and to remove three barriers to the deployment of automated road vehicles: the implementation framework, the legal framework and the unknown wider economic effect. CityMobil2 features 12 cities which will revise their mobility plans and adopt wherever they will prove effective automated transport systems. Then CityMobil2 will select the best 5 cases (among the 12 cities) to organize demonstrators. The project will procure two sets of automated vehicles and deliver them to the five most motivated cities for a 6 to 8 months demonstration in each city. CityMobil2 will establish a workgroup that will deliver a proposal for a European Directive to set a common legal framework to certify automated transport systems.

See also: http://www.citymobil2.eu/en/

8.2.1.2. AutoNet2030

Title: Co-operative Systems in Support of Networked Automated Driving by 2030

Objectif: NC

Duration: November 2013 - October 2016

Coordinator: Andras KOVACS – BROADBIT (Hungary)

Partners: BROADBIT (Hungary), BASELABS (Germany), CRF (Italy), Armines (France), VOLVO (Sueden), HITACHI EUROPE (France), EPFL (Switzerland), ICCS (Greece), TECHNISCHE UNIVERSITAET DRESDEN (Germany) (9 partners)

Inria contact: Fawzi Nashashibi

AutoNet2030 shall develop and test a co-operative automated driving technology, based on a decentralized decision-making strategy which is enabled by mutual information sharing among nearby vehicles. The project is aiming for a 2020-2030 deployment time horizon, taking into account the expected preceding introduction of co-operative communication systems and sensor based lane-keeping/cruise-control technologies. By taking this approach, a strategy can be worked out for the gradual introduction of fully automated driving systems, which makes the best use of the widespread existence of co-operative systems in the near-term and makes the deployment of fully automated driving systems beneficial for all drivers already from its initial stages.

See also: http://www.autonet2030.eu

8.2.1.3. AUTOCITS

Title: AUTOCITS Regulation Study for Interoperability in the Adoption of Autonomous Driving in European Urban Nodes

Program: CEF- TRANSPORT Atlantic corridor

Duration: November 2016 - December 2018

Coordinator: Indra Sistemas S.A. (Spain)

Partners: Indra Sistemas S.A. (Spain); Universidad Politécnica de Madrid (UPM), Spain; Dirección General de Tráfico (DGT), Spain; Inria (France); Instituto Pedro Nunes (IPN), Portugal; Autoridade Nacional de Segurança Rodoviária (ANSR), Portugal; Universidade de Coimbra (UC), Portugal.

Inria contact: Fawzi Nashashibi

Abstract: The aim of the Study is to contribute to the deployment of C-ITS in Europe by enhancing interoperability for autonomous vehicles as well as to boost the role of C-ITS as catalyst for the implementation of autonomous driving. Pilots will be implemented in 3 major Core Urban nodes (Paris, Madrid, Lisbon) located along the Core network Atlantic Corridor in 3 different Member States. The Action consists of Analysis and design, Pilots deployment and assessment, Dissemination and communication as well as Project Management and Coordination.

8.2.2. Collaborations with Major European Organizations

RITS is member of the **euRobotics AISBL** and the Leader of “People transport” Topic. This makes from Inria one of the rare French robotics representatives at the European level. See also: http://www.eu-robotics.net/

RITS is a full partner of **VRA – Vehicle and Road Automation**, a support action funded by the European Union to create a collaboration network of experts and stakeholders working on deployment of automated vehicles and its related infrastructure. VRA project is considered as the cooperation interface between EC funded projects, international relations and national activities on the topic of vehicle and road automation. It is financed by the European Commission DG CONNECT and coordinated by ERTICO – ITS Europe. See also: http://vra-net.eu/

RITS is member of the Working Group on Automation: **iMobility**. This group has been created and is animated by ERTICO ITS Europe. The Automation Working Group was formed under the iMobility Forum, with the initial high level aims of exploring and promoting the potential of highly automated vehicles and applications and working towards the development of a roadmap for the deployment of automated systems.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. International Academics Partners

NAIST – Japan: RITS has a close cooperation with NAIST (Nara institute of Science and Technology), Japan since 2009. Based on this collaboration NAIST and Inria established the MoU agreement to accelerate and strengthen future research collaborations and the exchange of researchers and students. During the period February 2015 - March 2016 RITS hosted Sakriani Watiasri Sakti, assistant professor at NAIST.

Seoul National University - S. Korea: An International Cooperation Agreement has been signed between RITS team of Inria and the Vehicle Dynamics and Control Laboratory (VDCL) of Seoul National University (SNU). RITS and VDCL recognize the value of educational, cultural, and scientific exchanges between international research laboratories, and have determined that sufficient interest exists to establish an academic and research partnership for collaborative research and education in the area of future intelligent vehicle systems for sustainable safety and environment.

International Chaire "Drive4U": Inria-RITS, Mines ParisTech, EPFL, Univ. of Berkeley (PATH Program) and Shanghai Jiao Tong Univ. (SJTU) are the academic partners of the international Chaire GAT, funded and supported by: VALEO Group, SAFRAN Group and MPSA Group (Peugeot-Citroën). A recent NDA has been signed recently. This Chaire will promote and fund academic activities related to Ground Automated Transportation and autonomous driving.

8.3.2. Participation in Other International Programs

8.3.2.1. ICT-Asia

SIM-Cities

Title: "Sustainable and Intelligent Mobility for Smart Cities"

International Partner (Institution - Laboratory - Researcher):

- Nanyang Technical University (NTU), School of Electrical and Electronic Engineering – Singapore. Prof. Dan Wei Wang

- National University of Singapore (NUS), Department of Mechanical Engineering – Singapore. Dr. Marcelo Ang

- Kumamotoo University - Japan. Intelligent Transportation Systems Lab, Graduate School of Science and Technology, Prof. James Hu / Prof. Ogata

- Shanghai Jiao-Tong University (SJTU), Department of Automation – China. Prof. Ming Yang

- Hanoi University of Science and Technology, International Center MICA Institute – Vietnam. Prof. Eric Castelli

- Inria, RITS Project-Team – France. Dr. Fawzi Nashashibi

- Inria, e-Motion/CHROMA Project-Team – France. Dr. Christian Laugier

- Ecole Centrale de Nantes, IRCCyN – France. Prof. Philippe Martinet

Duration: Jan. 2015 - May 2017

Start year: 2015

This project aims at conducting common research and development activities in the field of sustainable transportation and advanced mobility of people and goods in order to move in the direction of smart, clean and sustainable cities.

RITS and MICA lab have obtained from the Vietnamese Program 911 the financing of the joint PhD thesis of Dinh-Van Nguyen (co-directed by Eric Castelli from MICA lab and Fawzi Nashashibi).

8.3.2.2. ECOS Nord – Venezuela

ECOS Nord

Title: "Les Techniques de l'Information et de la Communication pour la Conception de Systèmes Avancés de Mobilité durable en Milieu Urbain."

