



RESEARCH CENTER  
Saclay - Île-de-France

FIELD

Activity Report 2016

# Section Highlights of the Team

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## **COMETE Project-Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### ***5.1.1. Notable New Projects and Contracts***

- New ANR project REPAS: Reliable and Privacy-Aware Software Systems via Bisimulation Metrics (Section [9.3.4.1](#))
- New industrial contract with Renault: Protection techniques for location data (Section [8.1.1](#))

## **DATASHAPE Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### **5.1.1. Awards**

Jean-Daniel Boissonnat has been elected a professor at the Collège de France, on the Chair Informatics and Computational Sciences for the academic year 2016-2017.

### **5.1.2. Books**

Publication of a book [29], providing a self-contained presentation of the theory of persistence modules over the real line, the objects that are at the heart of the field of TDA.

**DEDUCTEAM Team (section vide)**

## GRACE Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. Events organization

- A. Couvreur, D. Augot and D. Lucas organized with L. De Feo and Hugues Randriambololona (ENST ParisTech) a **spring school on coding and cryptology** in la Chapelle Gauthier (Seine et Marne).
- A. Couvreur and D. Augot organized 4 days workshop in november 2016 for the ANR MANTA. The topics were: “Decoding” and “Codes from surfaces”.
- **SageDays75**. To conclude the ACTIS projet, we organized a one-week SageDays in August 2016. The day was spent at Inria Saclay, and people were staying at night in a cottage in Vallée de Chevreuse.

The overall theme of this Sage Days was coding theory and exact linear algebra related to it, but there was be lots of general hacking. The aim of this Sage Days was to Introduce Sage to coding theorists; have presentations about the enhancements we made to Sage’s coding theory library during Inria’s ACTIS project; Help people to work on their own projects.

We had a few talks on the mornings, and coding sprints on the afternoons. The first days’ talks were focused on basic functionalities of our library, the last 2 days on advanced functionalities, with an emphasis on Sage development.

We were glad to attract several core sage developpers, who recognized the quality of the work done by D. Lucas.

## MEXICO Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### Diagnosis, Anti-alignments and Coverability

#### DIAGNOSIS

Several new advances were obtained, concerning Diagnosis in Infinite-State Probabilistic Systems, Approximate Diagnosability of Stochastic Systems, and Diagnosability of Repairable Faults; see the 'New Results' section for a detailed description.

#### ANTI-ALIGNMENTS IN CONFORMANCE CHECKING – THE DARK SIDE OF PROCESS MODELS

Conformance checking techniques assess the suitability of a process model in representing an underlying process, observed through a collection of real executions. These techniques suffer from the well-known state space explosion problem, hence handling process models exhibiting large or even infinite state spaces remains a challenge. One important metric in conformance checking is to assess the precision of the model with respect to the observed executions, i.e., characterize the ability of the model to produce behavior unrelated to the one observed. By avoiding the computation of the full state space of a model, current techniques only provide estimations of the precision metric, which in some situations tend to be very optimistic, thus hiding real problems a process model may have. In [15], [25] we present the notion of anti-alignment as a concept to help unveiling traces in the model that may deviate significantly from the observed behavior. Using anti-alignments, current estimations can be improved, e.g., in precision checking. We show how to express the problem of finding anti-alignments as the satisfiability of a Boolean formula, and provide a tool which can deal with large models efficiently. In [19], [20], a novel approach to measure precision and generalization is presented, which relies on the notion of anti-alignments. We propose metrics for precision and generalization that resemble the leave-one-out cross-validation techniques, where individual traces of the log are removed and the computed anti-alignment assesses the model's capability to describe precisely or generalize the observed behavior.

