Activity Report 2015

Section Partnerships and Cooperations

VISION, PERCEPTION AND MULTIMEDIA INTERPRETATION

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. European Initiatives

8.2.1. MEALS

Title: Mobility between Europe and Argentina applying Logics to Systems

Programm: FP7

Duration: October 2011 - September 2015

Coordinator: Université de la sarre

Partners:

> Imperial College of Science, Technology and Medicine (United Kingdom)
>
> Rheinisch-Westfaelische Technische Hochschule Aachen (Germany)
>
> Technische Universiteit Eindhoven (Netherlands)
>
> Technische Universitaet Dresden (Germany)
>
> University of Leicester (United Kingdom)
>
> Universitaet Desarlandes (Germany)

Inria contact: Castuscia Palamidessi

Computing systems are getting ever more ubiquitous, making us dependent on their proper functioning. Therefore we require that they are correct (i.e. they conform their intended behavior), safe (i.e. its operation does not have catastrophic consequences), reliable, available to provide the intended service, and secure (i.e., no user without appropriate clearance can access or modify protected data). Guarantees for such charcteristics rely on rigid specification and analysis techniques for both the required system functionality as well as its behavior. Formal methods provide a mathematical approach to model, understand, and analyze systems, especially at early development stages. In this project we focus on three aspects of formal methods: specification, verification, and synthesis. We consider the study of both qualitative behavior and quantitative behavior (extended with probabilistic information). We aim to study formal methods in all their aspects: foundations (their mathematical and logical basis), algorithmic advances (the conceptual basis for software tool support) and practical considerations (tool construction and case studies). The MEALS project includes five tightly interconnected thematic work packages. They focus on quantitative analysis of concurrent program behaviour (WP1), reasoning tasks for specification and verification (WP2), security and information

flow properties (WP3), synthesis in model-based systems engineering (WP4) and foundations for the elaboration and analysis of requirements specifications (WP5). The crosscutting concern of all these work packages is the development of formal techniques for the specification, verification and synthesis of dependable ubiquitous computing systems. Five carefully planned MEALS gatherings and workshops give the project an effectve structure for knowledge transfer, communitiy building, and result dissemination, aimed at a sustained transcontinental collaboration.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

Victor Vianu, June 1st till December 31st, UC San diego

8.3.2. Visits to International Teams

8.3.2.1. Research stays abroad

Sylvain Schmitz visited the University of Warwick for six months thanks to a grant by the Leverhulme Trust, from February 1st to July 31st, 2015.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. PEPS: Pharmaco-epidemiology for Health Products
Participants: Thomas Guyet, René Quiniou, Véronique Masson, 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 (3.6M€).

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. The pharmaco-epidemiology is the study of the uses, the effectiveness and the effects of health products (especially drugs) for the patients in a real live context, on a large population. Using medico-administrative databases – that contains information about the reimbursement of the medication, the medical visits and the cares – is a recent approach to enable studies on large cohortes and to reduce the response time to a pharmaco-epidemiology question.

Our contribution to this project will be the proposal of pattern mining algorithms and reasoning techniques to analyze typical care pathways of specific groups of insured patients.

9.2. International Initiatives

9.2.1. Inria International Partners

9.2.1.1. Informal International Partners

9.2.1.1.1. 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.

9.2.1.1.2. 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. T. Guyet and J. Romero worked together on using preferences to select best sequential patterns with ASP (see section 7.2.4) using the ASPRIN system. T. Guyet visited the Potascco group in may 2015.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. 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 §7.2).

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. Ready4SmartCities

Title: ICT Roadmap and Data Interoperability for Energy Systems in Smart Cities

Programm: FP7

Duration: October 2013 - September 2015

Coordinator: D'Appolonia SPA

Partners:

    Aec3 Ltd (United Kingdom)

    Ait Austrian Institute of Technology (Austria)

    Ethniko Kentro Erevnas Kai Technologikis Anaptyxis (Greece)

    Centre Scientifique et Technique Du Batiment (France)

    D'appolonia Spa (Italy)

    Empirica Gesellschaft für Kommunikations- und Technologie Forschung Mbh (Germany)

    Politecnico di Torino (Italy)

    Universidad Politecnica de Madrid (Spain)

    Teknologian Tutkimuskeskus Vtt (Finland)

Inria contact: Jérôme Euzenat

See also: http://ready4smartcities.eu

READY4SmartCities operates in a European context where other initiatives are currently running in order to create a common approach on Smart Cities, Such initiatives, even if of fundamental importance for the EU, have some relevant gaps not allowing them to fully cover fundamental aspects for Smart Cities, i.e. to define a common data framework allowing full interoperability among different city system, as well as a consistent vision on how ICT can support energy systems in smart cities. Within this context READY4SmartCities cover a unique role thanks to its specific mission of bringing together relevant stakeholders including engineering specialists, ICT software and equipment providers, RES providers, energy companies (including ESCOs – Energy Service Companies), construction sector companies, as well as local and regional authorities. In co-operation with these stakeholders, the aim is to deliver:

A new energy data ecosystem that will accommodate cross-domain data (climatic, occupation, pollution, traffic, activity, etc.) and will allow the exploitation of such data at global scale; by identifying the set of ontologies relevant to energy-efficiency in Smart Cities and the different requirements and guidelines on how to use (publish and interchange) data described according to those ontologies.

An holistic and shared vision, allowing feasible step-by-step action plans for city authorities and other relevant stakeholder groups to develop and use ICT-based solutions for energy system in urban and rural communities towards future Smart Cities, and thus, leading to reduced energy consumption and CO_2 emissions.

9.3. International Initiatives

9.3.1. 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).

9.3.2. 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 will be working with the team of Fernanda Baião and Kate Revoredo at the Universidade Federal do Estado do Rio de Janeiro (UNIRIO). Together, we investigate methods for evolving ontologies and alignments which involve users and agents. The goal of the project is to design methods and algorithms for both revising ontologies to represent the evolution of knowledge in a reliable manner and obtaining better quality alignments.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

Kate Revoredo and Fernanda Baião (Federal University of the State of Rio de Janeiro) visited EXMO in May 2015, working on learning alignments to evolve alignments.

9.4.2. Visits to International Teams

9.4.2.1. Research stays abroad

Tatiana Lesnikova and Jérôme Euzenat visited Tsinghua University from March 30 to April 15, 2015 within the LINDICLE project (§9.1.1) on multilingual data interlinking and key extraction.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

9.1.1.1. ASPIQ

Participants: Jean-François Baget, Fabien Garreau, Marie-Laure Mugnier, Jérôme Fortin, Michel Leclère.

ASPIQ (ASP technologIes for Querying large scale multisource heterogeneous web information), is an ANR white project (duration: 4 years) that started in Oct. 2012. 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 7.1 for this year's results (Extensions of the Framework).*

9.1.1.2. 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 7.1 for this year's results.*

9.1.1.3. Qualinca

Participants: Michel Leclère, Michel Chein, Madalina Croitoru, Rallou Thomopoulos, Alain Gutierrez, Swan Rocher, 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 7.3 for this year's results.*

9.1.1.4. Dur-Dur
Participants: Abdallah Arioua, Patrice Buche, Madalina Croitoru, Jérôme Fortin, 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.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. EcoBioCap
Participants: Patrice Buche, Madalina Croitoru, Jérôme Fortin, Nouredine Toumani.

EcoBiocap is a FP7-KBEE project that lasted 4 years and ended in March 2015. It was led by INRA (and scientifically managed by Montpellier IATE laboratory). It involved sixteen partners among which Cork University (Ireland), CSIC (Spain), Roma University La Sapienza (Italy), SIK (Sweden). The objective of EcoBioCAP was to "provide the EU food industry with customizable, ecoefficient, biodegradable packaging solutions with direct benefits both for the environment and EU consumers in terms of food quality and safety". The budget was managed by IATE team.

- *See Section 7.2 for this year's results.*

9.2.2. Collaborations with Major European Organizations

- On existential rules, we collaborate with TU Dresden and have scientific contacts with the University of Oxford.
- On description logics, we collaborate with the universities of Bremen, Liverpool, London, Rome and Vienna (new collaborations brought by Meghyn Bienvenu).
- On argumentation, we work with the universities of Aberdeen and Southampton.

9.3. International Research Visitors

Odile Papini, PR Univ. Aix-Marseille, is a visitor from Sept. 2015 (one year CNRS delegation) (see ASPIQ project in Section 9.1).

Pierre Bisquert is currently an international visitor for one year at the University of Amsterdam (from May 2015).

Rallou Thomopoulos is currently a visitor at the University of Quebec for one year (from July 2015).

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

Links participates in the CPER DATA (2015-19)

9.2. National Initiatives

ANR Aggreg (2014-19): Aggregation Queries.

- Participants: 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], A. Bonifati, S. Tison.
- Parteners: 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.

9.2.1. Competitivity Cluster Picom

FUI Hermes (2012-15): The future of shopping

- We participate in the Hermes project of the Pôle de compétitivité PICOM, a regional research cluster on the industy of commerce.
- Participants: I. Boneva [correspondent], A. Bonifati, J. Niehren
- Objective: Here we work on filtering publicity offers by newspaper arriving on complex event streams in real time.
- Parteners: Norsys, Auchan, etc

9.3. International Initiatives

9.3.1. Inria Associate Teams not involved in an Inria International Labs

Associated Team "Integrating Linked Data" with the Datbase group of the University of Oxford (2013-15).

9.3.2. Inria International Partners

9.3.2.1. Declared Inria International Partners

AMSud project "Foundations of Graph Databases" (2016-17)

Partners: Santiago de Chili (C. Riveros), Buenos Airos (S. Figuera), Bordeaux (G. Puppis).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

George Fletcher, Eindhoven University of Technology, Belgium, Apr 2015

Martin Musicante, Federal University of Rio Grande do Norte, Bresil, Sep 2014- Oct 2015.

9.4.1.1. Internships

M. Linardi, University of Trento. On Web Data Integration, from Feb 2015 until Sep 2015.

9.4.2. Visits to International Teams

9.4.2.1. Research stays abroad

Slawek Staworko, University of Edinburgh, 2014-16.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

MIKAELA KELLER participated in the joint Inria Campus-Institut Pasteur workshop whose goal was to reinforce the collaboration between both institutes.

MARC TOMMASI belongs to the drafting committee of the Lille IDEX project, and is a representative for the COMUE in the DAS commission "Ubiquitaire et Internet des Objets".

MARC TOMMASI and PASCAL DENIS supervise the PhD thesis of DAVID CHATEL on semi-supervised spectral clustering. The PhD is funded by Inria and the "Région Nord - Pas de Calais".

9.2. National Initiatives

9.2.1. *Competitivity Clusters*

We are part of FUI HERMES (2012-2015), a joint project in collaboration with many companies (Auchan, KeyneSoft, Cylande, ...). The main objective is to develop a platform for contextual customer relation management. The project started in November 2012.

9.2.2. *EFL*

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

9.2.3. *SCAGLIA*

The project SCAGLIA (Scalable Graph Algorithms for Learning in Networked Data) of FABIO VITALE was accepted at the JCJC INS2I 2015 call.

9.3. European Initiatives

9.3.1. *Collaborations in European Programs, except FP7 & H2020*

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

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.

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

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.

9.4. International Initiatives

9.4.1. Inria Associate Teams not involved in an Inria International Labs

Program: Inria North-European Labs

Project acronym: RSS

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 derive 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.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

We have started a collaboration with Fei Sha (University of California, Los Angeles) on the topic of representation learning for Natural Language Processing, materialized by the submission of a proposal to the 2016 call of the Inria Associate Teams program.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

We invited Prof. Claudio Gentile (Università dell'Insubria, Italy) in July, collaborating with MARC TOMMASI and FABIO VITALE on contextual node classification and bipartite graph matching problems on social network with user binary feedback.

Prof. Mark Herbster (University College London, UK) was invited for the PhD dissertation defense of THOMAS RICATTE in January and for Amir Sani's thesis in May 2015. He also collaborated with FABIO VITALE.

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

- Jan Ramon (KU Leuven, Belgium): "Learning theory for network-structured data" (January)
- Borja Balle (University of McGill, Canada): "A General Framework for Learning Weighted Automata" (February)
- Tiago P. Peixoto (Universität Bremen, Germany): "Inferring the large-scale structure of networks" (April)
- Dan Roth (University of Illinois at Urbana/Champaign, USA): "Learning, Inference and Supervision for Structured Prediction Tasks" (May)
- Michael Mathioudakis (Helsinki Institute for Information Technology, Finland): "Absorbing random-walk centrality – theory and algorithms" (June)
- Andre Martins (Priberam Labs and Instituto Superior Técnico Lisbon, Portugal): "Advances in Structured Regularization" (December)

9.5.2. *Visits to International Teams*

In July and in August, FABIO VITALE visited Aalto University (Helsinki, Finland), collaborating with Prof. Aristides Gionis on learning influence processes in social networks and graph reconstruction with queries.

<div style="text-align:center; color:red; font-weight:bold">

OAK Project-Team

</div>

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

Content Management Techniques for Fact-Checking: Models, Algorithms, and Tools (ContentCheck) is a 4-year project starting in January 2016, supported by ANR under DEFI 7 - Société de l'information et de la communication. The project is coordinated by Ioana Manolescu; Bogdan Cautis and Michaël Thomazo also participate. Other partners are U. Rennes 1, INSA Lyon, Le Monde's fact-checking team, and the LIMSI lab of Université Paris Sud. The project aims at establishing fact-checking as a data management problem, and endow it with the appropriate fundamental models, algorithm and tools, validated in interaction with the journalists.

Apprentissage Adaptatif pour le Crowdsourcing Intelligent et l'Accès à l'Information (ALICIA) is a 4-year project, started in February 2014, supported by the ANR CONTINT call. The project is coordinated by Bogdan Cautis, with Nicole Bidoit, and Ioana Manolescu; other partners include LIG (Grenoble) and the Vodkaster company. Its goal is to study models, techniques, and the practical deployment of adaptive learning techniques in user-centric applications, such as social networks and crowdsourcing.

Cloud-Based Organizational Design (CBOD) is a 4-year ANR started in 2014, coordinated by prof. Ahmed Bounfour from UNIV. PARIS-SUD. Its goal is to study and model the ways in which cloud computing impacts the behavior and operation of companies and organizations, with a particular focus on the cloud-based management of data, a crucial asset in many companies.

Datalyse is funded for 3.5 years as part of the *Investissement d'Avenir - Cloud & Big Data* national program. The project is led by the Grenoble company Eolas, a subsidiary of Business & Decision. It is a collaboration with LIG Grenoble, U. Lille 1, U. Montpellier, and Inria Rhône-Alpes aiming at building scalable and expressive tools for Big Data analytics.

8.1.2. LabEx, IdEx

Structured, Social and Semantic Search is a 3-year project started in October 2013, financed by the *LabEx (Laboratoire d'Excellence)*DIGICOSME. The project aims at developing a data model for rich structured content enriched with semantic annotations and authored in a distributed setting, as well as efficient algorithms for top-k search on such content.

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 cloud services, and from the cloud to outside the cloud.

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 Inria Saclay (OAK). The project aims to develop a complete framework for analytics on Web data, in particular taking into account uncertainty, based on Semantic Web technologies such as RDF.

Google Award I. Manolescu has received a Google Award in collaboration with X. Tannier from LIMSI. 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".

8.2. International Initiatives

8.2.1. Inria International Labs

Inria@SiliconValley

Associate Team involved in the International Lab:

8.2.1.1. OAKSAD

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

International Partner (Institution - Laboratory - Researcher):

University of California, San Diego (United States) - Computer Science and Engineering (CSE) - Alin Deutsch

Start year: 2013

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

Data on the Web is increasingly large and complex. The ways to process and share it have also evolved, from the classical scenario where users connect to a database, to today's complex processes whereas data is jointly produced on the Web, disseminated through streams, corroborated and enriched through annotations, and exploited through complex business processes, or workflows. The OAK and San Diego teams work together to devise expressive languages, efficient techniques and scalable platforms for such applications. Our work in 2015 has focused on scalable hybrid stores [9], [18]. The OAKSAD team ended with 2015 but we continue collaborating on this topic.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Erietta Liarou, Harvard University, May 2015
- Helena Galhardas, University of Lisbon, March 2015
- Paolo Papotti, Qatar Computing Research Institute, February 2015
- Puya - Hossein Vahabi, Yahoo Labs, January 2015
- Yanlei Diao, University of Massachusetts Amherst, January 2015

8.3.2. Visits to International Teams

8.3.2.1. Sabbatical programme

Bogdan Cautis went on a sabbatical to Hong Kong starting in September 2015, for a duration of one year.

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

8. Partnerships and Cooperations

8.1. International Initiatives

8.1.1. *Inria International Labs:SNOWFLAKE*
Participants: Adrien Coulet [contact person], Malika Smaïl-Tabbone.

Inria@SiliconValley
Associate Team involved in the International Lab: SNOWFLAKE

>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

>See also: http://snowflake.loria.fr/

Snowflake (http://snowflake.loria.fr/) 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 LOD (Linked Open Data). Such a connection would 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. The considered use case is related to pharmacogenomics drugs, i.e., drugs known to cause variable effects depending on the genetic profile of patients. Data associated with pharmacogenomics drugs and their mechanisms are available in LOD and, once connected to EHRs, they can be used to classify drugs and then patients showing a specific reaction profile to a given group of drugs.

8.1.2. *Participation In other International Programs: Ciência Sem Fronteiras*
Participant: Amedeo Napoli [contact person].

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.

8.1.3. *STIC AmSud: Autonomic Knowledge Discovery (AKD)*
Participants: Victor Codocedo, Amedeo Napoli [contact person].

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 projects targets 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.

8.1.4. Miscellaneous

Participants: Mehwish Alam, Aleksey Buzmakov, Victor Codocedo, Adrien Coulet, Amedeo Napoli [contact person], Chedy Raïssi, Jean-Sébastien Sereni, Mario Valencia.

- An on-going collaboration involves the Orpailleur team and Sergei Kuznetsov at Higher School of Economics in Moscow (HSE). Amedeo Napoli visited HSE laboratory several times (with the support of HSE) while Sergei Kuznetsov visited Inria Nancy Grand Est several times too. The collaboration is materialized by the joint supervision of the thesis of Aleksey Buzmakov and the organization of scientific events, and in particular the workshop FCA4AI whose fifth edition should take place this year in August at ECAI 2016 (see http://www.fca4ai.hse.ru).

- 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.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. HEREDIA

Participant: Jean-Sébastien Sereni [contact person].

HEREDIA (http://www.liafa.univ-paris-diderot.fr/~sereni/Heredia/) is an ANR JCJC ("Jeunes Chercheurs") focusing on hereditary properties of graphs, which provide a general perspective to study graph properties. Several important general theorems are known and the approach offers an elegant way of unifying notions and proof techniques. Further, hereditary classes of graphs play a central role in graph theory. Besides their theoretical appeal, they are also particularly relevant from an algorithmic point of view. With Jean-Sébastien Sereni, the HEREDIA project involves Pierre Charbit (LIAFA, Paris), Louis Esperet (G-SCOP, Grenoble) and Nicolas Trotignon (LIP, Lyon).

8.2.1.2. Hybride

Participants: Adrien Coulet, Luis-Felipe Melo, Amedeo Napoli, Matthieu Osmuk, Chedy Raïssi, My Thao Tang, Mohsen Sayed, Yannick Toussaint [contact person].