International Partner (Institution - Laboratory - Researcher):

- Simon Bolivar University, Department of Mecatronics – Venezuela. Dr. Gerardo Fernandez

- Inria, RITS Project-Team – France. Dr. Fawzi Nashashibi

Duration: Jan. 2014 - Dec. 2017

Start year: 2014

The main objective of this project is to contribute scientifically and technically to the design of advanced sustainable mobility systems in urban areas, particularly in dense cities where mobility, comfort and safety needs are more important than in other types of cities. In this project, we will focus on the contribution of advanced systems of perception, communication and control for the realization of intelligent transport systems capable of gradually integrating into the urban landscape. These systems require the development of advanced dedicated urban infrastructures as well as the development and integration of on-board intelligence in individual vehicles or mass transport.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Sakriani Watiasri Sakti, assistant professor at NAIST, from February 2015 until March 2016. A part of the work done during her stay has been published in [51].

Aidos Ibrayev, PhD student, from Kazakhstan.

Pablo Marin Plaza, PhD student, from Universidad Carlos III de Madrid, Spain.

8.4.1.1. Internships

Rafael Colmenares Prieto, Juan Jose Larez Urdaneta, Daniel Sanchez Aranguren from Simon Bolivar University, Venezuela.

Aitor Gomez Torres, Alfredo Valle Barrio and Myriam Vaca Recalde from Universidad Politécnica de Madrid, Spain.

Jose Emilio Traver Becerra from Universidad de Extremadura, Spain.

Kenneth Martinez Torres from Universidad del Turabo, Porto Rico.

Alexis Meyer from Télécom SudParis.

AYIN Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

- Josiane Zerubia has been in contact with Dr. Sandrine Mathieu, image processing quality expert at Thales Alenia Space in Cannes (https://www.thalesgroup.com/en/worldwide/space) to discuss AYIN's research in remote sensing.
- Josiane Zerubia is part of the FAULTS-R-GEMS project funded by Academy 3 of Idex UCA-Jedi (http://univ-cotedazur.fr/english/idex-uca-jedi/academies-of-excellence), PI: Isabelle Manighetti of Geoazur (OCA, CNRS, UCA), in collaboration with Yuliya Tarabalka from TITANE Inria team, as well as members of UCA, Institut de Physique du Globe in Paris, Geoscience in Montpellier, ETH Zurich, CalTech, Arizona State University and UNAVCO consortium in the USA.

7.2. International Initiatives

7.2.1. Inria International Partners

- Josiane Zerubia has a strong collaboration with University of Genoa, Italy, for more than 20 years [11].
- Another collaboration in Canada with Mc Master University, Hamilton, started in 2012 [9], and has been extended to Juravinski Cancer Center (http://www.jcc.hhsc.ca/) in Hamilton and Simon Fraser University.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

7.3.1.1. Research Stays Abroad

Josiane Zerubia was invited to spend 2 months, from late August to late October, at the Coordinated Science Laboratory (CSL, http://www.csl.illinois.edu/) of the University of Illinois at Urbana Champaign (UIUC) to work with Prof. Farzad Kamalabadi (https://www.ece.illinois.edu/directory/profile/farzadk) and his team on FUV image processing for ICON NASA mission.

LINKMEDIA Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. CominLabs Project Linking Media in Acceptable Hypergraphs (LIMAH)

Participants: Rémi Bois, Vincent Claveau, Guillaume Gravier, Grégoire Jadi, Pascale Sébillot, Arnaud Touboulic.

Duration: 4 years, started in April 2014
Partners: Telecom Bretagne (IODE), Univ. Rennes II (CRPCC, PREFics), Univ. Nantes (LINA/TAL)
URL: http://limah.irisa.fr

LIMAH aims at exploring hypergraph structures for multimedia collections, instantiating actual links reflecting particular content-based proximity—similar content, thematic proximity, opinion expressed, answer to a question, etc. Exploiting and developing further techniques targeting pairwise comparison of multimedia contents from an NLP perspective, LIMAH addresses two key issues: How to automatically build from a collection of documents an hypergraph, i.e., a graph combining edges of different natures, which provides exploitable links in selected use cases? How collections with explicit links modify usage of multimedia data in all aspects, from a technology point of view as well as from a user point of view? LIMAH studies hypergraph authoring and acceptability taking a multidisciplinary approach mixing ICT, law, information and communication science as well as cognitive and ergonomy psychology.

9.1.2. CominLabs Project BigCLIN

Participants: Vincent Claveau, Ewa Kijak, Clément Dalloux.

Duration: 3 years, started in September 2016
Partners: STL-CNRS, Inserm/CHU Rennes, Inria Cidre URL: http://www.bigclin.cominlabs.ueb.eu

Data collected or produced during clinical care process can be exploited at different levels and across different domains. Yet, a well-known challenge for secondary use of health big data is that much of detailed patient information is embedded in narrative text, mostly stored as unstructured data. The project proposes to address the essential needs when reusing unstructured clinical data at a large scale. We propose to develop new clinical records representation relying on fine-grained semantic annotation thanks to new NLP tools dedicated to French clinical narratives. To efficiently map this added semantic information to existing structured data for further analysis at big scale, the project also addresses distributed systems issues: scalability, management of uncertain data and privacy, stream processing at runtime, etc.

9.2. National Initiatives

9.2.1. ANR Project IDFRAud

Participant: Teddy Furon.

Duration: 3 years, started in Feb. 2015
Partners: AriadNext, IRCGN, École Nationale Supérieure de Police

The IDFRAud project consists in proposing an automatic solution for ID analysis and integrity verification. Our ID analysis goes through three processes: classification, text extraction and ID verification. The three processes rely on a set of rules that are externalized in formal manner in order to allow easy management and evolving capabilities. This leads us to the ID knowledge management module. Finally, IDFRAud addresses the forensic link detection problem and to propose an automatic analysis engine that can be continuously applied on the detected fraud ID database. Cluster analysis methods are used to discover relations between false IDs in their multidimensional feature space. This pattern extraction module will be coupled with a suitable visualization mechanism in order to facilitate the comprehension and the analysis of extracted groups of inter-linked fraud cases.

9.2.2. FUI 19 NexGenTV

Participants: Vincent Claveau, Guillaume Gravier, Ewa Kijak, Gabriel Sargent, Ronan Sicre.

Duration: 2.5 years, started in May 2015
Partners: Eurecom, Avisto Telecom, Wildmoka, Envivio-Ericsson

Television is undergoing a revolution, moving from the TV screen to multiple screens. Today's user watches TV and, at the same time, browses the web on a tablet, sends SMS, posts comments on social networks, searches for complementary information on the program, etc. Facing this situation, NexGen-TV aims at developing a generic solution for the enrichment, the linking and the retrieval of video content targeting the cost-cutting edition of second screen and multiscreen applications for broadcast TV. The main outcome of the project will be a software platform to aggregate and distribute video content via a second-screen edition interface connected to social media. The curation interface will primarily make use of multimedia and social media content segmentation, description, linking and retrieval. Multiscreen applications will be developed on various domaine, e.g., sports, news.

