RESEARCH CENTER

FIELD

Activity Report 2012

Section highlights of the Team

Edition: 2013-04-24

BYMOORE Exploratory Action

2.2. Highlights of the Year

- Set up of a joint lab on *Accelerators for Emerging Applications* between Inria (BYMOORE) and the Institute for Computing Technology (Beijing, China). Official signature ceremony took place in Dec. 2012.
- Our paper entitled *BenchNN: On the Broad Potential Application Scope of Hardware Neural Network Accelerators* was short-listed for best paper award at IISWC 2012.
- I have been elected to become Steering Committee Chair of the International Symposium on Code Generation and Optimization starting 2013 for a 3-year tenure.

POPIX Exploratory Action (section vide)

ABSTRACTION Project-Team

2.2. Highlights of the Year

Antoine Miné was the program cochair and the local organizer of the 19th international statis analysis symposium (SAS 2012) in Deauville, September 11–13 2012 and Radhia Cousot is the program chair the 40th ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL 2013) in Roma, January 23–25 2013.

ALF Project-Team

2.2. Highlights of the Year

- André Seznec has received the **first Intel Research Impact Medal** for "His exemplary work on high-performance computer micro-architectures, branch prediction, and cache architecture, have been of tremendous benefit to Intel, the industry, and the academic community as a whole.". (See http://www.intel.es/content/www/us/en/education/university/university-research-award.html).
- André Seznec has been elevated as an IEEE Fellow "for contributions to design of branch predictors and cache memory for processor architectures".

AOSTE Project-Team

2.2. Highlights of the Year

Aoste underwent its periodical Inria evaluation, as part of the Real-Time Embededded theme, in its eighth year of existence. Evaluation was very positive.

ARIC Team

2.2. Highlights of the Year

Damien Stehlé received the CNRS-INS2I bronze medal.

ATEAMS Project-Team

2.2. Highlights of the Year

Paul Klint was awarded the CWI Fellowship, for lifetime contributions to science and CWI in particular. This distinction is given to prominent researchers at Centrum Wiskunde & Informatica (CWI) in Amsterdam for their contribution to CWI's research and administration.

Floor Sietsma defended her PhD on December 13, 2012. This makes her the *youngest PhD in Dutch academic history*, at 20 years old. Remarkably, Floor Sietsma has still two years of research time to go, for her thesis preparation took her about half of the allotted four years. NWO granted her a personalized grant on account of her unusual talents. Sietsma will stay at CWI and use the rest of her research grant to expand her research on the formal analysis of communication, exploring connections with data stream analysis, cryptography and agent technology in artificial intelligence.

CAIRN Project-Team

2.2. Highlights of the Year

- Olivier Berder defended its "Habilitation à Diriger des Recherches (HDR)" thesis in 2012.

CAMUS Team

2.2. Highlights of the Year

- CAMUS takes part of the Laboratory of Excellence (LabEx) IRMIA (Institut de Recherche en Mathématiques, ses Interactions et Applications) whose proposal has been accepted by the french government.
- Alexandra Jimborean defended her PhD thesis September the 14th at the University of Strasbourg. She presented the first version of the dynamic and speculative code parallelizer VMAD (Virtual Machine for Advanced Dynamic analysis & transformation). Her jury was composed bu Albert Cohen (reviewer), Senior researcher at Inria, André Seznec (reviewer), Senior researcher at Inria, John Cavazos (reviewer), Professor at the University of Delaware, USA, François Bodin (examiner), Professor at the University of Rennes, Jean Christophe Beyler, HPC Software Engineer at Intel (examiner), Philippe Clauss and Vincent Loechner, advisors.
- Alain Ketterlin and Philippe Clauss published a paper on data dependence profiling at the The 45th Annual IEEE/ACM International Symposium on Microarchitecture [18].

CARAMEL Project-Team

2.2. Highlights of the Year

- The ANR proposal “CATREL” (in French, “Cribles, Améliorations Théoriques et Résolution Effective du Logarithme discret”) has been one of the eight accepted proposals among 59 submitted to the “programme blanc” in computer science for the year 2012. The ANR-CATREL project is beginning on January 1st, 2013.
- A new (second place) integer factorization record was set using the CADO-NFS software developed by the team, namely the factorization of RSA-704.
- Members of the team received the “Prix La Recherche” 2012 for their work on integer factorization.

CARTE Project-Team

2.2. Highlights of the Year

- We solved a problem that has been open for 15 years, relating three notions of complexity and information: Shannon information and entropy, Kolmogorov algorithmic information and Martin-Löf randomness [23].
- We developed a tool which is able to retrieve implementations of cryptographic primitives inside a trace of a binary. This result is published at CCS [22].
- We presented our work on behavioural malware detection using rewriting and model checking at ESORICS 2012 [20].
- For the Alan Turing year, we published an invited paper in the journal Phil. Trans. R. Soc. [16].

CASCADE Project-Team (section vide)

CASSIS Project-Team

2.4. Highlights of the Year

Cl-Atse Version 2.5-21 has been released by Mathieu Turuani. This efficient security protocol analyser offers advanced tracing options, supports set semantics as well as multiset one for modeling protocols, allows for Horn clause local deductions (for verifying assertions), and can handle in a complete and decidable manner negative constraints on the intruder's knowledge (for expressing non-disclosure policies).

CELTIQUE Project-Team (section vide)

COMETE Project-Team

2.2. Highlights of the Year

Mário Alvim, an ex PhD student of Comète who defended his thesis in October 2011, has been nominated for the “Prix de thèse ParisTech 2012”.

2.5. Highlights of the Year

For 2012, from the point of view of organization, funding, collaborations, the main points to highlight are the following:

- Compsys II was positively evaluated in Spring 2012 by Inria. The evaluation committee members were Walid Najjar (University of California Riverside), Paolo Faraboschi (HP Labs), Scott Mahlke (University of Michigan), Pedro Diniz (University of Southern California), Peter Marwedel (TU Dortmund), and Pierre Paulin (STMicroelectronics, Canada), the last three assigned specifically to Compsys.
- Compsys prepared the installation in 2013 of Fabrice Rastello in the Giant center (Grenoble) with two PhD students and one post-doc, as a second component of Compsys. As already mentioned, this new organization is not fully validated yet.
- Compsys started a new industrial collaboration with Kalray, a multi-core french company, and the Inria team Parkas, through the ManyCoreLabs project coordinated by Kalray. The research activities are linked to compilation for the Kalray platform, in particular back-end code optimizations and compilation related to stream computing.
- Compsys obtained some important funding, mainly from the MI-LYON LaBex, to organize in Lyon a thematic quarter on compilation, languages, and architectures in 2013.

From a scientific point of view, the following points can be highlighted:

- Compsys finalized the developments in static single assignment (SSA) and register allocation, leading to the PhD defense of Quentin Colombet [1] and the habilitation of Fabrice Rastello [2].
- In high-level synthesis (HLS), the research and development efforts within the incubated start-up Zettice have been pursued and Zettice may become a full start-up in 2013.
- Compsys obtained several results in program analysis for parametric communication optimizations, scalable program termination, and dependence analysis for the X10 language.

For a detailed description of these new scientific results, see Section 6 “New Results”.

CONTRAINTES Project-Team (section vide)

CONVECS Team

2.2. Highlights of the Year

- F. Lang and R. Mateescu's paper entitled "*Partial Model Checking Using Networks of Labeled Transition Systems and Boolean Equation Systems*" [15] was selected as one among the three "*best paper nominees*" of the TACAS 2012 conference, which had 36 papers published out of 147 submitted.
- At the end of 2012, the number of software licenses granted for the CADP toolbox since the beginning of its distribution has reached 10000.

DART Project-Team (section vide)

DEDUCTEAM Team (section vide)

ESPRESSO Project-Team

2.4. Highlights of the Year

Polarsys is an Industry Working Group focusing on open source tools for the development of embedded systems. Polychrony was used to define the Tool Quality Assurance Plan of the Polarsys platform according to the DO-178B and DO-178C certification standards. Polychrony has been integrated in the experimental Polarsys platform.

Jean-Pierre Talpin received the ACM/IEEE LICS Test of Time Award for his paper “A type and effect discipline”, with his co-author Pierre Jouvelot.

FORMES Team

2.2. Highlights of the Year

- The automated termination prover HOT developed by Frédéric Blanqui won the 2012 termination competition in the category “higher-order rewriting union beta”.

GALAAD Project-Team (section vide)

GALLIUM Project-Team

2.2. Highlights of the Year

Xavier Leroy was awarded the 2012 Microsoft Research Verified Software Milestone Award in recognition of his work on the CompCert C verified compiler.

GEOMETRICA Project-Team

2.2. Highlights of the Year

- Creation of a new Inria research team called TITANE on geometric modeling of 3D environments. Creation expected in 2013.
- Best Paper Award for "The Simplex Tree: An Efficient Data Structure for General Simplicial Complexes" at ESA 2012.

GRACE Team

2.1. Highlights of the Year

D. Augot co-edited a special issue of Designs, Codes and Cryptography, devoted to WCC 2011. Online versions of the articles are avalaible, while the issue will appear as volume number 66, issue 1-3, in January 2013.

LFANT Project-Team

2.2. Highlights of the Year

- Vincent Verneuil has defended his PhD thesis on “Cryptographie à base de courbes elliptiques et sécurité de composants embarqués” [12] in June 2012.
- Pierre Lezowski has defended his PhD thesis on “Questions d’Euclidianité ” [11] in December 2012.
- The ERC project ANTICS of Andreas Enge started in January 2012.
- The 2nd Atelier PARI/GP was held in 2012 (after the first installment in 2004), with the aim of creating a yearly event dedicated to the development of the main software product of the LFANT team.

MARELLE Project-Team

2.2. Highlights of the Year

This year, the Mathematical Components project of the Microsoft Research-Inria joint center under the direction of Georges Gonthier completed the major objective it had set six years ago: the complete formal verification of the Odd Order theorem, also known as the Feit Thompson theorem, which states that every odd order finite group is solvable. The Marelle project-team is a key participant in this project.

For more information : http://www.msr-inria.inria.fr/Projects/math-components/feit-thompson

MEXICO Project-Team (section vide)

MUTANT Project-Team

2.2. Highlights of the Year

The Antescofo software and programming language was featured in more than 15 world-premier creations and 30 events worldwide, including its premiers with *New York Philharmonics*, *Orchestre de Paris*, and prestigious venues in USA, Japan, Turkey, Poland, England and more. See website for more details.

PAREO Project-Team

2.2. Highlights of the Year

BEST PAPER AWARD :
[14] **Turing-100, The Alan Turing Centenary Conference**. S. STRATULAT.

PARKAS Project-Team (section vide)

PARSIFAL Project-Team

2.2. Highlights of the Year

- Stefan Hetzl received his Habilitation 5 November 2012 from the Technical University of Vienna.
- Kaustuv Chaudhuri and Stefan Hetzl organized "Collegium Logicum 2012: Structural Proof Theory" at Inria-Saclay.
- Dale Miller and Gopalan Nadathur (Professor at the University of Minnesota) published a book title "Programming with higher-order logic" (June 2012, Cambridge University Press).

PI.R2 Project-Team (section vide)

POLSYS Project-Team

2.2. Highlights of the Year

- In [4], we obtain an algorithm to solve Boolean systems with an expected complexity of $O(2^{0.792\,n})$ breaking the 2^n barrier.
- In [10], we propose an algorithm to solve a variant of the Quantififer Elimination Problem for which the output formula is *almost equivalent* to the input formula. The complexity of this algorithm is much better than other algorithms and can solve previously untractable problems.
- In [25], we improve the complexity of Index Calculus Algorithms in Elliptic Curves by means of Gröbner basis techniques and we analyze the complexity of this new approach by using the multi-homogeneous structure of the equations.

POP ART Project-Team (section vide)

PROSECCO Project-Team

2.2. Highlights of the Year

This year, we published 5 articles in international journals and 11 articles in peer-reviewed international conferences, including presitigious conferences such as CCS (1), CRYPTO (1), and CSF (2). In addition to these, we published 1 HDR thesis, 3 master's theses, 4 technical reports, and 5 workshop papers. We also have 4 articles already accepted for publication in international conferences in 2013.

We released updates to 3 verification tools and released 3 new software packages. We discovered and reported major security vulnerabilites in dozens of commercial software packages, hardware devices, and websites.

Of our work published in 2012, we would like to highlight the following:

- Our paper in CRYPTO 2012 [22] describing new attacks on cryptographic hardware devices, which got significant interest from both the cryptographer community and from the press.
- Our work on generating implementation code from verified models of cryptographic protocols [26], [27].
- Our work on formally analyzing web application security using automated verification tools, which uncovered major attacks in popular websites and web browsers [21], [24], [20].

S4 Project-Team (section vide)

SECRET Project-Team

2.2. Highlights of the Year

- Extensive study of the hash function proposal Keccak, which has been chosen as the winner of the SHA-3 competition. The analysis of the algebraic properties of Keccak due to C. Boura and A. Canteaut is the best known result on the new hash function standard.
- Design of a variant of the McEliece public-key cipher based on a moderate density parity-check codes (MDPC). This family of codes leads to public keys with a reasonable size and does not weaken the underlying security proof.
- Construction of spatially coupled quantum LDPC codes which performs well under iterative decoding almost up to the coherent capacity of the quantum channel.

SECSI Project-Team

2.2. Highlights of the Year

- Workshop celebrating the 15th anniversary of LSV (the lab where SECSI is hosted) and Jean Goubault-Larrecq's CNRS silver medal, ENS Cachan, February 06-07, 2012 (http://www.lsv.ens-cachan.fr/Events/LSV15Y/)
- The ANR project AVOTÉ on the formal analysis of electronic voting protocols (http://www.lsv.ens-cachan.fr/Projects/anr-avote/) has been nominated to receive a price awarded by the ANR.

TASC Project-Team

2.2. Highlights of the Year

1. The IBEX library has been entirely re-factored from scratch to provide a more clean and easy-to-use interface as well as a more powerful engine and made available in December 2012 on multiple platforms (Linux, MacOs, Windows). Global optimization and system solving front-end algorithms have been tested on more than 500 benchmarks.
2. Significant advance on learning constraints models for highly structured problems was done in 2012. The system [19] is based on the global constraint catalog, providing the library of constraints that can be used in modeling, and the Constraint Seeker tool, which finds a ranked list of matching constraints given one or more sample call patterns. Surprisingly, the system often finds usable models even when working with a single, positive example.

TOCCATA Team

2.2. Highlights of the Year

A major event in the life of our team this year is naturally its creation, as a refoundation of the former ProVal team, starting officially on September 1st, with C. Marché as a new leader. This report indeed covers all the activities of the team in 2012, including the activities of ProVal from January to August.

Another important event is the arrival of Arthur Charguéraud as a new “Chargé de Recherche”, since October.

The current section and the next one present the scientific foundations, objectives and axes of research of the new team. The theme of verification of numerical programs, that took importance in the former project, is now a major axis. We also emphasize a new axis of research concerning the certification of tools.