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 and 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).

8.2.1.3. ISTEX

Participants: Luis-Felipe Melo, Amedeo Napoli, Yannick Toussaint [contact person].

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. Thus ISTEX is in concern with a massive acquisition of documentation 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 the ATILF laboratory and the INIST Institute (both in Nancy). ISTEX-R aims at developing new tools for querying full-text documentation, analyzing content and extracting information. A platform is currently under development to provide robust NLP tools for text processing, as well as methods in text mining and domain conceptualization.

8.2.1.4. Termith

Participants: Luis-Felipe Melo, Yannick Toussaint [contact person].

Termith (http://www.atilf.fr/ressources/termith/) is an ANR Project which involves the following laboratories: ATILF, LIDILEM, LINA, INIST, Inria Saclay and Inria Nancy Grand Est. 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.

8.2.2. FUI PoQemon

Participants: Matthieu Osmuk, Chedy Raïssi [Contact Person], Mickaël Zehren.

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 trade-off 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 involves the following partners: Altran, DataPublica, GenyMobile, HEC, IP-Label, Next Interactive Media, Orange and Université Paris-Est Créteil, along with Inria Nancy Grand Est.

8.2.3. PEPS

8.2.3.1. PEPS Approppre

Participants: Mehwish Alam, Quentin Brabant, Aleksey Buzmakov, Victor Codocedo, Miguel Couceiro [Contact Person], Adrien Coulet, Esther Galbrun, Amedeo Napoli, Chedy Raïssi, Yannick Toussaint.

This PEPS Approppre research project (see http://www.cnrs.fr/ins2i/spip.php?article1183) is aimed at setting a framework for characterizing the mining of preferences in massive data. Such a unified framework for the mining of qualitative preferences is not yet existing and can be related to recent studies in decision theory (aggregation models and consensus), machine learning and data mining. A particular focus will be done on the aggregation model of Sugeno integral which can be applied on a symbolic representation of preferences for two main operations, reduction of dimensionality (feature selection) and prediction.

8.2.3.2. PEPS Confocal

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 planning to adapt 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

Participants: Mehwish Alam, Quentin Brabant, Aleksey Buzmakov, Victor Codocedo, Adrien Coulet, Miguel Couceiro [Contact Person], Esther Galbrun, Amedeo Napoli, Chedy Raïssi, 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. For leading such a process, which actually is a loop, an analyst who is most of the time an expert of the data domain, is present. This materializes the fact that the KD process requires interaction and iteration. However, it appears that until recently the most important progress were made on the second step of the KD process, i.e. data mining, and especially form the algorithmic point of view. This gave birth to a variety of efficient and fast algorithms. This second step is in between the two other steps whose importance is now becoming very clear as the analyst is facing very large amounts of data and even larger amounts of resulting patterns. Actually, KDDK is one possible way of tackling such a problem as the principle is to push domain knowledge for improving 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 some original and generic pattern which can be considered as a reference for going farther and to search the pattern space w.r.t. this original pattern linked to some preferences of the analyst. In this way, the interesting pattern space is much more concise and of much lower size. Moreover, the PEPS Prefute project contributes also to consolidate the place of the analyst in the KD process. In particular this means that more studies have to be carried out on the possible interactions with the analyst and on the importance of preferences and domain knowledge in this interaction. In addition, visualization tools associated to KD systems have to be improved for being able to work with the actual large amounts of data and patterns as well (see https://www.greyc.fr/fr/node/2207).

8.3. Regional Initiatives

8.3.1. PEPS Mirabelle EXPLOD-Biomed

Participants: Adrien Coulet [contact person], Malika Smaïl-Tabbone.

This project has initiated a collaboration with geneticists from the Hospital of Nancy, namely Philippe Jonveaux and Céline Bonnet. The aim of the EXPLOD-Biomed project is to propose novel knowledge discovery methods applied to Linked Open Data for discovering gene that could be responsible for intellectual deficiencies. Linked Open Data are available on-line, interconnected and encoded in a format which can be straightforwardly mapped to ontologies. Thus they offer novel opportunities for knowledge discovery in biomedical data. Here, geneticists play the role of experts and guide the knowledge discovery process at different steps.

8.3.2. Hydreos

Participant: Jean-François Mari [contact person].

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 (see § 6.2.2) 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. Currently, various display tools are under study and implementation for providing the agrnomy expert an easier interpretation of the clustering outputs http://www.loria.fr/~jfmari/App/Arpentage/Yar.avi.

8.3.3. PEPS Truffinet

Participant: Chedy Raïssi [contact person].

The Truffinet PEPS project aims at developing new graph mining methods and tools to support knowledge discovery from the truffle's complex network of interactions happening in the soil between different bacterias and the subterranean Ascomycete fungus. This work uses Log-Linear Analysis (LogLA) which is a well established statistical technique for finding associations between discrete variables in data. The general objective of LogLA is to select a model that satisfactorily explains the observed frequencies of a given categorical dataset. General approaches to LogLA are exponential with respect to the number of variables. Recently, new approaches based on multiplicative log-linear models and using notions from graph theory have been developed. We applied successfully these methods in the case of the truffle bacterial environment to discover new associations in our data.

The Truffinet PEPS project involves several partners among which Intitut Elie Cartan de Lorraine (IECL), Intitut National de Recherche en Agronomie (INRA) and Centre de Recherche en Automatique de Nancy (CRAN) along with Inria Nancy Grand Est.

SMIS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR KISS (Dec. 2011 - Dec. 2015)

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.

8.1.2. CAPPRIS Project-Lab (Dec. 2011 - Dec. 2015)

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.

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

Inria Partners: ARLES-MIMOVE, CLIME, DICE, FUN, MYRIADS, OAK, 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/

8.1.4. 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.

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

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. 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.

7.1.2. ANR

Typex

> Title: Typeful certified XML: integrating language, logic, and data-oriented best practices
>
> Call: Programme Blanc
>
> Duration: January 2012 - December 2015
>
> Coordinator: PPS (CNRS - Paris 7 Diderot)
>
> Others partners: LRI (Orsay)
>
> See also: http://typex.lri.fr
>
> Abstract: The highly ambitious and final goal of this project is to produce a new generation of XML programming languages stemming from the synergy of integrating three approaches into a unique framework:
>
> - a logical approach based on solvers
> - a programming language (PL) approach
> - a data-oriented approach

These languages will feature precise and polymorphic type systems that merge PL typing techniques with logical-solver-based type inference. They will be implemented efficiently using the latest research on tree automata and formally certified using modern theorem prover technology. They will offer the capacity to specify and formally verify invariants, business rules, and data integrity, and will have a direct and immediate impact on standardization processes.

7.1.3. Transfer Contracts with Startups

Oppidoc

Title: Study of Potential Benefits of Introducing Static Analyses in the Oppidum Development Process

Duration: November - December 2015

Coordinator: Pierre Genevès

Abstract: The Oppidoc startup develops "Oppidum": an XQuery web application framework which simplifies the development of XML-REST-XQuery applications (XRX) with the full XML technology stack (XQuery, XSLT, native XML database). It relies on a RESTful approach and on a well defined application model using concepts (routes, conventions, pipelines) popularized in other frameworks such as Ruby On Rails, Orbeon Forms and more recently Express on nodejs. Our collaboration concerns a study about the introduction of advanced static analyses techniques in the Oppidum development process.

7.2. International Research Visitors

7.2.1. Internships

Martì Bosch Padros from Universitat Politècnica de Catalunya (UPC) Spain spent six months in the team to work on Automated Refactoring for Size Reduction of CSS Style Sheets.

Joel Ferreira Dos Santos from Universidade Federal Fluminense, UFF, Brasil spent a one year sandwich PhD in the team to work on the formal verification of multimedia presentations.

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Seminar with UNS

We organize a seminar with Lise Arena (UNS, Gredeg) and Bernard Conein (UNS, Gredeg) between Inria and Univ. Nice-Sophia Antipolis on *Digital artifacts and materialities*. We organize a seminar on *Law, Philosophy and Digitality* between UNS faculties of Law and Philosophy and Inria. Alexandre Monnin will address the impact of digital technologies on law itself.

8.1.2. PEPS GéoIncertitude

We participated in the CNRS PEPS GéoIncertitude, with researchers of the UMR 7300 ESPACE of Nice and of the IRIT of Toulouse on the modeling of uncertainty in Geography using fuzzy logic and possibility theory, which was re-financed for a second year.

8.1.3. 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.

8.1.3.1. 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.

8.1.3.2. SPARKS ELK Axis

Wimmics contributes to the SPARKS ELK research axis (Knowledge Learning and Extracting). Andrea Tettamanzi is co-animator of ELK. Elena Cabrio, Tom Bosc and Farhad Nooralahzadeh contribute on it.

8.1.3.3. 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.

8.1.4. HCI Group (I3S)

Participant: Alain Giboin.

The HCI Group animated by Anne-Marie Dery brings together I3S researchers 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 SPARKS. The group establishes collaborations between researchers in the design and implementation of experiments. This year Wimmics collaborated in the design, running and analysis of two experiments aiming at identifying and testing a set of principles for designing tabletop applications. One of the experiment involved Alzheimer people.

Wimmics also contributed to a working paper on the teaching of task modeling in the HCI curriculum of Polytech (with Philippe Renevier, Anne-Marie Dery and Gaëtan Rey). This paper was requested by the AFIHM working group "Enseignement sur l'analyse de tâches : leçons acquises et nouveaux défis".

8.1.5. 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 co-animator of this group-project with Lise Arena (GREDEG). 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." During the first workshop organized this year on this topic, a talk was given by Alain Giboin on "Mesurer l'acceptabilité des collecticiels : de l'observation et/ou de la théorisation des activités collectives à l'élaboration de critères de mesure de l'acceptabilité". Alexandre Monnin is co-animator (with Lise Arena and Bernard Conein (GREDEG)) of a series of seminars on "Digital Artifacts and Materialities." During the first seminar, talks were given by Alexandre Monnin on "Quelques réflexions autour des couples artefacts/objets et numérique/matérialité", and by Alain Giboin on "Les personas comme artefacts substituts des utilisateurs dans un processus de conception".

8.2. National Initiatives

8.2.1. BPI funded project : 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*, using Web technologies such as WebRTC and semantic Web technologies. The project started September 15th 2014. The first step of the project will be the evaluation/benchmarking of video and data solutions over internet, based on the WebRTC technology. The second step will consist in helping the robotic partner in the project (the Robosoft company) to implement these solutions on a real mobile robot that will be deployed in museums or in homes for helping seniors in their daily tasks. Semantic Web technologies, will be used in the project for describing the services, the context of the application domain, the content transmitted, etc.

This year, Wimmics main contributions were: a state-of-the-art on the techniques for transferring Web-based data/audio/video ; prototypes based on the technologies selected from the state-of-the-art ; a procedure and quantitative and qualitative criteria for benchmarking the prototypes.

8.2.2. ANR LabCom SMILK

Participants: Farhad Nooralahzadeh, Elena Cabrio, Fabien Gandon.

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.

8.2.3. Ministry of Culture: DBpedia.fr

Participants: Raphaël Boyer, Fabien Gandon.

This project named "DBpedia.fr" proposes the creation of a French chapter of the base DBpedia used in many English applications, in particular for the publication of cultural collections. Because DBpedia is focused on the English version of Wikipedia it ignores some of the French topics and their data. This project aims at extracting a maximum of RDF data from the French version and providing a stable and scalable end-point for them. We now consider means to improve both the quantity and the quality of the data. The DBpedia.fr project was the first project of the Semanticpedia convention signed by the Ministry of Culture, the Wikimedia foundation and Inria.

A new complete DBpedia extraction has been performed, together with a technical documentation to reproduce it and a documentation for the users has been done too. In addition we have included the last community user interface and adapted it for French DBpedia. This version is more ergonomic and detailed, but also integrates a new SPARQL editor named Flint for students and beginners. A new DBpedia service from the community has been adapted for the French version: it's called "fragments", a service made for minimizing server processing.

Some scripts have been developed, one for generation of statistics based on log, others for grouping the abstracts of each language, based on redirections and interlanguages linked data. Also to increase our amount of available data, we created a new extractor that can extract historic and make statistics of modifications of each Wikipedia article.

Web site: http://wimmics.inria.fr/projects/dbpedia

8.2.4. *Ministry of Culture: GT 6*
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.

8.2.5. *ANR OCKTOPUS*
Participants: Fabien Gandon, Catherine Faron-Zucker, Zide Meng.

OCKTOPUS is an ANR project (2012-2016). The objective of OCKTOPUS is 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 believe that 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 will focus 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 will take 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

8.2.6. *GDRI Zoomathia*
Participants: Olivier Corby, Catherine Faron-Zucker, Alexandre Monnin, Andrea Tettamanzi.

Wimmics is partner of 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 started to work on 1) the translation of manual annotations of middle-age structured texts from XML to RDF, 2) the automatic extraction of RDF annotations from text using NLP techniques and 3) 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/

8.2.7. *Semantic EDUCLOUD Carnot Project*

Participants: Oscar Rodriguez Rocha, Catherine Faron-Zucker.

Partner : GAYAtech. This project was just accepted this year on the topic of *semantic Web for e-learning*. This is a joint project with Gayatech on the recommendation of pedagogical resources adapted to user profile and context in the EDUCLOUD 06 Serious Game. To get help in his quests and various quiz testing his knowledge, the gamer can use external digital resources (books, video, TV, Web) and an in-game social network to work with his teacher and comrades. In this context, and to meet the needs of GAYATECH developing edutainment solutions, the Semantic EDUCLOUD project aims to improve the recommendation of educational resources to learners in EDUCLOUD 06, by using semantic Web and social Web models and techniques.

8.2.8. *Carnot Project Vigiglobe*

Participants: Elena Cabrio, Serena Villata.

Partner : Vigiglobe.

This project was just accepted this year on the topic of *Natural Language Argumentation on Twitter: Retrieval of Argumentative Structures and Reasoning*. this is a joint project with Vigiglobe on the natural language processing of argumentation on Twitter to retrieve argumentative structures and reason on them. The goal of the project is to : (1) Automate the selection and annotation of tweets, i.e., retrieval of those tweets that can be considered as arguments (2) Automate the assignment of labels to the type of relation holding between arguments - positive relation or negative relation. (3) Create an argumentation graph illustrating the relations between the arguments about a certain subject, and the further application of argumentation semantics to compute the set of "winning" arguments This graph-based visualization provides a summary of the ongoing discussion on Twitter.

8.2.9. *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) 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.

This year, Wimmics main contributions were: a state-of-the-art on user-centered privacy and security (leading to the identification of the security and privacy aspects to be taken into account, from a user's point of view, in the design of a mobile device used to communicate personal data and documents); a field study of users performing administrative procedures from the point of view of security and privacy; and the functional mock-ups of the GUIs of the PadDOC mobile application to be used by the client of a commercial or administrative service.

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

8.3.1.1. 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: http://www.dis.uniroma1.it/~aloof

8.4. International Initiatives

8.4.1. Inria International Labs

We participate to the LIRIMA Africa (Laboratoire international de recherche en informatique et mathématiques appliquées) where we have a long term collaboration with University Gaston Berger in Saint-Louis, Senegal, with Pr. Moussa Lo. We host two PhD students in co-supervision with UBG: Papa Fary Diallo and Oumy Seye [60].

8.4.2. Inria Associate Teams not involved in an Inria International Labs

8.4.2.1. SEEMPAD
Participants: Elena Cabrio, Serena Villata, Valerio Basile, Fabien Gandon, Claude Frasson.

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

Team site: 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.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

8.5.1.1. Internships

> Lautaro Petaccio
>
> > Title: Design and development of a fact-checking framework based on argumentation theory and Natural Language Processing techniques.
> >
> > Date: August 2015-December 2015
> >
> > Institution: Universidad de Buenos Aires (Argentina)
> >
> > Supervisor: Elena Cabrio, Serena Villata
>
> Clémence Chauvet

Title: GUI for a requirement system
Date: from June 2015 until August 2015
Univ. Nice
Supervisor: Isabelle Mirbel et Serena Villata

Molka Dhouib
Title: Integration and enrichment of cultural heritage metadata on the Web of Data.
Date: until September 2015
Univ. Nice, Master 2
Supervisor: Catherine Faron-Zucker, Elena Cabrio

Raphael Gazzotti
Title: Checking OWL profile conformance with SPARQL Template Transformation Language
Date: from May 2015 until September 2015
Univ. Nice, Master 2
Supervisor: Olivier Corby

Racha Gouareb
Title: Semantic Annotation of Lyrics
Date: from May 2015 until October 2015
Univ. Nice
Supervisor: Michel Buffa, Catherine Faron-Zucker

Ahmed Missaoui
Title: Integration and enrichment of cultural heritage metadata on the Web of Data
Date: October 2014 - February 2015
Univ. Nice
Supervisor: Elena Cabrio, Catherine Faron-Zucker and Serena Villata

Baffoue Kangah
Title: Robot Navigation Web Control
Date: from May 2015 until October 2015
Univ. Nice
Supervisor: Michel Buffa, Catherine Faron-Zucker

Garance Vallat
Title: Semantic Web based platform for bibliography query and visualisation
Date: from June 2015 until August 2015
Univ. Nice, Master 1
Supervisor: Olivier Corby, Mireille Blay-Fornarino (I3S)

Reda Zarhbouch
Title: From user requirement to BPMN service composition modeling
Date: from May 2015 until October 2015
Univ. Nice, Master MIAGE
Supervisor: Isabelle Mirbel

Konstantina Poulida
Title: Extraction of Zoological Knowledge from Ancient and Middle-Age Scientific Texts
Date: from November 2015 to January 2016
Inria, University of Patras, Greece
Supervisor: Catherine Faron-Zucker, Andrea Tettamanzi

8.5.2. Visits to International Teams

8.5.2.1. Research stays abroad

Catherine Faron-Zucker spent the month of July at the Hasso Platner Institute (HPI) in Potsdam, Germany. She presented her research work in a seminar of the Semantic Web group.

Alexandre Monnin spent the month of November at the Digital Cultures Research Center (Leuphana University, Lüneburg, Germany), as a Research Fellow, to participate in the discussions on the semester's topic ("Non-knowledge and Digital Cultures"). Among other things he did a response to a talk delivered by Jeannie Moser's on "Mistrust", did two interviews on digital cultures, and participate in the non-knowledge seminar organized in Braunschweig, Germany.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Labex NUMEV, Montpellier
URL: http://www.lirmm.fr/numev

We are participating in the Laboratory of Excellence (labex) NUMEV (Digital and Hardware Solutions, Modelling for the Environment and Life Sciences) headed by University of Montpellier 2 in partnership with CNRS, University of Montpellier 1, 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 NUMEV 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 (with Pascal Poncelet) the theme on scientific data.

9.1.2. Institut de Biologie Computationnelle (IBC), Montpellier
URL: http://www.ibc-montpellier.fr

IBC is a 5 year project 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. Datascale (2013-2015), 250Keuros
Participants: Reza Akbarinia, Florent Masseglia, Saber Salah, Patrick Valduriez.

The Datascale project is a PIA on big data with Bull (leader), CEA, ActiveEon SAS, Armadillo, Twenga, IPGP, Xedix and Inria (Zenith) . The goal of the project is to develop the essential technologies for big data, including efficient data management, software architecture and database architecture, and demonstrate their scalability with representative applications. In this project, the Zenith team works on data mining with Hadoop MapReduce.