9.3. European Initiatives

9.3.1. Collaborations with Major European Organizations

Big Data Value Association (BDVA)

LINKMEDIA is a co-founder and co-leader of the media group (TF7) within BDVA

9.4. International Initiatives

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

9.4.1.1. MOTIF

Title: Unsupervised motif discovery in multimedia content

International Partner (Institution - Laboratory - Researcher):

Pontifícia Universidade Católica de Minas Gerais (Brazil) - Audio-Visual Information Processing Laboratory (VIPLAB) - Silvio Jamil Guimarães

Universidade Federal Minas Gerais, Brasil - NPDI - Arnaldo Albuquerque de Araújo

Duration: 2014–2016

MOTIF aims at studying various approaches to unsupervised motif discovery in multimedia sequences, i.e., to the discovery of repeated sequences with no prior knowledge on the sequences. On the one hand, we will develop symbolic approaches inspired from work on bioinformatics to motif discovery in the multimedia context, investigating symbolic representations of multimedia data and adaptation of existing symbolic motif discovery algorithms. On the other hand, we will further develop cross modal clustering approaches to repeated sequence discovery in video data, building upon previous work.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

- National Institute for Informatics, Japan
- University of Amsterdam, The Netherlands
- Czech Technical University, Czech Republic
- Katholieke Universiteit Leuven, Belgium

9.4.3. Participation in Other International Programs

- PICS CNRS MM-Analytics
  - Title: Fouille, visualisation et exploration multidimensionnelle de contenus multimédia ; Multi-Dimensional Multimedia Browsing, Mining, Analytics (num 6382).
  - International Partner (Institution - Laboratory - Researcher):

    Reykjavík University, Iceland - Björn Þór Jónsson
  - Jan. 2014 – Dec. 2016
- CNRS – CONFAP FIGTEM
  - Title: Fine-grained text-mining for clinical trials
  - International Partner (Institution - Laboratory - Researcher): Pontifícia Universidade Católica do Paraná - Health Informatics dept, Claudia Moro

    FIGTEM aims at developing natural language processing methods, including information extraction and indexing, dedicated to the clinical trial domain. The goal is to populate a formal representation of patients (via their electronic patient records) and clinical trial data in different languages (French, English, Portuguese).
  - Jan. 2016 – Dec. 2018

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Claudia Moro, Lucas Oliveira

Date: Oct. 2016 (1 week)

Institution: Pontifícia Universidade Católica do Paraná - Health Informatics dept

Giorgos Tolias

Date: Sept. 2016 (1 week)

Institution: Czech Technical University, Czech Republic

9.5.1.1. Internships

Gabriel B. de Fonseca

Date: Nov. 2016 - Jan. 2017

Institution: PUC Minas, Brazil

9.5.2. Visits to International Teams

Vincent Claveau

Date: 7-17 December 2016

Institution: Helth Informatics dept, Pontifícia Universidade Católica do Paraná, Curitiba, Brazil

Vincent Claveau

Date: 7-13 May 2016

Institution: OLST, Univ. of Montreal, Canada

Guillaume Gravier, Simon Malinowski

Date: Jul. 2016 (1 week)

Institution: PUC Minas, Brazil

Ahmet Iscen

Date: Apr. 2016 - May 2016

Institution: Czech Technical University, Czech Republic

Vedran Vukotić

Date: Sep. 2016 - Dec. 2016

Institution: TU Delft, The Netherlands

MAGRIT Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- Lorraine regional project about AR for liver surgery (2015-2018)
  The MAGRIT and the MIMESIS teams have been working for several years on the use of augmented reality for deformable organs and especially on liver surgery. The PhD of Jaime Garcia started in October 2015 and is funded by the Région Lorraine. It follows on from our past works and aims at improving the reliability and the robustness of AR-based clinical procedures.

8.2. National Initiatives

8.2.1. Projet RAPID EVORA

Participant: M.-O. Berger, V. Gaudillière, G. Simon.
This 3-year project is supported by DGA/DGE and led by the SBS-Interactive company. The objective is to develop a prototype for location and object recognition in large-scale industrial environments (factories, ships...), with the aim to enrich the operator's field of view with digital information and media. The main issues concern the size of the environment, the nature of the objects (often non textured, highly specular...) and the presence of repeated patterns. Use cases will be provided by industrial partners such as DCNS and Areva. A class of officer cadets and professors of the Merchant Marine School will also be associated to judge the pedagogical interest of such a tool. A PhD student, Vincent Gaudillière, has been recruited to work on this project and his contract started on 1rst December 2016.

8.2.2. Project funded by GDR ISIS in collaboration with Institut Pascal

Participant: F. Sur.
Since June 2012, we have been engaged in a collaboration with Pr. Michel Grédiac. The aim is to give a mathematical analysis and to help improving the image processing tools used in experimental mechanics at Institut Pascal.

The TIMEX project (2014-2016) is funded by GDR ISIS ("Appel à projet exploratoire, projet interdisciplinaire"). It aims at investigating image processing tools for enhancing the metrological performances of contactless measurement systems in experimental mechanics.

8.2.3. Collaboration with the MIMESIS team

Participants: R. Anxionnat, M.-O. Berger, E. Kerrien.
The SOFA-InterMedS large-scale Inria initiative is a research-oriented collaboration across several Inria project-teams, international research groups and clinical partners. Its main objective is to leverage specific competences available in each team to further develop the multidisciplinary field of Medical Simulation research. Our action within the initiative takes place in close collaboration with both the MIMESIS team and the Department of diagnostic and therapeutic interventional neuroradiology of Nancy University Hospital. We aim at providing in-vivo models of the patient's organs, and in particular a precise geometric model of the arterial wall. Such a model is used by the MIMESIS team to simulate the coil deployment within an intracranial aneurysm. The associated medical team in Nancy, and in particular our external collaborator René Anxionnat, is in charge of validating our results. For three years, we have also been collaborating with the MIMESIS team about real-time augmentation of deformable organs.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

Pierre-Frederic Villard has a "Harvard Affiliate" status through his collaboration with the Harvard Biorobotics Lab led by Professor Robert D. Howe. It follows a one year and a half sabbatical years (2014-2016) that Pierre-Frederic Villard spent in Harvard University in Cambridge (USA) working on heart valve modeling.

MORPHEO Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. ARC6 project PADME – Perceptual quality Assessment of Dynamic MEshes and its applications

In this project, we propose to use a new and experimental "bottom-up" approach to study an interdisciplinary problem, namely the objective perceptual quality assessment of 3D dynamic meshes (i.e., shapes in motion with temporal coherence). The objectives of the proposed project are threefold:

1. to understand the HVS (human visual system) features when observing 3D animated meshes, through a series of psychophysical experiments;
2. to develop an efficient and open-source objective quality metric for dynamic meshes based on the results of the above experiments;
3. to apply the learned HVS features and the derived metric to the application of compression and/or watermarking of animated meshes.

This work is funded by the Rhône-Alpes région through an ARC6 grant for the period 2013-2016. The three partners are LIRIS (University Lyon 1, Florent Dupont), GIPSA-Lab (CNRS, Kai Wang) and LJK (University of Grenoble, Franck Hétroy-Wheeler). A PhD student, Georges Nader, is working on this project.

9.2. National Initiatives

9.2.1. Persyval-Lab exploratory project Carambole

The Carambole projects initiates a new collaboration between the Morpheo team and biophysicists from University Paris Diderot. The objectives are to develop hardware and software to help tracking feature points on a leaf of Averrhoa Carambola during its growth with a multi-camera system and to measure their 3D motion. Averrhoa carambola is of special interest because of the distinctive nutation balancing motion of a leaf during its growth.
This exploratory project is funded for 18 months in 2016 and 2017 by the Persyval-Lab LabEx.