TRIO Project-Team

2.2. Highlights of the Year

- The release of the Open-PEOPLE platform.
- The organization of the 20th International Conference on Real-Time and Network Systems (RTNS2012).
- The acceptance of two TRIO papers to the two premier real-time conferences: the 33rd IEEE Real-time Systems Symposium (RTSS 2012) and the 24th Euromicro Conference on Real-Time Systems (ECRTS 2012).
- Successful completion of the TIMMO-2-USE project in September 2012 in which TRIO was leader of the work package on the algorithms and tools within the project.

TYPICAL Project-Team

2.2. Highlights of the Year

Assia Mahboubi, Enrico Tassi and Cyril Cohen were among the main participants in the project of formalization of the Feit-Thompson (Odd Order) theorem finally completed in September 2012 by the Mathematical Components team (lead by Georges Gonthier).

Bruno Barras and Assia Mahboubi have been granted fellowships by the Insititute for Advanced Study (Princeton, USA).

VEGAS Project-Team

2.2. Highlights of the Year

BEST PAPER AWARD :
[18] **Symposium on Computational Geometry - SoCG '12**. É. C. DE VERDIÈRE, G. GINOT, X. GOAOC.

VERIDIS Project-Team (section vide)

VERTECS Project-Team

2.2. Highlights of the Year

The article [6] entitled Probabilistic omega-automata and co-authored by Nathalie Bertrand, together with Christel Baier and Marcus Grösser from TU Dresden, has been published in the Journal of the ACM. This article extends a paper published in 2008 in the proceedings of FoSSaCS, which received the EATCS best paper award, and already had a strong impact in the verification community.

ALEA Project-Team

2.2. Highlights of the Year

The book [33] presents a series of novel results on the design and analysis of new classes of mean field particle models in numerical finance, including particle sensitivity measures, calibration models, and particle option pricing algorithms.

APICS Project-Team (section vide)

ASPI Project-Team (section vide)

BACCHUS Team

2.2. Highlights of the Year

- Many achievements in rocket science have been made since Apollo, but prediction of the heat flux to the surface of spacecraft remains an imperfect science, and inaccuracies in these predictions can be fatal for the crew or the success of robotic missions. Predicting an accurate heat flux is a particularly complex task, regarding uncertainty on the complex multi-physics phenomena involved in hypersonic flows models as well as on atmospheric properties such as density and temperature. Hence, it is difficult to establish "error bars" on the heat flux prediction. We succeded the first call for project from ESA concerning uncertainty quantification for aerospace applications. In this project, we are the main investigator concerning the set-up of efficient numerical techniques for UQ.
- In June and July, we joined the NASA Center for Turbulence Research (CTR) Summer Program at Stanford University. We developed a novel method to solve stochastic partial differential equations, in particular hyperbolic equations.
- We have developed an algorithm for the robust construction of curved simplicial meshes in two and three dimensions. Starting from a classical (straight) mesh, we are able to curve the boundary elements then the volumic ones in keeping as much as possible the structure of the initial mesh. In particular, this algorithm does not destroy the boundary layer structures, even for meshes designed for turbulent simulations.
- We have succeded in having Residual Distribution schemes that are *uniformly* accurate whatever the Peclet number for scalar advection diffusion problems. The schemes have been extended to turbulent flow simulations.
- The native scheduler of the PaStiX solver can be replaced with generic runtimes to address sparse direct factorizations on heterogeneous architectures (clusters of multicore/multigpu). Our results on heterogeneous architectures show we can easily improve the factorization time on a personal computer (1 GPU and several cores), and we have identified leads, both on algorithms and on schedulers, to optimize the performances on larger platforms.

BIPOP Project-Team (section vide)

CAD Team (section vide)

CAGIRE Team (section vide)

CALVI Project-Team

2.2. Highlights of the Year

January 2012 : Anaïs Crestetto and Philippe Helluy have been awarded the fourth prize of the international "OpenCL Innovation Challenge" organized by the AMD company. They have simulated the electron beam inside an X ray generator on GPU. See http://developer.amd.com/community/events/amd-opencl-coding-competition-2/

September 2012 : Eric Sonnendrücker has obtained a position at the Max Planck Institute in Garching.

October 2012 : Michel Mehrenberger has defended his 'Habilitation à diriger des recherches'.

CASTOR Team (section vide)

CLASSIC Project-Team (section vide)

COFFEE Project-Team (section vide)

COMMANDS Project-Team (section vide)

CONCHA Project-Team (section vide)

CORIDA Project-Team

2.2. Highlights of the Year

BEST PAPER AWARD :
[45] **2nd International Symposium on Environement-Friendly Energies and Applications, EFEA 2012**.
T. MANRIQUE-ESPINDOLA, H. MALAISE, M. FIACCHINI, T. CHAMBRION, G. MILLÉRIOUX.

CQFD Project-Team

2.2. Highlights of the Year

CQFD made advances in the pratical use of its algorithms with DCNS. In the particular case of submarine command, we have coupled an tracking algorithm with an optimization code in order to compute optimal trajectories using only signals issued from embedded sonars. These results will be developped in an operating simulator.

The CQFD team created in 2012 a new annual national conference for the users of the statistical software R. The "Premières Rencontres R" are conceived as a place to present and share ideas on using the R statistical software. This meeting is designed to be a nationwide event where various topics belong, such as graphical tools, applied statistics, biostatistics, bayesian statistics, bioinformatics, data analysis, modeling, machine learning, high performance computing, etc...

The Rencontres R contained 5 guest lectures, 32 regular talks, 12 Lightning Talks and 6 posters on the following topics :

- new advances in statistics and their implementation with R,
- new R packages,
- applications or original case studies involving the R software (genetics, bioinformatics, environment, psychometrics, social sciences, neuroscience, etc...),
- computer features about the R software (multithreading, graphical tools, binding with other sofwares, etc...) ,
- topics about teaching methods with R.

This meeting was intended to everyone interested in R: researchers, teachers, people from industries, students, etc... It was built for both beginners and advanced R users, statisticians and informaticians, as well as wellwishers from every area where R can be useful. More than hundred participants attended this first edition of the conference.

DEFI Project-Team

2.2. Highlights of the Year

- Grégoire Allaire was elected as president of SMAI.

DISCO Project-Team

2.2. Highlights of the Year

With Anja Korporal and Markus Rosenkranz, G. Regensburger got the *Distinguished software presentation* award at ISSAC 2012 (International Symposium on Symbolic and Algebraic Computation) for the MAPLE packages `IntDiffOp` and `IntDiffOperations` (see [17]).

DOLPHIN Project-Team

2.2. Highlights of the Year

- Francois Clautiaux: Premier accessit for Prix Robert Faure 2012.
- Best paper award at conference ICORES'2012 1st International Conference on Operations Research and Entreprise Systems, Vilamora, Portugal, Feb 2012 [44] . Rita Macedo, Said Hanafi, Francois Clautiaux, Claudio Alves, José Valério de Carvalho, Generalized disaggregation algorithm for the vehicle routing problem with time windows and multiple routes.
- Best paper award at GECCO'2012 (Genetic and Evolutionary Computation Conference, EMO Track), Philadelphia, USA, July 2012 [37] . D. Brockhoff, T. Wagner, H. Trautmann, On the Properties of the R2 Indicator.

BEST PAPERS AWARDS :

[44] **ICORES 2012, 1st International Conference on Operations Research and Entreprise Systems, Vilamora, Portugal, 4-6 february, 2012**. R. MACEDO, S. HANAFI, F. CLAUTIAUX, C. ALVES, J. M. VALÉRIO DE CARVALHO.

[37] **GECCO'2012**. D. BROCKHOFF, T. WAGNER, H. TRAUTMANN.

GAMMA3 Project-Team

2.2. Highlights of the Year

Paul-Louis George : Inria - Dassault Systèmes 2012 Innovation Award winner:

Team leader of the Gamma3 project team (Inria, Troyes University of Technology), Paul-Louis George is one of the inventors of the GHS3D volume mesh, a software used throughout the world by players in the industry, researchers and academics. Integrated in several software for 3D calculations by finished elements, GHS3D helps obtain simulations which are particularly reliable and high performing. A success based on teamwork undertaken over the long term and which is now being rewarded with the innovation award.

GECO Team

2.1. Highlights of the Year

Emmanuel Trélat obtained the Felix Klein Prize at the 6th European Congress of Mathematics in Krakow.

Motivations by the prize committee: Emmanuel Trélat receives the Felix Klein Prize for combining truly impressive and beautiful contributions in fine fundamental mathematics to understand and solve new problems in control of PDE's and ODE's (continuous, discrete and mixed problems), and above all for his studies on singular trajectories, with remarkable numerical methods and algorithms able to provide solutions to many industrial problems in real time, with substantial impact especially in the area of astronautics.

GEOSTAT Project-Team (section vide)

I4S Team

2.2. Highlights of the Year

+ Prize : M. Döhler has received the Fundation of Rennes 1st Prize 2012 for his PhD.
+ The team was given the privilege to organize the next joint EWSHM and PHM conference in 2014 in Nantes together with IFSTTAR and Nantes University.

IPSO Project-Team

2.3. Highlights of the Year

- The team is part of the newly accepted Labex “Lebesgues Center" (see http://www.lebesgue.fr/).

  The Lebesgue Center (Foundations, Interactions, Application and Training) has been selected as an excellence cluster in February 2012. The Center proposes to build a highly attractive and efficient Research Center and Graduate School in Western France that will coordinate the research in geometry, analysis, statistics and probabilities with strong interdisciplinary links to the socio-economic environment and its applications.

  Coordinators : Vũ Ngọc San (Irmar, Rennes 1) together with Arnaud Debussche (Irmar, ENS Cachan, IPSO), Christoph Sorger and Laurent Guillopé (LMJL, Nantes).
- Two members of the team, Florian Méhats and Mohammed Lemou, published a paper in “Inventiones Mathematicae” (see [31])
- Erwan Faou published the book [34] in the series “Zurich Lectures in Advanced Mathematics. Zürich: European Mathematical Society (EMS)".
- Arnaud Debussche has launched with Boris Rozovskii a new journal entitled "Stochastic Partial Differential Equations: Analysis and Computations", edited by Springer.

MATHRISK Team

2.6. Highlights of the Year

Creation of the Mathrisk Project Team.

MAXPLUS Project-Team (section vide)

MC2 Project-Team (section vide)

MCTAO Team

2.2. Highlights of the Year

- The team started this year.
- Bernard Bonnard publishes, with Dominique Sugny from University of Bourgogne, a reference book on control applications to Quantum Dynamics and Space Dynamics [18].

MICMAC Project-Team (section vide)

MISTIS Project-Team

2.2. Highlights of the Year

Our paper [33] entitled *An Improved CUDA-Based Implementation of Differential Evolution on GPU* was nominated and finalist for the best paper award in the Digital Entertainment Technologies and Arts / Parallel Evolutionary Systems session of the Genetic and Evolutionary Computation Conference 2012 (Gecco 2012).

MODAL Project-Team

2.2. Highlights of the Year

- The team finished the development of the blockcluster R package, allowing to process efficient and parsimonious generative models on huge data sets for different kinds of variables (see Section 5.2).
- The team developed also a R package of MIXMOD and started to develop a new version for simultaneous mixed categorical and continuous data (see Section 5.1).

NACHOS Project-Team (section vide)

NANO-D Team

2.3. Highlights of the Year

Stephane Redon has received an ERC Starting Grant in 2012 for his ADAPT project (ADAPT: Theory and algorithms for Adaptive Particle Simulation). The grant is about 1.5 million euros over 5 years.

2.2. Highlights of the Year

The most relevant events for the NeCS team in 2012 are the following:

- Carlos Canudas de Wit has been elected as member of the Board of Governor (BoG) of the IEEE Control System Society (CSS)
- The team animated the In'Tech seminar on intelligent transportation systems in November 2012.

NON-A Project-Team

2.3. Highlights of the Year

- The survey paper on delay systems [126] is the ScienceDirect TOP 1 hottest article of Automatica since July 2009;
- HdR of Join C. "Une approche algébrique pour la pratique de l'estimation, du diagnostic, de la commande et de la finance" [12], Université de Lorraine, June 2012;
- HdR of Efimov D. "Analysis, control and estimation of nonlinear oscillations" [11], Inria, November 2012;
- Patent pending (FR11/51604) on the control of traffic flow.

OPALE Project-Team

2.3. Highlights of the Year

Our activity in road traffic modeling is reinforced by the creation of the Associated Team ORESTE with UC Berkeley.

Our activity in pedestrian flow modeling is reinforced by the doctoral thesis of M. Mimault, started in October, and the enrollment of M. Twagorowska on a post-doctoral position.

POEMS Project-Team

2.2. Highlights of the Year

Among the significative scientific advances and successes of this year, we would like to emphasize:

- The habilitation of L. Bourgeois on various imverse problems governed by elliptic equations.
- The PhD thesis of J. Chabassier on the numerical simulation of a grand piano
- The PhD thesis of L. Chesnel on the analysis of dign changing transmission coefficients with applications to electromagnetic metamaterials.
- Three new ANR Projects : CHROME on electromagnetic wave propagation in fusion plasmas, SODDA on the non destructive testing of networks of electric cables and RAFFINE about a posteriori estimators for integral equations.

REALOPT Project-Team

2.2. Highlights of the Year

Our scientific output is marked by strong publications in prestigious journals such as Discrete Mathematics, Mathematical Programming, EURO Journal on Computational Optimization, INFORMS Journal on Computing, and Operations Research, for instance, with contributions ranging from theoretical and methodological to numerical and applied industrial problem solving. This is completed by conference invitations in China, Chili and Canada and proceedings in selective conferences.

Our methodology of combining an extended formulation approach with Dantzig-Wolfe decomposition and column generation, that is now published [21], is a great illustration of our team's threefold objective: it is a theoretically proved method, playing the complementary between exact optimization techniques, and leading to an computational edge in application solving. This methodology is a key tool for currently ongoing collaboration with EDF and Russian partners on railway applications.

The Samba project with our associated team in Brasil is picking up a new pace, with good progress on primal heuristics [27] [30] and stabilization techniques [23] [25] [29] [32]. In the coming year, short term visits will be completed by a one-month stay of Professor Uchoa, and a one-year-stay of his PhD student.

The composition of the team is going through rapid evolution: Gautier Stauffer, our Inria Chair, has been promoted as a Professor in Grenoble; Andrew Miller has returned to the US. Both positions have been republished in our thematic. We are currently building tighter links with CEPAGE by building closer work relations with Olivier Beaumont, Lionel Eyraud-Dubois, and Paul Renaud-Goud who share our methodologies, while emphasizing our expertise in the application domain of cloud computing.

The team has been integrated in the LaBEX CPU. The complete team participates in the WP5 "Network and Service Optimization". At the same time, there is a participation in the WP6 "Codes, Cryptologie, Algorithmique Arithmétique" with the proper methodology of the team.

REGULARITY Project-Team

2.2. Highlights of the Year

- Release of version 2.1 of the software toolbox FracLab.

BEST PAPER AWARD :
[39] **International Conference on Mass Data Analysis of Images and Signals (MDA'2012)**. J. LÉVY-VÉHEL, M. TESMER.

