Activity Report 2013

Section Contracts and Grants with Industry

ABSTRACTION Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. License agreement

7.1.1.1. Astrée

In February 2009 was signed an exploitation license agreement between CNRS, École Normale Supérieure, and AbsInt Angewandte Informatik GmbH for the industrialization of the ASTRÉE analyzer. ASTRÉE is commercially available from AbsInt since January 2010. Continuous work goes on to adapt the ASTRÉE static analyzer to industrial needs, in particular for the automotive industry. Radhia Cousot is the scientific contact.

ALPAGE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

Alpage has developed several collaborations with industrial partners. Apart from grants described in the next section, specific collaboration agreements have been set up with the following companies:

- Verbatim Analysis (license agreement, transfer agreement, "CIFRE" PhD, see section 4.3),
- Lingua et Machina (DTI-funded engineer, see section 4.4), Viavoo,
- Yseop ("CIFRE" PhD of Raphael Salmon which started in 2012 on automatic text generation)
- CEA-List ("CIFRE" PhD of Quentin Pradet on the development of lexical resources which help annotating semantic roles; e.g., development of a French VerbNet)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

BPI France (ex OSEO) supports our work on superresolution methods in acoustics. It enabled us to establish a collaboration with Laboratoire d'Acoustique du Mans (LAUM).

ANGE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The team is engaged in two industrial contracts:

- **La compagnie du vent (subsidiary of GDF-Suez)** The team is intented to provide simulations of hydrodynamics in salt marshes This contract is shared with the BIOCORE Inria project-team and comes to 20.000 euros.
- **SAUR** Discussions have been engaged in 2013 and might lead to a research contract in 2014. This project would rely on the optimization of hydrodynamics in a lagoon in order to depollute it.

7.2. Bilateral Grants with Industry

The PhD thesis of P. Ung is financed by CNRS, by AMIES (French agency for mathematics in interaction with companies and the society) and by GeoHyd (now a part of ANTEA–group) whose mission is the management of integrated natural resources. The PhD comprises simulations of concrete cases by means of the EDF software Telemac.

AOSTE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Kalray MPPA256 experiments

As part of a larger collaborative programme between Inria and this company, new experimental machines equipped with Kalray MPPA256 manycore processor were provided to a small number of Inria teams. The processor itself consists of 16 processing clusters, each itself a 16-core processor (hence 256 cores altogether), The clusters are connected by an on-chip network, and the whole architecture (driven by a host, out-of-chip main CPU) may be programmed according to several computation models, some quite close from the MoCCs considered in our researches.

Part of this 10-month contract was meant to fund two internships, in our case on:

- The evaluation of performance (and most of all performance variability) of the various parts of the chip (in the Sophia Antipolis branch of the team). Results are discussed in section 6.5 .

- The evaluation of the possibility of code generation for the MPPA256 platform using the Lopht tool described in sections 5.4 ,6.6 .

7.1.2. Astrium/CNES PostDoc

Astrium Space Transportation (now part of Airbus Defence and Space) asked us if we could provide automatic methods for the design and implementation of embedded software and system/network configuration in an aerospace context. The objective is to reduce the design and validation costs (especially in case of system evolutions), while preserving an assurance level superior to that of the Ariane 5 flight program. We are exploring automation of the real-time allocation, scheduling, and code generation using the novel algorithms developed and implemented in the Lopht tool.

The post-doctoral position of Raul Gorcitz was funded on this contract.

7.1.3. Kontron CIFRE

This contract provides us means to partially support the PhD thesis of Mohamed Bergach (which is physically most of the time at Kontron Toulon). The topic is to study how to efficiently implement various sizes of the FFT (Fast Fourier Transform) algorithm on multicore and GP-GPU architectures from the range of processors used at Kontron, in order to understand in a second phase how to best allocate several such algorithms in parallel, as part of a single application, in the most efficient way (regarding performance but also power consumption and thermal constraints).

