



RESEARCH CENTER

FIELD

Activity Report 2017

# Section Contracts and Grants with Industry

Edition: 2018-02-19



## ALGORITHMICS, PROGRAMMING, SOFTWARE AND ARCHITECTURE

1. ANTIQUE Project-Team	9
2. AOSTE2 Team	10
3. ARIC Project-Team	11
4. AROMATH Project-Team	12
5. CAIRN Project-Team (section vide)	13
6. CAMUS Team	14
7. CARAMBA Project-Team	15
8. CARTE Team	16
9. CASCADE Project-Team (section vide)	17
10. CELTIQUE Project-Team (section vide)	18
11. CIDRE Project-Team	19
12. COMETE Project-Team (section vide)	21
13. CONVECS Project-Team	22
14. CORSE Project-Team	23
15. DATASHAPE Project-Team	24
16. DATASPHERE Team (section vide)	25
17. DEDUCTEAM Project-Team (section vide)	26
18. GALLIUM Project-Team	27
19. GAMBLE Project-Team	28
20. GRACE Project-Team	29
21. HYCOMES Project-Team	30
22. KAIROS Team	31
23. LFANT Project-Team (section vide)	32
24. MARELLE Project-Team (section vide)	33
25. MEXICO Project-Team (section vide)	34
26. PACAP Project-Team	35
27. PARKAS Project-Team	36
28. PARSIFAL Project-Team (section vide)	37
29. PESTO Project-Team	38
30. PLR2 Project-Team (section vide)	39
31. POLSYS Project-Team	40
32. PRIVATICS Project-Team	41
33. PROSECCO Project-Team (section vide)	42
34. SECRET Project-Team	43
35. SPADES Project-Team	44
36. SPECFUN Project-Team (section vide)	45
37. SUMO Project-Team	46
38. TAMIS Team	47
39. TEA Project-Team	48
40. TOCCATA Project-Team	49

41. VERIDIS Project-Team .....	50
APPLIED MATHEMATICS, COMPUTATION AND SIMULATION	
42. ACUMES Project-Team (section vide) .....	51
43. APICS Project-Team .....	52
44. ASPI Team .....	53
45. BIPOP Project-Team .....	55
46. CAGIRE Project-Team .....	56
47. CARDAMOM Project-Team .....	57
48. COMMANDS Project-Team .....	58
49. CQFD Project-Team .....	61
50. DEFI Project-Team .....	62
51. DISCO Project-Team .....	63
52. DOLPHIN Team .....	64
53. ECUADOR Project-Team .....	65
54. GAMMA3 Project-Team .....	66
55. GECO Project-Team (section vide) .....	67
56. GEOSTAT Project-Team .....	68
57. I4S Project-Team .....	69
58. INOCS Team .....	71
59. IPSO Project-Team (section vide) .....	72
60. MATHERIALS Project-Team .....	73
61. MATHRISK Project-Team .....	74
62. MCTAO Project-Team .....	75
63. MEMPHIS Project-Team .....	76
64. MEPHYSTO Project-Team (section vide) .....	77
65. MISTIS Project-Team .....	78
66. MODAL Project-Team .....	79
67. MOKAPLAN Project-Team .....	80
68. NACHOS Project-Team (section vide) .....	81
69. NANO-D Project-Team (section vide) .....	82
70. NECS Project-Team (section vide) .....	83
71. NON-A Project-Team .....	84
72. POEMS Project-Team .....	85
73. QUANTIC Project-Team (section vide) .....	86
74. RANDOPT Team .....	87
75. RAPSODI Project-Team .....	88
76. REALOPT Project-Team .....	89
77. SELECT Project-Team .....	90
78. SEQUEL Project-Team .....	91
79. SIERRA Project-Team .....	93
80. SPHINX Project-Team .....	94