SCIPORT Team (section vide)

SELECT Project-Team (section vide)

SEQUEL Project-Team (section vide)

SIERRA Project-Team

2.2. Highlights of the Year

- Rodolphe Jenatton (former PhD student, graduated in 2011) received two thesis prizes (Fondation Hadamard and AFIA).
- Francis Bach received the Inria young researcher prize.
- Monograph published in the collection *Foundations and Trends in Machine Learning*: “Optimization with sparsity-inducing penalties”.

SIMPAF Project-Team (section vide)

TAO Project-Team

2.3. Highlights of the Year

- Energy management is becoming one of the main focuses, and the most important applicative focus of TAO UCT-SIG. Underlying the various debates, ranging from climate change to nuclear power and integration of renewable energies in the grid (including transportation and storage), is a burning need for scenario simulation, evaluation and optimization. The scientific challenges concern the handling of continuous and discrete uncertainties (e.g. ecological impacts or emergence of future technologies) with a long term horizon. Our commitment is to provide principled studies of various investment scenarios in economical and ecological terms, including a rigorous handling of uncertainties. Specifically,
  - We actively worked to develop collaborations between European and Taiwanese experts of energy management (organization of a forum in Taiwan, http://top.twman.org/2012frtw, of meetings between French companies and Taiwanese academic visitors in Limoges and Paris http://www.lri.fr/ teytaud/france2012.html).
  - We developed a Ilab (collaboration between Inria Saclay-IDF / Artelys) on energy, involving our common participation to the European project Citines http://www.citines.com, aimed at optimal energy management at the scale of a city or an industrial area. We also successfully applied for an ADEME project named POST, aimed at the long term (2050) optimization of the power grid in Europe and North Africa and raising hard stochastic stock management issues. Another critical issue concerns the representation of strategies enabling to combine the good long term properties of direct policy search, and the efficiency of combinatorial optimization tools for structured problems.
    Additionally, a collaboration with Inria-Chile is under discussion. We are also working on creating a company in Taiwan, working with tools from the French industry.
  - We also participated in several energy-related European meetings, including companies (section 8.5.1).
- Games remain a key and cool showcase to demonstrate the efficiency of our algorithms:
  Our meta-learning approach in Monte-Carlo Tree Search (MCTS) was illustrated by playing 12 games against professional players in even conditions in 7x7; it won 7 games (6/6 win with the easy side and 1/6 win with the difficult side). We achieved the best performances so far on small board minesweeper, demonstrating the efficiency of MCTS on one-player stochastic games. In collaboration with Olivier Buffet (Loria), we scaled up previous implementations to large boards, demonstrating the efficiency of Monte-Carlo Tree Search as a tool for improving existing heuristics. For illustrating the pedagogical properties of simulation-based approaches, we developed tools for generating nice test cases in games and automatically checking the opponent level.
  Besides, we realized experimental biological measurements (neuro-imagery, skin conductivity) on amateur and professional players, for further comparison and analysis.
- One of the main fundamental milestones on the TAO research agenda has been achieved by the OPT-SIG, bridging the gap between practice and theory in stochastic optimization through information-geometric optimization (IGO). IGO is devised as a canonical way to turn any smooth parametric family of probability distributions on an arbitrary, discrete or continuous search space X into a continuous-time black-box optimization method on X. Rooted on the Fisher metric, IGO shows invariance properties under various parameterizations of the distribution family [71], [19], [20]. IGO covers the state-of-art CMA-ES (invariant w.r.t. monotonous transformations of the objective function and linear transformations of the coordinate space) as a special case where the probability distribution is Gaussian.

This paper got the *excellent paper award* (international track) at TAAI conference (given to 3/55 papers).
BEST PAPER AWARD :
[36] **TAAI**. C.-W. CHOU, P.-C. CHOU, C.-S. LEE, D. LUPIEN SAINT-PIERRE, O. TEYTAUD, M.-H. WANG, L.-W. WU, S.-J. YEN.

TOSCA Project-Team (section vide)

ABS Project-Team

2.2. Highlights of the Year

Three key achievements were obtained in 2012.

The first one deals with the problem of modeling high resolution protein complexes, a topic for which we came up with an original binding patch model [14]. Our model not only provides more accurate descriptors of key quantities (the binding affinity in particular), but also sheds new light on the flexibility of proteins upon docking. These developments will in particular be used to investigate complexes from the immune system in the future.

The second one deals with the problem of modeling large protein assemblies, involving up to hundreds of polypeptide chains. We finalized the application of our Toleranced Models framework to the nuclear pore complex [13], [19], and started to produce novel algorithms for mass-spectrometry data [18], an emerging technique to infer structural information on large molecular machines.

Finally, we have also made a steady progress on algorithmic foundations, in particular on the problem of developing a Morse theory for point cloud data, in the perspective of analyzing molecular dynamics data. Tests are currently on the way, so that this work will be advertised in 2013.

AMIB Project-Team (section vide)

ASCLEPIOS Project-Team

2.2. Highlights of the Year

- N. Ayache, H. Delingette, X. Pennec, M. Sermesant, G. Malandain, I. Strobant, A. Cortell were largely involved in the organization of the MICCAI 2012 conference (Medical Imaging Computing and Computer Assisted Interventions). The conference gathered together 1200 from more than 40 countries between October 1 to October 5, 2012 in Nice Acropolis.
- The ERC Advanced Grant MedYMA on Biophysical Modeling and Analysis of Dynamic Medical Images has started in April 2012 for a period of 5 years.
- **Stéphanie Marchesseau** received the Young Investigator award at the MICCAI 2012 conference held in Nice (Oct. 2012) for her paper [42] .
- **Hervé Lombaert** won the MCV 2012 best paper award at the MICCAI workshop on Medical Computer Vision (Oct. 2012) for his paper [38] .
- **Hervé Lombaert** has received a prize from the research fund of Québec FRQ (http://www.frq.gouv.qc.ca) as the "star research student" of the month January 2013 for his paper [] .

BEST PAPERS AWARDS :

[42] **Proceedings of Medical Image Computing and Computer Assisted Intervention 2012 (MICCAI)**. S. MARCHESSEAU, H. DELINGETTE, M. SERMESANT, K. RHODE, S. DUCKETT, C. ALDO. RINALDI, R. RAZAVI, N. AYACHE.

[38] **Medical Computer Vision (MCV'12) MICCAI workshop**. H. LOMBAERT, L. GRADY, X. PENNEC, J.-M. PEYRAT, N. AYACHE, F. CHERIET.

[] **IEEE Trans. on Medical Imaging**. H. LOMBAERT, J.-M. PEYRAT, P. CROISILLE, S. RAPACCHI, L. FANTON, F. CHERIET, P. CLARYSSE, I. MAGNIN, H. DELINGETTE, N. AYACHE.

ATHENA Project-Team (section vide)

BAMBOO Project-Team

2.1. Highlights of the Year

One highlight, both scientific and organisational, for 2012 concerns the setting up of a CNRS-UCBL-Inria Laboratoire International Associé (LIA) with the Laboratório Nacional de Computação Científica (LNCC), Petrópolis, Brazil. The LIA has for acronym LIRIO ("Laboratoire International de Recherche en BInformatique") and is coordinated by Ana Tereza Vasconcelos from the LNCC and Marie-France Sagot from BAMBOO. The LIA is created for 4 years, renewable once. A preliminary web page for the LIA LIRIO is available at this address: https://team.inria.fr/bamboo/en/cnrs-lia-laboratoire-international-associe-lirio/.

BANG Project-Team

2.2. Highlights of the Year

The ERC Starting Grant allocated to M. Doumic-Jauffret in 2012 will sustain a long term programme in mathematical biology. The many faces of the subject imply modelling of biopolymer size repartition, applications to prion (and other neurodegenerative) diseases, inverse problems, numerical simulations in biology and a strong interaction with biologists.

BEAGLE Team

2.2. Highlights of the Year

- We published at least three papers in high impact journals [16], [31], [23]: two in *PNAS* about the use of horizontal transfer in reconstructing and dating the history of bacterial diversification, and one in *Nature reviews microbiology* about the comparison between experimental and artificial evolution.
- Guillaume Beslon was nominated as a member of the CoNRS, section 06.
- 2012 has been fructuous in terms of collaborations between permanent members of the team, sometimes coming from different teams and backgrounds, as it is shown by a submitted article [43], gathering the different projects in the Computational Cell Biology part.

BEST PAPER AWARD :
[39] **Artificial Life XIII**. D. MISEVIC, A. FRÉNOY, D. P. PARSONS, F. TADDEI.

BIGS Project-Team

2.2. Highlights of the Year

For 2012 we stress the following noticeable events:

- HdR defense of Céline Lacaux, 12/6 (see [1]).
- Cybernano, an incubating start-up specialized in nano-cancerology created by Thierry Bastogne, has received the "emergence" award in 2012 from the French Research ministry for the creation of start-up based on innovative technology.

BIOCORE Project-Team

2.2. Highlights of the Year

- A model was developed in order to determine how to mix resistant and sensitive plants to vector-borne plant pathogens in order to best protect the crop. The model includes a process that would allow for the resistance breakdown through adaptation of the virus population and the wintering of the virus in the environment. The best mixing rate was then proposed in order to either maximize the production over a 15 year period or prevent the resistance breakdown [16]. This work is done with Frédéric Fabre and Benoît Moury of INRA Avignon.
- Green Stars, Institute of Excellence for Decarbonated Energy, was created this year, supported by a *Projet d'Investissement d'Avenir* funding. Recent Biocore developments in microalgae modeling strongly support the Green Stars Institute: including the temperature effect [14], [28], representing fast time scales of photosynthesis [37], coupling with hydrodynamics [13], representing N_2 fixation [89], modeling metabolism of microalgae [67], modeling anaerobic digestion of microalgae [20], developing observers [21] [101] and optimal strategies to produce biomass [90], [109].

BEST PAPER AWARD :
[36] **10th Conference on Computational Methods in Systems Biology**. A. CARTA, M. CHAVES, J.-L. GOUZÉ.

BONSAI Project-Team (section vide)

CARMEN Team

2.2. Highlights of the Year

- S. Labarthe was awarded the poster price for the theoretical and applied aspects of his work on atrial modeling by to distinct communities:
  - poster award by the medical community after at the « printemps de la cardiologie 2012 »;
  - poster award by the applied mathematics community at the CANUM 2012.
- N. Zemzemi: best poster presentation award at the international conference Computing in Cardiology 2012 (CINC'2012), [25].

CLIME Project-Team (section vide)

CORTEX Project-Team

2.2. Highlights of the Year

We designed a computational model of the primary somatosensory cortex that is able to develop topographic maps, maintain and reorganize them in the face of lesions. We used neural fields as a mathematical and computational framework and focused on area 3b innervated by hand mechanoreceptors. The combination of such neural field with a simple Hebbian/anti-Hebbian like learning rule advocates for an unsupervised, distributed, robust and biologically plausible model of a (simplified) somatosensory cortical model where thalamocortical connections are the main sites of plasticity. The major finding of our model is that a topographic map can emerge as a consequence of the interaction between thalamus and cortical excitatory afferent connections. These results were recently published in PLoS ONE [6].

DEMAR Project-Team

2.2. Highlights of the Year

- David Andreu received the 1rst Price 2012 of the FIEEC-OSEO on Applied Research, for his research and innovation transfer with Vivaltis company.

DRACULA Project-Team (section vide)

DYLISS Team

2.1. Highlights of the Year

- François Coste was the co-chair of the French conference in bioinformatics (JOBIM) which was organized in Rennes in July 2012.
- Matthias Gallé, a former PhD in the team, won the accessit thesis prize from AFIA. This work followed by F. Coste has been achieved in the framework of a cooperation with Universidad Nacional de Cordoba, thanks to a MinCYT-Inria program [14].
- Santiago Videla won a best paper award at the conference CMSB [19] [1]. This work implies a cooperation with EBI (UK) together with universities of Heidelberg, Potsdam and Padova.

BEST PAPERS AWARDS :
[19] **CMSB - 10th Computational Methods in Systems Biology 2012**. S. VIDELA, C. GUZIOLOWSKI, F. EDUATI, S. THIELE, N. GRABE, J. SAEZ-RODRIGUEZ, A. SIEGEL.

[1] http://sites.brunel.ac.uk/cmsb2012

FLUMINANCE Project-Team (section vide)

GALEN Team

2.2. Highlights of the Year

- **BIOMED Summer School**: Galen has organized the Biomedical Image Analysis Summer School : Modalities, Methodologies & Clinical Research at Paris between July 9^{th} and July 14^{th}, 2012 involving international leaders/contributors in the field of biomedical image analysis as instructors where approx 100 participants were selected from an outstanding number of applications.
- **China Research Council Award**: Chaohui Wang was the recipient of the Chinese Government Award for Outstanding (self-financed) PhD. In 2012, a total of 495 awards were given worldwide in all disciplines, with 17 Chinese students in France receiving awards.
- **CVPR Participation**: GALEN has participated in the 2012 annual IEEE Conference in Computer Vision and Pattern Recognition (CVPR'12) conference, the leading event in the field of computer vision with five papers (double blind full submissions, acceptance rate %25).
- **EU FP7 Success**: GALEN has secured cutting edge research funding from the European Union through the highly competitive 2012 "Cognitive Vision and Robotics" FP7-ICT-9 call (5% acceptance) through two accepted grants (out of 12 for the entire call): MOBOT (Intelligent Active MObility Assistance RoBOT integrating Multimodal Sensory Processing, Proactive Autonomy and Adaptive Interaction) and RECONFIG (Cognitive, Decentralized Coordination of Heterogeneous Multi-Robot Systems).
- **MICCAI Participation**: GALEN has participated in the 2012 annual Medical Image Computing and Computer Assisted Intervention (MICCAI'12) conference one of the leading events in the field of medical image analysis with four papers (double blind full submissions, acceptance rate %30) and two invited talks in the associated workshops.

GENSCALE Team

2.2. Highlights of the Year

- GenScale organized **JOBIM 2012**, the French conference on computational biology wich gathered 375 participants in Rennes. [web site: http://jobim2012.inria.fr/].
- GenScale and CWI proposed the first web server for comparison of protein structure alignments (**CSA**). [web site: http://csa.project.cwi.nl]
- KLAST software released by Korilog. KLAST is an improved version of the PLAST technology developed by GenScale for bank-to-bank sequence similarity search. [Korilog promotion]

IBIS Project-Team

2.2. Highlights of the Year

Three students defended their PhD thesis this year: Guillaume Baptist [1], Sara Berthoumieux [2], and Jérôme Izard [3]. One of the papers derived from the work of Sara Berthoumieux was accepted for *Molecular Systems Biology* [7].

The collaborative project RESET was accepted in the Bioinformatics call of the Investissements d'Avenir program. RESET joins seven partners, including the company Metabolic Explorer SA, and runs until 2016. RESET studies the gene expression machinery in bacteria, by means of models and experiments, and develops biotechnological applications based on the control of the gene expression machinery.

Former IBIS member Caroline Ranquet and Johannes Geiselmann created, with Marie-Gabrielle Jouan (Floralis, Université Joseph Fourier), the start-up company BGene, active in the field of DNA engineering.