9.2.1.2. Xdata (2013-2015), 125Keuros
Participants: Julien Diener, Patrick Valduriez.

The X-data project is a PIA with Data Publica (leader), Orange, La Poste, EDF, Cinequant, Hurence and Inria (Indes, Planete and Zenith) . The goal of the project is to develop a big data plaftform with various tools and services to integrate open data and partners's private data for analyzing the location, density and consuming of individuals and organizations in terms of energy and services. In this project, the Zenith team heads the workpackage on data integration.

9.2.1.3. PIA Floris'Tic (2015-2018), 430Keuro.
Participants: Julien Champ, Alexis Joly.

Floris'tic is a PIA aimed 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 and the TelaBotanica social network.

9.2.2. Others

9.2.2.1. CIFRE INA/Inria (2013-2016), 100Keuros
Participants: Alexis Joly, Valentin Leveau, Patrick Valduriez.

This CIFRE 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. CNRS INS2I Mastodons (2013-2015), 90Keuros
Participants: Alexis Joly, Florent Masseglia, Esther Pacitti [leader], Patrick Valduriez.

This project deals with the problems of big data in the context of life science, where masses of data are being produced, e.g. by Next Generation Sequencing technologies or plant phenotyping platforms. In this project, Zenith addresses the specific problems of large-scale data analysis and data sharing.

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

Accessing and managing large amounts of data is becoming a major obstacle to developing new cloud applications and services with correct semantics, requiring tremendous programming effort and expertise. CoherentPaaS addresses this issue in the cloud PaaS landscape by 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 beyond-the-state-of-the-art high performance simulation tools that can help the energy industry to respond future energy demands and also to carbon-related environmental issues using the state-of-the-art 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 will 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 industry. This includes sharing supercomputing infrastructures between Brazil and EU. The cross-fertilization between energy-related problems and other scientific fields will be beneficial at both sides of the Atlantic. In this project, Zenith is working on Big Data management and analysis of numerical simulations.

9.4. International Initiatives

9.4.1. Inria Associate Teams

9.4.1.1. 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/

The cloud has become a good match for managing big data since it provides unlimited computing, storage and network resources on demand. 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.

9.4.1.2. BIGDATANET

Title: A hybrid P2P/cloud for big data
Inria principal investigator: Patrick Valduriez
International Partner : University of California at Santa Barbara (USA) - Amr El Abbadi and Divy Agrawal
Duration: 2013 - 2015
See also: https://team.inria.fr/zenith/projects/international-projects/bigdatanet/

The main objective of this research and scientific collaboration is to develop a hybrid architecture of a computational platform that leverages the cloud computing and the P2P computing paradigms. The resulting architecture will enable scalable data management and data analysis infrastructures that can be used to host a variety of next-generation applications that benefit from computing, storage, and networking resources that exist not only at the network core (i.e., data-centers) but also at the network edge (i.e., machines at the user level as well as machines available in CDNs – content distribution networks hosted in ISPs).

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).
- Asia: National Univ. of Singapore (Beng Chin Ooi, Stéphane Bressan), Wonkwang University, Korea (Kwangjin Park)
- Europe: Univ. of Amsterdam (Hamideh Afsarmanesh), 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)

9.4.3. *Inria International Labs*

The Bigdatanet associated team takes part of the Inria@SiliconValley lab.

9.4.4. *Participation In other International Programs*

We are involved in the following international actions:

- CNPq-Inria project Hoscar (HPC and data management, 2012-2015) with LNCC (Fabio Porto), UFC, UFRGS (Philippe Navaux), UFRJ (Alvaro Coutinho, Marta Mattoso) to work on data management in high performance computing environments.

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.

9.5.2. *Visits to International Teams*

Maximilien Servajean visited UCSB in june, in the context of the Bigdatanet associated team.

<div style="text-align: center; color: red;">

ALICE Project-Team

</div>

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. 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.

8.1.2. 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

The SHAPEFORGE project (ERC Starting Grant, FP7, 2012–2017) aims at developing new methods for creating objects from examples, with 3D printers. The main challenge with this project is combining approaches that are very different in nature: algorithms from computer graphics which are used to build forms and textures using examples are combined with digital optimization methods which make sure that the real object complies with the function it is assigned. Thus, to produce a Louis XV bench, on the basis of a Louis XV chair, you need to not only capture the appearance of the example but also formalize the characteristics of a bench as well as its mechanical properties to ensure that it is solid enough. You then need to find, from among all the shapes that can be produced from a single example, the one that best complies with the various criteria. The project is led by Sylvain Lefebvre.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Informal International Partners

We have continued our informal collaboration with Wenping Wang and Li-Yi Wei from Hong Kong University, both on geometry processing and by-example techniques. We published two joint papers this year [7], [12].

Bruno Lévy and Nicolas Ray collaborated with Gilles-Philippe Paillé, Pierre Poulin (U. Montréal, Canada) and Alla Sheffer (UBC). The result of this collaboration was published in Transactions on Graphics [17].

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*

Connelly Barnes visited our team for four weeks in June 2015. We initiated a collaboration on 3D printing, which is ongoing.

Gilles-Philippe Paillé (U. Montréal, Canada) visited us (2 months) to develop "dihedral angle-based maps")

Wenping Wang (Hong-Kong U.) visited us (2 days) to discuss/launch new cooperation projects on Voronoi diagrams and on 3D printing.

8.5.1.1. Internships

Bolun Zhang is an undergraduate student from the mechanical engineering department of Hong Kong University. He visited us for three months as a summer intern, and worked on FEM simulation of infilling patterns within 3D printed parts. He was co-supervised by Jonas Martínez Bayona and Sylvain Lefebvre.

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.

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

8.1.2. ANR EASEA-Cloud

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

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

- a professional-grade API, development environment and human-computer interface for the existing academic EASEA platform,
- cloud-management tools (in order to launch an experiment on a grid of computers, monitor the experiment and bill the laboratories or companies that will be using EASEA-CLOUD for intensive computation,
- novel visualisation tools, in order to monitor an evolutionary run, potentially launched on several hundred heterogeneous GPU machines.

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

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CENDARI

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 & Scholars of The College of The Holy and Undivided Trinity of Queen Elizabeth Near Dublin (Ireland)

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

Universitaet Stuttgart (Germany)

The University of Birmingham (United Kingdom)

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

Inria contact: Jean-Daniel Fekete & Lauerent 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.'

8.2.2. Collaborations with Major European Organizations

We collaborate with several larger european research organizations, such as:

Fraunhofer Institute, IGD (DE)

We are collaborating on visual analytics, setting up European projects and coordinating European initiatives on the subject.

University of Stuttgart, Visualization Center (DE)

We are collaborating on the development of a comprehensive visualization publication dataset

Technical University of Vienna, Visualization Research Group (AT)

We are collaborating on a project to derive major visualization domain keywords and collaborating on projects and workshops related to the evaluation of visualization.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

- We hosted a visiting PhD student as part of the Inria-Mitacs collaboration.
- AVIZ collaborates with several researchers from Microsoft Research Redmond, in particular on the topic of new interactions for information visualization and brain connectivity visualization.

8.3.1.2. Informal International Partners

- Arizona State University, USA
- University of Groningen, the Netherlands
- University of Granada, Spain
- New York University, USA
- Harvard University, USA
- Google, USA

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Teresa Onorati, PostDoc at the University of Madrid visited us for three months.

8.4.1.1. Internships

- Paul Lapides and Alice Thudt visited from the University of Calgary, Canada.

8.4.2. Visits to International Teams

8.4.2.1. Sabbatical programme

Fekete Jean-Daniel

Date: Jan 2015 - Dec 2015

Institution: NYU (United States) and Harvard University (United States)

<p align="center" style="color:red">EX-SITU Team</p>

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. DigiPods – Remote Collaborative Interaction among Heterogeneous Visualization Platforms

Type: CESAME equipment grant

Funding: Région Île-de-France

Duration: 2012-2015

Coordinator: Stéphane Huot

Partners: Digiteo/FCS Campus Paris-Saclay, Univ. Paris-Sud, Inria, CNRS, CEA, Telecom Paris-Tech

Abstract: The goal is to design new interactive equipment and devices for collaborative interaction in immersive and high-resolution visualization platforms, connected through a high-end telepresence infrastructure. Beyond the usual interactive devices of such platforms (motion capture, interactive surfaces, haptic devices, audio and video systems), we are creating new devices to facilitate co-located or remote interaction and collaboration: telepresence robots and Digicarts, mobile hubs that gather interaction and communication devices. This equipment will be used by Human-Computer Interaction researchers to explore the visualization and manipulation of large datasets, interaction in virtual reality, and remote collaboration among heterogeneous platforms. Researchers and professionals in other fields will also be able to use DigiPods to explore and manipulate complex datasets.

9.1.2. DigiCarts – Remote Collaborative Interaction Devices for Heterogeneos Visualization Platforms

Type: Post-doctoral fellowship

Funding: Digiteo research network

Duration: 2013-2015

Coordinator: Stéphane Huot

Partners: Univ. Paris-Sud, Inria, CNRS, CEA, Telecom ParisTech

Abstract: This grant complements the DigiPods project with funding for a 18-month post-doctoral position focused on the design, implementation and evaluation of the DigiCart devices. This project funded Joe Malloch, a post-doctoral fellow who received his Ph.D. from McGill University.

9.1.3. DigiZoom – Multiscale navigation: from mobile devices to collaborative wall-sized displays

Type: Ph.D. grant

Funding: Digiteo network

Duration: 2012-2015

Coordinator: Olivier Chapuis

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

Abstract: The goal of the project was to study multiscale navigation on a variety of devices, with an emphasis on large wall-sized displays in the context of the Digiscope project. This requires to properly operationalize the relevant factors in the various tasks that we seek to study. This work led to an award-winning publication at ACM CHI'14 [6], which introduces an abstract classification task to compare the performance of interaction techniques for navigating and manipulating content. This project funded Can Liu, a joint PhD student between the VIA group at Institut Mines-Telecom and InSitu who defended her thesis [10] in december, 2015.

9.1.4. 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.

9.1.5. 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.

9.1.6. 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.

9.1.7. 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 will be active during the month of December, 2016 in the Evry shopping mall, next to the Agora Theater. A prototype will also be shown during the Fête de la Science on the Plateau de Saclay in October, 2016.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. DRAO – Dessin Réaliste Assisté par Ordinateur

Type: Jeunes Chercheuses - Jeunes Chercheurs

Duration: 2012-2015

Coordinator: Adrien Bousseau (Inria Sophia Antipolis)

Partners: Inria Saclay, Inria Sophia Antipolis

ExSitu contacts: Theophanis Tsandilas, Wendy Mackay

Abstract: The goal of the project was to facilitate and accelerate drawing for amateurs as well as for expert designers and illustrators (https://www-sop.inria.fr/members/Adrien.Bousseau/drao). The project explored the following research directions: (1) understanding how professionals draw, (2) automating parts of the drawing process, and (3) teaching people to draw.

9.2.2. Investissements d'Avenir

9.2.2.1. 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 2015, nine of the ten rooms are operational, and the telepresence network is being developed.

9.2.3. Institut Universitaire de France

9.2.3.1. 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 [18] illustrate this approach.

9.3. European Initiatives

9.3.1. CREATIV

Type: IDEAS

Instrument: ERC Advanced Grant

Duration: June 2013 - May 2018

Coordinator: Wendy Mackay

Partner: Inria (France)

Inria contact: Wendy Mackay

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

9.3.2. Collaborations with Major European Organizations

EIT Digital Master School, European Institute of Technology. Coordinator: M. Beaudouin-Lafon. Partners: KTH (Sweden), U. Paris-Sud (France), U. Aalto (Finland), Technical University Berlin (Germany), Technical University Twente (Netherlands), U. College London (UK), U. Trento (Italy). InSitu participates in the Human-Computer Interaction and Design (HCID) major of the EIT Digital European Master School. Paris-Sud is one the sites for the first year of this Master Program, and host one of the specialties for second-year students. Students in this program receive a double degree after studying in two countries. https://www.dep-informatique.u-psud.fr/en/formation/lmd/M1_HCID.

9.4. International Initiatives

9.4.1. Inria Associate Teams not involved in an Inria International Labs

The MidWay Equipe Associée, *Musical Interaction Design Workbench And technologY*, was created in collaboration with the Input Devices and Music Interaction Technology (IDML) at the Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT) at McGill University. The Principle investigator from Inria, Stéphane Huot, was promoted to a Research Director position at Inria Lille, so the projet is now based there, but members of ExSitu have continued to collaborate on the project. The NIME paper on evaluation is a first result from this collaboration [14].

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

We are collaborating with Clemens Klokmose from University of Aarhus, Denmark, on our exploration of information substrates. This resulted in Webstrates [18], which received a best paper award at ACM UIST'15.

We are working with Shumin Zhai from Google in Mountain View, California, on our project on "expressive keyboards", which allows users to produce expressive output from "shapewriting" on soft keyboards.

We are working with Professor Bjoern Hartmann from U.C. Berkeley and will be starting an Inria Equipe Associée, called DECIBel, in 2016.

We are working with Professor Jürgen Steimele from the Max Planck Institute for Informatics and Saarland University on paper electronics and have recently recruited one of his students as a Ph.D. candidate, Michael Wesseley.

We are working with Marco Gilles, Rebbecca Fiebrink and Atau Tanaka of Goldsmith's college in London, U.K. on Human-Centred Machine Learning, and will run a workshop together in 2016.

We are working with Kim Halkov and Peter Dalsgaard from Aarhus University, on blended interaction spaces.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Joanna McGrenere, Professor at the University of British Columbia, Canada, from August 2015.
- Ana Bernardos, Universidad Politécnica de Madrid, Spain, from September to December 2015.

GRAPHDECO Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Regional Ph.D. Scholarship

The thesis of T. Thonat is financed in part by a Région Provence Alpes-Côte d'Azur Ph.D. scholarship, with the industrial support of Kaleidoscope (Toulon).

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. ANR ALTA

Participants: Emmanuelle Chapoulie, Stefan Popov, George Drettakis.

The ANR ALTA project started in October 2011, and focuses on the development of novel algorithms for realistic and efficient global illumination. The project is coordinated by the Grenoble Inria group ARTIS (N.Holzschuch), and the Bordeaux Inria group MANAO (X. Granier) is also a partner. Our participation is the study of error bounds for these algorithms and the development of interactive global illumination. This year we developed a new global illumination algorithm described in Sec. 7.2.12 which was published at EGSR [10].

9.2.1.2. ANR DRAO

Participants: Emmanuel Iarussi, 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.

The first part of the project involved the observation of how people draw with existing tools. To do so we conducted observational studies where we will interview designers and illustrators and collect data by videotaping drawing sessions and by recording drawings with digital pens. In the second part of the project we deduced from our observations new user interfaces and rendering algorithms that automate part of the drawing process and enrich 2D drawings with realistic rendering capabilities. We combined computer vision and computer graphics techniques to estimate geometric information from sketches and then used this information to guide rendering algorithms that generate plausible depictions of material and lighting over the drawing. We also developed computer-assisted drawing lessons to help amateurs draw from photographs and 3D models, using image analysis algorithms to estimate the structure of a photograph and use that structure as guidance for drawing. To summarize, the goal of the ANR DRAO project was to make amateurs more confident in their drawing skills and to allow expert designers to produce complex illustrations more effectively.

The ANR DRAO has resulted in three publications this year on normal field estimation from rough sketches [7], 3D interpretation of line drawings [14] and jewelry design [8].

9.2.1.3. ANR SEMAPOLIS

Participant: George Drettakis.

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 part.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. 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.

We have started specific scientific collaborations with TUD on capture guidance and IBR and with UCL on video-based rendering.

9.4. International Initiatives

Inria@SiliconValley
Associate Team involved in the International Lab:

9.4.1. 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 2015 we published two papers in the Computer Graphics Forum journal, which were presented at the Eurographics Symposium on Rendering (EGSR). In the first paper we used a model of texture similarity to transfer seasons between photographs . Our algorithm predicts how to change colors and textures in an image to give it the seasonal appearance of another image. In particular, our method captures season-related effects such as leaves on trees, snow and flooding. This work was done in collaboration with Alexei Efros who is an expert in data-driven image manipulation.

The second paper contributes to more traditional, physically-based rendering using bidirectional path tracing . The key idea behind our approach is to exploit combinatorial explosion to cheaply construct a set of light paths as the Cartesian product of the eye and light sub-paths. The novelty of our work is to approximate the contribution of these paths in a probabilistic manner, without constructing each path in the set explicitly. This work results from collaboration with Ravi Ramamoorthi.

We are currently focusing our efforts on two core topics of the CRISP collaboration: perceptual rendering and plausible image-based rendering. In particular, we plan to explore several projects related to the perception and rendering of stereo images. This research will greatly benefit from an Inria postdoc, George Koulieris, who will share his time between Inria and UC Berkeley. In addition, Martin S. Banks from UC Berkeley plans to spend part of his sabbatical at Inria.

CRISP has resulted in two publications this year with Aloyha Efros [9] and R. Ramammoorthi [10].

9.4.2. Inria International Partners

9.4.2.1. Declared Inria International Partners

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

United Kingdom. In the context of the postdoctoral fellowship of K. Vanhoey, we collaborate with I. Jermyn from Durham University.

India. A. Bousseau collaborates with Vinay Namboodiri from IIT Kanpur. They co-advised two master students, one came for an internship at Inria (Rahul Arora).

United States. We have several collaborations with Adobe Research. We worked on jewelry design [8] with Wilmot Li, who hosted Emmanuel Iarussi for an 3-months internship. We also work with Eli Shechtman and Sylvain Paris in the context of the multi-view inpainting project of T. Thonat. We collaborate with F. Durand from MIT in the context of the global illumination project [10]. We collaborate with Daniel Aliaga from Purdue University on sketch-based procedural modeling.

Greece. We collaborate with the Technical University of Crete in the context of the project on attention and Virtual Reality (G. Koulieris).

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Prof. D. Aliaga from Purdue (US) visited in June for two weeks, Prof. K. Bala (Cornell, US), A. Shamir (IDC, IS), D. Salesin (Adobe, US) visited early September and participated in a workshop after the HDR defense of A. Bousseau. Prof. N. Mitra (UCL, UK), M. Alexa (TU Berlin, D) visited end September and participated in a scientific workshop after the defense of E. Iarussi.

9.5.1.1. Internships

Rahul Arora, was a Masters Intern, until Apr 2015 from IIT Kampur. Vivien Cabannes was a 3rd year intern from ENS Ulm from June 2015 until July 2015. Lorenzo Caroggio and Huayi Huang were last year engineering student interns from Univ. Genova in teh context of an ERASMUS exchange. Ayush Tewari was a Masters II intern from MOSIG Grenoble Feb. -Jul. 2015. Georgios Kopanas, was an ERASMUS intern from the Tech. Un. Thessaly, Sep.-Dec. 2015.

9.5.2. Visits to International Teams

G. Drettakis visited Berkeley in the context of the CRISP Associate team in August.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. 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 - IRISA/Inria, Hycomes - IRISA/Inria. 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.

9.1.2. Labex HEMISFER

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

HEMISFER is a 3-year project (2013-2016) 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).

9.1.3. Labex SABRE

Participants: Anatole Lécuyer [contact], Jussi Lindgren, Nataliya Kosmina.