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ARAMIS Team

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7. Bilateral Contracts and Grants with Industry

7.1. Patents

Participants: Thomas Similowski [Inventor], Mathieux Raux [Inventor], Pierre Pouget [Inventor], Jacques Martinerie [Inventor], Mario Chavez [Inventor].

Patent title: Procédé de caractérisation de l'état physiologique d'un patient à partir de l'analyse de son activité électrique cérébrale, et dispositif de surveillance faisant application

Publication date: 07.11.2013

Publication number: WO 2013/164462 Al

Abstract: The invention relates to a method for detecting a physiological state of a patient deviating from a reference physiological state, in which, after having determined, in Q frequency band, R reference matrices which correspond to the reference physiological state, the following steps are repeated in a loop: carrying out measurements, in M time segments, of an electroencephalographic signal; filtering and centring the measurements in Q frequency bands to obtain and determine MxQ scaled matrices of spatial covariance; for each time segment m, calculating a deviation from the reference physiological state, and comparing each of the deviations from the reference physiological state to a predefined threshold. The invention also relates to a monitoring device.

ARLES Project-Team (section vide)

AXIS Project-Team (section vide)

BANG Project-Team (section vide)

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. Geometry

We contributed to some industrial applications, mainly:

- Aircraft industry: Design of winglets (with EADS)

  In this project, our aim was to improve the geometric preprocessing of the CAD models generation that were used for the manufacturing of the multi parted wing-fuselage configuration and the generation of the numerical grids for the corresponding numerical simulations. We try developing algorithms for automatic generation of winglets with different bending radii, angles and top views. Some of the methods for approximation, fairing, modeling and grid generation used for this task are in principle well known in literature. However, standard commercial CAD systems cannot be used for the modeling of the surfaces because they do not provide the interfaces to fulfill the special constraints, which stem from the design wishes and the manufacturing and the needs of the applied flow solver for the aerodynamics equations.

- NC Simulation (with Spring Technologies)

  The aim of this work was to rebuild a CAD file (Brep, STEP format) from the result of a machining simulation (set of triangles). Any CAM software would use this reverse engineered model for any further application (inspection / FEM / definition of further tool paths). Another expected application was to rebuild CAD files from old G -code programs for which the initial CAD files do not exist anymore (or had never been modeled in 3D). Spring NCSimul provides a set of triangles as a solid. This set is topologically closed and represents a single solid. All data could be used to help gather triangles by geometric entities and then to help compute the exact surfaces. Different types of machining operations have been considered: Machining of simple shapes: The movement of the tool generates the same kind of surfaces as the tool ones: planes, cylinders, torus, etc. and Machining of complex shapes: the tool moves on a surface (canonic surface as well as NURBS surface) along a point-to-point path. Here, the reverse engineering is far from straightforward and the surface recognition would be computed at a tolerance.

- Dam Construction (with CHIDI / Dassault System)

  Once the digital terrain modeling and the geological shapes are represented, dam design issue is one of the most important difficult applications for geological modeling. This issue considers a multiple geometric representation of geological and design features. The dam design is based on NURBS surfaces representation and parametric design is an important key point when modifying shape or geometrical parameters and properties. In the other hand, geological shapes are mesh-based (surface meshes for geometrical characteristics, and volume meshes for material and engineering properties). In the plant interaction, we have impact the dam basement on the geological modeling. That is to say, remove a solid to a mesh. Then map geological properties to the solid. At this time, there was no feasible well-designed NURBS-Mesh Boolean operation algorithm in both research and industrial field and the aim of our work was to develop a stable NURBS-Mesh Boolean operation algorithm. This long-term work was developed for the CHIDI Company (Chengdu) with the participation of Dassault System. Moreover, in order to provide simulations after the Earthquake in Sichuan, we first focused our work on the Boolean operation algorithms.

6.1.2. Computer Graphics

6.1.2.1. Image resizing (with Shanghai Film Studio)

We have developed an image resizing method that succeed in generating impressive results by using image similarity measure to guide the resizing process. An optimal operation path is found in the resizing space.

