RESEARCH CENTER

FIELD

Activity Report 2019

Section Contracts and Grants with Industry

Edition: 2020-03-21

ABS Project-Team (section vide)

ACUMES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **Etic Data** (2019-2020): Acumes has set up a 12 months research and development contract with the company Etic Data on "Predictive modeling and proactive driving of customers behaviour in massive data BtoC context".

AGORA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- We have contracted a first bilateral contract with Total (2018-2021) where we work with the laboratory LQA of Total on the design and the test of autonomous low cost air quality sensors. The Lora-based developed platform is currently deployed and evaluated by LQA.
- We have contracted bilateral cooperation with industrial and academic partners in the context of the PSPC Fed4PMR project (2015-2019). In this context, we are working on the design of new professional mobile radio solutions, compatible with 4G and 5G standards. This collaboration funds the PhD thesis of Jad Oueis, the PhD thesis of Romain Pujol, and a part of the PhD thesis of Abderrahman Ben Khalifa.

8.2. Bilateral Grants with Industry

- Common Laboratory Inria/Nokia Bell Labs - ADR Network Information Theory.
  Agora is part of the ADR Network Information Theory of the common laboratory Inria/Nokia Bell Labs.
- Spie - INSA Lyon IoT Chaire.
  Agora is involved in the SPIE INSA Lyon IoT Chaire, launched in November 2016. The IoT Chaire partially funds the PhD thesis of Abderrahman Ben Khalifa.
- Volvo - INSA Lyon Chaire.
  Agora is involved in the Volvo Chaire at INSA Lyon, on the area of autonomous electrical distribution vehicle in urban environments. Razvan Stanica is a member in the steering committee of this structure.

AIRSEA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

A 3-year contract (from June 2016 to June 2019) named ALBATROSS with Mercator-Ocean on the topic « Interaction océan, vagues, atmosphère à haute résolution» (PI: F. Lemarié).

A 2-year contract with Mercator-Ocean on the thematic "The AGRIF software in the NEMO European ocean model": see 5.1

Contract with IFPEN (Institut Français du pétrole et des énergies nouvelles), for the supervision of a PhD (Adrien Hirvoas). Research subject: Development of a data assimilation method for the calibration and continuous update of wind turbines digital twins

The Chair OQUAIDO – for "Optimisation et QUAntification d'Incertitudes pour les Données Onéreuses" in French – is the chair in applied mathematics held at Mines Saint-Étienne (France). It aims at gathering academical and technological partners to work on problems involving costly-to-evaluate numerical simulators for uncertainty quantification, optimization and inverse problems. This Chair, created in January 2016, is the continuation of the projects DICE and ReDICE which respectively covered the periods 2006-2009 and 2011-2015. Reda El Amri's PhD thesis [1] has been funded by OQUAIDO. The Chair is reconducted for one year in 2020 and then a new contract should be approved by all partners for a new 4-years period.

ALICE Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- *Company:* Polygonal Design
  Duration: 01/02/2018 – 01/08/2020
  Participants: Bruno Lévy and Laurent Alonso
  Amount: 38k euros
  Abstract: The goal of this project is to provide a scientific and technical expertise to Polygonal Design. In particular this concerns the Unfold3d software, developed and marketed by the company. This software is built based on our algorithms developed in 2002–2006.

ALMANACH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Ongoing contracts:

Verbatim Analysis Verbatim Analysis is an Inria start-up co-created in 2009 by Benoît Sagot. It uses some of ALMAnaCH's free NLP software (SxPipe) as well as a data mining solution co-developed by Benoît Sagot, VERA, for processing employee surveys with a focus on answers to open-ended questions.

opensquare was co-created in December 2016 by Benoît Sagot with 2 senior specialists of HR (human resources) consulting. It is dedicated to designing, carrying out and analysing employee surveys as well as HR consulting based on these results. It uses a new employee survey analysis tool, *enqi*, which is still under development. This tool being co-owned by opensquare and Inria, both parties have signed a Software Licence Agreement in exchange for a yearly fee paid by opensquare to ALMAnaCH based on its turnover. Benoît Sagot currently contributes to opensquare, under the "Concours scientifique" scheme.

Facebook A collaboration on text simplification ("français Facile À Lire et à Comprendre", FALC) is ongoing with Facebook's Parisian FAIR laboratory. It involves a co-supervised (CIFRE) PhD thesis in collaboration with UNAPEI, the largest French federation of associations defending and supporting people with special needs and their families. This collaboration, is part of a larger initiative called Cap'FALC involving (at least) these three partners as well as the relevant ministries. Funding received as a consequence of the CIFRE PhD thesis: 60,000 euros

Bluenove A contract with this company has been signed in 2018, which initiated a collaboration for the integration of NLP tools within Bluenove's platform Assembl, dedicated to online employee and citizen debating forums. It involved 12 months of fixed-term contracts (a post-doc, who worked at ALMAnaCH in 2018-2019). Funding received: 77,137 euros

Active collaborations without a contract:

Science Miner ALMAnaCH (following ALPAGE) has collaborated since 2014 with this company founded by Patrice Lopez, a specialist in machine learning techniques and initiator of the Grobid and NERD (now entity-fishing) suites. Patrice Lopez provides scientific support for the corresponding software components in the context of the Parthenos, EHRI and Iperion projects, as well as in the context of the Inria anHALytics initiative, aiming to provide a scholarly dashboard on scientific papers available from the HAL national publication repository.

Software Heritage , whose goal is to collect and preserve software in source code form. ALMAnaCH's collaboration with Software Heritage, on large-scale programming language identification, also involves Qwant, who provided some funding to Software Heritage.

Fortia Financial Solutions ALMAnaCH members led a proposal for the creation of an ANR LabCom with this French FinTech company on the analysis of (raw, PDF) financial documents from investment funds. The proposal was rejected, but future collaboration is still planned.

Hyperlex A collaboration was initiated in 2018 on NLP and information extraction from raw legal documents (mostly PDF format), involving especially Éric de La Clergerie, who is now a part-time employee of the company.

Ongoing discussions that should/could be formalised in the form of a contract in 2020:

Winespace : information extraction from wine descriptions to develop a wine recommendation system

Newsbridge : automatic extraction of short summaries of filmed events (e.g. sport events) based on social media coverage analysis

INPI : Patent classification

Cour de cassation (in the context of the LabIA): retrieval of relevant jurisprudence

DGCCRF (in the context of the LabIA): automatic identification of illicit clauses in B-to-C commercial contracts

ALPINES Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Contract with IFPen, February 2016 - April 2019, that funds the Phd thesis of Zakariae Jorti on adaptive preconditioners using a posteriori error estimators. Supervisor L. Grigori.
- Contract with IFPen, October 2016 - October 2019, that funds the Phd thesis of Julien Coulet on the virtual element method (VEM). Supervisor F. Nataf and V. Girault.

ANGE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- A contract between Institut Carnot SMILES and the corporation GTT involving (Jacques Sainte-Marie, Cindy Guichard, Yohan Penel and Julien Salomon) of 78 k€ has been approved. The aim is to improve the numerical modelling tool to simulate gas flows in the insulation spaces of LNG tankers. A Ph. D. thesis should start next year on that topic.

8.2. Bilateral Grants with Industry

- The ANR project Hyflo-Eflu relies on a collaboration with the company "HydroTube Energie", that ended in December has given rise to deep collaboration with Hydotube Energy.
- The ANR project Firecaster supports the Ph. D. Thesis of F. Allaire on the developpment of a fire decision support system at the national scale to estimate upcoming fire risk. The collaborations are CERFACS and CNRM (recherche de Météo-France).
- The ANR project Cense supports the Ph. D. Thesis of A. Lesieur on the developpment of a new methodology for the production of more realistic noise maps. The industrial collaborations include:
  - Bouygues Énergies & Services
  - Wi6Labs
  - Bruitparif (association)

  We refer to
  https://cense.ifsttar.fr/partenaires/entreprises-privees/

  https://cense.ifsttar.fr/partenaires/associations/

  for more details.

8.3. Other collaborations with Industry

- On the public operational side, ANGE team works with IRSN and its Modelling Bureau environmental transfers for the study of consequences of accidents (BMCA). This collaboration led to Bao Le's thesis. For more details, we refer to

  https://www.irsn.fr/FR/Larecherche/Organisation/equipes/radioprotection-homme/BMCA/Pages/bureau-modelisation-transferts-environnement-etude-consequences-accidents.aspx
- On the corporate side, ANGE collaborates with NUMTECH for pollution modelling. We mention also the long term collaboration with Ambiciti- co-founded by V. Mallet. In particular, the newspaper Ouest-France uses Ambiciti's air quality forecasts since the summer, so with the algorithms that come from ANGE.

  https://www.ouest-france.fr/meteo/
- Y. Penel obtained a partial support from EDF for the organisation of the project SGN-Num at CEMRACS 2019.

ANTIQUE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Follow up to the AnaStaSec project

Title: Analyse de propriété de sécurité

Type: Research contracts funded by AirBus France

Duration: March 2019 - August 2018 and November 2019 - March 2020

Inria contact: Jérôme Feret

Abstract: An emerging structure in our information processing-based society is the notion of trusted complex systems interacting via heterogeneous networks with an open, mostly untrusted world. This view characterises a wide variety of systems ranging from the information system of a company to the connected components of a private house, all of which have to be connected with the outside.

The goal of these constracts is to analyse an application that is used to filter messages from higher-level security regions to lower-level ones in trusted complex systems. This application shall check that messages are well-formed and that they match with existing requests. Moreover, so as to limit potential flows of information, one shall prove that the internal state of buffers are reset between the processing of each packet.

To certify these properties, the front-end of ASTRÉE has been upgraded with new directives to specify the properties of interest, and the analysis has been tuned to improve the analysis : 1) ghost variables are used to record the value of buffers between each packet processing so that already existing relational domains can prove that they are restored to the correct value, and 2) data-partitioning strategies have been implemented to separate the different modes of usage.

ARAMIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Carthera

Participants: Stéphane Epelbaum [Correspondant], Alexandre Carpentier, Anne Bertrand, Marie Odile Habert.

Project title: Open label phase 1/2 study evaluating the safety and usefulness of transient opening of the blood-brain barrier using low intensity pulsed ultrasounds generated by the implantable device SONOCLOUD in patients with mild Alzheimer's disease

Started in 2016

Amount: 400 K€

Coordinator: Stéphane Epelbaum

Other partners: UPMC, AP-HP

Abstract: This project aims at opening the blood brain barrier (BBB) in 10 mild Alzheimer's disease patients in order to improve the clearance of beta-amyloid and tau deposits in their brain as suggested in mice models of the disease. This first in man study will evaluate the safety and efficacy of an implanted device, SONOCLOUD, to open the BBB 7 times in each participant. Efficacy will be evaluated on the ability of the method to decrease the amyloid load evidenced by AV45 Positron Emission Tomography (PET), increase the brain metabolism analyzed by Fluorodeoxyglucose PET and improve cognition. If successful, this study will pave the way for future trials in which drugs can be used in addition to BBB opening to maximize their effect.

ARIC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Bosch (Germany) ordered from us some support for implementing complex numerical algorithms (participants: Claude-Pierre Jeannerod and Jean-Michel Muller).

8.2. Bilateral Grants with Industry

- Miruna Rosca and Radu Titiu are employees of BitDefender. Their PhD's are supervised by Damien Stehlé and Benoît Libert, respectively. Miruna Rosca works on the foundations of lattice-based cryptography, and Radu Titiu works on pseudo-random functions and functional encryption.
- Adel Hamdi is doing is PhD with Orange Labs and is supervised by Fabien Laguillaumie. He is working on advanced encryption protocols for the cloud.

AROMATH Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

• **NURBSFIX: Repairing the topology of a NURBS model in view of its approximation.** We have a research contract with the industrial partner GeometryFactory, in collaboration with the project-team Titane (Pierre Alliez). The post-doc of Xiao Xiao is funded by this research contract together with a PEPS from the labex AMIES.

Because of their flexibility and accuracy, NURBS (Non-Uniform Rational Basis Spline) models have become a standard in the modeling community for generating and representing complex shapes. They are made of several surface patches and a collection of curves that are used for trimming. As a direct consequence of software quirks, designer errors, and representation flaws, these NURBS models have inconsistencies that introduce small gaps and overlaps between surface patches. They are mainly located on the singularity graph of a NURBS model, near the trimming curves, especially near singularities such as sharp edges or corners. Building a correct approximation of a NURBS model in the presence of inconsistencies is a challenging problem. Most of the current approaches are based on the repairing of the geometry of the surface patches. This requires an interactive process which is difficult to control and rarely completely successful. In this project, we develop another approach which consists in repairing the topology of the singularity graph within a tolerance volume. This tolerance volume will be considered as a protected region that will not receive any query of geometric computations. Based on that, three types of approximations will be treated: triangular isotropic surface meshing of NURBS models, volume approximation of multi-domains delimited by NURBS surfaces, and NURBS models approximation within a given tolerance volume.

ATHENA Project-Team (section vide)

Auctus Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral collaboration with SAFRAN EP

An industrial collaboration has been initiated with SAFRAN EP (Villemur-sur-Tarn) on the analysis of manual industrial activities for the improvment of working conditions in highly demanding tasks. Vincent Padois and Jean-Marc Salotti have supervised the internship of Gaëlle Lannuzel who was focusing on knot tying activities for electrical cables. A CIFRE PhD thesis is being discussed to pursue this work.

8.2. Bilateral collaboration with SUEZ

A contract has been signed with Suez (see 7.12) for a 6-month internship under Auctus supervision (David Daney and jean-Marc Salotti). The objective was the development of a new method to improve strenuous manual activities and an implementation of the method for the specific activity of pipe cover raising. This study has been performed by Nina Doctor, ENSC student (recruitment February - September 2019).

8.3. Bilateral collaboration with PSA

An industrial collaboration has been initiated with PSA on the synthesis and dynamic analysis of shared workspaces for safety in collaborative robotics. A CIFRE PhD thesis has been approved by ANRT and will start in February 2020.

AVALON Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Nokia Bell Labs

AVALON has been actively collaborating with Nokia, formerly Alcatel-Lucent Bell Labs, in the framework of the Nokia/Alcatel-Lucent Inria Joint Laboratory. We was involved in the following Research Actions (Actions de Recherche (ADR) in French) of this laboratory. ADR Nokia Bell Labs /Inria: Procedural Generation of Networks for Security Research & Experimentations. The objective of this project is to address such challenge. We aim at devising a new way where researchers can communicate in a comprehensive and accurate way the experimentation set-up used in their work. The main objective would be to research and develop the procedural generation of credible network topologies and test beds resembling real operational infrastructures of various kinds (e.g. classical ICT, virtualized Cloud or SDN based, SCADA infrastructures etc.), as a method of creating data algorithmically as opposed to manually. This work is done with a postdoc position: Cyril Seguin.

7.1.2. MUMPS Technologies

AVALON has a collaboration with MUMPS Technologies. The funding is dedicated for Marie Durand during few months to make experimental validation of the interest of using XKBLAS library to let MUMPS software to gain in performance on multi-GPUs server.

7.2. Bilateral Grants with Industry

7.2.1. Orange

We have a collaboration with Orange. This collaboration is sealed through a CIFRE Phd grant. The research of the Phd student (Arthur Chevalier) focuses on placement and compliance aspects of software licenses in a Cloud architecture. Today, the use of software is regulated by licenses, whether they are free, paid for and with or without access to its sources. The number of licenses required for specific software can be calculated with several metrics, each defined by the software vendor. Our goal is to propose a deployment algorithm that takes into account different metrics.

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 investigates new progressive methods to compute PCA over large amounts of time-series in interactive time.

BEAGLE Project-Team (section vide)

BIGS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Bruno Scherrer has done some consulting for EDF. This was a skill transfer activity involving training and consulting on the theory and algorithms for reinforcement learning, for the Research & Development team of EDF lead by Lorenzo Audibert. This R&D team wants to apply reinforcement learning to several EDF problems: optimizing maintenance of uranium rods in the cores of nuclear power plants, optimization of load profiles for a network of electric vehicles. Bruno Scherrer's role was to give them the basics of reinforcement learning theory, and help them to use the algorithms of the literature. It was a one-shot action, running in 2018 and 2019, and contractualized via a "framework agreement" Inria-EDF. This contract brings in approximately 12,000 euros to BIGS team (among which 2,000 for mission expenses).

R. Azaïs, A. Gégout-Petit, F. Greciet collaborated with SAFRAN Aircraft Engines (through a 2016-2019 contract). SAFRAN Aircraft Engines designs and products aircraft engines. For the design of pieces, they have to understand the mechanism of crack propagation under different conditions. BIGS models crack propagation with Piecewise Deterministic Markov Processes (PDMP).

BIOCORE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

BioEnTech: the collaboration with the BioEnTech start-up is aiming at developing new functionalities for ODIN in order to improve the advanced monitoring and control of industrial anaerobic digesters.

Inalve: with the Inalve start-up we develop a breakthrough process that we patented, in which microalgae grow within a moving biofilm. The objective of the collaboration is to optimize the process by enhancing productivity, while reducing environmental footprint.

8.2. Bilateral Grants with Industry

Exactcure: in the collaboration with the start-up Exactcure (Nice), the goal of the project is to study pharmacokinetic models. Exactcure and Biocore agreed for a transfer of intellectual property concerning the work of former intern L. Dragoni.

BIOVISION Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Helping visually impaired employees to follow presentations in the company: Towards a mixed reality solution

Participants: Riham Nehmeh [InriaTech], Carlos Zubiaga [InriaTech], Julia-Elizabeth Luna [InriaTech], Arnaud Mas [EDF], Alain Schmid [EDF], Aurélie Calabrèse, Pierre Kornprobst

Duration: 2 months

The objective of the work is to develop a first proof-of-concept (PoC) targeting a precise use-case scenario defined by EDF (contract with InriaTech, supervised by Pierre Kornprobst). The use-case is one of an employee with visual impairment willing to follow a presentation. The idea of the PoC is a vision-aid system based on a mixed-reality solution. This work aims at (1) estimating the feasibility and interest of such kind of solution and (2) identifying research questions that could be jointly addressed in a future partnership.

APP Deposit (on-going)

BONUS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Our current industrial contracts and granted projects are completely at the heart of the BONUS project. They are summarized in the following.

- *EDF (2015-2019, Paris)*: this project deals with demand-side management in smart grids with EDF, a major electrical power player in France. The Energy Management System (EMS) in the home receives the market and system signals and controls the loads, Heating, Ventilation and Air Conditioning systems (HVAC), storages and local generation units according to the user preferences. A large number of home users and appliances and several conflicting objectives have to be considered.
- *ONERA & CNES (2016-2020, Paris)*: the focus of this project with major European players in vehicle aerospace is put on the design of aerospace vehicles, a high-dimensional expensive multidisciplinary problem. Such problem needs the use of the research lines of BONUS to be tackled effectively and efficiently. Two jointly supervised PhD students (J. Pelamatti and A. Hebbal) are involved in this project.
- *In contact with Decathlon (2019, Lille)*: This project deals with scalable multi-objective optimization for the eco-design of material, clothing and sports shoes.
- *In contact with Vinci Autoroutes (2019, Paris)*: This project deals with the optimization of deep neural networks for computer vision.

CAGE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Contract CIFRE with ArianeGroup (les Mureaux), 2019–2021, funding the thesis of A. Nayet. Participants : M. Cerf (ArianeGroup), E. Trélat (coordinator).

CAGIRE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- EDF: "Advanced modelling of heat transfer for industrial configurations with or without accounting of the solid wall", contract associated to the PhD thesis of Gaëtan Mangeon
- EDF: "Hybrid RANS/LES modelling for unsteady loadings in turbulent flows", contract associated to the PhD thesis of Vladimir Duffal
- IFPEN: "3D simulation of non-reactive internal aerodynamics of spark-ignition engines using an hybrid RANS/LES method", contract associated to the PhD thesis of Hassan Al Afailal
- PSA: ""Turbulence modelling in the mixed and natural convection regimes in the context of automotive applications", contract associated to the PhD thesis of Saad Jameel.

8.2. Bilateral Grants with Industry

- EDF (Cifre PhD grant): "Advanced modelling of heat transfer for industrial configurations with or without accounting of the solid wall", PhD student: Gaëtan Mangeon
- EDF (Cifre PhD grant): "Hybrid RANS/LES modelling for unsteady loadings in turbulent flows", PhD student: Vladimir Duffal
- IFPEN (PhD grant): "3D simulation of non-reactive internal aerodynamics of spark-ignition engines using an hybrid RANS/LES method", PhD sutdent: Hassan Al Afailal
- PSA (Cifre PhD grant): "Turbulence modelling in the mixed and natural convection regimes in the context of automotive applications", PhD student: Saad Jameel.
- Dassault Aviation (Cifre PhD grant): "Amélioration des modèles pour la turbulence. Applications à la prédiction des écoulements aérodynamiques.", PhD student: Gustave Sporschill.

CAIRN Project-Team (section vide)

CAMBIUM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. The Caml Consortium

Participant: Damien Doligez.

The Caml Consortium, is a formal structure where industrial and academic users of OCaml can support the development of the language and associated tools, express their specific needs, and contribute to the long-term stability of OCaml. Membership fees are used to fund specific developments targeted towards industrial users. Members of the Consortium automatically benefit from very liberal licensing conditions on the OCaml system, allowing for instance the OCaml compiler to be embedded within proprietary applications.

Damien Doligez chairs the Caml Consortium.

The Consortium currently has 9 member companies:

- Aesthetic Integration
- Citrix
- Docker
- Esterel Technologies
- Facebook
- Jane Street
- LexiFi
- Microsoft
- SimCorp

The Caml Consortium is being gradually phased out. In the future, we would like to replace it entirely with the OCaml Software Foundation, discussed below.

7.2. Bilateral Grants with Industry

7.2.1. The OCaml Software Foundation

Participants: Damien Doligez, Xavier Leroy.

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.

Damien Doligez and Xavier Leroy serve as advisors on the foundation's Executive Committee.

We receive substantial basic funding from the OCaml Software Foundation in order to support research activity related to OCaml.

[0] http://ocaml-sf.org/

7.2.2. Funding from Nomadic Labs

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 have received three 3-year grants:

- "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. This grant has allowed us to fund Jacques Garrigue's visit (10 months) and to hire Gabriel Radanne on a Starting Research Position (3 years).
- "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. This grant has allowed us to hire Florian Angeletti as an engineer for 3 years.
- "Multicore OCaml". This grant is intended to encourage research work on Multicore OCaml within our team. This grant has allowed us to fund Glen Mével's PhD thesis (3 years).

7.2.3. Funding from the Microsoft-Inria joint lab

Funding from the Microsoft-Inria joint lab has allowed us to hire Ioannis Filippidis on a Starting Research Position (until March 2020) to work on the TLAPS system.

CAMIN Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

NEURINNOV startup finances half of the PhD thesis salary of Lucie William.

CAMUS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Caldera

Participants: Cédric Bastoul, Vincent Loechner.

