



RESEARCH CENTER  
**Paris**

FIELD

Activity Report 2018

# Section Contracts and Grants with Industry

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## ALMAnaCH Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Industrial Collaborations

- **Verbatim Analysis:** this Inria start-up was co-created in 2009 by BS. It uses some of ALMAnaCH's free NLP software (SxPipe) as well as a data mining solution co-developed by BS, VERA, for processing employee surveys with a focus on answers to open-ended questions.
- **opensquare** A new Inria startup, opensquare, was co-created in December 2016 by BS with 2 senior specialists in HR consulting. opensquare designs, carries out and analyses employee surveys and offers HR consulting based on these results. It uses a new employee survey analysis tool, *enqi*, which is still under development.
- **Facebook:** A collaboration on text simplification ("français Facile À Lire et à Comprendre", FALC) is ongoing with Facebook's Parisian FAIR laboratory. In particular, a co-supervised (CIFRE) PhD thesis started in 2018 in collaboration with UNAPEI, the largest French federation of associations defending and supporting people with special needs and their families. This collaboration is expected to pave the way for a larger initiative involving (at least) these three partners as well as the relevant ministries.
- **Bluenove:** A contract with this company has been signed, which defines the framework of our collaboration on the integration of NLP tools (e.g. chatbot-related modules) within Bluenove's platform Assembl, dedicated to online citizen debating forums. It involves a total of 24 months of fixed-term contracts (12 months for a post-doc, currently working on the project, and 12 months for a research engineer, which is still to be recruited).
- **Science Miner:** ALMAnaCH (previously ALPAGE) has been collaborating since 2014 years 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 on 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 at providing a scholarly dashboard on the scientific papers available from the HAL national publication repository.
- **Hyperlex** A collaboration was initiated in 2018 on NLP for legal documents, involving especially EVdLC.
- ALMAnaCH members led a proposal for the creation of an ANR LabCom with Fortia Financial Solutions, a company specialized in *Financial Technology*, namely the analysis of financial documents from investment funds. The proposal has been rejected. Meanwhile, this project is currently being extended toward a FUI with Systran, the market leader in specialized machine translation systems, and the BNP as industrial partner. The funding requested will cross the 3 millions euros bar.
- ALMAnaCH members have recently initiated discussions with other companies (Louis Vuitton, Suez...), so that additional collaborations might start in the near future. They have also presented their work to companies interested in knowing more about the activities of Inria Paris in AI and NLP.

## **ALPINES Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

- Contract with Total, February 2015 - August 2018, that funds the PhD thesis of Hussam Al Daas on enlarged Krylov subspace methods for oil reservoir and seismic imaging applications. Supervisor L. Grigori.
- 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.
- Contract with Total, February - September 2018, that funded an internship on Helmholtz domain decomposition solvers for multiple right hand sides. Supervisor F. Nataf.

## **ANGE Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

- A contract (2016-2018) has been made (130.000 euros) with SAUR, IAV (Institut d'Aménagement de la Vilaine) and Agence de l'eau Loire-Bretagne in collaboration with SciWorks Technologies. It deals with the modelling and the simulation of chlorides entry in the Vilaine reservoir.
- A part of the ANR project Hyflo-Eflu relies on a collaboration with the company "HydroTube Energie". It comprises the recruitment of a young engineer (J. Ledoux) and regular meetings with industrial (Bordeaux) and academic partners (Nantes). See below for more details about the scientific content of this project.
- A part of the ANR project ESTIMAIR includes the SME NUMTECH for a commercial deployment of the project results. (Bordeaux) and academic partners (Nantes). See below for more details about the scientific content of this project.
- J. Sainte-Marie, C. Guichard, Y. Penel, J. Salomon are part of an agreement between Institut Carnot SMILES (Sorbonne Univ., Thomas Boiveau) and the corporation GTT about the improvement of a modeling tool for gas flows in the isolation spaces of LNG tanks

## **8.2. Bilateral Grants with Industry**

P. Quémar's PhD thesis is funded by EDF (CIFRE). His PhD is entitled "3D numerical simulations of environmental hydrolics: application to Telemac".