However, the slow resizing speed caused by inefficient computation strategy of the bidirectional patch matching becomes a drawback for practical use. Then, we proposed a novel method to address this problem. By combining seam carving with scaling and cropping, our method can realize content-aware image resizing very fast. We define cost functions combing image energy and dominant color descriptor for all the operators to evaluate the damage to both local image content and global visual effect. Therefore our algorithm can automatically find an optimal sequence of operations to resize the image by dynamic programming or greedy algorithm. We also extended our algorithm to indirect image resizing which can protect the aspect ratio of the dominant object in an image.

CASCADE Project-Team (section vide)

CLASSIC Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

An industrial contract with EDF R&D (cf. CIFRE PhD of Pierre Gaillard) has come into effect as of November 8, 2012, and will last 3 years.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Clime is partner with INERIS (National Institute for Environmental and Industrial Risks http://www.ineris.com/en) in a joint cooperation devoted to air quality forecast. This includes research topics in uncertainty estimation, data assimilation and ensemble modeling.

  Clime also provides support to INERIS in order to operate the Polyphemus system for ensemble forecasting, uncertainty estimations and operational data assimilation at continental scale.

- Clime is partner with IRSN http://www.irsn.fr/, the French national institute for radioprotection and nuclear safety, for inverse modeling of emission sources and uncertainty estimation of dispersion simulations. The collaboration aims at better estimating emission sources, at improving operational forecasts for crisis situations and at estimating the reliability of forecasts. The work is derived at large scale (continental scale) and small scale (a few kilometers around a nuclear power plant).

- Clime takes part to a joint Ilab with the group SETH (Numtech http://www.numtech.fr/). The objective is to (1) transfer Clime work in data assimilation, ensemble forecasting and uncertainty estimation, with application to urban air quality, (2) identify the specific problems encountered at urban scale in order to determine new research directions.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Cifre PhD accompanying contract with General Electric Transportation on urban railway time tabling optimization (2011-2014).

7.2. Bilateral Grants with Industry

- DTI ITI support for the industrialization of our Rules2CP modeling software and technological transfer to SME KLS-Optim (2011-2013).

CRYPT Team (section vide)

DEDUCTEAM Exploratory Action (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CRE Inria-Orange

"Distribution of the SINR in real networks"
participants: B Błaszczyszyn, M. K. Karray (Orange Labs) and H.P. Keeler (hired by Inria as a research engineer) started 01/11/2013, ends 01/11/2014

7.2. Bilateral Grants with Industry

7.2.1. Alcatel Lucent

The collaboration with Alcatel Lucent (France) went on with the postdoctoral position of Chandramani Singh, funded by the Alcatel–Lucent/Inria joint lab. This materilized into two publications on the game theoretic analysis of Spatial Aloha, including one paper to appear in the Proceedings of Infocom'14.

7.2.2. Qualcom

The collaboration with Qualcomm (USA) led to a new line of research on the analysis of MAC protocols in Vehicular Networks. This materilized into a publications on the analysis of CSMA in dense Vehicular Networks that appeared in the Proceedings of IEEE Infocom'13, and in the hiring of Tien Viet Nguyen in the team of T. Richardson at Qualcomm NJ.

7.2.3. CIFRE Orange

PhD: Miodrag Jovanović
supervisorss: Bartek Błaszczyszyn, M.K. Karray

7.2.4. CIFRE Technicolor

PhD: Mathieu Leconte
supervisors: Marc Lelarge, Laurent Massoulié
title: Load-balancing and resource-provisioning in large distributed systems

FORMES Team (section vide)

GALLIUM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *The Caml Consortium*

Participants: Xavier Leroy [correspondant], Damien Doligez, Didier Rémy.

The Caml Consortium is a formal structure where industrial and academic users of Caml can support the development of the language and associated tools, express their specific needs, and contribute to the long-term stability of Caml. Membership fees are used to fund specific developments targeted towards industrial users. Members of the Consortium automatically benefit from very liberal licensing conditions on the OCaml system, allowing for instance the OCaml compiler to be embedded within proprietary applications.