Duration : 2016 - 2019

Caldera (www.caldera.com) is a company specialized in software development for wide image processing. The goal of this collaboration is the development of a parallel and scalable image processing pipeline for industrial printing. The project started in September 2016 and it includes the industrial thesis (CIFRE) of Paul Godard, defended in Dec. 2019.

CAPSID Project-Team (section vide)

CARAMBA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Together with the PESTO team, we had a contract with the Docapost company, the purpose of which is to improve their e-voting solution by adding some verifiability properties and switching to elliptic curve cryptography.
- Together with the PESTO team, we have a contract with the Idemia company about e-voting.

8.2. Bilateral Grants with Industry

- A contract with Orange Gardens at Chatillon-Montrouge is dedicated to the supervision of Sandra Rasoamiaramanana's PhD thesis about security in the white box context. The co-supervisor for Orange Gardens is Gilles Macario-rat.
- A contract with Thales (Thales Communication & Security, Gennevilliers, subsidiary of Thales Group) is dedicated to the supervision of Simon Masson's PhD thesis about elliptic curves for bilinear and post-quantum cryptography. The co-supervisor for Thales is Olivier Bernard.

CARDAMOM Project-Team (section vide)

CARMEN Project-Team (section vide)

CASCADE Project-Team (section vide)

CASH Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

CIFRE Ph.D of Julien Emmanuel with Bull/Atos, hosted by Inria. 2020-2023.

CASTOR Project-Team (section vide)

CEDAR Project-Team (section vide)

CELESTE Project-Team (section vide)

CELTIQUE Project-Team (section vide)

CHORALE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. AXYN (2017 - 2021)

Participants: Patrick Rives and Paolo Salaris
This contract (30k€) is linked to the PhD Thesis of Dyanna Hassan (Cifre Thesis). The objective is to develop assistive navigation techniques.

7.1.2. Renault (2018 - 2021)

Participant: Philippe Martinet (in collaboration with A. Spalanzani and C. Laugier from CHROMA)
This contract (CHROMA 45k€, CHORALE (15k€ for supervision)) is linked to the PhD Thesis of Luiz Guardini (Cifre Thesis). The objective is to develop contextualized emergency trajectory planning with minimum criticality by employing dynamic probabilistic occupancy grid.

7.2. Bilateral Grants with Industry

7.2.1. AXYN (2017 - 2021)

Phd Student: Dayanna Hassan
Dayanna Hassan is employed by AXYN (Cifre Thesis).
Title of the PhD: Plate-forme robotisée d'assistance aux personnes à mobilité réduite

7.2.2. Renault (2018 - 2021)

Phd Student: : Luiz Guardini
Luiz Guardini is employed by Renault (Cifre Thesis).
Title of the PhD: Autonomous car driving: use of dynamic probabilistic occupancy grids for contextualized planning of emergency trajectory with minimal criticity

CHROMA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. VOLVO-Renault Trucks Group (2016-2019)

Participants: Olivier Simonin, Jilles Dibangoye, Guillaume Bono, Mohamad Hobballah, Laetitia Matignon.

This collaboration has been built inside the INSA-VOLVO Chair, led by Prof. Didier Remond (INSA). In this context, the Chair funds the PhD Thesis of Guillaume Bono (2016-19) in Chroma. The objective is to study how machine learning techniques can deal with optimization of goods distribution using a fleet of autonomous vehicles. In the following of the first results, VOLVO proposed to extend our collaboration by funding a Post-doc position concerning good distribution with platoons of autonomous vehicles. This is the Post-Doc of Mohamad Hobballah, started on February 2018.

8.1.2. Toyota Motor Europe (2006 - 2018)

Participants: Christian Laugier, David Sierra González, Özgür Erkent, Jilles Dibangoye, Christian Wolf.

The contract with Toyota Motors Europe is a joint collaboration involving Toyota Motors Europe, Inria and ProbaYes. It follows a first successful short term collaboration with Toyota in 2005. This contract aims at developing innovative technologies in the context of automotive safety. The idea is to improve road safety in driving situations by equipping vehicles with the technology to model on the fly the dynamic environment, to sense and identify potentially dangerous traffic participants or road obstacles, and to evaluate the collision risk. The sensing is performed using sensors commonly used in automotive applications such as cameras and lidar.

This collaboration has been extended in 2018 for 4 years (period 2018-2021) and Toyota provides us with an experimental vehicle Lexus equipped with various sensing and control capabilities. Several additional connected technical contracts have also been signed, and an exploitation licence for the *CMCDOT* software has been bought by Toyota in 2018.

8.2. Bilateral Grants with Industry

8.2.1. Renault (2015 - 2018)

Participants: Mathieu Barbier, Christian Laugier, Olivier Simonin.

This contract was linked to the PhD Thesis of Mathieu Barbier (Cifre Thesis). The objective is to develop technologies for collaborative driving as part of a Driving Assistance Systems for improving car safety in road intersections. Both vehicle perception and communications are considered in the scope of this study. Some additional short-term contracts (about 3 months) and an evaluation license for the team *CMCDOT* software have also been signed during this period. *We are on the process of signing a new PhD research agreement for the period 2019 – 2021, with objective to address the open problem of emergency obstacle avoidance in complex traffic situations (for ADAS or AD applications).*

8.2.2. IRT Nanoelec – Security of Autonomous Vehicles project (2018 - 2020)

Participants: Christian Laugier, Lukas Rummelhard, Jerome Lussereau, Jean-Alix David, Thomas Genevois, Nicolas Turro [SED].

Security of Autonomous Vehicles is a project supported by ANR in the scope of the program PULSE of IRT Nanoelec. The objective of this project is to integrate, develop and promote technological bricks of context capture, for the safety of the autonomous vehicle. Building on *Embedded Bayesian Perception for Dynamic Environment*, Bayesian data fusion and filtering technologies from sets of heterogeneous sensors, these bricks make it possible to secure the movements of vehicles, but also provide them with an enriched and useful representation for autonomy functions themselves. In this context, various demonstrators embedding those technology bricks are developed in cooperation with industrial partners.

CIDRE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **HP (2013-2019): Embedded Systems Security** One of the main activities of HP Inc. is to develop and manufacture computing platforms (such as laptops, printers, etc). These platforms consist of hardware and embedded software (usually referred to as firmware). Such embedded software is typically required for the proper functioning of the hardware and relied upon by high level operating system, application or solution software. One of the research tracks of this collaboration consists in enhancing the security level of low-level software components (firmware and OS) in future computing platforms. The final objective is to provide a more resilient and trustworthy platform to the end-user. This work is carried out in the context of the PhD of Ronny Chevalier.
- **DGA (2018-2020)** Traditionally, IDSes are evaluated based on their detection ability against a labeled dataset that contains normal and abnormal network traffic. Upon inspection, it is clear that datasets publicly available are usually obsolete in the span of a couple years in both anomaly types and background, benign Internet traffic. They also suffer from a lack of volume and diversity in traffic, and ultimately, lack of representativeness and realism. In this context, the goal of this project is to come up with an evolutive platform for IDS evaluation that solves many of the issues that exist in the state of the art methods. In order to create such an evolutive platform, there is a need for dynamic infrastructure that allows continuous and automatic change. Here are a number of design principles that we followed for our platform: reproducibility (it is possible to rebuild the infrastructure of the platform or any element of it); repeatability (any action carried out on the infrastructure tested in the platform is repeatable); live evaluation (while traditional IDS evaluation is carried out using a static benchmark dataset, we propose an environment that resembles what IDS does in real life); realism (in terms of traffic generation, real world attack representativeness, and system setup. This will surely be a continuous and evolutive effort to try to approach real world conditions as best as can be); automatization (scripts allow a complete description of the system in which an IDS is tested, and of normal/malicious activity generation inside this system).

  This work is carried out in the context of the postdoc of Mouad Lemoudden.
- **DGA (2019-2021)** DGA and its industrial partners have to regularly implement filters applied to standard or proprietary protocols on communication interfaces or directly in products. In order to allow administrators to easily adapt these filters to the specific context of the various devices, filtering languages specific to the different filtering policies applicable to the different devices should be developed. Even for simple static filters, the definition of such languages is a complex task. A methodological approach that would simplify this task for higher level abstraction filtering languages (and therefore simpler to use) would be to allow the definition of higher level abstraction filtering languages by relying on a single language of lower level of abstraction. This would make it possible to define high-level abstraction and easy-to-use languages in a recursive way by progressively increasing the levels of abstraction (and specificity). In addition, this approach would improve reusability. Indeed, it would be possible to rely on a filtering language, previously developed for another project, in order to more easily develop a more specific (and easy to use) language for another project.

  This work is carried out in the context of the postdoc of Ludovic Claudepierre

7.2. Bilateral Grants with Industry

- **DGA: Intrusion Detection in Distributed Applications** David Lanoé has started his PhD thesis in October 2016 in the context of a cooperation with DGA-MI. His work is focussing on the construction of behavioral models (during a learning phase) and their use to detect intrusions during an execution of the modelled distributed application.
- **Idemia: Hardware Security for Embeded Devices** Kevin Bukasa has started his PhD in January 2016 in a bilateral contract between Inria and Idemia. He explored fault injection attacks using EM probes on two different kind of devices: microcontroller (representing IoT) and SoC (representing Smart phone). He demonstrated the vulnerability of both architectures on this kind of attack. On IoT device he has developped an attack allowing to take a full control on the device. He discovered also new fault attacks never described in the litterature.
- **Idemia: Protection against fuzzing attack** Leopold Ouairy has started his PhD in October 2017 in a bilateral contract between Inria and Idemia. The context is related with security testing of Java applications to avoid fuzzing attack. The approach is based on AI to design automatically a model use for the oracle. He used machine learning to serach in a corpus of applicatons methods having the same semantics. Then in a second step, after convertir the source code into a vector he compute a similarity value which is related with absence of conditions evaluation.
- **Ministry of Defence: Visualisation for the characterization of security events** Laetitia Leichtnam has started his PhD thesis in November 2016 in the context of a contract between CentraleSupelec and the French Ministry of Defence. His work consists in presenting events appearing in heterogeneous logs as a dependency graph between the lines of logs. This permits to the administrator to investigate easily the logs to discover the different steps that has performed an attack in the supervised system.
- **Ministry of Defence: Characterization of an attacker** Aïmad Berady has started his PhD thesis in November 2018 in the context of a contract between CentraleSupelec and the French Ministry of Defence. His work is to highlight the characteristics of an attacker performing a targeted and long-term attack on an information system.
- **Nokia: Risk-aware security policies adaptation in modern communication infrastructures** Pernelle Mensah was hired in January 2016 on this CIFRE funding in order to work on unexplored aspects of information security, and in particular response strategies to complex attacks, in the context of cloud computing architectures. The use case proposed by our industrial partner is a multi-tenant cloud computing platform involving software-defined networking in order to provide further flexibility and responsiveness in architecture management. The topic of the thesis is to adapt and improve the current risk-aware reactive response tools, based on attack graphs and adaptive security policies, to this specific environment, taking into account the heterogeneity of actors, platforms, policies and remediation options.
- **Orange LAb's: Storage and query in a massive distributed graph for the web of things** Cyprien Gottstein has started his PhD thesis in October 2018 in the context of a collaboration between Inria and Orange (I/O Lab). In this thesis, we consider storage and query problems that arise when massive distributed graphs are used to represent the web of things. In particular, access to the data and partitioning of the graph are studied to propose efficient geographical services.
- **Thales: Privacy and Secure Multi-party Computation** Aurélien Dupin has started his PhD thesis in January 2016 within the context of a CIFRE contract with Thales. His PhD subject concerns secure multi-party computation. Secure two-party computation provides a way for two parties to compute a function, that depends on the two parties' inputs, while keeping them private. Known since the 1980s, Yao's garbled circuits appear to be a general solution to this problem, in the semi-honest model. Decades of optimizations have made this tool a very practical solution. However, it is well known that a malicious adversary could modify a garbled circuit before submitting it. Many protocols, mostly based on cut-&-choose, have been proposed to secure Yao's garbled circuits in the presence of malicious adversaries. Nevertheless, how much an adversary can modify a circuit and make it still executable have not been studied. In the context of his PhD, Aurélien Dupin is interested by such a question.

- **Thales: Combining Attack Specification and Dynamic Learning from traces for correlation rule generation** Charles Xosanavongsa has started his PhD thesis in December 2016 in the context of a CIFRE with Thales. His work will focus on the construction of correlation rules. In previous work on correlation rule generation, the usual approach is static. It always relies on the description of the supervised system using a knowledge base of the system. The use of correlation trees is an appealing solution because it allows to have a precise description of the attacks and can handle any kind of IDS. But in practice, the behavior of each IDS is quite difficult to predict, in particular for anomaly based IDS. To manage automatically the correlation rules (and adapt them if necessary), we plan to analyze synthetic traces containing both anomaly based and misused based IDS alerts resulting from an attack.

COAST Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Open Group

Participants: Claudia-Lavinia Ignat, François Charoy [contact], Gérald Oster, Olivier Perrin, Anis Ahmed Nacer.

Company: Open Group

Dates: 2017-2020

The objective of the project is to propose and validate a model of service composition for middleware services for software as a service architecture. The composition must take into account middleware service quality attributes and service plan in order to optimise the operational cost while ensuring a level of quality of service.

COATI Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Oui!Greens, 2019

Participant: Joanna Moulierac.

Duration: January 2019 - February 2019

Coordinator: Joanna Moulierac

Other partners: Dorian Mazauric from EP ABS

Abstract: Supervision of an InriaTech engineer for the development of the algorithm proposed in a previous collaboration with Oui!Greens.

The aim of the algorithm is to propose to clients the adequate products (fruits or vegetables) that are almost out-of-date with the objective of maximizing the satisfaction of the clients, and the diminution of the wastage. During one month, this algorithm has been implemented into the mobile application pepino, owned by Oui!Greens.

8.1.2. MillionRoads, 2019-2020

Participants: David Coudert, Frédéric Giroire, Luc Hogie, Nicolas Nisse, Michel Syska.

Duration: October 2019 - April 2020

Project title: HumanRoads

Coordinator: Nicolas Nisse

Other partners: SME MillionRoads; EP Zenith (Didier Parigot)

Abstract: HumanRoads uses a graph database, in the Neo4j environment, to store and structure its data. This database is already large and is regularly enriched with new data. However, to date, response times to queries are not satisfactory. This Project aims at identifying the limiting factors and to propose alternatives. More precisely, we will work on analyzing the data structure in the graph database to optimize queries, in the Neo4j environment, and on graph algorithms to speed up queries.

COFFEE Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Contract with Andra financing the two year postdoctoral position of Joubine Aghili (october 2017 - september 2019) and dealing with the simulation of compositional liquid gas Darcy flows in highly heterogeneous porous medium with network of fractures using Discrete Fracture Matrix models (DFM). It is applied to the simulation of the desaturation of the nuclear waste storage in the neighbourhood of the galleries. Supervision Roland Masson and Konstantin Brenner from LJAD-Inria, Jean-Raynald de Dreuzy from Geosciences Rennes and Laurent Trenty from Andra.
- The team has also on-going collaboration with Storengy (post-doc of Daniel Constantin-Quiroz).

COMETE Project-Team (section vide)

COML Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- **Facebook AI Research Grant** (2019, PI: E. Dupoux, 350K€) - Unrestricted Gift - The aim is to help the development of machine learning tools geared towards the psycholinguistic research community.
- **Google Research Award** (2019, PI E. Dunbar, 37K€) - Unrestricted Gift - Develop a first version of a universal synthesizer which can be tuned to specific dialects with sparse data.

COMMANDS Project-Team (section vide)

COMMEDIA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Notocord Systems

Participants: Damiano Lombardi, Fabien Raphel.

This work is devoted to the investigation on new approaches and efficient algorithms in the context of safety pharmacology and the analysis of biological signals.

8.1.2. Casis

Participants: Mocia Agbalessi, Miguel Ángel Fernández Varela, Damiano Lombardi.

This work is devoted to the combination of 4D-MRI data and fluid-structure interaction models of blood flow to asses indicators of aneurysm rupture.

CONVECS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Orange Labs

Participants: Umar Ozeer, Gwen Salaün.

Umar Ozeer is supported by a PhD grant (from November 2016 to November 2019) from Orange Labs (Grenoble) on detecting and repairing failures of data-centric applications distributed in the cloud and the IoT (see § 7.5.1), under the supervision of Loïc Letondeur (Orange Labs), Gwen Salaün (CONVECS), François Gaël Ottogalli (Orange Labs), and Jean-Marc Vincent (POLARIS project-team).

8.1.2. Nokia Bell Labs

Participants: Radu Mateescu, Ajay Muroor Nadumane, Gwen Salaün.

Ajay Muroor Nadumane is supported by a PhD grant (from October 2017 to October 2020) from Nokia Bell Labs (Nozay) on IoT service composition (see § 7.5.2) supported by formal methods, under the supervision of Gwen Salaün (CONVECS), Radu Mateescu (CONVECS), Ludovic Noirie, and Michel Le Pallec (Nokia Bell Labs).

CORSE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Atos/Bull

- Title: Static and dynamic approaches for the optimization of the energy consumption associated with applications of the High Performance Computing (HPC) field
- CORSE participants: François Broquedis, Frédéric Desprez, Mathieu Stoffel
- Partner: Atos/Bull
- Duration: February 2018 - February 2021
- Abstract: The purpose of this project is to dynamically improve the energy consumption of HPC applications on large-scale platforms. It relies on an adaptation of the CPU frequency at runtime, based on the analysis of hardware-related metrics to determine an *application profile*. This profile is then split into different *phases*, each of which being associated to a best CPU frequency, depending on its nature (CPU bound, memory bound, ...). This project is funding the PhD of Mathieu Stoffel, and the corresponding development is to be integrated into *Bull Dynamic Power Optimizer*, a software suite developed by Atos/Bull.

7.2. Bilateral Grants with Industry

7.2.1. ES3CAP

- Title: Embedded Smart Safe Secure Computing Autonomous Platform
- CORSE participants: Fabrice Rastello, Nicolas Tolenaere
- Duration: July 2018 - August 2021
- INRIA Partners: AOSTE, PARKAS, CHROMA
- Other Partners: Renault-Nissan, EasyMile, Safran E&D, MBDA, ANSYS/ESterel Technologies, Kronno-Safe, Prove & Run, Kalray, Prophesee, CEA
- Abstract: The objective of ES3CAP is to develop a tool-chain that targets multi- and many-core architectures for critical systems. In particular it should address the different challenges related to making existing critical systems solutions (heterogeneous, decentralized, single-core, single-task) match the industrial constraints targeted by Kalray's MPPA (MPPA, high-performance, real-time, safety, security). Considered applications are autonmous driving, drones, avionics, and defense. CORSE is involved in the optimization of machine learning algorithms for many-core architectures.

CQFD Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Naval Group

Participants: Huilong Zhang, François Dufour, Dann Laneuville, Alexandre Genadot.
The increasing complexity of warfare submarine missions has led Naval Group to study new tactical help functions for underwater combat management systems. In this context, the objective is to find optimal trajectories according to the current mission type by taking into account sensors, environment and surrounding targets. This problem has been modeled as a discrete-time Markov decision process with finite horizon. A quantization technique has been applied to discretize the problem in order to get a finite MDP for which standard methods such as the dynamic and/or the linear programming approaches can be applied. Different kind of scenarios have been considered and studied.

7.1.2. Thales Optronique

Participants: Benoîte de Saporta, François Dufour, Tiffany Cerchi.
Maintenance, optimization, fleet of industrial equipements The topic of this collaboration with Université de Montpellier and Thales Optronique is the application of Markov decision processes to the maintenance optimization of a fleet of industrial equipments.

7.1.3. Case Law Analytics

Pierrick Legrand is a consultant for the startup Case Law Analytics. Thje object of the consulting is confidential.

CTRL-A Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Orange

We have a cooperation with Orange labs, around a CIFRE PhD grant, on the topic of autonomic device management (see Section 7.2.4.1). This activity is part of the Inria/Orange joint laboratory.

8.1.2. Nokia / Bell labs

We have a research action with Nokia / Bell labs, around a post-doctorate, co-advised with project-team Dyonisos at Inria Rennes, on the topic of the Autonomic management in Software Defined Networks. This activity is part of the Inria/ Nokia / Bell labs joint laboratory.

DANTE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. GranData

Participants: Márton Karsai [correspondant], Éric Fleury.

Founded in 2012, Grandata is a Palo Alto-based company that leverages advanced research in Human Dynamics (the application of « big data » to social relationships and human behaviour) to identify market trends and predict customer actions. Leading telecom and financial services firms are using Grandata's Social Universe product to transform « big data » into impressive business results.

The DANTE team and Grandata started to collaborate in 2014 on the analysis of large datasets provided by the company. The aim of the collaboration is to gain better understanding about the dynamical patterns of human interactions, mobility, and the socio-economic structure of the society. Currently the collaboration is supported by the MOTIF Stic-AmSud project (2018-2020) (coordinated by Márton Karsai) which allows to meet frequently with the company. Recent projects within this collaboration are focusing on socioeconomic inference using remote sensing techniques.

DATAMOVE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **EDF R&D (2019)**. Integration of Melissa and OpenTurn.
- **TOTAL SA (2019)**. Proof of Concept for performing large scale sensibility analysis with Melissa on Total use-case.

8.2. Bilateral Grants with Industry

- **ATOS-BULL (2016-2019)**. Two PhD grants (Michael Mercier and Adrien Faure). Job and resource management algorithms.
- **Qarnot Computing (2019-2022)**. PhD grant (Angan Mitra).

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 inetial sensors (CIFRE PhD of Bertrand Beaufils).
- 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).

DATASPHERE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The PhD Thesis of Colin Gerard is funded through a contract with DGA (Ministry of Defense).

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.

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 testting".
- 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.

DEFROST Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We would like to acknowledge FACEBOOK company for the donation of $25,000 for our research (department FACEBOOK Reality Labs).

8.2. Bilateral Grants with Industry

We received an industry grant (CIFRE) with Robocath to work on autonomous catheter navigation. This grant will fund a PhD student for 3 years, starting in February 2019.

We have an ongoing bilateral project with the company InSimo on the simulation of suture.

DELYS Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

DELYS has a CIFRE contract with Scality SA:

- Dimitrios Vasilas is advised by Marc Shapiro and Brad King. He works on secondary indexing in large-scale storage systems under weak consistency.

DELYS has three contracts with Orange within the I/O Lab joint laboratory:

- Guillaume Fraysse is advised by Jonathan Lejeune, Julien Sopena, and Pierre Sens. He works on distributed resources allocation in virtual network environments.
- Jonathan Sid-Otmane is advised by Marc Shapiro. He studies the applications of distributed databases to the needs of the telco industry in the context of 5G.
- José Alves Esteves Jurandir is advised by Pierre Sens. He works on network slice placement stategies.

DIANA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Collaboration with Safran

Participant: Damien Saucez.
The research collaboration with Safran on Constrained Software Defined Networks has evolved into a new stage: Damien Saucez took a one year secondment from Inria to join Safran and further develop this activity from "inside".

7.1.2. Collaboration with Ekinops

Participant: Thierry Turletti, Walid Dabbous.
We have started a collaboration with EKINOPS on the topic of Multi-access Edge Computing. The activity started with a CIFRE thesis. The PhD student Mamoutou Diarra started his PhD on this topic on November 2019.