#### APPROACHING THE COVERABILITY PROBLEM CONTINUOUSLY

The coverability problem for Petri nets plays a central role in the verification of concurrent shared-memory programs. However, its high EXPSPACE-complete complexity poses a challenge when encountered in real-world instances. In [13], we develop a new approach to this problem which is primarily based on applying forward coverability in continuous Petri nets as a pruning criterion inside a backward coverability framework. A cornerstone of our approach is the efficient encoding of a recently developed polynomial-time algorithm for reachability in continuous Petri nets into SMT. We demonstrate the effectiveness of our approach on standard benchmarks from the literature, which shows that our approach decides significantly more instances than any existing tool and is in addition often much faster, in particular on large instances.



## PARSIFAL Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

D. Miller gave invited talks at the following two regularly held international meetings.

- TYPES 2016: 22nd International Conference on Types for Proofs and Programs (Novi Sad, Serbia, 23-26 May 2016) and
- Linearity 2016: 4th International Workshop on Linearity (Porto, 25 June 2016).

D. Miller gave invited talks at the following research oriented meetings.

- Workshop on linear logic, mathematics and computer science as part of “LL2016-Linear Logic: interaction, proofs and computation”, 7-10 November 2016, Lyon. France.
- Research seminar titled “Interactions between logic, computer science and linguistics: history and philosophy”, Université de Lille 3, 15 June 2016.
- CIPPMI (Current issues in the philosophy of practice of mathematics and informatics) Workshop on Proofs, justifications and certificates. 3-4 June 2016, Toulouse, France.

A seminar in honor of the 60th birthday of Professor Miller was held on 15-16 December at Université Paris Diderot-Paris 7 in Paris, France. Several members of the team contributed talks and original research papers.

- Tomer Libal and Marco Volpe, *A general proof certification framework for modal logic*.
- Roberto Blanco and Zakaria Chihani, *An interactive assistant for the definition of proof certificates*. Preprint available as [36].
- Lutz Straßburger, *Combinatorial flows as proof certificates with built-in proof compression*.
- Taus Brock-Nannestad, *Substructural cut elimination*.

B. Accattoli gave an invited talk at the following regularly held international meeting.

- WPTE 2016: 3rd International Workshop on Rewriting Techniques for Program Transformations and Evaluation (Porto, 23 June 2016).

S. Graham-Lengrand gave an invited talk at the following international conference.

- CLAM 2016: 5th Latin American Congress of Mathematicians, thematic session on Logic and Computability (Barranquilla, Colombia, 15th July 2016).

## **SPECFUN Project-Team**

### **4. Highlights of the Year**

#### **4.1. Highlights of the Year**

##### **4.1.1. Awards**

Pierre Lairez has received the *ISSAC Distinguished Paper Award* for his joint work with T. Vaccon on  $p$ -adic differential equations [58].

## TOCCATA Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

- S. Conchon: co-organizes POPL'2017 (January, Paris, <http://conf.researchr.org/home/POPL-2017>)
  - Major Int. Conference on Foundations of Programming Language, Semantics, Type Systems, Formal Proof Techniques

### 5.1.1. Awards

- [April 2016] Martin Clochard, Léon Gondelman, Mário Pereira: jointly receive the "Best student team" award of the *VerifyThis@ETAPS2016 verification competition*
- [July 2016] S. Boldo: Best Talk Award at workshop NSV *Computing a correct and tight rounding error bound using rounding-to-nearest*

## **COMMANDS Project-Team**

### **5. Highlights of the Year**

#### **5.1. Highlights of the Year**

We started at the beginning of 2016 an Innovation Lab (Ilab) 'OSCAR', jointly with the startup Safety Line. The subject of the Ilab is the design of algorithmic tools for the (i) identification of aircraft dynamics, based on flight data recorders, and (ii) the computation of energy efficient flight trajectories.

## **DEFI Project-Team**

### **5. Highlights of the Year**

#### **5.1. Highlights of the Year**

- L. Audibert obtained the PhD prize Paul CASEAU of EDF.
- Grégoire Allaire was appointed as president of the scientifique board of IFP Energies Nouvelles.
- Grégoire Allaire broke 15 bones in a climbing accident on the 19th of July, 2016. It takes a long time to fully recover...