The Consortium currently has 11 member companies:

- CEA
- Citrix
- Dassault Aviation
- Dassault Systèmes
- Esterel Technologies
- Jane Street
- LexiFi
- Microsoft
- Mylife.com
- OCamlPro
- SimCorp

For a complete description of this structure, refer to http://caml.inria.fr/consortium/. Xavier Leroy chairs the scientific committee of the Consortium.

7.1.2. *OCamlPro*

Participant: Fabrice Le Fessant.

Fabrice Le Fessant is consulting for OCamlPro, a SME that provides services and tools to companies wanting to use OCaml as their development language.

GAMMA3 Project-Team

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

- Dassault Aviation, *Extraction de la topologie et simplification des détails géométriques*, P. Laug et H. Borouchaki, 66 k-euros, 2013-2015.
- Lectra, *Maillage et CAO paramétrée*, P. Laug et H. Borouchaki, 12 k-euros, 2013.

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. *Radiocéros*

Participant: Fabien Mathieu.

A contract has been signed between Inria, RadioCeros and the ARITT Center. Gang has provided a feasibility study on the subject of the use of Peer-to-peer mechanisms for high quality Internet radio.

6.1.2. *Alcatel*

Participants: François Durand, The-Dang Huynh, Leonardo Linguaglossa, Fabien Mathieu, Laurent Viennot.

Gang has a strong collaboration with Alcatel-Lucent. Fabien Mathieu has moved from Gang to Alcatel-Lucent in May 2013. We focus on three aspects of networks :

- François Durand is funded through an ADR with the LINCS for studying voting systems and how they can be used to take distributed decision in multipartite networks.
- The-Dang Huynh is funded through a CIFRE PhD. for developping pagerank techniques in the context of social networks.
- Leonardo Linguaglossa is funded through an ADR with Inria in the context of the joint laboratory for studying the feasibility of information centric networking with a special focus on routing aspects.

HIPERCOM2 Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. OCARI2

Participants: Ichrak Amdouni, Pascale Minet, Cédric Adjih, Ridha Soua.

Partners: EDF, Inria.

The OCARI (Optimization of Ad hoc Communications in Industrial networks) project, funded by ANR, started in February 2007 and ended in 2010, EDF the coordinator decided to continue the project that deals with wireless sensor networks in an industrial environment. It aims at responding to the following requirements which are particularly important in power generation industry and in warship construction and maintenance:

- Support of deterministic MAC layer for time-constrained communication,
- Support of optimized energy consumption routing strategy in order to maximize the network lifetime,
- Support of human walking speed mobility for some particular network nodes, (e.g. sinks).

The development of OCARI targets the following industrial applications:

- Real time centralized supervision of personal dose in electrical power plants,
- Condition Based Maintenance of mechanical and electrical components in power plants as well as in warships,
- Environmental monitoring in and around power plants,
- Structure monitoring of hydroelectric dams.

To meet the requirements of supported applications (remote command of actuators, tele-diagnostic...), new solutions are brought to manage several communication modes, ranging from deterministic data transfers to delay tolerant transfers. A key issue is how to adapt routing algorithms to the industrial environment, taking into account more particularly limited network resources (e.g.; bandwidth), node mobility and hostile environment reducing radio range. The OCARI project aimed at developing a wireless sensor communication module, based on IEEE 802.15.4 PHY layer. In 2013, Inria took part with EDF to the specification of a simplified OCARI stack for a porting to a 32 bit platform.

IMARA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Valeo – "Driver Monitoring". Objective: achieve the state of the art of existing devices, algorithms and systems performing driver monitoring in real-time with embedded sensors.

- ADM Concept – "TRANS'YVES: Valet de Parking Automatisé". Two objectives: realize the control boards of the steering and the acceleration pedal of an automated vehicle, realize the automated valet using a single camera for vehicle guidance in a parking.