7.1.3. Collaboration with Orange

Participant: Thierry Turletti, Damien Saucez.
We have a collaboration with Orange on the topic of Network Function Virtualization. The activity includes the CIFRE PhD thesis of Giuseppe Di Lena that started his PhD on resilient NFV/SDN environments on April 2018.

7.2. Bilateral Grants with Industry

7.2.1. QWANT

Participant: Arnaud Legout.
The PIA ANSWER project is led by the QWANT search engine and the Inria Sophia Antipolis Méditerranée research center. This proposal is the winner of the "Grand Challenges du Numérique" (BPI) and aims to develop the new version of the search engine http://www.qwant.com with radical innovations in terms of search criteria, indexed content and privacy of users. In the context of this project, we got with Nataliia Bielova from the INDES project-team a funding for a 3 years Ph.D. working on Web tracking technologies and privacy protection.

DIONYSOS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Cifre contract on Device-Assisted Distributed Machine-Learning on Many Cores

Participants: Corentin Hardy, Bruno Sericola.

This is a Cifre contract (2016-2019) including a PhD thesis supervision (PhD of Corentin Hardy), done with Technicolor. The starting point of this thesis was to consider the possibility to deploy machine-learning algorithms over many cores, but out of the datacenter, on the devices (home-gateways) deployed by Technicolor in users' homes. In this device-assisted view, an initial processing step in the device may significantly reduce the burden on the datacenter back-end. Problems are numerous (power consumption, CPU power, network bandwidth and latency), but costs for the operator can be lowered and scale may bring some new level in data processing. The thesis has been defended in April 2019.

8.2. Cifre contract on Personalization for Cognitive Autonomic Networks in 5G

Participant: César Viho.

This is a Cifre contract (2017-2019) including a PhD thesis supervision (PhD of Illyyne Saffar), done with Nokia, on the proposition to use machine learning and data analytics to transform user and network data into actionable knowledge which in turn can be automatically exploited by Autonomic Networking approaches for cognitive self management of the 5G network.

8.3. Cifre contract on Resiliency as a Service for 5G networks using Machine Learning

Participants: Sofiene Jelassi, Gerardo Rubino.

The is a Cifre contract including a PhD thesis supervision (PhD of Soumaya Kaada), done with Nokia (Paris). It concerns providing on demand and evolving resiliency schemes over 5G network using advanced machine learning algorithms. It relies on a highly flexible network infrastructure supporting both wired and wireless programmable data planes through a highly-efficient distributed network operating system.

8.4. Bilateral Contract with Industry: Nokia Bell Labs

Participants: Yassine Hadjadj-Aoul, Quang Pham Tran Anh, Anouar Rkhami, Gerardo Rubino.

Gerardo Rubino is the coordinator of the research action "Analytics and machine learning", with Nokia Bell Labs. The objective is to carry out common research on an integrated framework for 5G, programmable networks, IoT and clouds that aims at statically and dynamically managing and optimizing the 5G infrastructure using, in particular, Machine Learning techniques.

DISCO Project-Team (section vide)

DIVERSE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. ADR Nokia

- Coordinator: Inria
- Dates: 2017-2021
- Abstract: The goal of this project is to integrate a chaos engineering principles to IoT Services frameworks to improve the robustness of the software-defined network services using this approach and to explore the concept of equivalence for software-defined network services and propose an approach to constantly evolve the attack surface of the network services.

7.1.2. BCOM

- Coordinator: UR1
- Dates: 2018-2024
- Abstract: The aim of the Falcon project is to investigate how to improve the resale of available resources in private clouds to third parties. In this context, the collaboration with DiverSE mainly aims at working on efficient techniques for the design of consumption models and resource consumption forecasting models. These models are then used as a knowledge base in a classical autonomous loop.

7.1.3. GLOSE

- Partners: Inria/CNRS/Safran
- Dates: 2017-2021
- Abstract: The GLOSE project develops new techniques for heterogeneous modeling and simulation in the context of systems engineering. It aims to provide formal and operational tools and methods to formalize the behavioral semantics of the various modeling languages used at system-level. These semantics will be used to extract behavioral language interfaces supporting the definition of coordination patterns. These patterns, in turn, can systematically be used to drive the coordination of any model conforming to these languages. The project is structured according to the following tasks: concurrent xDSML engineering, coordination of discrete models, and coordination of discrete/continuous models. The project is funded in the context of the network DESIR, and supported by the GEMOC initiative.

7.1.4. GLOSE Demonstrator

- Partners: Inria/Safran
- Dates: 2019-2020
- Abstract: Demonstrator illustrating the technologies involved in the WP5 off the GLOSE project. The use case chosen for the demonstrator is the high-level description of a remote control drone system, whose the main objective is to illustrate the design and simulation of the main functional chains, the possible interactivity with the model in order to raise the level of understanding over the models built, and possibly the exploration of the design space.

7.1.5. OneShotSoftware

- Partners: Inria/Orange
- Dates: 2017-2019

- Abstract: The OSS project investigates an extreme version of moving target defense where a slightly different version of the application is deployed each time it is used (e.g., for crypto functions or payment services). We investigate the analysis, synthesis and transformation techniques to support diversification at 5 points of a software construction pipeline, which, once combined yield up to billions of variants. We also evaluate the support of diversification as a first class property in DevOps.

7.1.6. Kereval

- Partners: INSA Rennes/Kereval
- Dates: 2019-2022
- Abstract: Front-ends testing in a DevOps context, Romain Lebouc's PhD Cifre project.

7.1.7. Obeo

- Partners: Inria/Obéo
- Dates: 2017-2020
- Abstract: Web engineering for domain-specific modeling languages, Fabien Coulon's PhD Cifre project.

7.1.8. OKWind

- Partners: UR1/OKWind
- Dates: 2017-2020
- Abstract: Models@runtime to improve self-consumption of renewable energies, Alexandre Rio's PhD Cifre project.

7.1.9. Orange

- Partners: UR1/Orange
- Dates: 2016-2019
- Abstract: Modelling and evaluating security of authentication paths, Youssou Ndiaye's PhD Cifre project.

7.1.10. Keolis

- Partners: UR1/Keolis
- Dates: 2018-2021
- Abstract: Urban mobility: machine learning for building simulators using large amounts of data, Gauthier LYAN's PhD Cifre project.

7.1.11. FaberNovel

- Partners: UR1/FaberNovel
- Dates: 2018-2021
- Abstract: Abstractions for linked data and the programmable web, Antoine Cheron's PhD Cifre project.

DRACULA Project-Team (section vide)

DYLISS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. SANOFI: co-supervised PhD

Participant: Emmanuelle Becker.

This collaboration project is focused on the implementation of an integrative analysis framework based on semantic web technologies and reasoning in the framework of systemic lupus erythematosus pathology [42]. **CIFRE co-supervised Grant: Ph.D. funding. 2017-2020**

8.1.2. Theranexus: co-supervised internship

Participant: Pierre Beaudier.

This collaboration project was focused on assessing public databases' relevance for predicting potential drug combinations in central nervous system's pathologies [32]. It opened the perspective of a CIFRE PhD with Insiliance (under review by ANRT) **Theranexus funding. 2019**

DYOGENE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CRE with Orange

Two year contract titled *Taking into account the "massive MIMO" in the assessment of QoS and the dimensioning of 5G cellular networks* between Inria and Orange Labs started 2018. It is a part of a long-term collaboration between TREC/DYOGENE, represented by B. Błaszczyszyn and Orange Labs, represented by M. K. Karray on the development of analytic tools and methods allowing one to capture macroscopic relation between antennas roll-out, frequency allocation, volume of traffic carried on the network and quality of service parameters such as the average and the variation of bandwidth available to end users. This work addresses crucial technical and economical issues related to the operator core business, particularly related to the current evolution of the cellular network technology (4G⇒5G). The developed solutions are implemented by Orange Labs in the internal toolbox *CapRadio* (see 6.1.1) and used by the Direction of Regulatory Affairs of Orange.

8.1.2. Contract with EDF

Collaborative research in the area of demand dispatch of flexible loads. PI : A. Busic.

8.1.3. CIFRE with Orange

Contract with Orange started in 2017 and continued in 2018 for the co-advising by B. Błaszczyszyn of a PhD student of Orange, Quentin Le Gall.

EASE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Project: SIMHet

Partner: YoGoKo

Coordinator: JM. Bonnin

Starting: Nov 2015 - Ending: April 2020

Abstract: The SIMHet project is performed in partnership with YoGoKo, a start-up that develops innovative communication solutions for cooperative intelligent transport systems. The SIMHet project aims to develop a decision making mechanism that would be integrated in the ISO/ETSI ITS communication architecture. It will allow mobile devices or mobile routers to choose the best network interface for each embedded application/flow. For example, in a vehicular environment this mechanism could manage global (Internet) and local connections for each on board device/application, in order to ensure that applications and services are always best connected. Aware that "best" concept is context-dependent, such a decision making mechanism should take into account requirements from different actors (e.g., applications, user, network administrators) and contextual information. One of the difficulties is to take advantage of the knowledge the system could have about near future connectivity. In the vehicular context such information about the movement and the availability of network resources is available. If taking into account the future makes the decision making more complex, this could allow a better usage of network resources when they are available. Once current solutions in the market are based on very simple decisions (use WiFi if available and 3G elsewhere), this smart mechanism will give competitive advantage for YoGoKo over its competitors.

7.2. Bilateral Grants with Industry

OKWIND

Coordinator: Y. Maurel

Starting: April 2017 - Ending: April 2020

Abstract: OKWind [0] is a company specialized in local production of renewable energy. This project, with Inria DiverSE and EASE teams, aims at building a system that optimizes the use of different sources of renewable energy, choosing the most suitable source for the current demand and anticipating future needs, so as to favor the consumption of locally produced electricity. The system must be able to model clients' activities. It must also trigger actions (local consumption vs. local storage). The final goal is to use "locally produced" energy in a smarter way and to tend towards a self-consumption optimum. This contract funds Alexandre Rio's PhD grant.

Orange Labs

Coordinator: JM. Bonnin

Starting: Jan 2016 - Ending: Jan 2019

Abstract: The objective of this thesis is to propose a new management architecture for optimizing the upstream bandwidth allocation in PON while acting only on manageable parameters to allow the involvement of self-decision elements into the network. To achieve this, classification techniques based on machine learning approaches are used to analyze the behavior of PON users and specify their upstream data transmission tendency. A dynamic adjustment of some SLA parameters is then performed to maximize the overall customers' satisfaction with the network. This contract funds Nejm Frigui's PhD grant, co-supersized with Tayeb Lemlouma (IRISA OCIF team).

[0] http://www.okwind.fr/

ECUADOR Project-Team (section vide)

ELAN Project-Team (section vide)

EMPENN Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Siemens

Participants: Elise Bannier, Christian Barillot, Emmanuel Caruyer, Olivier Commowick, Isabelle Corouge, Jean-Christophe Ferré, Jean-Yves Gauvrit.

In the context of the Neurinfo imaging platform, a master research agreement between Siemens SAS - Healthcare and University of Rennes 1 defines the terms of the collaboration between Siemens, Empenn and the Neurinfo platform. Relying on this research agreement contract, Neurinfo has received work in progress (WIP) sequences from Siemens in the form of object code for evaluation in the context of clinical research. The Neurinfo platform has also received source code of selected MRI sequences. As an example, the diffusion sequence code was modified to load arbitrary diffusion gradient waveforms for the FastMicroDiff project led by E. Caruyer. This is crucial in the collaboration since it enables the development of MRI sequences on site. The MR Diffusion pulse sequence source code was modified in collaboration with our Siemens clinical scientist as part of our Master Research Agreement, Marc Lapert, in order to play arbitrary gradient waveforms. This was done on the Syngo VB17 software version and again VE11C (nearly finished).

EPIONE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Microsoft Research

Microsoft Research is funding through the Inria-Microsoft joint lab the projects "4D Cardiac MR Images"[0] and "Medilearn"[0] which aim at analyzing large databases of cardiac images to help the diagnosis of cardiac diseases and planning of therapy. This project involves A. Crimisi from MSR and partially funds the PhDs of Pawel Mlynarski.

7.1.2. Spin-off company inHEART

inHEART[0] is a spin-off of the Epione team and IHU Liryc founded in 2017. inHEART provides a service to generate detailed anatomical and structural meshes from medical images, that can be used during ablation interventions. inHEART received 2 awards, one from Aquitaine region and one i-LAB from the BPI. It currently employs 10 people.

7.1.3. Live Anatomy

A 3 month InriaTech contract was performed with the Live Anatomy start-up between January and March 2019 in order to develop a remote viewer and to optimise image segmentation.

7.1.4. Siemens HealthCare

Siemens Healthcare, Medical Imaging Technologies, Princeton, NJ (U.S.A). is funding the PhD work of Julian Krebs which aims at developing robust medical image registration methods

7.1.5. Quantificare

The company Quantificare is funding the PhD of Florent Jousse through a CIFRE grant, on the statistical analysis of shapes, deformations and appearance of anatomical surfaces for computer-aided dermatology and plastic surgery. The primary purpose is to model complex face deformations such as natural aging, facial expressions, surgical interventions and posture motions.

7.1.6. Oticon Medical

Oticon Medical, Vallauris, France, is co-funding the PhD work of Zihao Wang which aims at developing robust medical image algorithms for cochlea image segmentation.

[0] http://www.msr-inria.fr/projects/4d-cardiac-mr-images
[0] http://www.msr-inria.fr/projects/medilearn
[0] https://www.inheart.fr/

ERABLE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Spock

- Title: characterization of hoSt-gut microbiota interactions and identification of key Players based on a unified reference for standardized quantitative metagenOmics and metaboliC analysis frameworK
- Industrial Partner: MaatPharma (Person responsible: Lilia Boucinha).
- ERABLE participants: Marie-France Sagot (ERABLE coordinator and PhD main supervisor with Susana Vinga from IST, Lisbon, Portugal, as PhD co-supervisor), Marianne Borderes (beneficiary of the PhD scholarship in MaatPharma).
- Type: ANR Technology (2018-2021).
- Web page: http://team.inria.fr/erable/en/projects/#anr-technology-spock.

EVA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Participants: Razanne Abu Aisheh, Mina Rady, Thomas Watteyne.

Razanne Abu Aisheh is doing her PhD under a CIFRE agreement between Inria and Nokia Bell Labs. Mina Rady is doing his PhD under a CIFRE agreement between Inria and Orange Labs.

EX-SITU Project-Team (section vide)

FACTAS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Contract CNES-Inria-Xlim

This contract (reference Inria: 11282) accompanied the PhD of David Martinez Martinez and focused on the development of efficient techniques for the design of matching network tailored for frequency varying loads. Applications of the latter to the design output multiplexers occurring in space applications has also been considered (see new results section). The contract ended mid 2019.

7.1.2. Contract Inria-Inoveos

A contract was signed with the SMB company Inoveos in order to build a prototypical robot dedicated to the automatic tuning of microwave devices, see Section 5.1.1 .

FLOWERS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Autonomous Driving Commuter Car

Participants: David Filliat [correspondant], Emmanuel Battesti.

We developed planning algorithms for a autonomous electric car for Renault SAS in the continuation of the previous ADCC project. We improved our planning algorithm in order to go toward navigation on open roads, in particular with the ability to reach higher speed than previously possible, deal with more road intersection case (roundabouts), and with multiple lane roads (overtake, insertion...).

8.2. Bilateral Grants with Industry

8.2.1. Perception Techniques and Sensor Fusion for Level 4 Autonomous Vehicles

Participants: David Filliat [correspondant], Vyshakh Palli-Thazha.

Financing of the CIFRE PhD grant of Vyshakh Palli-Thazha by Renault.

8.2.2. Incremental Methods of Deep Learning for detection and classification in an robotics environment

Participants: David Filliat [correspondant], Timothée Lesort.

Financing of the CIFRE PhD grant of Timothée Lesort by Thales.

8.2.3. Exploration of reinforcement learning algorithms for drone visual perception and control

Participants: David Filliat [correspondant], Florence Carton.

Financing of the CIFRE PhD grant of Florence Carton by CEA.

8.2.4. Incremental learning for sensori-motor control

Participants: David Filliat [correspondant], Hugo Caselles Dupré.

Financing of the CIFRE PhD grant of Hugo Caselles-Dupré by Softbank Robotics.

8.2.5. Curiosity-driven Learning Algorithms for Exploration of Video Game Environments

Participant: Pierre-Yves Oudeyer [correspondant].

Financing of a postdoc grant for a 2 year project with Ubisoft and Région Aquitaine.

8.2.6. Intrinsically Motivated Exploration for Lifelong Deep Reinforcement Learning in the Malmo Environment

Participants: Pierre-Yves Oudeyer [correspondant], Remy Portelas.

Financing of the PhD grant of Rémy Portelas by Microsoft Research.

8.2.7. Explainable continual learning for autonomous driving

Participants: Natalia Díaz Rodríguez [correspondant], Adrien Bennetot.

Financing of the CIFRE PhD grant of Adrien Bennetot by Segula Technologies.

FLUMINANCE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Contract ITGA

Participants: Dominique Heitz, Etienne Mémin.

duration 36 months. This partnership between Inria, Irstea and ITGA funds the PhD of Romain Schuster. The goal of this PhD is to design new image-based flow measurement methods for the study of industrial fluid flows. Those techniques will be used in particular to calibrate industrial fume hood.

7.1.2. Contract CSTB

Participants: Mohamed Yacine Ben Ali, Dominique Heitz, Etienne Mémin.

duration 36 months. This partnership between Inria, Irstea and CSTB funds the PhD of Yacine Ben Ali. This PhD aims to design new data assimilation scheme for Reynolds Average Simulation (RANS) of flows involved in wind engineering and buildings construction. The goal pursued here consists to couple RANS models and surface pressure data in order to define data driven models with accurate turbulent parameterization.

FOCUS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

In 2019 we have started the Innovation Lab on Blockchain and New Technologies (https://site.unibo.it/blockchain-and-newtechnologies/en). The Lab is a new joint laboratory of the Computer Science and Engineering Department of the University of Bologna and KPMG Advisory S.p.A. that is committed to scientific research and technology transfer of systems based on blockchain and new technologies. The laboratory joins the efforts of several researchers of the Department and uses the experience in technology transfer of KPMG Advisory S.p.A.

The Lab has received a grant of 10KE from KPMG and a grant of 10KE from CIRFOOD, one of the biggest Italian companies in organised commercial and collective catering.

FUN Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Sencrop
  Participants: Brandon Foubert, Nathalie Mitton [contact person].

  This collaboration aims to develop a complete multi-technology bilateral wireless communication stack for agriculture sensor networks.
- Enedis and NooliTic
  Participants: Ibrahim Amadou, Nathalie Mitton [contact person].

  This collaboration aims to investigate a novel localization approach based on wireless propagations. It is a tri-partite contract between our Inria team, the SME NooliTic and Enedis.
- Expleo
  Participants: Ibrahim Amadou, Nathalie Mitton [contact person].

  This collaboration aims to transfer self-deployment protocols to Expleo.

GALLINETTE Project-Team (section vide)

GAMBLE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Company: WATERLOO MAPLE INC
  Duration: 2 years
  Participants: GAMBLE and OURAGAN Inria teams
  Abstract: A two-years licence and cooperation agreement was signed on April 1st, 2018 between WATERLOO MAPLE INC., Ontario, Canada (represented by Laurent Bernardin, its Executive Vice President Products and Solutions) and Inria. On the Inria side, this contract involves the teams GAMBLE and OURAGAN (Paris), and it is coordinated by Fabrice Rouillier (OURAGAN).

  F. Rouillier and GAMBLE are the developers of the ISOTOP software for the computation of topology of curves. One objective of the contract is to transfer a version of ISOTOP to WATERLOO MAPLE INC.
- Company: GEOMETRYFACTORY
  Duration: permanent
  Participants: Inria and GEOMETRYFACTORY
  Abstract: CGAL packages developed in GAMBLE are commercialized by GEOMETRYFACTORY.

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

GANG Project-Team (section vide)

GENSCALE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Tank milk analysis

Participants: Dominique Lavenier, Jacques Nicolas.

The Seenergi company has developed a biotechnology protocol to detect cow mastitis directly by analyzing the DNA in the milk of the tanks. Cows are first genotyped. Since cows with mastitis produce a high level of lymphocytes, a DNA milk analysis can point out infested cows. Currently, DNA chips are used to support this analysis. We are currently investigating the possibility to use sequencing technologies in order to both reduce cost analysis and to extend the detection to larger herds.

8.2. Bilateral Grants with Industry

8.2.1. Rapsodyn project

Participants: Dominique Lavenier, Claire Lemaitre, Pierre Peterlongo, Gwendal Virlet.

RAPSODYN is a long term project funded by the IA ANR French program (Investissement d'Avenir) and several field seed companies, such as Biogemma, Limagrain and Euralis (http://www.rapsodyn.fr/). The objective is the optimization of the rapeseed oil content and yield under low nitrogen input. GenScale is involved in the bioinformatics work package to elaborate advanced tools dedicated to polymorphism detection and analysis.

GEOSTAT Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

InnovationLab with I2S company, starting scheduled after 1st 2019 COPIL in January 2019.

GRACE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Participants: Daniel Augot, Alain Couvreur, Guénaël 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 environement 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”.

GRAPHDECO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Valentin Deschaintre has a CIFRE PhD fellowship on Material Acquisition using Machine Learning, in collaboration with Optis - Ansys, a company specialized in material acquisition and rendering.

7.2. Bilateral Grants with Industry

- As part of a long standing collaboration with Adobe, this year Julien Philip interned with Michael Gharbi (San Francisco). This follows previous internships of J. Delanoy with Aaron Hertzmann (San Francisco) and Theo Thonnat with Sylvain Paris (Boston),
- Adrien Bousseau and Bastien Wailly worked with the InriaTech engineers to implement a sketch recognition engine in the context of a collaboration with the start-up EpicNPoc.

GRAPHIK Project-Team (section vide)

HEPHAISTOS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Symbolic tools for modeling and simulation

Participant: Yves Papegay.

This activity is the main part of a long-term ongoing collaboration with Airbus whose goal is to directly translate the conceptual work of aeronautics engineers into digital simulators to accelerate aircraft design.

An extensive modeling and simulation platform - MOSELA - has been designed which includes a dedicated modeling language for the description of aircraft dynamics models in term of formulae and algorithms, and a symbolic compiler producing as target an efficient numerical simulation code ready to be plugged into a flight simulator, as well as a formatted documentation compliant with industrial requirements of corporate memory.

Technology demonstrated by our prototype has been transferred : final version of our modeling and simulation environment has been delivered to Airbus in November 2012 and developer level know-how has been transferred in 2013 to a software company in charge of its industrialization and maintenance.

Since 2014, we are working on several enhancements and extension of functionalities, namely to enhance the performances and the numerical quality of the generated C simulation code, ease the integration of our environment into the airbus toolbox, help improving the robustness of the environment and the documentation.

HIEPACS Project-Team (section vide)

HYBRID Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Mensia Technologies

Participant: Anatole Lécuyer.