MACS Project-Team

2.2. Highlights of the Year

The team has relocated from Rocquencourt to the Saclay Ile-de-France Inria research center in June 2012. This change was motivated by the very strong potential of this rapidly-evolving environment in terms of multi-disciplinary collaborations, with the actors already in place as well as those to come, in particular with the creation of the ambitious new Paris-Saclay University. We are already part of a local initiative entitled “Mechanics and living systems” in association with various components of the two mechanics laboratories of Ecole Polytechnique, and which encompasses fundamental, experimental and numerical aspects in biomechanics. This environment is also foreseen as most favorable to the launching of our successor-team, since 2012 was the last year of the Macs team itself, indeed.

MAGIQUE-3D Project-Team (section vide)

MAGNOME Project-Team (section vide)

MASAIE Project-Team

2.4. Highlights of the Year

Malaria infection is characterized by the fact that only the peripheral infected red blood cells (young parasites), also called circulating, can be observed (can be seen on peripheral blood smears) and the other ones (sequestered), hidden in some organs like brain and heart, can not be observed. There is no clinical method of measuring those sequestered infected cells. We have developed a simple tool to estimate the sequestered parasites and hence the total parasite burden for *Plasmodium falciparum* malaria patients [14].

MNEMOSYNE Team

2.2. Highlights of the Year

As a good illustration of our thematic shift from models of visuomotor functions to applications to neurodegenerative diseases, this recent publication in PNAS [1] proposes that the Degus, a rodent from Chile used for the design of models of the retina, is also an animal model for the Alzheimer disease.

MODEMIC Project-Team

2.6. Highlights of the Year

- *The characterization of interconnections of chemostats that provide a global stability of bioprocesses with inhibition, mentioned in Section 6.1.1 , has led to a patent application by INRA [59].*
- *Anaerobic membrane bioreactors (AnMBR) have a great potential for treating wastewater since they allow energy recovery (the biogas produced is mostly composed of methane) while guaranteeing a total separation of the treated water and of the microbial content of the process. However, their main drawback is the fouling of the membrane. In order to control the process while limiting the risk of clogging, we have developed a new model for AnMBR in coupling a two-step anaerobic model (called the "AM2" or the "AMOCO" model) with a model describing fouling dynamics [16].*
- *We have proposed hybrid models (deterministic/stochastic and continuous/discrete) of population dynamics as alternatives to conventional models based on ordinary differential equations. The later models are generally accepted as a good approximation of the former ones in large population asymptotic, but even in very large population size the two groups of models present drastically different behavior, notably in terms of persistence properties [15], see Section 6.1.5 .*

MOISE Project-Team

2.2. Highlights of the Year

François-Xavier Le Dimet has been nominated Fellow of the American Meteorological Society. He received this distinction in New Orleans on the January, 22, 2012 during the annual General Assembly of the Association. He is the second French scientist to get this award. See http://www.ujf-grenoble.fr/universite/medias-et-communication/actualities/francois-xavier-le-dimet-elu-fellow-of-the-american-meteorological-society-244259.htm?RH=UJF

The paper *"Variational algorithms for analysis and assimilation of meteorological observations."* by F.-X. Le Dimet and O. Talagrand [86] has received more than 1 000 citations.

MORPHEME Team

2.2. Highlights of the Year

- Laure Blanc Féraud has obtained the “grade de chevalier dans l’Ordre National du Mérite”.

NEUROMATHCOMP Project-Team

2.2. Highlights of the Year

1. **Organisation of the Workshop on Biological and Computer Vision Interfaces in Firenze October 12, 2012, held in conjunction with ECCV 2012.** This workshop was organised by Olivier Faugeras and Pierre Kornprobst. This workshop was a one-day event with prestigious invited speakers discussing several aspects of biological and computer vision interfaces, namely biological vision, mathematical and computational paradigms for biological and human vision, computational and hardware models of the visual brain and bio-inspired methods for computer vision. More information is available at http://www-sop.inria.fr/manifestations/wbcvi2012/index.shtml
2. **Organisation of the workshop NeuroComp/KEOpS'12, Bordeaux, 10-11 October 2012.** This workshop was joinly organized by F. Alexandre and T. Viéville (Mnemosyne), B. Cessac (Neuromathcomp), A. Palacios and M.J. Escobar (CN Valparaiso). It addressed the following issues (i) neural population dynamics and coding; (ii) architecture (and information flow) at the retinal and the brain level. The workshop was a two days event involving speakers in the field of vision and cognition, robotics, retina healthcare and prosthesis, and dynamical systems modeling. More information is available at http://neurocomp.risc.cnrs.fr/neurocomp-2012/index.php?page=1.
3. **European Union project "MATHEMACS" accepted.** The MATHEMACS project aims to develop a mathematical theory of complex multi-level systems and their dynamics. This is done through a general formulation based on the mathematical tools of information and dynamical systems theories. To ensure that the theoretical framework is at the same time practically applicable, three key application areas are represented within the project, namely neurobiology, human communication, and economics. These areas not only provide some of the best-known epitomes of complex multi-level systems, but also constitute a challenging test bed for validating the generality of the theory since they span a vast range of spatial and temporal scales. Furthermore, they have an important common aspect; namely, their complexity and self-organizational character is partly due to the anticipatory and predictive actions of their constituent units. The MATHEMACS project contends that the concepts of anticipation and prediction are particularly relevant for multi-level systems since they often involve different levels. Thus, as a further unique feature, the project includes the mathematical representation and modeling of anticipation in its agenda for understanding complex multi-level systems.
4. **European Union project "RENVISION" accepted.** RENVISION's goal is twofold: i) to achieve a comprehensive understanding of how the retina encodes visual information through the different cellular layers; ii) to use such insights to develop a retina-inspired computational approach to high-level computer vision tasks. By exploiting the integration of recent advances in high-resolution light microscopy, 3D imaging and high-density multielectrode array technologies, RENVISION will be in an unprecedented position to investigate pan-retinal signal processing at high spatiotemporal resolution, allowing simultaneous recording from the entire population of ganglion cells and functional imaging of inner retinal layers at near-cellular resolution, combined with 3D structural imaging of the whole inner retina. The combined analysis of these complex datasets will require the development of novel multimodal analysis methods. Resting on these neuroscientific and computational grounds, RENVISION will generate new knowledge on retinal processing. It will provide advanced pattern recognition and machine learning technologies to ICTs by shedding a new light on how the output of retinal processing (natural, modelled) solves complex vision tasks such as automated scene categorization and action recognition.

NUMED Project-Team (section vide)

PARIETAL Project-Team

2.1. Highlights of the Year

Fabian Pedregosa, PhD candidate at the Parietal team won the best poster award at the EuroScipy 2012 conference. The poster, Memory Profiler: monitor memory usage of Python code describes the Python package memory_profiler, a tool to monitor memory usage from within the Python language. Among other features, the package is able to perform line-by-line analysis of the memory usage program and to insert breakpoints on excessive memory consumption.

POMDAPI Project-Team (section vide)

REO Project-Team

2.2. Highlights of the Year

- Marc Thiriet et al. were awarded the "JBSE Paper of the Year 2010" for their article [6].
- New european project (FP7-PEOPLE Marie-Curie Action: "Initial Training Networks") REVAMMAD about Retinal Modeling, Measurement and Diagnosis (Jean-Frédéric Gerbeau, Working Package leader)
- New ANR project EXIFSI (ANR JCJC) about fluid-structure interaction (Miguel Fernández, Principal Investigator)

SAGE Project-Team

2.2. Highlights of the Year

The results of the year are focused on numerical models and simulations for flow in porous fractured media. For this subject only, the team published three papers in journals, gave an invited plenary talk and two invited talks in minisymposia. Societal and economical issues concern environment and energy, such as groundwater resources, prevention and remediation of pollution, geothermy, etc.

SERPICO Team (section vide)

SHACRA Project-Team

2.3. Highlights of the Year

2.3.1. Two full papers at MICCAI'2012 in Nice

Two full papers have been accepted in the International Conference on Medical Imaging Computing and Computer Assisted Intervention (MICCAI, ERA's Ranking A).

2.3.2. IHU Mix-Surg and Haystack Project

The team is involved in the creation of the IHU Mix-Surg in Strasbourg, a new institute dedicated to minimally invasive therapies, guided by image and simulation. It involves interdisciplinary expertise of medical groups, academic partners and strong industry partnerships. IHU has provided financial support for a project named Haystack (image guided surgery for brachyterapy).

2.3.3. HelpMeSee Project

The team has been involved on a project funded by the non-governmental organization *HelpMeSee*[1]. HelpMeSee aims at providing ways to treat cataract surgery in third world countries. Their main objective is to develop a simulator to train surgeons. Shacra has been involved for its expertise in real-time simulation of soft anatomical structures.

[1] http://www.helpmesee.org

SISYPHE Project-Team

2.2. Highlights of the Year

The feedback scheme for quantum systems proposed by Mazyar Mirrahimi and his co-authors have been very successful in some important physical experiments. After the preparation and stabilization of a small number of photons in a cavity in 2011 with the group of Serge Haroche, Nobel Prize for Physics (2012) at ENS Paris ([9], [8], [17], some new results have been obtained by Mazyar and his PhD student, Zaki Leghtas with the groups of Robert Schoelkopf and Michel Devoret at Yale University [74], [75], [77], [78]. In particular, they have proposed a new method to autonomously correct for errors of a logical qubit induced by energy relaxation. This proposal directly addresses the task of building a hardware-efficient and technically realizable quantum memory.

STEEP Exploratory Action

2.3. Highlights of the Year

A highlight of our young team has been the successful submission of a multi-disciplinary ANR project coordinated by us (CITiES project, see further below). It is our first significant grant and creates a formal framework for our already existing collaborations with various partners throughout France.

Amaël Delaunoy has been the recipient of the annual PhD thesis award of AFRIF (Association Française pour la Reconnaissance et l'Interprétation des Formes), for his thesis *Modélisation 3D à partir d'images : contributions en reconstruction photométrique à l'aide de maillages déformables*, supervised by E. Prados and P. Sturm.

VIRTUAL PLANTS Project-Team

2.2. Highlights of the Year

- **Move of the team to a new campus to join other Inria teams.** Until this year, the team was located at the Cirad Lavalette campus in Montpellier. In May 2012, it moved to the *Maison de la Modélisation pour le vivant et l'environnement* in Montpellier close to the campus of Computer Science research (LIRMM). This move is intended to strengthen the presence of Inria in Montpellier by gathering several Inria teams at the same place, fostering interactions between them and consequently augment the visibility of Inria in the region. It is also meant to support the creation of the *Computational Biology Institute of Montpellier*, IBC, that succeeded to the national call on *investissements d'avenir* of ANR, and in which both Zenith and Virtual Plants Inria teams are strongly involved.
- **Acceptation of the Inria Large Scale Initiative Morphogenetics.** The Inria *action d'envergure* Morphognetics was evaluated by Inria and accepted. The project gathers 3 Inria teams (Imagine, Morpheme and Virtual Plants) from 2 Inria centers (Rhône-Alpes and Sophia-Antipolis-Méditerranée) and 2 Inra teams (RDP and RFD) from Lyon an Grenoble respectively to address the problem of flower development at early stages. The kick-off meeting of the project was held in November in Montpellier. The project will last 4 years and will focus in particular on the modelling of meristem mechanics during the early phases of organogenesis and how it is related to genes.
- **First paper on L-Py published.** The first paper describing our simulation system language *L-Py* has been published in Frontiers in Plant Science. The maturity and the diffusion of this software module increases and is now the basis of the work of several groups worldwide. Several training sessions have been organized by the team in the last two years and will be at the core of the future training program proposed by the Virtual Plants team on plant modeling.
- **Completion of a series of papers on tree development analysis using various types of stochastic processes.** Understanding tree development over several years has been the object of active research since about 10 years. This has generated the development of integrative models for analyzing tree growth components (ontogeny, climate and local environment influence) and patterns, in particular models combining latent state variables, tree response variables and environmental explanatory variables but also individual and population parameters [39] [2]. This approach has been applied to forest and fruit trees, to tropical and temperate species growing in various conditions (orchard, managed forest stand and unmanaged forest understory) [7] [49], [16].

VISAGES Project-Team

2.2. Highlights of the Year

Aymeric Stamm received the Magna Cum Laude Merit Award from the ISMRM organisation for [42] .
BEST PAPERS AWARDS :
[42] **Proc. Intl. Soc. Mag. Reson. Med.**. A. STAMM, P. PEREZ, C. BARILLOT.

ACES Project-Team

2.2. Highlights of the Year

Aces designed and developed several applications based on the coupled objects (see section 3.3). Our results have been recognized: the paper that presents the principle of "pervasive integrity checking" has received a best paper award in ANT 2011. And a part of Ubi-check software has been demonstrated at IEEE Percom 2012, and has received the Best Demo Award [7].

ADAM Project-Team

2.2. Highlights of the Year

We highlight two results that are of particular interest with respect to our annual activity. Both of them deal with the reconfiguration of software systems and are related to PhD theses that have defended in 2012. The first one is concerned with the application of the notion of reconfiguration to software processes in service-oriented architectures. The second one deals with the formalization of quality of service contracts in reconfigurable software systems.

Gabriel Hermosillo's PhD thesis [11], that was defended on 5 June 2012, deals with reconfigurable middleware, and has provided a solution for dynamically reconfiguring business processes in service-oriented architectures. So far, our results in terms of reconfiguration were mainly in terms of fine-grained artefacts, such as components. This thesis has demonstrated that this property can be achieved for coarse-grained artefacts, such as business processes. This opens interesting perspectives, especially in terms of industrial impact, since many complex workflow activities in IT systems are expressed as business processes with stringent needs for adaptation to evolving execution conditions. Furthermore, the thesis demonstrated that the domains of Complex Event Processing (CEP) [107] can be integrated in a comprehensive framework where events and their processing rules are the triggering conditions for process adaptation. This has resulted in the development of the CEVICHE framework that was the topic of several major publications [104], [103], [114] in addition to the thesis manuscript itself.

Gabriel Tamura's PhD thesis [12], that was defended on 28 May 2012, deals with the reliable preservation of quality of service (QoS) contracts in component-based software systems under changing conditions of execution. In response to this challenge, the presented contribution is twofold. The first one is a model for component-based software applications, QoS contracts and reconfiguration rules as typed attributed graphs, and the definition of QoS-contracts semantics as state machines in which transitions are performed as software reconfigurations. Thus, we effectively use (formal) models at runtime to reliably reconfigure software applications for preserving its QoS contracts. More specifically, we show the feasibility of exploiting design patterns at runtime in reconfiguration loops to fulfill expected QoS levels associated to specific context conditions. We realize this formal model through a component-based architecture and a reference implementation that can be used to preserve the QoS contracts of executed middleware applications. The second contribution is the characterization of adaptation properties to evaluate self-adaptive software systems in a standardized and comparable way. By its own nature, the adaptation mechanisms of self-adaptive software systems are essentially feedback loops as by defined in control theory. Thus, it is reasonable to evaluate them using the standard properties used to evaluate feedback loops, re-interpreting these properties for the software domain. We define the reliability of our formal model realization in terms of a subset of the characterized adaptation properties, and we show that these properties are guaranteed in this realization. This has resulted in the development of the QOS-CARE framework that was the topic of several major publications [66], [67], [63], [127] in addition to the thesis itself.

