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RESEARCH CENTER  
Lille - Nord Europe

FIELD

Activity Report 2019

## Section Highlights of the Team

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## BONUS Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. Awards

- + The paper [30] was nominated for the *Best Student Workshop Paper Award* at the 28<sup>th</sup> ACM (Companion) Genetic and Evolutionary Computation Conference (GECCO 2019).
- + *USA Patent* with Beckman & Coulter on the optimization of large medical laboratories (Prof. E-G. Talbi, S. Faramarzi Oghani, M. Bué), 2019.
- + The paper [29] has received the *Best Student Paper Award* at the 10<sup>th</sup> International Conference on Evolutionary Multi-Criterion Optimization (EMO 2019).

BEST PAPERS AWARDS :

[29]

Y. MARCA, H. AGUIRRE, S. Z. MARTINEZ, A. LIEFOOGHE, B. DERBEL, S. VEREL, K. TANAKA. *Approximating Pareto Set Topology by Cubic Interpolation on Bi-objective Problems*, in "EMO 2019 - International Conference on Evolutionary Multi-Criterion Optimization", East Lansing, Michigan, United States, February 2019, p. 386-398 [DOI : 10.1007/978-3-030-12598-1\_31], <https://hal.archives-ouvertes.fr/hal-02064548>

## DEFROST Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. *Fundamental results*

Three PhD students have defended excellent thesis in 2019:

- **Eulalie Coevoet**: Optimization-Based Inverse Model of Soft Robots With Contact Handling
- **Zhongkai Zhang**: Vision-based Calibration, Position Control and Force Sensing for Soft Robots
- **Maxime Thieffry**: Dynamic control of soft robots

In each of these thesis we presented fundamental results on the team's roadmap. Eulalie Coevoet presented the first algorithms that allow inverting the robot model in contact situations. It can be used for planning, manipulation and locomotion. Zhongkai Zhang's results allow the use of the robot as a generalized force sensor thanks to vision. We use that for feedback control for both position and force. Maxime Thieffry developed the first method for dynamic control based on model order reduction. The method is very generic and significantly improves the precision of soft robots.

### 5.1.2. *Awards for software development*

DEFROST actively contributed to the open source community by developing plugins for the **SOFA framework**. The team participated in the **SofaWeek2019**, during which the SOFA consortium organized the "Open-Source SOFA awards". One prize was offered to the candidate who developed the best open source plugin for SOFA. Another prize was offered to the best open source plugin according to the public (conference attendants). **Both prizes were won by the DEFROST team**, for the Model Order Reduction plugin and the SofaPython3 plugin respectively: [link](#).

### 5.1.3. *Organization of workshops and tutorials*

This year, special effort was expended on the promotion of our tools through the organization of workshops and tutorials. A full tutorial day about our tools was organized at the IEEE International Conference on Soft Robotics (RobotSoft019). We then organized the first **Journée de Robotique Souple** in Lille with 70 participants from 9 countries. The team also participated in the organization of the (**2nd Workshop on Proximity Perception in Robotics**) at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2019).

### 5.1.4. *ANR project ROBOCOP*

The project ROBOCOP (ROBOTization of COchlear ImPlant) was funded by the ANR (Agence nationale de la recherche) for the development of cochlear implants for the future that are activated by electroactive polymers. The project is in collaboration with the IEMN, the LPPI, Inserm and Oticon Medical. This project will allow us to fund a PhD Student and a postdoctoral fellow for 2 years.

## FUN Project-Team

# 4. Highlights of the Year

## 4.1. Highlights of the Year

### 4.1.1. Awards

Paper [17] has been awarded best paper of the 34th ACM/SIGAPP Symposium On Applied Computing (SAC 2019).

BEST PAPERS AWARDS :

[17]

A. BLANCHARD, N. KOSMATOV, F. LOULERGUE. *Logic against Ghosts: Comparison of Two Proof Approaches for a List Module*, in "SAC 2019 - The 34th ACM/SIGAPP Symposium On Applied Computing", Limassol, Cyprus, April 2019 [DOI : 10.1145/3297280.3297495], <https://hal.inria.fr/hal-02100515>

## **INOCS Project-Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

### **5.1.1. Awards**

- Martine Labbé received the EURO Gold Medal in June 2019. This is the highest distinction in Operations Research in Europe.

## LINKS Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

### 5.1.1. Data Integration and Schema Validation

The ShEx language for defining RDF schemas was proposed and developed earlier by the Links team in cooperation with the W3C. S. Staworko et al. now studied the containment problem for ShEx schemas for RDF documents. They showed at *PODS* [10] – the best database theory conference – that the problem is decidable, but co-NEXP-hard. This is a joint work with P. Wiecek from the University of Wrocław, Poland.

