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FIELD

Activity Report 2019

Section Highlights of the Team

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CAMUS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

One of the main challenges of parallelization is the selection of the appropriate granularity to balance between the ideal degree of parallelism and the mitigation of the runtime system's overhead. We have worked on the granularity control for parallel applications focusing on two different paradigms. In the first one, which is the tasks with spawn/sync mechanism, we combined the use of asymptotic complexity functions provided by the programmer, with runtime measurements to predict the execution time of tasks with reasonable accuracy. This estimation can then be used to select the proper task granularity, while making sure to put enough work inside each task. In the second one, which is related to the tasks with dependencies paradigm, we have improved an existing algorithm to cluster a graph of tasks to obtain a meta-graph with larger tasks. This approach was used in an application in collaboration with the TONUS team, and we have demonstrated that it allows for a significant speedup.

CARAMBA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- On December 2nd, 2019, the factorization of RSA-240 and the computation of a 240-digit discrete logarithm were announced.
- In August 2019, Pierrick Gaudry found a vulnerability in the encryption scheme of the Internet voting system of Moscow.
- Pierrick Gaudry and Cécile Pierrot were invited speakers at the ECC 2019 conference (Bochum, Germany).

5.1.1. Awards

- Simon Abelard received the PhD prize of Université de Lorraine from the doctoral school IAEM (computer science, automatic) [25].

GAMBLE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

We are happy to report that some of our past work appeared this year in highly visible journals. Our proof that deciding *shellability* of simplicial complexes, a problem that was open for 40 years, was published in the Journal of the ACM [15], and our survey on *combinatorial geometry and topology and their applications* was published in the Bulletin of the AMS [13].

MOCQUA Team

5. Highlights of the Year

5.1. Highlights of the Year

The ZX-calculus is a powerful diagrammatic language which can be used to reason on quantum computing. The ZX-calculus is also an essential tool for the development of the quantum computer allowing for instance optimisation of quantum programs. Indeed the ZX-calculus is equipped with an equational theory which allows one to transform and optimize quantum programs. A few years ago, we have proved the first completeness result of the ZX-calculus [41] [28], guaranteeing that two equivalent evolutions can be transformed one into the other thanks to the equational theory. Its completeness gives to the ZX-calculus a competitive advantage compared to the other models of quantum computation, like the quantum circuits, for which no complete equational theory is known.

In [31], Renaud Vilmart introduced a new, simple, and meaningful equational theory for the ZX-calculus, based on the famous Euler angle decomposition. Renaud participated to the various previous results of the team on this subject during his PhD thesis in the Mocqua team, and culminated with this sole author paper published at LICS for which he obtained the best student paper award.

5.1.1. Awards

Best student paper award at LICS'19 for Renaud Vilmart. [31].

PESTO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Itsaka Rakotonirina was awarded a Google PhD fellowship in Security and Privacy.

Steve Kremer was granted an ANR Chair of research and teaching in artificial intelligence: ASAP – Tools for automated, symbolic analysis of real-world cryptographic protocols.

VERIDIS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Christoph Weidenbach received the Skolem test-of-time award of CADE, the international conference on automated deduction, for his paper *Towards an Automated Analysis of Security Protocols* [72].

Martin Bromberger, Mathias Fleury, Simon Schwarz and Christoph Weidenbach received the best student paper award at CADE 27 for their paper *SPASS-SATT: A CDCL(LA) Solver* .

BEST PAPERS AWARDS :

[31]

M. BROMBERGER, M. FLEURY, S. SCHWARZ, C. WEIDENBACH. *SPASS-SATT: A CDCL(LA) Solver*, in "27th International Conference on Automated Deduction (CADE-27)", Natal, Brazil, P. FONTAINE (editor), Lecture Notes in Computer Science, 2019, vol. 11716, p. 111-122 [DOI : 10.1007/978-3-030-29436-6_7], <https://hal.inria.fr/hal-02405524>

SPHINX Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Four members of the team are involved in the scientific project ODISSE funded by the ANR (october 2019-october 2023). The goal of this project, which gathers researchers from communities of automatic control and applied mathematics, is to investigate inverse problems using observer techniques.

TOSCA Team (section vide)

BIGS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

BIGS participated to the organization the JdS 2019 (Journées de Statistique 2019) <http://www.jds2019.sfds.asso.fr/> in Nancy.

B. Scherrer and his co-authors received the Outstanding paper award for AAAI-2019“ from the AAAI (Association for the Advancement of Artificial Intelligence).

