RESEARCH CENTER
Bordeaux - Sud-Ouest

FIELD

Activity Report 2019

Section Highlights of the Team

Edition: 2020-03-21

LFANT Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Guilhem Castagnos defended his professorial degree (“habilitation à diriger des recherches”) on the topic of *Cryptography based on quadratic fields: cryptanalyses, primitives and protocols*[11].

4.1.1. Awards

Fredrik Johansson won the best paper award at the conference ARITH26 — 26th IEEE Symposium on Computer Arithmetic in Kyoto for his contribution on dot products and matrix multiplication in arbitrary precision .

BEST PAPERS AWARDS :

[21]

F. JOHANSSON.*Faster arbitrary-precision dot product and matrix multiplication*, in "26th IEEE Symposium on Computer Arithmetic (ARITH26)", Kyoto, Japan, June 2019, https://arxiv.org/abs/1901.04289 , https://hal.inria.fr/hal-01980399

CAGIRE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. R. Manceau, new Cagire team leader

After having taken over the responsibility of the team since its creation, Pascal Bruel, 59, has decided this year to hand over the reins! After consultation, Inria's management has appointed Remi Manceau as the new head of the Cagire team as of 18 November 2019.

CARDAMOM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- In September 2019 Martin Parisot, previously CR in the ANGE team, has joined CARDAMOM;
- In September 2019 Nicolas Barral, previously post-doc in the Computational Geoscience and Energy division of the Department of Earth Science and Engineering at Imperial College London, has joined CARDAMOM
- H. Beaugendre has contributed to the organization of Inria's Autumn school, November 4-8 2019, Inria Bordeaux Sud-Ouest.
  School's objective: The school will aim at simulating a physical problem, from its modeling to its implementation in a high performance computing (HPC) framework. The school will offer both plenary courses and hands-on sessions. The physical problem considered will be the harmonic wave propagation.
  The first day will be dedicated to the modeling of the problem and its discretization using a Discontinuous Galerkin scheme. The following two days will be dedicated to linear algebra for solving large sparse systems. Background on direct, iterative and hybrid methods for sparse linear systems will be discussed. Hands-on on related parallel solvers will then be proposed. Will follow a session dedicated to advanced parallel schemes using task-based paradigms, including a hands-on with the starpu runtime system. The ultimate hands-on session will be devoted to the use of parallel profiling tools. The school will be closed with plenary talks illustrating the usage of such a workflow in an industrial context.
  38 participants, mostly PhD students and Post-docs.
  This school received support form cea, Inria, prace and sysnum.

5.1.1. Awards

In November 2019 M. Ricchiuto has been granted the honorary appointment of Adjunct Professor at the Civil and Environmental Engineering department of Duke University in North Carolina (USA).

CQFD Project-Team (section vide)

GEOSTAT Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Inria's exploratory action "TRACME" led by N. Brodu, starting October 2019.

MEMPHIS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. 3D Numerical Model of a Zebra Fish Larva

The full reconstruction of a 3D larval zebrafish (5 days post fertilization) was realized using a serial-section electron microscopy data set combined with the technique of level-set and optimal transportation for shape interpolation. From an experimental video of zebrafish escape swimming, the kinematics of the swimming is extracted removing both translational and rotating displacements. Based on this video-extracted body deformation, 3D zebrafish snapshots of the body surface were generated deforming the 3D model according to the midline motion. The escape response of the zebrafish larva has been simulated using the NaSCar solver. The numerical simulation of the hydrodynamic zebrafish-locomotion provides a full range of the energetic performance performed by the larva during an escape response that are used by the MRGM biology lab in Bordeaux for toxicology evaluations. See figures 6 and 7 .