9.2.2. ANR

9.2.2.1. ANR project Achmov – Accurate Human Modeling in Videos

The technological advancements made over the past decade now allow the acquisition of vast amounts of visual information through the use of image capturing devices like digital cameras or camcorders. A central subject of interest in video are the humans, their motions, actions or expressions, the way they collaborate and communicate. The goal of ACHMOV is to extract detailed representations of multiple interacting humans in real-world environments in an integrated fashion through a synergy between detection, figure-ground segmentation and body part labeling, accurate 3D geometric methods for kinematic and shape modeling, and large-scale statistical learning techniques. By integrating the complementary expertise of two teams (one French, MORPHEO and one Romanian, CLVP), with solid prior track records in the field, there are considerable opportunities to move towards processing complex real world scenes of multiple interacting people, and be able to extract rich semantic representations with high fidelity. This would enable interpretation, recognition and synthesis at unprecedented levels of accuracy and in considerably more realistic setups than currently considered. This project is currently ongoing with 2 PhDs on the Inria side: Vincent Leroy and Jinlong Yang.

9.2.3. Competitivity Clusters

9.2.3.1. FUI project Creamove

Creamove is a collaboration between the Morpheo team of the Inria Grenoble Rhône-Alpes, the 4D View Solution company specialized in multi-camera acquisition systems, the SIP company specialized in multimedia and interactive applications and a choreographer. The objective is to develop new interactive and artistic applications where humans can interact in 3D with virtual characters built from real videos. Dancer performances will be pre-recorded in 3D and used on-line to design new movement sequences based on inputs coming from human bodies captured in real time. Website: http://www.creamove.fr.

9.3. International Initiatives

9.3.1. Inria International Partners

9.3.1.1. Declared Inria International Partners

9.3.1.1.1. Joint projects with the Forestry Commission, UK

A common project with an ecophysiologist from the British Forestry Commission, Eric Casella, is currently carried out. It aims at reconstructing accurate virtual models of forest trees, for biomass measurement purposes. This project is called Digitree and is funded by the University of Grenoble Alpes, through the AGIR framework. A PhD student, Romain Rombourg, is working on it. Two presentations related to this project have been made this year at the FSPMA conference [15], [21].

The long term collaboration with TU Munich and Slobodan Ilic on human motion capture is ongoing with the work of Paul Huang [10] that was published at CVPR this year. The work contributes with an approach that combines detection by learning with traditional generative tracking approaches.

PERCEPTION Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. MIXCAM

Type: ANR BLANC

Duration: March 2014 - February 2016

Coordinator: Radu Horaud

Partners: 4D View Solutions SAS

Abstract: Humans have an extraordinary ability to see in three dimensions, thanks to their sophisticated binocular vision system. While both biological and computational stereopsis have been thoroughly studied for the last fifty years, the film and TV methodologies and technologies have exclusively used 2D image sequences, including the very recent 3D movie productions that use two image sequences, one for each eye. This state of affairs is due to two fundamental limitations: it is difficult to obtain 3D reconstructions of complex scenes and glass-free multi-view 3D displays, which are likely to need real 3D content, are still under development. The objective of MIXCAM is to develop novel scientific concepts and associated methods and software for producing live 3D content for glass-free multi-view 3D displays. MIXCAM will combine (i) theoretical principles underlying computational stereopsis, (ii) multiple-camera reconstruction methodologies, and (iii) active-light sensor technology in order to develop a complete content-production and -visualization methodological pipeline, as well as an associated proof-of-concept demonstrator implemented on a multiple-sensor/multiple-PC platform supporting real-time distributed processing. MIXCAM plans to develop an original approach based on methods that combine color cameras with time-of-flight (TOF) cameras: TOF-stereo robust matching, accurate and efficient 3D reconstruction, realistic photometric rendering, real-time distributed processing, and the development of an advanced mixed-camera platform. The MIXCAM consortium is composed of two French partners (Inria and 4D View Solutions). The MIXCAM partners will develop scientific software that will be demonstrated using a prototype of a novel platform, developed by 4D Views Solutions, and which will be available at Inria, thus facilitating scientific and industrial exploitation.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. EARS

Title: Embodied Audition for RobotS

Program: FP7

Duration: January 2014 - December 2016

Coordinator: Friedrich Alexander Universität Erlangen-Nünberg

Partners:

Aldebaran Robotics (France)

Ben-Gurion University of the Negev (Israel)

Friedrich Alexander Universität Erlangen-Nünberg (Germany)

Imperial College of Science, Technology and Medicine (United Kingdom)

Humboldt-Universitat Zu Berlin (Germany)

Inria contact: Radu Horaud

The success of future natural intuitive human-robot interaction (HRI) will critically depend on how responsive the robot will be to all forms of human expressions and how well it will be aware of its environment. With acoustic signals distinctively characterizing physical environments and speech being the most effective means of communication among humans, truly humanoid robots must be able to fully extract the rich auditory information from their environment and to use voice communication as much as humans do. While vision-based HRI is well developed, current limitations in robot audition do not allow for such an effective, natural acoustic human-robot communication in real-world environments, mainly because of the severe degradation of the desired acoustic signals due to noise, interference and reverberation when captured by the robot's microphones. To overcome these limitations, EARS will provide intelligent 'ears' with close-to-human auditory capabilities and use it for HRI in complex real-world environments. Novel microphone arrays and powerful signal processing algorithms shall be able to localise and track multiple sound sources of interest and to extract and recognize the desired signals. After fusion with robot vision, embodied robot cognition will then derive HRI actions and knowledge on the entire scenario, and feed this back to the acoustic interface for further auditory scene analysis. As a prototypical application, EARS will consider a welcoming robot in a hotel lobby offering all the above challenges. Representing a large class of generic applications, this scenario is of key interest to industry and, thus, a leading European robot manufacturer will integrate EARS's results into a robot platform for the consumer market and validate it. In addition, the provision of open-source software and an advisory board with key players from the relevant robot industry should help to make EARS a turnkey project for promoting audition in the robotics world.

8.2.1.2. VHIA

Title: Vision and Hearing in Action

Program: FP7

Type: ERC

Duration: February 2014 - January 2019

Coordinator: Inria

Inria contact: Radu Horaud

The objective of VHIA is to elaborate a holistic computational paradigm of perception and of perception-action loops. We plan to develop a completely novel twofold approach: (i) learn from mappings between auditory/visual inputs and structured outputs, and from sensorimotor contingencies, and (ii) execute perception-action interaction cycles in the real world with a humanoid robot. VHIA will achieve a unique fine coupling between methodological findings and proof-of-concept implementations using the consumer humanoid NAO manufactured in Europe. The proposed multimodal approach is in strong contrast with current computational paradigms influenced by unimodal biological theories. These theories have hypothesized a modular view, postulating quasi-independent and parallel perceptual pathways in the brain. VHIA will also take a radically different view than today's audiovisual fusion models that rely on clean-speech signals and on accurate frontal-images of faces; These models assume that videos and sounds are recorded with hand-held or head-mounted sensors, and hence there is a human in the loop who intentionally supervises perception and interaction. Our approach deeply contradicts the belief that complex and expensive humanoids (often manufactured in Japan) are required to implement research ideas. VHIA's methodological program addresses extremely difficult issues: how to build a joint audiovisual space from heterogeneous, noisy, ambiguous and physically different visual and auditory stimuli, how to model seamless interaction, how to deal with high-dimensional input data, and how to achieve robust and efficient human-humanoid communication tasks through a well-thought tradeoff between offline training and online execution. VHIA bets on the high-risk idea that in the next decades, social robots will have a considerable economical impact, and there will be millions of humanoids, in our homes, schools and offices, which will be able to naturally communicate with us.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

