Activity Report 2017

Section Highlights of the Team

COMETE Project-Team (section vide)

DATASHAPE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Chairs

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

DEDUCTEAM Project-Team (section vide)

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

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Presentation at Inria@SiliconValley

D. Augot made a presentation at a one day workshop "Blockchain Technology for Cybersecurity and Social Impact" at Berkeley's CITRIS https://project.inria.fr/siliconvalley/bis2017-day1-conference-blockchain

4.1.2. Workshop on Coding theory and Cryptography (WCC)

D. Augot was co-chair of the Program Commitee of WCC 2017 (St Petersburg, Russia).

4.1.3. NIST Call for post quantum cryptography

In the context of NIST's call for post quantum cryptography:

https://csrc.nist.gov/Projects/Post-Quantum-Cryptography

members of the team participated to two sumbissions:

- A. Couvreur and E. Barelli participated to the submission of **BIG QUAKE** proposal [19]:

  https://bigquake.inria.fr/

- L. De Feo participated to the submission of **SIKE** proposal:

  https://rwc.iacr.org/2018//Slides/Longa.pdf

5. Highlights of the Year

5.1. Highlights of the Year

See the 'New results' section.

PARSIFAL Project-Team (section vide)

SPECFUN Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

Pierre Lairez was awarded the SIAM/AAG (SIAM Activity Group on Algebraic Geometry) Early Career Prize.

TOCCATA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

S. Conchon has co-organized POPL'2017 (January, Paris, http://conf.researchr.org/home/POPL-2017).

C. Marché has co-organized the first joint Frama-C/SPARK day (May, Paris, http://frama-c.com/FCSD17.html), in the context of the Open Source Innovation Spring (http://www.open-source-innovation-spring.org/).

S. Boldo and G. Melquiond have published a book: Computer Arithmetic and Formal Proofs, Verifying Floating-point Algorithms with the Coq System [32].

5.1.1. Awards

M. Pereira and R. Rieu-Helft received the "Best student team" award, and J.-C. Filliâtre the "Best overall team" award, at the *VerifyThis@ETAPS2017 verification competition*.

COMMANDS Project-Team

5. Highlights of the Year

5.1. Suboptimal feedback control of PDEs

In [13], J. Garcke (SCAI-Fraunhofer I.) and A. Kröner were able to solve finite time horizon suboptimal feedback control problems for partial differential equations is proposed by solving dynamic programming equations on adaptive sparse grids. The approach is illustrated for the wave equation and an extension to equations of Schrödinger type is discussed. A semi-discrete optimal control problem is introduced and the feedback control is derived from the corresponding value function. A semi-Lagrangian scheme is combined with spatially adaptive sparse grids. An adaptive grid refinement procedure is explored. We present several numerical examples studying the effect the parameters characterizing the sparse grid have on the accuracy of the value function and the optimal trajectory. Problems with dimensions up to eight were solved.

DEFI Project-Team (section vide)

DISCO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Silviu-Iulian Niculescu is a 2018 IEEE Control Systems Society Fellow for research on the effects of delays in system dynamics.

GAMMA3 Project-Team (section vide)

GECO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

GECO has ended in June 2017, after being evaluated earlier in the year. A new team, including all former members of GECO, has started in July 2017 in the Inria Paris center. Its name is CAGE, for *Control And GEometry*.

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

5. Highlights of the Year

5.1. Waves diffracted by Patrick Joly

On the occasion of Patrick Joly's 60th birthday, a conference with about hundred attendees has been organized by Sonia Fliss, Xavier Claeys, Bérangère Delourme and Julien Diaz, from August 28th to August 30th 2017, to acknowledge and celebrate his decisive scientific contributions in the mathematical and numerical analysis of wave propagation.