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.

9.1.4. 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 collaborate with b<>com within two 3-year projects: ImData (on "Immersive Interaction") and GestChir (on "Augmented Healthcare").

9.1.5. CNPAO Project

Participants: Valérie Gouranton [contact], Jean-Baptiste Barreau, Quentin Petit.

CNPAO ("Conservatoire Numérique du Patrimoine Archéologique de l'Ouest") is an on-going research project partially funded by the Université Européenne de Bretagne (UEB). 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.

9.1.6. Imag'In CNRS IRMA

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

The IRMA project is an Imag'In project directly funded by CNRS which aims at developping innovative methodologies for research in the field of cultural heritage based on a combination of medical imaging technologies and methods of interactive 3D modalities (virtual reality, augmented reality, haptic, additive manufacturing). These tools are based on recent research results from a close collaboration between Hybrid team with the National Institute of Preventive Archaeological Research (Inrap), the Research Center Archaeology, and History Archéosciences (CReAAH UMR 6566) and the company Image ET, and are intended for cultural heritage professionals such as museums, curators, restorers, and archaeologists. The innovative methodologies proposed in the project gave rise to a real interest in the archaeological community. We worked on a large number of archeological artefacts (15), of different nature, composition and/or fabrication on various time period (Paleolithic, Mesolithic, and Iron Age Medieval) from all over France. We mention in particular: the oldest human bones found in Brittany (clavicle Beg Er Vil), a bone-made flute outcome of an archeo-musicology study conducted at the University of Burgundy, a cremation of the late First Iron Age Guipry (35), metal and organic furniture from the chariot burial of Warcq (08) (horses harnessed skull, char tiller, buckets), a Bronze Cauldron from a burial of the Merovingian necropolis Crassés Saint-Dizier (51). This work involves a strong collaboration with Ronan Gaugne (IMMERSIA), Théophane Nicolas (INRAP), and Grégor Marchand (CReAAH).

9.2. National Initiatives

9.2.1. ANR MANDARIN

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

MANDARIN ("MANipulation Dextre hAptique pour opéRations INdustrielles en RV") is a 4-year ANR project (2012-2015). MANDARIN partners are CEA-List (coordinator), Inria/Hybrid, UTC, Haption and Renault. It aims 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 is 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 will be evaluated with a representative industrial application which is not feasible with currently existing technologies: the bi-manual manipulation of complex rigid objects and cables bundles.

9.2.2. ANR HOMO-TEXTILUS

Participants: Anatole Lécuyer [contact], Maud Marchal, Jonathan Mercier-Ganady.

HOMO-TEXTILUS is a 4-year ANR project (2012-2015). Partners of the project are : Inria/Hybrid, CHART, LIP6, TOMORROW LAND, RCP and potential end-user is Hussein Chalayan fashion designer. The objective of HOMO TEXTILUS is 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 is strongly oriented towards human science, with both user studies and sociological studies. The involvement of Hybrid team in the project consists in studying the design of next-gen prototypes of clothes embedding novel kinds of sensors and actuators. Envisionned sensors relate to physiological measurements such as with EEG (electroencephalograpohy and Brain-Computer Interfaces), EMG (muscular activity), GSR (galvanic skin response) or Heart Rate (HR). Envisionned actuators relate to new sensory stimulations such as vibrotactile displays or novel visual (eg LED) displays. These prototypes will thus be used in the various experiments planned in the project.

9.2.3. FUI Previz

Participants: Bruno Arnaldi [contact], Valérie Gouranton [contact], Emmanuel Badier, Thomas Boggini, Rozenn Bouville Berthelot, Cédric Le Cam.

Previz is a 3-year project (2013-2016) funded by the competitive cluster "Images et Réseaux". Previz involves 4 Academic partners (Hybrid/INSA Rennes, ENS Louis-Lumière, LIRIS, Gipsa-Lab) and 9 Industrial partners (Technicolor, Ubisoft, SolidAnim, loumasystem, Polymorph). Previz aims at proposing new previsualization tools for movie directors. The goal of Hybrid in Previz is 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 will end 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. ADT MAN-IP

Participant: Valérie Gouranton [contact].

The ADT MAN-IP is a 2-year project (2013-2015) funded by Inria for software support and development. MAN-IP involves two Inria teams: Hybrid and MimeTIC. MAN-IP aims at proposing a common software pipeline for both teams to facilitate the production of populated virtual environments. The resulting software should include functionalities for motion capture, automatic aquisition and modification, and high-level authoring tools.

9.2.5. ADT OpenViBE-NT

Participants: Anatole Lécuyer [contact], Jussi Lindgren [contact].

The ADT OpenViBE-NT is a 3-year project (2012-2015) funded by Inria for support and development of the OpenViBE software (section 6.1). OpenViBE-NT involves four Inria teams: Hybrid, Potioc, Athena, Neurosys - all being extensive users of OpenViBE. OpenViBE-NT aims at improving the current functionalities of OpenViBE platform, and helping in supporting its active and ever growing community of users.

9.2.6. Ilab CertiViBE

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

CertiViBE is a 1-year "Inria Innovation Lab" (2015-2016) 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 developing a novel version of the software wich should comply with medical certification rules.

9.2.7. IPL BCI-LIFT

Participants: Anatole Lécuyer [contact], Jussi Lindgren [contact], Andéol Evain, Lorraine Perronnet, Nataliya Kosmina.

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 - January 2018

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 contacts: Nicolas Roussel, 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.

9.4. International Research Visitors

9.4.1. *Visits of Scientists*

We have welcomed Dr. Antonio Capobianco from team IGG (Université de Strasbourg) between November 3rd and December 4th, 2015.

<div align="center" style="color:red">**ILDA Team**</div>

8. Partnerships and Cooperations

8.1. 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.

8.2. National Initiatives

8.2.1. 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.

8.2.2. 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: Emmanuel Pietriga (PI), André Spritzer.

8.3. European Initiatives

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

8.4. International Initiatives

8.4.1. Inria International Labs

Inria Chile / CIRIC. Since 2012, Emmanuel Pietriga is 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.

8.4.2. Inria International Partners

8.4.2.1. Informal International Partners

Japan Advanced Institute of Science and Technology (JAIST): René Vestergaard on the interactive visualization of complex networks in molecular biology.

Microsoft Research: Nathalie Henry Riche and Bongshin Lee on defining the value of interaction on complex visualization systems. Participants: Anastasia Bezerianos.

Northwestern University: Steven Franconeri and Steve Haroz on understanding the impact of animations on interactive visual exploration. Participants: Anastasia Bezerianos.

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

Universidad Carlos III de Madrid: Teresa Onorati and Paloma Diaz on the visualization of tweet feeds related to crisis events using a wall display, so as to help crisis monitoring and management. Participants: Anastasia Bezerianos, Emmanuel Pietriga.

8.4.3. Participation In other International Programs

Program MIT-France, Hae-Jin Song, summer 2015 (3-month senior student internship).

8.5. International Research Visitors

Steve Feiner, Professor of Computer Science, head of the Computer Graphics and User Interfaces Lab at Columbia University (March 2015).

Deb Agarwal and David Brown, LBNL Computational Research Division, University of California at Berkeley (June 2015).

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

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. *Labex Persyval*

Participants: Rémi Ronfard, Olivier Palombi, Armelle Bauer.

We received a doctoral grant from LABEX PERSYVAL, as part of the research program on authoring augmented reality (AAR) for PhD student Adela Barbelescu. Her thesis is entitled *directing virtual actors by imitation and mutual interaction - technological and cognitive challenges*. Her advisors are Rémi Ronfard and Gérard Bailly (GIPSA-LAB).

Additionally, this project funds the PhD thesis of Armelle Bauer which has started in October, co-advised by François Faure, Olivier Palombi, and Jocelyne Troccaz from TIMC-GMCAO. The goal is to tackle the scientific challenges of visualizing one's self anatomy in motion using Augmented Reality techniques.

7.1.2. *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), is a follow-up and a generalization of Dynam'it. The goal is to propose an integrated software for the animation and final rendering of high-quality movies, as an alternative to the ever-ageing Maya. It will include dynamics similarly to Dynam'it, as well as innovative sketch-based kinematic animation techniques invented a Imagine by Martin Guay and Rémi Ronfard. This contract, started in October, funds 2 engineers for 3 years.

7.2.2. *ANR CHROME (01/2012 - 08/2015)*

Participant: Rémi Ronfard.

Chrome is a national project funded by the French Research Agency (ANR). The project is coordinated by Julien Pettré, member of MimeTIC. Partners are: Inria-Grenoble IMAGINE team (Remi Ronfard), Golaem SAS (Stephane Donikian), and Archivideo (Francois Gruson). The project has been launched in september 2012. The Chrome project develops new and original techniques to massively populate huge environments. The key idea is to base our approach on the crowd patch paradigm that enables populating environments from sets of pre-computed portions of crowd animation. These portions undergo specific conditions to be assembled into large scenes. The question of visual exploration of these complex scenes is also raised in the project. We develop original camera control techniques to explore the most relevant part of the animations without suffering occlusions due to the constantly moving content. A long-term goal of the project is to enable populating a large digital mockup of the whole France (Territoire 3D, provided by Archivideo). Dedicated efficient human animation techniques are required (Golaem). A strong originality of the project is to address the problem of crowded scene visualisation through the scope of virtual camera control, as task which is coordinated by Imagine team-member Rémi Ronfard.

Three phd students are funded by the project. Kevin Jordao is working on interactive design and animation of digital populations and crowds for very large environments. His advisors are Julien Pettré and Marie-Paule Cani. Quentin Galvanne is working on automatic creation of virtual animation in crowded environments. His advisors are Rémi Ronfard and March Christie (Mimetic team, Inria Bretagne). Julien Pettre. Chen-Kin Lim is working on crowd simulation and rendering of the behaviours of various populations using crowd patches. Her advisors are Rémi Ronfard and March Christie (Mimetic team, Inria Bretagne). Julien Pettre.

7.2.3. AEN MorphoGenetics (10/2012 - 09/2015)

Participant: François Faure.

3-year collaboration with Inria teams Virtual Plants and Demar, as well as INRA (Agricultural research) and the Physics department of ENS Lyon. The goal is to better understand the coupling of genes and mechanical constraints in the morphogenesis (creation of shape) of plants. Our contribution is to create mechanical models of vegetal cells based on microscopy images. This project funds the Ph.D. thesis of Richard Malgat, who started in October, co-advised by François Faure (IMAGINE) and Arezki Boudaoud (ENS Lyon).

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 injurypredictionsthan 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 interestwhen 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 ergonomicsmodeling. The consortium will be balanced between industrial users (with seven European car manufacturers represented), academic users involved ininjury biomechanics, 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

- Laurent Grisoni (Univ. Lille / Inria): An HCI view of sketch-based interaction. (12/11/2015).

- Philippe Guillotel (Technicolor), Arnav Jhala (Univ. of California Santa Cruz), Mateu Sbert (University of Girona), Karan Singh (University of Toronto), participated to the Expressive Cinematography seminar (26/10/2015).

- Adrien Bousseau (Inria Sofia Antipolis): Computer Drawing Tools for Assisting Learners, Hobbyists, and Professionals (01/10/2015).

- Ludovic Hoyet (Inria Rennes), Perception of Biological Human Motion: Towards New Perception-Driven Virtual Character Simulations (10/09/2015).

- Michiel van de Panne (University of British Columbia), Animation Potpourri: New Models for Animated Vector Graphics, Motion Optimization, and Data-driven Animation (03/07/2015).

- Henri Gouraud, Histoire de l'ombrage de Gouraud (05/06/2015).

- Jean-Michel Dischler (Univ. Strasbourg), Procedural texturing from Example (28/05/2015).

- Paul Kry (MacGill University), Balancing Speed and Fidelity in Physics Based Animation and Control (23/04/2015).

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.

9.2.2. *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.

<div align="center">

MAVERICK Project-Team

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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. 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.

We are funded by the ANR for a joint research project on acquisition and restitution of micro-facet based materials.

two other Inria research teams, REVES in Sophia-Antipolis and iPARLA 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.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

We have an ongoing cooperation with the Université De Montréal (Derek Nowrouzhezarai, Pierre Poulin), dealing with light transport and isotropic filter decomposition in the spherical domain, based on zonal harmonic basis.

We also have an ongoing cooperation with Polytechnique de Montréal (Thomas Hurtut) dealing with procedural texture design and color transfer.

8.3. International Research Visitors

8.3.1. Visits to International Teams

8.3.1.1. Sabbatical programme

Soler Cyril

Date: Aug 2015 - Jul 2016

Institution: Université de Montréal (Canada)

8.3.1.2. Research stays abroad

Neyret Fabrice

Date: Jan 2015 - Mar 2015 and Nov 2015 - Mar 2016

Institution: WETA Digital (New-Zeland)

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

9.1.1.1. Cinecitta

Participants: Marc Christie [contact], Cunka Sanokho, Quentin Galvane, Christophe Lino, Hui-Yin Wu.

Cinecitta is a 3-year young researcher project funded by the French Research Agency (ANR) lead by Marc Christie. The project started in October 2012 and will end in March 2016. The main objective of Cinecitta is 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 propose a novel cinematographic workflow that features a dynamic collaboration of a creative human filmmaker with an automated virtual camera planner. We expect the process to enhance the filmmaker's creative potential by enabling very rapid exploration of a wide range of viewpoint suggestions. The process has the potential to enhance the quality and utility of the automated planner's suggestions by adapting and reacting to the creative choices made by the filmmaker. This requires 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 will gather feedback on our prototype by involving professionals (during dedicated workshops) and will perform user evaluations with students from cinema schools.

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 a metrics to measure the performance of users. It will be used to develop a technological system embedded on users to evaluate his performance and provide him with real-time feedback to correct potential errors.

9.1.3. ADT

9.1.3.1. ManIP

Participants: Franck Multon, Ludovic Hoyet.

The ADT-MAN-IP aims at proposing a common production pipeline for both MimeTIC and Hybrid teams. This pipeline intends to facilitate the production of populated virtual reality environments.

The pipeline starts with the motion capture of an actor, using motion capture devices such as a Vicon (product of Oxford Metrics) system. To do so, we need to design new methods to automatically adapt all motion captures data to an internal skeleton that can be reused to retarget the motion to various types of skeletons and characters. The purpose is then to play this motion capture data on any type of virtual characters used in the demos, regardless their individual skeletons and morphology. The key point here is to make this process be as automatic as possible.

The second step in the pipeline is to design a high level scenario framework to describe a virtual scene and the possible user's interactions with this scene so that he/she can interact with the story directly.

In this ADT we also connect these two opposite parts into a unique framework that can be used by non-experts in computer animation to design new immersive experiments involving autonomous virtual humans. The resulting framework can consequently be used in the Immersia immersive room for various types of application.

9.1.3.2. Immerstar

Participants: Franck Multon, Georges Dumont.

The ADT-Immerstar is drivenby 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 will have to homogeneize the software modules and development facilities in each platform, help installing new upgrades and to develop collaborative applications between the two sites.

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) - Computer Science Department - Pr. Tsai-yen Li

Start year: 2013

The application context targeted by this proposal is Interactive Virtual Storytelling. The growing importance of this form of media reveals the necessity to re-think and re-assess the way narratives are traditionally structured and authored. In turn, this requires from the research community to address complex scientific and technical challenges at the intersection of literature, robotics, artificial intelligence, and computer graphics. This joint collaboration addresses three key issues in virtual storytelling: (i) delivering better authoring tools for designing interactive narratives based on literary-founded narrative structures, (ii) establishing a bridge between the semantic level of the narrative and the geometric level of the final environment to enable the simulation of complex and realistic interactive scenarios in 3D, and (iii) providing a full integration of the cinematographic dimension through the control of high-level elements of filmic style (pacing, preferred viewpoints, camera motion). The project is founded on a past solid collaboration and will rely on the team's complementarity to achieve the tasks through the development of a joint research prototype.

9.2.1.2. 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. Inria International Partners

9.2.2.1. Informal International Partners

Hubert Shum, Northumbria University, Newcastle, UK, collaboration with Franck Multon with joint papers,

Edouard Auvinet, Imperial College London, UK, collaboration with Franck Multon with joint papers,

Alexandra Covaci, Middlesex University of London, collaboration with Franck Multon with joint papers,

Jean Meunier, Carl-Eric Aubin, and Maxime Raison, University of Montreal, collaboration with Franck Multon with joint papers,

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. MATRICE

24 month project. lead: Lille school of architecture. Partners: Telecom Lille, Ecole des mines de douai, Centrale Lille, Lille school of design. Subject: 3D printing for construction industry. Funding for MINT: 12 months engineer, 12 months post-doc.

8.1.2. Iconographie Numérique (Sept. 2015-Dec. 2018)

From sept. 2015 to dec. 2018.
Funding from MEL, 24 months for post-doctoral position.
Subject: Design of a digital tool for historians and archaeologists.

8.1.3. Art/science projects

Pauline de Chalendar (FreeHands project). Shown at Panorama exposition sept-dec. 2015, Fresnoy (Tourco-ing). Also shown at VISAP, IEEE Infoviz ArtTrack, august 2015, Chicago.
Pauline Delwaulle
Out of space: Mirror Lake Station Pictanovo project 2013-2015 in collaboration with Mathilde Lavesnne. Shown at "Portes ouvertes, La Malterie, October 17th to 19th 2014; "Expériences interactives" de Pictanovo, l'Hospice d'Havré, May 28th to July 10th 2015; La cartographie, Espace Culture de l'Université de Lille 1, October 6th to December 11th 2015; "Hyper-archéologie", Centre Arc-en-ciel de Liévin, January 29th to February 29th 2016

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. Smart-Store (12th FUI, 2011-2014, extended to 2015)

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

The aim of this project is to set up, in the context of retail, some middleware and hardware setup for retail interactive terminal, that allows customer to connect with their own smart-phone on a system that includes a large screen, and allows to browse some store offer, as well as pre-order and/or link to further reconsulting. SME Ides-3com leads this FUI, which also includes Immochan, Oxylane, and VisioNord. Grant for MINT is 301 Keuros. This project started on September 2012 (start of this project has been delayed due to administrative problems), for a duration of 36 months.

Associated competitivity cluster: PICOM (retail)

8.2.3. 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.

8.2.4. 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.

8.2.5. 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.

8.2.6. 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).

8.3. International Initiatives

8.3.1. Participation In other International Programs

8.3.1.1. Mac Gill University, Canada, (CIRRMT, Marcelo Wanderley)

Technological tool for an Opera, Two years project, Planned for January 2017. Composed by Arnaud Petit, written by Alain Fleischer.

8.3.1.2. Université de Liège

Application for project C-SHADE

8.3.1.3. Institut Superior Technico, Lisbon (Joaquim jorge)

Application for project C-SHADE

Mjolnir Team

8. Partnerships and Cooperations

8.1. National initiatives

8.1.1. 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 2015 publications: [23], [18], [27].

8.1.2. ParkEvolution (Carnot Inria - Carnot STAR, 2015-2016)
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/

8.1.3. 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/

8.2. European initiatives

8.2.1. Happiness (H2020-ICT-2014-1/ICT-03-2014/RIA, 2015-2018)
Participants: Thomas Pietrzak, Nicolas Roussel [correspondent].

The main objective of this project is to develop and evaluate new types of haptic actuators based on Advanced Thin, Organic and Large Area Electronics (TOLAE) technologies for use in car dashboards.