- Professor Sharon Gannot, Bar Ilan University, Tel Aviv, Israel,
- Dr. Miles Hansard, Queen Mary University London, UK,
- Professor Nicu Sebe, University of Trento, Trento, Italy,
- Professor Adrian Raftery, University of Washington, Seattle, USA,
- Dr. Rafael Munoz-Salinas, University of Cordoba, Spain,
- Dr. Noam Shabatai, Ben Gourion University of the Negev, Israel.
- Dr. Christine Evers, Imperial College of Science and Medecine, UK.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Professor Sharon Gannot, Bar Ilan University, Tel Aviv, Israel,
- Yuval Dorfan, Bar Ilan University, Tel Aviv, Israel,
- Dr. Rafael Munoz-Salinas, University of Cordoba, Spain,
- Dr. Noam Shabatai, Ben Gourion University of the Negev, Israel.
- Dr. Christine Evers, Imperial College of Science and Medecine, UK.

SIROCCO Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. CominLabs/InterCom project

Participants: Aline Roumy, Thomas Maugey.

- Title : Interactive Communication (INTERCOM): Massive random access to subsets of compressed correlated data .
- Research axis : 7.4.1
- Partners : Inria-Rennes (Sirocco team and i4S team); LabSTICC, Telecom Bretagne, Signal & Communications Department; External partner: Kieffer L2S, CentraleSupelec, Univ. Paris Sud.
- Funding : Labex CominLabs.
- Period : Oct. 2016 - Nov. 2019.

This project aims to develop novel compression techniques allowing massive random access to large databases. Indeed, we consider a database that is so large that, to be stored on a single server, the data have to be compressed efficiently, meaning that the redundancy/correlation between the data have to be exploited. The dataset is then stored on a server and made available to users that may want to access only a subset of the data. Such a request for a subset of the data is indeed random, since the choice of the subset is user-dependent. Finally, massive requests are made, meaning that, upon request, the server can only perform low complexity operations (such as bit extraction but no decompression/compression). Algorithms for two emerging applications of this problem will be developed: Free-viewpoint Television (FTV) and massive requests to a database collecting data from a large-scale sensor network (such as Smart Cities).

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. ERC-CLIM

Participants: Pierre David, Elian Dib, Christine Guillemot, Xin Su.

Light fields yield a rich description of the scene ideally suited for advanced image creation capabilities from a single capture, such as simulating a capture with a different focus and a different depth of field, simulating lenses with different apertures, for creating images with different artistic intents or for producing 3D views. Light fields technology holds great promises for a number of application sectors, such as photography, augmented reality, light field microscopy, but also surveillance, to name only a few.

The goal of the ERC-CLIM project is to develop algorithms for the entire static and video light fields processing chain, going from compact sparse and low rank representations and compression to restoration, high quality rendering and editing.

9.3. International Initiatives

9.3.1. Informal International Partners

- Reuben Farrugia, Prof. at the University of Malta has been one sabbatical year Sept. 2015-Aug. 2016) within the team, working on inverse problems (super-resolution, inpainting) for several applications.
- The study on guided image inpainting is carried out in collaboration with Prof. Pascal Frossard from EPFL (Ecole Polytechique Federal de Lausanne).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

Sheila Hemami, Prof. at Northeastern University, Boston, has visited the team during three months (May 2016-July 2016), working on the problem of demultiplexing and decoding of micro-lenses based light fields.

STARS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. MOVEMENT

Program: ANR CSOSG

Project acronym: MOVEMENT

Project title: AutoMatic BiOmetric Verification and PersonnEl Tracking for SeaMless Airport ArEas Security MaNagemenT

Duration: January 2014-June 2017

Coordinator: MORPHO (FR)

Other partners: SAGEM (FR), Inria Sophia-Antipolis (FR), EGIDIUM (FR), EVITECH (FR) and CERAPS (FR)

Abstract: MOVEMENT is focusing on the management of security zones in the non public airport areas. These areas, with a restricted access, are dedicated to service activities such as maintenance, aircraft ground handling, airfreight activities, etc. In these areas, personnel movements tracking and traceability have to be improved in order to facilitate their passage through the different areas, while insuring a high level of security to prevent any unauthorized access. MOVEMENT aims at proposing a new concept for the airport's non public security zones (e.g. customs control rooms or luggage loading/unloading areas) management along with the development of an innovative supervision system prototype.

8.1.1.2. SafEE

Program: ANR TESCAN

Project acronym: SafEE

Project title: Safe & Easy Environment for Alzheimer Disease and related disorders

Duration: December 2013-May 2017

Coordinator: CHU Nice

Other partners: Nice Hospital(FR), Nice University (CobTeck FR), Inria Sophia-Antipolis (FR), Aromatherapeutics (FR), SolarGames(FR), Taichung Veterans General Hospital TVGH (TW), NCKU Hospital(TW), SMILE Lab at National Cheng Kung University NCKU (TW), BDE (TW)

Abstract: SafEE project aims at investigating technologies for stimulation and intervention for Alzheimer patients. More precisely, the main goals are: (1) to focus on specific clinical targets in three domains behavior, motricity and cognition (2) to merge assessment and non pharmacological help/intervention and (3) to propose easy ICT device solutions for the end users. In this project, experimental studies will be conducted both in France (at Hospital and Nursery Home) and in Taiwan.

8.1.2. FUI

8.1.2.1. Visionum

Program: FUI

Project acronym: Visionum

Project title: Visonium.

Duration: January 2015- December 2018

Coordinator: Groupe Genious

Other partners: Inria(Stars), StreetLab, Fondation Ophtalmologique Rothschild, Fondation Hospitaliere Sainte-Marie.

Abstract: This French project from Industry Minister aims at designing a platform to re-educate at home people with visual impairment.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CENTAUR

Title: Crowded ENvironments moniToring for Activity Understanding and Recognition

Programm: FP7

Duration: January 2013 - December 2016

Coordinator: Honeywell

Partners:

Ecole Polytechnique Federale de Lausanne (Switzerland)

"honeywell, Spol. S.R.O" (Czech Republic)

Neovision Sro (Czech Republic)

Queen Mary University of London (United Kingdom)

Inria contact: François Bremond

'We aim to develop a network of scientific excellence addressing research topics in computer vision and advancing the state of the art in video surveillance. The cross fertilization of ideas and technology between academia, research institutions and industry will lay the foundations to new methodologies and commercial solutions for monitoring crowded scenes. Research activities will be driven by specific sets of scenarios, requirements and datasets that reflect security operators' needs for guaranteeing the safety of EU citizens. CENTAUR gives a unique opportunity to academia to be exposed to real life dataset, while enabling the validation of state-of-the-art video surveillance methodology developed at academia on data that illustrate real operational scenarios. The research agenda is motivated by ongoing advanced research activities in the participating entities. With Honeywell as a multi-industry partner, with security technologies developed and deployed in both its Automation and Control Solutions and Aerospace businesses, we have multiple global channels to exploit the developed technologies. With Neovison as a SME, we address small fast paced local markets, where the quick assimilation of new technologies is crucial. Three thrusts identified will enable the monitoring of crowded scenes, each led by an academic partner in collaboration with scientists from Honeywell: a) multi camera, multicoverage tracking of objects of interest, b) Anomaly detection and fusion of multimodal sensors, c) activity recognition and behavior analysis in crowded environments. We expect a long term impact on the field of video surveillance by: contributions to the state-of-the-art in the field, dissemination of results within the scientific and practitioners community, and establishing long term scientific exchanges between academia and industry, for a forum of scientific and industrial partners to collaborate on addressing technical challenges faced by scientists and the industry.'