### 5.1.2. Aggregates

Florent Capelli et al. showed at *STACS* [7] – a top conferences in theoretical computer science – a new knowledge compilation procedure for quantified Boolean formulas allowing to decide the satisfiability quantified Boolean formulas with bounded tree width in polynomial time. This can be applied in particular to first-order database queries with quantifiers. This is joined work with S. Mengel from the CNRS in Lens.



## LOKI Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

Géry Casiez and Mathieu Nancel received a very selective Google Faculty Research Award for their project “Real-time Latency Measure and Compensation”.

Mathieu Nancel contributed to the writing of the new NF Z71-300 French keyboard standard, and spoke at the official launch event in April 2019 at the National Assembly.

### 5.1.1. Personnel

Edward Lank joined Loki in October as part of the Inria International Chair program and will spend more than 50% of his time with us until 2023.

### 5.1.2. Awards

Best paper award from the ACM EICS conference to the paper “Polyphony: Programming Interfaces and Interactions with the Entity-Component-System Model”, from T. Raffailac & S. Huot .

Best paper award from the Francophone Conference on Human-Computer Interaction (IHM) to the paper “Reducing Error Aversion to Support Novice-to-Expert Transitions with FastTap”, from A. Goguey, S. Malacria, A. Cockburn & C. Gutwin .

BEST PAPERS AWARDS :

[22]

T. RAFFAILLAC, S. HUOT. *Polyphony: Programming Interfaces and Interactions with the Entity-Component-System Model*, in "EICS 2019 - 11th ACM SIGCHI Symposium on Engineering Interactive Computing Systems", Valencia, Spain, June 2019, vol. 3 [DOI : 10.1145/3331150], <https://hal.inria.fr/hal-02147180>

[25]

A. GOGUEY, S. MALACRIA, A. COCKBURN, C. GUTWIN. *Reducing Error Aversion to Support Novice-to-Expert Transitions with FastTap*, in "Actes de la 31e conférence francophone sur l'Interaction Homme-Machine (IHM 2019)", Grenoble, France, ACM, 2019, p. 1:1-10 [DOI : 10.1145/3366550.3372247], <https://hal.archives-ouvertes.fr/hal-02381584>

## MAGNET Project-Team

### 5. Highlights of the Year

#### 5.1. Highlights of the Year

- Metric-Learn software has been included in the scikit-learn-contrib packages. It records more than 900 stars and 190 forks on GitHub. It is also used by 51 projects.
- AURÉLIEN BELLET has applied for a ERC Starting Grant on privacy-preserving decentralized machine learning.
- MATHIEU DEHOUCK has successfully defended his PhD dissertation on *Multi-Lingual Dependency Parsing: Word Representation and Joint Training for Syntactic Analysis*, and he is doing a post-doc at University of A Coruña (Spain) funded by ERC grant FASTPARSE.
- MARIANA VARGAS VIEYRA's work on probabilistic end-to-end graph-based semi-supervised learning was accepted as one of the 8 contributed talks (among 92 accepted submissions) as the NeurIPS' 19 workshop on Graph Representation Learning <sup>0</sup>.

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<sup>0</sup><https://grlearning.github.io/papers/>

## **MEPHYSTO Team**

### **4. Highlights of the Year**

#### **4.1. Highlights of the Year**

The team has almost completed the process of creation of a new project-team named *Paradyse* (for *PAR*ticles *And* *DY*namical *SystE*ms), between Inria and the Laboratoire Paul Painlevé of the Université de Lille in 2019.

In 2019, the Mephysto team has been granted an Action de Développement Technologique (ADT) by Inria. This allowed the team to hire Alexandre Roget as an engineer for 2 years. The goal of this ADT is to develop software using mathematical techniques developed in the team, to be used by theoretical and experimental physics communities.

In 2019, the team also had individual successes that can be highlighted. Amongst others, M. Simon submitted an ERC Starting Grant project which was ranked A, and S. De Bièvre became Associate Editor of the Journal of Mathematical Physics.

## MODAL Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

- Benjamin Guedj gave (with John Shawe-Taylor) a plenary tutorial of 2 hours for opening the ICML 2019 (Longbeach, California, USA – June 2019).
- Official creation in July 2019 of a startup DiagRAMS using MODAL's technology (MixtComp software) for predictive maintenance.
- Benjamin Guedj has received two best reviewer awards (top 5% of reviewers) for ICML 2019 and NeurIPS 2019, the flagship conferences in machine learning. Pascal Germain received the best reviewer award (top 5% of reviewers) for NeurIPS 2019.