81. TAU Team .....	95
82. TOSCA Project-Team .....	96
83. TROPICAL Team .....	97

#### DIGITAL HEALTH, BIOLOGY AND EARTH

84. ABS Project-Team .....	98
85. AIRSEA Project-Team .....	99
86. AMIBIO Team (section vide) .....	100
87. ANGE Project-Team .....	101
88. ARAMIS Project-Team .....	102
89. ASCLEPIOS Project-Team .....	103
90. ATHENA Project-Team .....	104
91. BEAGLE Project-Team (section vide) .....	105
92. BIGS Project-Team .....	106
93. BIOCORE Project-Team .....	107
94. BIOVISION Team .....	108
95. BONSAI Project-Team (section vide) .....	109
96. CAMIN Team .....	110
97. CAPSID Project-Team (section vide) .....	111
98. CARMEN Project-Team (section vide) .....	112
99. CASTOR Project-Team (section vide) .....	113
100. COFFEE Project-Team .....	114
101. DRACULA Project-Team .....	115
102. DYLISS Project-Team .....	116
103. ERABLE Project-Team .....	117
104. FLUMINANCE Project-Team .....	118
105. GALEN Project-Team .....	120
106. GENSCALE Project-Team .....	121
107. IBIS Project-Team .....	122
108. LEMON Team (section vide) .....	123
109. LIFEWARE Project-Team (section vide) .....	124
110. M3DISIM Project-Team .....	125
111. MAGIQUE-3D Project-Team .....	126
112. MAMBA Project-Team .....	127
113. MATHNEURO Team (section vide) .....	128
114. MIMESIS Team .....	129
115. MNEMOSYNE Project-Team .....	130
116. MONC Project-Team .....	131
117. MORPHEME Project-Team .....	132
118. MYCENAE Project-Team (section vide) .....	133
119. NEUROSYS Project-Team (section vide) .....	134
120. NUMED Project-Team (section vide) .....	135

121. PARIETAL Project-Team .....	136
122. PLEIADE Team (section vide) .....	137
123. REO Project-Team .....	138
124. SERENA Project-Team .....	139
125. SERPICO Project-Team .....	140
126. SISTM Project-Team .....	142
127. STEEP Project-Team (section vide) .....	143
128. TAPDANCE Team (section vide) .....	144
129. TONUS Team .....	145
130. VIRTUAL PLANTS Project-Team (section vide) .....	146
131. VISAGES Project-Team .....	147
132. XPOP Project-Team .....	148

#### NETWORKS, SYSTEMS AND SERVICES, DISTRIBUTED COMPUTING

133. AGORA Team .....	149
134. ALPINES Project-Team .....	150
135. ASAP Project-Team (section vide) .....	151
136. ASCOLA Project-Team .....	152
137. AVALON Project-Team .....	153
138. COAST Project-Team .....	154
139. COATI Project-Team (section vide) .....	155
140. CTRL-A Project-Team .....	156
141. DANTE Project-Team .....	157
142. DATAMOVE Project-Team .....	158
143. DIANA Project-Team .....	159
144. DIONYSOS Project-Team .....	160
145. DIVERSE Project-Team .....	162
146. DYOGENE Project-Team .....	163
147. EVA Project-Team .....	164
148. FOCUS Project-Team (section vide) .....	165
149. FUN Project-Team .....	166
150. GANG Project-Team .....	167
151. HIEPACS Project-Team .....	168
152. INDES Project-Team (section vide) .....	169
153. INFINE Project-Team .....	170
154. KERDATA Project-Team .....	171
155. MADYNES Team .....	172
156. MIMOVE Team .....	173
157. MYRIADS Project-Team .....	174
158. NEO Project-Team .....	175
159. PHOENIX Project-Team (section vide) .....	176
160. POLARIS Team .....	177

161. RAP2 Team .....	178
162. REGAL Project-Team .....	179
163. RMOD Project-Team .....	180
164. ROMA Project-Team .....	181
165. SOCRATE Project-Team .....	182
166. SPIRALS Project-Team .....	183
167. STORM Project-Team .....	184
168. TACOMA Team .....	185
169. TADaaM Project-Team .....	186
170. WHISPER Project-Team .....	187

#### PERCEPTION, COGNITION AND INTERACTION

171. ALICE Project-Team .....	188
172. ALMANACH Team .....	189
173. AVIZ Project-Team (section vide) .....	190
174. CEDAR Team (section vide) .....	191
175. CHROMA Project-Team .....	192
176. COML Team .....	194
177. DEFROST Project-Team .....	195
178. EX-SITU Project-Team (section vide) .....	196
179. FLOWERS Project-Team .....	197
180. GRAPHDECO Project-Team .....	198
181. GRAPHIK Project-Team .....	199
182. HEPHAISTOS Project-Team .....	200
183. HYBRID Project-Team .....	201
184. ILDA Project-Team .....	202
185. IMAGINE Project-Team .....	203
186. LACODAM Project-Team .....	204
187. LAGADIC Project-Team .....	206
188. LARSEN Project-Team .....	208
189. LINKMEDIA Project-Team .....	209
190. LINKS Project-Team (section vide) .....	210
191. MAGNET Project-Team .....	211
192. MAGRIT Project-Team .....	212
193. MANAO Project-Team .....	213
194. MAVERICK Project-Team (section vide) .....	214
195. MIMETIC Project-Team .....	215
196. MINT2 Team .....	216
197. Mjolnir Team .....	217
198. MOEX Project-Team (section vide) .....	218
199. MORPHEO Project-Team .....	219
200. MULTISPEECH Project-Team .....	220