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

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

8.2.2. 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.

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

8.3. International initiatives

8.3.1. 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 2015 publications: [16].

8.4. International research visitors

8.4.1. Visits of international scientists

Visiting scholars:

- Marcelo Wanderley, 4 one week visits, Professor at McGill University, Canada
- Edward Lank, November 24-25th, Associate Professor at the University of Waterloo, Canada
- Mathieu Nancel, March-April, Postdoctoral researcher at the University of Waterloo, Canada

Internships:

- Jeronimo Barbosa, November-December, PhD student at McGill University, Canada
- Aakar Gupta, February-May, PhD student at University of Toronto, Canada

8.4.2. Visits to international teams

Two internships sponsored by Mitacs — Inria research awards:

- Alix Goguey: 4 months (June-September) at the University of Waterloo with Daniel Vogel
- Justin Mathew: 3 months (June-August) at McGill University with Catherine Guastavino and Marcelo Wanderley

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

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://team.inria.fr/potioc/scientific-subjects/papart/

Cap Sciences:
- Potioc has strong relationships with the Cap Sciences museum (http://www.cap-sciences.net/), especially through its Living Lab. In 2015, we have co-supervised a Master thesis on augmented interactive maps that was partly done at Cap Sciences and Inria-Potioc. We are currently investigating how this map prototype can be used in a smart city project with Cap Sciences.

Immersion:
- Potioc has strong relationships with Immersion. In 2015, Immersion and Potioc notably co-supervised a Master student (Maxime Daniel) on the topic "Évaluation de la charge de travail, de l'attention, et de la reconnaissance d'erreur dans un environnement interactif par analyse EEG".

9.2. National Initiatives

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.

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.

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 (e.g. a ball on the figure). 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 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)
- Project around BCI in the evaluation process, first meeting with all the partners was in October 2013
- 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: 2014-2015
- 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 will focus 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. Collaborations in European Programs, except FP7 & H2020

Assessing and Optimising Human-Machine Symbiosis through Neural signals for Big Data Analytics:

- duration: 2014-2018
- partners: Ulster University (UK)
- funding: DGA-DSTL project
- This project objective is to design new tools for Big Data analysis, and in particular visual analytics tools that tap onto human cognitive skills as well as on Brain-Computer Interfaces. The goal is to enable the user to identify and select relevant information much faster than what can be achieved by using automatic tools or traditional human-computer interfaces. More specifically, this project will aim at identifying in a passive way various mental states (e.g., different kinds of attention, mental workload, relevant stimulus perception, etc.) in order to optimize the display, the arrangement of the selection of relevant information.

9.3.2. Collaborations with Major European Organizations

Collaboration with the University of Sussex, Brighton, Interact Lab, UK (Head: Pr. Sriram Subramanian)

- We have strong relationships with Sriram Subramanian. This has led to joint paper publications, numerous visits and a co-supervision of a PhD thesis (Camille Jeunet).

Bordeaux Idex project "Conception de Système d'interfaces cerveau-ordinateur prenant en compte les facteurs humains afin d'optimiser l'apprentissage de l'utilisateur" for international PhD project

- partners: Bordeaux Segalen University (Handicap & Système nerveux team), Bristol University (BIG team)
- duration: October 2013 - September 2016

9.4. International Initiatives

9.4.1. Inria International Partners

9.4.1.1. Informal International Partners

- Pr. Roger N'KAMBOU, department of Computer Sciences at the UQAM (Université du Québec à Montréal) who is a specialist of Intelligent Tutoring Systems (ITS). We are collaborating with him to develop such a system in order to optimise human learning in Brain-Computer Interfaces (BCI), and thus improve the performances with such systems.
- We are collaborating with Dr. Cuntai Guan (I2R, Singapore), Pr. Jonathan Bromberg (Kansas University, USA) and Pr. Gerwin Schalk (Wadsworth center, USA) on ElectroCorticoGraphic (ECoG) signal analysis.
- We are collaborating with Prof. Johannes Schoening (Univ. Hasselt, Belgium), Prof. Beat Signer (Vrije Universiteit Brussel, Belgium) and Dr. Brent Hecht (University of Minnesota, USA) on customization of geographic maps.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Pr. Pierre Dillenbourg, EPFL, visited team Potioc in April, 2015
- Dr. Thorsten Zander, group leader at TU Berlin, Germany, visited team Potioc from November to December 2015 with two of his students (Lena M. Andreessen and Laurens R. Krol)
- Pr. Sriram Subramanian, University of Sussex, visited team Potioc in December 2015

9.5.2. Visits to International Teams

9.5.2.1. Research stays abroad

- Jérémy Frey was working at the INRS in Montreal, Canada, in the MuSAE (Multimedia/Multimodal Signal Analysis and Enhancemen) laboratory of Prof. Tiago H. Falk, from October to November 2015
- Camille Jeunet was working at the University of Sussex, Brighton, UK, in the Interact Lab of Pr. Sriram Subramanian, from November 2015 to January 2016.
- Fabien Lotte was working at the Sugiyama Laboratory, The University of Tokyo, Japan, from July to August 2015

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. Grand Emprunt

Culture 3D Clouds (started in October 2012, duration 3 years) is a national project aimed at devising a cloud computing platform for 3D scanning, documentation, preservation and dissemination of cultural heritage.

Information and communication technologies in the world offer new possibilities for cultural exchange, creation, education and shared knowledge to greatly expand the access to culture and heritage. Culture 3D Cloud is part of a process that aims to create a technical breakthrough approach in the field of digitization of heritage artifacts to allow the emergence of new viable business models. Today the field of 3D scanning artifacts heritage evolves slowly and only provides resources for researchers and specialists and the technology and equipment used for 3D scanning are sophisticated and require highly specialized skills. The cost is significant and limits the practicality. Culture 3D Clouds project aims at empowering the photographers and the distribution to the agencies and image banks that will develop a value chain to commercialize 3D reproductions demand for their customers and expand the market valuation of business assets (commercial publishers, public).

Partners: IGN, CMN, RMN, Inria, EISTI, CNRS-MAP, UCP-ETIS, CEA, HPC Project, ValEISTI, BeIngenious.

Web site: http://c3dc.fr/.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. IRON - Robust Geometry Processing

Type: IDEAS

Instrument: ERC Starting Grant

Duration: January 2011 - December 2015

Coordinator: Pierre Alliez

Inria contact: Pierre Alliez

Abstract: The purpose of this project is to bring forth the full scientific and technological potential of Digital Geometry Processing by consolidating its most foundational aspects. Our methodology draws from and bridges the two main communities (computer graphics and computational geometry) involved in discrete geometry to derive algorithmic and theoretical contributions that provide both robustness to noisy, unprocessed inputs, and strong guarantees on the outputs. The intended impact is to make the digital geometry pipeline as generic and ironclad as its Digital Signal Processing counterpart.

9.3. International Research Visitors

9.3.1. Visits of International Scientists

9.3.1.1. Internships

Venkata Kusupati (IIT Bombay): design of anisotropic metrics on surfaces.

Hao Fang (Ecole Centrale Paris): scale-space analysis of mesh simplification for urban scenes.

Guillaume Matheron (ENS Paris): an efficient approach to compute the optimal transportation cost for surface reconstruction.

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

9. Partnerships and Cooperations

9.1. National Initiatives

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

Participants: Laurence Danlos, Benoît Sagot, Chloé Braud, Marie Candito, Benoit Crabbé, Pierre Magistry, Djamé Seddah, Sarah Beniamine, 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" (see Section 4.6). 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 2015,Benoît Sagot, Marie Candito and Benoit Crabbé were respectively deputy-head of strand 6 on "Language Resources", strands 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.

9.1.2. *ANR*

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

Participants: Marie Candito, Mathieu Constant [principal investigator], Benoit 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 will be participate 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.

9.1.2.2. ANR project ASFALDA (2012 – 2016)

Participants: Marie Candito [principal investigator], Marianne Djemaa, Benoît Sagot, Éric Villemonte de La Clergerie, Laurence Danlos, Virginie Mouilleron, Vanessa Combet Meunier.

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 [45] 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.

9.1.2.3. 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 [65], [66], [67]. As regards discursive analysis, D-STAG formalism created by Laurence Danlos in the 00's has also been rewritten in ACG in 2015 [24] and enhanced with some preliminary linguistic work on attributions [39].

9.1.3. Other national initiatives

9.1.3.1. "Investissements d'Avenir" project PACTE (2012 – 2015)
Participants: Benoît Sagot, Kata Gábor, Pierre Magistry.

PACTE (*Projet d'Amélioration de la Capture TExtuelle*) is an "Investissements d'Avenir" project sumbitted within the call "Technologies de numérisation et de valorisation des contenus culturels, scientifiques et éducatifs". It started in November 2012, although the associated fundings only arrived at Alpage in July 2013.

PACTE's aims was the improvement of performance of textual capture processes (OCR, manual script recognition, manual capture, direct typing), using NLP tools relying on both statistical (n-gram-based, with scalability issues) and hybrid techniques (involving lexical knowledge and POS-tagging models). It was more specifically targeted to the application domain of written heritage. The project takes place in a multilingual context, and therefore aims at developing as language-independant techniques as possible.

PACTE involved 3 companies (Numen, formerly Diadeis, main partner, as well as A2IA and Isako) as well as Alpage and the LIUM (University of Le Mans). It brings together business specialists, large-scale corpora, lexical resources, as well as the scientific and technical expertise required.

9.1.3.2. FUI project COMBI (2014-2016)
Participants: Laurence Danlos, Vanessa Combet Meunier, Jacques Steinlin.

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.

9.1.3.3. Institut de Linguistique Française and Consortium Corpus Écrits 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 *Corpus Écrits* consortium, which is dedicated 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 Corpus Écrits 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).

9.2. European Initiatives

9.2.1. H2020 PARTHENOS

Participants: Laurent Romary, Charles Riondet.

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.

9.2.2. H2020 EHRI

Participants: Laurent Romary, 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.

9.2.3. H2020 Iperion

Participant: Laurent Romary.

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.

9.2.4. 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.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. EQUIPEX ORTOLANG

Project acronym: ORTOLANG [0]

Project title: Open Resources and TOols for LANGuage

Duration: September 2012 - May 2016 (phase I, signed in January 2013)

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 is 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 text-speech alignment and speech visualization tools.

9.1.2. ANR-DFG IFCASL

Project acronym: IFCASL

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

Duration: March 2013 - February 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.

The work involved the design and recording of a French-German learner corpus. French speakers were recorded in Nancy, wheras 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.

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

9.1.3. ANR ContNomina

Project acronym: ContNomina

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

Duration: February 2013 - July 2016

Coordinator: Irina Illina, MULTISPEECH

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).

9.1.4. ANR DYCI2

Project acronym: DYCI2 [0]

Project title: Creative Dynamics of Improvised Interaction

Duration: March 2015 - February 2018 (signed in October 2014)

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.

9.1.5. ANR JCJC KAMoulox

Project acronym: KAMoulox

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

Duration: January 2016 - January 2019 (signed in October 2015)

Coordinator: Antoine Liutkus, MULTISPEECH

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.

9.1.6. 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.

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[0] http://repmus.ircam.fr/dyci2/
[0] http://www.agence-nationale-recherche.fr/en/anr-funded-project/?tx_lwmsuivibilan_pi2[CODE]=ANR-12-CORP-0005

In this project, we are 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).

9.1.7. FUI RAPSODIE

Project acronym: RAPSODIE [0]

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

Duration: March 2012 - February 2016 (signed in December 2012)

Coordinator: eRocca (Mieussy, Haute-Savoie)

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

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

In this project, MULTISPEECH is involved for optimizing the speech recognition models for the envisaged task, and contributes also to 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.

9.1.8. 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.

9.1.9. ADT Plavis

Project acronym: Plavis

Project title: Platform for acquisition and audiovisual speech synthesis

Duration: January 2015 - December 2016

Coordinator: Vincent Colotte, MULTISPEECH

Abstract: The objective of this project is to develop a platform acquisition and audiovisual synthesis system (3D animation of the face synchronously with audio). The main purpose is to build a comprehensive platform for acquisition and processing of audio-visual corpus (selection, acquisition and acoustic processing, 3D visual processing and linguistic processing). The acquisition is performed using a motion capture system (Kinect-like) or from Vicon system or EMA system. We also propose to develop a 3D audiovisual synthesis system text to audio and 3D information of a talking head. The system will incorporate an animation module of the talking head to reconstruct the face animated with audio. During the first year of the project, we are setting up and testing the acquisition techniques that will be used. We have developed several tools to acquire the audiovisual data and to process it. A synchronization step was developed.

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[0]http://erocca.com/rapsodie

9.1.10. ADT VisArtico

Project acronym: VisArtico

Project title: Software for Processing, analysis and articulatory data visualization

Duration: November 2013 - October 2015

Coordinator: Slim Ouni, MULTISPEECH

Abstract: The Technological Development Action (ADT) Inria Visartico aims at developing and improving VisArtico, an articulatory vizualisation software (see 6.5). In addition to improving the basic functionalities, several articulatory analysis and processing tools are being integrated.

9.1.11. COРExp

Project acronym: COРExp

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

Duration: December 2014 - December 2016

Coordinator: S. Ouni, MULTISPEECH

Cofunded by Inria and Région Lorraine

Abstract: The main objective of this project is 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 signal). The main purpose is to acquire, process and analyze the corpus and to study the expressiveness; the results will be used for the expressive audiovisual speech synthesis system.

9.1.12. LORIA exploratory project

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

Duration: June 2015 - May 2016

Coordinator: S. Ouni, MULTISPEECH

Abstract : The aim of this project is the study of the various mechanisms involved in multimodal human communication that can be oral, visual, gestural and tactile. This project focuses 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. We will set up and integrate hardware and software acquisition. Thereafter, we will acquire and structure the multimodal data.

9.2. European Initiatives

9.2.1. Collaborations with major european organizations

Jon Barker: University of Sheffield (UK)

Robust speech recognition [25].

9.3. International Initiatives

9.3.1. Inria international partners

9.3.1.1. Informal international partners

Nobutaka Ono: National Institute for Informatics (NII, Tokyo, Japan)

Machine learning and source separation [14], [58], [69] (former Inria associate team).

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

Source separation [19], [21], [24].

Bryan Pardo, Northwestern University (Evanston, IL, USA)

Audio source separation [52].

Derry Fitzgerald, Nimbus Center, Cork Institute of Technology (Ireland)

Audio source separation [43], [67].

Taylan Cemgil, Bosphorus University (Istambul, Turkey)

Multimodal data analysis [44] and source separation [16].

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

Robust speaker recognition [53], [54].

9.3.2. Participation in other international programs

9.3.2.1. 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

National Coordinators: Juan Carlos GÓMEZ (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.

9.3.2.2. 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 corpora, 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.

9.4. International Research Visitors

9.4.1. Visits of international scientists

9.4.1.1. Internships

Liu Jen-Yu

Date: Apr 2015 - Sep 2015

Institution: NTU (Taiwan)

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PANAMA Project-Team

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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, . . .).

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. OSEO-FUI: S-POD: "Assistance à personnes en danger potentiel"

Participants: Frédéric Bimbot, Romain Lebarbenchon, Ewen Camberlein, Jérémy Paret, Vincent Soupé.

Duration: August 2012-December 2015

Research axis: 3.2

Partners: ERYMA, CAPT/FOTON, CASSIDIAN, KAPTALIA, KERLINK, le LOUSTIC and Telecom Bretagne

Coordinator: ERYMA

Description: S-POD gathers research teams and industrial partners to that aim at setting up a framework to process and fuse audio, physiological and contextual data. The goal is to design an embedded autonomous system able to detect situations of potential danger arising in the immediate environment of a person (military, police, CIT, fire, etc.)

Contribution of PANAMA: PANAMA is in charge of R&I activities related to the qualitative and quantitative analysis of information from the acoustic environment (intensity, direction of arrival, nature of noise sounds, properties of voices, etc.) as well as to the exploitation of these analyses. The need for real-time embedded processing induces specific constraints.

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, Pierre Machart, Luc Le Magoarou, Nancy Bertin, Nicolas Keriven, Yann Traonmilin, Laurent Albera, Gilles Puy, Thomas Gautrais, 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.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Pierre Vandergheynst, in July, Professor of Signal and Image Processing, EPFL (Chaire Internationale Inria)
- Gitta Kutyniok, in April, Professor, Technical University of Berlin

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

7. Partnerships and Cooperations

7.1. Regional Initiatives

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

SLAM: Schizophrenia and Language, Analysis and Modeling

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 SLAM project starts for three years at the Maison des Sciences de l'Homme de Lorraine (MSH–Lorraine, USR 3261). While this year work was dedicated to the test protocol definition, the coming years will be devoted to building an open-access corpus of pathological uses of language.

The first transcriptions of pathological interviews are analyses. The management chain was implemented for disfluencies and POS. Moreover, we have focused on implementing the treatment of lexicography issues and proposed an interface for SDRT-annotations.

Other participants are: Denis Apotheloz (ATILF, Université de Lorraine),Valérie Aucouturier (Centre Léo Apostel, Université Libre de Bruxelles), Katarina Bartkova (ATILF, Université de Lorraine), Fethi Bretel (CHS Le Rouvray, Rouen), Michel Musiol (InterPSY, Université de Lorraine), Manuel Rebuschi (Archives Poincaré, Université de Lorraine).

The SLAM project was supported by the MSH–Lorraine, USR 3261, and won a PEPS project HuMaIn (mission pour l'interdisciplinarité du CNRS). The CNRS part of the budget allowed the organization of the third workshop which gathers linguists, psychologists and computer scientists in December: http://discours. loria.fr.

The SLAM project was chosen for the bi-annual report of the CNRS MI as a major illustration.

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). 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.

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[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.

The complexity of the phenomena, of their formal description, and of their interactions, require to set up a testing and development environment for linguistic modeling. It will consist in extending and stabilizing a software implementing the functionalities of the ACG framework. It will provide a tool for experimentation and validation of the approach.

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.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

7.3.1.1. Sabbatical programme

Pogodalla Sylvain
> Date: Aug 2014 - Jul 2015
> Institution: HHU (Germany)

The objective of the research project dealt with studying the syntax-semantics interface. It was relying on two alternative approaches of this interface for mCSG: a unification based approach for Lexicalized Tree Adjoining Grammars (LTAG) [48], [49] as proposed in [44], [51], and a type-theoretic approach using Abstract Categorial Grammars (ACG) [6], [72], [73].

On the semantic side, the project focused on the modeling of quantification in Frame Semantics [40], [31], [59]. We proposed to use Hybrid Logic (HL) [27]. We developed a syntax-semantics interface with ACG to model scope ambiguity [18], as well as a syntax-semantics interface in LTAG for iterative events [23].

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[0] http://www.loria.fr/~pogodall/cauld/

<div align="center">

Chroma Team

</div>

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".

9.2. 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, [42]) 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 7.1.1 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 will start on february 2016 and will be codirected 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 in European Programs, except FP7 & H2020

Program: PHC (Barande) French-Czech bilateral project

Project acronym: MUROTEX

Project title: Multi-Agent Coordination in Robotic Exploration and Reconnaissance Missions

Duration: Jan. 2014 - Dec. 2015

Coordinator: O. Simonin & J. Faigl (Prague Univ.)

Other partners: CTU (Czech Republic), Inria Larsen team.