### 5.1.1. More relevant results in 2019.

While Section 7 contains a complete list of results for 2019, the important results which were published in peer-reviewed international conferences/journals are described in Sections [7.2](#) , [7.3](#) , [7.13](#) , [7.16](#) , [7.17](#) , [7.18](#) , [7.19](#) , [7.21](#) , [7.22](#) , [7.27](#) , [7.28](#) , [7.32](#) , [7.37](#) , [7.43](#) and [7.47](#) .

## RAPSODI Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

In 2019, RAPSODI members have been the laureates of several calls for projects.

- T. Rey has been awarded an ERC Generator grant (116 545 euros) from I-SITE Université Lille - Nord Europe for his project MANAKINEQ0 (R-ERCGEN-19-007-REY). Upon the next two years, T. Rey aims at investigating mathematical properties, as well as developing efficient numerical schemes, for multiscale collisional kinetic equations of the Boltzmann type. A 20-months post-doc will be funded using this grant, as well as an international conference. Following this ERC Generator grant, T. Rey will apply for an ERC Consolidator grant.
- S. Lemaire is the PI of the ADT project ParaSkel++, which is one of the funded Actions of Technological Development of the Inria Lille - Nord Europe 2019 campaign. The aim of the project is to develop an optimized C++ platform for the arbitrary-order numerical approximation of PDEs by skeletal methods on general 2D/3D meshes, with a particular emphasis on the implementation of HPC facilities. L. Beaudé has been hired as a development engineer for this project. She will start in February 2020.
- C. Cancès, C. Chainais-Hillairet and B. Merlet are involved in the H2020 project EURAD (European Joint Programme on RADioactive Waste Management). The aim of their project inside EURAD is to establish an energetic formulation of the Diffusion Poisson Coupled Model leading to new large-time robust numerical methods for the simulation of the corrosion processes in an underground repository. C. Cancès is the leader of the task “Numerical methods for high-performance computing of coupled processes” within the EURAD project.

One can also mention the obtention by T. Rey of a Young Researcher PEPS grant from CNRS’s INSMI (3 500 euros, from March to November 2019). The granted project aimed at investigating high-order (in time and velocity) numerical methods for approximating the solutions to the granular gases equation.

## RMOD Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

- Steven Costiou was hired as CR.
- We released Pharo 7. More information at <http://pharo.org>.
- The paper *Rotten Green Tests* has been accepted at ICSE.  
<https://hal.inria.fr/hal-02002346>

### 5.1.1. Awards

- Best paper award: *SATToSE 2019 Migrating GWT to angular 6 using MDE*.  
<https://hal.inria.fr/hal-02304301>
- 2nd place best paper award IWST 2019: *Illicium: a modular transpilation toolchain from Pharo to C*.  
<https://hal.archives-ouvertes.fr/hal-02297860>
- 3rd place best paper award IWST 2019: *GildaVM: a Non-Blocking I/O Architecture for the Cog VM*.  
<https://hal.archives-ouvertes.fr/view/index/docid/2379275>

## SEQUEL Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

- Organization of the 1st Reinforcement Learning Summer School: 2 weeks of lectures, keynotes, and practical sessions fully dedicated to bandits and reinforcement learning. We received about 300 applications from all around the world and selected 110 participants.
- Julien Seznec and Michal Valko have obtained an oral at AI&Stats (2,5% acceptance rate) [32].
- This is the ultimate SEQUEL highlight: after 12 years, following Inria's policy, SEQUEL comes to an end. We have designed a new team-project which will be named SCOOOL.

### 5.1.1. Awards

BEST PAPERS AWARDS :

[16]

M. ASADI, M. S. TALEBI, H. BOUREL, O.-A. MAILLARD. *Model-Based Reinforcement Learning Exploiting State-Action Equivalence*, in "ACML 2019, Proceedings of Machine Learning Research", Nagoya, Japan, 2019, vol. 101, p. 204 - 219, <https://hal.archives-ouvertes.fr/hal-02378887>

## SPIRALS Project-Team

# 5. Highlights of the Year

## 5.1. Highlights of the Year

In 2019, Christophe Gourdin and Philippe Merle have created the **XScalibur** company. XScalibur is a startup company that sells an innovative software solution to design, deploy and monitor software systems in a multi-cloud environment. The company is the result of a transfert activity initiated by Philippe Merle and Christophe Gourdin around the **OCCIware Studio** software tool suite. This model-driven based solution for cloud management is the result of several years of research [26], [15] and has especially been developed in the context of the **OCCIware** collaborative project from 2014 to 2017. XScalibur has been selected in March 2019 by the *Alliancy* magazine in the top-13 of startup companies in the domain of cloud computing to "follow closely"<sup>0</sup>.

