

Inria

RESEARCH CENTER
Saclay - Île-de-France

FIELD

Activity Report 2019

Section Contracts and Grants with Industry

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COMETE Project-Team (section vide)

DATASHAPE Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Collaboration with Sysnav, a French SME with world leading expertise in navigation and geopositioning in extreme environments, on TDA, geometric approaches and machine learning for the analysis of movements of pedestrians and patients equipped with inertial sensors (CIFRE PhD of Bertrand Beaufiles).
- Research collaboration with Fujitsu on the development of new TDA methods and tools for Machine learning and Artificial Intelligence (started in Dec 2017).
- Research collaboration with MetaFora on the development of new TDA-based and statistical methods for the analysis of cytometric data (started in Nov. 2019).

6.2. Bilateral Grants with Industry

- DATASHAPE and Sysnav have been selected for the ANR/DGA Challenge MALIN (funding: 700 kEuros) on pedestrian motion reconstruction in severe environments (without GPS access).

DEDUCTEAM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Valentin Blot obtained with Chantal Keller funding for a 4-year project involving a PhD student, a research engineer (2 years) and a post-doctoral researcher (2 years). This funding is part of the Inria - Nomadic labs partnership for Tezos blockchain.

GRACE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Participants: Daniel Augot, Alain Couvreur, Guénaél Renault, François Morain.

- Through École polytechnique, Daniel Augot is leader of a teaching and research chair on Blockchains for business, funded by CapGemini.
- IRT System-X funds a PhD student for Secure Multiparty Computation in blockchains
- Ernst & Young funds a contract for providing PhD guidance to one of its employee, on the topic of blockchains
- Idemia funds a CIFRE PhD student on the secure implementation in constrained environment of post-quantum cryptosystems.
- Quarkslab funds a CIFRE PhD student on the analysis of malware code
- French Min. Arm. funds a PhD student on the analysis of the ToR network
- Grant with Nokia with the Privacy “Action de recherche”.

MEXICO Project-Team (section vide)

PARSIFAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. OCaml Software Foundation

Participant: Gabriel Scherer.

The OCaml Software Foundation (OCSF),⁰ established in 2018 under the umbrella of the Inria Foundation, aims to promote, protect, and advance the OCaml programming language and its ecosystem, and to support and facilitate the growth of a diverse and international community of OCaml users.

Gabriel Scherer serves as the director of the foundation.

8.1.2. Funding from Nomadic Labs

Participant: Gabriel Scherer.

Nomadic Labs, a Paris-based company, has implemented the Tezos blockchain and cryptocurrency entirely in OCaml. This year, Nomadic Labs and Inria have signed a framework agreement (“contrat-cadre”) that allows Nomadic Labs to fund multiple research efforts carried out by Inria groups. Within this framework, we participate to two 3-year grants, in collaboration with the Cambium team at Inria Paris:

- “Évolution d’OCaml”. This grant is intended to fund a number of improvements to OCaml, including the addition of new features and a possible re-design of the OCaml type-checker.
- “Maintenance d’OCaml”. This grant is intended to fund the day-to-day maintenance of OCaml as well as the considerable work involved in managing the release cycle.

⁰<http://ocaml-sf.org/>

SPECFUN Project-Team (section vide)

TOCCATA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have two bilateral contracts which are closely related to a joint effort called the ProofInUse joint Laboratory. The objective of ProofInUse is to provide verification tools, based on mathematical proof, to industry users. These tools are aimed at replacing or complementing the existing test activities, whilst reducing costs.

This joint laboratory is a follow-up of the former “LabCom ProofInUse” between Toccata and the SME AdaCore, funded by the ANR programme “Laboratoires communs”, from April 2014 to March 2017 <http://www.spark-2014.org/proofinuse>.

8.1.1. ProofInUse-AdaCore Collaboration

Participants: Claude Marché [contact], Jean-Christophe Filliâtre, Andrei Paskevich, Guillaume Melquiond, Sylvain Dailier.

This collaboration is a joint effort of the Inria project-team Toccata and the AdaCore company which provides development tools for the Ada programming language. It is funded by a 5-year bilateral contract from Jan 2019 to Dec 2023.

The SME AdaCore is a software publisher specializing in providing software development tools for critical systems. A previous successful collaboration between Toccata and AdaCore enabled Why3 technology to be put into the heart of the AdaCore-developed SPARK technology.