Abstract: The main objective of the project is to develop a distributed planning framework for efficient task-allocation planning in exploration and reconnaissance missions by a group of mobile robots operating in an unknown environment with considering communication constraints and uncertainty in localization of the individual team members. One main challenge is to decentralize the decision, in order to scaling up with large fleet of robots (existing solutions are centralized or depend on full communication).

9.3.3. 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).

- Czech Technical University CTU in Prague (Czech Republic)

Subject: Distributed algoritms for multi-robot cooperation (PHC "Murotex" 2013-15 and renewal).

- 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.

- SAMPEN
  Title: self adaptive mobile perception and navigation
  International Partner (Institution - Laboratory - Researcher):

  NTU (TAIWAN)

  Duration: 2014 - 2016
  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.

9.4.1.1. 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.

9.4.2. 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.

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

DEFROST Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

+ **IDeaS (ANR JCJC)**: this is a project targeted at per-operative guidance for interventional radiology proce-dures. 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. Defrost is involved with Magrit, MIMESIS and Nancy Hospital.

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

Partner 1: King's College, Robotics Dept (UK)

Soft robot modeling and control using pneumatic and hydraulic technology

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

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: http://comacina.org. 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

F. Stulp: Collaboration: with Olivier Sigaud of the Institut des Systèmes Intelligents (ISIR) et de Robotique of Université Pierre et Marie Curie (UPMC) [37].

F. Stulp: Collaboration: with Xavier Lamy of Laboratoire d'Intégration de Systèmes et des Technologies of the Commissariat à l'énergie atomique et aux énergies alternatives (CEA-LIST) and Pedro Rodriguez-Ayerbe and Sami Tliba of Supélec [57], [58]. Funded by Digiteo, project "PrActIx".

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.

A collaboration with the national InMediats project was organized around the Poppy project. InMediats is a national project gathering 6 science museums (Bordeaux, Rennes, Grenoble, Caen, Toulouse, Paris) that aims at setting large popular science actions allowing the general public to access the latest research and development http://inmediats.fr/le-programme/. In this context, the collaboration with the Flowers team consisted in setting up a network of educational activities around robotics and the use of the Poppy platform in the six towns, with the target to foster the discovery of robotics technologies and their societal dimensions: http://inmediats.fr/poppy-lhistoire-dune-collaboration-inter-centre/. In this context several successful workshops with the general public were organized.

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 Universitaet Darmstadt (Germany)

      Universitaet Innsbruck (Austria)

      Universitaet 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. http://www.3rdhandrobot.eu

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):

University of Columbia (United States) - Neuroscience - Jacqueline Gottlieb

Start year: 2013

See also: https://flowers.inria.fr/curiosity-information-seeking-and-attention-in-human-adults-models-and-experiments/

One of the most striking aspects of human behavior is our enormous curiosity, drive for exploration. From a child feverishly examining a new toy with its hands and its eyes, to a tourist exploring a new city, to a scientist studying the brain, humans incessantly want to know. This exuberant curiosity shapes our private and social lives, and is arguably a key cognitive feature that allows our species to understand, control and alter our world. We aim to develop a novel unified biological and computational theory, which explains curiosity in the domain of visual exploration and attention as a deliberate decision motivated by learning progress. This theory will build and improve upon pioneer computational models of intrinsic motivation elaborated in developmental robotics, and be empirically evaluated in the context of visual exploration in monkeys through behavioral and brain imaging techniques. This will be the first attempt at a biological-computational framework of intrinsic motivation and perceptual exploration and their underlying cognitive mechanisms.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

AL Vollmer and PY Oudeyer continued a major collaboration with Katharina Rohlfing (**Univ. Paderborn, Germany**) and Britta Wrede (**CITEC/Univ. Bielefeld, Germany**) on the study of how interactional structures help learners to acquire sensorimotor and linguistic skills in interaction with teachers, and based on the development of a new framework for conceptualizing pragmatic frames.

In the context of the Neurocuriosity project, a collaboration was initiated with Celeste Kidd, **Rochester Baby Lab, Univ. Rochester, US**.

In the context of the SMART-E Marie Curie Project (http://smart-e-mariecurie.eu), Yasmin Ansari from **SSSA, Pisa, Italy**, is visiting the Flowers team for 3 months for a collaboration involving the study of how algorithms for active learning of inverse models can be applied to learn soft robot control.

In the context of our projects on educational robotics research and applications, Didier Roy and PY Oudeyer have collaborated with Francesco Mondada, Morgane Chevallier and Gordana Gerber (**EPFL, Lausanne**), and Stéphane Magnenat and Fanny Riedo (**Mobsya association, Switzerland**).

Collaboration with Vittorio Loreto, Physics Department, Sapienza University of Rome, on statistical aspects of the Language Games. (W. Schueller and P.-Y. Oudeyer)

9.4.3. Participation In other International Programs

F. Stulp: Collaboration with Andrej Gams and Rok Vuga of the Josef Stefan Institute, Ljubljana, Slovenia. Funded by the "Programme Proteus 2015" for cooperations between France and Slovenia. Project "LoCoRoS".

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Marc Toussaint, University of Stuttgart, Sept 2015
- Michele Sebag, CNRS, Sept 2015
- Oliver Brock, Technical University of Berlin, Sept 2015
- Stephano Cerri, University of Montpellier, Sept 2015
- Pierre Bessière, Univ. Paris VI and CNRS, april 2015
- Verena Hafner, Univ. Berlin, Germany, april 2015
- Jean-Baptiste Mouret, Inria, april 2015
- Yasmin Ansari, SSSA, Italy, december 2015

9.5.2. Visits to International Teams

- Pierre-Yves Oudeyer visited the SPECS Lab, Univ. Pompeu Fabra, Barcelona
- Pierre-Yves Oudeyer visited ISIR, Univ. Paris VI
- Pierre-Yves Oudeyer visited LPNC/GIPSA Lab, Grenoble

9.5.2.1. Research stays abroad

- Manuel Lopes spent 2 weeks at the University of Columbia
- Anna-Lisa Vollmer is visiting Bielefeld University, Germany for a long-term research stay

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

- B. Senach participated in the regional event : Workshop Santé - Maison des Sciences de l'Homme (NICE)
- project *Le refuge-Lecture: accéssibilité à la compréhension d'un texte pour des personnes en situation de handicap (auditif, visuel, cognitif)*, Conseil général projet Santé
- CPER project MADORSON for the assistance to elderly people (with the STARS project)

9.2. National Initiatives

9.2.1. Other activities

9.2.1.1. FHU

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

9.2.1.2. Challenges and grants

- Submission to the I-Lab 2015 challenge (prize winner)
- Submission to Charles Foix Grant
- Submission to the call AUTON (CNRS) with Marc Relieu (Telecom ParisTech) (accepted)

9.2.1.3. Euthenia Start-up

Participants: Ting Wang, Bernard Senach, Jean-Pierre Merlet.

We pursued our actions to valuate technologies developed within HEPHAISTOS project team. The goal is to bring to the market an instrumented walker which provides to its users and to other stakeholder various information about walking performance. This year we proposed the creation of the Inria start-up Euthenia and we submitted to two national challenges. We won a prize for the I-Lab 2015 challenge (30 keuros) and were nominated for the Charles Foix Grant. Our Safe Walker was used as a pilot during the first Summer school of the European Institute of Technology and it was presented in Nice at the opening ceremony the Living Lab "27 Delvalle". For personal reasons the start-up is in stand-by for now but we hope to be able to reactivate it.

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), IN-GEMA (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. Inria International Partners

9.4.1.1. 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. Visit of International Scientists

We have received our joint PhD student J. Pickard from University of New Brunswick, K. Hanahara from Kobe University 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. HandiViz project - SATT Ouest Valorisation

Participants: François Pasteau, Marie Babel.

duration: 12 months.

This project started in June 2014. Thanks to a strong collaboration with Ergovie Company and the rehabilitation center Pôle Saint Hélier (Rennes), the semi-autonomous navigation solution designed for wheelchair systems (see Section 7.3.3) has been medically validated and tested by patients. The resulting technology is currently under transfer towards Ergovie (SATT/INSA funding). This technology, compliant with any off-the-shelf electrical wheelchair, is expected to be commercialized at mid 2016. We expect that this technology should be helpful for many handicapped people. In particular, intensive clinical trials have shown that such a system can lift the medical interdiction to drive wheelchairs for people who suffer from severe handicap such as hemispatial neglect or cerebral palsy.

9.1.2. 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 started in October 2013. It supports in part Suman Raj Bista's Ph.D. about visual navigation (see Section 7.3.1).

9.1.3. 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 shearlet transform. (see Section 7.6.5).

9.1.4. 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).

9.1.5. "Equipement mi-lourd Rennes Metropoles"

Participant: Paolo Robuffo Giordano.

no Irisa 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 6.12 has been purchased in part thanks to this grant.

9.2. National Initiatives

9.2.1. ANR P2N Nanorobust

Participants: Le Cui, Eric Marchand.

no. UR1 11FA310-06D, duration: 48 months.

This project started in November 2011 and will end in March 2016. It is composed of a consortium managed by Femto-ST in Besançon with LPN and Isir in Paris, Thalès and Lagadic group through the "Université de Rennes 1". Nanorobust deals with the development of micro- and nano-manipulation within SEM (Scanning Electron Microscope). We provided visual servoing techniques for positioning and manipulation tasks with a micrometer precision.

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 7.1.4).

9.2.3. ANR Platinum

Participants: Patrick Rives, Vincent Drevelle.

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 through Inria Sophia Antipolis. It aims at proposing novel solutions to robust long-term mapping of urban environments.

9.2.4. ANR SenseFly

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

no Irisa CNRS 50476, duration: 36 months.

The ANR "Jeune Chercheur" project SenseFly 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 6.12 has been purchased thanks to this grant.

9.2.5. PEA Decsa

Participants: Aurélien Yol, François Chaumette, Eric Marchand.

no Inria Rennes 6630, duration: 36 months.

This project started in November 2011 and ended in November 2015. It was composed of a consortium managed by Astrium/Airbus with the Novadem, Sirehna, Spot Image and Magellium companies, and with the Inria Lagadic and Steep groups (Peter Sturm). It was devoted to the development of navigation and perception algorithms for small drones in urban environment.

9.2.6. Oseo Romeo 2

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

no Inria Rennes 7114, duration: 48 months.

This project started in November 2012. It is composed of a large consortium managed by Aldebaran Robotics. It aims at developing advanced control and perception functionalities to a humanoid robot. It supports in part Suman Raj Bista's Ph.D. about visual navigation (see Section 7.3.1), as well as Nicolas Cazy's Ph.D. about model-based predictive control for visual servoing (see Section 7.2.3).

9.2.7. *Equipex Robotex*

Participants: Fabien Spindler, François Chaumette.

no Inria Rennes 6388, duration: 10 years.

Lagadic is one of the 15 French partners involved in the Equipex Robotex network. It is devoted to get significative equipments in the main robotics labs in France. In the scope of this project, we have got the humanoid robot Romeo (see Section 6.11).

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 2016

Coordinator: University of Surrey (United Kingdom)

Partners: Surrey Satellite Technology (United Kingdom), Astrium (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. [38]

9.3.1.2. Comanoid

Participants: Paolo Robuffo Giordano, François Chaumette.

Title: Multi-contact Collaborative Humanoids in Aircraft Manufacturing

Programm: H2020

Duration: January 2015 - January 2019

Coordinator: CNRS (Lirmm)

Partners: Airbus Groups (France), DLR (Germany), Universita Degli Studi di Roma La Sapienza (Italy)

Inria contact: François 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. Romans

Participants: Paolo Robuffo Giordano, Nicolo Pedemonte, Firas Abi Farraj, François Chaumette.

Title: Robotic Manipulation for Nuclear Sort and Segregation

Programm: H2020

Duration: May 2015 - May 2018

Coordinator: Univ. Birmingham (UK)

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

CNRS contact: Paolo Robuffo Giordano

The RoMaNS project aims at advancing the state of the art in autonomous, tele-operative and shared control for remote manipulation. This has far reaching cross-sector applications in nuclear, aerospace, oil and gas, space, food and agriculture. Within the nuclear industries of multiple EU states, it applies across the entire sector, such as waste processing, decommissioning, asset care, maintenance, repair, characterization and sampling. The novel technology that will be produced within this project will be applied to a very challenging and safety-critical nuclear "sort and segregate" industrial problem, which is driven by urgent market and societal needs. The purpose of nuclear sort and segregate is to place low-level waste in low-level storage containers, rather than occupying extremely expensive and resource intensive higher level storage containers and facilities. Also, Waste Requiring Additional Treatment (WRAT) will be either decontaminated, recycled, compacted, incinerated or grouted. Finally, any unstable waste items are sorted into a more suitable storage state. Indeed, it can be noted that cleaning up the past half century of nuclear waste, in the UK alone (mostly at the Sellafield site), represents one of the largest environmental remediation projects in Europe. Most EU countries have similar challenges. Many older EU nuclear sites (> 60 years in UK) contain large numbers of legacy storage containers, many of which have contents of mixed contamination levels, and sometimes unknown contents. Some of this waste have been temporarily stored in containers, which may need to be disrupted or cut open, to investigate their contents, before sorted and segregated. Any country that possesses a nuclear plant, even without a current backlog of legacy waste, will face similar challenges when they begin decommissioning. Vast quantities of highly contaminated plant machinery and infrastructure will have to be demolished, cut and resized, and the parts sorted and segregated. Much of this work can only be done by remote manipulation methods, because the high levels of radioactive material are hazardous to humans. In this respect, the RoMaNS project will address the following points: (i) development of novel hardware, and improvement the TRL level of existing experimental hardware, to enable robot arms and grippers with advanced capabilities, but which are suitable for deployment in high radiation environments; (ii) development of advanced autonomy methods for highly adaptive and generalizable automatic grasping and manipulation actions; (iii) development of hardware and software solutions for advanced bi-lateral tele-operation of arms and grippers; (iv) combination of autonomy and tele-operation methods using state-of-the-art understanding of mixed initiative planning, variable autonomy and shared control approaches; (v) delivery of a TRL 6 demonstration in an industrial plant-representative environment at the UK National Nuclear Lab Workington test facility, in close proximity to the Sellafield nuclear site.

9.4. International Initiatives

9.4.1. *Inria Associate Teams not involved in an Inria International Labs*

Participants: Marie Babel, Vishnu Karakkat Narayanan.

Sampen (Self Adaptive Mobile Perception and Navigation) is an Inria associated team with the Iceira Lab supervised by Prof Ren C. Luo at the National University of Taiwan. It has been accepted in 2014 for 2 years. The coordinator of the team for Inria is Anne Spalanzani from UPMF University at Grenoble. The other French participants are Marie Babel, Daney David (Phoenix group in Bordeaux) and Christian Laugier (e-Motion group in Grenoble).

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.

In the scope of this project, Marie Babel and Vishnu Karakkat Narayanan spent a one-week visit in Iceira Lab in April 2015. Vishnu Karakkat Narayanan was then invited to spend a three-month visit from August till November 2015 in that lab.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

- As a follow up to the long term collaboration with the "Centro de Tecnologia da Informação Renato Archer" (CTI) in Campinas (Brazil), Renato José Martins benefits a Ph.D. grant from the CNPq (2013-2017). He is co-directed by Patrick Rives and Samuel Siqueira Bueno from "Divisio de Robotica e Viseo Computacional" at CTI.

- Alexandre Krupa has a collaboration with Nassir Navab from the Technische Universität München concerning the joint supervision of Pierre Chatelain's Ph.D.

- Patrick Rives has a collaboration with Javier Gonzales-Jimenez from the University of Malaga (Spain). Eduardo Fernandez-Moral who received his Ph.D. in Malaga by September 2014, is currently on a Postdoctoral position in Sophia Antipolis.

9.4.3. Participation In other International Programs

The Lagadic group is one of the few external partners of the Australian Center for Robotic Vision roboticvision.org. It groups QUT in Brisbane, ANU in Canberra, Monash University and Adelaide University. In the scope of this project, Riccardo Spica spent a six-month visit at ANU collaborating with Prof Rob Mahony, and François Chaumette spend a short visit at QUT and ANU in November 2015.

9.5. International Research Visitors

9.5.1. Research stays abroad

- Pierre Chatelain spent a nine-month visit in Nassir Navab's lab at TUM, Germany, in the scope of his Ph.D. (see Section 9.4.2).

- Ricardo Spica spent a six-month visit in Rob Mahony's lab at ANU, Canbera, in the scope of the Australian Center of Robotic Vision (see Section 9.4.3).

- Vishnu Karakkat Narayanan spent a three-month visit in Ren Luo's lab at Iceira Lab, National Taiwan University, Taiwan, in the scope of his Ph.D as well as the SAMPEN associated team (see Section 9.4.1).

LARSEN Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. AME Satelor

Participants: François Charpillet, Maxime Rio, Nicolas Beaufort, Xuan Son Nguyen, Thomas Moinel, Mélanie Lelaure, Théo Biasutto-Lervat.

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.

9.1.2. PEPS PsyPhINe: Cogito Ergo Es

Participant: Amine Boumaza.

PEPS site Mirabelle (CNRS & University of Lorraine) gathering researchers from the following institutes: MSH Lorraine (USR3261), InterPsy (EA 4432), APEMAC, EPSaM (EA4360), Archives Henri-Poincaré (UMR7117), Inria Bordeaux Sud-Ouest, Loria (UMR7503). Refer to sec. 7.2.2.1 for further information.

9.2. National Initiatives

9.2.1. PIA LAR Living Assistant Robot

Participants: François Charpillet, Abdallah Dib.

Partners : Crédit Agricole, Diatelic, Robosoft
LAR project has the objective to designing an assistant robot to improve the autonomy and quality of life for elderly and fragile persons. The project started at the beginning of the year. 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 dynamic environment. Another issue is for the robot to be able to behave with acceptable social skills.

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. RESIBOTS
Participants: Jean-Baptiste Mouret, Dorian Goepp, Konstantinos Chatzilygeroudis, Vassilis Vassiliades, Federico Allocati.

Title: Robots with animal-like resilience

Program: H2020

Type: ERC

Duration: May 2015 - May 2020

Coordinator: Inria

Inria contact: Jean-Baptiste Mouret

Abstract: 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 damages 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, nor 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 open new research avenues for adaptive machines.

9.3.1.2. 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 about robust, goal-directed whole-body motion interaction with multiple contacts. CoDyCo will go beyond traditional approaches: (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) was 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.

9.3.2. Collaborations in European Programs, except FP7 & H2020

9.3.2.1. PHC MUROTEX
Participant: François Charpillet.

Program: Hubert Curien Partnerships

Project acronym: MUROTEX

Project title: Multi-agent coordination in robotics exploration and reconnaissance missions

Duration: Jan. 2014 – Dec. 2015

Coordinator: O. Simonin (INSA LYON)

Other partners: Jan Faigl at the Czech Technical University in Prague

Abstract: The main objective of the project is to develop a distributed planning framework for efficient task-allocation planning in exploration and reconnaissance missions by a group of mobile robots operating in an unknown environment with considering communication constraints and uncertainty in localization of the individual team members. One main challenge is to decentralize the decision, in order to scaling up with large fleet of robots (existing solutions are centralized or depend on full communication).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

9.4.1.1. Internships

- Valerio Modugno, PhD student at the Robotics Lab, DIAG, Sapienza (Rome, Italy), visited LARSEN for 9 months (Apr. 2015 – Dec. 2015) to work on learning of task priorities for a robotic arm.