**ANTIQUE Project-Team (section vide)**

## **AOSTE2 Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

The IFPEN grant which started on December 2014 and ended on February 2018, provides full support for the PhD thesis of Salah Eddine Saidi. The thesis concerns the automatic parallelization and scheduling approaches for co-simulation of numerical models on multi-core processors. The goal of the first research topic is to propose multi-core scheduling solutions for the co-simulation in order to accelerate its execution. The second research topic aims at proposing multi-core scheduling solutions in order to enable the execution of co-simulation under real-time constraints in the context of Hardware-in-the-Loop validation.



## 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.

## **CAGE Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Contracts with Industry**

A bilateral contract with CNES funded the PhD thesis of Antoine Olivier, who defended in October 2018.

**CASCADE Project-Team (section vide)**

## **COML Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Grants with Industry**

- Google Faculty Award - 100K€
- Facebook AI Research Grant - 350K€

## **DELYS 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 two CIFRE contracts with Magency SA:

- Damien Carver is advised by Julien Sopena and Sébatien Monnet. He works on designing kernel-level mechanisms that automatically give more memory to the most active containers.
- Lyes Hamidouche is advised by Pierre Sens and Sébatien Monnet. He works on efficient data dissemination among a large number of mobile devices. He defended his thesis in April 2018.

DELYS has two 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.

## **DYOGENE Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. CRE with Huawei**

18-month contract titled “Mathematical Modeling of 5G Ultra Dense Wireless Networks” between Inria represented by B. Blaszczyzyn (PI) and F. Baccelli, and Huawei comes to an end in December 2018. It aimed at investigating obstacle-based shadowing fields in the spatial models of cellular networks and efficient scheduling policies. Paul Keeler was hired by Inria as a research engineer thanks to this contract. The publication [39] is one of the deliverable of this contract.

## **7.2. CIFRE with Nokia**

Contract with Nokia started in 2015 for the co-advising by B. Blaszczyzyn of a PhD student of Nokia, Dalia-Georgiana Herculea came to an end in December 2018. Dalia-Georgiana Herculea has successfully defended her PhD Thesis in November 2018.

## **7.3. CIFRE with Orange**

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

## EVA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

**Participants:** Pascale Minet, Ines Khoufi, Zied Soua.

In the framework of the CNES Launchers Research and Technology program, Inria and CNEs co-funded a study dealing with wireless sensor networks in a spatial environment. More precisely, this study deals with the improvement and performance evaluation of a solution of wireless sensor networks based on the IEEE 802.15.4e standard of TSCH (Time Slotted Channel Hopping), operating in a spatial environment.

In space launch vehicles, a NASA study shows that the mass per channel of 0.45 kg for a wiring approach can be reduced to 0.09 kg for a wireless approach.<sup>8</sup> A question arises: which wireless technology is able to meet the requirements of space launch vehicles in terms of latency, throughput and robustness. The IEEE 802.15.4e amendment has been designed to meet such requirements. More specifically, the Time Slotted Channel Hopping (TSCH) mode of the IEEE 802.15.4e standard that has been designed for industrial automation, process control and equipment monitoring, appears very promising for space launch vehicles. More precisely, the study for CNES deals with:

- Building an IEEE 802.15.4e TSCH network: see [11] the Acta Astronautica 2018 publication.
- Scheduling transmissions in an IEEE 802.15.4e TSCH network.
- Adapting the schedule to traffic or topology changes.

This study ended in July 2018 with very satisfying results.

## 8.2. Bilateral Grants with Industry

**Participants:** Thomas Watteyne, Felipe Moran.

Felipe Moran was awarded a 6-month EDF fellowship to conduct a 6-month internship around low-power wireless networking in extreme industrial environments. Details are confidential.

## GALLIUM Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *The Caml Consortium*

**Participants:** Damien Doligez [ **contact** ], Xavier Leroy, Michel Mauny, Didier Rémy.

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.

The Consortium currently has 15 member companies:

- Aesthetic Integration
- Ahrefs
- Be Sport
- Bloomberg
- CEA
- Citrix
- Docker
- Esterel Technologies
- Facebook
- Jane Street
- Kernelyze LLC
- LexiFi
- Microsoft
- OCamlPro
- SimCorp

For a complete description of this structure, please refer to <https://ocaml.org/consortium/index.html>.