In 2019, Laurence Duchien has been general chair of the 13th edition of the European Conference on Software Architecture (ECSA) [49], [48] and program co-chair of the 23rd edition of the International Systems and Software Product Line Conference (SPLC) [47], [46]. These two events have been co-located in Paris from 9 to 13 September 2019. The fact that a member of the Spirals project-team was proposed by the software architecture research community to serve in these two major events is a testimony of the recognition and of the visibility of our research activities in this domain.

### 5.1.1. Awards

Walter Rudametkin and Pierre Laperdrix were awarded in January 2019 the *Prix Inria CNIL protection de la vie privée*. The award was announced during the 12th edition of the International Computers, Privacy and Data Protection (CPDP) conference, and rewards research undertaken with a view to creating a trustworthy digital society. The award was granted thanks to the work of Walter Rudametkin, Pierre Laperdrix, and Benoit Baudry [63] on browser fingerprinting.

Thomas Durieux was awarded in June 2019 a honorable mention (*accessit*) at *Prix de thèse GDR GPL* for his PhD work on software automated repair that was defended in September 2018 [55]. GDR GPL (*Génie de la Programmation et du Logiciel*) is the group that gathers the French research community on software engineering and programming languages. This is the third time that a PhD student from the Spirals project-team wins either this prize or an honorable mention (Clément Quinton won the prize in 2014, and Maria Gomez won a honorable mention in 2017).

Lakhdar Meftah and Romain Rouvoy won a Best Paper award at the 19th International Conference on Distributed Applications and Interoperable Systems (DAIS 2019) [37]. This award distinguishes their work on improving user privacy in crowdsourced mobile datasets. They propose a decentralized approach, named Fougere, to convey data samples from user devices to third-party servers. By introducing an a priori data anonymization process, they show that Fougere defeats state-of-the-art location-based privacy attacks with little impact on the quality of crowd-sourced datasets. This work takes place in the context of the Inria Project Lab **BetterNet** and involves Isabelle Chrisment, who is heading the BetterNet IPL, and who is co-supervising with Romain Rouvoy the PhD thesis of Lakhdar Meftah [13] that was defended in December 2019.

Philippe Merle won a Best Demo Paper award at the 5th IEEE International Conference on Network Softwarization (NetSoft 2019) [39]. This award distinguishes his work on the formal verification of virtualized network and cloud environments. Philippe Merle and his co-authors demonstrate a lightweight toolchain for validating descriptors of network functions compliant with the latest ETSI NFV standards, visualizing these descriptors in the form of various diagrams (i.e. network-oriented, function-oriented, and UML2-based), analyzing these descriptors formally with Alloy Analyzer, and deploying these virtualized network functions

<sup>0</sup><https://www.alliancy.fr/a-laffiche/cloud/2019/03/13/13-start-up-du-cloud-a-suivre-de-pres>



on OpenStack. This work takes place in the context of a funded project that ended in 2019 with the Orange telecom operator and that involved, in addition to Philippe Merle, Jean-Bernard Stefani from the Inria Grenoble - Rhône-Alpes research center.

Laurence Duchien was awarded the rank of Chevalière de l'Ordre National du Mérite (JO du 29 mai 2019).

BEST PAPERS AWARDS :

[37]

L. MEFTAH, R. ROUYOY, I. CHRISMENT. *FOUGERE: User-Centric Location Privacy in Mobile Crowdsourcing Apps*, in "19th IFIP International Conference on Distributed Applications and Interoperable Systems (DAIS)", Kongens Lyngby, Denmark, J. PEREIRA, L. RICCI (editors), Distributed Applications and Interoperable Systems, Springer International Publishing, 2019, vol. LNCS-11534, p. 116-132 [DOI : 10.1007/978-3-030-22496-7\_8], <https://hal.inria.fr/hal-02121311>

[39]

P. MERLE, A. NDEYE SYLLA, M. OUZZIF, F. KLAMM, K. GUILLOUARD. *A Lightweight Toolchain to Validate, Visualize, Analyze, and Deploy ETSI NFV Topologies*, in "NetSoft 2019 - The 5th IEEE International Conference on Network Softwarization", Paris, France, June 2019 [DOI : 10.1109/NETSOFT.2019.8806632], <https://hal.archives-ouvertes.fr/hal-02124164>

## **VALSE Project-Team**

# **5. Highlights of the Year**

## **5.1. Highlights of the Year**

- This year Valse published 6 papers in Automatica and 4 in IEEE Transaction on Automatic Control (the top journals in the domain of control theory).
- A. Polyakov wrote a book **Generalized Homogeneity in Systems and Control**.