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

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

9.1.1.1. 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.

9.1.1.2. 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.

9.1.2. FUI

9.1.2.1. 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.

9.1.3. 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 Pierre Merdrignac, Younes Bouchaala, Fernando Garrido Carpio and Zayed Alsayed.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. CityMobil2

Type: COOPERATION (TRANSPORTS)

Instrument: Large-scale integrating project

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/

9.2.1.2. Mobility2.0

Title: Co-operative ITS systems for enhanced electric vehicle mobility

Type: COOPERATION (TRANSPORTS)

Duration: September 2012 - February 2015

Coordinator: Broadbit (Slovakia)

Partners: ETRA (Spain), Barcelona Digital (Spain), ICCS (Greece), MRE (Italy), Armines (France), University of Twente (Netherlands), Privé (Italy), NEC (United Kingdom)

Inria contact: Jean-Marc Lasgouttes

Abstract: Mobility2.0 will develop and test an in-vehicle commuting assistant for FEV mobility, resulting in more reliable and energy-efficient electro-mobility. In order to achieve a maximum impact, Mobility2.0 takes an integrated approach of addressing the main bottlenecks of urban FEV mobility: "range anxiety" related to the limited FEV range, scarcity of parking spaces with public recharging spots, and the congestion of urban roads. Our integrated approach means the application developed by Mobility2.0 will utilize co-operative systems to simultaneously consider these bottlenecks, so that such an optimization can be achieved which still guarantees reliable transportation for each FEV owner. Mobility2.0 will focus on assisting the daily urban commute, which represents the bulk of urban mobility.

See also: http://mobility2.eu/

9.2.1.3. DESERVE

Title: DEvelopment platform for Safe and Efficient dRiVE

Duration: September 2012 - August 2015

Coordinator: VTT (Finland)

Partners: CRF (Italy), Armines (France), CONTINENTAL AUTOMOTIVE FRANCE SAS (France), FICOSA (Italy), Inria (France), TRW (Great Britain), AVL (Austria), BOSCH (Germany), DAIMLER (Germany), VOLVO (Sweden),...(26 partners)

Inria contact: Fawzi Nashashibi

Abstract: To manage the expected increase of function complexity together with the required reduction of costs (fixed and variable) DESERVE will design and build an ARTEMIS Tool Platform based on the standardization of the interfaces, software (SW) reuse, development of common non-competitive SW modules, and easy and safety-compliant integration of standardized hardware (HW) or SW from different suppliers. With innovative design space exploration (DSE) methods system design costs can be reduced by more than 15%. Hence, DESERVE will build an innovation ecosystem for European leadership in ADAS embedded systems, based on the automotive R&D actors, with possible applications in other industrial domains.

See also: https://artemis-ia.eu/project/38-deserve.html

9.2.1.4. AutoNet2030

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

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

9.2.1.5. FURBOT

Title: Freight Urban RoBOTic vehicle

Type: FP7

Instrument: Specific Targeted Research Project

Duration: November 2011 - December 2015

Coordinator: Genova University (Italy)

Partner: Bremach (Italy), ZTS (Slovakia), Universite di Pisa (Italy), Persico (Italy), Mazel (Spain), TCB (Portugal), Inria (France).

Inria contact: Fawzi Nashashibi

Abstract: The project proposes novel concept architectures of light-duty, full-electrical vehicles for efficient sustainable urban freight transport and will develop FURBOT, a vehicle prototype, to factually demonstrate the performance expected.

9.2.2. 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. See also: http://www.imobilitysupport.eu/imobility-forum/working-groups/automation

9.3. International Initiatives

9.3.1. Inria International Partners

9.3.1.1. 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. This year RITS hosted Sakriani Watiasri Sakti, assistant professor at NAIST.

- 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.

- Technical University of Sophia – Bulgaria: RITS is conducting a close partnership with the Technical University of Sophia (Department of Mechanical Engineering). Since 2009, Professor Plamen Petrov has been a visiting professor at Inria. He contributed in conducting common advanced researches with RITS researchers in the field of dynamic modeling and adaptive motion control for vehicles and robots. Joint works have been also driven to develop and validate platooning concepts for normal speed driving of automated vehicles.

9.3.2. Participation In other International Programs

- ASIA-ITC (STIC-ASIE) programme: project SIM-CITIES (2015-2016), "Sustainable and Intelligent Mobility for Smart Cities", coordinated by F. Nashashibi.
  Partners: RITS, IRCCyN/CNRS, NTU (Singapore), Dept. of Computer Science and Electrical Engineering Graduate School of Science and Technology Kumamoto University (Japan), Department of Automation of the Shanghai Jiao Tong University (SJTU University, China) and the Information and Communication Engineering and the MICA Lab (Vietnam). 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).

- ECOS Nord international program: cooperation between Simon Bolivar University – Venezuela and RITS. This program started effectively in 2014 with the visit of two researchers and a PhD student from each institute to the other institute. This year, Adriana Zurita Villamizar engineer (trainee) from SBU made several months stay at RITS. She worked in the field of intelligent control.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- **Plamen Petrov**, professor at Sofia University, Bulgaria, from July 2015 until September 2015.
- **Sakriani Watiasri Sakti**, assistant professor at NAIST, from February 2015. A part of the work done during her stay has been published in [38].

9.4.1.1. Internships

- **Aidos Ibrayev**, from Al-Farabi Kazakh National University, Kazakhstan.
- **Jose Emilio Traver Becerra and Myriam Vaca Recalde** from Universidad de Extremadura, Spain.
- **Jaycee Holmes** from Spelman College, U.S.A.
- **Adriana Zurita Villamiza** from Simon Bolivar University, Venezuela.

AYIN Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

- Seong-Gyun Jeong, Nazre Batool and Josiane Zerubia have been in contact with image processing experts for early clinical evaluation at Galderma R&D in Sophia Antipolis [http://www.galderma.com/About-Galderma/Worldwide-presence/R-D-Locations] to discuss AYIN's research on wrinkle detection.
- Zhao Liu and Josiane Zerubia discussed several times with Dr Catherine Queille-Roussel, CPCAD managing director at CHU Nice (Faculty of Medicine, Dermatology department, at l'Archet 2 hospital in Nice) about AYIN's research on semi-automatic acne detection.
- Josiane Zerubia have 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 on remote sensing.

9.2. International Initiatives

9.2.1. Inria International Partners

- Josiane Zerubia has been working for more than 20 years with MTA SZTAKI (Hungarian Academy of Sciences) in Budapest, Hungary, and with University of Szeged, Hungary.
- Josiane Zerubia has also a strong collaboration with University of Genoa, Italy, for more than 20 years.
- Finally, another collaboration with Mc Master University, Hamilton, Canada, started in 2012.

9.3. International Research Visitors

9.3.1. Visits of International Scientists

- 2 young researchers visited AYIN team during one week each: Ganchi Zhang, PhD student, working with Prof. Nick Kingsbury at University of Cambridge, UK, in March and Dr. Vladimir Krylov, post-doc researcher, working with Prof. Sebastiano Serpico and Prof. Gabriele Moser at University of Genoa, Italy in Nov.
- several senior researchers visited AYIN team during a few days this year: Prof. Qiyin Fang, Mc Master University, Hamilton, Canada, in June; Prof. Hassan Foroosh, University of Central Florida, Orlando, USA, in July; Prof. Rozen Dayhiot, Trinity College Dublin, Ireland, in October; Prof. Freddy Buckstein, Technion, Haifa, Israel, in November; Prof. Pascal Fua, EPFL, Lausanne, Switzerland, in November; Prof. Daniela Zaharie, West University of Timioara, Romania, in November and Prof. Tamas Sziranyi, MTA Sztaki and Univ. of Technology and Economics Budapest, Hungary in November.

9.3.1.1. Internships

- Ali Madooei, PhD student, supervised by Prof. Joseph Hayward from Simon Fraser University, Burnaby, Canada, got a Mitacs/Inria internship fellowship (Mitacs Globalink Research Award [https://www.mitacs.ca/en/programs/globalink/globalink-research-award-inria]) to work in AYIN team during 3 months (June to August) in collaboration with Josiane Zerubia and the research group of Prof. Qiyin Fang at Mc Master University and Juravinsky Cancer Center, Hamilton, Canada.

9.3.2. Visits to International Teams

- Seong-Gyun Jeong was invited in January to visit the Institute of Space and Earth Information Science (ISEIS, [http://www.iseis.cuhk.edu.hk/eng/]) at the Chinese University of Hong Kong (CUHK), China.
- Josiane Zerubia was invited during a few days in April at Trinity College Dublin, Ireland, to visit the School of Computer Science and Statistics [https://www.cs.tcd.ie/] and the School of Engineering [http://www.tcd.ie/Engineering/].

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LEAR Project-Team

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9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. 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 LEAR.

9.1.2. ANR Project Macaron

Participants: Julien Mairal, Zaid Harchaoui, 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.

9.1.3. MASTODONS Program CNRS - Project Titan

Participants: Zaid Harchaoui, Julien Mairal.

The project is concerned with machine learning and mathematical optimization for big data. The partners are from LJK (Grenoble), LIG (Grenoble), LIENS (ENS, Paris), Lab. P. Painleve (Lille). Principal investigator/leader: Zaid Harchaoui. Dates: Jan 2015-Dec. 2015

9.1.4. Equipe-action ADM du Labex Persyval (Grenoble) "Khronos"

Participants: Zaid Harchaoui, Massih-Reza Amini [LIG].

The partners of this project are from the laboratories LJK, LIG, GIPSA, TIMC, CEA. The principal investigators/leaders are Zaid Harchaoui (Inria and LJK), Massih-Reza Amini (LIG). The project started in Jan. 2014 and ends in Dec. 2016.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. AXES

Participants: Ramazan Cinbis, Matthijs Douze, Zaid Harchaoui, Dan Oneata, Danila Potapov, Cordelia Schmid, Jakob Verbeek, Clement Leray, Anoop Cherian.

This 4-year project started in January 2011 and ended in May 2015. Its goal is to develop and evaluate tools to analyze and navigate large video archives, eg. from broadcasting services. The partners of the project are ERCIM, Univ. of Leuven, Univ. of Oxford, LEAR, Dublin City Univ., Fraunhofer Institute, Univ. of Twente, BBC, Netherlands Institute of Sound and Vision, Deutsche Welle, Technicolor, EADS, Univ. of Rotterdam. See http://www.axes-project.eu/ for more information.

9.2.1.2. ERC Advanced grant Allegro

Participants: Cordelia Schmid, Karteek Alahari, Jerome Revaud, 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. International Initiatives

9.3.1. Inria International Partners

- **UC Berkeley:** This collaboration between Bin Yu, Jack Gallant, Yuval Benjamini, Adam Bloniarz (UC Berkeley), Ben Willmore (Oxford University) and Julien Mairal (Inria LEAR) 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. Yuansi Chen, from UC Berkeley visited LEAR in the summer 2015 to work on this project.

- **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. J. Mairal also started a collaboration with Peter Richtarik, professor at university of Edinburgh and Dominik Csiba (PhD student), on the topic of local low-rank matrix estimation.

- **MPI Tübingen:** C. Schmid collaborates with M. Black, a research director at MPI since 2013. She spent one month at MPI in January 2015. End of 2015 she was award a Humbolt research award funding a long-term research project with colleagues at MPI.

- **Technion:** J. Mairal started a collaboration with Yonina Eldar (Technion) and Andreas Tillmann (Darmstadt university) to develop dictionary learning techniques for phase retrieval. Andreas Tillmann visited the LEAR team for a week in May 2015. Their collaboration resulted in a paper accepted to the ICASSP'16 conference.

9.3.2. Participation In other International Programs

- **France-Berkeley fund:** The LEAR team was awarded in 2014 a grant from the France-Berkeley fund for a project between Julien Mairal and 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 for a period of one year, from November 2014 to April 2016. The funds are meant to support scientific and scholarly exchanges and collaboration between the two teams.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

Andreas Tillmann (Darmstadt university) and Dominik Csiba (Edinburgh university) visited Julien Mairal for a week, respectively in May and October 2015.

9.4.2. Visits to International Teams

- **Sabbatical program** Zaid Harchaoui was on sabbatical at New-York university, from October 2014 to September 2015.

LINKMEDIA Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. *CominLabs Project Linking Media in Acceptable Hypergraphs (LIMAH)*

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

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., 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.

8.2. National Initiatives

8.2.1. *ANR Project FIRE-ID*

Participant: Hervé Jégou.

Duration: 3 years, started in May 2012
Partner: Xerox Research Center Europe

The FIRE-ID project considers the semantic annotation of visual content, such as photos or videos shared on social networks, or images captured by video surveillance devices or scanned documents. More specifically, the project considers the fine-grained recognition problem, where the number of classes is large and where classes are visually similar, for instance animals, products, vehicles or document forms. We also assumed that the amount of annotated data available per class for the learning stage is limited.

8.2.2. *ANR Project Secular*

Participants: Laurent Amsaleg, Teddy Furon, Hervé Jégou, Ewa Kijak.

Duration: 3 years, started in September 2012
Partners: Morpho, Univ. Caen GREYC, Telecom ParisTech

Content-based retrieval systems (CBRS) are becoming the main multimedia security technology to enforce copyright laws or to spot illegal contents over the Internet. However, CBRS were not designed with privacy, confidentiality and security in mind. This comes in serious conflict with their use in these new security-oriented applications. Privacy is endangered due to information leaks when correlating users, queries and the contents stored-in- the-clear in the database. This is especially the case of images containing faces which are so popular in social networks. Biometrics systems have long relied on protection techniques and anonymization processes that have never been used in the context of CBRS. The project seeks to a better understanding of how biometrics related techniques can help increasing the security levels of CBRS while not degrading their performance.

8.2.3. *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.

8.2.4. *FUI 19 NexGenTV*

Participants: Vincent Claveau, Guillaume Gravier, Ewa Kijak, Pascale Sébillot.

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

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.

8.3. International Initiatives

8.3.1. *Inria Associate Teams not involved in an Inria International Labs*

8.3.1.1. *MOTIF*

Title: Unsupervised motif discovery in multimedia content

International Partner (Institution - Laboratory - Researcher):

Pontifícia Universidade Católica de Minas Gerais, Brasil - VIPLAB - Silvio Jamil Guimãraes

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

Duration: 2014 - 2017

See also: http://www-linkmedia.irisa.fr/motif

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.

8.3.2. Inria International Partners

8.3.2.1. Informal International Partners

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

8.3.3. 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
- STIC AmSud MAXIMUM Unsupervised Multimedia Content Mining
    - International coordinator: Guillaume Gravier, CNRS – IRISA, France
    - Scientific coordinators : Arnaldo de Albuquerque Araújo (Universidade Federal de Minas Gerais, Computer Science Department, NPDI); Benjamin Bustos (Universidad de Chile, Department of Computer Science, PRISMA); Silvio Jamil F. Guimarães (Pontifícia Universidade Católica de Minas Gerais, VIPLAB)
    - Jan. 2014 - Dec. 2015
- France Berkeley Fund Graph-NN: Computing and Manipulating Very Large Graphs of Nearest Neighbors
    - International coordinator: Laurent Amsaleg, CNRS – IRISA, France
    - Scientific coordinators : Michael Franklin (AMPLab, UC Berkeley)
    - Jun. 2015 - Dec. 2015

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Bùi Văn Thạch (Ph.D. Student)

Date: Oct 2015 - Nov 2015

Institution: National University of Sokendai, Japan

8.4.2. Visits to International Teams

Ahmet Iscen

Date: Apr 2015 - Jun 2015

Institution: McGill University, Montreal, Canada

8.4.2.1. Explorer programme

Balu Raghavendran

Date: Jul 2015 - Sep 2015

Institution: University of California Berkeley (United States of America)

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

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 Guevara 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. ANR

- ANR IDeaS (2012-2015)
  Participants: R. Anxionnat, M.-O. Berger, E. Kerrien.
  The IDeaS Young Researcher ANR grant explores the potential of Image Driven Simulation (IDS) applied to interventional neuroradiology. IDS recognizes the current, and maybe essential, incapacity of interactive simulations to exactly superimpose onto actual data. Reasons are various: physical models are often inherently approximations of reality, simplifications must be made to reach interactive rates of computation, (bio-)mechanical parameters of the organs and surgical devices cannot but be known with uncertainty, data are noisy. This project investigates filtering techniques to fuse simulated and real data. MAGRIT team is in particular responsible for image processing and filtering techniques development, as well as validation.

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 and AEN SOFA

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 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 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 Research Visitors

8.3.1. Visits to International Teams

8.3.1.1. Research stays abroad

Pierre-Frédéric Villard is spending one year and a half as a visiting professor in the Harvard Biorobotics Lab (http://biorobotics.harvard.edu) led by Professor Robert D. Howe in Harvard University, Cambridge (USA). The first year (Sept 2014-Aug 2015) was funded by the CNRS and the last semester (Sept 2015-Jan 2016) is funded by Inria. The research is on individual-specific heart mitral valve simulation with biomechanical models.

MORPHEO Project-Team

9. Partnerships and Cooperations

9.1. 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. *Motion analysis of laboratory rodents*

In order to evaluate the scalabililty of previous work on motion analysis of laboratory rodents, a collaboration has been initiated with the Institut Clinique de la Souris (ICS), in Institut de Génétique et de Biologie Moléculaire et Cellulaire (IGBMC). This institute is dedicated to phenotypping of mice and requires reliable motion analysis tools. A multicamera plateform has been deployed at ICS and will be exploited next year for tests ranging from one to two hundreds mice.

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. Analyzing video data of humans, collected for complex real-world events–extracting high-fidelity content, transferring raw data into knowledge–, detecting, reconstructing or understanding human motion are problems of key importance for the advancement of a variety of technological fields, including video coding, entertainment, culture, animation and virtual reality, intelligent human-computer interfaces, protection and security. The visual analysis of humans in real-world environments, indoors and outdoors, faces major scientific and computational challenges however. The proportions of the human body vary largely across individuals, any single human body has many degrees of freedom due to articulations, and individual limbs deform due to moving muscles and clothing. Finally, real-world events involve multiple interacting humans occluded by each other or by other objects, and the scene conditions may also vary due to camera motion or lighting changes. All these factors make appropriate models of human structure, motion and action difficult to construct and difficult to estimate from images. 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 was kicked off on November 26th, 2015, in Bucharest, Romania.

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 specialised in multi-camera acquisition systems, the SIP company specialised in multi-media 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. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. Re@ct

> Type: FP7 COOPERATION
>
> Defi: IMMERSIVE PRODUCTION AND DELIVERY OF INTERACTIVE 3D CONTENT
>
> Instrument: Specific Targeted Research Project
>
> Objectif: Networked Media ans Search Systems
>
> Duration: December 2011 - November 2014 (Evaluation January through March 2015)
>
> Coordinator: BBC (UK)
>
> Partner: BBC (UK), Fraunhofer HHI (Germany), University of Surrey (UK), Artefacto (France), OMG (UK).
>
> Inria contact: Jean-Sébastien Franco, Edmond Boyer
>
> Abstract:RE@CT will introduce a new production methodology to create film-quality interactive characters from 3D video capture of actor performance. Recent advances in graphics hardware have produced interactive video games with photo-realistic scenes. However, interactive characters still lack the visual appeal and subtle details of real actor performance as captured on film. In addition, existing production pipelines for authoring animated characters are highly labour intensive. RE@CT aims to revolutionise the production of realistic characters and significantly reduce costs by developing an automated process to extract and represent animated characters from actor performance capture in a multiple camera studio. The key innovation is the development of methods for analysis and representation of 3D video to allow reuse for real-time interactive animation. This will enable efficient authoring of interactive characters with video quality appearance and motion. The project builds on the latest advances in 3D and free-viewpoint video from the contributing project partners. For interactive applications, the technical challenges are to achieve another step change in visual quality and to transform captured 3D video data into a representation that can be used to synthesise new actions and is compatible with current gaming technology.

