RESEARCH CENTER
Saclay - Île-de-France

FIELD

Activity Report 2018

Section Highlights of the Team

Edition: 2019-03-07

AVIZ Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

- Steve Haroz joined Aviz as a research scientist (SRP) for three years.
- Catherine Plaisant joined Aviz as an International Chair for 5 years.
- The team welcomed two invited professors (Claudio Silva and Michael McGuffin).
- Aviz members presented seven papers at IEEE VIS 2018 and won a best paper award at Eurovis 2018.
- Former Aviz PhD student Lonni Besançon received a PhD thesis prize honorable mention award from GDR, AFIG, AFRV, and EGFR for his thesis "An interaction Continuum for 3D Data Visualization."
- Aviz started an Associated Team with the ilab at the University of Calgary on the topic of Situated and Embedded Visualization.

CEDAR Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Conference Chair

Ioana Manolescu has been a general chair of the IEEE International Conference on Data Engineering (ICDE) 2018.

Keynotes

Ioana Manolescu has given invited keynote talks at the Extended Semantic Web Conference (ESWC) 2018 [25], and at the *34ème Conférence sur la Gestion de Données – Principes, Technologies et Applications* (BDA) 2018 [24].

PVLDB paper

A paper on "Optimization for active learning-based interactive database exploration" by Enhui Huang and co-authors has been accepted at PVLDB 2018 [10].

Prix de stage de l'Ecole Polytechnique

Camille Chanial, third-year (M1) student at Ecole Polytechnique, has been awarded a Prix de Stage for his work on the ConnectionLens prototype [9].

COMETE Project-Team (section vide)

COMMANDS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Variational analysis for options with stochastic volatility and multiple factors

Publication of the paper [3] in the SIAM J. finance. This paper clarifies the issue of well-posedness of some PDEs arising in finance.

A stochastic data-based traffic model applied to vehicles energy consumption estimation

Publication [10] of a new method for the analysis of road traffic, in relation with energy consumption.

DATASHAPE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Books

- Jean-Daniel Boissonnat, Frédéric Chazal, Mariette Yvinec. *Geometric and Topological Inference*. Cambridge Texts in Applied Mathematics, vol. 57, Cambridge University Press, 2018.

5.1.2. Awards

- Mathieu Carrière was awarded the Prix de thèse solennel Thiessé de Rosemont / Schneider in Mathematics by the Chancellerie des Universités de Paris for his Ph.D. work under Steve Oudot's supervision (Ph.D. funded by ERC grant Gudhi), December 2018.

DEDUCTEAM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Logipedia

We have launched in September the first system independent encyclopedia of formal proofs: LOGIPEDIA.

Awards

Serge Abiteboul and Gilles Dowek have received the Award *La science se livre* in January.

DEFI Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Fellowship for the participation to the Center for Turbulence Research Summer Program in Stanford University, June-July 2018 (PM Congedo, G. Gori).

DISCO Project-Team (section vide)

EX-SITU Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- ANR ELEMENT project was accepted.
- CNRS PEPS project was accepted.
- ERC CREATIV was extended for a year.
- Wanyu Liu, Olivier Rioul, Joanna McGrenere, Wendy Mackay, and Michel Beaudouin- Lafon: Honorable Mention award at ACM CHI 2018 for “BIGFile: Bayesian Information Gain for Fast File Retrieval” [22]

GALEN-POST Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

The work on graph-based text categorization by F. Malliaros et al. [39] has received the best paper award at the 12th NAACL-HLT Workshop on Graph-Based Natural Language Processing (TextGraphs), held in New Orleans, Louisiana in June 2018.

Riza Alp Güler obtained the 2nd place at Prix du Doctorant for the Doctoral School STIC of Univ. Paris Saclay.

M. Papadomanolaki and M. Vakalopoulou got the 2nd place at the Earth Observation Challenge organised by Digital Globe and ESA for the project UrbanMonitor: Mapping Changes in Urban Environments towards Resilient Cities and Urban Sustainability. http://blog.digitalglobe.com/news/earth-observation-challenge-the-three-winners/

A. Pirayre whose PhD thesis was advised by J.-C. Pesquet received the Yves Chauvin PhD award (IFPEN).

Our M.Sc. program in Data Sciences and Business Analytics (with ESSEC Business School) was ranked 4th worldwide in the QS World University Rankings.