- AXTER Automation – "Laser-based navigation in industrial plants". Confidential.

- Valeo – "V50 project". Objective: dealing with intersection by an automated vehicle using on-board perception. This is the framework of the PhD thesis of Guillaume Tréhard.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

PREMIA consortium: presently composed of Crédit Agricole CIB, and Natixis.

7.2. Bilateral Grants with Industry

Chair "Financial Risks" , Risk Foundation.
Partners: Ecole des Ponts ParisTech, Ecole Polytechnique, UPMC, Société Générale.

A. Alfonsi, B. Jourdain, B. Lapeyre.

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

6. Bilateral Contracts and Grants with Industry

6.1. Contracts and Grants with Industry

Many research activities of the project-team are conducted in close collaboration with private or public companies: CEA, SANOFI, Safety Line, ERAMET, IRDEP, EADS . The project-team is also supported by Office of Naval Research and European Office of Aerospace Research and Development, for multiscale simulations of random materials. All these contracts are operated at and administrated by the Ecole des Ponts.

6.2. National Initiatives

The project-team is involved in several ANR projects:

- the ANR MANIF focuses on the mathematical and numerical analysis of electronic structure models, such as, in particular, the Kohn-Sham model. It includes two research teams: researchers from the JL Lions Laboratory (Paris 6) and the Micmac team. It is coordinated by E. Cancès.
- E. Cancès is involved in the ANR BECASIM, which is concerned with the numerical simulation of Bose-Einstein condensates. This ANR has been accepted in June 2012, and is coordinated by I. Danaila (Université de Rouen).
- C. Le Bris participates to the ANR EMAQS. The scientist in charge is Karine Beauchard (CMLS, Ecole polytechnique).
- T. Lelièvre is member of the ANR-project "STAB" (PI: I. Gentil, Université de Lyon).

In addition, the team is participating in

- the GdR Quantum dynamics. This interdisciplinary research network is focused on physical and mathematical problems related to the time evolution of quantum systems (transport problems, nonequilibrium systems, etc),
- the GdR CoDFT,
- the GdR Maths et entreprise,
- the GdR correl (correlated methods in electronic structure computations),
- the GDR-CNRS 2434 Analyse des Equations aux Dérivées Partielles.

The MICMAC team project is involved in two Labex, namely the Labex Bezout (started in 2011) and the Labex MMCD (started in 2012).

We have invited the following National researchers to visit our team:

- A. Lozinski (University of Besançon): April 8-12 and Dec 16-20, 2013.

MOKAPLAN Exploratory Action (section vide)

MUTANT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Qwant

Together with Qwant, the MuTant team is in the process of defining and developing the Antescofo accompaniment engines for the entertainment industries on various mobile terminals.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Kalray 20K grant including the donation of an MPPA Developer workstation (with MPPA 256 accelerator) and support for a short-term research project (2 months of postdoc).
- Google Doctoral Fellowships of Tobias Grosser and Robin Morisset.

PI.R2 Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts and Grants with Industry

- Oberthur Technologies
  Oberthur Technologies is the World second largest provider of security and identification solutions and services based on smart card technologies for mobile, payment, transport, digital TV and convergence markets. Since 2007, SALSA co-supervised 3 internships of first year master student on cryptology in smart-cards, and one internship of a 2nd year master student. The goal of this last internship was to study the feasibility of implementing multivariate schemes in constrained environments (typically a smart card). A new jointly supervised PhD thesis (PolSys/Oberthur) has start in march 2012.

- Gemalto
  Gemalto is an international IT security company providing software applications, secure personal devices such as smart cards and token, etc.Governments, wireless operators, banks, and enterprises use Gemalto's software and personal devices to deliver mobile services, payment security, authenticated cloud access, identity and privacy protection, eHealthcare, eGovernment, transport ticketing and machine to machine (M2M) communications applications.