The objective of ProofInUse-AdaCore is to significantly increase the capabilities and performances of the Spark/Ada verification environment proposed by AdaCore. It aims at integration of verification techniques at the state-of-the-art of academic research, via the generic environment Why3 for deductive program verification developed by Toccata.

8.1.2. ProofInUse-MERCE Collaboration

Participants: Claude Marché [contact], Jean-Christophe Filliâtre, Andrei Paskevich, Guillaume Melquiond, Sylvain Dailier.

This bilateral contract is part of the ProofInUse effort. This collaboration joins efforts of the Inria project-team Toccata and the company Mitsubishi Electric R&D (MERCE) in Rennes. It is funded by a bilateral contract of 18 months from Nov 2019 to April 2021.

MERCE has strong and recognized skills in the field of formal methods. In the industrial context of the Mitsubishi Electric Group, MERCE has acquired knowledge of the specific needs of the development processes and meets the needs of the group in different areas of application by providing automatic verification and demonstration tools adapted to the problems encountered.

The objective of ProofInUse-MERCE is to significantly improve on-going MERCE tools regarding the verification of Programmable Logic Controllers and also regarding the verification of numerical C codes.

8.2. Bilateral Grants with Industry

8.2.1. CIFRE contract with TrustInSoft company

Participants: Guillaume Melquiond [contact], Raphaël Rieu-Helft.

Jointly with the thesis of R. Rieu-Helft, supervised in collaboration with the TrustInSoft company, we established a 3-year bilateral collaboration contract, that started in October 2017. The aim is to design methods that make it possible to design an arbitrary-precision integer library that, while competitive with the state-of-the-art library GMP, is formally verified. Not only are GMP's algorithm especially intricate from an arithmetic point of view, but numerous tricks were also used to optimize them. We are using the Why3 programming language to implement the algorithms, we are developing reflection-based procedures to verify them, and we finally extract them as a C library that is binary-compatible with GMP [9] [67] [33].

CELESTE Project-Team (section vide)

COMMANDS Project-Team (section vide)

DEFI Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- A CIFRE PhD thesis started in April 2017 with Safran Tech. The student is M. Florian Feppon who is working on "topology optimization for a coupled thermal-fluid-structure system".
- A CIFRE PhD thesis started in October 2017 with Renault. The student is Mrs Lalaina Rakotondrainibe who is working on "topology optimization of connections between mechanical parts".
- A CIFRE PhD thesis started in January 2019 with Safran Tech. The student is M. Martin Bihr who is working on "Optimisation Topologique du couple support/pièce pour la fabrication additive métallique sur lit de poudre".
- A CIFRE PhD thesis started November 2017 with EDF. The student is H. Girardon who is working on "level set method for eddy current non destructive testing".
- A CIFRE PhD thesis started May 2017 with ArianeGroup. The student is M. Mickael Rivier who is working on "Optimization under uncertainty methods for expensive computer codes".
- A CIFRE PhD thesis started November 2018 with CEA CESTA. The student is M. Paul Novello who is working on "Deep Learning for atmospheric reentry".

6.2. Bilateral Grants with Industry

- The SOFIA project (Solutions pour la Fabrication Industrielle Additive métallique) started in the summer of 2016. Its purpose is to make research in the field of metallic additive manufacturing. The industrial partners include Michelin, FMAS, ESI, Safran and others. The academic partners are different laboratories of CNRS, including CMAP at Ecole Polytechnique. The project is funded for 6 years by BPI (Banque Publique d'Investissement).
- G. Allaire is participating to the TOP project at IRT SystemX which started in February 2017. It is concerned with the development of a topology optimization platform with industrial partners (Renault, Safran, Airbus, ESI).
- FUI project Saxsize. This three years project started in October 2015 and extended till April 2019 and it involves Xenocs (coordinator), Inria (DEFI), Pyxalis, LNE, Cordouan and CEA. It is a followup of Nanolytix where a focus is put on SAXS quantifications of dense nanoparticle solutions.
- Contract with ArianeGroup, Activity around techniques for Uncertainty Quantification, Coordinator: P.M. Congedo.
- Contract with CEA, Activity around techniques for numerical error estimation and uncertainty quantification, Coordinator: P.M. Congedo.