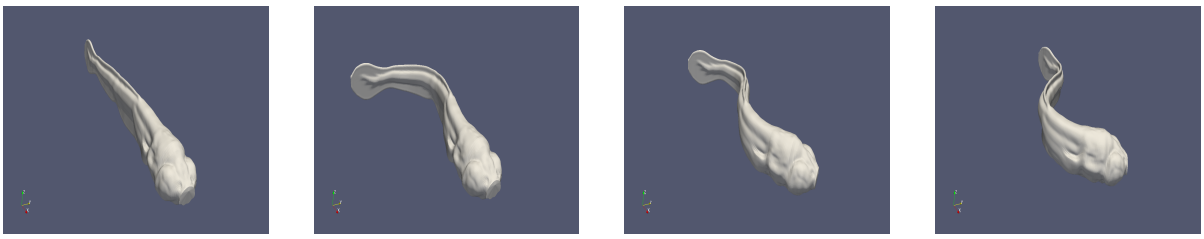

Figure 6. Snaphshots from left to right: reconstruction from electron microscopy and experimental video provided by MRGM Bordeaux of a zebra fish larva swimming movement.

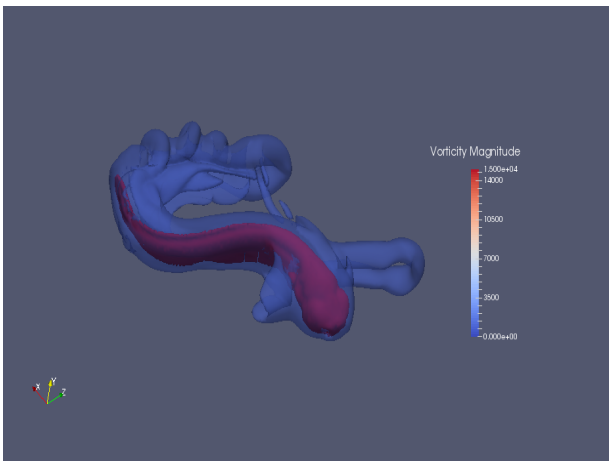

Figure 7. Numerical simulation of the swimming displacement of a zebra fish larva.

REALOPT Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The team has recruited Aurélien Froger as assistant professor.

Ruslan Sadykov has defended his habilitation (HDR) [2].

A paper [8] was accepted in conference IPCO, which is the most prestigious conference in the field.

CARMEN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Mark Potse has been recruited on a permanent position researcher at Bordeaux University.

The team has been involved in the organization of the 10th international conference on Functional Imaging and Modeling of the Heart (FIMH), that was held at Bordeaux in July 2019.

The Direction Generale de l'offre de soins (DGOS) has accepted to found the clinical project of phase III Parkeo2 In this project 11 hospitals in France will use the software OptimDBS for the planification of deep cerebral surgery. The project will start in October 2020 and will last three years.

MAGIQUE-3D Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Inria's Autumn school, November 4-8 2019, Inria Bordeaux Sud-Ouest co-organized by E. Agullo (HIEPACS), H. Beaugendre (CARDAMOM) and J. Diaz The school aimed at simulating a physical problem, from its modeling to its implementation in a high performance computing (HPC) framework. The school offered both plenary courses and hands-on sessions that involved many members of the three teams. The physical problem considered was the harmonic wave propagation.

The first day was dedicated to the modeling of the problem and its discretization using a Discontinuous Galerkin scheme. The following two days were dedicated to linear algebra for solving large sparse systems. Background on direct, iterative and hybrid methods for sparse linear systems were discussed. Hands-on on related parallel solvers were then be proposed. Has followed a session dedicated to advanced parallel schemes using task-based paradigms, including a hands-on with the starpu runtime system. The ultimate hands-on session was devoted to the use of parallel profiling tools. The school was closed with plenary talks illustrating the usage of such a workflow in an industrial context.

The hands-on session were conducted on the Federative Platform for Research in Computer Science and Mathematics (PlaFRIM) machine in a guix-hpc reproducible environment

The school was attended by about 40 participants mostly PhDs and postdocs from Inria teams.

MNEMOSYNE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

We recently considered a new domain of application for our models, educational science. In a very stimulating perspective, we wonder how our cognitive models of cerebral architectures can be used to study children performing problem solving. Our first steps in this domain concern the etablishment of relations with a laboratory in educational science, designing a software platform (*cf.* § 6.4). and being associated to ongoing projects, one project with the French ANR regarding cocreativity and problem solving evaluation during a computational thinking initiation activity and one in the Erasmus+ CAI « Communauté d'Apprentissage de l'Informatique » 19PE0004 project, in link with the Erasmus+ Let'Steam project.