Mensia Technologies was an Inria start-up company created in November 2012 as a spin-off of Hybrid team. Mensia was focused on wellness and healthcare applications emerging from the BCI and Neurofeedback technologies. The Mensia startup benefited from the team's expertise and of valuable and proprietary BCI research results. Mensia was based in Rennes and Paris. Anatole Lécuyer and Yann Renard (former Inria expert engineer who designed the OpenViBE software architecture and was involved in team projects for 5 years) are co-founders of Mensia Technologies.

The contract between Hybrid and Mensia started in November 2013 and ended in August 2019 with the closing of the company. The contract supported the transfer of several softwares designed by Hybrid team (eg, OpenViBE and StateFinder) to Mensia Technologies for medical and multimedia applications of Mensia.

8.1.2. Orange Labs

Participants: Anatole Lécuyer [contact], Hakim Si-Mohammed, Ferran Argelaguet.

This four months contract between Hybrid and Orange labs (Jan - April 2019) covered the design of a proof of concept of a smart home system controlled using a brain computer interface in and augmented reality context.

8.2. Bilateral Grants with Industry

8.2.1. Orange Labs

Participants: Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton [contact].

This grant started in October 2017. It supports Guillaume Bataille's PhD program with Orange Labs company on "Natural Interactions with IoT using VR/AR".

In the context of this collaboration the following patent has been filled:

- "Dispositif d'affichage portatif de contenu 3D, système et procédé correspondants" (FR1914557), Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton, Jérémy Lacoche. Filed in Dec. 2019.

8.2.2. InterDigital

Participants: Nicolas Olivier, Ferran Argelaguet, Anatole Lécuyer [contact].

This grant started in February 2019. It supports Nicolas's Olivier CIFRE PhD program with InterDigital company on "Avatar Stilization". This PhD is co-supervised with the MimeTIC team.

HYCOMES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Glose: Globalisation for Systems Engineering

Participants: Benoît Caillaud, Benoît Vernay.

Glose is a bilateral collaboration between Inria and Safran Tech., the corporate research entity of Safran Group. It started late 2017 for a duration of 44 months. Three Inria teams are involved in this collaboration: Diverse (Inria Rennes), Hycomes and Kairos (Inria Sophia-Antipolis). The scope of the collaboration is systems engineering and co-simulation.

The simulation of system-level models requires synchronizing, at simulation-time, physical models with software models. These models are developed and maintained by different stakeholders: physics engineers, control engineers and software engineers. Models designed by physics engineers are either detailed 3D finite-elements models, with partial differential equations (PDEs), or finite-dimension 0D models (obtained by model reduction techniques, or by empirical knowledge) expressed in modeling languages such as Simulink (with ordinary differential equations, or ODEs), Modelica (with differential algebraic equations, or DAEs), or directly as a C code embedding both the differential equations and its discretization scheme. Coupling together heterogeneous models and programs, so that they can be co-simulated, is not only a technological challenge, but more importantly raises several deep and difficult questions: Can we trust simulations? What about their reproducibility? Will it be possible to simulate large systems with hundreds to thousands of component models?

Co-simulation requires that models are provided with interfaces, specifying static and dynamic properties about the model and its expected environments. Interfaces are required to define how each model may synchronize and communicate, and how the model should be used. For instance, an interface should define (i) which variables are inputs, which are outputs, (ii) their data types, physical units, and sampling periods, but also (iii) the environmental assumptions under which the model is valid, and (iv) the causal dependencies between input and output variables and for continuous-time models, (v) the stiffness of the model, often expressed as a time-varying Jacobian matrix.

Formally, an interface is an abstraction of a model's behavior. A typical example of interface formalism for 0D continuous-time models is the FMI standard. Co-simulation also requires that a model of the system architecture is provided. This architectural model specifies how components are interconnected, how they communicate and how computations are scheduled. This is not limited to the topology of the architecture, and should also specify how components interact. For instance, variables in continuous-time models may have different data-types and physical units. Conversion may be required when continuous-time models are plugged together. Another fine example is the coupling of a 3D finite-element model to a 0D model: effort and flow fields computed in the 3D model must be averaged in a scalar value, before it can be sent to the 0D model, and conversely, scalar values computed by the 0D model must be distributed as a (vector) field along a boundary manifold of the 3D model. For discrete-time models (eg., software), components may communicate in many ways (shared variables, message passing, ...), and computations can be time- or event-triggered. All these features are captured as data-/behavior-coordination patterns, as exemplified by the GEMOC initiative [0].

In the Glose project, we propose to formalize the behavioral semantics of several modeling languages used at system-level. These semantics will be used to extract behavioral language interfaces supporting the definition of coordination patterns. These patterns, in turn, can systematically be used to drive the coordination of any model conforming to these languages. The co-simulation of a system-level architecture consists in an orchestration of hundreds to thousands of components. This orchestration is achieved by a master algorithm, in charge of triggering the communication and computation steps of each component. It takes into account the

[0] http://gemoc.org

components' interfaces, and the data-/behavior-coordination patterns found in the system architecture model. Because simulation scalability is a major issue, the scheduling policy computed by the master algorithm should be optimal. Parallel or distributed simulations may even be required. This implies that the master algorithm should be hierarchical and possibly distributed.

In 2019, the Hycomes team has been working on the use of Quantized State System (QSS) nethods for the cosimulation of aeronautics system models. The aim is to design new distributed simulation protocols, capable of simulating large, but heterogeneous system models. The investigation is on the trade-offs between pessimistic simulation techniques, where no roll-back is required, and speculative methods, where roll-back may be required. The latter method can be beneficial to the performance and scalability of the simulation, provided roll-backs do not happen too often. The models under consideration are cyberphysical systems consisting in both Modelica models (for the physics) and discrete-time models expressed in a dedicated language (for the control).

In 2019, the Hycones team has delivered one report, detailing the state-of-the-art techniques for continuous systems cosimulation.

I4S Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Collaboration with SNCF on Road circuits

Participants: Vincent Le Cam, Arthur Bouché.

The 2 objectives of the Circuit de Voie project aimed to detect the phenomenon of deshuntage are, with SNCF Innovation Research, develop criteria and models to detect, in real time, the appearance of the phenomenon, and implementing in one of several PEGASE boxes spread over several test sites these models and comparison indicators.

3 criteria have been developed and validated in simulation on real dataset: 1 criterion in residual power on the spectral band of the harmonic of rank 3, a criterion of spectral shape recognition typical in case of bad deshuntage, a statistical criterion on the RMS component of the residual signal. Future work is envisaged in 2020 to go further in comparing these models with real field data and comparison with other detection systems. Several PEGASE units have been built, deployed and implemented for one-off or long-term measurement phases, including during deshuntage tests conducted by SNCF teams.

7.1.2. Collaboration with SNCF Reseau

Participants: Vincent Le Cam, Arthur Bouché.

SNCF has commissioned 5 new DETECTEAU water level sensors adapted to the conditions of nozzles and waterways in the rail network. From a technological point of view the sensor is of small size and very weak consumption. DETECTEAU communicates according to the LORA network. From September to November 2019, one to 3 sites of LGV Paris East will probably be deployed. Scientifically a dynamic sending algorithm has been implemented, taking into account the dynamics of the watercourse (sending more information if there are phases of flood or recession). As it stands, the DETEC-TEAU project is opening the field, probably for 2020, to a more scientific follow-up of the project where the data collected will feed watershed flow models that SNCF wishes to qualify.

7.1.3. Collaboration with SNCF : Hot boxes detection

Participants: Jean Dumoulin, Thibaud Toullier.

The main strategic issue is the maintenance in operational condition of the Hot Box Detectors (DBC). The removal of the DBC from the track is part of Tech4Rail's ambition: reducing equipment to the track. The innovation aimed at in this project is to study and develop a measurement solution to be deployed at the edge of a lane out of danger zone and independent of track equipment. Among the scientific obstacles identified are the following three:

- the behavior of the measurement system in deteriorated meteorological conditions in a real site
- the design and implementation of an automated prototype for in-situ deployment (connection to an existing announcement system, hardware packaging of the system, study and design of a scalable software solution allowing pre-processing data).
- the development of automatic processing tools for the analysis of massive data generated by in-situ measurement systems

7.1.4. Contract with SIEMENS : Poof of Concept monitoring coupled with prediction model for deicing metro lane surface

Participants: Jean Dumoulin, Nicolas Le Touz, Thibaud Toullier.

This proof of concept aims at combining real site monitoring solutions with adjoint state FE thermal model approach to predict optimal heating required to preserve surface from icing in winter conditions. Furthermore, we introduced in our prediction model connection with in-line weather forecast provided by Meteo France Geoservice at different time horizon and spatial scale.

IBIS 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.

IMAGINE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have an ongoing CIFRE PhD contract with PSA on the topic of aesthetic shape modeling in immersive virtual reality environments, which is funding the PhD of Youna Le Vaou.

INDES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The ANSWER project (Advanced aNd Secured Web Experience and seaRch) is lead by the QWANT search engine and the Inria Sophia Antipolis Méditerranée research center. This proposal is the winner of the "Grand Challenges du Numérique" (BPI) and aims to develop the new version of the search engine http://www.qwant.com with radical innovations in terms of search criteria, indexed content and privacy of users. Nataliia Bielova, Manuel Serrano and Tamara Rezk are involved in this project. The project started on January 1, 2018. In the context of this project, we got

- with Arnaud Legout from the DIANA project-team a funding for a 3 years Ph.D. student to work on Web tracking technologies and privacy protection. Imane Fouad was hired to work on this project.
- a funding for 18 months Postdoc to work on Web application security. Yoon Seok Ko has worked on this project as a postdoc.

INOCS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Utocat (2018-2020): Study optimization problems arising in the blockchain

8.2. Bilateral Grants with Industry

- Program PGMO funded by the Fondation Mathématiques Jacques Hadamard. EDF is the industrial partner (2017-2019)
- Program PGMO funded by the Fondation Mathématiques Jacques Hadamard. A generic framework for routing and scheduling problems (2019-2021)
- Program PGMO funded by the Fondation Mathématiques Jacques Hadamard. Integrated models for the dimensioning and location of charging electric vehicles stations in the presence of renewable energy sources: Models and Algorithms (2019-2020)

Kairos Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Safran : Desir/Glose We participate to the bilateral collaborative program Desir, put up by Safran to work with selected academic partners. We share the Glose project started in this program with two other Inria teams : HyComes, and DiverSE. The aim of the project is to improve early stages of system engineering by allowing early execution and co-simulation of heterogeneous models. The technical content of our contributions is described in section 7.13 . A CIFRE PhD is funded by Renault on related topics.

IRT Saint-Exupery ATIPPIC This cooperative project aims at building a computing digital electronic structure of micro-satellites on ordinary, "COTS" processors. The project was accepted for 30 months and will reach completion by the end of 2019. It funds two temporary research engineers working under our own supervision, while exchanging extensively with the rest of the ATIPPIC project, which is actually physically hosted by Inria. The technical content of our contributions is described in section 7.2 .

Airbus In the continuation of the ITEA3 ASSUME project, Airbus has provided funding for the extension of the Real-Time Systems Compilation method to allow parallelization onto multi-cores with classical ARM or POWER architecture. The technical content of our contributions is described in section 7.16 . The technical content of our contributions is described in section 7.2 .

IRT Saint-Exupery The CAPHCA project of IRT Saint-Exupéry has provided funding for the extension of the Real-Time Systems compilation method to allow parallelization onto timing predictable multi-cores different from the Kalray MPPA 256. The targets of this work are Infineon TC27x and FlexPRET.

Renault Software Lab We have started, at the end of 2018, a collaboration with Renault Software Labs on the definition of rules for ensuring safe maneuvers in autonomous vehicles. The rules express conditions from the environments, safety rules to preserve the integrity of the vehicles, driving legislation rules, local rules from the authorities. The rules must be updated dynamically when the vehicle evolves and are used to monitor at run-time the behavior of the ADAS. While the ADAS contains several algorithms relying on machine learning, the monitoring system must be predictive and rules must guarantee formally that the system does not cause any accident. So it can be seen as a way to build trustworthy monitoring of learning algorithms. A CIFRE PhD is funded by Renault on this topic and has started in April 2019.

Accenture Labs We have continued discussions with Accenture Labs, started in 2018, on Smart Contract languages for permissioned blockchains. A CIFRE funding is under way.
In recent years, various platform developments focused on so-called *private* (or *permissioned*) blockchain(s) and digital ledgers. Almost all private blockchains present their own implementation of Smart Contract. Between public and private blockchains we are observing a wide variety of different languages with different capabilities and limitations. Inspired by our researches in object-oriented languages [40], we aim at designing a language which might extend an object instance upon receiving a message, an ability referred to by Cardelli as *self-inflicted* operation. Public and private blockchains would take advantage of this novel capability in building safe and flexible intelligent smart contracts.

KERDATA Project-Team (section vide)

KOPERNIC Team (section vide)

LACODAM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **AdvisorSLA 2018 - Inria**
  Participants: E. Bourrand, L. Galárraga, E. Fromont, A. Termier
  Contract amount: 7,5k€
  Context. AdvisorSLA is a French company headquartered in Cesson-Sévigné, a city located in the outskirts of Rennes in Brittany. The company is specialized in software solutions for network monitoring. For this purpose, the company relies on techniques of network metrology. AdvisorSLA's customers are carriers and telecommunications/data service providers that require to monitor the performance of their communication infrastructure as well as their QoE (quality of service). Network monitoring is of tremendous value for service providers because it is their primary tool for proper network maintenance. By continuously measuring the state of the network, monitoring solutions detect events (e.g., an overloaded router) that may degrade the network's operation and the quality of the services running on top of it (e.g., video transmission could become choppy). When a monitoring solution detects a potentially problematic sequence of events, it triggers an alarm so that the network manager can take actions. Those actions can be preventive or corrective. Some statistics gathered by the company show that only 40% of the triggered alarms are conclusive, that is, they manage to signal a well-understood problem that requires an action from the network manager. This means that the remaining 60% are presumably false alarms. While false alarms do not hinder network operation, they do incur an important cost in terms of human resources.
  Objective. We propose to characterize conclusive and false alarms. This will be achieved by designing automatic methods to "learn" the conditions that most likely precede the fire of each type of alarm, and therefore predict whether the alarm will be conclusive or not. This can help adjust existing monitoring solutions in order to improve their accuracy. Besides, it can help network managers automatically trace the causes of a problem in the network. The aforementioned problem has an inherent temporal nature: we need to learn which events occur before an alarm and in which order. Moreover, metrology models take into account the measurements of different components and variables of the network such as latency and packet loss. For these two reasons, we resort to the field of multivariate time sequences and time series. The fact that we know the "symptoms" of an alarm and whether it is conclusive or not, allows for the application of supervised machine learning and pattern mining methods.
  Additional remarks. This is a pre-doctoral contract signed with AdvisorSLA to start the work for the PhD of E. Bourrand (Thèse CIFRE) while the corresponding administrative formalities are completed.
- **ATERMES 2018-2021 - Univ Rennes 1**
  Participants: H. Zhang, E. Fromont
  Contract amount: 45k€
  Context. ATERMES is an international mid-sized company, based in Montigny-le-Bretonneux with a strong expertise in high technology and system integration from the upstream design to the long-life maintenance cycle. It has recently developed a new product, called BARIERTM ("Beacon Autonomous Reconnaissance Identification and Evaluation Response"), which provides operational and tactical solutions for mastering borders and areas. Once in place, the system allows for a continuous night and day surveillance mission with a small crew in the most unexpected rugged terrain. BARIER™ is expected to find ready application for temporary strategic site protection or ill-defined border regions in mountainous or remote terrain where fixed surveillance modes are impracticable or overly expensive to deploy.

Objective. The project aims at providing a deep learning architecture and algorithms able to detect anomalies (mainly the presence of people or animals) from multimodal data. The data are considered "multimodal" because information about the same phenomenon can be acquired from different types of detectors, at different conditions, in multiple experiments, etc. Among possible sources of data available, ATERMES provides Doppler Radar, active-pixel sensor data (CMOS), different kind of infra-red data, the border context etc. The problem can be either supervised (if label of objects to detect are provided) or unsupervised (if only times series coming from the different sensors are available). Both the multimodal aspect and the anomaly detection one are difficult but interesting topics for which there exist few available works (that take both into account) in deep learning.

- **PSA - Inria**
  Participants: E. Fromont, A. Termier, L. Rozé, G. Martin
  Contract amount: 15k€
  Context. Peugeot-Citroën (PSA) group aims at improving the management of its car sharing service. To optimize its fleet and the availability of the cars throughout the city, PSA needs to analyze the trajectory of its cars.
  Objective. The aim of the internship is (1) to survey the existing methods to tackle the aforementioned need faced by PSA and (2) to also investigate how the techniques developed in LACODAM (e.g., emerging pattern mining) could be serve this purpose. A framework, consisting of three main modules, has been developped. We describe the modules in the following.
  - A town modelisation module with clustering. Similar towns are clustered in order to reuse information from one town in other towns.
  - A travel prediction module with basic statistics.
  - A reallocation strategy module (choices on how to relocate cars so that the most requested areas are always served). The aim of this module is to be able to test different strategies.

  Additional remarks. This is a pre-doctoral contract to start the work for the PhD of G. Martin (Thèse CIFRE) while the corresponding administrative formalities are completed.

LARSEN Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Cifre with Diatelic Pharmagest

Participants: François Charpillet, Yassine El Khadiri.

We have a long term collaboration with Diatelic compagny which is a start-up created among other by François Charpillet in 2002. Currently we have a collaboration through a Cifre PhD whose the objective is to work on daily activity recognition for monitoring elderly people at home. The work will be included in a product that will be launched next year (carelib solution).

8.1.2. Cifre with PSA

Participants: François Charpillet, Julien Uzzan.

This work is done in collaboration with François Aioun, Thomas Hannagan and Franck Guillemard from PSA.

The subject of the thesis is : « Reinforcement learning for the autonomous vehicle in urban-like environments ». This PhD started in January on the Vélizy site where he stayed for 3 months and the he moved to Inria Nancy in the LARSEN team and we started working on applications of deep reinforcement learning algorithms for autonomous vehicles. The first one was a decision-making problem for autonomous driving on highways using the Deep Q-Networks algorithm. The aim was to build a controler outputing high level decisions (like changing to left/right lane, braking...) to navigate on highways and interacting with many other actors. Even though the results were convicing for simple simulations like a basic overtaking or just following a leader car, the performances on the general case were lackluster, so this is still an ongoing work. The other application we worked on later this year is a longitudinal control application. The aim was to create a controller able to drive behind a leader, but this time, the controller is low-level, meaning that it has to output direct commands, like an acceleration. More recently, we have been testing a idea meant to enhance the performances of the deep reinforcement learning algorithm by adding noise to the observations during training in order to obtain a safer and more cautious controller.

8.1.3. Cifre with SAFRAN

Participants: François Charpillet, Nicolas Gauville, Christophe Guettier.

The thesis began on May 6, 2019 after a "prethesis" of 6 month and is related to the Furious Project. The objective is to propose new Coordination mechanisms for a group of autonomous robotic evolving in an unknown environment for search and rescue (Robot Search and Rescue). The thesis is a continuation of a previous work made during the Cartomatic project which won in 2012 the French robotics contest Defi CAROTTE organized by the General Delegation for Armaments (DGA) and French National Research Agency (ANR).

8.1.4. Cifre iFollow

Participants: Francis Colas, Jérôme Truc, Cédric Pradalier, Nirmal Giftsun.

Cédric Pradalier is co-supervisor at GeorgiaTech Lorraine and Nirmal Giftsun is at iFollow.

iFollow is a startup, located in Paris area, providing solutions for shopping carts. Their first market of interest is logistics, wherein they develop robots for alleviating the workload of order pickers. Their second, longer-term, target is retail, with the development of intelligent shopping carts to help persons with disabilities.

The aim of this Cifre program is to endow the robots with more intelligent behaviors. In warehouses, the aim will be to improve the autonomy of the robots to better assist the pickers, leveraging the knowledge of the current order being prepared. In supermarket, the shopping carts should learn to properly interact with other carts and people while positioning themselves to better serve its current user.

This year, Jérôme Truc set up a simulated warehouse environment modeled on an actual warehouse from a logistic partner of iFollow. In this environment, he tested and compared several behaviors for a cart robot helping an order picker.

For personal reasons, Jérôme Truc had to resign from his PhD in July 2019.

LEMON Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. IRT

In late 2019, we started a new collaboration with IRT Saint-Exupéry for the hybridization of numerical models and large amount of data for the modeling of urban floods.

7.2. Berger-Levrault

A research collaboration convention was signed with Berger-Levrault company (Montpellier) for three years, in the framework of Yassine Bel-Ghaddar thesis (CIFRE ANRT France/Maroc).

7.3. CEREG/GERIMU

The GERIMU project entered its second phase in 2019. The industrial version of the SW2D computational code was parallelized and tested by ASA Company (subcontractor). Integration of all software components into the final software product will take place during the first half of 2020.

LFANT Project-Team (section vide)

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.

LINKMEDIA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE PhD: Incremental dynamic construction of knowledge bases from text mining

Participants: Guillaume Gravier, Cyrielle Mallart, Pascale Sébillot.

Duration: 3 years, started in Dec. 2018
Partner: Ouest France

In the context of a newspaper, the thesis explores the combination of text mining and knowledge representation techniques to assist the extraction, interpretation and validation of valuable pieces of information from the journal's content so as to incrementally build a full-scale knowledge base. This thesis is in close relation with the iCODA Inria Project Lab, with direct contribution to the project's results.

8.1.2. CIFRE PhD: Embedding heterogeneous data for directory search

Participants: Vincent Claveau, Guillaume Gravier, François Torregrossa.

Duration: 3 years, started in Dec. 2018
Partner: SoLocal

The thesis aims at learning how to jointly exploit heterogeneous sources of information (e.g., names, activity sector, user profiles, queries, etc.) in the design of neural network embeddings for information retrieval and language understanding. Applications cover natural language query analysis and personalized information retrieval in Pagesjaunes' directory.

8.1.3. CIFRE PhD: Few shot learning for object recognition in aerial images

Participants: Yannis Avrithis, Yann Lifchitz.

Duration: 3 years, started in March 2018
Partner: Safran Tech

This is a CIFRE PhD thesis project aiming to study architectures and learning techniques most suitable for object recognition from few samples and to validate these approaches on multiple recognition tasks and use-cases related to aerial images.

LINKS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Strapdata C. Paperman is actively collaborating with the Strapdata company on efficient distributed graph database using an Apache novel technology to query distributed graph *Gremlin* that could benefit of the main product of Strapdata: Elassandra as a *database backend*.

LOKI Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A research agreement between Synaptics Incorporated (San Jose, California) and Inria/Loki has been signed in September 2019, for a duration of nine months. The goal is to conduct joint studies on the impact of touchpads' characteristics (size, resolution) on the quality of interaction and users' performance.

8.2. Bilateral Grants with Industry

Géry Casiez and Mathieu Nancel have been awarded a Google Faculty Research Award for their project "Real-time Latency Measure and Compensation".

