RESEARCH CENTER
Nancy - Grand Est

FIELD

Activity Report 2017

Section Highlights of the Team

Edition: 2018-02-19

CAMUS Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

A team composed of four CAMUS members (Cédric Bastoul, Vincent Loechner, Harenome Ranaivoarivony-Razanajato and Maxime Schmitt) participated to the Google Hash Code contest. They were ranked 9 during the qualification round, over more than 26000 participants from Europe, Middle-East and Africa, and qualified for the final. They were 34th at the final hosted in the Google Paris office.

CARAMBA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The CARAMBA team organized the “Journées Codage et Cryptographie 2017”, whose objective is to regroup the French speaking community working on error-correcting codes and on cryptography. It is affiliated with the “Groupe de travail C2” of the GDR-IM.

CARTE Team

5. Highlights of the Year

5.1. Highlights of the Year

We worked on the computable aspects of an elementary problem in real analysis: extending a continuous function on a larger domain. More precisely, if a real-valued function f is defined on an interval $[0, a)$ (with $0 < a < 1$) and is computable there, under which conditions can it be extended to a computable function on $[0, 1]$? Our results show how the answer depends on a and on the way f converges at a. This provides new characterizations of already existing classes of real numbers previously defined in computability theory. Our work was presented at LICS 2017 [19].

GAMBLE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The project-team VEGAS terminated at the end of 2016. Our main highlight is actually the creation of the new project-team GAMBLE (Geometric Algorithms and Models Beyond the Linear and Euclidean realm) on July 1st.

Another highlight of this year is that after two failures, both ANR projects we are coordinating finally won at the ANR lottery with two projects that will start in 2018: ASPAG (ANR-17-CE40-0017) and SoS (ANR-17-CE40-0033).

PESTO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The paper [3] is listed in ACM Computing Reviews' 21st Annual Best of Computing list of notable books and articles [0] for 2016.

The voting system Belenios, developed in the Pesto and Caramba teams, has served as a basis of the development of two industrial systems (Docapost and Orange).

A 4-year ANR project on *Protocol Analysis — Combining Existing Tools* (TECAP) has been accepted. It will start in 2018 with Vincent Cheval as project leader.

[0] http://www.computingreviews.com

VERIDIS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Jasmin Blanchette, Mathias Fleury, and Christoph Weidenbach were invited to submit a short version of their IJCAR 2016 paper "A Verified SAT Solver Framework with Learn, Forget, Restart, and Incrementality" (which had received the Best Paper Award) to the Sister Conference Best Paper Track of IJCAI 2017 [25]. The paper was also invited to a special issue of *Logical Methods in Computer Science*.

The paper "A Formal Proof of the Expressiveness of Deep Learning" [22] by Jasmin Blanchette et al., presented at ITP 2017, has been invited to a special issue of the *Journal of Automated Reasoning*.

The paper "Decidability of the Monadic Shallow Linear First-Order Fragment with Straight Dismatching Constraints" [39] by Andreas Teucke and Christoph Weidenbach presented at CADE 26 has been invited to a special issue of the *Journal of Automated Reasoning*.

Two systems developed in the context of the SMArT project were submitted to the SMT competition SMT-COMP 2017. Redlog won the non-linear real arithmetic (NRA) category, and veriT+Redlog performed nicely on the quantifier-free non-linear real arithmetic (QF_NRA) category.

SPHINX Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Sphinx was evaluated in March 2017.
- A new ANR project (QUACO) has been accepted; its coordinator is Thomas Chambrion.

TOSCA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

BEST PAPERS AWARDS :

[] **A simple spiking neuron model based on stochastic STDP**.

BIGS Project-Team (section vide)

CAPSID Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Following a collaboration with Emmanuel Levy at the Weizmann Institute, a manuscript on annotating protein quaternary structures using our Kpax software has been published in Nature Methods [16].

MIMESIS Team

5. Highlights of the Year

5.1. Highlights of the Year

Prix de thèse 2016 en Génie Biologique et Médical attributed to Rosalie Plantefève for her thesis *Augmented Reality and Numerical Simulation for Resection of Hepatic Tumor*. The award is attributed by three scientific bodies: IEEE EMBS, Société Française de Génie Biologique et Médical, and Alliance pour le Génie Biologique et Médical. In this context, R. Plantefève was invited to submite a paper to the Journal on Innovation and Research in BioMedical Engineering and the manuscript was accepted for publication [17].