GAMMA3 Project-Team

3. Highlights of the Year

3.1. Highlights of the Year

3.1.1. Awards

- Adrien Loseille. Deuxième Prix FIEEC de la Recherche Appliquée.

GRACE Project-Team (section vide)

ILDA Project-Team (section vide)

INFINE-POST Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

Together with his co-authors, Emmanuel Baccelli was awarded the **best demo award** at the 3rd Cloudification of the Internet of Things Conference, in Paris, July 2018, for the demo on **Orchestration of IoT Device and Business Workflow Engine on Cloud** (collaboration with S. Kikuchi, I. Thomas, O. Jallouli, J. Dörr, A. Morgenstern, and K. Schleiser).

RIOT Summit 2018

We successfully organized in September 2018 the thrid RIOT Summit, in Amsterdam. The RIOT Summit 2018 gathered 100+ enthusiastic industrial participants, makers and academics involved in RIOT. Relevant partners such as Ericsson, HERE Technologies, CodeCoup, 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.

Associated team - EMBRACE

2018 was the second 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/embrace/

LIFEWARE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- **Multistationarity Analysis in CRNs**

  The non-existence of multiple steady states in very large chemical reaction networks, out of reach of symbolic computation methods, can be predicted by a remarkably fast graph rewriting algorithm, based on Soliman 2013's theorem [0]. Study published in the *Journal of Theoretical Biology* [1] (graphical abstract in Fig. 1).

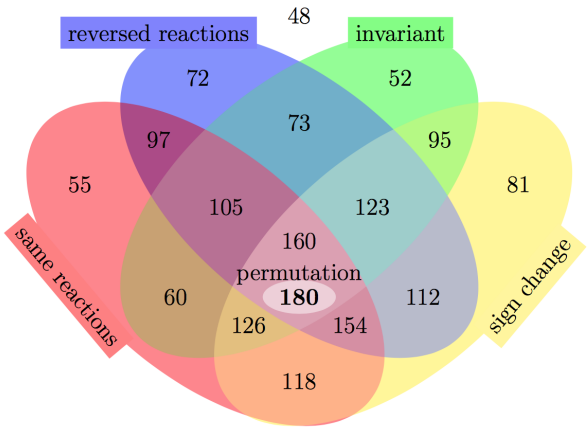

Figure 1. Graphical abstract of [1].

- **Distinguishing resistence from resilience to prolong antibiotic potency**

  Biomedical engineers at Duke University, in collaboration with Grégory Batt and Virgile Andréani, have shown experimentally that there is more than one flavor of antibiotic resistance and that it could – and should – be taken advantage of to keep first-line antibiotics in our medical arsenal. While an individual bacterium can be resistant to antibiotics, resilience only arises within a community. This happens when bacterial cells produce enough beta-lactamases to degrade the antibiotics, but not enough to save themselves from the initial onslaught. As some cells die and release more and more of the enzyme, the population as a whole eventually rids their environment of the antibiotic. Study published in *Science Advances* [6].

- **Biochemical Programs in Synthetic Cell-like Microreactors**

[0] Sylvain Soliman. A stronger necessary condition for the multistationarity of chemical reaction networks. Bulletin of Mathematical Biology, 75(11):2289–2303, 2013.

Researchers at Lab. CNRS-ALCEDIAG Sys2Diag in Montpellier, in collaboration with François Fages, have shown that an algorithm for the differential diagnosis of diabetes can be specified by three Boolean circuits and robustly implemented with real enzymes encapsulated in artificial vesicles that become fluorescent according to 5 different forms of diabetes. The robustness of the circuit was optimized in BIOCHAM by optimizing the initial concentrations of the enzymes with respect to a behavior specification in quantitative temporal logic. The protocells built with a microfluidic device were validated on a cohorte of patients' urines from Montpellier's Hospital. Study published in *Molecular Systems Biology* [3] (see Fig. 2).