Below is the list of invited Speakers

- Grégoire Allaire (CMAP, Ecole Polytechnique)
- Jean-David Benamou (Inria Paris)
- Anne-Sophie Bonnet-BenDhia (ENSTA/CNRS/Inria POems)
- Yann Brenier (Centre de Mathématiques Laurent Schwarz)
- Antoine Chaigne (MDW Vienna, Autriche)
- Simon Chandler-Wilde (Univ. Reading, UK)
- Lucas Chesnel (Inria Defi / CMAP Ecole Polytechnique)
- Bernardo Cockburn (Univ. Minnesota, USA)
- Francis Collino (freelance)
- Alexander Comech (Vienna University, Autriche)
- Martin Costabel (IRMAR, Univ. Rennes)
- Bruno Despres (LJLL UPMC)
- Bjorn Engquist (Univ. Texas Austin, USA)
- Martin Gander (Univ. Genève Suisse)
- Marcus Grote (Univ. Bâle Suisse)
- Houssem Haddar (Inria Defi / CMAP Ecole Polytechnique)
- Laurence Halpern (LAGA Univ. Paris 13)
- Thomas Hagstrom (Southern Methodist University Dallas, USA)
- Jan Hesthaven (EPF Lauzanne Suisse)
- Ralf Hiptmair (ETH Zurich Suisse)
- Andreas Kirsch (Karlsruhe Institute of Technology Allemagne)
- Claude Le Bris (CERMICS ENPC)
- Jérome Le Rousseau (LAGA Univ. Paris 13)
- Pierre Louis Lions (College de France)
- Peter Monk (Univ. Delaware)
- Serge Nicaise (Univ. Valenciennes)
- Konstantin Pankrashkin (Univ. Paris 11 Orsay)
- George Papanicolaou (Stanford University USA)
- Jerónimo Rodriguez (Univ. Saint Jacques de Compostelle)
- Chrysoula Tsogka (University of Crete Grèce)
- Ricardo Weder (University of Mexico Mexique)

A short presentation of former PhD students of Patrick Joly has also given an overview of his recent activities:

- Antoine Bensalah (ENSTA/CNRS/Inria Poems)

- Maxence Cassier (University of Utah)

- Juliette Chabassier (Inria Bordeaux, EPI Magique 3D)

- Julien Coatleven (IFP)

- Sebastien Imperiale (Inria Saclay, EPI M3DISIM)

- Elizaveta Vasilevskaya (High School teacher)

5.2. A day for Marc Lenoir

A day entitled *Un Lenoir... ça Marc... donc ça se fête* was organized at ENSTA on June, 23th, and gathered about 60 people. This day was intended to make a festive tribute to Marc Lenoir for his role in what has become the Applied Mathematics Laboratory of ENSTA (including POEMS). Two scientific talks have been given by longtime friends of Marc: Michel Crouzeix (University of Rennes) and Jacques Rappaz (Ecole Polytechnique Fédérale de Lausanne, Switzerland). The other talks, which emphasized the scientific and human qualities of Marc, were given by four former students: Nicolas Salles, Eric Lunéville and Christophe Hazard (all from POEMS) and Nabil Gmati (LAMSIN, Tunis).

RANDOPT Team

5. Highlights of the Year

5.1. Highlights of the Year

- A Auger has been (re)-elected member of the ACM-SIGEVO executive board.

SELECT Project-Team   (section vide)

5. Highlights of the Year

5.1. Organisation and Distinctions

- Isabelle Guyon, General Chair, **NIPS 2017** in Los Angleles (8000+ attendees). She also co-organized several workshops (two *See.4C* workshops, *Connecting the dots* at LAL, *AutoML* a ICML, BayLearn, and CiML at NIPS).

- Flora Jay co-organized **JDSE17**, the second edition of the Junior Conference on Data Science and Engineering, Paris-Saclay (September 2017).

- Yann Ollivier coordinated several events in France (workshop, public conferences, initiatives with school teachers, ...) related to **Shannon100**, the celebration of the Claude Shannon's hundredth birthday, a world-wide event. In particular he created a public exhibit that took place from December 2016 to April 2017 in the Musee des Arts et Metiers in Paris, with extremely positive feedback.

- Marc Schoenauer, expert with Cédric Villani for his national mission on the French AI strategy.

- Michèle Sebag, elected at the *Académie Française des Technologies*; ephemeral nominated member of the *Conseil National du Numérique* (Dec. 2017); member of TransAlgo; head of the DataIA Research programme.