MONC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- 2 abstracts accepted as oral communications at the PAGE meeting (main international conference in population modeling) (C. Nicolò and S. Benzekry)

5.1.1. Awards

- Floriane Gildel is French Young Talent 2019 - L'Oréal-UNESCO for Women in Science.

PLEIADE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Genomic determinants:

The study [7] appearing in *BMC Genomics* resolves a longstanding enigma in winemaking. While the *fact* of resistant strains of wine yeasts has been known for many years, the actual mechanism underlying the phenomena have only now been elucidated by a combined genetic and bioinformatic analysis.

5.1.2. INRAE-Inria PhD:

PLEIADE was succesful in applying for a PhD in 2019 INRA-Inria call for PhD. The submitted topic is: "Statistical Learning for OTU identification and Biodiversty characterizaton." This PhD is a collaboration between PLEIADE (INRAE-Inria, supervision), HiePACS (Inria) and MIAT Toulouse (INRAE).

SISTM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Team structure

The SISTM team was re-structured into three research axes (formerly two) in 2019:

- Axis “High Dimensional Statistical Learning” (coordinator Boris Hejblum)
- Axis “Mechanistic Learning” (coordinator Mélanie Prague)
- Axis “Translational Vaccinology” (coordinator Laura Richert)

  The third research axis on "Translational vaccinology" was created in order to formalize research activities already performed previously in a less structure way. This axis is dedicated to applied research questions in early stage clinical vaccine trials, with two objectives:

  – to elucidate the potential effects and mechanisms of action of vaccines and immunotherapies in integrative statistical analyses of the induced responses at various levels of the immune system

  – to better inform future trial designs and statistical analysis methods by means of modelling and methodological developments.

The three axes collaborate closely with each other.

In fact, the third axis gives the motivating examples leading to the methodological work done in the two other axes. The first axis deals with the raw high-dimensional data generated in clinical epidemiology or biological studies and aims at reducing the dimension of the problem or better annotate the data available (e.g. automatic gating of cytometry data). The second axis aims at building mechanistic model to understand and predict the biological phenomenons by using the available information. The idea then is that the results of this modelling part feed the third axis to define the next strategies to be evaluated in clinical studies and the design of these studies.

5.1.2. Team composition

The SISTM team core has changed in December 2019: Daniel Commenges, DRE Inserm, HDR (emeritus from September 2014) has retired from research activities. Daniel Commenges founded the “Biostatistic” team of Bordeaux within an Inserm unit in the 1990s. The research team was officially labelled by Inserm in the early 2000s and was lead by Daniel Commenges until 2013. The team split in 2014 into two teams: the Inserm “Biostatistic” team (led by Hélène Jacqmin-Gadda), and the “SISTM” team (led by Rodolphe Thiébaut) that joined the Inria BSO center.

5.1.3. Funded projects

- Launch of the Graduate’s School Digital Public Health (PI: R Thiébaut) including the Master of Public Health Data Sciences that started with its first cohort of 9 international students in Sep 2019.
- Positive response for funding of the H2020 IP-Cure-B project (Immune profiling to guide host-directed interventions to cure hepatitis B infections, project coordinator: Pr. F. Zoulim, Inserm U1052 CRCL), in which the work package “Data Science” is led by the SISTM team. The project will be launched in January 2020.
- Kick-off of the EDTCP-2 funded project PREVAC-UP (partnership for research on Ebola vaccinations – extended follow-up and clinical research capacity build-up, project coordinator: Pr Y. Yazdanpanah, Inserm), in which the work package “Systems vaccinology” is led by the SISTM team.

- A new collaboration has started with the pharmaceutical company Ipsen on the integration of "omics" data into in-silico modelling of early-stage clinical trials in cancer. This project will be conducted with a "*CIFRE*" (*Conventions Industrielles de Formation par la REcherche*) PhD contract starting in January 2020.
- *Action de Développement technologique* VASI: Visualization and Analytics Solution for Immunologists.
- The Ebovac2 IMI project on Ebola vaccine development has been extended to 11/2020 (no cost extension).
- Associate Team DYNAMHIC: Dynamical Modeling of HIV Cure in Collaboration With Harvard Program for evolutionary dynamics.