9.4. International Initiatives

9.4.1. Inria International Partners

9.4.1.1. Declared Inria International Partners

9.4.1.1.1. Joint projects with the Forestry Commission, UK

Two common works with an ecophysiologist from the British Forestry Commission, Eric Casella, are currently carried out. The first one aims at detecting, analysing and correcting acquisition noise from terrestrial laser scans (t-LiDAR) of plants and trees. The second one aims at reconstructing accurate virtual models of forest trees, for biomass measurement purposes. Both projects are funded by the University of Grenoble Alpes, through the AGIR framework. A PhD student, Romain Rombourg, is working on them.

9.4.1.2. Informal International Partners

The long term collaboration with TU Munich and Slobodan Ilic on human motion capture is ongoing with the work of Paul Huang [4] and [12] that was published at CVPR and IJCV this year. The work contributes with an approach that identifies and takes benefit of key poses when tracking shapes and 4D modeling.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

9.5.1.1. Internships

> Victoria Fernández Abrevaya
>> Date: 29th June 2015 - 27th September 2015
>> Institution: Universidad de Buenos Aires (Argentina)
>> Supervisor: Franck Hétroy-Wheeler

9.5.2. Visits to International Teams

9.5.2.1. Sabbatical programme

> Reveret Lionel
>> Date: Jul 2014 - June 2015
>> Institution: Brown University (United States)

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

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 MIX-CAM 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 Roboticss (France)

Ben-Gurion University of the Negev (Israel)

Friedrich Alexander Universitat, Erlangen, Nurenberg (Germany)

Imperial College London (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.

8.2.2. Inria International Partners

8.2.2.1. Informal International Partners

- Professor Sharon Gannot, Bar Ilan University, Tel Aviv, Israel,
- Professor Yoav Schechner, Technion, Haifa, Israel,
- Dr. Miles Hansard, Queen Mary University London,
- Dr. Thomas Hueber, Gipsa Lab, CNRS, Grenoble,
- Professor Daniel Gatica Perez, IDIAP Institute, Martigny, Switzerand,
- Professor Nicu Sebe, University of Trento, Trento, Italy,
- Professor Adrian Raftery, University of Washington, Seattle, USA.
- Dr. Zhengyou Zhang, Microsoft, Redmond WA, USA.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Professor Sharon Gannot (Bar Ilan University), February and October 2015.
- Dr. Romain Sérizel (Telecom Paris Tech), February 2015.
- Dr. Christine Evers (Imperial College), March 2015.
- Dr. Xavier Alameda-Pineda (University of Trento), November 2015.

8. Partnerships and Cooperations

8.1. Nationally Funded Projects

8.1.1. ANR project Involved

Participants: Amr Al-Zouhri Al-Yafi, Patrick Reignier [correspondant].

The partners are G-SCOP, LIG (Prima, IIHM), CEA Liten, PACTE, Vesta Systems and Elithis.

The project focuses on bringing solutions to building actors for upcoming challenges in energy management in residential buildings. Many technical solutions have been proposed so far, but without sufficiently considering sufficiently actors as key. It is generally considered that energy management can be done by measurement and computation means with few contributions of actors. The project explores a new paradigm: a user centric energy management system, where user needs and tacit knowledge drive the search of solutions. These are calculated thanks to 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

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 Neuro-Science. The aim of this project is to experimentally evaluate and compare current theories for mental modeling 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 provided a structured environment that we will use for experimental evaluation of current theories of mental modelling and emotional response during problem solving and social interaction.

The project is organised 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 which elicit particularly strong physiological reactions. In the final phase, we will use these recordings to evaluate the effectiveness of competing techniques for mental modelling 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, multi-modal 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.

8.1.3. EquipEx AmiQual4Home - Ambient Intelligence for Quality of Life

Participants: Stanislaw Borkowski, Sabine Coquillart, Joelle Coutaz, James Crowley [correspondant], Alexandre Demeure, Thierry Fraichard, Amaury Negre, Patrick Reignier, Dominique Vaufreydaz, Nicolas Bonnefond, Remi Pincent.

Ambient Intelligence, Equipment d'Excellence, Investissement d'Avenir

The AmiQual4Home Innovation Factory is an open research facility for innovation and experimentation with human-centered services based on the use of large-scale deployment of interconnected digital devices capable of perception, action, interaction and communication. The Innovation Factory is composed of a collection of workshops for rapid creation of prototypes, surrounded by a collection of living labs and supported by a industrial innovation and transfer service. Creation of the Innovation Factory has been made possible by a 2.140 Million Euro grant from French National programme "Investissement d'avenir", together with substantial contributions of resources by Grenoble INP, Univ Joseph Fourier, UPMF, CNRS, Schneider Electric and the Commune of Montbonnot. The objective is to provide the academic and industrial communities with an open platform to enable research on design, integration and evaluation of systems and services for smart habitats.

The AmiQual4Home Innovation Factory is a unique combination of three different innovation instruments: (1) Workshops for rapid prototyping of devices that embed perception, action, interaction and communication in ordinary objects based on the MIT FabLab model, (2) Facilities for real-world test and evaluation of devices and services organised as open Living Labs, (3) Resources for assisting students, researchers, entrepreneurs and industrial partners in creating new economic activities. The proposed research facility will enable scientific research on these problems while also enabling design and evaluation of new forms of products and services with local industry.

The core of the AmiQual4Home Innovation Factory is a Creativity Lab composed of a collection of five work-shops for the rapid prototyping of devices that integrate perception, action, interaction and communications into ordinary objects. The Creativity Lab is surrounded by a collection of six Living Labs for experimentation and evaluation in real world conditions. The combination of fabrication facilities and living labs will enable students, researchers, engineers, and entrepreneurs to experiment in co-creation and evaluation. The AmiQual4Home Innovation Factory will also include an innovation and transfer service to enable students, researchers and local entrepreneurs to create and grow new commercial activities based on the confluence of digital technologies with ordinary objects. The AmiQual4Home Innovation Factory will also provide an infrastructure for participation in education, innovation and research activities of the European Institute of Technology (EIT) KIC ICTLabs.

The AmiQual4Home Innovation Factory enables a unique new form of coordinated ICT-SHS research that is not currently possible in France, by bringing together expertise from ICT and SHS to better understand human and social behaviour and to develop and evaluate novel systems and services for societal challenges. The confrontation of solutions from these different disciplines in a set of application domains (energy, comfort, cost of living, mobility, well-being) is expected to lead to the emergence of a common, generic foundation for Ambient Intelligence that can then be applied to other domains and locations. The initial multidisciplinary

consortium will progressively develop interdisciplinary expertise with new concepts, theories, tools and methods for Ambient Intelligence.

The potential impact of such a technology, commonly referred to as "Ambient Intelligence", has been documented by the working groups of the French Ministry of Research (MESR) [29] as well as the SNRI (Stratégie Nationale de la Recherche et de l'Innovation).

The Amiqual4Home Innovation Factory has been constructed with the Atelier Numerique Technology incubator across the street from the Inria Grenoble Rhone-Alpes Research Center in Monbonnot. The workshops, storage space and multi-functional workspace occupy 300 square meters on the ground floor. The LovelyLoft smart home technologies living lab occupies the apartment on the ground and 1st floor formerly occupied by the building guardian. The entire building has been equipped with an extensive suite of sensors and an open building management system and is currently used as the smart energy living lab.

8.1.4. IRT Silver Economy

IRT Silver economy is a multi-year collaboration between the PRIMA team of Inria, Université Grenoble Alpes, CEA LETI and Schneider Electric to develop smart devices and services for healthy ageing. The project is funded by the IRT nanoelec and has begun during the final months of 2015.

Within this project, Inria PRIMA and Schneider Electric are have begun development of a smart LW infrared imaging sensor for fall detection. The target system would build on a embedded integrated sensor system constructed by PRIMA with Schneider electric in 2014 and 2015.

8.1.5. FUI PRAMAD

Participants: Maxime Portaz, Amaury Negre, Dominique Vaufreydaz [correspondant].

Pramad is a collaborative project about *Plateforme Robotique dÁssistance et de Maintien à Domicile*. There are seven partners:

- R&D/industry: Orange Labs (project leader) and Covéa Tech (insurance company),
- Small companies: Interaction games (game designer, note that Wizardbox, the original partner was bought by Interaction games) and Robosoft (robot).
- Academic labs: Inria/PRIMA, ISIR (Paris VI) and Hôpital Broca (Paris).

The objectives of this project are to design and evaluate robot companion technologies to maintain frail people at home. Working with its partners, PRIMA research topics are:

- social interaction,
- robotic assistance,
- serious game for frailty evaluation and cognitive stimulation.

8.2. International Initiatives

8.2.1. Inria International Labs

Anne Spalanzani is implied in the iceira lab (in cooperation with the CNRS laboratories LAAS, ISIR and Taiwan). The laboratory is hosted by the National University of Taiwan, it is supported for 5 years (2013-2018), and the collaborative research focuses on Human centered Robotics.

8.2.2. Inria Associate Teams

Sampen is a associate team managed by Anne Spalanzani and Ren Luo (NTU Taipei) and involves other inria researchers (David Daney for Inria Bordeaux and Marie Babel from Lagadic-Rennes). In the scope of thi associate team, Anne Spalanzani gave a seminar à NTU in may 2015. Vishnu Narayanan (PhD student co-directed by Anne Spalanzani and Marie Babel) and Aurélien Mallein (PhD student supervised by David Daney) spent 3 months at the Iceira Lab (Taipei) to work respectively on Navigation following conventions and Localization using heterogenous sensors.

8.3. European Projects

8.3.1. CATRENE Project AppsGate - Smart Home Application Gateway

Duration: june 2012 - June 2015

Coordinator: ST Microelectronics

Other partners: Pace, Technicolor, NXP, Myriad France SAS, 4MOD Technology, HI-IBERIA Ingenieria y Proyectos, ADD Semiconductor, Video Stream Network, SoftKinetic, Optrima, Fraunhofer, Vsonix, Evalan, University UJF/LIG, and Institut Telecom.

The Prima Project team has worked with 15 other partners to develop a new generation of set-top box for smart home applications. In close collaboration with ST Microelectronics and Immotronics, Prima has developed the core middleware components for plug and play integration of smart home devices for distributed smart home services, as well as interactive tools for End User Development of Smart Home services.

AppsGate has developed an Open Platform to provide integrated home applications to the consumer mass market. The set-top box is the primary point of entry into the digital home for television services including cable TV, satellite TV, and IPTV. AppsGate will transform the set-box into a residential gateway, capable of delivering multiple services to the home, including video, voice and data. PRIMA is involved in designing End User Development tools dedicated for the Smart Home

8.4. International Research Visitors

8.4.1. Visits to International Teams

8.4.1.1. Sabbatical programme

Fraichard Thierry

Date: May 2014 - June 2015

Institution: BIU (Israel)

SIROCCO Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

- T. Maugey has received a grant for scientific intallation from Rennes Metropole.
- The postdoc of Xin Su on multi-view data representation and compression is partly funded (at the level of 75%) by the Brittany region.

9.2. International Initiatives

9.2.1. Inria International Partners

9.2.1.1. Informal International Partners

- The study on guided image inpainting is carried out in collaboration with Prof. Pascal Frossard from EPFL (Ecole Polytechique Federal de Lausanne).
- The study on adaptive clustering with Kohonen self-organizing maps for second-order prediction has been carried out in collaboration with Prof. Philippe Salembier from UPC (Universitat Politecnica De Catalunya).

9.3. International Research Visitors

9.3.1. Visits of International Scientists

- Pr. Reuben Farrugia from Malta University, is spending one sabbatical year in the team from Sept. 2015 until August 2016.

<div align="center">

STARS Project-Team

</div>

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

9.1.1.1. 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.

9.1.1.2. 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.

9.1.2. Investment of Future

9.1.2.1. Az@GAME

Program: DGCIS

Project acronym: Az@GAME

Project title: Medical diagnosis aid tool for Alzheimer desease and similar pathologies (un outil d'aide au diagnostic médical sur l'évolution de la maladie d'Alzheimer et les pathologies assimilées).

Duration: January 2012- December 2015

Coordinator: Groupe Genious

Other partners: IDATE (FR), Inria(Stars), CMRR (CHU Nice) and CobTek(Nice University).

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

Abstract: This French project aims at providing evidence concerning the interest of serious games to design non pharmacological approaches to prevent dementia patients from behavioral disturbances, most particularly for the stimulation of apathy.

9.1.3. FUI

9.1.3.1. 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.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

9.2.1.1. CENTAUR

Title: Crowded ENvironments moniToring for Activity Understanding and Recognition

Programm: FP7

Duration: January 2013 - December 2016

Coordinator: Honeywell

Partners:

> Computer Vision Laboratory, Ecole Polytechnique Federale de Lausanne (Switzerland)
>
> honeywell, Spol. S.R.O (Czech Republic)
>
> Data Centric Technologies Group, Neovision Sro (Czech Republic)
>
> Centre for Intelligent Sensing, Queen Mary University of London (United Kingdom)

Inria contact: François Brémond

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.

9.2.1.2. PANORAMA

Title:Ultra Wide Context Aware Imaging

Programm: FP7

Duration: April 2012 - March 2015

Coordinator: Philips

Inria contact: François Brémond

PANORAMA aims to research, develop and demonstrate generic breakthrough technologies and hardware architectures for a broad range of imaging applications. For example, object segmentation is a basic building block of many intermediate and low level image analysis methods. In broadcast applications, segmentation can find people's faces and optimize exposure, noise reduction and color processing for those faces; even more importantly, in a multi-camera setup these imaging parameters can then be optimized to provide a consistent display of faces (e.g., matching colors) or other regions of interest. PANORAMA will deliver solutions for applications in medical imaging, broadcasting systems and security & surveillance, all of which face similar challenging issues in the real time handling and processing of large volumes of image data. These solutions require the development of imaging sensors with higher resolutions and new pixel architectures. Furthermore, integrated high performance computing hardware will be needed to allow for the real time image processing and system control. The related ENIAC work program domains and Grand Challenges are Health and Ageing Society - Hospital Healthcare, Communication & Digital Lifestyles - Evolution to a digital lifestyle and Safety & Security - GC Consumers and Citizens security.

9.2.1.3. DEM@CARE

Title: Dementia Ambient Care: Multi-Sensing Monitoring for Intelligent Remote Management and Decision Support

Type: FP7

Defi: Cognitive Systems and Robotics

Instrument: Industry-Academia Partnerships and Pathway

Objective: development of a complete system providing personal health services to persons with dementia

Duration: November 2011-November 2015

Coordinator: Centre for Research and Technology Hellas (G)

Other partners: Inria Sophia-Antipolis (FR); University of Bordeaux 1(FR); Cassidian (FR), Nice Hospital (FR), LinkCareServices (FR), Lulea Tekniska Universitet (SE); Dublin City University (IE); IBM Israel (IL); Philips (NL); Vistek ISRA Vision (TR).

Inria contact: François Brémond

Abstract: The objective of Dem@Care is the development of a complete system providing personal health services to persons with dementia, as well as medical professionals, by using a multitude of sensors, for context-aware, multiparametric monitoring of lifestyle, ambient environment, and health parameters. Multisensor data analysis, combined with intelligent decision making mechanisms, will allow an accurate representation of the person's current status and will provide the appropriate feedback, both to the person and the associated medical professionals. Multi-parametric monitoring of daily activities, lifestyle, behavior, in combination with medical data, can provide clinicians with a comprehensive image of the person's condition and its progression, without their being physically present, allowing remote care of their condition.

9.3. International Initiatives

9.3.1. Inria International Labs

9.3.1.1. Informal International Partners

9.3.1.1.1. 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.

9.3.1.1.2. Collaboration with U.S.A.:

Stars collaborates with the University of Southern California.

9.3.1.1.3. Collaboration with Europe:

Stars collaborates with Multitel in Belgium, the University of Kingston upon Thames UK, and the University of Bergen in Norway.

9.3.1.2. Other IIL projects

The ANR SafEE (see section 9.1.1.2) 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).

9.4. International Research Visitors

9.4.1. 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;
- Jesse Hoey, University of Waterloo, Canada;
- Adlen Kerboua, University of Skikda, Algeria;
- Caroala Strumia, University of Genova, Italy.

9.4.1.1. Internships

    Ujjwal Ujjwal

        Date: June 2015 - Nov 2015

        Institution: International Institute of Information, Hyderabad (India)

        Supervisor: François Brémond

    Ghada Bahloul

        Date: Jul 2015 - Sept 2015

        Institution: Ecole Polytechnique de Sousse (Tunisia)

        Supervisor: Rachid Guerchouche

    Kanishka Nithin Dhandapani

        Date: June 2015 - Nov 2015

        Institution: IIT Madras (India)

        Supervisor: Carlos Fernando Crispim Junior

    Ramiro Leandro Diaz

        Date: Jul 2015

        Institution: UNICEN, Buenos Aires, Argentina

        Supervisor: Carlos Fernando Crispim Junior

    Alvaro Gomez Uria Covella

        Date: Jan 2015 - Apr 2015

        Institution: Universidad Nationale de Rosario, Argentina

        Supervisor: Carlos Fernando Crispim Junior

9.4.2. Visits to International Teams

9.4.2.1. Research stays abroad

    Piotr Bilinski

- Date:Apr 2015- Aug 2015
- Institution: Honeywell, Spol. S.R.O (Czech Republic)

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

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.'

9.2.4. EIT-ICT labs: Mobile visual content analysis (Inria)

Participants: Ivan Laptev, Josef Sivic.

The goal of this project within the European EIT-ICT activity is to mature developed technology towards real-world applications as well as transfer technology to industrial partners. Particular focus of this project is on computer vision technology for novel applications with wearable devices. The next generation mobile phones may not be in the pocket but worn by users as glasses continuously capturing audio-video data, providing visual feedback to the user and storing data for future access. Automatic answers to "Where did I leave my keys yesterday?" or "How did this place look like 100 years ago?" enabled by such devices could change our daily life while creating numerous new business opportunities. The output of this activity is new computer vision technology to enable a range of innovative mobile wearable applications.

This is a collaborative effort with S. Carlsson (KTH Stockholm) and J. Laaksonen (Aalto University).

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) has visited Willow for one month in 2015. Prof. John Canny (UC Berkeley) has visited Willow during three months in 2015 within the framework of Inria's International Chair program.

9.4.1.1. Internships

Filip Srajer (Czech Technical University) has been a visiting MSc student at Willow in Feb 2015. Nishant Agrawal (IIIT, India) has been a visiting intern at Willow for three months in 2015. Yumin Suh (Seoul National Univ., South Korea) has been a visiting intern at Willow for five months in 2015. Michail Nikita (Moscow State Univ., Russia) has been a visiting intern at Willow for three weeks in 2015.