- Paola Tubaro organized **RECSNA17**, an international conference on Recent Ethical Challenges in Social Network Analysis with support from Maison des Sciences de l'Homme Paris-Saclay and Institute for Advanced Studies, in partnership with British Sociological Association, Association Française de Sociologie and European Network on Digital Labor.

5.2. Awards and Prizes

- **AS-AC-CMA-ES Winner**, single objective track at **BBComp**, the Black Box Competition for continuous optimization at ACM-GECCO 2017 (July, Berlin). Nacim Belkhir, Johann Dréo, Pierre Savéant and Marc Schoenauer.

- **ASAP** V2 and V3 [23] ranked **first and second** at the **Open Algorithm Selection Challenge 2017** (see the official results – slide 22). François Gonard, Marc Schoenauer, and Michèle Sebag.

BEST PAPERS AWARDS :

[28] **GSI 2017 - 3rd conference on Geometric Science of Information**. Y. OLLIVIER, G. MARCEAU-CARON.

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Performance evaluation of the 17-18-112 call center in Paris

Vianney Bœuf completed his PhD, done in collaboration with Brigade des Sapeurs Pompiers de Paris, on the performance evaluation of the new organization of the Paris emergency call center developed by Préfecture de Police. See Section 7.5.2 .

5.1.2. Maximal upper bounds in Löwner order

A classical theorem of Kadison (1951) shows that the set of real quadratic forms, equipped with the pointwise order, is an antilattice, meaning that two quadratic forms have a least upper bound (or dually, a greatest lower bound) if and only if they are comparable. In [23], Nikolas Stott gave a quantitative version of Kadison theorem, characterizing the set of minimal upper bound as the quotient an indefinite orthogonal group. Applications of these ideas to hybrid systems verification appeared in [16], [30].

5.1.3. Formal proofs in linear programming

Xavier Allamigeon and Ricardo Katz have formalized in the proof assistant Coq several basic results in the theory of convex polyhedra and linear optimization. These include Farkas Lemma, the duality theorem of linear programming, separation from convex hulls, Minkowski Theorem, etc. See [27] and Section 7.3.1 .

AMIBIO Team (section vide)

GALEN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

The work on dense registration of faces [22] was selected as demo at the IEEE Conference on Computer Vision and Pattern Recognition.

The work [26] received the best poster award at the BASP workshop 2017.

5.1.2. Others

Emilie Chouzenoux received an ANR JCJC grant, for her project MajIC:Majorization-Minimization algorithms for Image Computing.

Evangelia Zacharaki has defended her 'Habilitation à Diriger des Recherches' [3].

Emilie Chouzenoux has defended her 'Habilitation à Diriger des Recherches' [1].

LIFEWARE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- **Virtual Reality for Bacteria**

  Individual bacteria have been interfaced with a computer to build hybrid bio-digital circuits. Study published in Nature Communications [1].

- **Dynamical stabilization: real-time control allows maintaining cells in unstable configurations.**

  Using real-time control or periodic forcing one can drive cells towards a region of instability and dynamically maintain them there. Study published in Nature Communications [2].

- **Strong Turing Completeness of Continuous CRNs** solving a long standing open problem in CRN theory [8].

5.1.1. Awards

BEST PAPERS AWARDS :

[8]   **CMSB 2017 - 15th International Conference on Computational Methods in Systems Biology**. F. FAGES, G. LE GULUDEC, O. BOURNEZ, A. POULY.

M3DISIM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Promotion of Jean-Marc Allain as a professor at Polytechnique.
- Patent submitted and accepted on heart and vessels modelling with data interaction ([40]).
- Submission of a IHU proposal, of 3 ERC proposals, 1 associated team proposal with UT Southwestern Medical Center Dallas
- Contract of collaboration with UT Southwestern Medical Center Dallas (Profs. G. Greil and T. Hussain)

PARIETAL Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. ERC

Demian Wassermann obtained an ERC starting grant, Neurolang, *Accelerating Neuroscience Research by Unifying Knowledge Representation and Analysis Through a Domain Specific Language*.