BEST PAPERS AWARDS :

[9]

Y. EFRONI, G. DALAL, B. SCHERRER, S. MANNOR. *How to Combine Tree-Search Methods in Reinforcement Learning*, in "AAAI 19 - Thirty-Third AAAI Conference on Artificial Intelligence", Honolulu, Hawaii, United States, January 2019, <https://arxiv.org/abs/1809.01843> - AAAI 2019, <https://hal.inria.fr/hal-02273713>

CAPSID Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Malika Smaïl-Tabbone was invited with Bastien Rance to coordinate the selection of the best contributions from 2018 literature on Bioinformatics and Translational Informatics for the 2019 IMIA YearBook of Medical Informatics [20].

Bishnu Sarker (PhD student) obtained a DrEAM fellowship from Lorraine Université d'Excellence for a 3-month internship at the MILA (Machine Learning Laboratory of the University of Montreal and University of Quebec) in Montreal.

MIMESIS Team

5. Highlights of the Year

5.1. Highlights of the Year

- Our paper entitled "Physics-based Deep Neural Network for Augmented Reality during Liver Surgery" was selected for oral presentation at the MICCAI conference in Shenzhen China and presented to more than 2,000 attendees [22]. In this work we demonstrated that it is possible to combine a neural network with physics-based simulation to reproduce the deformation of a complex organ.
- SOFA, our open source simulation software, continues to grow and attract scientists and companies. New results were presented during the SOFA week in November at Station F in Paris. Three start-ups created by former SOFA engineers or researchers, were among the attendees.

NEUROSYS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Laurent Bougrain is the coordinator of the 4-years ANR project Grasp-IT on the design and the evaluation of a tangible and haptic brain-computer interface for upper limb rehabilitation after stroke including 4 research teams, 3 centers or hospital departments for physical medicine and rehabilitation and one manufacturer of 3D printers (see Sec. [8.2.1](#)).

TONUS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Low Mach relaxation scheme

We designed a new relaxation scheme [16]-[18] for the Euler/shallow water equations in the low Mach regime. The scheme admits a uniform convergence and a close to uniform cost compare to the Mach number. Additionally the implicit part (the most complicated classically) is reduced at the maximum. This method is a good candidate for the MHD in Tokamak and the extension of the method for this problem is an ongoing work.

COAST Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

In collaboration with Valerie Shalin (Department of Psychology, Wright State University), we proposed a novel validation methodology for automatic trust assessment of users based on their collaboration behavior. Our validation methodology relies on experimental game theory, namely trust game. In the large scale collaboration context of our team research, results of our experimental design [7] suggest that trust score could enhance or even replace traditional identity mechanisms.

RESIST Team

5. Highlights of the Year

5.1. Highlights of the Year

The impact of the RESIST team in network and service management community has been highly recognized and awarded this year in recognition of their exceptional contributions and leadership in this research area.

- R. Badonnell has been elected as the chair of the IFIP (International Federation for Information Processing) WG6.6 (Working Group 6.6).
- J. François has been appointed as co-chair of NMRG (Network Management Research Group) of IRTF (Internet Research Task Force).
- T. Cholez gets involved in the new H2020 European project Concordia (section [9.3.1.4](#)).

5.1.1. Awards

- O. Festor has received the *Dan Stokesberry award*.
- J. François has received the *IEEE Young Professional in Network and Service Management award*.

ALICE Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Dmitry Sokolov has won the "best expertise" nomination for TechnoText 2019, the challenge for the best russian language IT-related text of 2019. The award was given for the article on understandable raytracing ⁰.

⁰<https://github.com/ssloy/tinyraytracer/wiki>

LARSEN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Arrival of a Talos robot in our team (Fig. 1). This is a full-scale humanoid (1.7 m / 100kg / 32 degrees of freedom) that can be fully torque-controlled. The robot is made by PAL Robotics, a Spanish company and is funded by the CPER “Cyber-Entreprise”.
- Arrival of Pauline Maurice as a CRCN (CNRS).