POMDAPI Project-Team

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

RTE (*Réseau de Transport de l'Électricité*) financially supports the supervision of the PhD thesis of C. Josz, through a convention that is part of the Cifre, which also partly finances the thesis. J. Ch. Gilbert is the thesis advisor.

Andra (*Agence Nationale pour la gestion des Déchets Radioactifs*) has sponsored the PhD of T. T. P. Hoang, (surpervised by J. E. Roberts, C. Japhet and M. Kern) on space–time domain decomposition methods for modeling ransport in porous media. This work was part of the Andra–Inria research agreement. The thesis was defended in December 2013 [1].

This work will be continued in the PhD of S. Ali Hassan (supervised by M. Vohralík), to integrate a posteriori error estimated, and adaptive stopping criteria for the iterative methods.

IFPEN (*Institut Français du Pétrole Énergies Nouvelles*) supports a collaboration on numerical methods for the flow simulation in porous media with fractures for modeling sedimentary basins or oil reservoirs. This collaboration concerns J. E, Roberts and J. Jaffré on the Inria side and I. Faille and A. Fumagalli on the IFPEN side.

5.2. Bilateral Grants with Industry

M. Vohralík, together with Vivette Girault (Université de Paris 6), have led the ERT (*Équipe de Recherche Technologique*) project between the Laboratoire Jacques-Louis Lions (LJLL) and IFPEN on "enhanced oil recovery and geological sequestration of CO_2: mesh adaptivity, a posteriori error control, and other advanced techniques". Project with an industrial partner designed to *overcome a technological issue*.

PROSECCO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Contract with Airbus (http://www.airbus.com/), on the modeling and verification of avionic security protocols. Participant: Bruno Blanchet. From October to December 2013.

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

5. Bilateral Contracts and Grants with Industry

5.1. Contracts

- CRE with Orange Labs " Dynamical Optical Networking in the Internet". Contract on bandwidth allocation algorithm in optical networks. Duration 2 years starting from 01/01/12.

- CELTIC-Plus Saser "Safe and Secure European Routing" submitted. RAP participates in the section on optical networks. Participants include Orange labs, Alcaltel-Lucent, Telecom Institute, ENSSAT as well as a number of German laboratories. Duration three years.

- ANR Project "CONNECT: Content-Oriented Networking: a New Experience for Content Transfer". The proposal submitted to the VERSO programme has been accepted. The planned starting date is January 2011 and the project is scheduled to last 2 years. The lead partner is Alcatel-Lucent Bell Labs France and the other partners are RAP, Inria/PLANETE, Orange LAbs, TelecomParisTech, UPMC.

- PGMO project "Systèmes de véhicules en libre-service: Modélisation, Analyse et Optimisation" with G-Scop (CNRS lab, Grenoble) and Ifsttar. From 1 to 3 years. Starting at 1/10/2013.

- The ANR Boole contract (Models for random Boolean functions and applications) has been transferred from the Algorithms project, and the funding will last until August 2013.

- PhD grant CJS (Contrat Jeune Scientifique) Frontières du vivant of INRA for Emanuele Leoncini.

- PhD grant CJS (Contrat Jeune Scientifique) Frontières du vivant of INRA for Renaud Dessalles.

5.2. Bilateral Grants

- A bilateral project PHC Tournesol funded by Campus France (formerly Egide) will cover the costs of exchanges between *Nicolas Broutin* and Stefan Langerman (FNRS, UL Brussels). The topic of the collaboration is coloration of random hypergraphs for channel assignment in networks.

REGAL Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Metaware Technologies, 31,250 euros for the development of Coccinelle. Metaware offers software renovation services. It is using Coccinelle to modernize a large legacy C application for a client.