Runner up for the best poster award at the IEEE International Symposium on Mixed and Augmented Reality 2017 with the poster *Deformed Reality: Proof of concept and Preliminary Results* [32]. The poster introduced a new paradigm to interactively manipulate objects in a scene in a deformable manner. Using the core principle of augmented reality to estimate a rigid pose over time, the method enables the user to deform the targeted object while it is being rendered with its natural texture, giving the sense of a real-time object editing in the user environment. The results show that the method is capable of opening new ways of not only augmenting the scene but also to interact with it in real by imposing possibly non-linear transformations to selected entities.

The **physics-based image and video editing tool *Calipso* was resumed in *Two-minutes papers* on YouTube.** At the end of 2017, the video has more that 35k views. Calipso is an interactive method for editing images and videos in a physically-coherent manner. The main idea is to perform physics-based manipulations by running a full physics simulation on proxy geometries given by non-rigidly aligned CAD models. Running these simulations allows us to apply new, unseen forces to move or deform selected objects, change physical parameters such as mass or elasticity, or even add entire new objects that interact with the rest of the underlying scene.

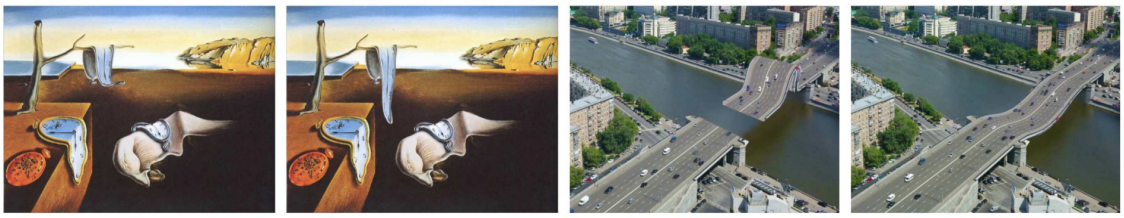

Figure 5. Illustration of Calipso deformed reality on two static images.

NEUROSYS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Laurent Bougrain is one of the three members of the committee, with Laurent Koessler and Stéphanie Caharel, that has successfully valued and amplified Neuroscience in Lorraine building a network of research in neuroscience at university of Lorraine. Neuroscience is currently being developed in different laboratories at the university of Lorraine in different institutes such as Inria, CNRS, INSERM, INRA and the university hospital of Nancy. The network will bring together more than 80 researchers in neuroscience to propose common researchers and to give national and international visibilities to neuroscience in Lorraine.
- Neurosys is the leader of the Brain-Computer Interface (BCI) for stroke platform in the Inria Project Lab BCI LIFT (see section 8.2). We developed Grasp'it, an innovative Brain-Computer Interface designed to enhance the motor rehabilitation of stroke patients with Stéphanie Fleck from Perseus lab at university of Lorraine [7], [11], [14]. Our system records users' cerebral activity during the kinesthetic motor imageries (KMI) execution using an electroencephalographic system and gives patients some visual feedback according to the accuracy of the performed imagined task. The graspIT platform was ranked second in the IHM2017 conference demonstrations and first in terms of utility. Grasp'it tends to become a serious game, whose aim is to support the learning and the practice of the KMI tasks in playful and motivating conditions. A French national (ANR) project has been submitted with two other Inria teams (Hybrid and Camin), three rehabilitation centers and an industrial partner, OpenEdge.

TONUS Team

5. Highlights of the Year

5.1. Highlights of the Year

We have developed [7] a new numerical method for solving any hyperbolic system of conservation laws (and among them the reduced plasma models). The method is based on a vectorial kinetic representation of the equations, an efficient transport solver (suc as DG or Semi-Lagrangian) and palindromic time integration. The resulting scheme is unconditionally stable, matrix-free and high order. We applied it successfully to the simulation of Rayleigh-Taylor instabilities and we are extending it to the simulation of MHD instabilities.