ALGORILLE Project-Team

2.2. Highlights of the Year

- Our team (composed of Luc Sarzyniec, Sébastien Badia, Emmanuel Jeanvoine and Lucas Nussbaum) won the **best challenge entry award during the Grid'5000 winter school**. We successfully demonstrated the deployment of 4500 virtual machines using Kadeploy3 in less than an hour. An earlier iteration of this work was selected as a **finalist of the SCALE challenge, held with CCGrid'2013**.

ARLES Project-Team

2.2. Highlights of the Year

During this year, while we have pursued our research on advanced service-oriented architectures and related middleware solutions for next generation networking environments, we have also made advances over our initial progress in research on several new subjects, called for by the ongoing drastic evolution of the networking environment:

- Dynamic interoperability among networked systems towards making them eternal, by way of on-the-fly generation of connectors based on adequate system models. This research is part of a major European collaborative project within the Future and Emerging Technology program of the EC FP7-ICT (§ 6.2 , § 7.2.1.1), which was successfully completed in November 2012 with the highest rating of "Excellent progress (the project has fully achieved its objectives and technical goals for the period and has even exceeded expectations)".
- Interaction paradigm abstractions and service oriented middleware for choreographies in the ultra-large scale future Internet. This research is also part of a major European collaborative project within the Software and Service Architectures and Infrastructures programme of the EC FP7-ICT (§ 6.4 , § 7.2.1.2).

ASAP Project-Team

2.3. Highlights of the Year

- **Best Paper Award PODC 2012** ACM Symposium on Principles of Distributed Computing (G. Giakkoupis and P. Woelfel, *On the time and space complexity of randomized test-and-set*).
- **Chair of the ACM Software System Award committee** (A.-M. Kermarrec)
- **ERC Proof of Concept Grant** (A.-M. Kermarrec)

ASCOLA Project-Team

2.2. Highlights of the Year

This year we have produced three major scientific results. Concerning the foundations of programming, we have extending the Calculus of Construction, the type theory underlying the Coq theorem prover by new logical principles that haven't been tractable before [22], see Sec. 6.1 . We have also extended the A Calculus, the currently most comprehensive foundational calculus for AspectJ-like and history-based aspect models, by a non-deterministic semantics and have provided a type soundness proof that is close to standard mathematical reasoning and automated using Coq [12], see Sec. 6.2 . In the domain of efficient Cloud infrastructures, we have proposed DVMS, a fully-distributed and autonomous system for VM scheduling, that includes one of the currently most highly-scalable scheduling algorithm [13], see Sec. 6.3 .

ASCOLA is part of the new EU FP7 IP project A4Cloud on Accountability for the Cloud, a project with 13 industrial and academic partners, see Sec. 8.2 .

Finally, ASCOLA members have organized the Grid'5000 international winter school at École de Mines de Nantes, which brought together seventy, mostly European, PhD students and senior researchers, see Sec. 9.1 .

ATLANMOD Team

2.3. Highlights of the Year

- Jordi Cabot has successfully defended his HdR. Title of the habilitation thesis: *MDE 2.0.: pragmatic model verification and other stories*
- Publication of the book *Model-Driven Software Engineering in Practice* (Morgan and Claypool) co-authored by Jordi Cabot. See also the popularization section.

AVALON Team (section vide)

CEPAGE Project-Team

2.3. Highlights of the Year

- A long paper has been presented at the STOC'12 Conference: I. Abraham, S. Chechik and C. Gavoille. *Fully Dynamic Approximate Distance Oracles for Planar Graphs via Forbidden-Set Distance Labels* in 44th Annual ACM Symposium on Theory of Computing (STOC), pp. 1199-1217, New York, May 2012.
- Ralf Klasing was the Conference Chair of the *11th International Symposium on Experimental Algorithms (SEA 2012)*, Bordeaux, France, June 7-9, 2012.
- The members of CEPAGE have been involved in the following program committees: SODA 2013, IPDPS 2013, DISC 2012, ISAAC 2012, ICDCN 2012, IPDPS 2012 FOMC 2012, ADHOC-NOW 2012, IWOCA 2012, SEA 2012, ALGOTEL 2012, FUN2012.

CIDRE Project-Team (section vide)

DANTE Team

2.2. Highlights of the Year

2.2.1. Electronic Sensors to measure the exposition of Health care worker to Tuberculosis

Direct observation has been widely used to assess interactions between healthcare workers (HCWs) and patients but is time-consuming and feasible only over short periods. We used a wireless sensors (RFID like) system to automatically measure HCW-patient interactions. Methods: We equipped 50 patient rooms with fixed sensors and 111 HCW volunteers with mobile sensors in two clinical wards of two hospitals. For 3 months, we recorded all interactions between HCWs and 54 patients under airborne precautions for suspected ($n = 40$) or confirmed ($n = 14$) tuberculosis. Number and duration of HCW entries into patient rooms were collected daily. Concomitantly, we directly observed room entries and interviewed HCWs to evaluate their self-perception of the number and duration of contacts with tuberculosis patients. The RFID was well accepted by HCWs. This original technique holds promise for accurately and continuously measuring interactions between HCWs and patients, as a less resource-consuming substitute for direct observation. The results could be used to model the transmission of significant pathogens. HCW perceptions of interactions with patients accurately reflected reality. Results are published in PLoS ONE 7(5): e37893. doi:10.1371/journal.pone.0037893 (See[6])

2.2.2. Network science as a tool to study the Complex Systems Science field: Dreams of Universality, Reality of Interdisciplinarity...

Using a large database (more than 215 000 records) of relevant articles, we empirically study the "*complex systems*" field and its claims to find universal principles applying to systems in general. The study of references shared by the papers allows us to obtain a global point of view on the structure of this highly interdisciplinary field. We show that its overall coherence does not arise from a universal theory but instead from computational techniques and fruitful adaptations of the idea of self-organization to specific systems. We also find that communication between different disciplines goes through specific "*trading zones*, *i.e.*, sub-communities that create an interface around specific tools (a DNA microchip) or concepts (a network) [5].

2.2.3. Equipex FIT (Futur Internet of Things)

Within the FIT project, DANTE is leading the IoT-LAB workpackage and testbeds (Internet of Things Lab). Through its IoT-LAB testbeds, the FIT project will provide a very large-scale infrastructure suitable for testing heterogeneous embedded communicating objects of all sorts. Going beyond the existing SensLAB testbed, a pioneering testbed for small wireless sensor devices, the five ECO testbeds developed within FIT will encompass the following test environments:

- Internet
- wireless networks
- mobile networks
- sensor and actuator networks (SANETs)
- home gateways and access networks
- low-power and lossy networks (LLNs)

The testbeds will include a fleet of mobile robots which can be deployed to simulate a wide variety of different scenarios. The movement of each robot is controllable, and several smart objects can be embedded on each to simulate a Body Area Network. These mobile objects may act as an ad hoc network or use the fixed infrastructure that surrounds them to communicate via a real or emulated network. With full control of the network nodes and an access to the gateways these nodes are connected to, researchers are able to monitor their energy consumption as well as network-related metrics such as the end-to-end delay, throughput or overhead. DANTE leads the design of the software and hardware of all IoT-LAB nodes and a strong collaboration was set up with HiKoB company, created in 2011, an innovative startup in the field of sensor networking and embedded communicating measure.

2.2.4. Awards and honours

Classification of Content and Users in BitTorrent by Semi-supervised Learning Methods [21] was granted the best paper award at the 3rd International Workshop on Traffic Analysis and Classification (in conjunction with the 8th International Wireless Communications and Mobile Computing Conference, 2012). This result is part of M. Sokol PhD work, which is co-advised by Ph. Nain (Inria MAESTRO) and P. Gonçalves.

BEST PAPERS AWARDS :

[21] **8th International Wireless Communications and Mobile Computing Conference (3rd International Workshop on Traffic Analysis and Classification)**. K. AVRACHENKOV, P. GONCALVES, A. LEGOUT, M. SOKOL.

DIONYSOS Project-Team

2.2. Highlights of the Year

We had two best paper awards in 2012, one on video delivery techniques (see 5.4 and the project VIPEER 7.2.3), and the other one on QoE for Femto cells (see 5.1).
BEST PAPERS AWARDS :
[73] **International Conference on Network of the Future**. L. ZHE, K. SBAI, Y. HADJADJ-AOUL, A. GRAVEY, D. ALLIEZ, J. GARNIER, G. MADEC, G. SIMON, K. D. SINGH.
[71] **IEEE International Conference on Communication (ICC)**. T. TALEB, A. KSENTINI.

DISTRIBCOM Project-Team (section vide)

FOCUS Project-Team

2.2. Highlights of the Year

- Jacopo Mauro's PhD thesis, entitled "Constraints meet concurrency", has been awarded a price as the best dissertation for the two years 2010 and 2011 by the Italian Association for Logic Programming (GULP).

FUN Team

2.2. Highlights of the Year

The DECARTE funding project received the European RFID Award in March 2012 by RFID European Lab of ESCP Europe.

GANG Project-Team (section vide)

GRAND-LARGE Project-Team (section vide)

HIEPACS Project-Team

2.2. Highlights of the Year

- With the Lawrence Berkeley National Laboratory (LBNL) and Stanford an associate team has been initiated, which name is FASTLA http://people.bordeaux.inria.fr/coulaud/projets/FastLA_Website/index.html. In this collaborative research initiative we propose to study, design and implement hierarchical parallel scalable numerical techniques to address two challenging numerical kernels involved in many intensive simulation codes: namely, the N-body interaction calculations and the solution of large sparse linear systems.
- In the framework of the EADS-ASTRIUM/Inria/Conseil Régional Aquitaine agreement officially signed on March 29th, HiePACS hosts Guillaume Sylvand, EADS-IW senior engineer, who has a strong expertise in large scale parallel simulation and is an expert of parallel fast multipole techniques. Guillaume Sylvand already plays an active role in the scientific activities and will enable to strength the interaction between the academic applied and industrial research and will contribute to shrink the gap between the two.

HIPERCOM Project-Team

2.2. Highlights of the Year

- **Habilitation à Diriger des recherches**: Emmanuel Baccelli got his HDR entitled "IP-Disruptive Wireless Networking: Integration in the Internet", from the University Pierre et Marie Curie - Paris VI, December 2012.
- **PhD Thesis**: During year 2012, four PhD theses were defended:
  - **Salman Malik**, "Evaluation et Optimisation des Réseaux Sans Fil Denses", University Pierre et Marie Curie - Paris VI, November 2012, with Philippe Jacquet as adviser.
  - **Yacine Mezali**, "Algorithme de Géolocalisation Intérieure par Différenciation de Signaux WiFi", University Pierre et Marie Curie - Paris VI, March 2012, with Philippe Jacquet as adviser.
  - **Iskander Banaouas**, "Analyse et Optimisation des Protoocles d'Accès dans les Réseaux sans fil Ad Hoc", University Pierre et Marie Curie - Paris VI, February 2012, with Paul Muhlethaler as adviser.
  - **Ana Cristina B. Kochem Vendramin**, "Cultural GrAnt: um protocolo de roteamento baseado em inteligência coletiva para redes tolerantes a atrasos", Federal Technological University of Paraná, June 2012, with Anelise Munaretto Fonseca, Myriam R. De B. da Silva Delgado and Aline Carneiro Viana as co-advisers.
- **PEMWN 2012**, Performance Evaluation and Modeling of Wireless Networks is the workshop held in conjunction with the NoF 2012 conference (Network of the Future) : The HIPERCOM team actively contributed to the technical and practical organization of the PEMWN 2012 workshop held in Tunis in November 2012. Pascale Minet and Leila Saidane from ENSI (Tunis) were co-general chairs. Cedric Adjih and Paul Muhlethaler were members of the program committee. Christine Anocq was in charge of the registration.
- **Demonstration of OCARI**: The HIPERCOM team and more precisely, Cedric Adjih, Ichrak Amdouni, Ines Khoufi, Pascale Minet and Ridha Soua made a presentation and a demonstration of the routing protocol and the coloring algorithm of OCARI, an energy-efficient wireless sensor network supporting determinism, at:
  - the EPRI international workshop organized by EDF, Chatou, April 2012,
  - the ICSSEA international conference in Paris, October 2012.
- **Vulgarisation of computer science**: The HIPERCOM team and more precisely, Cedric Adjih, Ichrak Amdouni, Ines Khoufi and Ridha Soua explained the principles of communication and routing in wireless sensor networks to undergraduates and students.

INDES Project-Team (section vide)

KERDATA Project-Team

2.2. Highlights of the Year

- The KerData project-team has been officially created on July 1st 2012 as a Joint Project-Team with ENS Cachan/Brittany and INSA Rennes, for a 4-year term.
- Alexandru Costan, a former Post-Doc fellow at the KerData project-team, has been hired on a permanent position at INSA. Alexandru got his PhD in Valentin Cristea's NCIT group at Polytechnic University of Bucharest (Romania), our partner in the *DataCloud@work* Inria Associate Team.
- The KerData project-team organized the 7th Workshop of the Inria-Illinois Joint Laboratory on Petascale Computing, June 13-15, 2012 http://jointlab.ncsa.illinois.edu/events/workshop7/.
- After successful experiments with up to 9000 cores on the Kraken Cray XT5 machine (NICS) in 2011, Damaris scaled up to 16000 cores on Oak Ridge's leadership supercomputer Titan (now first in the Top500), providing in-situ analysis to the CM1 tornado simulation.

LOGNET Team

2.2. Highlights of the Year

- The contrat Alcotra Interreg *myMed: a peer-to-peer programmable social network and cloud platform* 2010-2013 ends. LogNet was the head of this ambitious project. The project can be visited at the page http://www.mymed.fr Please have a try, see Fig 2 !