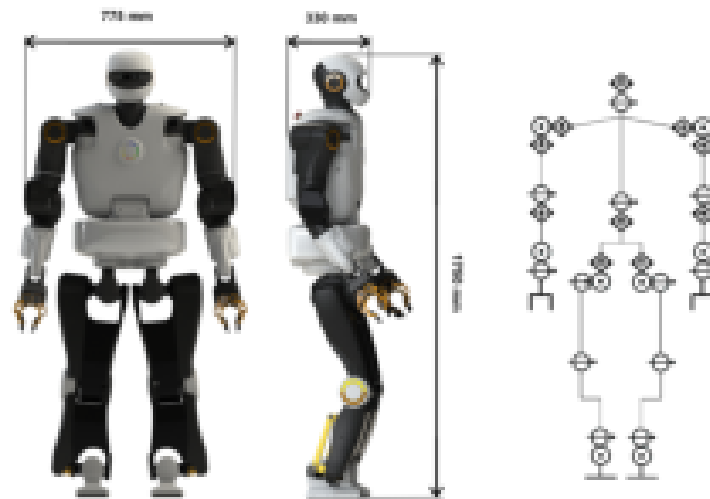


Figure 1. The Talos robot.

5.1.1. Awards

- International Society for Artificial Life (ISAL) award for the Outstanding Publication of the Decade 2004-2014: Clune J, Mouret JB, Lipson H. The evolutionary origins of modularity. Proceedings of the Royal Society b: Biological sciences. 2013 Mar 22;280(1755):20122863.

BEST PAPERS AWARDS :

[16]

N. GAUVILLE, F. CHARPILLET. *Exploration et couverture par stigmergie d'un environnement inconnu avec une flotte de robots autonomes réactifs*, in "JFSMA 2019 - 27emes Journées Francophones sur les Systèmes Multi-Agents", Toulouse, France, Cépaduès 2019, ISBN 9782364937192, July 2019, <https://hal.inria.fr/hal-02195812>

MAGRIT Team

5. Highlights of the Year

5.1. Highlights of the Year

Two patents have been filed during this year: [28] relates to computational photomechanics and [27] relates to localization from objects.

MFX Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

This year we advanced on all of our main research axes [11], [12], [13], [14], [15], [17]. We would like to highlight two of these results. First, we cast a new view on the Gabor noise – a now well established procedural texturing technique – by reformulating it to enable new controls and properties [17]. This opens interesting possibilities for microstructure synthesis, a direction we are now pursuing. Second, we introduced a novel algorithm for curved 3D printing [11], a long term ongoing effort within the team. This algorithm is the first – to our knowledge – to optimize for curved layers throughout a part, under constraints allowing fabrication on standard 3D printers using thermoplastic filament. This paves the way to more general techniques for 6-DOF 3D printing.

Our software efforts have also intensified, with a clear increase in the use and popularity of our software IceSL (see *software*). We also announced an exciting collaboration with *AddUp*, a leading French company in the field of metal 3D printing.

MULTISPEECH Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

We developed the first deep learning-based multichannel speech enhancement algorithm that jointly reduces acoustic echo, reverberation, and background noise [57].

E. Vincent gave a keynote at the Voice Tech Paris 2019 trade fair [18].

A. Deleforge organized the IEEE Signal Processing Cup 2019 on "Search & Rescue with Drone-Embedded Sound Source Localization", to which 20 teams of undergraduate students from 18 universities in 11 countries participated, for a total of 132 participants [5]. The final took place on May the 13th at the international conference ICASSP in Brighton. The associated DREGON dataset, which was made publicly available afterwards, has received over 1,000 file downloads as of December 2019.

5.1.1. Awards

L. Perotin obtained the Best Poster Award of the 2019 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA) .

BEST PAPERS AWARDS :

[43]

L. PEROTIN, A. DÉFOSSEZ, E. VINCENT, R. SERIZEL, A. GUÉRIN. *Regression versus classification for neural network based audio source localization*, in "WASPAA 2019 - IEEE Workshop on Applications of Signal Processing to Audio and Acoustics", New Paltz, United States, IEEE, October 2019, <https://hal.inria.fr/hal-02125985>

ORPAILLEUR Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

This year we would like to mention two publications as highlights of the year.

- The conference paper [10] got the best paper award at the International Conference on Formal Concept Analysis 2019 in Frankfurt, June 2019 (<https://icfca2019.frankfurt-university.de/>).
- Classical properties of functions such as associativity, although algebraically easy to read, are hard to meaningfully interpret. In [18], Miguel Couceiro and colleagues 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.

BEST PAPERS AWARDS :

[42]

J. REYNAUD, Y. TOUSSAINT, A. NAPOLI. *Using Redescriptions and Formal Concept Analysis for Mining Definitions Linked Data*, in "ICFCA 2019 - 15th International Conference on Formal Concept Analysis", Francfort, Germany, June 2019, <https://hal.inria.fr/hal-02170760>

SEMAGRAMME Project-Team (section vide)