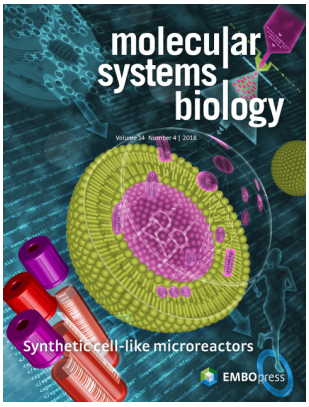

Figure 2. Artistic illustration by Courbet in cover page of Molecular Systems Biology [3].

5.1.1. Awards

- **La Recherche magazine 2019 Award - mention Information Sciences**

  The article[6] "Strong Turing Completeness of Continuous Chemical Reaction Networks and Compilation of Mixed Analog-Digital Programs" by F. Fages, G. Le Guludec, O. Bournez and A. Pouly, presented and awarded Best Paper at CMSB'17 last year has received the 2019 Award of magazine "La Recherche" - in Information Sciences.

M3DISIM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

During the 8th World Congress of Biomechanics in Dublin, Martin Genet received the Young Investigator Award from the Francophone Society of Biomechanics for his talk on “A continuum relaxed growth framework for controlling growth-induced residual stresses in living tissues”.

MEXICO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Reaching agreement in unstable times

Reaching approximate agreement in a distributed system among a set of local input values is a problem that often is repeatedly solved in artificial and natural distributed systems. Time efficient algorithms for this problem are thus of great theoretical and practical relevance. In [28] we studied the performance of such algorithms in dynamic networks. We showed lower time complexity bounds, demonstrating that already relatively simple broadcast and averaging algorithms achieve optimal time complexity. The results also imply new tight lower time complexity bounds for approximate agreement in classic distributed computing models with stable network architectures; solving a previously open problem.

5.1.2. New Semantics and State Spaces for Biological networks (and beyond)

We have gained major new insights into the dynamics of biological networks by

- obtaining [34], on the one hand, bi-directional translations between Contextual nets and BNs and correspondences between results on synchronism sensitivities. Taking advantage of CPN semantics enabling more behaviour than the generalized asynchronous updating mode, we propose an encoding of BNs that ensures correct abstraction of any multivalued refinement; and
- [20], [32] investigating update modes for discrete networks. It is commonly expected that Boolean networks produce an over-approximation of behaviours (reachable configurations), and that subsequent refinements would only prune some impossible transitions. However, we show that even generalized asynchronous updating of Boolean networks, which subsumes the usual updating modes including synchronous and fully asynchronous, does not capture all transitions doable in a multivalued or timed refinement. We introduce a new semantics for interpreting BNs which meets with a correct abstraction of any multivalued refinements, with any update mode. This semantics subsumes all the usual updating modes, while enabling new behaviours achievable by more concrete models. Moreover, it appears that classical dynamical analyses of reachability and attractors have a simpler computational complexity: – reachability can be assessed in a polynomial number of iterations (instead of being PSPACE-complete with update modes); – attractors are hypercubes, and deciding the existence of attractors with a given upper-bounded dimension is in NP (instead of PSPACE-complete with update modes). The computation of iterations is in NP in the very general case, and is linear when local functions are monotonic, or with some usual representations of functions of BNs (binary decision diagrams, Petri nets, automata networks, etc.). In brief, the most permissive semantics of BNs enables a correct abstract reasoning on dynamics of BNs, with a greater tractability than previously introduced update modes. These works open new perspectives in concurrent semantics, and at the same time will allow to capture hitherto inaccessible phenotypes and pathways in biological networks.

5.1.3. Awards

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PARIETAL Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- Pierre Ablin got a best student paper award at the LVA-ICA conference for his paper [34].
- First PhD prize from STIC doctoral school for Tom Dupré la Tour.