5.1.4. Advancements in projects

- A translational phase I clinical trial of an experimental placental malaria vaccine, conducted by an interdisciplinary consortium including members of the SISTM team (Primalvac trial), has reached its publication, with a manuscript accepted for publication in the Lancet Infectious Diseases
- Two HIV clinical vaccine trials have reached their final stage with all resultats available, including integrative data analyses of the immune responses, and the corresponding manuscripts are in preparation (ANRS VRI01 trial and ANRS 149 Light trial).
- The two phase II Ebola vaccine trials conducted by the IMI-2 EBOVAC2 consortium that is coordinated by Rodolphe Thiébaut are terminated. Results have been presented at international conferences and the manuscripts with the primary results are either submitted (EBL2001 study, submitted to the Lancet) or in preparation (EBL2002 study). Systems vaccinology analyses of the data from these trials are ongoing in the SISTM team.
- Robin Genuer co-authored a book with Jean-Michel Poggi on random forests entitled *Les forêts aléatoires avec R* in *Presses Universitaires de Rennes*, Rennes, France.

5.1.5. Awards

- Award for Doctoral Supervision and Research Activity (PEDR) attributed by the University of Bordeaux to Marta Avalos and Robin Genuer

HIEPACS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- HIEPACS was extremely pleased to welcome two new permanent Inria members, namely O. Beaumont and L. Eyraud-Dubois, whose scientific expertises clearly strengthen the impact of the team on the HPC research.
- We are very delighted to report that seven new PhD students have joined the team this year on research topics covering the full range of those adressed by the team. These PhD students, with gender parity, come from different places in France (Bordeaux, Strasbourg) as well as other places worldwide (China, Italy and Russia). This cultural and scientific variety will surely lead to a nice and fruitful blend and will contribute to the stimulating research atmosphere within the team.
- In June 2019, we organized the 14th Scheduling for Large Scale Systems Workshop, in the campus of Victoire in Bordeaux. 48 participants from all over the world registered to the workshop and gave 36 presentations over 3 days, covering topics like Numerical Algorithms, Resilience, Performance Evaluation, Job and DAG Scheduling.
- Inria's Autumn school, November 4-8 2019, Inria Bordeaux Sud-Ouest co-organized by E. Agullo (HIEPACS), H. Beaugendre (CARDAMON) and J. Diaz (MAGIQUE3D)

  The school aimed at simulating a physical problem, from its modeling to its implementation in a high performance computing (HPC) framework. The school offered both plenary courses and hands-on sessions that involved many members of the three teams. The physical problem considered was the harmonic wave propagation.

  The first day was dedicated to the modeling of the problem and its discretization using a Discontinuous Galerkin scheme. The following two days were dedicated to linear algebra for solving large sparse systems. Background on direct, iterative and hybrid methods for sparse linear systems were discussed. Hands-on on related parallel solvers were then be proposed. Has followed a session dedicated to advanced parallel schemes using task-based paradigms, including a hands-on with the starpu runtime system. The ultimate hands-on session was devoted to the use of parallel profiling tools. The school was closed with plenary talks illustrating the usage of such a workflow in an industrial context.

  The hands-on session were conducted on the Federative Platform for Research in Computer Science and Mathematics (PlaFRIM) machine in a guix-hpc reproducible environment

  The school was attended by about 40 participants mostly PhDs and postdocs from Inria teams.

STORM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- 1st year for the CoHPC team in collaboration with the Lawrence Berkeley National Lab. (9.4.1.1). A PhD student of the team obtained a joint postdoc with InriaSiliconValley at this lab to initiate the collaboration.

TADAAM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Guillaume PALLEZ was an invited speaker at the Royal Society https://royalsociety.org/science-events-and-lectures/2019/04/high-performance-computing/
- Brice GOGLIN is co-chair of the Architecture & Networks area of the SuperComputing 2020 conference.
- François PELLEGRINI has been re-appointed a member of the French *Commission Nationale de l'Informatique et des Libertés* (French data protection authority) by the President of the French Senate.