The Caml Consortium is being gradually phased out. In the future, it should be entirely replaced by the OCaml Foundation, described next (§8.1.2).

### 8.1.2. *The OCaml Foundation*

**Participant:** Michel Mauny.

In June 2018, Michel Mauny created the OCaml Software Foundation (OCSF), a structure sheltered by the Inria Foundation. The OCSF now has a few patrons. With the help of Yann Régis-Gianas, it is running the Learn-OCaml project, which aims at developing the usage of OCaml in higher education. A paper that presents the project has been accepted for publication at JFLA 2019 [20]. The OCaml Software Foundation and the Learn-OCaml project have been presented at the 2018 OCaml workshop.

The OCaml Software Foundation is expecting more patrons at the beginning of 2019, and shall organize meetings where donors discuss and produce suggestions for actions of general interest to be funded.



## **GANG Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

### ***8.1.1. Collaboration with Nokia Bell Labs***

Gang has a strong collaboration with Bell Labs (Nokia). We notably collaborate with Fabien Mathieu who is a former member of GANG and Élie de Panafieu. An ADR (joint research action) is dedicated to distributed learning.

This collaboration is developed inside the Alcatel-Lucent and Inria joint research lab.

## **MAMBA Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

Contract with Orange labs (2016-2018) for Veronica Quintuna's PhD. See Reference [2].

## **MATERIALS 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.

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

## **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.

**MOKAPLAN Project-Team (section vide)**

## OURAGAN Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

The objective of our Agreement 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.

## **PARKAS Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Contracts with Industry**

Polly Labs contract with ARM, 2015-2019, with the participation of Qualcomm, Xilinx and Facebook (human resources, consulting services and and hiring former PARKAS members).

## **7.2. Bilateral Grants with Industry**

In 2018 Francesco Zappa Nardelli was awarded a Google Research Fellowship to pursue the work on DWARF unwinding, about 50k euros.



**PL.R2 Project-Team (section vide)**

## **POLSYS Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Grants with Industry**

Until the mid 2000's, multivariate cryptography was developing very rapidly, producing many interesting and versatile public-key schemes. However, many of them were soon successfully cryptanalysed (a lot have been done in this group). As a consequence, the confidence in multivariate cryptography cryptosystems declined. It seems that there have emerged new important reasons for renewal of the interest in a new generation of multivariate schemes. In the past two years, the algorithms for solving the Discrete Logarithm Problem over small characteristic fields underwent an extraordinary development. This clearly illustrates the risk to not consider alternatives to classical assumptions based on number theory. In parallel, two of the most important standardization bodies in the world, NIST and ETSI have recently started initiatives for developing cryptographic standards not based on number theory, with a particular focus on primitives resistant to quantum algorithms. An objective here is then to focus on the design of multivariate schemes.

The team is involved in the industrial transfer of post-quantum cryptography. The maturation project, called HFEBOOST, is supervised by SATT-LUTECH.

SATT-LUTECH specializes 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, Université Panthéon-Assas, Paris Sorbonne University and National School of Industrial Creation).

The team has recently developed, in partnership with a mobile application development company (WASSA), an Android app for smartphones (Samsung S5 type) that uses multivariate cryptography. The application has been tested mid-November in a series of experiments supervised by DGA and French Ministry of Defense. The experiment gathered a total of hundred participants from various operational units. This is a first milestone in the maturation project whose goal is to create a start-up.

## **7.2. Public Contracts**

CEA LETI / DSYS / CESTI

In smart card domain, the emanations of a component during a cryptographic computation may compromise the information that is directly or not linked to the secret keys. The most part of the side channel attacks are based on statistical tools that exploit relations between the handled data and the signals. However these methods do not take advantage of all the signal information. The goal is to study the existing algorithms in pattern and speech recognition and to apply them to signals related to cryptographic computations. The objective will be to improve the attacks efficiency and resolve more complex problems.

- CIFRE Contract with ST Micro electronics that funds the PhD thesis of Simon Landry on "Threshold Implementations Against Side Channel Analysis". Supervisor Emmanuel Prouff.

**PROSECCO Project-Team (section vide)**

**QUANTIC Project-Team (section vide)**

## REO Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Philips Research

**Participants:** Miguel Ángel Fernández Varela, Jean-Frédéric Gerbeau, Alexandre This.

CIFRE convention and contract with Philips Research for the PhD thesis of Alexandre This (January 2016 - December 2018) on fusion data/simulation for the assessment of mitral regurgitation.