8.3. International Initiatives

8.3.1. Inria International Labs

8.3.1.1. Informal International Partners

- **Collaborations with Asia:** Stars has been cooperating with the Multimedia Research Center in Hanoi MICA on semantics extraction from multimedia data. Stars also collaborates with the National Cheng Kung University in Taiwan and I2R in Singapore.
- **Collaboration with U.S.A.:** Stars collaborates with the University of Southern California.
- **Collaboration with Europe:** Stars collaborates with Multitel in Belgium, the University of Kingston upon Thames UK, and the University of Bergen in Norway.

8.3.1.2. Other IIL projects

The ANR SafEE (see section 8.1.1.2) collaborates with international partners such as Taichung Veterans General Hospital TVGH (TW), NCKU Hospital(TW), SMILE Lab at National Cheng Kung University NCKU (TW) and BDE (TW).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

This year, Stars has been visited by the following international scientists:

- Salwa Baabou, Ecole Nationale d'Ingénieurs de Gabès, Tunisia;
- Siyuan Chen, University of New South Wales, Australia;
- Adlen Kerboua, University of Skikda, Algeria;
- Karel Krehnac, Neovision, Praha, Czech Republic;
- Jana Trojnova, Honeywell, Praha, Czech Republic;
- Luis Emiliano Sanchez, Rosario University, Argentina.

8.4.1.1. Internships

Seongro Yoon

Date: Apr 2016-Dec 2016

Institution: Korea Advanced Institute of Science and Technology, Daejeon, Korea

Supervisor: François Brémond

Yashas Annadani

Date: May2016-June 2016

Institution: National Institute Of Technology Karnataka, India

Supervisor: Carlos Fernando Crispim Junior

Chandraja Dharmana

Date: May 2016-June 2016

Institution: Birla Institute of Technology and Science, Pilani, Hyderbrad

Supervisor: Carlos Fernando Crispim Junior

Shanu Vashistha

Date: May 2016-June 2016

Institution: Indian Institute of Technology, Kanpur, India

Supervisor: Carlos Fernando Crispim Junior

Nairouz Mrabah

Date: Apr 2016-Sep 2016

Institution: National School of Computer Science (ENSI), Tunisia

Supervisor: Inès Sarray

Isabel Rayas

Date: June 2016-Dec 2016

Institution: Massachusetts Institute of Technology, USA

Supervisor: Farhood Negin

THOTH Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. DeCore (Deep Convolutional and Recurrent networks for image, speech, and text)

Participants: Jakob Verbeek, Maha Elbayad.

DeCore is a project-team funded by the Persyval Lab for 3.5 years (september 2016 - February 2020), coordinated by Jakob Verbeek. It unites experts from Grenoble's applied-math and computer science labs LJK, GIPSA-LAB and LIG in the areas of computer vision, machine learning, speech, natural language processing, and information retrieval. The purpose of DeCore is to stimulate collaborative interdisciplinary research on deep learning in the Grenoble area, which is likely to underpin future advances in machine perception (vision, speech, text) over the next decade. It provides funding for two full PhD students. Maha Elbayad is one of them, supervised by Jakob Verbeek and Laurant Besacier (UGA).

9.2. National Initiatives

9.2.1. ANR Project Physionomie

Participants: Jakob Verbeek, Shreyas Saxena, Guosheng Hu.

Face recognition is nowadays an important technology in many applications ranging from tagging people in photo albums, to surveillance, and law enforcement. In this 3-year project (2013–2016) the goal is to broaden the scope of usefulness of face recognition to situations where high quality images are available in a dataset of known individuals, which have to be identified in relatively poor quality surveillance footage. To this end we will develop methods that can compare faces despite an asymmetry in the imaging conditions, as well as methods that can help searching for people based on facial attributes (old/young, male/female, etc.). The tools will be evaluated by law-enforcement professionals. The participants of this project are: Morpho, SensorIT, Université de Caen, Université de Strasbourg, Fondation pour la Recherche Stratégique, Préfecture de Police, Service des Technologies et des Systèmes d'Information de la Sécurité Intérieure, and Thoth. The project ended in June 2016.

9.2.2. ANR Project Macaron

Participants: Julien Mairal, Zaid Harchaoui [University of Washington], Laurent Jacob [CNRS, LBBE Laboratory], Michael Blum [CNRS, TIMC Laboratory], Joseph Salmon [Telecom ParisTech].

The project MACARON is an endeavor to develop new mathematical and algorithmic tools for making machine learning more scalable. Our ultimate goal is to use data for solving scientific problems and automatically converting data into scientific knowledge by using machine learning techniques. Therefore, our project has two different axes, a methodological one, and an applied one driven by explicit problems. The methodological axis addresses the limitations of current machine learning for simultaneously dealing with large-scale data and huge models. The second axis addresses open scientific problems in bioinformatics, computer vision, image processing, and neuroscience, where a massive amount of data is currently produced, and where huge-dimensional models yield similar computational problems.

This is a 3 years and half project, funded by ANR under the program "Jeunes chercheurs, jeunes chercheuses", which started in October 2014. The principal investigator is Julien Mairal.

9.2.3. ANR Project DeepInFrance

Participant: Jakob Verbeek.

DeepInFrance (Machine learning with deep neural networks) project also aims at bringing together complementary machine learning, computer vision and machine listening research groups working on deep learning with GPUs in order to provide the community with the knowledge, the visibility and the tools that brings France among the key players in deep learning. The long-term vision of Deep in France is to open new frontiers and foster research towards algorithms capable of discovering sense in data in an automatic manner, a stepping stone before the more ambitious far-end goal of machine reasoning. The project partners are: INSA Rouen, Univ. Caen, Inria, UPMC, Aix-Marseille Univ., Univ. Nice Sophia Antipolis.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. ERC Advanced grant Allegro

Participants: Cordelia Schmid, Pavel Tokmakov, Nicolas Chesneau, Vicky Kalogeiton, Konstantin Shmelkov, Daan Wynen, Xiaojiang Peng.

The ERC advanced grant ALLEGRO started in April 2013 for a duration of five years. The aim of ALLEGRO is to automatically learn from large quantities of data with weak labels. A massive and ever growing amount of digital image and video content is available today. It often comes with additional information, such as text, audio or other meta-data, that forms a rather sparse and noisy, yet rich and diverse source of annotation, ideally suited to emerging weakly supervised and active machine learning technology. The ALLEGRO project will take visual recognition to the next level by using this largely untapped source of data to automatically learn visual models. We will develop approaches capable of autonomously exploring evolving data collections, selecting the relevant information, and determining the visual models most appropriate for different object, scene, and activity categories. An emphasis will be put on learning visual models from video, a particularly rich source of information, and on the representation of human activities, one of today's most challenging problems in computer vision.