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€)

MAGIQUE-3D Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Contracts with TOTAL

- Depth Imaging Partnership (DIP)
- Depth Imaging Partnership (DIP2)

  Period: 2014 May - 2019 April , Management: Inria Bordeaux Sud-Ouest, Amount: 120000 euros/year.
- Depth Imaging Partnership (DIP3)

  Period: 2019 May - 2021 December , Management: Inria Bordeaux Sud-Ouest, Amount: 120000 euros/year.
- Tent Pitcher algorithm for space-time integration of wave problems Period: 2019 November - 2022 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros.
- Isogeometric analysis of sharp boundaries in fullwaveform inversion Period: 2019 January - 2021 December, Management: Inria Bordeaux Sud-Ouest, Amount: 55000 euros.
- FWI (Full Waveform Inversion) dans le domaine temporel utilisant des méthodes numériques hybrides pour la caractérisation de milieux élasto-acoustiques. Period: 2017 October - 2020 December , Management: Inria Bordeaux Sud-Ouest, Amount: 180000 euros.
- Petrophysics in pre-salt carbonate rocks

  Period: 2019 November - 2021 June, Management: Inria Bordeaux Sud-Ouest, Amount: 142000 euros.

MAGNET Project-Team (section vide)

MAGRIT Team (section vide)

MAMBA Project-Team (section vide)

MANAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE PhD contract with Imaging Optics (2017-2020)

Participants: C. Herzog & X. Granier
For this project, we aim at developing 3 dimensions X-rays imaging techniques for medical applications.

MARACAS Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have currently the following partnerships

1. Inria-Nokia Bell Labs common lab (600k€) : we are involved in two research actions (Analytics, and Network Information Theory), with the funding of two PhDs and 1 postdoc (to be hired) for Maracas.
2. SPIE-ICS (1Meuros, 2017-2021) : The Insa-Spie IoT Chair http://www.citi-lab.fr/chairs/iot-chair/ relies on the expertise of the CITI Lab. The skills developed within the different teams of the lab integrate the study, modelling, conception and evaluation of technologies for communicating objects and dedicated network architectures. It deals with network, telecom and software matters as well as societal issues such as privacy. The chair will also lean on the skills developed at INSA Lyon or in IMU LabEx. The SPIE-ICS / Insa Lyon chaire on IoT has been setup in 2017 by JM Gorce for the benefit of the CITIlab. JM Gorce was the head of this chair from 2016 to 2019 and is now vice-head (Frédéric Le Mouel is heading the chair since sept 2019). The remaining budget for Maracas corresponds to one postdoc to be hired nad overhead costs.
3. Sigfox : we are collaborating with Sigfox for several years. Maracas explored the performance of UNB networks with an emphasis on robust signal processing techniques (PhD defended on Dec 2018) and a new contract is in preparation for a PhD grant to be started in September, 2020.
4. Orange Labs : our research contract ended in 2018 and we are preparing a new contract.

8.2. Bilateral Grants with Industry

1. PhD grant of Mathieu Goutay (with Nokia Bell Labs, 2019-2022).

MATHERIALS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts and grants with Industry

Many research activities of the project-team are conducted in close collaboration with private or public companies: CEA, SANOFI, EDF. The project-team is also supported by the Office of Naval Research and the European Office of Aerospace Research and Development, for multiscale simulations of random materials. All these contracts are operated at and administrated by the École des Ponts.

MATHNEURO Project-Team (section vide)

MATHRISK Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Consortium PREMIA, Natixis - Inria
- Consortium PREMIA, Crédit Agricole Corporate Investment Bank (CA - CIB) - Inria
- AXA Joint Research Initiative on Numerical methods for the ALM, from September 2017 to August 2020. PhD grant of Adel Cherchali, Supervisor: A. Alfonsi.
- CIFRE agreement Milliman company/Ecole des Ponts (http://fr.milliman.com),

  PhD thesis of Sophian Mehalla (started November 2017) on "Interest rate risk modeling for insurance companies", Supervisor: Bernard Lapeyre.
- Collaboration with IRT Systemx

  PhD grant of Adrien Touboul (started November 2017) on "Uncertainty computation in a graph of physical simulations", Supervisors: Bernard Lapeyre and Julien Reygner.

8.2. Grants with Industry

Chair X-ENPC-SU-Société Générale "Financial Risks" of the Risk fondation : A. Alfonsi, B. Jourdain, B. Lapeyre

MAVERICK Project-Team (section vide)

MCTAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

- A grant "PEPS AMIES", title: "Conception d'un électrostimulateur intelligent", was obtained, co-financed by AMIES and SEGULA.

  PI: Bernard Bonnard.

  Start: December 2018. Duration: 2 years.
- A grant CIFRE co-financed by and SEGULA, title: "Réalisation d'un prototype d'électrostimulateur intelligent", was obtained.

  PI: Bernard Bonnard and T. Bakir (IMvia).

  Start: January 2020. Duration: 3 years.

MEMPHIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry: EDF

40kEuro contract for a study on the development of projection-based reduction strategies for the shallow-water equations, for applications in Hydraulics.

8.2. Bilateral Grants with Industry: ANDRA

36kEuro contract for the development of a projection-based reduced model for a thermo-hydraulic-mechanical (THM) system.

MEPHYSTO Team (section vide)

MEXICO Project-Team (section vide)

MFX Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Partnership with AddUp

- Company: AddUp.
- Duration: Started in 2019.
- Participants: Sylvain Lefebvre.
- Abstract: AddUp (https://www.addupsolutions.com/en/) is a French manufacturer of metal 3D printers for high-end industrial applications. We announced during FormNext 2019 (November) a partnership towards the creation of new software technologies.

8.1.2. Partnership with Black[Foundry]

- Company: Black[Foundry].
- Duration: January to June 2019.
- Participants: Samuel Hornus, Adrien Tétar.
- Abstract: Black[Foundry] is a company in Paris that specializes in font design. Inria signed a contract with the company to fund an internship on font rasterization on the GPU. An intern, Adrien Tétar, joined our team from January to June, and then spent 3 more weeks at the company offices in Paris. He was supervised by Samuel Hornus and Nicolas Rougier (Inria Bordeaux).

MIMESIS Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **Siemens:** A global leader in healthcare industry. Via IHU, we collaborate with Siemens in the context of the IHU project CIOS Alpha Fusion dealing with augmentation of the intra-operative image provided by a fluoroscopic imaging modality with pre-operative data.
- **Naviworks:** A South Korean company specialized in ICT convergence simulation/IoT smart controlling. We collaborate on simulation and visualization in the context of interventional radiology.
- **Marion surgical**: we have continued our interactions with the start-up Marion Surgical based in Canada through the transfer of our technology related to the simulation of needle insertion.

MIMETIC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Cifre Faurecia - Monitoring of gestual efficiency at work

Participants: Franck Multon [contact], Georges Dumont, Charles Pontonnier, Olfa Haj Mahmoud.

This Cifre contract has started in September 2018 for three years and is funding the PhD thesis of Olfa Haj Mamhoud. It consists in designing new methods based on depth cameras to monitor the activity of workers in production lines, compute the potential risk of musculoskeletal disorders, and efficiency compared to reference workers. It raises several fundamental questions, such as adapting previous methods to assess the risk of musculoskeletal disorders, as they generally rely on static poses whereas the worker is performing motion. Based on previous works in the team (previous Cifre PhD thesis of Pierre Plantard) we will provide 30Hz motion capture of the worker, that will enable us to evaluate various time-dependent assessment methods.

We will also explore how to estimate joint forces based and torques on such noisy and low-sampling motion data. We will then define a new assessment method based on these forces and torques.

The Cifre contracts funds the PhD salary and 10K€ per year for the supervision and management of the PhD thesis.

8.1.2. Cifre InterDigitial - Adaptive Avatar Customization for Immersive Experiences

Participants: Franck Multon [contact], Ludovic Hoyet, Nicolas Olivier.

This Cifre contract has started in February 2019 for three years and is funding the PhD thesis of Nicolas Olivier. The aim of the project is to design stylized avatars of users in immersive environment and digital arts such as videogames or cinema.

To this end, we will design a pipeline from motion and shape capture of the user to the simulation of the 3D real-time and stylized avatar. It will take hairs, eyes, face, body shape and motion into account. The key idea is to stylized both appaearance and motion to make avatar better correspond to the style of the movie of immersive experience. We will carry-out perceptual studies to better understand the expectation of the users when controlling stylized avatars, to maximize embodiment. The Cifre contracts funds the PhD salary and 15K€ per year for the supervision and management of the PhD thesis. This contract is also in collaboration with Hybrid team.

8.2. Bilateral Grants with Industry

8.2.1. Collaboration with company SolidAnim (Bordeaux, France)

Participants: Marc Christie [contact], Xi Wang.

Thsi contract started in November 2019 for three years. Its purpose is to explore novel means of performing depth detection for augmented reality applied to the film and broadcast industries. The grant serves to fund the PhD of Xi Wang.

MIMOVE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

"Application Performance Bottleneck Detection", Comcast Gift to R. Teixeira 2018-2019.

MINGUS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Contrat with RAVEL (onne year, budget 15000 euros): this is a collaboration with the startup RAVEL on a one-year basis (with possible renewal at the end of the year). The objective is to study the mathematical fondations of artificial intelligence and in particular machine learning algorithms for data anonymized though homomorphic encryption.
  Participants: P. Chartier, M. Lemou and F. Méhats.
- Contract with Cailabs (6 months, budget 3000 euros): This collaboration aims at exploring the possibility of deriving new fiber optics devices based on neural networks architecture.
  Participants: P. Chartier, E. Faou, M. Lemou and F. Méhats.

MISTIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Contract with EDF (2019). Stéphane Girard is the advisor of the internship of Valentin Chevalier founded by EDF. The goal is to investigate sensitivity analysis and extrapolation limits in extreme-value theory with application to extreme weather events. The financial support for MISTIS is of 50 keuros.

Contract with VALEO (2018-2019). Stéphane Girard and Pascal Dkengne Sielenou are involved in a study with Valeo to assess the relevance of extreme-value theory in the calibration of sensors for autonomous cars. The financial support for MISTIS is of 100 keuros.

Contract with Andritz. F. Forbes and C. Braillon (SED) are involved in a study with Andritz to elaborate metrics based on image analysis to assess the quality of nonwaven tissues. The financial support for MISTIS is of 15 keuros.

MNEMOSYNE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Contract with CEA Cesta

Participants: Frédéric Alexandre, Guillaume Padiolleau.

In the context of the PhD of Guillaume Padiolleau, we are working with the CEA on possible interactions between model-based and model-free approaches of reinforcement learning, based on cognitive consideration. Particularly, to decrease the complexity of exploration of a large data space in model-free approaches, we aim at considering introducing a priori knowledge coming from a model and we also propose to consider motivation as another way to orient the search in the learning space. This is applied in the robotic domain to manipulations by a robotic arm.

8.1.2. Contract with Ubisoft

Participants: Frédéric Alexandre, Pramod Kaushik.

Together with the Inria Project-team Flowers, we are working with the video game editor Ubisoft to define original bio-inspired learning methods, to qualify the behavior of human players observed during runs of games. Such learning algorithms will be specifically considered in the PhD of Pramod Kaushik.

MOCQUA Team (section vide)

MODAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. COLAS company

Participant: Christophe Biernacki.

COLAS is a world leader in the construction and maintenance of transport infrastructure. This bilateral contract aims at classifying mixed data obtained with sensors coming from a study of the aging of road surfacing. The challenge is to deal with many missing (sensors failures) and correlated data (sensors proximity).

8.2. Bilateral Grants with Industry

8.2.1. EIT-Sysbooster: Nokia - Apsys/Airbus

Participant: Alain Celisse.

Nokia and Airbus are two worldwide known companies respectively working in communications and transport areas. The purpose of this contract is to perform root cause analysis to reduce (at the end) the number of failures.

MOEX Project-Team (section vide)

MOKAPLAN Project-Team (section vide)

MONC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Research contract between Roche and the MONC team.
- Collaboration contract with Sophia Genetics in the context of the Pimiento project.

8.2. Bilateral Grants with Industry

Pimiento project from MSDAvenir (http://www.msdavenir.fr/) through Inria Foundation.

MORPHEME Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

General Electric Healthcare: a 2 months (from feb. 2019 to mar. 2019) for the end of the thesis of E. Poulain.

Bayer, Lyon: a 36 months (from aug. 2018 to jul. 2021) companion contract for the Cifre thesis of S. Laroui.

MORPHEO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

1. The Morpheo Inria team and Microsoft research set up a collaboration on the capture and modelling of moving shapes using multiple videos. Two PhD works are part of this collaboration with the objective to make contributions on 4D Modeling. The PhDs take place at Inria Grenoble Rhône-Alpes and involve visits and stays at Microsoft in Cambridge (UK) and Zurich (CH). The collaboration is part of the Microsoft Research - Inria Joint Centre.
2. The Morpheo Inria team has another collaboration with Facebook reality lab in San Francisco. The collaboration involves one PhD who is currently at the Inria Grenoble Rhône-Alpes working on the estimation of shape and appearance from a single image. The collaboration started in 2019.

MOSAIC Project-Team (section vide)

MULTISPEECH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Studio Maia

Company: Studio Maia SARL (France)

Other partners: Imaging Factory

Duration: Jul 2017 – March 2019

Participants: Yassine Boudi, Vincent Colotte, Mathieu Hu, Emmanuel Vincent

Abstract: We developed a software suite for voice processing in the multimedia creation chain. The software was designed for sound engineers, and relied on the team's expertise in speech enhancement, robust speech and speaker recognition, and speech synthesis.

8.1.2. Honda Research Institute Japan

Company: Honda Research Institute Japan (Japan)

Duration: Aug 2018 – Mar 2019

Participants: Nancy Bertin (CNRS - IRISA), Antoine Deleforge, Diego Di Carlo

Abstract: This was a follow-up contract targeting collaborative research on multichannel speech and audio processing and eventual software licensing in order to enable voice-based communication in challenging noisy and reverberant conditions in which current hands-free voice-based interfaces perform poorly.

8.1.3. Dassault and Thalès - Man Machine Teaming Initiative

Company: Dassault and Thalès (France)

Duration: Apr 2019 - Sept 2020

Participants: Irène Illina, Dominique Fohr, Ismael Bada, Stephane Level

Abstract: The primary goal of the project is to develop a new approach that allows coupling speech enhancement with semantic analysis for improving speech recognition robustness.

8.2. Bilateral Grants with Industry

8.2.1. Orange

Company: Orange SA (France)

Duration: Nov 2016 – Oct 2019

Participants: Lauréline Perotin, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funded the PhD thesis of Lauréline Perotin. Our goal was to develop deep learning based speaker localization and speech enhancement algorithms for robust hands-free voice command. We were especially targeting difficult scenarios involving several simultaneous speakers.

8.2.2. Invoxia

Company: Invoxia SAS (France)

Duration: Mar 2017 – Apr 2020

Participants: Guillaume Carbajal, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Guillaume Carbajal. Our goal is to design a unified end-to-end deep learning based speech enhancement system that integrates all steps in the current speech enhancement chain (acoustic echo cancellation and suppression, dereverberation, and denoising) for improved hands-free voice communication.

8.2.3. Ministère des Armées

Company: Ministère des Armées (France)

Duration: Sep 2018 – Aug 2021

Participants: Raphaël Duroselle, Denis Jouvet, Irène Illina

Abstract: This contract corresponds to the PhD thesis of Raphaël Duroselle on the application of deep learning techniques for domain adaptation in speech processing.

8.2.4. Facebook

Company: Facebook AI Research (France)

Duration: Nov 2018 – Nov 2021

Participants: Adrien Dufraux, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Adrien Dufraux. Our goal is to explore cost-effective weakly supervised learning approaches, as an alternative to fully supervised or fully unsupervised learning for automatic speech recognition.

Myriads Project-Team (section vide)

NACHOS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. DGTD solver for time-domain elecromagnetics with application to geoseismics

Participants: Andreas Atle [TOTAL], Henri Calandra [TOTAL], Karim El Maarouf [TOTAL], Alexis Gobé, Stéphane Lanteri, Michael Sekachev [TOTAL].

This contract with TOTAL CSE (Computational Science and Engineering) division in Houston, Texas, is concerned with the development of a DGTD solver for applications in geoseismics. The R&D division of the EP (Oil, Gas Exploration & Production) branch of TOTAL has been interested in DG type methods since many years. It acquired a know-how on these methods and developed internally software tools integrating DG methods as solvers of the direct problem (forward propagators) in different seismic imaging processes (RTM - Reverse Time Migration, and FWI - Full Waveform Inversion). These solvers are concerned with the numerical resolution of PDE systems of acoustics and elastodynamics. TOTAL is now interested in having a similar DGTD solver for the numerical resolution of the system of time-domain Maxwell equations, in view of the development of an electromagnetic imaging process to identify conductivity of a medium. This electromagnetic imaging process would then be coupled to the existing seismic imaging ones.

NANO-D Team (section vide)

NECS Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

TMI-V (Tachymètre Magnéto-Inertiel couplé Vision). Co-PI: H. Fourati (2018-2022)
The objective of the TMI-V project is the indoor localization without infrastructure, by developing an autonomous, precise, robust solution with no prior knowledge of the environment integrated in equipment worn on the upper body to be used in virtual reality and augmented reality applications. An array of magnetometers and inertial sensors will be used. The project is ongoing, in collaboration with SysNav company.

NEO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

NEO members are involved in the

- Inria-Nokia Bell Labs joint laboratory: the joint laboratory consists of five ADRs (Action de Recherche/Research Action) in its third phase (starting October 2017). NEO members participate in two ADRs: "Distributed Learning and Control for Network Analysis" (see §8.1.1) and "Rethinking the network: virtualizing network functions, from middleboxes to application" (see §8.1.2).
- Inria-QWANT joint laboratory "Smart search is privacy" (see §8.1.3);
- Inria-Orange Labs joint laboratory (see §8.1.4).

NEO has contracts with Accenture (see §8.1.5), Azursoft (see §8.1.6), MyDataModels (see §8.1.7), Huawei (see §8.1.8), and Payback Network (see §8.1.9).

8.1.1. ADR Nokia on the topic "Distributed Learning and Control for Network Analysis" (October 2017 – September 2021)

Participants: Eitan Altman, Konstantin Avrachenkov, Mandar Datar, Maximilien Dreveton.

- Contractor: Nokia Bell Labs (http://www.bell-labs.com)
- Collaborator: Gérard Burnside

Over the last few years, research in computer science has shifted focus to machine learning methods for the analysis of increasingly large amounts of user data. As the research community has sought to optimize the methods for sparse data and high-dimensional data, more recently new problems have emerged, particularly from a networking perspective that had remained in the periphery.

The technical program of this ADR consists of three parts: Distributed machine learning, Multiobjective optimisation as a lexicographic problem, and Use cases / Applications. We address the challenges related to the first part by developing distributed optimization tools that reduce communication overhead, improve the rate of convergence and are scalable. Graph-theoretic tools including spectral analysis, graph partitioning and clustering will be developed. Further, stochastic approximation methods and D-iterations or their combinations will be applied in designing fast online unsupervised, supervised and semi-supervised learning methods.

8.1.2. ADR Nokia on the topic "Rethinking the network: virtualizing network functions, from middleboxes to application" (October 2017 – September 2021)

Participants: Sara Alouf, Giovanni Neglia.

- Contractor: Nokia Bell Labs (http://www.bell-labs.com)
- Collaborators: Fabio Pianese, Massimo Gallo

A growing number of network infrastructures are being presently considered for a software-based replacement: these range from fixed and wireless access functions to carrier-grade middle boxes and server functionalities. On the one hand, performance requirements of such applications call for an increased level of software optimization and hardware acceleration. On the other hand, customization and modularity at all layers of the protocol stack are required to support such a wide range of functions. In this scope the ADR focuses on two specific research axes: (1) the design, implementation and evaluation of a modular NFV architecture, and (2) the modelling and management of applications as virtualized network functions. Our interest is in low-latency machine learning prediction services and in particular how the quality of the predictions can be traded off with latency.

8.1.3. Qwant contract on "Asynchronous on-line computation of centrality measures" (15 December 2017 – 14 May 2020)

Participants: Nicolas Allegra, Konstantin Avrachenkov, Patrick Brown.

- Contractor: Qwant
- Collaborators: Sylvain Peyronnet, Thomas Aynaud

We shall study asynchronously distributed methods for network centrality computation. The asynchronous distributed methods are very useful because they allow efficient and flexible use of computational resources on the one hand (e.g., using a cluster or a cloud) and on the other hand they allow quick local update of centrality measures without the need to recompute them from scratch.

8.1.4. Orange CIFRE on the topic "Self-organizing features in the virtual 5G radio access network" (November 2017 – October 2020)

Participants: Eitan Altman, Marie Masson.

- Contractor: Orange Labs (https://www.orange.com/en/Infographics/Orange-and-Research/Orange-and-Research)
- Collaborator: Zwi Altman

The considerable extent of the complexity of 5G networks and their operation is in contrast with the increasing demands in terms of simplicity and efficiency. This antagonism highlights the critical importance of network management. Self-Organizing Networks (SON), which cover self-configuration, self-optimization and self-repair, play a central role for 5G Radio Access Network (RAN).

This CIFRE thesis aims at innovating in the field of managing 5G RAN, with a special focus on the features of the SON-5G. Three objectives are identified: a) develop self-organizing features (SON in 5G-RAN), b) develop cognitive managing mechanisms for the SON-5G features developed, and c) demonstrate how do the self-organizing mechanisms fit in the virtual RAN.

8.1.5. Accenture contract on the topic "Distributed Machine Learning for IoT applications" (Dec 2019 – May 2020)

Participant: Giovanni Neglia.

- Contractor: Accenture Labs (https://www.accenture.com/fr-fr/accenture-lab-sophia-antipolis)
- Collaborators: Laetitia Kameni, Richard Vidal

IoT applications will become one of the main sources to train data-greedy machine learning models. Until now, IoT applications were mostly about collecting data from the physical world and sending them to the Cloud. Google's federated learning already enables mobile phones, or other devices with limited computing capabilities, to collaboratively learn a machine learning model while keeping all training data locally, decoupling the ability to do machine learning from the need to store the data in the cloud. While Google envisions only users' devices, it is possible that part of the computation is executed at other intermediate elements in the network. This new paradigm is sometimes referred to as Edge Computing or Fog Computing. Model training as well as serving (provide machine learning predictions) are going to be distributed between IoT devices, cloud services, and other intermediate computing elements like servers close to base stations as envisaged by the Multi-Access Edge Computing framework. The goal of this project is to propose distributed learning schemes for the IoT scenario, taking into account in particular its communication constraints. This 6-month contract prepares a CIFRE.

8.1.6. AzurSoft contract on the topic "Proof of concept on automatic detection of false alarms" (May 2019 – April 2020)

Participants: Konstantin Avrachenkov, Andrei Bobu.