DISCO Project-Team (section vide)

GAMMA Project-Team

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

- Boeing
- Safran Tech

5.2. Bilateral Grants with Industry

- Projet RAPID DGA

POEMS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Contract and CIFRE PhD with Naval Group on *modelling the fluid-structure coupling caused by a far-field underwater explosion*
Participants: M. Bonnet, S. Chaillat, D. Mavaleix-Marchessoux
Start: 11/2017. End: 10/2020. Administrator: CNRS
- Contract and CIFRE PhD with Naval Group on *flow noise prediction*
Participants: J-F Mercier, B. Cotté, N. Trafny
Start: 04/2018. End: 03/2021. Administrator: ENSTA
- Contract and CIFRE PhD with CEA on *Modelling of thin layers of randomly distributed nanoparticles for electromagnetic waves* Participants: A. Boucart, S. Fliss, L. Giovangigli
Start: 10/2019. End: 09/2022. Administrator: ENSTA

RANDOPT Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Contract with the company Storengy partially funding the PhD thesis of Cheikh Touré (2017–2020)
- Contract with Thales in the context of the CIFRE PhD thesis of Konstantinos Varelas (2017–2020)
- Contract with PSA in the context of the CIFRE PhD thesis of Marie-Ange Dahito (2019–2022)
- Pending contract for the thesis of Paul Dufossé with Thales (2020–2022)

TAU Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

TAU will continue TAO policy about technology transfer, accepting any informal meeting following industrial requests for discussion (and we are happy to be too much solicited), and deciding about the follow-up based upon the originality, feasibility and possible impacts of the foreseen research directions, provided they fit our general canvas. This lead to the following 5 on-going CIFRE PhDs, with the corresponding side-contracts with the industrial supervisor, plus 3 other bilateral contracts. In particular, we now have a first “Affiliate” partner, the SME DMH, and hope to further develop in the future this form of transfer. Note that it can also sometimes lead to collaborative projects, as listed in the following sections.

- **DMH 2019** (1 an, 45kEuros) related to consulting activities with DMH (Digital for Mental Health)⁰.
Coordinator: Aurélien Decelle and Simon Moulieras (DMH)
Participants: Michèle Sebag
- **CIFRE Renault 2017-2020** (45 kEuros), related to Marc Nabhan’s CIFRE PhD *Sûreté de fonctionnement d’un véhicule autonome - évaluation des fausses détections au travers d’un profil de mission réduit*
Coordinator: Marc Schoenauer and Hiba Hage (Renault)
Participants: Marc Nabhan (PhD), Yves Tourbier (Renault)
- **BOBCAT** The new B-tO-B work intermediaries: comparing business models in the “CollaborATive” digital economy, 2018-2020 (100k euros), funded by DARES (French Ministry of Labor).
Coordinator : Odile Chagny (IRES)
Participants: Paola Tubaro and Antonio A. Casilli (Telecom Paris)
- **INDL-KW** International Network on Digital Labor - Kickoff Workshops, 2019 (10k euros), funded by CNRS and the University of Toronto.
Coordinator: Paola Tubaro and Alessandro Delfanti (UoT)
Participants: Antonio A. Casilli (Telecom Paris)
- **CIFRE Thalès 2018-2021** (45 kEuros), with Thales Teresis, related to Nizam Makdoud’s CIFRE PhD
Coordinator: Marc Schoenauer and Jérôme Kodjabatchian
Participants: Nizam Makdoud
- **CIFRE RTE 2018-2021** (72 kEuros), with Réseau Transport d’Electricité, related to Balthazar Donon’s CIFRE PhD
Coordinator: Isabelle Guyon and Antoine Marot (RTE)
Participants: Balthazar Donon, Marc Schoenauer
- **CIFRE FAIR 2018-2021** (45 kEuros), with Facebook AI Research, related to Leonard Blier’s CIFRE PhD
Coordinator: Marc Schoenauer and Yann Olliver (Facebook)
Participants: Guillaume Charpiat, Michèle Sebag, Léonard Blier
- **IFPEN** (Institut Français du Pétrole Energies Nouvelles) 2019-2023 (300 kEuros), to hire an Inria Starting Research Position (PhD + 4-6 years) to work in all topics mentioned in Section 3.2 relevant to IFPEN activity (see also Section 4.2). Started October 2019.
Coordinator: Marc Schoenauer
Participants: Alessandro Bucci, Guillaume Charpiat