9.3.1.2. EU Marie Curie project: Egovision4health

Participants: Grégory Rogez, Cordelia Schmid.

After the 2-year outgoing phase hosted by the University of California, Irvine, G. Rogez spent the return (and final) phase of the project in the team. In 2015, he analyzed functional object manipulations focusing on fine-grained hand-object interactions and created a large dataset of 12000 RGB-D images covering 71 everyday grasps in natural interactions. This Grasp UNderstanding dataset (GUN-71) has been made publicly available in 2016 (http://www.gregrogez.net/research/egovision4health/gun-71/). In the last period of the fellowship, G. Rogez and C. Schmid addressed the more general problem of full-body 3D pose estimation in third-person images. They developed a new data synthesis technique to generate large-scale (2 millions images) training data that were later used to train Deep Convolutional Neural Networks. The collaboration resulted in a publication [19]. Dataset, code and models will be released soon.

9.4. International Initiatives

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

9.4.1.1. GAYA: Semantic and Geometric Models for Video Interpretation

We have formed an associate team GAYA, with the primary goal of interpreting videos in terms of recognizing actions, understanding the human-human and human-object interactions. Despite several years of research, it is yet unclear what is an efficient and robust video representation to attack this challenge. In order to address this, GAYA will focus on building semantic models, wherein we learn the video feature representation with limited supervision, and also geometric models, where we study the geometric properties of object shapes to better recognize them. The team consists of researchers from two Inria project-teams (Thoth and WILLOW) and a US university (Carnegie Mellon University [CMU]). It will allow the three teams to effectively combine their respective strengths in areas such as inference and machine learning approaches for vision tasks, feature

representation, large-scale learning, geometric reasoning. The main expected outcomes of this collaboration are: effective learnt representations of video content, new machine learning algorithms for handling minimally annotated data, large-scale public datasets for benchmarking, theoretical analysis of objects shapes and contours. Cordelia Schmid and Karteek Alahari are involved in this associate team.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

- **University of Edinburgh:** C. Schmid collaborates with V. Ferrari, associate professor at university of Edinburgh. Vicky Kalogeiton started a co-supervised PhD in September 2013; she is bi-localized between Uni. Edinburgh and Inria. Her subject is the automatic learning of object representations in videos. The collaboration resulted in a joint publication in IEEE PAMI [7]
- **MPI Tübingen:** C. Schmid collaborates with M. Black, a research director at MPI, starting in 2013. She spent one month at MPI in May 2016. End of 2015 she was award a Humbolt research award funding a long-term research project with colleagues at MPI. In 2016 the project resulted in the development of a large-scale synthetic human action dataset.
- **Technion:** J. Mairal started a collaboration with Yonina Eldar (Technion) and Andreas Tillmann (Darmstadt university) to develop dictionary learning techniques for phase retrieval. Their collaboration resulted in a paper accepted to the ICASSP'16 conference [22] and a paper accepted to IEEE Transaction on signal processing [12].
- **UC Berkeley:** This collaboration between Bin Yu, Jack Gallant, Yuval Benjamini, Adam Bloniarz, Yuansi Chen (UC Berkeley), and Julien Mairal (Inria Thoth) aims to discover the functionalities of areas of the visual cortex. We have introduced an image representation for area V4, adapting tools from computer vision to neuroscience data. The collaboration started when Julien Mairal was a post-doctoral researcher at UC Berkeley and is still ongoing.

9.4.3. Participation in Other International Programs

- **Indo-French project EVEREST** with IIIT Hyderabad, India, funded by CEFIPRA (Centre Franco-Indien pour la Promotion de la Recherche Avancee). The aim of this project between Cordelia Schmid, Karteek Alahari and C. V. Jawahar (IIIT Hyderabad) is to enable the use of rich, complex models that are required to address the challenges of high-level computer vision. The work plan for the project will follow three directions. First, we will develop a learning framework that can handle weak annotations. Second, we will build formulations to solve the non-convex optimization problem resulting from the learning framework. Third, we will develop efficient and accurate energy minimization algorithms, in order to make the optimization computationally feasible.
- **France-Berkeley fund:** Julien Mairal was awarded in 2014 a grant from the France-Berkeley fund for a project with Pr. Bin Yu (statistics department, UC Berkeley) on "Invariant image representations and high dimensional sparse estimation for neurosciences". The award amounts to 10,000 USD, from November 2014 to April 2016. The funds are meant to support scientific and scholarly exchanges and collaboration between the two teams.

9.5. International Research Visitors

9.5.1. Visits to International Teams

9.5.1.1. Research Stays Abroad

- H. Lin visited Microsoft Research at New York from September to December 2016, as part of the MSR-Inria joint centre collaboration.
- G. Chéron visited Microsoft Research at Cambridge from April to July 2016, as part of the MSR-Inria joint centre collaboration.

WILLOW Project-Team

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. Agence Nationale de la Recherche (ANR): SEMAPOLIS

Participants: Mathieu Aubry, Josef Sivic.

The goal of the SEMAPOLIS project is to develop advanced large-scale image analysis and learning techniques to semantize city images and produce semantized 3D reconstructions of urban environments, including proper rendering. Geometric 3D models of existing cities have a wide range of applications, such as navigation in virtual environments and realistic sceneries for video games and movies. A number of players (Google, Microsoft, Apple) have started to produce such data. However, the models feature only plain surfaces, textured from available pictures. This limits their use in urban studies and in the construction industry, excluding in practice applications to diagnosis and simulation. Besides, geometry and texturing are often wrong when there are invisible or discontinuous parts, e.g., with occluding foreground objects such as trees, cars or lampposts, which are pervasive in urban scenes. This project will go beyond the plain geometric models by producing semantized 3D models, i.e., models which are not bare surfaces but which identify architectural elements such as windows, walls, roofs, doors, etc. Semantic information is useful in a larger number of scenarios, including diagnosis and simulation for building renovation projects, accurate shadow impact taking into account actual window location, and more general urban planning and studies such as solar cell deployment. Another line of applications concerns improved virtual cities for navigation, with object-specific rendering, e.g., specular surfaces for windows. Models can also be made more compact, encoding object repetition (e.g., windows) rather than instances and replacing actual textures with more generic ones according to semantics; it allows cheap and fast transmission over low- bandwidth mobile phone networks, and efficient storage in GPS navigation devices.

This is a collaborative effort with LIGM / ENPC (R. Marlet), University of Caen (F. Jurie), Inria Sophia Antipolis (G. Drettakis) and Acute3D (R. Keriven).

9.2. European Initiatives

9.2.1. European Research Council (ERC) Advanced Grant: "VideoWorld" - Jean Ponce

Participants: Jean Ponce, Ivan Laptev, Josef Sivic.

WILLOW will be funded in part from 2011 to 2016 by the ERC Advanced Grant "VideoWorld" awarded to Jean Ponce by the European Research Council.