**DISCO Project-Team (section vide)**

**GAMMA3 Project-Team (section vide)**

## **GECO Project-Team**

### **5. Highlights of the Year**

#### **5.1. Highlights of the Year**

The European Research Council (ERC) has awarded Ugo Boscain with a "Proof of concept grant" for his project *An Artificial Visual Cortex for Image Processing*.



## POEMS Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### Workshop METAMATH

This event marked the end of the project METAMATH,

funded by the French National Research Agency (ANR). The METAMATH project, led by Sonia Fliss, involved:

- from POEMS, Sonia Fliss, Anne-Sophie Bonnet Ben Dhia, Patrick Ciarlet, Patrick Joly, Camille Carvalho and Valentin Vinales;
- from DEFI, Lucas Chesnel, Houssein Haddar, Mathieu Chamaillard and Thi Phong Nguyen;
- from Laboratoire Jacques Louis Lions, Xavier Claeys ;
- from IMATH, Université de Toulon, Guy Bouchitté and Christophe Bourel.

The motivation of this project was to contribute to the development of mathematical models for the study of periodic media and metamaterials, which are both physically relevant and available for numerical computations.

The aim of the workshop was to bring together physicists and mathematicians to make an overview of the recent researches and the new perspectives on the field.

The colloquium has taken place at Institut d'études scientifiques de Cargèse, near Ajaccio, at Corsica from November 23rd until November 25th. There were about 40 participants.

### Workshop on Mathematical and Numerical Modeling in Optics

This workshop, co-organized by Anne-Sophie Bonnet-Ben Dhia, was a part of the yearlong IMA (Institute of Mathematics and Applications) program in Mathematics and Optics, which brings together applied mathematicians, physical scientists and engineers to confront challenging problems arising in optics. It has taken place in Minneapolis from December 12th to December 16th.

It concerned more specifically researchers interested in the mathematical and numerical modeling of optical phenomena, especially spectral problems arising in photonics involving dispersion relations and band structures, eigenfunctions, and scattering resonances. Specific areas of focus included: (i) efficient computational methods for scattering and spectral problems and (ii) properties and optimal design of extreme materials and photonic devices. These problems arise in the study of photonic crystals and periodic media, diffraction gratings, metamaterials, graphene and related materials with Dirac points, and cloaking devices.

There were about 70 participants.

**SELECT Project-Team (section vide)**

## **TAO Project-Team**

### **5. Highlights of the Year**

#### **5.1. Highlights of the Year**

- Yann Ollivier was invited to contribute to Yann LeCun's official series of talks on Deep Learning at College de France.
- Isabelle Guyon was program chair of the NIPS 2016 conference (in 2017 she will be general chair).
- The TAO team was selected by Microsoft to become the community lead of the competition platform Codalab. We received a \$20 000 Azure for research grant.
- Paola Tubaro co-organized the Second European Social Networks (EUSN) Conference, a major interdisciplinary event for the international research community interested in social networks. Jean-Daniel Fekete (AVIZ) was keynote speaker, and some TAO members contributed papers.

## **TROPICAL Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### **5.1.1. Awards**

- The Gaspard Monge Programme for Optimization and Operations Research (PGMO), a corporate sponsorship of EDF operated by Fondation Mathématique Jacques Hadamard, coordinated by Stéphane Gaubert, received the “Grand Prix AEF – meilleures initiatives partagées Universités Entreprises”.
- Mateusz Skomra received the Dodu prize (distinction for the best talk of a young researcher) at the conférence SMAI-MODE 2016.