⁰This “Affiliate” contract has been inspired by [the affiliate program of Technion](#)

TROPICAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Decentralized mechanisms of operation of power systems: equilibria and efficiency. Collaboration with Nadia Oudjane and Olivier Beaude from EDF-labs, with the PhD work of Paulin Jacquot (CIFRE PhD), supervised by Stéphane Gaubert.
- Stochastic optimization of multiple flexibilities and energies in micro-grids, collaboration with Wim Van Ackooij, from EDF labs, with the PhD work of Maxime Grangereau (CIFRE PhD), supervised by Emmanuel Gobet (CMAP) and cosupervised by Stéphane Gaubert.

LIFEWARE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contract with Institut de recherche Servier

In the framework of the Cifre PhD thesis of Jeremy Grignard at Servier, we work on the coupling between computational modeling and biological experiment design, and on chemical reaction network inference methods from data time series.

8.2. Bilateral Grant with Johnson&Johnson France

In the framework of the Cifre PhD thesis of Eléa Greugny at Johnson&Johnson Santé Beauté France, we work on the computational modeling of inflammatory process in the skin, using multi-scale modeling and multi-agent simulation.

M3DISIM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Technical contract with CEA-LIST on the modelling of rough interfaces in the context of wave scattering (10k€)

OPIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- PhD Contract with IFP Energies Nouvelles
Project title: Polynomial optimization for sparse signal recovery
Duration: 2018-2020
Leaders: M. Castella and J.-C. Pesquet
- PhD Contract with IFP Energies Nouvelles
Project title: Seismic signal analysis by using neural networks
Duration: 2019-2022
Leaders: A. Fraysse and J.-C. Pesquet
- PhD Contract with Thales Group
Project title: Neural network solutions for safety of complex systems
Duration: 2019-2022
Responsible: J.-C. Pesquet and F. Malliaros
- PhD Contract with General Electric Healthcare
Project title: Minimally invasive assessment of coronary disease
Duration: 2018-2021
Leader: Hugues Talbot
- PhD Contract with General Electric Healthcare
Project title: Optimization methods for breast tomosynthesis
Duration: 2017-2020
Leader: J.-C. Pesquet and E. Chouzenoux
- PhD Contract with General Electric Healthcare
Project title: Reconstruction 3D interventionnelle
Duration: 2019-2022
Leader: J.-C. Pesquet and E. Chouzenoux
- PhD Contract with IFP Energies nouvelles
Project title: Graph-based learning from integrated multi-omics and multi-species data
Duration: 2019-2022
Leader: F. Malliaros and J.-C. Pesquet
- Contract with Schneider Electric
Project title: Neural network modeling of electrical motors
Duration: 2019
Leader: J.-C. Pesquet
- Contract with SNCF
Project title: SIARA project: Developing an automatic system based on deep learning which monitors different types of defects in the current railway network of France.
Duration: 2018-2019
Leader: M. Vakalopoulou
- Contract with SNCF
Project title: SNCF Platipus: Examining the potential of machine learning algorithms in the analysis of scouring reports of aquatic foundations.
Duration: 2019-2020
Leader: F. Malliaros, M. Vakalopoulou.

PARIETAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

In 2019, a CIFRE PhD thesis was launched with Siemens-Healthineers France. This contract supports the PhD thesis of Guillaume Daval-Fr erot.

8.2. Scikit-learn Consortium

Scikit-learn is a machine-learning library in Python. It is the engine that powers many applications of artificial intelligence and data science.

Scikit-learn is used on a regular basis by more than half a million people in the world, with applications ranging from medical imaging to product recommendation.

Scikit-learn is an open-source software, under BSD license that facilitates commercial usage. It is developed by a world-wide community, gathering many different expertise on statistics, algorithms and software production.

The quality of scikit-learn, its algorithms, its interfaces, its documentation, are universally acclaimed. Its development follows a strict process to ensure this quality.

The goal of the foundation is to enable maintaining scikit-learn's high standards addressing new challenges.

The foundation employs central contributors to the project, to support scikit-learn's community and to develop new ambitious features. The priorities of the foundation are set jointly by the community and its sponsors.