Besides, Alexandre Gramfort joined Parietal just after the start of his ERC grant entitled SLAB, *Signal processing and Learning Applied to Brain data*.

XPOP Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Eric Moulines was elected at the Académie des Sciences.

The ADT *SPIX* (Analysis of very high-resolution mass spectra) was selected. This project started in November 2017 for a period of one year.

The Math-AmSud project *SaSMoTiDep* (Statistical and Stochastic modeling for time-dependent data) was selected. It begins in January 2018 for a period of two years.

INFINE Project-Team

4. Highlights of the Year

4.1. Awards

Laurent Massoulié received the Grand Prix Scientifique Cino Del Duca 2017, awarded by the French Academy of Sciences for his project on *S*ocial Information Networks. More details about the price here: http://www.academie-sciences.fr/fr/Prix-en-chimie-et-sciences-du-vivant/grand-prix-scientifique-fondation-simone-et-cino-del-duca.html. More details about his project here: https://www.inria.fr/en/centre/saclay/news/laurent-massoulie-grand-prix-cino-del-duca.

Oliver Hahm received the 1st prize of Université Paris Saclay (Prix Doctorant ED STIC 2017) for his PhD work on RIOT, supervised by Emmanuel Baccelli.

4.2. Associated team - EMBRACE

2017 was the first year of the EMBRACE Associated team. The EMBRACE (lEveraging huMan Behavior for Resource AlloCation and services orchestration modEls) team is composed by members of the INFINE and by three Brazilian teams from three different Brazilian Universities. The EMBRACE project addresses the topic of designing efficient solutions for 5G networks taking into account human behavior, uncertainty, and heterogeneity of networking resources.

More information is available here: https://team.inria.fr/infine/embrace/

4.3. RIOT Summit 2017

We successfully organized in September 2017 the second RIOT Summit in Berlin. The RIOT Summit 2017 gathered 100+ enthusiastic industrial participants, makers and academics involved in RIOT. Relevant partners such as Cisco, Fujitsu, OTA Keys, Wolf SSL, 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.

AVIZ Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

BEST PAPERS AWARDS :

[] **IEEE Transactions on Visualization and Computer Graphics**. J. ZHAO, M. GLUECK, P. ISENBERG, F. CHEVALIER, A. KHAN.

[] **IEEE Transactions on Visualization and Computer Graphics**. E. DIMARA, A. BEZERIANOS, P. DRAGICEVIC.

CEDAR Team

5. Highlights of the Year

5.1. Program Committee Chair

Yanlei Diao has been the PC chair of the IEEE International Conference on Data Engineering (ICDE) 2017.

5.2. Strong recruitment of PhD students

The team has started work on many new projects, particularly ; six new PhD thesis starting this year (M. Buron, L. Di Palma, L. Duroyon, F. Raimundo, A. Sevin and K. Zaouk) have rejoined the three more senior students (D. Cao, S. Cebiric, E. Huang). These recruitments boost our efforts on core topics of the team, namely: data exploration, fact checking and data journalism, and performance optimization in the cloud.

5.3. Keynotes

Y. Diao gave a distinguished talk at TU Darmstadt; I. Manolescu gave two keynotes at the international conferences DEXA 2017 and iiWAS 2017.

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

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- Wendy Mackay: Doctor Honoris Causa, Aarhus University (Denmark), September 2017
- Wanyu Liu: "1er Prix Doctorants ED STIC" of Université Paris-Saclay, November 2017, for "BIGNav: Information Theory meets Human-Computer Interaction"

BEST PAPERS AWARDS :

[20] **ACM CHI 2017 - International conference of Human-Computer Interaction**. W. LIU, R. LUCAS D'OLIVEIRA, M. BEAUDOUIN-LAFON, O. RIOUL.

ILDA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Caroline Appert was papers co-chairs for the 2017 ACM CHI Conference on Human Factors in Computing Systems, the flagship conference in HCI, with more than 2,400 submissions in 2017.
- Caroline Appert joined the editorial board of ACM ToCHI (Transactions on Computer-Human Interaction), one of the two top journals in HCI.

PETRUS Project-Team (section vide)