**AMIB Project-Team (section vide)**

## GALEN Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. Awards

- Wacha Bounliphone and Eugène Belilovsky received the Université Paris-Saclay STIC Doctoral School Best Scientific Contribution Award
- Eugène Belilovsky received the MITACS-Inria Globalink Award
- Prof. Iasonas Kokkinos was invited as keynote speaker in Astronomical Data Analysis Summer School, Chania, Greece, May 2016
- Prof. Iasonas Kokkinos was invited as keynote speaker in Local features workshop, held in conjunction with ECCV, October 2016
- Dr. Evangelia Zacharaki was appointed as guest associate editor for the Medical Physics journal
- 2nd place at the 2016 IEEE GRSS Data Fusion Contest for the paper: Simultaneous Registration, Segmentation and Change Detection from Multisensor, Multitemporal Satellite Image Pairs [30].
- Finalists (not-awarded) of the Best Papers award at the IEEE conference ICIP'16 for the paper: A Block Parallel Majorize-Minimize Memory Gradient Algorithm [16].
- Oral presentation in the Neural Information Processing Systems (NIPS), 2016 conference of the paper: Testing for Differences in Gaussian Graphical Models: Applications to Brain Connectivity [15] (oral presentations: only 1% of more than 2000 submitted papers).
- Oral presentation in the British Machine Vision Conference (BMVC), 2016, of the paper: Efficient Learning for Discriminative Segmentation with Supermodular Losses [33] (oral presentations: 7% of submitted papers).
- Oral presentation in the International Conference on Artificial Intelligence and Statistics (AISTATS), 2016, of the paper: A Convex Surrogate Operator for General Non-Modular Loss Functions [32] (oral presentations: 11% of submitted papers).

### 5.1.2. Other

- Acceptance of the project entitled «Predicteurs performants de l'efficacité des agents anticancéreux par apprentissage profond (deep learning) de données radiomiques et génomiques» as part of the program *Imagerie Médicale Computationnelle*. PI: Dr. Charles Ferte, Gustave Roussy, 94805 Villejuif.

## LIFEWARE Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### **Creation of the Exploratory Action *InBio* with Pasteur Institute in Paris**

The InBio project has been selected in the context of a call for new research groups organized by the Center for Bioinformatics, Biostatistics and Integrative Biology (C3BI) of Institut Pasteur.

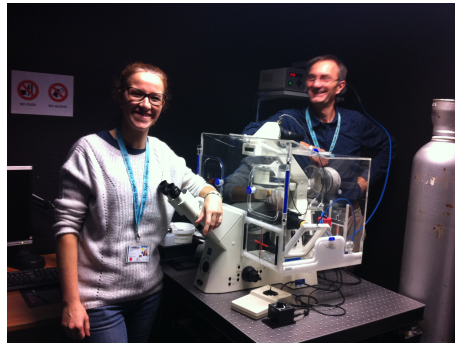
The main scientific question investigated in InBio is how one can exploit cell-to-cell differences to better learn and control the functioning of biological systems. That is, instead of seeing phenotypic variability as undesired noise that beclouds the processes of interest, we will try to harness cellular heterogeneity. In particular for control problems, because one interacts with the system, it is important to be able to predict the dynamical evolution of phenotypic heterogeneity.

A second important scientific objective of InBio is to develop more rational and systematic interactions between experimental and computational work. The virtuous loop in which experiments nurture models, that in turn, orient further experiments is universally acclaimed and installing such a loop is a central objective of many research projects. In interdisciplinary research, it is expected that this exchange of information will emerge from the interactions between the two disciplinary groups. For both practical and theoretical reasons, this is actually often not the case. In InBio, we will adopt a multidisciplinary research approach and develop an integrated environment around the design-and-test loop. This will notably involve the rational design of cell stains and of experimental plans, so that experiments are maximally-informative, and of efficient model calibration and discrimination methods. This specific focus explains the full name given to the InBio group: “Experimental and Computational Methods for Modeling Cellular Processes” (InBio simply abridges integrative biology).

InBio will be hosted at Institut Pasteur and will host experimental and theoretical research. It is a mixed structure between Inria (action exploratoire attached to Lifeware) and Institut Pasteur (research unit attached to the C3BI), and is headed by Grégory Batt.