PARSIFAL Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

D. Miller has been made General Chair of the LICS Conference Series for three years, starting July 2018.

PETRUS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Creation of the Inria Innovation Lab 'OwnCare'

PETRUS has set up the OwnCare Inria Innovation Lab (IILab) with UVSQ and the Hippocad company in January 2018. The objective of this IILab is to industrialize PlugDB, a flagship software/hardware platform initiated in the SMIS team and today pursued in PETRUS, and deploy it in the medical/social field. A first deployment over 10.000 patients is planned in the Yvelines district (see Section 8.1.1 for details).

POEMS-POST Team

5. Highlights of the Year

5.1. Highlights of the Year

- POEMS project-team reached the deadline of 12 years at the end of 2017. We have devoted a large part of our time during the first half-year to conceive and write a text of 20 pages which describes the new project that we submit to the management of Inria, in order to pursue our research on the modeling and simulation of wave phenomena. This project is currently discussed by several experts, in interaction with ourselves, before the final decision of creation of the new project-team.
- S. Chaillat co-organized with X. Claeys (Sorbonnes & EPI ALPINES) the symposium of the *International Association for Boundary Element Methods (IABEM)*, which took place in Paris in June 2018. There were about 140 attendees.
- A.-S. Bonnet-Ben Dhia co-organized a workshop entitled *"Advanced Theoretical and Numerical Methods for waves in structured Media"* in Paris in March 2018, in the framework of the GDR Ondes. There were about 90 attendees.
- P. Ciarlet is co-author of a book entitled *"Mathematical Foundations of Computational Electromagnetism"*, published in the serie *Applied Mathematical Sciences* by Springer.

RANDOPT Team

5. Highlights of the Year

5.1. Highlights of the Year

A. Auger appointed general chair of the ACM GECCO 2019 conference (GECCO being the largest most selective conference in EC)

SELECT Project-Team (section vide)

SPECFUN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Georges Gonthier, Martìn Abadi and Cédric Fournet receiver the 20 year test-of-time award for their LICS 1998 paper *Secure Implementation of Channel Abstractions*, during LICS 2018 in Oxford.

TAU Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- *GECCO 2018 10-years impact award*, awarded to the paper published in GECCO 2008 that had the greatest impact, seen from 10 years later, for the paper

  Adaptive operator selection with dynamic multi-armed bandits, by Luis DaCosta, Alvaro Fialho, Marc Schoenauer, and Michèle Sebag, in Maarten Keijzer (Ed), Proc. ACM-GECCO, pp 913-920, 2008.
- Nacim Belkhir, Winner ACM-GECCO 2018 **BBComp single-objective** and **expensive single-objective** tracks. Nacim completed his PhD in TAU in 2017 [71], co-supervised by Marc Schoenauer, Johann Dréo and Pierre Savéant (Thalès TRT).

5.1.2. Visibility

- Marc Schoenauer, member of the core team responsible for the *Villani mission* regarding the French strategy on Artifical Intelligence. The mission started Sept. 2017 and the final report was delivered on March 29. 2018.
- Michèle Sebag, elected member of French Académie des Technologies, Apr. 2018.
- Michèle Sebag, chevalière de la Légion d'Honneur, Dec. 2018.

TOCCATA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

J.-C. Filliâtre served as judge at the ICPC regional programming contests SWERC 2017 and 2018. These two editions were organized in Paris and gathered each year 80 teams of three students from universities and schools from South-West Europe. https://swerc.eu/

The 2nd edition of the Handbook of Floating-Point arithmetic was published [28]

5.1.1. Awards

R. Rieu-Helft received the "Student Gold Medal" award, and J.-C. Filliâtre the "Best challenge submitted" award, at the *VerifyThis@ETAPS2018 verification competition*http://www.pm.inf.ethz.ch/research/verifythis/Prizes.html

TROPICAL Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- The paper [89] has been included in a list of "10 notable papers published over the last 50 years by the journal Linear Algebra and its applications", at the occasion of the golden anniversary of the journal.
- The article [17] answers an old question in the theory of interior point methods: it provides a counter example showing that log-barrier interior point methods are not strongly polynomial.

XPOP Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Version 1.0 of the SPIX software was available in November 2018.