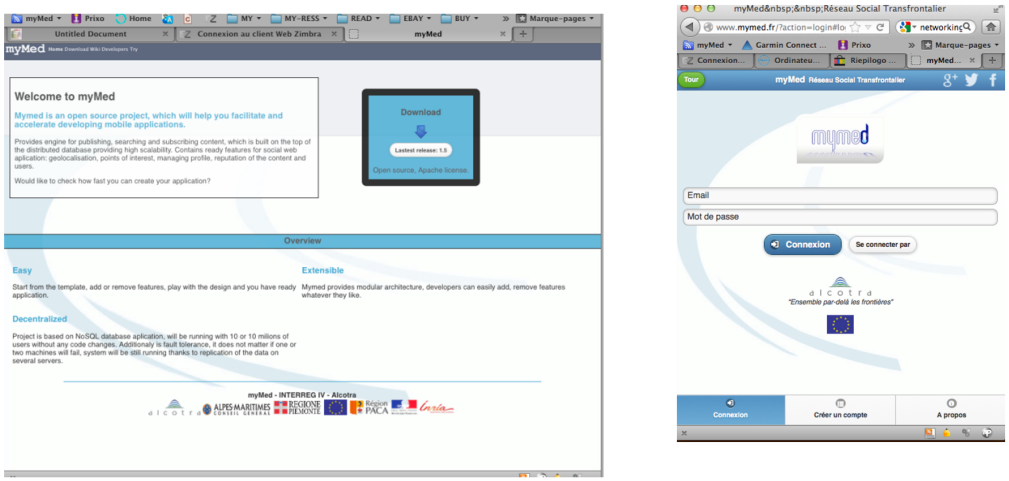

Figure 2. http://www.mymed.fr

- Four articles on myMed has been published in the newspaper “Nice Matin”
  - http://www.nicematin.com/article/lapplication-myriviera-lancement-en-fevrier.689848.html
  - http://www.nicematin.com/papier/tout-sur-la-riviera%E2%80%A6-a-portee-de-doigt.831703.html
  - http://www.nicematin.com/derniere-minute/myriviera-bientot-sur-les-smartphones.831394.html
  - See Fig 3 .
- A quite nice “artistic video” on myMed can be seen on www-sop.inria.fr/teams/lognet/multimedia/myMed_v3.mov. Please enjoy it!

nice-matin
Lundi 29 octobre 2012 | 5

CHÂTEAUNEUF-VILLEVIEILLE

Le Pays des Paillons aura son propre réseau social sur le web

D'abord, il y a eu la diffusion du guide des transports. Puis, un travail de terrain qui a permis de recenser environ soixante-dix points d'intérêts du Pays des Paillons. Maintenant, l'Association pour le développement du Pays des Paillons (ADPP) caresse un nouveau projet qui s'articulera autour des réseaux sociaux. Le conseil de développement vient de réunir, à Châteauneuf-villevieille, les maires des communes du Pays des Paillons, les membres du conseil de développement, les professionnels du tourisme. Geneviève Bach, vice-présidente de l'ADPP, et Nadine Broch, présidente du conseil de développement, ont présenté le projet.

Le maire Edmond Mari a accueilli les porteurs du projet MyMed. (Photo N. P.)

MyMed est un réseau social transfrontalier, à coût zéro, élaboré dans le cadre du programme européen Alcotra qui favorise l'échange d'informations à partir d'un ordinateur ou d'un smartphone. Luigi Liquori, chef de file du projet et directeur de recherche à l'Inria, à Sophia Antipolis, a précisé que MyMed se proposait de conjuguer les fonctionnalités offertes par les réseaux sociaux classiques (Facebook, Linkedin...) et les sites de partage (Youtube, Wikipédia...) aux besoins et particularités de la zone transfrontalière. Différentes applications composent ainsi MyMed, parmi lesquelles MyRiviera. M. Vani, ingénieur, a souligné que cette dernière communiquerait principalement sur des événements comme les manifestations sportives, concerts, festivals...

Pour le maire Edmond Mari, *« ce réseau social contribue notamment à valoriser les spécificités territoriales du Pays des Paillons, ses richesses patrimoniales et son dynamisme »*.

Afin de concrétiser ce projet, des ateliers seront planifiés pour communiquer plus amplement sur ce réseau social.

NELLY PUJOL

Figure 3. Nice Matin

MADYNES Project-Team (section vide)

MAESTRO Project-Team

2.2. Highlights of the Year

- Eitan Altman has received the France Telecom Prize awarded by the French Academy of Sciences.

BEST PAPERS AWARDS :

[47] **8th International Wireless Communications and Mobile Computing Conference (IWCMC)**. K. AVRACHENKOV, P. GONÇALVES, A. LEGOUT, M. SOKOL.

[53] **6th International Conference on Performance Evaluation Methodologies and Tools (VALUETOOLS)**. N. CHOUNGMO FOFACK, P. NAIN, G. NEGLIA, D. TOWSLEY.

[58] **14èmes Rencontres Francophones sur les Aspects Algorithmiques des Télécommunications (AlgoTel)**. F. V. FOMIN, F. GIROIRE, A. JEAN-MARIE, D. MAZAURIC, N. NISSE.

MASCOTTE Project-Team (section vide)

MESCAL Project-Team

2.3. Highlights of the Year

- Brigitte Plateau received the *Grand Prix des sciences de l'informatique et de leurs applications* of the EADS foundation.
- Panayotis Mertikopoulos received the best paper award at NETGCOOP 2012.

MOAIS Project-Team

2.2. Highlights of the Year

- Moais participates to the Kinovis project (leaded by E. Boyer, Morpheo team): Kinovis is the successor of the Grimage platform and has been selected in the equipex call for proposal.

MYRIADS Project-Team

2.5. Highlights of the Year

- Support for research and innovation Inria Award received in June 2012 by David Margery, Grid'5000 technical director, hosted in Myriads team;
- ASF (ACM SIGOPS de France) Best PhD thesis in system for Anne-Cécile Orgerie who has joined Myriads team in October 2012 (PhD advised by Laurent Lefèvre and Isabelle Guérin-Lassous at ENS de Lyon and defended in September 2011) ;
- Best Paper finalist at CloudCom 2012 (paper presenting the results of the work of the Master internship of Armel Esnault, co-advised by Eugen Feller and Christine Morin);
- Highly successful second annual review by the European Commission of the Contrail project, coordinated by Christine Morin, assisted by Roberto Cascella, technical manager.

OASIS Project-Team

2.2. Highlights of the Year

Ludovic Henrio defended his HdR entitled: “Formal Models for Programming and Composing Correct Distributed Systems” in September 2012.
BEST PAPER AWARD :
[22] **8th International ICST Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities, Tridentcom**. F. HERMENIER, R. RICCI.

PHOENIX Project-Team

2.2. Highlights of the Year

- Our first user experiments in the domain of digital assistance:
  - Experimental evaluation of a digital assistance for school inclusion of autistic children (first deployment in the *Gérard Philipe* College in Pessac from September 2012),
  - Need analysis and pre-evaluation of DiaSuiteBox with 80 elderly persons, in collaboration with the UDCCAS Gironde (Union Départementale des Centres Communaux d'Action Sociale) managing elderly care and the "Université du Temps Libre" in Bordeaux,
  - Experimental evaluation of a cognitive assistance for supporting the autonomy of persons with intellectual disabilities, in collaboration with the TSA Chair of UQTR (Université du Québec à Trois-Rivières).

  These experiments are supervised by Hélène Sauzéon, a researcher in Cognitive Science member of the PHOENIX project-team, on leave from the University of Bordeaux 2 since September 2012.
- The DiaSuiteBox project has been accepted to the startup accelerator program "Le Camping" in Toulouse. This program allows 6 startup projects to be mentored by experienced entrepreneurs during 6 months.
- Five articles accepted in top-ranked journals (IEEE Transactions on Software Engineering, Visual Languages and Computing, 2 Software Practice and Experience, and Science of Computer Programming).

PLANETE Project-Team

2.2. Highlights of the Year

- Our paper entitled “I know who you will meet this evening! Linking wireless devices using Wi-Fi probe requests,” got the Best Paper Award – Runner Up, in IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (IEEE WoWMoM 2012), San Francisco, California, USA.
- After several years of heavy involvement in the IETF activities in the transport and routing areas, four document authored or co-authored by project-team members reached the RFC status in 2012.
  - RFC 6726 (“Standards Track”) is a revision of the RFC 3926 that specifies FLUTE, the application that enables the reliable transmission of multimedia files to a large set of receivers, typically portable devices (smartphones). Over the years FLUTE and the underlying transport protocol, ALC, became key components that are now part of all the wireless Internet standards. This revision benefits from the insight gained by the deployment and usage of these components since 2006.
  - RFC 6584 (“Standards Track”) explains how to use classic authentication and integrity schemes (i.e. group MAC and digital signatures) in the ALC and NORM reliable multicast protocols. All the applications built on top of them, FLUTE for instance, directly benefit from this service.
  - RFC 6816 (“Standards Track”) specifies how to use the LDPC-Staircase AL-FEC codes (that we previously specified in RFC 5170) in the context of FECFRAME, a framework that enables AL-FEC codes to be dynamically and flexibly inserted in communication stacks for improved robustness. The typical use-case is the reliable delivery of multimedia contents in streaming mode. Therefore this RFC 6816 enlarges the fields of application of our LDPC-Staircase codes, initially designed to address file delivery use-cases (e.g. with FLUTE/ALC), to the realtime transmission of contents in streaming mode.
  - RFC 6834 (“Experimental Track”) specifies a mechanism to enforce state consistency between LISP sites by using version numbers in LISP mappings. LISP (Locator/ID Separation Protocol) uses mappings and encapsulation to improve the scalability of Internet routing and data-centers. This RFC is an enabler for fast and scalable resiliency and mobility techniques in LISP but also for state consistency in complex LISP (e.g., large datacenters).

RAP Project-Team (section vide)

REGAL Project-Team

2.2. Highlights of the Year

: Tegawendé F. Bissyandé (LaBRI, Bordeaux), Laurent Réveillère (LaBRI, Bordeaux), Julia Lawall (Regal) and Gilles Muller (Regal) received the best paper award at ASE 2012 for their work on Diagnosys: Automatic Generation of a Debugging Interface to the Linux Kernel.
BEST PAPER AWARD :
[24] **27th IEEE/ACM International Conference on Automated Software Engineering (ASE 2012)**. T. F. BISSYANDÉ, L. RÉVEILLÈRE, J. LAWALL, G. MULLER.

RMOD Project-Team

2.4. Highlights of the Year

- *Emergence Award*: Synectique is a startup project of RMoD around building customized software analysis tools. The project participated in the competition by French Ministry of research and higher education for innovative projects ("Concours OSEO"). The project was selected in the competition and won an award of 30K€ to develop its activities (http://rmod.lille.inria.fr/web/pier/blog/synectique-oseo).
- Moose 4.6 (our open-source reengineering platform) was released (http://www.moosetechnology.org/).
- Pharo 1.4 (our open-source language and environment) was released (http://www.pharo-project.org).
- RMoD organized the first Pharo Conference during two days in May (60 participants).
- RMoD participated to the organization of the ESUG conference in Ghent, Belgium in August (130 participants).
- Marcus Denker got promoted to CR1.
- RMoD launched the Pharo Consortium and the Pharo Association.

ROMA Team (section vide)

RUNTIME Project-Team

2.2. Highlights of the Year

- The hwloc software 5.2 is used for node topology discovery and process binding by the most popular MPI implementations, including MPICH2 and OPEN MPI and all their derivatives such as Intel MPI.
- The StarPU software 5.7 is used for dynamic scheduling by the state-of-the art dense linear algebra library, Magma v1.1 http://icl.cs.utk.edu/magma/ .

SARDES Project-Team

2.2. Highlights of the Year

ICI Vous pouvez ecrire du texte

SCORE Team (section vide)

SOCRATE Team

2.1. Highlights of the Year

2.1.1. CortexLab room construction start

FIT(Future Internet of Things) is a french Equipex (Équipement d'excellence) which aims to develop an experimental facility, a federated and competitive infrastructure with international visibility and a broad panel of customers. FIT will be composed of four main parts: a Network Operations Center (NOC), a set of Embedded Communicating Object (ECO) testbeds, a set of wireless OneLab testbeds, and a cognitive radio testbed (CorteXlab) deployed by the Socrate team in the Citi lab. In 2012 the construction of the room started in the Citi lab building basement. Photos of the room are now available on-line.

2.1.2. Socrate at Paris' Marathon

Former french cycle Champion Laurent Jalabert ran the 42,195 km of Paris Marathon, commenting lively his performances and wearing an experimental set of sensors analysing in real time data from the race (stride, heart, etc.). Data was sent by radio to a motocycle relaying information with euromedia bus and printed on the TV screen in real time (see the press release for instance). This experiment was made in a collaboration between socrate, Euromedia and HiKoB, next demostration should happen tour de France in 2013 targeting full deployment at Olympic Games of 2016 in Rio de Janeiro.

TREC Project-Team

2.2. Highlights of the Year

F. Baccelli was awarded the Simons Math+X Chair to further develop Wireless Stochastic Geometry.

M. Lelarge was the recipient of the 2012 ACM SIGMETRICS Rising Star Researcher Award. http://www.sigmetrics.org/risingstar-2012.shtml

TRISKELL Project-Team

2.2. Highlights of the Year

The evaluation seminar has been the main event for the team in 2012. We believe it is a highlight, since we have been evaluated on all our results and activities on the 2008 - 2012 period, and the feedback from the reviewers panel is very positive. They have emphasized the high quality of our results and also encouraged to pursue our perspectives of software engineering for open systems.

URBANET Team

2.2. Highlights of the Year

First, Quentin Lampin, Orange Labs PhD student, co-supervised by Isabelle Augé-Blum and Fabrice Valois in the settings of a bilateral contract with Orange Labs (Dominique Barthel) and contributing for Orange Labs to the ANR ARESA2 project, has been hired by Orange Labs on a permanent researcher position in december 2012.

In september 2012, Razvan Stanica has been hired Associate Professor at INSA Lyon and joined the Urbanet team. He did his PhD thesis at IRIT, Toulouse, supervised by André-Luc Beylot. Khaled Boussetta has also been awarded an Inria "delegation" temporary position and joined the Urbanet team. His permanent Associate Professor position is within University of Paris XIII.

An ARC 7 regional grant has been awarded to the team for hiring a PhD student (namely Trista Lin) and collaborating with the "Agence d'Urbanisme de Lyon" on mobility measurement and service cartography. This research is focusing on networking and software issues of smart parking applications.

Within the second phase of the Inria/Alcatel-Lucent lab, an ADR has been created on green networking issue and granted one postdoc and one PhD positions. The PhD position is dedicated to the topic we are in charge within the ADR: dynamic switch on/off mechanisms for micro-cellular network leveraging wireless sensor techniques.

ALICE Project-Team

2.2. Highlights of the Year

Sylvain Lefebvre received an ERC Starting grant for his project ShapeForge. The project will start in December 2012, for five years, and is funded for 1.3M euros.

ALPAGE Project-Team

2.2. Highlights of the Year

- A statistical parsing architecture for Italian using MELT in a pre-processing step has obtained the best results in the EVALITA shared task on Italian parsing [35] (cf. 5.7).
- Two different instances of Alpage parsing architectures were ranked 2nd and 3rd at the SANCL shared task on parsing user-generated content, organized by Google [38] (cf. 5.7 and 6.4).
- Release of two freely available out-of-domain treebanks for French: the SequoiaBank focusing on well-edited texts such as Wikipedia, Europarl, ...; the French Social Media Bank, focusing on noisy user-generated content (Facebook, Twitter, ...), the latter being the first available dataset for Facebook in any language – cf 6.4 .

AVIZ Project-Team

2.3. Highlights of the Year

AVIZ has received two best paper honorable mentions at the VisWeek 2012 conference [] , [] .

AVIZ has also received a best poster award [39] and best poster honorable mention [40] .

Tobias Isenberg has been recruited as Senior Researcher and will broaden the scope of AVIZ in the direction of Scientific Visualization and Non-Photorealistic Rendering (NPR) for interactive visualization.

AVIZ has started to port its visualizations for standard Web platforms and collaborate with industry to deploy it in various domains. For example, the French Open Data Provider "Data Publica" has deployed ScatterDice to visualize employment data in France: http://labs.data-publica.com/emploi.

BEST PAPERS AWARDS :

[] **IEEE Transactions on Visualization and Computer Graphics**. L. MICALLEF, P. DRAGICEVIC, J.-D. FEKETE.