### **The Dogma of the Control of the Cell Cycle by the Circadian Clock Revisited**

Our long-standing and tight collaboration with Franck Delaunay’s lab in Nice culminated this year with a revisiting of the dogma of the control of the cell cycle by the circadian clock. In [9] we showed, using a coupled reaction model of the cell cycle and the circadian clock and BIOCHAM analysers [4], that a selective upregulation of *Reverb- $\alpha$*  (or an inhibition of *Bmal1*) during mitosis is necessary to explain the period and phase data observed in NIH3T3 fibroblasts in different serum concentrations. This mechanism constitutes a reverse control of the circadian clock by the cell divisions which was previously overlooked but is overriding in some spontaneously dividing cell types such as non-confluent NIH3T3 fibroblasts.



*Figure 1.*

*Céline Feillet and Franck Delaunay, CNRS Nice,  
with the large-scale time-lapse video microscope which produced the unicellular 72h data studied in [9].*



## **M3DISIM Project-Team**

### **5. Highlights of the Year**

#### **5.1. Highlights of the Year**

- Official launch of M3DISIM as an Inria project-team (joint with Ecole Polytechnique / LMS) on June 1st
- Habilitation (HDR) of Philippe Moireau on November 28th

**PARIETAL Project-Team (section vide)**

## **XPOP Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### **R Foundation**

Julie Josse has been elected member of the R Foundation for Statistical Computing.

### **mlxR 3.1**

mlxR 3.1 available on CRAN

## INFINE Project-Team

# 4. Highlights of the Year

## 4.1. Highlights of the Year

### 4.1.1. Conferences and Presentations

We organized a high-profile conference in May 2016 at the Institut Henri Poincaré on “Networks: learning, information and complexity” (see: <http://www.msr-inria.fr/conferences-workshops/workshop-on-networks-learning-information-and-complexity/>) which gathered leading scientists in computer science, maths and statistical physics.

We organized in January 2016 a workshop at the Turing building involving top executives of LVMH and Inria researchers to exchange on innovation opportunities for LVMH notably around advertising with online social networks, data visualization, and computer vision.

We gave several invited talks at: Stochastic Networks Conference, UCSD; CIRM workshop on random matrices; Institut Henri Poincaré’s “Nexus” of Information and Computation Theories; EPFL workshop for birthdays of Shannon, Urbanke and Telatar (see: <http://www.etr50.com/invited-speakers/>) ; LINCNS scientific advisory board.

### 4.1.2. RIOT Summit

We successfully organized in July 2016 the first RIOT Summit in Berlin. The RIOT Summit 2016 gathered 100+ enthusiastic industrial participants, makers and academics involved in RIOT. Relevant partners such as Cisco, Samsung, Siemens, Nordic Semiconductors, as well as a number of SMEs and startups from various places in Europe gave talks on aspects of IoT communication, use cases IoT hardware, IoT open source community aspects and concepts for future IoT software and networks, as well as hands-on sessions and tutorials. See: <http://summit.riot-os.org/#speakers>.

### 4.1.3. Opening of the IoT-LAB experimental platform at the site Saclay

The project Equipex FIT deploys experimental facilities on several sites. In 2016, at the site of Saclay, the opening of the FIT IoT-LAB site followed the move from its previous location at Rocquencourt.

The platform of Saclay is an Internet-of-Things testbed and includes more than 300 nodes (175 A8-M3, 12 M3 and 120 WSN430), deployed in large experimentation rooms and space. All A8 nodes are equipped with GPS.

More information about the topology and the resources of this new site is available here: <https://www.iot-lab.info/deployment/saclay/>.

### 4.1.4. Awards

The team members have received a number of awards:

M1 intern Davi Castro de Silva received best internship prize of LIX for his work on modifying spectral methods for community detection to increase their robustness.

Best Poster Award [26] O. Hahm, C. Adjih, E. Baccelli, T. C. Schmidt, M. Waehlich.

