



RESEARCH CENTER
Grenoble - Rhône-Alpes

FIELD

Activity Report 2012

Section highlights of the Team

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ARIC Team

2.2. Highlights of the Year

Damien Stehlé received the CNRS-INS2I bronze medal.

AVALON 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/>.

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 fruitful 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.

BIPOP Project-Team (section vide)

COMPSYS Project-Team

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”.

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.

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.

DRACULA 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, Alcala 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)

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 Geiselman created, with Marie-Gabrielle Jouan (Floralis, Université Joseph Fourier), the start-up company BGene, active in the field of DNA engineering.

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].

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).

MAVERICK Team

2.3. Highlights of the Year

BEST PAPER AWARD :

[16] **High Performance Graphics**. E. HEITZ, F. NEYRET.

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.

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).

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.

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.

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.

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.

NECS Project-Team

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.

NUMED Project-Team (section vide)

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.

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. Within 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#>.

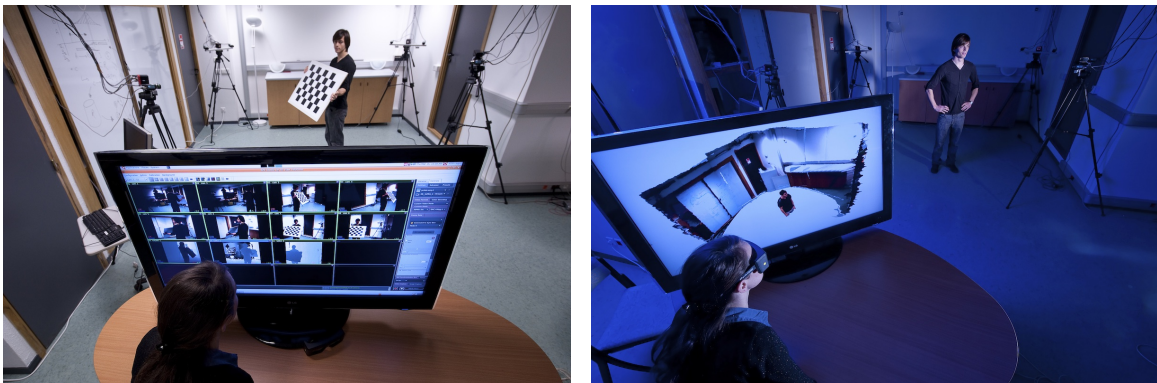


Figure 2. The mixed TOF-stereo multiple-camera system developed in collaboration with Samsung Electronics. Left: Geometric calibration of the camera system. Right: Live 3D display.

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 documents 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).

POP ART Project-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].

ROMA Team (section vide)

SARDES Project-Team

2.2. Highlights of the Year

ICI Vous pouvez ecrire du texte

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 motorcycle 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 demonstration should happen tour de France in 2013 targeting full deployment at Olympic Games of 2016 in Rio de Janeiro.

STEPP 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.

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.

WAM Project-Team (section vide)