COAST Project-Team (section vide)

MADYNES Team

5. Highlights of the Year

5.1. Highlights of the Year

- The team (Jérôme François and Lucas Nussbaum) organized the Cloud Days (GdR CNRS RSD, Virtualizaion and Cloud Action) in Loria (Nancy).
- Loic Rouch demonstrated in Blackhat Europe 2017 an attack to tack over a z-wave network https://www.blackhat.com/eu-17/briefings/schedule/#a-universal-controller-to-take-over-a-z-wave-network-8459.

BEST PAPER AWARD :
[17] **IFIP/IEEE Symposium on Integrated Network and Service Management (IM) - AnNet workshop**.
S. LAGRAA, J. FRANCOIS.

ALICE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Sylvain Lefebvre initiated the team creation process for MFX (Matter from Graphics), a new team that will focus on synthesizing and designing complex shapes for additive manufacturing.

Jonàs Martínez have been awarded an ANR JCJC 2017 project entitled MuFFin (Microstructures Procedurales et Stochastiques pour la Fabrication Fonctionnelle). MuFFin aims at contributing a unified pipeline for the efficient and scalable synthesis, visualization, and modeling of additively manufactured microstructures with tailored macroscopic physical behavior. In an interdisciplinary effort, MuFFin will blend together computer and material science perspectives to deliver an integrated approach that is both computationally and physically sound.

LARSEN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- "2017 ISAL Award for Distinguished Young Investigator in the field of Artificial Life" to Jean-Baptiste Mouret
- "Prix du stage de recherche" awarded by the École Polytechnique to Rémi Pautrat (intern, supervised by Jean-Baptiste Mouret)
- "Prix de thèse DGA" awarded to Antoine Cully (former PhD student, co-supervised by Jean-Baptiste Mouret)

5.1.2. New Projects

- beginning of the AnDy project (H2020)
- beginning of the collaboration with ScanPyramds about "Minimally invasive robotics for heritage buildings"
- beginning of a new collaboration with Diatelic, a subsidiary of the Pharmagest group, for the development of an innovative tele-assistance service based on smart home technologies in order to allow elderlies to stay in their home longer. A PhD thesis has been funded by Diatelic to support this collaboration.

BEST PAPERS AWARDS :

[27] **Genetic and Evolutionary Computation Conference (GECCO 2017)**. A. GAIER, A. ASTEROTH, J.-B. MOURET.

[26] **18th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference**. A. GAIER, A. ASTEROTH, J.-B. MOURET.

MAGRIT Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Our paper entitled "The grid method for in-plane displacement and strain measurement: a review and analysis" [23] has been awarded with the Fylde Best Paper in Strain Prize 2016 by the British Society for Strain Measurement (BSSM).

MULTISPEECH Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Best student paper award at LTC'2017 (8th Language & Technology Conference) [39]

Third best paper award at ICNLSP'2017 (International Conference On Natural Language, Signal and Speech Processing) [42]

BEST PAPERS AWARDS :

[39] **LTC 2017 - 8th Language & Technology Conference**. A. HOUIDHEK, V. COLOTTE, Z. MNASRI, D. JOUVET, I. ZANGAR.

[42] **ICNLSSP'2017 - International Conference on Natural Language, Signal and Speech Processing**. D. JOUVET, D. LANGLOIS, M. A. MENACER, D. FOHR, O. MELLA, K. SMAÏLI.

ORPAILLEUR Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Classical properties of functions such as associativity, although algebraically easy to read, are hard to meaningfully interpret. In [60] Miguel Couceiro and colleagues at the University of Luxembourg (Jean-Luc Marichal, Jimmy Devillet) showed that associative and quasi-trivial operations that are non-decreasing are characterized in terms of total and weak orderings through the so-called single-peakedness property introduced in social choice theory by Duncan Black. This enabled visual interpretations of the above mentioned algebraic properties, and the enumeration of such operations led to several, previously unknown, integer sequences in Sloane's On-Line Encyclopedia of Integer Sequences (http://www.oeis.org), e.g., `A292932`, `A292933`, and `A292934`.

SEMAGRAMME Project-Team (section vide)