ICN over TSCH: Potentials for Link-Layer Adaptation in the IoT, September 2016, pp. 195-196, ACM-ICN '16 Proceedings of the 3rd ACM Conference on Information-Centric Networking , Poster. [DOI:10.1145/2984356.2985226] <https://hal.inria.fr/hal-01369704>

Best Demo Award [18] H. Petersen, C. Adjih, O. Hahm, E. Baccelli.

Demo: IoT Meets Robotics - First Steps, RIOT Car, and Perspectives, in: ACM International Conference on Embedded Wireless Systems and Networks (EWSN), Graz, Austria, February 2016. <https://hal.inria.fr/hal-01262638>

BEST PAPERS AWARDS :

[15] **5th IFIP International Conference on Performance Evaluation and Modeling in Wired and Wireless Networks (PEMWN 2016)**. F. SOMAA, C. ADJIH, I. E. KORBI, L. A. SAIDANE.

## AVIZ Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

We had a number of highlights this year:

- Aviz researchers contributed 35 publications this year. Amongst these 6 papers were presented at IEEE VIS, the largest international Visualizations and Visual Analytics conference. One full paper was presented at UIST, one the most prestigious international conference on human computer interaction;
- Aviz researchers organized two workshops at international conferences (IEEE VIS);
- Three awards were won by Aviz researchers for papers (see below);
- We welcomed four international students to our lab for research visits;
- Aviz researchers taught four lectures at various French and international universities.

### 5.1.1. Awards

[8]

E. DIMARA, P. DRAGICEVIC, A. BEZERIANOS. *The Attraction Effect in Information Visualization*, in "IEEE Transactions on Visualization and Computer Graphics", 2017, vol. 23, no 1 [DOI : 10.1109/TVCG.2016.2598594], <https://hal.inria.fr/hal-01355750>

BEST PAPERS AWARDS :

[24] **Proceedings of the Symposium on User Interface Software and Technology (UIST)**. M. LE GOC, L. H. KIM, A. PARSAEI, J.-D. FEKETE, P. DRAGICEVIC, S. FOLLMER.

[25] **IEEE VIS 2016**. S. K. BADAM, C. KINKELDEY, P. ISENBERG.

## CEDAR Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### ERC Proposal Accepted

Y. Diao's ERC Consolidator proposal "Charting a New Horizon of Big and Fast Data Analysis through Integrated Algorithm Design" has been accepted by the EU.

### Awards

- A team of five including the team's PhD student Tien Duc Cao has won the first place at the Start-up Week-End in Artificial Intelligence (SWAI) in November 2016 (<https://twitter.com/i/moments/796004617410711552>, <http://swai.fr/>).
- Šejla Čebirić has been awarded the Google Anita Borg Scholarship.
- The paper "On the Complexity of Evaluating Regular Path Queries over Linear Existential Rules." by M. Bienvenu and M. Thomazo received the best paper award at the RR'16 conference .

BEST PAPERS AWARDS :

[3] **10th International Conference on Web Reasoning and Rule Systems**. M. BIENVENU, M. THOMAZO.

## **DAHU Project-Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### **Awards**

Luc Segoufin together with Mikolaj Bojanczyk, Claire David, Anca Muscholl, and Thomas Schwentick obtained the ACM Alberto O. Mendelzon PODS Test of Time Award in 2016.



## **EX-SITU Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

Michel Beaudouin-Lafon received an ERC Advanced Grant: *ONE – Unified Principles of Interaction*.

Ex-situ had a record of three research papers accepted at ACM/UIST 2016 and eleven research papers accepted at ACM/CHI 2017.

## ILDA Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. Awards

- ACM CHI 2016 Honorable mention for **TouchTokens: Guiding Touch Patterns with Passive Tokens** [4], awarded to the top 5% of all 2325 paper submissions.
- IEEE InfoVis 2016 Honorable mention for **The Attraction Effect in Information Visualization** [13].

**SMIS Project-Team (section vide)**