- Orange Lab, 90,000 euros for 3 PhD Students (CIFRE), Ralucca Diaconu, Guthemberg Da Silva Silvestre, and Koutheir Attouchi

- Renault, 60,000 over 3 years (2013 - 2016) for a CIFRE. In the context of a Cifre cooperation with Renault, we are supervising the PhD of Antoine Blin on the topic of scheduling processes on a multicore machine for the automotive industry. The goal is to allow real-time and multimedia applications to cohabit on a single processor. The challenge here is to control resource consumption of non real-time processes so as to preserve the real-time behavior of critical ones. As part of this cooperation, we will use the Bossa DSL framework for implementing process schedulers that we have previously developed.

6.2. Bilateral Grants with Industry

6.2.1. *Joint PhD: CRDTs for Large-Scale Storage Systems, with Scality SA*

We are starting a research project (CIFRE: industrial PhD) with the French start-up company Scality, on CRDTs for large scale storage systems.

Storage architectures for large enterprises are evolving towards a hybrid cloud model, mixing private storage (pure SSD solutions, virtualization-on-premise) with cloud-based service provider infrastructures. Users will be able to both share data through the common cloud space, and to retain replicas in local storage. In this context we need to design data structures suitable for storage, access, update and consistency of massive amounts of data at the object, block or file system level.

Current designs consider only data structures (e.g., trees or B+-Trees) that are strongly consistent and partition-tolerant (CP). However, this means that they are not available when there is a network problem, and that replicating a CP index across sites is painful. The traditional approaches include locking, journaling and replaying of logs, snapshots and Merkle trees. All of these are difficult to scale using generic approaches, although it is possible to scale them in some specific instances. For instance, synchronization in a single direction (the Active/Passive model) is relatively simple but very limited. A multi-master (Active/Active) model, where updates are allowed at multiple replicas and synchronization occurs in both directions, is difficult to achieve with the above techniques.

Our previous work has shown that many storage indexing operations commute; this enables a the highly-scalable CRDT approach. For those that do not, Red-Blue-Purple approach (Section 5.3.6) appears promising.

The objective of the joint research will be to design new algorithms for object, block and file storage systems. Note that these thee kinds of systems, although related, support different kinds of operations, and have different consistency requirements.

REO Project-Team (section vide)

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- **High Tech Communications Services** ($09/13 \rightarrow 09/14$)
  Recovering a convolutional encoder followed by a block interleaver
  19 kEuros

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Technicolor: "Tensor factorization algorithms for recommendation systems".
- Xerox: CIFRE PhD student "IMAGE2TXT: From images to text".
- Microsoft Research: "Structured Large-Scale Machine Learning". Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challeges faced by machine learning in the " big data" era : structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites (Paris-Rocquencourt and Grenoble) and four MSR sites (Cambridge, New England, Redmond, New York).

7.2. Bilateral Grants with Industry

- Google Research Award: "Large scale adaptive machine learning with finite data sets"

7. Bilateral Contracts and Grants with Industry

7.1. CGAO_v2 contract: glycemic control system

Participants: Alexandre Guerrini, Michel Sorine.

Our work on glycaemic control done in the framework of the CIFRE contract of A. Guerrini [31] with LK2 (Tours, France), has led to develop an improved controller, CGAO_v2 (see Sections 4.3 and 5.3). This year, our rights on CGAO_v2 have been sold to LK2 which has packaged it with a user interface in a system used by Fresenius-Kabi in their control software *master GC*.

7.2. SciWorks Technologies contract: development of K-Assessor

Participants: Habib Jreige, Michel Sorine.

The development and a first application of K-Assessor (see Section 5.6) has been done with SciWorks Technologies: risk analysis for *master GC*, a software of Fresenius-Kabi dedicated to glycemic control assistance based on the control algorithm CGAO_v2 (see Section 5.3).

SMIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The SMIS project has a long lasting cooperation with Gemalto, the world's leading providers of microprocessor cards. Gemalto provides SMIS with advanced hardware and software smart card platforms which are used to validate numbers of our research results. In return, SMIS provides Gemalto with requirements and technical feedbacks that help them adapting their future platforms towards data intensive applications. While no bilateral contract exists between Gemalto and SMIS, we are partners in several projects. Meanwhile, we are developing partnerships with SMEs capable of building ad-hoc hardware prototypes conforming to our own design.