- Contractor: AzurSoft (https://www.azursoft.com/)
- Collaborators: Marc Vaillant, Beatrice Escuyer

Intrusion detection or telesurveillance systems generates signals from sensors that allow to raise alarm and start a checking procedure for a potential intrusion or anomaly. Typically, one telesurveillance system surveys many sites and is challenged by a stream of false alarms. In this project, we aim to reduce the rate of false alarms by using various supervised and semi-supervised learning methods.

8.1.7. MyDataModels contract on the topic "Semi supervised variational autoencoders for versatile data" (June 2019 – May 2022)

Participants: Konstantin Avrachenkov, Mikhail Kamalov.

- Contractor: MyDataModels (https://www.mydatamodels.com/)
- Collaborators: Denis Bastiment, Carlo Fanara

Variational autoencoders are highly flexible machine learning techniques for learning latent dimension representation. This model is applicable for denoising data as well as for classification purposes. In this thesis we plan to add semi-supervision component to the variational autoencoder techniques. We plan to develop methods which are universally applicable to versatile data such as categorical data, images, texts, etc. Initially starting from static data we aim to extend the methods to time-varying data such as audio, video, time-series, etc. The proposed algorithms can be integrated into the internal engine of MyDataModels company and tested on use cases of MyDataModels.

8.1.8. Huawei CIFRE on the topic "Scalable Online Algorithms for SDN controllers" (June 2016 – May 2019)

Participants: Zaid Allybokus, Konstantin Avrachenkov.

- Contractor: Huawei Technologies (http://www.huawei.com/en/about-huawei/research-development)
- Collaborators: Jérémie Leguay

Software-Defined Networking (SDN) technologies have radically transformed network architectures. They provide programmable data planes that can be configured from a remote controller platform.

The objective of this CIFRE thesis was to provide fundamental answers on how powerful SDN controller platforms could solve large online flow problems to optimize networks in real-time and in a distributed or semi-distributed fashion. We use methods from both optimization and dynamic programming.

8.1.9. Consulting contract with Payback Network (November 2019 - January 2020)

Participant: Giovanni Neglia.

- Contractor: Payback Network
- Collaborators: Tanguy Racinet, Anne Legencre

Consulting with the startup Payback Network on differential privacy techniques.

NEUROSYS Project-Team (section vide)

NUMED Project-Team (section vide)

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 assessement 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.

ORPAILLEUR Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. AGREV-3

Participant: Jean-François Mari.

The AGREV 3 project (for "Agriculture Environment Vittel") is part of "Agrivair" –a subsidiary of Nestlé Waters– in actions to protect the natural resources of natural mineral water. We used ARPEnTAge to mine survey data about the Vittel-Contrexéville territory, which is suspected of groundwater quality risks [8]. This allowed us to locate regions having the same behavior. In addition, this provided a more contrasted simulation by eliminating the influence of stable zones (forests, permanent grasslands) and a more precise definition of a "neutral" model.

8.1.2. Hydreos

Participants: Nicolas Dante, Jean-François Mari, Amedeo Napoli.

Hydreos is a state organization, so-called "Pôle de compétitivité", aimed at monitoring and evaluating the quality of water and its delivery (http://www.hydreos.fr/fr). Actually, data about water resources rely on many agronomic variables, including land use successions. The data to be analyzed are obtained by surveys or by satellite images and describe the land use at the level of the agricultural parcel. Then there is a search for detecting changes in land use and for correlating these changes to groundwater quality. Accordingly, one main challenge in our participation in Hydreos is to process and analyze space-time data for reaching a better understanding of the changes in the organization of a territory. The systems ARPEnTAge and CarottAge are used in this context, especially by agronomists of INRA (ASTER Mirecourt http://www6.nancy.inra.fr/sad-aster).

On other aspects, we tested new deep graph convolutional learning over data provided by the SEDIF "Syndicat des eaux d'Île-de-France" to predict the likelihood of water leaks in a network of pipes and compared it with a master thesis where spatial point process techniques were used (master thesis of Nicolas Dante, M2 IMSD Nancy).

8.1.3. The Smart Knowledge Discovery Project

Participants: Laureline Nevin, Amedeo Napoli.

The SKD project for "Smart Knowledge Discovery" aims at analyzing complex industrial data for troubleshooting and decision making, and is funded by "Grand Est Region". We are working on exploratory knowledge discovery with the Vize company, which is based in Nancy and specialized in visualization-based data mining. The data which are under study are provided by the Arcelor-Mittal Steel Company and are related to the monitoring of rolling mills. Data are complex time series and the problem is related to a so-called "predictive maintenance", or how to anticipate problems in the furnaces and avoid their stop. In this way, one main objective of SKD is to combine sequence mining and visualization tools for recognizing temperature problems in the furnaces, and thus preventing the occurrences of defects in the outputs of the rolling mills.

OURAGAN Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- The objective of our Agrement with WATERLOO MAPLE INC. is to promote software developments to which we actively contribute.

  On the one hand, WMI provides man power, software licenses, technical support (development, documentation and testing) for an inclusion of our developments in their commercial products. On the other hand, OURAGAN offers perpetual licenses for the use of the concerned source code.

  As past results of this agreement one can cite our C-Library *RS* for the computations of the real solutions zero-dimensional systems or also our collaborative development around the Maple package *DV* for solving parametric systems of equations.

  For this term, the agreement covers algorithms developed in areas including but not limited to: 1) solving of systems of polynomial equations, 2) validated numerical polynomial root finding, 3) computational geometry, 4) curves and surfaces topology, 5) parametric algebraic systems, 6) cylindrical algebraic decompositions, 7) robotics applications.

  In particular, it covers our collaborative work with some of our partners, especially the Gamble Project-Team - Inria Nancy Grand Est.
- In 2019, a contract was signed with the company *Safran Tech*. Its goal is to bring our scientific expertise on mathematical and algorithmic aspects on certain problems studied in gearbox vibration analysis. Gear fault diagnosis is an important issue in aeronautics industry since a damage in a gearbox, which is not detected in time, can have dramatic effects on the safety of a plane. Since the vibrations of a spur gear can be modeled as a product of two periodic functions related to the gearbox kinematic, [92] has proposed to recover each function from the global signal by means of an optimal reconstruction problem which, by means of Fourier analysis, yields a Frobenius norm minimization problem for structured matrices. The goal of the collaboration is to use symbolic-numeric to study this problem.

PACAP Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Intel research grant INTEL2016-11174

Participants: Niloofar Charmchi, Kleovoulos Kalaitzidis, Anis Peysieux, André Seznec.

Intel is supporting the research of the PACAP project-team on “Design tradeoffs for extreme cores”.

PANAMA Project-Team (section vide)

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-Frérot.

8.2. Scikit-learn Consortium

Scikit-learn is a machine-learning library in Python. It is the engine that powers many applications of artifical 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.

PARKAS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Collaboration with Airbus

Our work on multi-clock Lustre programs is funded by a contract with Airbus.

7.2. Bilateral Grants with Industry

7.2.1. Google Research Fellowship: DWARF unwinding

Francesco Zappa Nardelli benefits from a Google Research Fellowship to pursue the work on DWARF unwinding, about 50k euros.

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/

PERCEPTION Project-Team (section vide)

PERVASIVE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CIFRE Doctoral Contract with eLichens

The main topic of the project is to develop cloud-based services for Building Management System (BMS) framework. The aim is to develop predictive algorithms to control Heat Ventilation and Air Conditioning (HVAC) systems addressing two main goals:

1. Improve the well-being of the occupants keeping different variables as temperature, humidity, CO2, air quality measures inside a pre established optimal range;
2. Saving costs optimizing energy consumption

This research is supervised by Patrick Reignier.

PESTO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have several contracts with industrial partners interested in the design of electronic voting systems:

- Since 2014, a collaboration agreement has been signed between Pesto and Scytl, a Spanish company which proposes solutions for the organization of on-line elections, including legally binding elections, in several countries. In this context, a first contract has been signed in 2016 to design a formal proof of both verifiability and privacy of the protocol developed by Scytl, for deployment in Switzerland. In 2018, a new contract has been signed to adapt the previous security proof to the new protocol proposed by Scytl, in order to achieve universal verifiability.
- Docapost signed a 18-month contract in September 2017, with Pesto and Caramba, to enhance the voting solution of Docapost, in particular with respect to verifiability.
- IDEMIA signed a 2-year contract in January 2019, with Pesto and Caramba. The goal is to design a voting protocol adapted to the elections they plan to organize, in various countries. This includes the use of smartcard, yet without having to trust them. Once designed, the protocol will be formally analysed with the tools developed in the team such as ProVerif or Tamarin.

8.2. Bilateral Grants with Industry

A CIFRE contract with Numeryx has started with the Resist research group at Inria Nancy and Pesto, to develop algorithms for optimizing sets of filtering rules in Software Defined Networks.

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 lauched a public call for tender to deploy an industrial solution aiming at covering the whole distinct (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 Petus 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 uses rather than professional uses 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.

PI.R2 Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Theo Zimmermann will start a research engineer position in January 2020 to continue his research and development work about improving the Software Engineering practices of the development of Coq, especially to continue the improvement of the collaborative development processes and of its ecosystem. This position is funded by the Inria-NomadicLabs grant.

PLEIADE Project-Team (section vide)

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

POLARIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Nicolas Gast obtained funding Enedis for a study on the PLC-G3 protocol (≈50k euros).

POLSYS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Technological Transfer

The group have had a continuous commitment into industrial transfer as well as a strong involvement into standardization bodies.

Industrial transfer. This activity is related to our long-standing activity in post-quantum cryptography. The transfer started at the beginning of the current evaluation period and culminated this year with the creation of a new spin-off, called CRYPTONEXT SECURITY[0], from Inria Paris and Sorbonne Université. The goal of CRYPTONEXT SECURITY is to propose security products that are resistant against the quantum computers. Its business model is based on B2B and targeted customers are Fortune 500 companies.

The activity has been partially founded and supervised by SATT-LUTECH who is specialized in the processing and transfer of technologies from research laboratories of its shareholders: Inria, CNRS, University of Technology of Compiègne, National Museum of Natural History, Institute Curie, University Panthéon-Assas, Paris Sorbonne University and National School of Industrial Creation). Typically, SATT-LUTECH has funded the post-quantum experiment described in the dedicated Section. The impact of such experiment can be partially measured by the press released covering out the test [0] (La Recherche, l'Usine Nouvelle, L'Informaticien).

As a preliminary step for launching the spin-off, two members of the team (J.-C. Faugère and L. Perret) followed two entrepreneurship programs for creating innovative companies : HEC Challenge plus [0] (1 week of courses by month, 9 months) and Deep Tech Founders [0] (3 months, 2 sessions by weeks). This was a necessary, but significant effort, before launching CRYPTONEXT in which the two members will work full-time from now on.

Post-quantum standardization. Besides the NIST PQC standardization process, we are involved in the on-going world effort for standardizing post-quantum cryptography. More precisely, the European Telecommunications Standards Institute (ETSI) has a strong standardization activity on post-quantum cryptography. ETSI is a EU standardization body with a worldwide scope. We are an active member of ETSI regarding post-quantum cryptography. In particular, we are the rapporteur of a technical document on post-quantum cryptosystems. The goal of our involvement is to bring our scientific expertise to define trustworthy post-quantum public-key standards; that are going to be the basis of our digital economy within $10/15$ years.

We are also involved in the Cloud Security Alliance (CSA). This is a large non-profit organization (80.000 member worldwide) whose main goal is to promote the best practices with the secure usage of cloud computing. CSA has a group dedicated to quantum-safe security. The group is ideation catalyzer for promoting the transition of companies to a quantum-safe security. In particular, the group has a significant educational activity in order to increase awareness regarding the quantum risk and the techniques to mitigate this risk. We are co-chairing this group and participated to several white papers. The group is probably now the main channel for promoting quantum-safe security. Standardization is a long-term effort.

[0] https://cryptonext-security.com/
[0] https://www-polsys.lip6.fr/Links/index.html
[0] http://entrepreneurship-center.hec.edu/learn-program/hec-challenge-plus/
[0] https://deeptechfounders.com/

POTIOC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Ullo:

Duration: 2017-2020

Local coordinator: Martin Hachet

Following our work with the Introspectibles (Teegi, TOBE, Inner Garden), we are currently working with the ULLO company to bring these new interfaces to healthcare centers.

AKIANI:

Duration: 2019-2020

Local coordinator: Fabien Lotte

InriaTech project on physiological computing and neuroergonomics.

PRIVATICS Project-Team (section vide)

PROSECCO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Evolution, Semantics, and Engineering of the F Verification System*

Grant from Nomadic Labs - Inria

PIs: Catalin Hritcu and Exequiel Rivas

Duration: March 2019 - April 2023

Abstract: While the F* verification system shows great promise in practice, many challenging conceptual problems remain to be solved, many of which can directly inform the further evolution and design of the language. Moreover, many engineering challenges remain in order to build a truly usable verification system. This proposal promises to help address this by focusing on the following 5 main topics: (1) *Generalizing Dijkstra monads*, i.e., a program verification technique for arbitrary monadic effects; (2) *Relational reasoning in F**: devising scalable verification techniques for properties of multiple program executions (e.g., confidentiality, noninterference) or of multiple programs (e.g., program equivalence); (3) *Making F*'s effect system more flexible*, by supporting tractable forms of effect polymorphism and allowing some of the effects of a computation to be hidden if they do not impact the observable behavior; (4) Working out more of the *F* semantics and metatheory*; (5) Solving the *engineering challenges* of building a usable verification system.

QUANTIC Project-Team (section vide)

RAINBOW Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. IRT B<>com

Participants: Hadrien Gurnel, Fabien Spindler, Alexandre Krupa.

No Inria Rennes 11774, duration: 36 months.

This contract started in October 2016 and concerns the leasing to IRT B<>com of two modules of the Rainbow medical robotic platform (see Sect. 5.4.3). Each module is rent 40 days during a 3-year period in the context of the IRT B<>com NeedleWare project (see Section 7.2.3).

7.2. Bilateral Grants with Industry

7.2.1. Creative

Participants: Benoît Antoniotti, François Chaumette, Eric Marchand.

No Inria Rennes 13996, duration: 36 months.

This project funded by Creative started in March 2019. It supports Benoît Antoniotti's Ph.D. about visual exploration (see Section 6.2.9).

7.2.2. IRT JV Perform

Participant: François Chaumette.

No Inria Rennes 14049, duration: 36 months.

This project funded by IRT Jules Verne in Nantes started in January 2018. It is achieved in cooperation with Stéphane Caro from LS2N in Nantes to support Zane Zake's Ph.D. about visual servoing of cable-driven parallel robots (see Section 6.2.8).

7.2.3. IRT B<>com NeedleWare

Participants: Hadrien Gurnel, Alexandre Krupa.

No Inria Rennes 9072, duration: 36 months.

This project started in October 2016. It supports Hadrien Gurnel's Ph.D. about the study of a shared control strategy fusing haptic and visual control for assisting manual steering of needles for biopsy or therapy purposes in a synergetic way (see Section 6.4.3). This year, we published [43] [44] in the scope of this project.

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)

RAPSODI Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A new contractual collaboration between C. Cancès and IFPEN corresponding to the supervision of the PhD thesis of S. Bassetto started in January 2019. This contract is part of the Inria-IFPEN framework agreement.

8.2. Bilateral Grants with Industry

C. Bataillon (CEA) and L. Trenty (ANDRA) are involved in the EURAD project on corrosion modeling together with C. Cancès, C. Chainais-Hillairet, and B. Merlet. More details in Section 9.3 .

REALOPT Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have an on-going contract with SNCF on scheduling of rolling-stock. The PhD thesis of Mohamed Benkirane is part of this contract.

Following the PhD thesis of Rodolphe Griset, our collaboration with EDF has continued through a new contract within Inria Tech. Its goal is to investigate the possibility of developing an operational prototype (called Fenix) for strategic planning of nuclear plant outages. Two scientific questions are raised. The first one concerns the new mechanisms of management of the power capacity market on the French power grid. The second one is about a new model of the stock variation during a refueling operation, which requires information of several previous production campaigns.

We also have a contract with RTE to develop strategies inspired from stochastic gradient methods to speed-up Benders' decomposition. The PhD thesis of Xavier Blanchot is part of this contract.

We have a contract with Thales Avionique to study a robust scheduling problem.

REO Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Participants: Lazaros Papamanolis, Irene Vignon-Clementel [local coordinator].

Contract with ESIEE (H. Talbot, L. Najman) for collaboration with the Heartflow company.

RESIST Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

- Thales (Palaiseau, France):
  - CIFRE PhD (Pierre-Olivier Brissaud, supervised by Isabelle Chrisment and Jérôme François)
  - Encrypted network traffic analysis (HTTP2 over TLS)
- Orange Labs (Issy-Les-Moulineaux, France):
  - CIFRE PhD (Paul Chaignon, supervised by Olivier Festor and Jérôme François)
  - Software Datapaths for Multi-Tenant Packet Processing
- Orange Labs (Issy-Les-Moulineaux, France):
  - CIFRE PhD (Matthews Jose, supervised by Olivier Festor and Jérôme François)
  - Complex arithmetic operation for in-network computing using hardware dataplanes
- Numeryx Technologies (Paris, France):
  - CIFRE PhD (Ahmad Abboud, supervised by Michael Rusinowitch, Abdelkader Lahmadi and Adel Bouhoula)
  - Compressed and Verifiable Filtering Rules in Software-defined Networking

RITS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Valeo Group: a very strong partnership is under reinforcement between Valeo and Inria. Several bilateral contracts were signed to conduct joint works on Driving Assistance, some of which Valeo is funding. This joint research includes:

- The PhD thesis of Pierre de Beaucorps under the framework of Valeo project "Daring",
- A CIFRE like PhD thesis is ongoing between Valeo and Inria (Maximilian JARITZ), dealing with multisensor processing and learning techniques for free navigable road detection.
- Valeo is currently a major financing partner of the "GAT" international Chaire/JointLab in which Inria is a partner. The other partners are: UC Berkeley, Shanghai Jiao-Tong University, EPFL, IFSTTAR, MPSA (Peugeot-Citroën) and SAFRAN.
- Technology transfer is also a major collaboration topic between RITS and Valeo as well as the development of a road automated prototype.
- Finally, Inria and Valeo are partners of the PIA French project CAMPUS (Connected Automated Mobility Platform for Urban Sustainability) including SAFRAN, Invia and Gemalto. The aim of the project is the development of autonomous vehicles and the realization of two canonical uses-cases on highways and urban like environments.

Renault Group: Collaboration between Renault and RITS re-started in 2016. Different research teams in Renault are now working separately with RITS on different topics.

- A CIFRE like PhD thesis is ongoing between Renault and Inria (Farouk GHALLABI) The thesis deals with the accurate localization of an autonomous vehicle on a highway using mainly on-board low-cost perception sensors.
- Another CIFRE PhD thesis is ongoing since November 2017 (Imane MAHTOUT).

AKKA Technologies: Collaboration with AKKA since 2012 (for the Link & Go prototype).

- Inria and AKKA Technologies are partners in the VALET projects (ANR projects).
- A CIFRE PhD thesis (Luis ROLDAO) dealing with 3D-environment modeling for autonomous vehicles begun in October 2017.

RMOD Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Pharo Consortium

Participants: Esteban Lorenzano, Marcus Denker, Stéphane Ducasse
From 2012, ongoing.

The Pharo Consortium was founded in 2012 and is growing constantly. By the end 2019, it has 25 company members, 19 academic partners. Inria supports the consortium with one full time engineer starting in 2011. In 2018, the Pharo Consortium joined InriaSoft.

More at http://consortium.pharo.org.

8.2. Bilateral Grants with Industry

8.2.1. Berger-Levrault: Remodularization of Architecture

Participants: Nicolas Anquetil, Santiago Bragagnolo, Stéphane Ducasse, Anne Etien, Benoît Verhaeghe
From 2017, ongoing.

We started a new collaboration with the software editor Berger-Levrault about software architecture remodularization. The collaboration started with an end study project exploring the architecture used in the company in order to later migrate from GWT to Angular since GWT will not be backward supported anymore in the next versions. A PhD CIFRE thesis started in 2019: Benoît Verhaeghe, *Support à l'automatisation de la migration d'interface d'applications Web : le cas de GWT vers Angular*.

8.2.2. Arolla: Machine Learning-Based Recommenders to Support Software Evolution

Participants: Nicolas Anquetil, Stéphane Ducasse, Anne Etien, Oleksandr Zaitsev

We started a new collaboration with the council company, Arolla, about software evolution. Arolla has daily problems with identifying architecture, design, and deviations from those artifacts. The goal of the thesis is to experiment which learning techniques can help with semi-automatically extracting design and architectural aspects and their violations. A PhD CIFRE has started in 2019: Oleksandr Zaitsev, *Machine Learning-Based Tools to Support Software Evolution*.

A second CIFRE around legacy system cartography will start in 2020.

ROMA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

In the context of a consortium (http://mumps-consortium.org) of users of the MUMPS library (http://mumps-solver.org), we had partnership contracts with EDF, ALTAIR, FFT-MSC Software, Michelin, LSTC, Siemens, ESI Group, Total, Safran, LBNL, Airbus, and SHELL. Following the creation of the start-up Mumps Technologies in January 2019, these contracts (scientific exchanges, support, organization of point-to-point and plenary meetings, releases in advance, ...) have been transferred to Mumps Technologies.

SECRET Project-Team (section vide)

SEMAGRAMME Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Industry Partner

As a follow-up to a Cifre PhD thesis [34] on the use of Abstract Categorial Grammars in an industrial context, the team worked on a common road-map with the Yseop company and proposed common master internships as a first step towards formalizing the partnership.

After a master internship supervised by Bruno Guillaume, a discussion opened on the use of Abstract Categorial Grammars in the industrial context. C&S - Communication and Systems - has tool specifications that need to be verified, which can be achieved through semantic representation. A Cifre PhD thesis is currently being prepared for early 2020.

SEQUEL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Lelivrescolaire.fr

- Contract with http://Lelivrescolaire.fr; PI: Michal Valko

  Title: Sequential Machine Learning for Adaptive Educational Systems

  Duration: 3 years (Mar 2018 – Feb 2021)

  Abstract: This contract comes along the CIFRE grant on the same topic. Adaptive educational content are technologies which adapt to the difficulties encountered by students. With the rise of digital content in schools, the mass of data coming from education enables but also ask for machine learning methods. Since 2010, Lelivrescolaire.fr has been developing some learning materials for teachers and students through collaborative creation process. For instance, during the school year 2015/2016, students has achieved more than 8 000 000 exercises on its homework platform Afterclasse.fr. Our approach would be based on sequential machine learning: the algorithm learns to recommend some exercises which adapt to students gradually as they answer.
  Participants: Julien Seznec, Michal Valko.

8.1.2. Renault

- Contract with Renault; PI: Philippe Preux

  Title: Control of an autonomous vehicle

  Duration: 3 years (Dec 2017 – Nov 2020)

  Abstract: This contract comes along the CIFRE grant on the same topic. This work is done in collaboration with the NON-A team-project.
  Participants: Édouard Leurent, Odalric-Ambrym Maillard, Philippe Preux.

8.1.3. Critéo

- Contract with “Criteo”; PI: Philippe Preux

  Title: Computational advertizing

  Duration: 3 years (Dec 2017 – Jun 2019)

  Abstract: This contract comes along the CIFRE grant on the same topic. The goal is to investigate reinforcmeent learning and deep learning on the problem of ad selection on the Internet.