[] **IEEE Transactions on Visualization and Computer Graphics**. L. YU, K. EFSTATHIOU, P. ISENBERG, T. ISENBERG.

AXIS Project-Team

2.2. Highlights of the Year

- Y. Lechevallier was scientific chair of the most important francophon conference in Knowledge Management and Extraction (EGC) in 2012 [39].
- Creation of the association France Living Labs (May): the french network of living labs (labelled by ENoLL) has decided with a majority in 2011 (after the 5th wave) to create an association due to their growing number in order to promote the French Living Labs and to facilitate user-driven open innovation at a national level. ICT Usage Lab (cf. section 6.1.8) is co-founder of France Living Labs with 20 other founders such as CNED, competivness clusters (Cap Digital, Image et reseaux), Lorraine Smart cities living Lab, Universcience, Urban Living Lab, etc. (cf. section 6.2.4). ICT Usage Lab is represented officially by B. Trousse (Inria) as permanent representative and A. Zarli (CSTB) as suppleant in the administration council.
- B. Trousse was elected President of France Living Labs.
- This year, AxIS experiments its Action-Research approach with more than ten workshops with citizen and/or professionnals (in the context of three contracts TIC TAC, ELLIOT and ECOFAMILIES) and mainly for the two first steps of a living lab process - the co-creation and/or exploration steps. Such an experience was very fruitful to identify the main research problems in deploying a living lab process and in designing and evaluating user experience in order to support user behaviour changes (cf. section 5.5).
- The ACM SIGSOFT 2012 Impact Paper Award has been attributed to Th. Despeyroux and his co-authors for a paper published in 1989: “CENTAUR: the system” [72].

AYIN Team

2.2. Highlights of the Year

- Yuliya Tarabalka was recruited as Inria CR2 to the AYIN team in September 2012.
- Yuliya Tarabalka received Best Reviewer Award of Transactions on Geoscience and Remote Sensing in July 2012.
- A new book was published: *Zoltan Kato and Josiane Zerubia. Markov Random Fields in Image Segmentation. Collection Foundation and Trends in Signal Processing. Now editor, World Scientific, 168 pages, September 2012.*
- A patent on skin care was deposited in collaboration with Galderma and the Morpheme research team in November 2012.

COPRIN Project-Team (section vide)

DAHU Project-Team

2.2. Highlights of the Year

Serge Abiteboul has been professor at College de France till September 2012. He organized a course on Web data management.

DREAM Project-Team (section vide)

E-MOTION Project-Team

2.2. Highlights of the Year

Awards:
- Stéphanie Lefevre has received the Best student paper award at IEEE Intelligent Vehicle conference 2012. The research work has been done in the scope of the PhD thesis of Stéphanie Lefevre (Cooperation Renault) supervised by Christian Laugier and Javier Ibanez-Guzman. Paper reference: S. Lefevre, C. Laugier, I. Ibanez-Guzman. “Risk assessment at road intersections: Comparing Intention and Expectation”, in IEEE Intelligent Vehicle Symposium, Alcalia de Henares, Spain, June 2012.
- Christian Laugier has received the IEEE/RSJ IROS Harashima Award for innovative technologies 2012 for his "contributions to embedded perception and driving decision for Intelligent Vehicles".

New major partnerships:
- The e-Motion project-team has won (in cooperation with the CNRS laboratories LAAS and ISIR) a major partnership with Taiwan in the scope of the call for “International Excellence Laboratories” (I-RiCE program) launched by the National Science Council (NSC) of Taiwan. The laboratory is hosted by the National University of Taiwan, it is supported for 5 years, and the collaborative research is focusing on Human centered Robotics.
- Establishment of a new strategic partnership focusing onto the “software / hardware integration for a robust and efficient perception in dynamic environments”. A first long term project named “Perfect” involving the CEA LETI and ST-Microelectronics has been launched in the scope of the IRT (Technological Research Institute) Nano. A more focused project involving the CEA LETI and several regional companies (Probayes, Calao, Delta Drone, ST-Ericson, Semitag) has been recently submitted.
- Toyota has renewed his long-term collaborative research agreement with the e-Motion project-team for 4 years (including a PhD grant for addressing the “Autonomous Driving" topic).

EXMO Project-Team (section vide)

FLOWERS Project-Team

2.2. Highlights of the Year

2.2.1. Ergo-Robots: Large-scale life-long learning robot experiment

The FLOWERS team, in collaboration with University Bordeaux I/Labri, has participated as a central actor of the exhibition "Mathematics: A Beautiful Elsewhere" at Fondation Cartier pour l'Art Contemporain in Paris. This installation, called "Ergo-Robots/FLOWERS Fields" was made in collaboration with artist David Lynch and mathematician Mikhail Gromov (IHES, France), and shows computational models of curiosity-driven learning, human-robot interaction as well as self-organization of linguistic conventions. This exhibition, at the crossroads of science and art, allowed to disseminate our work towards the general public, explaining concepts related to learning mechanims in humans and robots to a large audience (80000 visitors). This was also an opportunity for experimenting and improving our technologies for life-long robot learning experimentation. For one of the first times in the world outside the laboratory, we demonstrated how it is possible to achieve experimentation with learning robots quasi-continuously for 5 months. This opens novel stimulating scientific perspectives in the field of developmental robotics. This experimentation was presented through large audience radios, magazines and newspapers (France Inter, France Culture, RFI, Sciences et Avenir, Tangente, Financial Times, Daily Telegraph, Libération, ...).
More information available at: http://flowers.inria.fr/ergo-robots.php and http://fondation.cartier.com/.

2.2.2. MACSi: Integrated system for curiosity-driven visual object discovery on ICub robot

In the frame of the MACSi ANR project conducted together with ISIR (UPMC - Paris) a complete cognitive architecture for humanoid robots interacting with objects and caregivers in a developmental robotics scenario has been integrated on the iCub robot [43]. The architecture is foundational to the MACSi project and to several research axis of FLOWERS: it is designed to support experiments to make a humanoid robot gradually enlarge its repertoire of known objects and skills combining autonomous learning, social guidance and intrinsic motivation. This complex learning process requires the capability to learn affordances, i.e. the capacity for the robot to predict which actions are possible on scene elements. Several papers presenting the general framework for achieving these goals, focusing on the elementary action, perception and interaction modules have been published. This architecture is an important milestone of the project, enabling future experiments on object learning and recognition, object categorization and interaction between autonomous exploration and social guidance.

2.2.3. Algorithmic architecture for learning inverse models in high-dimensional robots

Through the design of the SAGG-RIAC algorithmic architecture, and its publication in a major robotics journal [22], we have produced a highly-efficient system for intrinsically motivated goal exploration mechanism which allows active learning of inverse models in high-dimensional redundant robots. Based on active goal babbling, this allows a robot to efficiently and actively learn distributions of parameterized motor skills/policies that solve a corresponding distribution of parameterized tasks/goals. We have conducted experiments with high-dimensional continuous sensorimotor spaces in three different robotic setups: 1) learning the inverse kinematics in a highly-redundant robotic arm, 2) learning omnidirectional locomotion with motor primitives in a quadruped robot, 3) an arm learning to control a fishing rod with a flexible wire. We showed that 1) exploration in the task space can be a lot faster than exploration in the actuator space for learning inverse models in redundant robots; 2) selecting goals maximizing competence progress creates developmental trajectories driving the robot to progressively focus on tasks of increasing complexity and is statistically significantly more efficient than selecting tasks randomly, as well as more efficient than different standard active motor babbling methods; 3) this architecture allows the robot to actively discover which parts of its task space it can learn to reach and which part it cannot.

2.2.4. Formalization of several links between intrinsic motivation architectures and statistical machine learning

We incorporated several key concepts of intrinsically motivated developmental learning, especially measures of learning progress for curiosity-driven exploration, in several standard machine learning formalisms. First, we introduced and formalized a general class of learning problems for which a developmental learning strategy is optimal [47]. This class of learning problems characterizes problems where the issue of life-long multitask learning under bouded ressources is crucial. Within this formalization, we related the SAGG-RIAC architecture [22] with multi-armed bandits formalisms [47] allowing to study the properties of problems where there several discrete choices to make to accelerate learning. Third, we also included empirical measures of learning progress in standard reinforcement learning problem allowing to automatically choose the best exploration strategy [42] and to extend Rmax approaches, for exploration in model-based RL, to non-stationary problems [46].

2.2.5. Bridging black-box optimization and RL for skill learning in robots

In this year, we have made substantial advances in understanding of the relationship between black-box optimization and reinforcement learning for direct policy search, and the application of such methods to robotics manipulation, as well as their use for modelling human behavior. The key discovery has been that black-box optimization and reinforcement learning have converged towards a same set of algorithmic properties, such as parameter perturbation and reward-weighted averaging, allowing for a direct comparison and integration of such algorithms (see "Relationship between Black-Box Optimization and Reinforcement Learning" below). On the one hand, this has enabled us to exploit principles from black-box optimization, such as covariance matric adaptation, in the context of reinforcement learning. The resulting algorithm (PI^2-CMAES) enables adaptive exploration and life-long learning in robots [63], and in reaching experiments leads to proximo-distal maturation as an emergent property [60] (see "Emergent Proximo-Distal Maturation through Adaptive Exploration" below). On the other hand, it has allowed us to demonstrate that black-box optimization outperforms reinforcement learning for a particular class of policies [69]. This is an important result, as these types of policies are typically used for robotic skill learning. Therefore, more efficient and robust black-box optimization algorithms may be applied to learning with such policies, *without* compromising convergence speed and cost of the final solution.

2.2.6. Algorithm for learning sequences of motion primitives

As for applications, we have also extended policy improvement algorithms to work with sequences of motion primitives, enabling 11-DOF manipulation robots to learn how to grasp under uncertainty through fine manipulation, and perform extended pick-and-place tasks [31] (see "Reinforcement Learning with Sequences of Motion Primitives for Robust Manipulation" below). We have also shown that learning variable impedance control is able to mimic the behavior of humans when exposed to force fields (see "Model-free Reinforcement Learning of Impedance Control in Stochastic Environments" below) .

2.2.7. Algorithms for autonomous dimensionality reduction

In 2012, we have made significant progress in incremental online learning algorithms capable of finding latent variables in high-dimensional sensory spaces, by either using the principle of multimodal correspondence[24] or weak, self-generated supervision[40]. These advances will be key in further extending the applicability of key artificial curiosity algorithms for learning with high-dimensional sensori spaces.

The following paper obtained the Best Paper Award in the category "Computational Models of Cognitive Development" at the IEEE ICDL-Epirob international conference: [53]
BEST PAPERS AWARDS :
[53] **ICDL-Epirob - International Conference on Development and Learning, Epirob**. C. MOULIN-FRIER, P.-Y. OUDEYER.

GRAPHIK Project-Team

2.5. Highlights of the Year

- Organization of ECAI 2012 (European Conference on Artificial Intelligence), one of the major conferences in AI, together with the Coconut team at LIRMM (see Sect. 9.1).
- Several keynote talks at international conferences and workshops: RuleML 2012, Effost 2012, Datalog 2.0 2012, MPREF 2012 (see Sect. 9.1).
- Three new ANR projects: ASPIQ, PAGODA and Qualinca, the latter being coordinated by GraphIK (see Sect. 8.1). The three projects tackle different aspects of ontology-based data management, with our rule-based framework as the kernel formalism.

BEST PAPER AWARD :
[31] **RR'2012: International Conference on Web Reasoning and Rule Systems**. M. KÖNIG, M. LECLÈRE, M.-L. MUGNIER, M. THOMAZO.

IMAGINE Team

2.2. Highlights of the Year

- CNRS Silver medal awarded to Marie-Paule Cani.
- We organized the International conference EXPRESSIVE 2012 (CAe, SBIM, NPAR) in Annecy in June 2012 and gathered 85 participants. The local and conference chair were respectively Jean-Claude Léon and Marie-Paule Cani (http://cae-sbim-npar-2012.inrialpes.fr/).
- Two publications were accepted at SIGGRAPH 2012: [1], [8], and one extra publication as a TOG paper [4].

IMARA Project-Team

2.2. Highlights of the Year

Gérard Le Lann has been awarded the Willis Lamb Prize by the French Académie des Sciences in November 2012, for his work on distributed, resilient, and real-time systems and networks.
BEST PAPER AWARD :
[36] **ICVES 2012 - IEEE International Conference on Vehicular Electronics and Safety**. H. LI, F. NASHASHIBI.

IMEDIA2 Team (section vide)

IN-SITU Project-Team

2.3. Highlights of the Year

- INSITU had 4 full papers and 2 notes accepted at the most prestigious conference in our field, ACM CHI 2012, including a Best Paper Award and an Honorable Mention Award.
- Wendy Mackay was awarded a five-year Advanced Grant by the European Research Council (ERC).
- Ilaria Liccardi was awarded a three-year Marie Curie grant by the European Research Council, to work with Wendy Mackay and Prof. H. Abelson at M.I.T.

BEST PAPERS AWARDS :
[24] **CHI '12: Proceedings of the SIGCHI Conference on Human Factors and Computing Systems**. E. GHOMI, G. FAURE, S. HUOT, O. CHAPUIS, M. BEAUDOUIN-LAFON.
[25] **CHI'12 - 30th International Conference on Human Factors in Computing Systems - 2012**. C. LIU, S. HUOT, J. DIEHL, W. E. MACKAY, M. BEAUDOUIN-LAFON.
[29] **MobileHCI '12: Proceedings of the 14th international conference on Human-computer interaction with mobile devices and services**. D. SPELMEZAN.

LAGADIC Project-Team

2.2. Highlights of the Year

- Marie Babel and Alexandre Krupa have defended their HdR in June 2012 [10] and December 2012 [13] respectively.
- Our paper [38] related to visual servoing based on dense ultrasound images (see Section 6.4.1) has been selected as one of the three finalists for the Best Oral Presentation in the Hamlyn Symposium on Medical Robotics'2012.

LEAR Project-Team

2.2. Highlights of the Year

- **Excellent results at TrecVid MED.** This year we participated for the second time in the Multimedia Event Detection (MED) track of TrecVid, one of the major benchmarks in automatic video analysis. In this task 25 event categories (from "making a sandwich" to "attempting a bicycle trick") have to be detected in a video corpus of 4,000 hours. We ranked first out of 13 participants on the ad-hoc event category task, and 2-nd out of 17 participants for the pre-specified event category task.
- **ERC advanced grant.** In 2012 Cordelia Schmid was awarded an ERC advanced grant for the ALLEGRO project on Active Large-scale LEarninG for visual RecOgnition. The aim of ALLEGRO is to automatically learn from large quantities of data with weak labels. In 2012 C. Schmid was also nominated IEEE fellow.
- **Inria Visual Recognition and Machine Learning Summer School**. This year we co-organized the third edition of the Inria Visual Recognition and Machine Learning Summer School in Grenoble. It attracted a total of 182 participants (48 from France, 94 from Europe and 40 from America and Asia).