### 8.1.2. Kephaliros & Epygon

**Participants:** Gautier Bureau, Miguel Ángel Fernández Varela, Jean-Frédéric Gerbeau, Ludovic Boilevin-Kayl, Marina Vidrascu.

REO is an academic partner of the industrial project MIVANA, dedicated to the development of new technologies for mitral valve treatment. It is led by the start-up company Kephaliros, with the participation of the start-up company Epygon, by the company MDB Texinov and the research institute IFTH. In this framework, REO has two bilateral contracts with Kephaliros and Epygon on the modeling and simulation of two medical devices for mitral valve repair.

### 8.1.3. Instem/NOTOCORD

**Participants:** Muriel Boulakia, Damiano Lombardi, Jean-Frédéric Gerbeau, Fabien Raphael.

REO partners with the software company NOTOCORD. The collaboration started in 2013 the framework of the LabCom “cardioXcomp”. In 2016, the ANR funding came to an end, and NOTOCORD was acquired by the company Instem. Our collaboration with Instem/NOTOCORD continues as a bilateral partnership with the purpose of developing the software cardioXcomp dedicated to the safety pharmacology industry. This project is also supported by a grant by AMIES (Agency for Interaction in Mathematics with Business and Society).

### 8.1.4. ESIEE-Heartflow

**Participant:** Irene Vignon Clementel.

Research contract with ESIEE-Heartflow on coronary tree modeling.

## RITS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. 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.

**SECRET Project-Team (section vide)**

## SERENA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

Three two-part contracts with **EDF** accompanying the PhD theses of Amina Benaceur, Nicolas Pignet, and Riccardo Milani.

Two two-part contract with **CEA** accompanying the PhD thesis of Frédéric Marazzato and the postdoc of Guillaume Delay.

Three-part contract Inria-**EDF**-Sciworks Technologies (from April 2017) on “Form-L for the formalization of constraints of complex systems”. SERENA representants are Sébastien Furic and Pierre Weis.

**AMIES** NEF-PEPS1 (Dec. 2018–Feb. 2020) Collaboration with the joint laboratory LabCom **fractory** (ITASCA, Géosciences Rennes). SERENA representants are F. Clément, Sébastien Furic, Florent Hédin, M. Kern and G. Pichot (Coordinator).

Two-part contract with **IFP Energies Nouvelles** for co-supervision of the post-doc of G. Mallik.



## **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: AXA, "mécénat scientifique, chaire Havas-Dauphine", machine learning.

**VALDA Project-Team (section vide)**

## **WHISPER Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

- Orange Labs, 2016-2018, 120 000 euros. The purpose of this contract is to apply the techniques developed in the context of the PhD of Antoine Blin to the domain of Software Defined Networks where network functions are run using virtual machines on commodity multicore machines.
- Thales Research, 2016-2018, 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.

## **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.

## **WILLOW Project-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:** Guilhem Cheron, Ivan Laptev, Maxime Oquab, Jean Ponce, Josef Sivic, Cordelia Schmid [Inria Lear].

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 is 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: Learning to annotate videos from movie scripts (Inria)**

**Participants:** Josef Sivic, Ivan Laptev, Jean Ponce.

The goal of this project is to automatically generate annotations of complex dynamic events in video. We wish to deal with events involving multiple people interacting with each other, objects and the scene, for example people at a party in a house. The goal is to generate structured annotations going beyond simple text tags. Examples include entire text sentences describing the video content as well as bounding boxes or segmentations spatially and temporally localizing the described objects and people in video. This is an extremely challenging task due to large intra-class variation of human actions. We propose to learn joint video and text representations enabling such annotation capabilities from feature length movies with coarsely aligned shooting scripts. Building on our previous work in this area, we aim to develop structured representations of video and associated text enabling to reason both spatially and temporally about scenes, objects and people as well as their interactions. Automatic understanding and interpretation of video content is a key-enabling factor for a range of practical applications such as content-aware advertising or search. Novel video and text representations are needed to enable breakthrough in this area.

### **8.2.3. 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.