  Note: this contract came to its end because the PhD candidate quitted Critéo, hence aborting his PhD studies.
  Participants: Philippe Preux, Kiewan Villatel.

8.1.4. Share My Space

- Contract with “Share My Space”.

  Duration: 6 months
  Participant: Philippe Preux.

SERENA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

One new two-part contract with EDF accompanying the PhD thesis of Idrissa Niakh.

One new two-part contract with CEA accompanying the postdoc of Guillaume Delay.

One new two-part contract with IFP Energies Nouvelles accompanying the PhD thesis of Joëlle Ferzly.

Three-part contract Inria–EDF–Sciworks Technologies (2017–2020) on "Form-L for the formalization of constraints of complex systems". SERENA representants are François Clément, Sébastien Furic and Pierre Weis.

AMIES contract with ITASCA, January 10, 2019 - March 10, 2020. SERENA representants are François Clément, Sébastien Furic, Florent Hédin, Michel Kern, Géraldine Pichot.

SERPICO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral grants with industry

8.1.1. Contract with Fourmentin-Guilbert Foundation: Macromolecule detection in 3D cellular cryo-electron tomograms

Participants: Emmanuel Moebel, Charles Kervrann.
Duration: 5 months (Dec 2019 – Apr 2020).

The objective of the project is to improve the DeepFinder software dedicated to the detection and identification of macromolecules within 3D cellular cryo-electron tomograms. In collaboration with Fourmentin-Guilbert Foundation, the goal is to build cellular atlases of several organisms from localizations of macromolecules (see Software DeepFinder in Section 6.9).

Funding: Fourmentin-Guilbert Foundation.
Collaborators: D. Larivière & E. Fourmentin (Fourmentin-Guilbert Foundation), A. Martinez & W. Baumeister (Max Planck Institute, Martinsried, Germany).

8.1.2. Contract with DGA: Motion saliency analysis in videos

Participants: Léo Maczyta, Patrick Bouthemy.
Duration: 36 months (Oct 2017 – Sep 2020).
This project funded by the DGA (Ministry of defense) and Région-Betagne concerns the PhD thesis (co-funding) carried out by Léo Maczyta. The goal is to develop motion saliency methods along three axes: temporal motion saliency detection, saliency map estimation, trajectory-based saliency detection (see Section 7.10).

Funding: DGA (National Defense Agency) and Région-Bretagne.

8.1.3. Contract with GATACA Systems: Super-resolution microscopy and in live cell imaging

Participants: Jean Salamero, Ludovic Leconte, Charles Kervrann.
Duration: 36 months (Jan 2017 – Dec 2019).

The objective of the project is to transfer innovations for Multi-Angle TIRFM (using Azymuthal TIRFM from Ilas2) and collaborate as "β-Test site" for SIM in Nipkow disk microscopy (product: Live-SR).

Funding: GATACA Systems company.
Collaborators: C. Gueudry (GATACA Systems), J. Boulanger (MRC Laboratory of Molecular Biology, Cambridge Biomedical Campus, UK).

8.1.4. Contract with CryoCapCell SA: 3D LIVE CLEM (Correlative Light and Electron Microscopy) to decipher fates and functions of exosomes in vivo

Participant: Jean Salamero.
Duration: 24 months (Oct 2018 – Sep 2020).

The objective of the project is to link dynamic biogenesis of intracellular membrane compartments with their ultrastructures. It combines fast high resolution photonic imaging (MA-TIRFM and fast high pressure freezing for 3D cryoEM. It requires adapted registration methods in 3D, in order to navigate through the multiple scales.

Funding: DIM–ELICIT Empowering LIfe sCiences with Innovative Technologies (Région Ile de France).
Collaborators: G. Van Niel (coordinator, Institute of Psychiatry and Neuroscience of Paris), G. Raposo (CNRS-UMR 144 Institut Curie PSL Research), X. Heiligenstein (CryoCapCell SA).

SIERRA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Microsoft Research: “Structured Large-Scale Machine Learning”. Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challenges faced by machine learning in the “big data” era: structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites (Paris and Grenoble) and four MSR sites (Cambridge, New England, Redmond, New York). Project website: http://www.msr-inria.fr/projects/structured-large-scale-machine-learning/.

8.2. Bilateral Grants with Industry

- Alexandre d’Aspremont, Francis Bach, Martin Jaggi (EPFL): Google Focused award.
- Francis Bach: Gift from Facebook AI Research.
- Alexandre d’Aspremont: fondation AXA, "Mécénat scientifique", optimisation & machine learning.

SIMSMART Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

1. **Scalian Alyotech**, through the CIFRE PhD project of Gabriel Jouan, dedicated to weather forecast corrections.
2. **Naval Group Research**, through the CIFRE PhD project of Audrey Cuillery dedicated to Bayesian tracking.
3. **Eau du Ponant**, through the R&D project MEDISA (https://www.eauduponant.fr/fr/actualite/lancement-du-projet-de-rd-medisa) on water industry.
4. **Cooper Standard**, Machine Learning for joints design.

6.2. Bilateral Grants with Industry

1. **EURAMED** (a Euro-Mediterranean Cooperation Initiative, which aims to develop an Internet-based, multi-parametric electronic platform for optimum design of desalination plants, supplied by Renewable Energy Sources (RES). PI: E. Koutroulis (GREECE).

SIROCCO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE contract with InterDigital on neural networks for video compression

Participants: Xuan Hien Pham, Christine Guillemot.

- Title : Neural networks for video compression
- Partners : InterDigital (Ph. Bordes, F. Galpin), Inria-Rennes.
- Funding : InterDigital, ANRT.
- Period : Jan.2019-Oct.2021.

The goal of this Cifre contract is to first investigate novel optical flow estimation methods using deep neural networks. Based on the optical flow methods, the next step will be to design temporal prediction schemes based on convolutional neural networks (CNN) for video compression. The methods will be assessed in the context of the VVC (Versatile Video Coding) standard.

8.1.2. CIFRE contract with Orange labs. on compression of immersive content

Participants: Patrick Garus, Christine Guillemot, Thomas Maugey.

- Title : Compression of immersive content
- Research axis : 7.1.3
- Partners : Orange labs. (J. Jung), Inria-Rennes.
- Funding : InterDigital, ANRT.
- Period : Jan.2019-Dec.2021.

The goal of this Cifre contract is to develop novel compression methods for 6 DoF immersive video content. This implies investigating depth estimation and view synthesis methods that would be robust to quantization noise. This also implies developing the corresponding coding mode decisions based on rate-distortion criteria.

SISTM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Contracts and Grants with Industry

Implication in research for the development of Ebola vaccine has lead to several indirect contracts with industry:

- The EBOVAC1, EBOVAC2 and EBOVAC3 project, collaboration with Janssen from Johnson et Johnson.
- The Prevac trial vaccine trial (legal sponsors: Inserm, NIH, London School of Hygiene and Tropical Medicine) involves collaborations with Merck and Janssen. The purpose of this study is to evaluate the safety and immunogenicity of three vaccine strategies that may prevent Ebola virus disease (EVD) events in children and adults. Participants will receive either the Ad26.ZEBOV (rHAd26) vaccine with a MVA-BN-Filo (MVA) boost, or the rVSVΔG-ZEBOV-GP (rVSV) vaccine with or without boosting, or placebo. The EDCTP-2 funded Prevac-UP project is set as a continuation of Prevac trial in the same framework.

A new collaboration has started with the pharma company Ipsen on the integration of OMICS data into an in-silico trials pipeline (Cifre Phd to start in January 2020)

SOCRATE Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. Research Contract with Bosch 2019

In collaboration with Aric, Socrate worked with Bosch on the impementation of the Power function in an embedded context.

SPADES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Inria and Orange Labs have established in 2015 a joint virtual research laboratory, called I/O LAB. We have been heavily involved in the creation of the laboratory and are actively involved in its operation (Jean-Bernard Stefani is one of the two co-directors of the lab). I/O LAB focuses on the network virtualization and cloudification. As part of the work of I/O LAB, we have cooperated with Orange Lab, as part of a cooperative research contract funded by Orange, on defining architectural principles and frameworks for network cloud infrastructures encompassing control and management of computing, storage and network resources.

7.2. Bilateral Grants with Industry

With Orange:

- Fault Management in Multi-Tenant Programmable Networks. This CIFRE grant funds the PhD of Sihem Cherrared.
- Dynamic dataflow models of computation. This CIFRE grant funds the PhD of Arash Shafiei.

SPECFUN Project-Team (section vide)

SPHINX Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Since September 2019, X. Antoine has been the co-advisor (with C. Geuzaine from Liège university) of two PhD theses, which are funded respectively by Siemens and Thales (CIFRE contracts).The aim of the first thesis is the numerical simulation by domain decomposition methods of aeroacoustic problems; the aim of the second one is the HPC simulation by domain decomposition methods of electromagnetic problems.

Zhanhao Liu works on a PhD thesis funded by Saint Gobain Recherche about the use of statistical methods for the effective control of industrial plants.

SPIRALS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. ip-label

Participant: Romain Rouvoy [contact person].

A software exploitation license (2014–ongoing) of the APISENSE® crowd-sensing platform has been sold to the ip-label company. They use this platform as a solution to monitor the quality of the GSM signal in the wild. The objective is to provide developers and stakeholders with a feedback on the quality of experience of GSM connection depending on their location.

8.2. Davidson

Participants: Mohammed Chakib Belgaid, Romain Rouvoy [contact person], Lionel Seinturier.

This collaboration (2017–20) aims at proposing new solutions for optimizing the energy footprint of ICT software infrastructures. We want to be able to measure and assess the energy footprint of ICT systems while preserving various quality of service parameters, such as performance and security. We aim at proposing a testbed for assessing the energy footprint of various programming languages. This testbed will also incorporate frameworks for web and mobile programming. Finally, we want to be able to issue recommendations to developers in order to assist them in improving the energy footprint of their programs. This collaboration will take advantage of the PowerAPI software library.

The PhD of Mohammed Chakib Belgaid takes place in the context of this collaboration.

8.3. Orange #1

Participants: Philippe Merle [contact person], Lionel Seinturier.

This collaboration (2017–19) aims at defining a computational model for software infrastructures layered on top of virtualized and interconnected cloud resources. This computational model provides application programming and management facilities to distributed applications and services [39], [44]. This computational model defines a pivot model that enables the interoperability of various existing and future standards for cloud systems such as OCCI and TOSCA. This pivot model is defined with the Alloy specification language [62]. This collaboration takes advantage of the expertise that we are developing since several years on reconfigurable component-based software systems [75], on cloud systems [69], and on the Alloy specification language [67].

This collaboration with Orange Labs is a joint project with Jean-Bernard Stefani from the Spades Inria project-team.

8.4. Orange #2

Participants: Zakaria Ournani, Romain Rouvoy [contact person], Lionel Seinturier.

This collaboration (2018–21) aims at proposing new solutions for modeling the energy efficiency of software systems and to design and implement new methods for measuring and reducing the energy consumption of software systems at development time. We especially target software systems deployed on cloud environments.

The CIFRE PhD of Zakaria Ournani takes place in the context of this collaboration.

8.5. Amaris (now Mantu)

Participants: Sacha Brisset, Romain Rouvoy [contact person], Lionel Seinturier.

This collaboration (2018–21) aims at proposing new solutions for automatically spotting and fixing recurrent user experience issues in web applications. We are interested in developing an autonomic framework that learns and classifies the behaviors and figures out causality links between data such as web GUI events, support tickets and user feedback, source version management events (e.g. recent commits). The ultimate objective is to implement an AI-powered recommendation system to guide the maintenance and even to automatically predict and solve user issues.

The CIFRE PhD of Sacha Brisset takes place in the context of this collaboration.

STACK Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Participants: Ronan-Alexandre Cherrueau, Marie Delavergne, Adrien Lebre [Contact point], Javier Rojas Balderrama, Matthieu Simonin.

Following the ENOS bilateral contract (“Contrat de Recherche Externalisé”) between Orange and Inria (Sept 2017-Oct 2018), we agreed with Orange Labs to pursue this collaboration around a second contrat. This new contrat, which is going to last 18 months for a budget of 150K€, targets the following objectives:

- Strengthen the Enos framework and the resulting EnosLib solution (see Section 6.4 and Section 6.5).
- Define an experimental protocol allowing the automatozed and reproducible evaluation of an OpenStack instance in a WANWide context.
- Develop a DSL to reify location aspects at the CLI level in order to create new resources (image, VM, etc.) through a set of OpenStack instances while guaranteeing a notion of master copy.

STAMP Project-Team (section vide)

Stars Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts and Grants with Industry

Stars team has currently several experiences in technological transfer towards industrials, which have permitted to exploit research result:

7.1.1. Ekinnox

is a spin-off project of the Stars team which aims at improving the rehabilitation process for caregivers and patients. Thanks to a computer vision based system (camera combined with algorithms detecting human motion), Ekinnox provides a simple and efficient tool to quantify and visualize the performance of patients (e.g. gait parameters computation such as side-by-side video comparison, automatic sequencing of video or 3D display) during their rehabilitation process. This company was created at the beginning of 2017.

7.1.2. Toyota

is working with Stars on action recognition software to be integrated on their robot platform. This project aims at detecting critical situations in the daily life of older adults alone at home. This will require not only recognition of ADLs but also an evaluation of the way and timing in which they are being carried out. The system we want to develop is intended to help them and their relatives to feel more comfortable because they know that potential dangerous situations will be detected and reported to caregivers if necessary. The system is intended to work with a Partner Robot - HSR - (to send real-time information to the robot) to better interact with the older adult.

7.1.3. Vedecom

is interested in developing algorithms for people detection for self-driving cars. Among many challenges in pedestrian detection, the ones of interest are a) Scale- handling, b) Occlusion-handling and c) Cross-dataset generalization. Each of the aforementioned challenges is critical to enable modern applications like self-driving vehicles become safe enough for active deployment. To improve the performance of contemporary pedestrian detectors, one of our first major idea is to use multiple layers of a CNN simultaneously. Towards this, we proposed a new pedestrian detection system called Multiple-RPN. Another recent work is adding pseudo-segmentation information to pedestrian detection. The proposed features of our system perform close to the best performing detectors today.

7.1.4. Kontron

has a collaboration with Stars, which runs from April 2018 until April 2021 to embed CNN based people tracker within a video-camera. Their system uses Intel VPU modules, such as Myriad X (MA2485), based on OpenVino library.

7.1.5. The company ESI

(European System Integration) has a collaboration with Stars, which runs from September 2018 until March 2022 to develop a novel Re-Identification algorithm which can be easily set-up with low interaction for video-surveillance applications. ESI provides software solutions for remote monitoring stations, remote assistance, video surveillance, and call centers. It was created in 1999 and ESI is a leader in the French remote monitoring market. Nowadays, ensuring the safety of goods and people is a major problem. For this reason, surveillance technologies are attracting growing interest and their objectives are constantly evolving: it is now a question of automating surveillance systems and helping video surveillance operators in order to limit interventions and staff. One of the current difficulties is the human processing of video, as the multiplication of video streams makes it difficult to understand meaningful events. It is therefore necessary to give video surveillance operators

suitable tools to assist them with tasks that can be automated. The integration of video analytics modules will allow surveillance technologies to gain in efficiency and precision. In recent times, deep learning techniques have been made possible by the advent of GPU processors, which offer significant processing possibilities. This leads to the development of automatic video processing.

7.1.6. Fantastic Sourcing

is a French SME specialized in micro-electronics, it develops e-health technologies. Fantastic Sourcing is collaborating with Stars through the UCA Solitaria project, by providing their Nodeus system. Nodeus is a IoT (Internet of Things) system for home support for the elderly, which consists of a set of small sensors (without video cameras) to collect precious data on the habits of isolated people. Solitaria project performs a multi-sensor activity analysis for monitoring and safety of older and isolated people. With the increase of the ageing population in Europe and in the rest of the world, keeping elderly people at home, in their usual environment, as long as possible, becomes a priority and a challenge of modern society. A system for monitoring activities and alerting in case of danger, in permanent connection with a device (an application on a phone, a surveillance system ...) to warn relatives (family, neighbours, friends ...) of isolated people still living in their natural environment could save lives and avoid incidents that cause or worsen the loss of autonomy. In this R&D project, we propose to study a solution allowing the use of a set of innovative heterogeneous sensors in order to: 1) detect emergencies (falls, crises, etc.) and call relatives (neighbours, family, etc.); 2) detect, over short or longer predefined periods, behavioural changes in the elderly through an intelligent analysis of data from sensors.

7.1.7. Nively

is a French SME specialized in e-health technologies, it develops position and activity monitoring of activities of daily living platforms based on video technology. Nively's mission is to use technological tools to put people back at the center of their interests, with their emotions, identity and behavior. Nively is collaborating with Stars through the UCA Solitaria project, by providing their MentorAge system. This software allows the monitoring of elderly people in nursing homes in order to detect all the abnormal events in the lives of residents (falls, runaways, strolls, etc.). Nively's technology is based on RGBD video sensors (Kinects type) and a software platform for event detection and data visualization. Nively is also in charge of Software distribution for the ANR Activis project. This project is based on an objective quantification of the atypical behaviors on which the diagnosis of autism is based, with medical (diagnostic assistance and evaluation of therapeutic programs) and computer scientific (by allowing a more objective description of atypical behaviors in autism) objectives. This quantification requires video analysis of the behavior of people with autism. In particular, we propose to explore the issues related to the analysis of ocular movement, gestures and posture to characterize the behavior of a child with autism. Thus, Nively will add autistic behavior analysis software to its product range.

More bilateral Grants with industries is available at: http://www-sop.inria.fr/members/Francois.Bremond/topicsText/researchProjec

STEEP Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Contract with **ADEME** (French Environment and Energy Management Agency [0]), within a collaboration with FCBA [0], Arvalis [0], Terres Univia [0], and Terres Inovia [0]. Design and development of an interactive spreadsheet application for scenarizing non-food biomass flows in France, from production to consumption (energy and non-energy uses). Visualization in the form of Sankey diagrams.

Contract with **Aura-EE** (Energy and Environment Agency of the Auvergne–Rhône-Alpes Region [0]), within the Interreg Alpine Region program. Estimation of material flows within the wood supply chain in the Alps European Region.

Contract with **Aura-EE** within the European project IMEAS. Estimation of wood flows between the Vercors Regional Natural Parc and the Grenoble metropolitan area.

[0] https://www.ademe.fr/en
[0] https://www.fcba.fr
[0] https://www.arvalisinstitutduvegetal.fr/gis-@/view-607-arvstatiques.html
[0] http://www.terresunivia.fr
[0] https://www.terresinovia.fr
[0] https://en.auvergnerhonealpes-ee.fr

STORM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Contract with ATOS/Bull for the PhD CIFRE of Tassadit Célia Ait Kaci (2019-2021),
- Contract with Airbus for 1 year, renewable, on StarPU in Flusepa code (2019-), for the engineer contract of Alexis Juven,
- Contract with CEA for the PhD of Arthur Loussert (2017-2019), for the PhD of Van Man Nguyen (2019-2021) and other short contracts.

SUMO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Nokia Bell Labs - ADR SAPIENS

Several researchers of SUMO are involved in the joint research lab of Nokia Bell Labs France and Inria. We participate in the common research team SAPIENS (Smart Automated and Programmable Infrastructures for End-to-end Networks and Services), previously named "Softwarization of Everything." This team involves several other Inria teams: Convecs, Diverse and Spades. SUMO focuses on the management of reconfigurable systems, both at the edge (IoT based applications) and in the core (*e.g.* virtualized IMS systems). In particular, we study control and diagnosis issues for such systems.

Two PhD students are involved in the project. Erij Elmajed (3rd year), on the topic of Diagnosis of virtualized and reconfigurable systems supervised by Éric Fabre and Armen Aghasaryan (Nokia Bell Labs). Abdul Majith (started in January 2019) on Controller Synthesis of Adaptive Systems, supervised by Hervé Marchand, Ocan Sankur and Dinh Thai Bui (Nokia Bell Labs).

8.1.2. Orange Labs

SUMO takes part in IOLab, the common lab of Orange Labs and Inria, dedicated to the design and management of Software Defined Networks. Our activities concern the diagnosis of malfunctions in virtualized multi-tenant networks.

This collaboration supports one Cifre PhD student, Sihem Cherrared (2nd year), supervised by Éric Fabre, Gregor Goessler (Inria Spades, Grenoble) and Sofiane Imadali (Orange Labs).

8.1.3. Alstom Transport - P22

Several researchers of SUMO are involved in the joint research lab of Alstom and Inria, in a common research team called P22. On Alstom side, this joint research team involves researchers of the ATS division (Automatic Train Supervision). The objective of this joint team is to evaluate regulation policies of urban train systems, to assess their robustness to perturbations and failures, to design more efficient regulation policies and finally to provide decision support for human regulators. The P22 project between Alstom and Inria ended in 2018. However, our collaboration with Alstom Transport continues. One of the outcomes of this collaboration is the PhD defense of Karim Kecir in July 2019 [2].

8.1.4. Mitsubishi Electric Research Center Europe (MERCE)

Several researchers of SUMO are involved in a collaboration on the verification of real-time systems with the "Information and Network Systems (INS)" Team led by David Mentré of the "Communication & Information Systems (CIS)" Division of MERCE Rennes. The members of the team at MERCE work on different aspects of formal verification. Currently the SUMO team and MERCE jointly supervise a Cifre PhD student (Emily Clément) funded by MERCE since fall 2018; the thesis is about robustness of reachability in timed automata. Moreover Reiya Noguchi, a young engineer, member of MERCE, on leave of a Japanese operational division of Mitsubishi is also hosted and co-supervised by the SUMO team since the beginning of 2019, one day per week; we collaborate with him on the consistency of timed requirements.

TADAAM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Intel

INTEL granted $30k and provided information about future many-core platforms and memory architectures to ease the design and development of the HWLOC software with early support for next generation hardware.

8.1.2. EDF

With Yvan Fournier from EDF R&D, we co-advise the PhD thesis of Benjamin Lorendeau under a CIFRE funding.

8.1.3. CEA

CEA/DAM granted the CIFRE PhD thesis of Florian Reynier on non-blocking MPI collectives.

TAMIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- CISCO (http://www.cisco.com) contract (2017–2019) to work on graph analysis of malware

7.2. Bilateral Grants with Industry

- CISCO (http://www.cisco.com) one grant (2016–2019) to work on semantical analysis of malware
- Thales (https://www.thalesgroup.com) one CIFRE (2016–2019) to work on verification of communication protocols, one grant (2018–2019) to work on learning algorithms
- Oberthur Technologies (http://www.oberthur.com/) one grant (2016–2020) to work on fuzzing and fault injection

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

[0]This "Affiliate" contract has been inspired by the affiliate program of Technion

TEA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Inria – Mitsubishi Electric framework program (2018+)

Title: Inria – Mitsubishi Electric framework program

Inria principal investigator: Jean-Pierre Talpin

International Partner: Mitsubishi Electric R&D Europe (MERCE)

Duration: 2018+

Abstract: Following up the fruitful collaboration of TEA with the formal methods group at MERCE, Inria and Mitsubishi Electric signed a center-wide collaboration agreement, which currently hosts projects with project-teams Sumo and Tea, as well as Tocata.