5.1.1. Awards

- Guillaume PALLEZ was one of the recipient of the IEEE Computer Society TCHPC Early Career Researchers Award for Excellence in High Performance Computing
- François PELLEGRINI was bestowed *Chevalier dans l'Ordre des Palmes Académiques* (Order of Academic Palms), promotion of July 2019.

Auctus Team

5. Highlights of the Year

5.1. Highlights of the Year

- Jean-Marc Salotti has been elected Member of the International Academy of Astronautics
- The startup Touch Sensity [0] has been created by Ganna Pugach.

[0] http://touchsensity.com/

FLOWERS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Clément Moulin-Frier was recruited as CRCN permanent research scientist.
- PY Oudeyer was invited to give plenary keynote talks at several international AI conferences, including ICLR 2019 in New Orleans (https://www.youtube.com/watch?v=7bJ0fnvPLaA) and ACM International Conference on Virtual Agents (ACM IVA 2019), Paris.
- The team published papers in several major machine learning conferences, including ICML [33], Neurips [32], CoRL [38] and IJCNN [36], [37], and one in a major educational technology conference, CHI 2019 [29].
- PY Oudeyer was awarded an individual "Chaire IA" in the context of the national plan on artificial intelligence.
- The Poppy Station association, initiated by the team from the Poppy Education project, and co-directed by Didier Roy, was created and gathers several major national and international educational associations. It aims at scaling up and disseminating the educational robotics kits designed by the Flowers team, and now used in many educational and artistic projects, see https://www.poppy-station.org.
- The work of the PhD of Sébastien Forestier (sup. by PY Oudeyer) on curiosity-driven learning of tool use in robots and children, was integrated as a video interview in the new permanent exhibition on robots at Cité des Sciences et de l'Industrie, Paris, see http://www.cite-sciences.fr/fr/au-programme/expos-permanentes/expos-permanentes-dexplora/robots/lexposition/.

5.1.1. Awards

- Y Oudeyer was awarded the Atos Joseph Fourier prize for his work on curiosity-driven machine learning.

MANAO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Public exhibitions

Textile(s) 3D, exhibition at the Musée Ethnographique de Bordeaux (MEB), until May 29th, 2020: measurement and reproduction of textiles.

The program has targeted the faithful reproduction of the appearance of fragile textiles. To this end, an optical appearance measurement setup has been developped and installed in the basement of the museum. Several textiles have been measured, including ancient asian textiles from the MEB collection; the originals along with their digital reproduction have been shown to the visitors of the museum.

5.1.2. Demonstration

SID Display Week I-Zone, San José Convention Center, May 14-16, 2019: Prototype of an autostereoscopic transparent display

We have showcased a 5-view, full-color, autostereoscopic transparent display prototype that we have developed [8], [13]. Its solution is much like a window that is able to superimpose autostereoscopic 3D data over the real world without the need of any wearables. There are many potential applications in augmented reality and head-up display fields; for example, in automotive, advertisement, and educational areas.

POTIOC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The HOBIT system has been exported to a foreign institution (University of Jena) for the first time. The licensing of the technology is in progress for a worldwide distribution.

5.1.1. Awards

- Honorable mention award at ACM ISS 2019
- Best paper award at ACM UIST 2019
- Best presentation award at Neuroadaptive Technologies 2019 (NAT'19): "Modular biofeedback: build your own tangible experience" by Joan Sol Roo and Jeremy Frey

BEST PAPERS AWARDS :

[23]

P. GIRAUDEAU, A. OLRY, J. SOL ROO, S. FLECK, D. BERTOLO, R. VIVIAN, M. HACHET.*CARDS: A Mixed-Reality System for Collaborative Learning at School*, in "ACM ISS'19 - ACM International Conference on Interactive Surfaces and Spaces", Deajon, South Korea, November 2019 [*DOI :* 10.1145/3343055.3359721], https://hal.inria.fr/hal-02313463

[25]

A. KHAN, J. SOL ROO, T. KRAUS, J. STEIMLE.*Soft Inkjet Circuits: Rapid Multi Material Fabrication of Soft Circuits Using a Commodity Inkjet Printer*, in "UIST'19 - 32nd ACM Symposium on User interface software and technology", New Orleans, United States, October 2019, https://hal.archives-ouvertes.fr/hal-02279960