More information can be found here <http://scikit-learn.fondation-inria.fr/home>.

The consortium is supported by 8 companies and has an annual budget of about half a million euros.

XPOP Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Contract with Dassault Systèmes

Contract with Lixoft

TRIBE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *GranData*:

Participants: Douglas Do Couto Teixeira, Licia Amichi, Lucas Santos de Oliveira [EMBRACE], Aline Carneiro Viana.

Since June 2014, we have a collaboration with GranData (<http://grandata.com/>), Buenos Aires, Argentina on traffic vs mobility modeling of smartphone users. GranData is a small company that integrates first-party and telco partner data to understand key market trends, to predict customer behavior, and to deliver business results. For the time being, the collaboration with Grandata has generated knowledge transfer. From both directions, (1) from myself to GranData, I have been transferring my knowledge in modeling and analysing human behavior in terms of mobility, encounters, and content demand, (2) from them to myself, they have advising me on issues related to machine learning and statistical methods to be used. It describes **an industrial partner's collaboration having the outcomes of our works impacting their products** (e.g., GranData data mining algorithms can be improved based on the better understanding on mobility and content consumption of mobile users) **or research/business decisions** (e.g., proved strong correlations between mobility and data traffic consumption can open new perspectives of services to telecom operators, i.e., clients of GranData).

Part of the thesis of Guangshuo Chen (ended April 2018) and of Eduardo Mucelli (ended in 2015) on data traffic analysis used telco traces provided by GranData.

7.2. Bilateral Grants with Industry

7.2.1. *Nokia (ADR)*:

Participants: Cedric Adjih, Iman Hmedoush.

Through the common Inria-Nokia laboratory, the team is involved in the action "Network Information Theory" (ADR, "Action De Recherche"). In collaboration with Nokia, and Inria EPI MARACAS, and EPI EVA, we are working on the subject of optimization and evaluating communications for IoT networks. This includes 5G and beyond, medium-access level/random access techniques protocols and applying machine learning techniques to wireless communications.

AVIZ Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Participants: Yuheng Feng, Jean-Daniel Fekete, Alejandro Ribs. Project title: *Visual Sensitivity Analysis for Ensembles of Curves*: The goal of this project is to investigate new progressive methods to compute PCA over large amounts of time-series in interactive time.

CEDAR Project-Team (section vide)

EX-SITU Project-Team (section vide)

ILDA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Tecknowmetrix (TKM): ANRT/CIFRE PhD (Hugo Romat), 3 years, June 2016-August 2019.

PETRUS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. OwnCare II-Lab (Jul 2017 - Dec 2020)

Partners: PETRUS (Inria-UVSQ), Hippocad (SME)

End 2016, the Yvelines district launched a public call for tender to deploy an industrial solution aiming at covering the whole district (10.000 patients). The Hippocad company, in partnership with Inria, won this call for tender with a solution called DomYcile in May 2017 and the project was launched in July 2017. DomYcile is based on a home box combining the PlugDB hardware/software technology developed by the Petrus team and a communication layer based on SigFox. Hippocad and Petrus then decided to launch a joint II-Lab (Inria Innovation Lab) named OwnCare. The objective is threefold: (1) build an industrial solution based on PlugDB and deploy it in the Yvelines district in the short-term, (2) use this Yvelines testbed to improve the solution and try to deploy it at the national/international level in the medium-term and (3) design flexible/secure/mobile personal medical folder solutions targeting individual users rather than professional users in the long-term. The DomYcile project with the Yvelines district has started in July 2017 and the II-Lab was officially created in January 2018.

7.2. Bilateral Grants with Industry

7.2.1. Cozy Cloud CIFRE - Loudet contract (Apr 2016 - Apr 2019)

Partners: Cozy Cloud, PETRUS

In relation with the bilateral contract mentioned above, a second CIFRE PhD thesis has been started by Julien Loudet. The objective is to allow for a secure execution of distributed queries on a set of personal clouds associated to users, depending on social links, user's localization or user's profile. The general idea is to build secure indexes, distributed on the users' personal clouds and to devise a secure execution protocol revealing solely the query result to the querier. Such highly distributed secure queries potentially enable new (social) applications fed by user's personal data which could be developed on the Cozy-PlugDB platform.