MAGRIT Project-Team (section vide)

MAIA Project-Team

2.2. Highlights of the Year

- A paper on non-stationary policies for infinite-horizon Markov decision processes written by Boris Lesner and Bruno Scherrer (see Section 6.1.9 for more details) was accepted at NIPS'2012 with a *full oral presentation* (1467 papers were submitted, 370 were accepted for publication, among which only 20 were selected for *full oral presentation*).
- The Cartomatic projet which was part of the French robotics contest Defi CAROTTE organized by the General Delegation for Armaments (DGA) and French National Research Agency (ANR), has won the third and final edition of the contest. The aim of the Cart-O-matic project was to design and build a multi-robot system able to autonomously map an unknown building and to recognize various objects inside. The scientific issues of this project deal with Simultaneous Localization And Mapping (SLAM), multi-robot collaboration, and object recognition and classification. The research teams involved in this project have developed innovative approaches to each of these fields.
- The paper "MOMDPs: a Solution for Modelling Adaptive Management Problems", cosigned by Olivier Buffet has won the best paper award in this year's Special Track on Computational Sustainability and Artificial Intelligence at the Association for the Advancement of Artificial Intelligence (AAAI-12) conference in Toronto.
- Emil Keyder, Joerg Hoffmann and Patrik Haslum (ANU/NICTA) won the best paper award of the International Conference on Automated Planning and Scheduling (ICAPS-12) for their paper "Semi-Relaxed Plan Heuristics" [24].

MANAO Team

2.1. Highlights of the Year

The main event of this year is the creation of the team *MANAO*. This is a big step for defining a new research domain, at the frontier of optical science and computer graphics.

The second hightlight is shared with our partners of the ANR SeARCH project (see Section 6.2.1). The results of our collaborative work on the Alexandria lighthouse was one of the key event of the exhibition dedicated to lighthouses at the "musée de la marine" in Paris (cf. Figure 1). These results were possible thanks to the new visualization and re-assembly tools developed in our team, using data from the new acquisition process developed by our partners Archéovision and CEAlex.

Figure 1. Participation to the "PHARE" exhibition at Musée de la marine in Paris. With our partners of the ANR SeARCH project, we have reproduced and provided a first-time-seen reconstructed statue of Isis (left) which was standing in front of the Alexandria lighthouse (1/5 scale).

This year was also very successful in terms of publications. We managed to publish 6 papers in major journals and conferences (2 at TOG/SIGGRAPH [16], [21], 2 at IEEE TVCG [17], [19] and finally 2 at Computer Graphics Forum [15], [18]). They cover the whole range of our project, from material properties [19] to geometry analysis [15], [18], shading analysis [21], content creation [16] and, augmented reality [17]. These publications have received a lot of attention as proved by the two interviews [24], [25] and the 3rd best paper award at the national conference on computer graphics [22].

MAVERICK Team

2.3. Highlights of the Year

BEST PAPER AWARD :
[16] **High Performance Graphics**. E. HEITZ, F. NEYRET.

METISS Project-Team

2.2. Highlights of the Year

The 2nd Prize of the Rennes 1 Foundation was given to Ngoc Duong for his PhD co-supervised by Emmanuel Vincent and Rémi Gribonval.

For his contributions to the field, Emmanuel Vincent was awarded the 2012 SPIE ICA Unsupervised Learning Pioneer Award and gave a keynote at the SPIE DSS conference [49].

Emmanuel Vincent defended his Habilitation à Diriger des Recherches [31].

Reaching the end of its maximum lifespan, the Metiss project-team terminated at the end of the year 2012 and led to the creation of a new project-team Panama, headed by Rémi Gribonval.

MIMETIC Team

2.2. Highlights of the Year

- Franck Multon co-organized (with Pr. Qunsheng Peng) the 3rd sino-French symposium on computer graphics and virtual reality in QingDao, China, June 18-21 2012 in coordination with the 17th National Chinese Conference on CAD&CG and the Ninth National Conference on Intelligent CAD and Digital Entertainment
- Organization of the 5th international conference on Motion in Games in Rennes, France, November 15-17, 2012. http://mig2012.inria.fr/.
- HDR defense of Benoit Bideau entitled "Biomécanique du mouvement et interactions sportives", Nov 19th, 2012.

MINT Project-Team

2.2. Highlights of the Year

- F. Giraud, M. Amberg, B. Lemaire-Semail, G. Casiez, P. Olivo and N. Roussel's demonstration of transparent tactile devices was nominated for the best demonstration award by the HAPTICS 2012 conference (Vancouver, March 4-7);
- About 500 people participated in FITG 2012, the third *Forum on Tactile and Gestural Interaction* co-organized by N. Roussel in cooperation with Plaine Images (November 13-14) in Tourcoing;
- equipex IrDIVE has been funded by french ministry of research, and started officially 1st of january 2012 (scientific coordinator Yann Coello, Pr. psychology of university Lille 3, ends in 2020); it gathers 3600 Keuros from ANR, associated to 3000 Keuros of FEDER funds; this platform is associated to a pluridisciplinary scientific project, that associates Lille 1 and Lille 3 universities, and gathers computer scientists, psychologists, and historians of arts. L. Grisoni is responsible for the art-science activity in this initiative.

MORPHEO Team

2.2. Highlights of the Year

2.2.1. Equipement d'Excellence - Kinovis

The Kinovis project has been granted 2 million Euros by the French government within the "Equipement d'Excellence 2012" call for proposals. Kinovis is a collaboration between Inria Grenoble Rhône-Alpes and the University Joseph Fourier and is lead by the Morpheo team. This equipment project will implement 2 acquisition platforms for the capture and the analysis of moving animals and humans. At Inria Grenoble Rhône-Alpes a large platform equipped with 50 cameras will be set up. This platform will be used to capture large and complex scenes, e.g. multiple moving humans. At the Laboratory of Anatomy of Grenoble Hospital (LADAF - UJF), a dual Xray imaging system will be installed, coupled with a multiple views camera system, with the objective to investigate how the motion of laboratory animals such as mice and complex articulation such as hands, knees or feet for humans, relates to their anatomical structures.

MOSTRARE Project-Team (section vide)

OAK Team

2.1. Highlights of the Year

Our best results of the year appeared in extremely visible and selective venues: automated recommendation of materialized XML views in ACM SIGMOD conference [18], XML query-update independence [6] and RDF materialized view selection in the VLDB 2012 conference, and scalable duplicate detection in IEEE TKDE [8].

On the national scientific stage, our team has invested significant effort in the recently accepted LabEx DigiCosme proposal, where I. Manolescu is coordinating the "Scalable and secure data management" task, and in the national database conference where I. Manolescu has been the Program Committee chair, while Nicole Bidoit and François Goasdoué were part of the Program Committee.

Significant prototype development effort was invested in particular leading to the ACM CIKM Amada [10] and Nautilus [15] software demonstrations.

ORPAILLEUR Project-Team

2.2. Highlights of the Year

A best paper award was granted to a paper published in the proceedings of ICCBR-2012 (the international conference on case-based reasoning) [41] . This paper presents an approach for adapting cases in the formalism of qualitative algebras, with an application in a temporal algebra, dedicated to adaptation of cooking recipe preparations, and an application in a spatial algebra, dedicated to the allocation of crops in a farmland.
BEST PAPERS AWARDS :
[41] **International Conference for Case-Based Reasoning**. V. DUFOUR-LUSSIER, F. LE BER, J. LIEBER, L. MARTIN.

PAROLE Project-Team

2.2. Highlights of the Year

The movie “Je peux voir les mots que tu dis” (ADT Handicom) won the award for the best documentary at the “festival universitaire pédagogique” in Lyon, April 2012

PERCEPTION Team

2.2. Highlights of the Year

Figure 1. Audio-visual interaction between a person and the humanoid robot NAO developed under the HUMAVIPS project.

2.2.1. The European project Humavips – Humanoids with Auditory and Visual Abilities in Populated Spaces

HUMAVIPS (http://humavips.inrialpes.fr) is a 36 months FP7 STREP project coordinated by Radu Horaud and which started in 2010. The project addresses multimodal perception and cognitive issues associated with the computational development of a social robot. The ambition is to endow humanoid robots with audiovisual (AV) abilities: exploration, recognition, and interaction, such that they exhibit adequate behavior when dealing with a group of people. Research and technological developments emphasize the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior.

2.2.2. Collaboration with SAMSUNG – 3D Capturing and Modeling from Scalable Camera Configurations

In 2010 started a multi-year collaboration with the Samsung Advanced Institute of Technology (SAIT), Seoul, Korea. Whithin this project we develop a methodology able to combine data from several types of visual sensors (2D high-definition color cameras and 3D range cameras) in order to reconstruct, in real-time, an indoor scene without any constraints in terms of background, illumination conditions, etc. In 2012 we developed a novel TOF-stereo algorithm.

2.2.3. Book on Time-of-Flight Cameras

A book on Time-of-Flight Cameras was published in 2012 in the collection *Springer Briefs in Computer Science*. The book stems from the scientific collaboration between the PERCEPTION team and SAIT. The book describes a variety of recent research into time-of-flight imaging. Time-of-flight cameras are used to estimate 3D scene-structure directly, in a way that complements traditional multiple-view reconstruction methods. The first two chapters of the book explain the underlying measurement principle, and examine the associated sources of error and ambiguity. Chapters three and four are concerned with the geometric calibration of time-of-flight cameras, particularly when used in combination with ordinary colour cameras. The final chapter shows how to use time-of-flight data in conjunction with traditional stereo matching techniques. The five chapters, together, describe a complete depth and colour 3D reconstruction pipeline. This book will be useful to new researchers in the field of depth imaging, as well as to those who are working on systems that combine colour and time-of-flight cameras. The publisher's url of the book is http://www.springer.com/computer/image+processing/book/978-1-4471-4657-5#.

Figure 2. The mixed TOF-stereo multiple-camera system developed in collaboration with Samsung Electronics. Left: Geometric calibration of the camera system. Right: Live 3D display.

POTIOC Team (section vide)

PRIMA Project-Team

2.2. Highlights of the Year

Publication of a special issue on motion safety in the Autonomous Robot journal edited by Thierry Fraichard and James Kuffner [30].

REVES Project-Team

2.2. Highlights of the Year

An image from the paper Optimizing Environment Maps for Material Depiction – by Emmanuelle Chapoulie and Adrien Bousseau – was selected to appear on the front cover of the 8 issues of the journal Computer Graphics Forum 2012.

Jorge Lopez Moreno was honored with the Outstanding Doctoral Thesis Award at Universidad de Zaragoza.

This year has been particularly productive for our group, with seven publications in the top journals of our field (ACM TOG, IEEE TVCG, CGF) [15], [20], [19], [14], [13], [17], [16]

SEMAGRAMME Team (section vide)

SIROCCO Project-Team

2.6. Highlights of the Year

- The paper "Hybrid template and block matching algorithm for image intra prediction" by Safa Cherigui, Christine Guillemot, Dominique Thoreau, Philippe Guillotel and Patrick Perez has received one of the three best student paper awards at IEEE-ICASSP, Kyoto, March 2012 [21].
- The paper "Map-aided locally linear embedding methods for image prediction" by Safa Cherigui, Christine Guillemot, Dominique Thoreau, Philippe Guillotel and Patrick Perez has been among the 11 finalists (out of 500 student papers) for the best student paper award at IEEE Intl. Conf. on Image Processing, ICIP, Oct. 2012.

SMIS Project-Team (section vide)

STARS Team

2.2. Highlights of the Year

Stars designs cognitive vision systems for activity recognition based on sound software engineering paradigms.

This year, we have designed several novel algorithms for activity recognition systems. In particular, we have extended an efficient algorithm for detecting people in a static image based on a cascade of classifiers. We have also proposed a new algorithm for re-identification of people through a camera network. This algorithm outperforms state-of-the-art approaches on several benchmarking datasets (e.g. Ilids). We have realized a new algorithm for the recognition of short actions and validated also its performance on several benchmarking databases (e.g. ADL). We have improved a generic event recognition algorithm by handling event uncertainty at several processing levels. We have extended an original work on learning techniques such as data mining in large multimedia databases based on offline trajectory clustering. We have designed a generic controller algorithm, which is able to automatically tune the parameters of tracking algorithms.

We have also continued a large clinical trial with Nice Hospital to characterize the behaviour profile of Alzheimer patients compared to healthy older people.

We have organized a summer school which was held at Inria in October 2012, entitled “Human Activity and Vision Summer School", with many prestigious researchers (e.g. M. Shah).

TEXMEX Project-Team

2.2. Highlights of the Year

- The project-team has participated to three tasks in the MediaEval'2012 evaluation campaign. We have obtained the best results for the Placing Task in the run without external data.
- We have obtained top results the ETAPE named entities evaluation campaign. Our system was rank first, significantly outperforming the concurrent submitted systems.

VR4I Team

2.2. Highlights of the Year

2.2.1. Best paper award

The paper "Combining Brain-Computer Interfaces and Haptics: Detecting Mental Workload to Adapt Haptic Assistance" [22] has obtained the best paper award at Eurohaptics 2012

2.2.2. Honorable mention

The paper "Efficient Collision Detection for Brittle Fracture" [23] has obtained the honorable mention at Symposium on Computer Animation (SCA-2012)

2.2.3. Inauguration of Immersia

The Immersia platform has been officially inaugurated the 20th of June 2012, by Bertrand Braunschweig, Inria Rennes, Bretagne Atlantique director, Claude Labit, vice-president of the Rennes 1 University scientific council, Antoine Petit, Inria deputy managing director, with Jean Le Traon, research and technology regional deputy director, Bernard Pouliquen, vice-president of the regional council, Clotilde Tascon-Mennetrier, vice-president of the general council, and Daniel Delaveau, Mayor of Rennes and president of Rennes Metropole. The platform is currently extended with the installation of the two lateral screens, improving the sensation of immersion in the VR applications.

WAM Project-Team (section vide)

WILLOW Project-Team

2.2. Highlights of the Year

+ I. Laptev was awarded a Junior ERC Grant, starting in Jan 2013.
+ J. Sivic and I. Laptev (together with C. Schmid, Inria Grenoble) co-organized one week summer school on visual recognition and machine learning http://www.di.ens.fr/willow/events/cvml2012/. The school has attracted 181 participants from 34 countries.
+ J. Ponce became a senior member of the Institut Universitaire de France.
+ J. Ponce was awarded a US patent for the PMVS software developed in collaboration with Yasutaka Furukawa.

WIMMICS Team

2.2. Highlights of the Year

Fabien Gandon was general co-chair of the most important academic conference about the Web: WWW 2012, Lyon.

Best poster award at ISWC 2012 for Serena Villata and Fabien Gandon, *Towards Licenses Compatibility and Composition in the Web of Data* [75].

Minister of Culture signed the Sematicpedia Convention with Inria and Wikimedia France thanks to the DBpedia.fr project we initiated.

Serena Villata was recruited on a research position at Inria.

Fabien Gandon was appointed Advisory Committee Representative of Inria at W3C

ZENITH Project-Team

2.2. Highlights of the Year

Patrick Valduriez has been elected ACM Fellow (2013).
At the 2012 competition of the Ontology Alignment Evaluation Initiative (http://oaei.ontologymatching.org), our YAM++ ontology matching tool ranked first at the Large Biomedical Ontologies (largebio) track.
Members of the team have published the first textbook on P2P data management [9]. in the series Synthesis Lectures on Data Management by Morgan & Claypool Publishers.