7.2. DMSP3 Yvelines District Grant (Nov 2013 - Nov. 2014)

Partners: Inria-SMIS (coordinator), Gemalto, UVSQ, Santeos.
SMIS funding: 75k€.
http://www-smis.inria.fr/_DMSP/accueil.php

Electronic Health Record (EHR) projects have been launched in most developed countries to increase the quality of care while decreasing its cost. Despite their unquestionable benefits, patients are reluctant to abandon their control of highly sensitive data to a distant server. The objective of the DMSP project is to complement a traditional EHR server with a secure and mobile personal medical folder (1) to protect and share highly sensitive data among trusted parties and (2) to provide a seamless access to the data even in disconnected mode. The DMSP architecture builds upon the technology designed in the PlugDB project (see above). This architecture has been designed and developed under grant DMSP1 ended in 2010. It has been experimented in the context of a medical-social network providing care and services at home for elderly people. The experiment in the field, founded by grant DMSP2, lasted from September 2011 to December 2012 with volunteer patients and practitioners in the Yvelines district. The goal of grant DMSP3 (Nov 2013 - Nov 2014) is to correct the imperfections observed during DMSP2 and port our prototype in an open hardware platform with the final objective to set up a technology transfer.

WILLOW Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. EADS (ENS)

Participants: Jean Ponce, Josef Sivic, Andrew Zisserman.

The WILLOW team has had collaboration efforts with EADS via tutorial presentations and discussions with A. Zisserman, J. Sivic and J. Ponce at EADS and ENS, and submitting joint grant proposals. In addition, Marc Sturzel (EADS) is doing a PhD at ENS with Jean Ponce and Andrew Zisserman.

7.2. MSR-Inria joint lab: Image and video mining for science and humanities (Inria)

Participants: Leon Bottou [MSR], Ivan Laptev, Maxime Oquab, Jean Ponce, Josef Sivic, Cordelia Schmid [Inria Lear].

This collaborative project brings together the WILLOW and LEAR project-teams with MSR researchers in Cambridge and elsewhere. The concept builds on several ideas articulated in the "2020 Science" report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project we propose will focus on fundamental computer science research in computer vision and machine learning, and its application to archaeology, cultural heritage preservation, environmental science, and sociology, and it will be validated by collaborations with researchers and practitioners in these fields.

In October 2013 a new agreement has been signed for 2013-2016 with the research focus on automatic understanding of dynamic video content. Recent studies predict that by 2014 video will account for more than 90% of traffic on the Internet. Automatic understanding and interpretation of video content is a key enabling factor for a range of practical applications such as organizing and searching home videos or content aware video advertising. For example, interpreting videos of "making a birthday cake" or "planting a tree" could provide effective means for advertising products in local grocery stores or garden centers. The goal of this project is to perform fundamental computer science research in computer vision and machine learning in order to enhance the current capabilities to automatically understand, search and organize dynamic video content.

7.3. Google: Learning to annotate videos from movie scripts (Inria)

Participants: Josef Sivic, Ivan Laptev, Jean Ponce.

The goal of this project is to automatically generate annotations of complex dynamic events in video. We wish to deal with events involving multiple people interacting with each other, objects and the scene, for example people at a party in a house. The goal is to generate structured annotations going beyond simple text tags. Examples include entire text sentences describing the video content as well as bounding boxes or segmentations spatially and temporally localizing the described objects and people in video. This is an extremely challenging task due to large intra-class variation of human actions. We propose to learn joint video and text representations enabling such annotation capabilities from feature length movies with coarsely aligned shooting scripts. Building on our previous work in this area, we aim to develop structured representations of video and associated text enabling to reason both spatially and temporally about scenes, objects and people as well as their interactions. Automatic understanding and interpretation of video content is a key-enabling factor for a range of practical applications such as content-aware advertising or search. Novel video and text representations are needed to enable breakthrough in this area.