‘Digital video is everywhere, at home, at work, and on the Internet. Yet, effective technology for organizing, retrieving, improving, and editing its content is nowhere to be found. Models for video content, interpretation and manipulation inherited from still imagery are obsolete, and new ones must be invented. With a new convergence between computer vision, machine learning, and signal processing, the time is right for such an endeavor. Concretely, we will develop novel spatio-temporal models of video content learned from training data and capturing both the local appearance and nonrigid motion of the elements—persons and their surroundings—that make up a dynamic scene. We will also develop formal models of the video interpretation process that leave behind the architectures inherited from the world of still images to capture the complex interactions between these elements, yet can be learned effectively despite the sparse annotations typical of video understanding scenarios. Finally, we will propose a unified model for video restoration and editing that builds on recent advances in sparse coding and dictionary learning, and will allow for unprecedented control of the video stream. This project addresses fundamental research issues, but its results are expected to serve as a basis for groundbreaking technological advances for applications as varied as film post-production, video archival, and smart camera phones.’

9.2.2. European Research Council (ERC) Starting Grant: "Activia" - Ivan Laptev

Participant: Ivan Laptev.

WILLOW will be funded in part from 2013 to 2017 by the ERC Starting Grant "Activia" awarded to Ivan Laptev by the European Research Council.

'Computer vision is concerned with the automated interpretation of images and video streams. Today's research is (mostly) aimed at answering queries such as 'Is this a picture of a dog?', (classification) or sometimes 'Find the dog in this photo' (detection). While categorisation and detection are useful for many tasks, inferring correct class labels is not the final answer to visual recognition. The categories and locations of objects do not provide direct understanding of their function i.e., how things work, what they can be used for, or how they can act and react. Such an understanding, however, would be highly desirable to answer currently unsolvable queries such as 'Am I in danger?' or 'What can happen in this scene?'. Solving such queries is the aim of this proposal. My goal is to uncover the functional properties of objects and the purpose of actions by addressing visual recognition from a different and yet unexplored perspective. The main novelty of this proposal is to leverage observations of people, i.e., their actions and interactions to automatically learn the use, the purpose and the function of objects and scenes from visual data. The project is timely as it builds upon the two key recent technological advances: (a) the immense progress in visual recognition of objects, scenes and human actions achieved in the last ten years, as well as (b) the emergence of a massive amount of public image and video data now available to train visual models. ACTIVIA addresses fundamental research issues in automated interpretation of dynamic visual scenes, but its results are expected to serve as a basis for ground-breaking technological advances in practical applications. The recognition of functional properties and intentions as explored in this project will directly support high-impact applications such as detection of abnormal events, which are likely to revolutionise today's approaches to crime protection, hazard prevention, elderly care, and many others.'

9.2.3. European Research Council (ERC) Starting Grant: "Leap" - Josef Sivic

Participant: Josef Sivic.

The contract has begun on Nov 1st 2014. WILLOW will be funded in part from 2014 to 2018 by the ERC Starting Grant "Leap" awarded to Josef Sivic by the European Research Council.

'People constantly draw on past visual experiences to anticipate future events and better understand, navigate, and interact with their environment, for example, when seeing an angry dog or a quickly approaching car. Currently there is no artificial system with a similar level of visual analysis and prediction capabilities. LEAP is a first step in that direction, leveraging the emerging collective visual memory formed by the unprecedented amount of visual data available in public archives, on the Internet and from surveillance or personal cameras - a complex evolving net of dynamic scenes, distributed across many different data sources, and equipped with plentiful but noisy and incomplete metadata. The goal of this project is to analyze dynamic patterns in this shared visual experience in order (i) to find and quantify their trends; and (ii) learn to predict future events in dynamic scenes. With ever expanding computational resources and this extraordinary data, the main scientific challenge is now to invent new and powerful models adapted to its scale and its spatio-temporal, distributed and dynamic nature. To address this challenge, we will first design new models that generalize across different data sources, where scenes are captured under vastly different imaging conditions such as camera viewpoint, temporal sampling, illumination or resolution. Next, we will develop a framework for finding, describing and quantifying trends that involve measuring long-term changes in many related scenes. Finally, we will develop a methodology and tools for synthesizing complex future predictions from aligned past visual experiences. Our models will be automatically learnt from large-scale, distributed, and asynchronous visual data, coming from different sources and with different forms of readily-available but noisy and incomplete metadata such as text, speech, geotags, scene depth (stereo sensors), or gaze and body motion (wearable sensors). Breakthrough progress on these problems would have profound implications on our everyday lives as well as science and commerce, with safer cars that anticipate the behavior of pedestrians on streets; tools that help doctors monitor, diagnose and predict patients' health; and smart glasses that help people react in unfamiliar situations enabled by the advances from this project.'

9.3. International Initiatives

9.3.1. IARPA FINDER Visual geo-localization (Inria)

Participants: Josef Sivic, Petr Gronat, Relja Arandjelovic.

Finder is an IARPA funded project aiming to develop technology to geo-localize images and videos that do not have geolocation tag. It is common today for even consumer-grade cameras to tag the images that they capture with the location of the image on the earth's surface ("geolocation"). However, some imagery does not have a geolocation tag and it can be important to know the location of the camera, image, or objects in the scene. Finder aims to develop technology to automatically or semi-automatically geo-localize images and video that do not have the geolocation tag using reference data from many sources, including overhead and ground-based images, digital elevation data, existing well-understood image collections, surface geology, geography, and cultural information.

Partners: ObjectVideo, DigitalGlobe, UC Berkeley, CMU, Brown Univ., Cornell Univ., Univ. of Kentucky, GMU, Indiana Univ., and Washington Univ.

9.3.2. Inria CityLab initiative

Participants: Josef Sivic, Jean Ponce, Ivan Laptev, Alexei Efros [UC Berkeley].

Willow participates in the ongoing CityLab@Inria initiative (co-ordinated by V. Issarny), which aims to leverage Inria research results towards developing "smart cities" by enabling radically new ways of living in, regulating, operating and managing cities. The activity of Willow focuses on urban-scale quantitative visual analysis and is pursued in collaboration with A. Efros (UC Berkeley).

Currently, map-based street-level imagery, such as Google Street-view provides a comprehensive visual record of many cities worldwide. Additional visual sensors are likely to be wide-spread in near future: cameras will be built in most manufactured cars and (some) people will continuously capture their daily visual experience using wearable mobile devices such as Google Glass. All this data will provide large-scale, comprehensive and dynamically updated visual record of urban environments.

The goal of this project is to develop automatic data analytic tools for large-scale quantitative analysis of such dynamic visual data. The aim is to provide quantitative answers to questions like: What are the typical architectural elements (e.g., different types of windows or balconies) characterizing a visual style of a city district? What is their geo-spatial distribution (see figure 1)? How does the visual style of a geo-spatial area evolve over time? What are the boundaries between visually coherent areas in a city? Other types of interesting questions concern distribution of people and their activities: How do the number of people and their activities at particular places evolve during a day, over different seasons or years? Are there tourists sightseeing, urban dwellers shopping, elderly walking dogs, or children playing on the street? What are the major causes for bicycle accidents?

Break-through progress on these goals would open-up completely new ways smart cities are visualized, modeled, planned and simulated, taking into account large-scale dynamic visual input from a range of visual sensors (e.g., cameras on cars, visual data from citizens, or static surveillance cameras).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

Prof. Alexei Efros (UC Berkeley, USA) visited Willow during May-June with his postdoc Phillip Isola and Phd student Richard Zhang. Prof. John Canny (UC Berkeley) has visited Willow in 2016 within the framework of Inria's International Chair program.

9.4.1.1. Internships

P. Trutman and O. Rybkin have visited Willow from Czech Technical University in Prague.