8.1.2. Mitsubishi Electric R&D Europe (2019-2022)

Title: A logical framework to verify requirements of hybrid system models

Inria principal investigator: Jean-Pierre Talpin, Stéphane Kastenbaum

International Partner: Mitsubishi Electric R&D Europe

Duration: 2015 - 2018

Abstract: The goal of this doctoral project is to verify and build cyber-physical systems (CPSs) with a correct-by-construction approach in order to validate system requirements against the two facets of the cyber and physical aspects of such designs. Our approach is based on components augmented with formal contracts that can be composed, abstracted or refined. It fosters the proof of system-level requirements by composing individual properties proved at component level. While semantically grounded, the tooling of this methodology should be usable by regular engineers (i.e. not proof theory specialists).

8.1.3. Mitsubishi Electric R&D Europe (2015-2019)

Title: Parallelism and modular proof in differential dynamic logic [1]

Inria principal investigator: Jean-Pierre Talpin, Simon Lunel

International Partner: Mitsubishi Electric R&D Europe

Duration: 2015 - 2018

Abstract: The primary goal of this Ph.D. project is to ensure correctness-by-design in cyber-physical systems, i.e., systems that mix software and hardware in a physical environment, e.g., Mitsubishi factory automation lines. We develop a component-based approach in Differential Dynamic Logic allowing to reason about a wide variety of heterogeneous cyber-physical systems. Our work provides tools and methodology to design and prove a system modularly.

THOTH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Intel

Participants: Cordelia Schmid, Karteek Alahari.

The Intel Network on Intelligent Systems in Europe brings together leading researchers in robotics, computer vision, motor control, and machine learning. We are part of this network and have participated in the annual retreat in 2018. Funding will be provided on an annual basis, every year, as long as we are part of the network.

8.2. Facebook

Participants: Cordelia Schmid, Jakob Verbeek, Julien Mairal, Karteek Alahari, Pauline Luc, Alexandre Sablayrolles, Mathilde Caron, Lina Mezghani.

The collaboration started in 2016. The topics include image retrieval with CNN based descriptors, weakly supervised object detection and semantic segmentation, and learning structured models for action recognition in videos. In 2016, Pauline Luc started her PhD funded by a CIFRE grant, jointly supervised by Jakob Verbeek (Inria) and Camille Couprie (Facebook AI Research). THOTH has been selected in 2016 as a recipient for the Facebook GPU Partnership program. In this context Facebook has donated two state-of-the-art servers with 8 GPUs. In 2017, Alexandre Sablayrolles started his CIFRE grant, jointly supervised by Cordelia Schmid, and Herve Jegou and Matthijs Douze at Facebook AI Research. In 2018, Mathilde Caron started as a CIFRE PhD student, jointly supervised by Julien Mairal, and Armand Joulin and Piotr Bojanowski at Facebook AI Research. Lina Mezghani is the new PhD student in this collaboration since 2019.

8.3. NAVER LABS Europe

Participant: Karteek Alahari.

This collaboration started when NAVER LABS Europe was Xerox Research Centre Europe, and has been on-going since October 2009 with two co-supervised CIFRE scholarships (2009–2012, 2011-2014). Starting June 2014 we signed a third collaborative agreement for a duration of three years. The goal is to develop approaches for deep learning based image description and pose estimation in videos. Jakob Verbeek and Diane Larlus (XRCE) jointly supervise a PhD-level intern for a period of 6 months in 2016-2017. XRCE then became Naver in 2017. A one-year research contract on action recognition in videos started in Sep 2017. The approach developed by Vasileios Choutas implements pose-based motion features, which are shown to be complementary to state-of-the-art I3D features. Nieves Crasto's internship in 2018 was jointly supervised by Philippe Weinzaepfel (NAVER LABS), Karteek Alahari and Cordelia Schmid. A new CIFRE PhD contract was submitted to ANRT for approval in October 2019.

8.4. Valeo AI

Participants: Karteek Alahari, Florent Bartoccioni.

This collaboration started in 2019 with the arrival of PhD student Florent Bartoccioni. Despite the progress seen in computer vision, artificial systems lack the capability to address the large disparity between human and machine-based scene understanding. For example, at any road intersection most people have the ability to accurately forecast or anticipate events in this scenario, such as changes in colour of the traffic lights, when and how pedestrians are likely to cross the street. This apparently natural human behaviour is not replicable by state-of-theart computer vision methods, which are ill-equipped to make such forecasts. The goal of this collaborative PhD is to address this forecasting problem.

8.5. Criteo

Participant: Julien Mairal.

This collaboration started in April 2019, with the arrival of a master student, Houssam Zenati, who will pursue a CIFRE PhD starting in 2020. The goal of this collaboration is to develop machine learning techniques for counterfactual loss optimization, which is a fundamental problem in machine learning related to causal inference. The goal is to learn stochastic policies, based on offline logged data. The problem is important for web advertising, which is the main activity of the Criteo company, but the potential scope of application is much larger, with possible applications in medicine and experimental sciences.

8.6. Google

Participants: Karteek Alahari, Minttu Alakuijala, Valentin Gabeur, Julien Mairal.

This collaboration started in February 2019, with the arrival of two CIFRE PhD students, Minttu Alakuijala and Valentin Gabeur, who are respectively working on visual models for robotics, and 3D human pose estimation.

TITANE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Google X

Participants: Cédric Portaneri, Pierre Alliez.

We developed a novel approach and software prototype for the compression of 3D models. Our main focus is on progressive compression of surface triangle meshes with color textures, with emphasis on fine grain, genericity and flexible metric. The proposed methodology is to turn the input models into a stream of refinements, in which both mesh and texture refinement details are multiplexed in accordance to rate-distortion principles. Fine grain control is achieved through considering all components, local as well as non-local, from both the mesh and its textures: mesh complexity, vertex accuracy, texture definition and accuracy. We leveraged the recent advances on perceptual metrics to improve the visual appearance, and performed joint consolidation and encoding of the models to further optimize the rate-distortion tradeoffs and visual perception.

8.1.2. Dorea technology

Participants: Vincent Vadez, Pierre Alliez.

In collaboration with SME Dorea Technology, our objective is to advance the knowledge on the radiative thermal simulation of satellites, via geometric model reduction. The survival of a satellite is related to the temperature of its components, the variation of which must be controlled within safety intervals. In this context, the thermal simulation of the satellite for its design is crucial to anticipate the reality of its operation. This CIFRE project started in August 2018, for a total duration of 3 years.

8.1.3. Luxcarta

Participants: Jean-Philippe Bauchet, Florent Lafarge.

The goal of this collaboration is to design automated approaches for producing city models from the last generation of satellites. In particular, this project investigates geometric representations for images and 3D data that are more compact and meaningful than traditional pixel and voxel grids, the intuition being to synthesize massive satellite data to reconstruct objects in 3D in a more scalable manner than existing methods. This CIFRE project started in October 2016, for a total duration of 3 years.

8.1.4. CNES and Acri-ST

Participants: Onur Tasar, Yuliya Tarabalka, Pierre Alliez.

The aim is to devise efficient representations for satellite images. The project started in October 2017, for a total duration of 3 years.

8.1.5. CSTB

Participants: Hao Fang, Mulin Yu, Florent Lafarge.

This collaboration takes the form of two independent contracts. The first project investigated the automatic conversion of raw 3D data to polyhedral surfaces that approximate man-made objects at some key structural representation scales. This project started in March 2016, for a total duration of 3 years. The second project investigates the design of as-automatic-as-possible algorithms for repairing and converting Building Information Modeling (BIM) models of buildings in different urban-specific CAD formats using combinatorial maps. This project started November 2019, for a total duration of 3 years.

8.1.6. IRT Saint-Exupéry

Participants: Gaetan Bahl, Florent Lafarge.

This project investigates low-power deep learning architectures for detecting, localizing and characterizing changes in temporal satellite images. These architectures are designed to be exploited on-board satellites with low computational resources. The project started in March 2019, for a total duration of 3 years.

8.1.7. Dassault Systèmes

Participants: Julien Vuillamy, Pierre Alliez, Florent Lafarge.

This project investigates algorithms for reconstructing city models from multi-sourced data. 3D objects are reconstructed by filtering, parsing and assembling planar shapes. The project started in April 2018, for a total duration of 3 years.

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 Dailler.

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 Dailler.

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].

TONUS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We collaborate with EDF Chatou in the context of L. Quibel PhD. The objective is to design new Equations Of States (EOS) for the simulation of multiphase flows. The EOScannot be chosen arbitrarily if one wants to ensure the stability of the fluid model. We are also interested to apply our palindromic method for computing low-Mach liquid-vapor flows.
We are involved in a common project with the company AxesSim in Strasbourg. The objective is to help to the development of a commercial software for the numerical simulation of electromagnetic phenomena. The applications are directed towards antenna design and electromagnetic compatibility. This project was partly supported by DGA through "RAPID" funds. A CIFRE PhD has started in AxesSim on the same kinds of subjects in March 2015 (Bruno Weber). The new project is devoted to the use of runtime system in order to optimize DG solvers applied to electromagnetism [33]. The resulting software will be applied to the numerical simulation of connected devices for clothes or medicine. The project is supported by the "Banque Publique d'Investissement" (BPI) and coordinated by the Thales company.

TOSCA Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- M. Bossy is the Coordinator of the POPART Industrial partnership project at UCA-JEDI on the modeling of fibre transport in turbulent flows. This partnership is granted by EDF and by UCA, and in collaboration with CEMEF (J. Bec and S. Allende).
- M. Bossy is member of a MERIC project (MERIC is the marine energy research & innovation center in Chile) on stochastic Lagrangian models to better estimate energy production variability with water turbine, granted with the LEMON Inria Team.

TRIBE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. GranData:

Participants: Douglas Do Couto Teixiera, 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 being 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 (endend 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.

TRIPOP Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Schneider Electric

This action started in 2001 with my post-doc co–supported by Schneider Electric and CNRS. With some brief interruptions, this action is still active and should further continue. It concerns mainly the simulation and modeling of multi–body systems with contact, friction and impacts with the application for the virtual prototyping of electrical circuit breakers. During these years, various forms of collaborations have been held. Two PhD thesis have been granted by Schneider Electric (D.E. Taha and N. Akhakdar) accompanied with research contracts between Inria and Schneider Electric. Schneider Electric participated also the ANR project Saladyn as a main partner. Without going into deep details of the various actions over the years, the major success of this collaboration is the statistical tolerance analysis of the functional requirements of the circuit breakers with respect to clearance in joints and geometrical tolerances on the parts. Starting from the geometrical descriptions (CAD files) of a mechanism with prescribed tolerances on the manufacturing process, we perform worst-case analysis and Monte–Carlo simulations of the circuit breaker with Siconos and we record the variations in the functional requirements. The difficulty in such simulations are the modeling of contact with friction that models the joints with clearances. The results of these analysis enable Schneider Electric to define the manufacturing precision that has a huge impact of the production cost (Schneider Electric produces several millions of C60-type circuit breaker per year). Note that it is not possible to perform such simulations with the existing software codes of the market. At the beginning, our interlocutor at Schneider Electric was the innovation (R&D) department. Now, we are working and discussing with the business unit, Division Power and Dinnov (M. Abadie, E. Boumediene, X. Herreros) in charge of designing and producing the circuit–breakers. The targeted users are the R&D engineers of Schneider Electric that use simulation tools for designing new models or improving existing circuit breakers. This collaboration continues with new modeling and simulation challenges (flexible parts, multiple impact laws) with the CIFRE PhD of Rami Sayoud.

7.2. STRMTG

We have recently started with STRMTG a research contract about modelling, simulation and control of cable-transport systems. In such systems, the question of the coupling between the nonlinear dynamics of cables and their supports with unilateral contact and friction appears now to be determinant in order to increase the performances of the cableway systems, especially for urban transportation systems.

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.

TYREX Project-Team (section vide)

VALDA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Juliette Achddou's PhD research is set up as a CIFRE contract and supervision agreement between her employer, the Numberly company, and École normale supérieure.

We are in the process of finalizing a contract with Neo4j, the leading company in the field of graph databases, to work towards the creation of a new standard for graph languages called GQL, building on Neo4j's Cypher query language. On this, we do not start from scratch. In a joint effort between the Neo4j's Cypher group and the Edinburgh database group led by Leonid Libkin, a formal specification of the core querying and update features of Cypher was produced. Starting in 2020, Libkin will chair a working group on the formal semantics of GQL. In addition to Valda, it will involve researchers from Edinburgh, Santiago, Warsaw, and other universities in Paris (Marne-la-Vallee and Paris-Diderot). The project is supported by a grant from Neo4j.

VALSE Project-Team (section vide)

VERIDIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Logic4Business

The Max Planck Institute for Informatics (MPI-INF) and Logic 4 Business GmbH (L4B) have signed a cooperation contract. Its subject is the application of automated reasoning methods to product complexity management, in particular in the car industry. MPI-INF is providing software and know-how, L4B is providing real-world challenges.

WHISPER Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Orange Labs, 2019-2021, 30 000 euros. The purpose of this contract is to design application-specific proxies so as to speed up network services. The PhD of Yoann Ghigoff is supported by a CIFRE fellowship as part of this contract.
- Thales Research, 2016-2019, 45 000 euros. The purpose of this contract is to enable the usage of multicore architectures in avionics systems. The PhD of Cédric Courtaud is supported by a CIFRE fellowship as part of this contract.
- DGA-Inria, 2019-2021, 60 000 euros. The purpose of this PhD grant is to develop a high-performance, certified packet processing system. The PhD of Pierre Nigron is supported by this grant.

8.2. Bilateral Grants with Industry

- Oracle, 2018-2019, 100 000 dollars.

Operating system schedulers are often a performance bottleneck on multicore architectures because in order to scale, schedulers cannot make optimal decisions and instead have to rely on heuristics. Detecting that performance degradation comes from the scheduler level is extremely difficult because the issue has not been recognized until recently, and with traditional profilers, both the application and the scheduler affect the monitored metrics in the same way.

The first objective of this project is to produce a profiler that makes it possible to find out whether a bottleneck during application runtime is caused by the application itself, by suboptimal OS scheduler behavior, or by a combination of the two. It will require understanding, analyzing and classifying performance bottlenecks that are caused by schedulers, and devising ways to detect them and to provide enough information for the user to understand the root cause of the issue. Following this, the second objective of this project is to use the profiler to better understand which kinds of workloads suffer from poor scheduling, and to propose new algorithms, heuristics and/or a new scheduler design that will improve the situation. Finally, the third contribution will be a methodology that makes it possible to track scheduling bottlenecks in a specific workload using the profiler, to understand them, and to fix them either at the application or at the scheduler level. We believe that the combination of these three contributions will make it possible to fully harness the power of multicore architectures for any workload.

As part of this project, we have already identified frequency scaling and the “fork/wait” paradigm as a source of inefficiency in modern multicore machines. These first results were published in the PLOS workshop that is held together with SOSP. The diagnosis of the problem was possible thanks to the *SchedLog and* SchedDisplay tools that we developed as part of this project.

WIDE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CIFRE Technicolor: Distributed troubleshooting of edge-compute functions (2018-2021)

Participants: Loïck Bonniot, François Taïani.

This project seeks to explore how recent generations of end-user gateways (or more generally end-user devices) could implement an edge-compute paradigm powered by user-side micro-services. Our vision is that the devices distributed among the homes of end-users will expose (as a service) their computing power and their ability to quickly deploy compute functions in an execution environment. In order for service and application providers to actually use the system and deploy applications, the system must however ensure an appropriate level of reliability, while simultaneously requiring a very low level of maintenance in order to address the typical size and economics of gateway deployments (at least a few tens of million units). Providing a good level of reliability in such a large system at a reasonable cost is unfortunately difficult. To address this challenge, we aim in this thesis to exploit the *natural distribution* of such large-scale user-side device deployments to quickly pinpoint problems and troubleshoot applications experiencing performance degradations.

WILLOW Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. MSR-Inria joint lab: Image and video mining for science and humanities (Inria)

Participants: Yana Hasson, Ivan Laptev, Jean Ponce, Josef Sivic, Dimitri Zhukov, Cordelia Schmid [Inria Thoth].

This collaborative project brings together the WILLOW and LEAR project-teams with MSR researchers in Cambridge and elsewhere. The concept builds on several ideas articulated in the 2020 Sciencea report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project we propose will focus on fundamental computer science research in computer vision and machine learning, and its application to archaeology, cultural heritage preservation, environmental science, and sociology, and it will be validated by collaborations with researchers and practitioners in these fields.

In October 2013 a new agreement has been signed for 2013-2017 with the research focus on automatic understanding of dynamic video content. Recent studies predict that by 2018 video will account for 80-90% of traffic on the Internet. Automatic understanding and interpretation of video content is a key enabling factor for a range of practical applications such as organizing and searching home videos or content aware video advertising. For example, interpreting videos of "making a birthday cake" or "planting a tree" could provide effective means for advertising products in local grocery stores or garden centers. The goal of this project is to perform fundamental computer science research in computer vision and machine learning in order to enhance the current capabilities to automatically understand, search and organize dynamic video content.

In 2018 a new agreement has been signed with a new focus on video understanding for personal assistants. The scientific objectives are to develop models, representations and learning algorithms for (i) automatic understanding of task-driven complex human activities from videos narrated with natural language in order to (ii) give people instructions in a new environment via an augmented reality device such as the Microsoft HoloLens. Besides the clear scientific interest of automatically understanding human activities in video streams, the main high-impact motivation of this project it to develop virtual assistants that may guide a child through simple games to improve his/her manipulation and language skills; help an elderly person to achieve everyday tasks; or facilitate the training of a new worker for highly-specialized machinery maintenance.

8.1.2. Louis Vuitton/ENS chair on artificial intelligence

Participants: Ivan Laptev, Jean Ponce, Josef Sivic.

The scientific chair Louis Vuitton - École normale supérieure in Artificial Intelligence has been created in 2017 and inaugurated on April 12, 2018 by the ENS Director Marc Mézard and the LV CEO Michael Burke. The goal of the chair is to establish a close collaboration between LV and ENS in the area of Artificial Intelligence. The chair enjoys the generous annual contribution of 200K Euros provided by LV in support of research activities in statistical learning and computer vision. In particular, the chair supports the costs of researchers, students, missions, computational resources as well as seminars and meetings, including the two days of meeting annually organized by LV and ENS. During 2018 ENS and LV have organized several joint meetings with the participation of researchers from SIERRA and WILLOW teams. The chair has also supported the hiring of one PhD student at the WILLOW team, missions to conferences and international research labs as well as data collection for research projects.

8.2. Bilateral Grants with Industry

8.2.1. Facebook AI Research Paris: Weakly-supervised interpretation of image and video data (Inria)

Participants: Jean Ponce, Minsu Cho, Ivan Laptev, Josef Sivic.

We will develop in this project (Facebook gift) new models of image and video content, as well as new recognition architectures and algorithms, to address the problem of understanding the visual content of images and videos using weak forms of supervision, such as the fact that multiple images contain instances of the same objects, or the textual information available in television or film scripts.

8.2.2. Google: Structured learning from video and natural language (Inria)

Participants: Simon Lacoste-Julien, Ivan Laptev, Josef Sivic.

People can easily learn how to change a flat tire of a car or assemble an IKEA shelve by observing other people doing the same task, for example, by watching a narrated instruction video. In addition, they can easily perform the same task in a different context, for example, at their home. This involves advanced visual intelligence abilities such as recognition of objects and their function as well as interpreting sequences of human actions that achieve a specific task. However, currently there is no artificial system with a similar cognitive visual competence. The goal of this proposal is to develop models, representations and learning algorithms for automatic understanding of complex human activities from videos narrated with natural language.

WIMMICS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. PREMISSE Collaborative Project

Participants: Molka Dhouib, Catherine Faron Zucker, Andrea Tettamanzi.

Partner: SILEX France.

This collaborative project with the SILEX France company started in march 2017, funded by the ANRT (CIFRE PhD). SILEX France is developing a B2B platform where service providers and consumers upload their service offers or requests in free natural language; the platform is intended to recommend service providers to the applicant, which are likely to fit his/her service request. The aim of this project is to develop a solution to link together service providers and consumers.

8.1.2. HealthPredict Collaborative Project

Participants: Raphaël Gazzotti, Catherine Faron Zucker, Fabien Gandon.

Partner: Synchronext.

This collaborative project with the Synchronext company started in april 2017, funded by the ANRT (CIFRE PhD). Synchronext is a startup aiming at developing Semantic Web business solutions. The aim of this project is to design a digital health solution for the early management of patients through consultations with their general practitioner and health care circuit. The goal is to develop a predictive Artificial Intelligence interface that allows to cross the data of symptoms, diagnosis and medical treatments of the population in real time to predict the hospitalization of a patient.

8.1.3. Joint Lab EduMICS

Participants: Olivier Corby, Catherine Faron Zucker, Géraud Fokou Pelap, Fabien Gandon, Alain Giboin.

Partner: Educlever.

EduMICS (Educative Models Interactions Communities with Semantics) is a joint laboratory (LabCom) between the Wimmics team and the Educlever company that ended in early 2019. The aim of EduMICS was to develop research and technologies with the ultimate goal to adapt educational progressions and pedagogical resource recommendation to learner profiles.

8.1.4. Curiosity Collaborative Project

Participants: Catherine Faron Zucker, Oscar Rodríguez Rocha.

Partner: TeachOnmars.

This collaborative project with the TeachOnmars company started in October 2019. TeachOnMars is developping a platform for mobile learning. The aim of this project is to develop an approach for automatically indexing and semantically annotating heterogeneous pedagogical resources from different sources to build up a knowledge graph enabling to compute training paths, that correspond to the learner's needs and learning objectives.

8.2. Bilateral Grants with Industry

Accenture gifts (June 2017 - January 2022): Wimmics has received two gifts from Accenture. Together with additional funds from another project these gifts have been used to fund the Engineer position and then the PhD Grant (June 2017 - January 2022) of Nicholas Halliwell on a topic agreed with Accenture: "interpretable and explainable predictions"

XPOP Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Contract with Dassault Systèmes

Contract with Lixoft

ZENITH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. SAFRAN (2018-2019)

Participants: Reza Akbarinia, Florent Masseglia.

SAFRAN and Inria are involved in the DESIR frame-agreement (Florent Masseglia is the scientific contact on "Data Analytics and System Monitoring" topic). In this context, SAFRAN dedicates 80K€ for a joint study of one year on time series indexing. The specific time series to be exploited are those of engine benchmarking with novel characteristics for the team (multiscale and multidimensional).

8.2. INA (2019-2022)

Participants: Quentin Leroy, Alexis Joly.

The PhD of Quentin Leroy is funded in the context of an industrial contract (CIFRE) with INA, the French company in charge of managing the French TV archives and audio-visual heritage. The goal of the PhD is to develop new methods and algorithms for the interactive learning of new classes in INA archives.