201. ORPAILLEUR Project-Team (section vide) .....	221
202. PANAMA Project-Team .....	222
203. PERCEPTION Project-Team .....	223
204. PERVASIVE INTERACTION Project-Team .....	224
205. PETRUS Project-Team .....	225
206. POTIOC Project-Team .....	226
207. RITS Project-Team .....	227
208. SEMAGRAMME Project-Team (section vide) .....	228
209. SIROCCO Project-Team .....	229
210. STARS Project-Team .....	231
211. THOTH Project-Team .....	232
212. TITANE Project-Team .....	234
213. TYREX Project-Team .....	236
214. Valda Team (section vide) .....	237
215. WILLOW Project-Team .....	238
216. WIMMICS Project-Team .....	240
217. ZENITH Project-Team .....	242



## **ANTIQUE Project-Team**

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

## **8.1. Bilateral Grants with Industry**

Xavier Rival received a Facebook Faculty Award (2017).

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

### **8.1. Bilateral Grants with Industry**

The Airbus CIFRE grant which started on March 2014, provides full support for the PhD thesis of Cristian Maxim. The thesis concerns the statistical timing analysis while different variability factors are taken into account. The proposed methods are built on top of existing statistical approaches while proving appropriate programs for training these methods and thus learning from the history of the execution.

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

The IFPEN grant which started on December 2014, 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.

## **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.

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

- Miruna Rosca and Radu Titu 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 Titu 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.
- Within the program Nano 2017, we collaborate with the Compilation Expertise Center of STMicroelectronics on the theme of floating-point arithmetic for embedded processors.

## **AROMATH Project-Team**

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

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

MISSLER Software provided a grant to the team AROMATH, related to the collaboration on geometric modeling methods for toolpath generation and machining.

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

## **CAMUS Team**

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

## **8.1. NANO 2017/PSAIC**

The CAMUS team is taking part of the NANO 2017 national research program and its sub-project PSAIC (Performance and Size Auto-tuning thru Iterative Compilation) with the company STMicroelectronics, which started in January 2015. Since the release of our automatic speculative parallelization framework Apollo, we have been working on an extension making Apollo usable as a advanced program profiling tool. We are currently working in extending Apollo to the memoization of the memory behavior for loops that are invoked several times.

## **8.2. Caldera**

Vincent Loechner and Cédric Bastoul are involved in a collaboration with the French company Caldera (<http://www.caldera.com>), specialized in software development for wide image processing. The goal of this collaboration is the development of parallel and scalable image processing pipeline for industrial printing. The project started in September 2016 and involves a contract established between the ICube laboratory and the Caldera company. This contract includes the funding of the industrial thesis (CIFRE) of Paul Godard (started in September 2016) on the topic of the collaboration, under the supervision of Vincent Loechner and Cédric Bastoul.

## **CARAMBA Project-Team**

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

## **8.1. Training and Consulting with French Ministry of Defense**

We have training and consulting activities with the French Ministry of Defense.

## **8.2. Consulting with Docapost**

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

## **8.3. Consulting with Canton of Geneva**

In this contract the goal is to audit and prove security properties of a new e-voting protocol to be used in a few cantons of Switzerland.

## **8.4. Research Contract with Orange**

This contract with Orange Gardens at Chatillon-Montrouge is dedicated to the supervision of Sandra Rasoami-aramanana's PhD thesis about security in the white box context.

## **8.5. FUI Industrial Partnership on Lightweight Cryptography**

This contract, called PACLIDO, is an FUI project with many companies dedicated to the definition of new lightweight cryptographic primitives for the IoT.

## **CARTE Team**

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

## **8.1. Bilateral Grants with Industry**

- PRCE ANR SoftQPro has Atos-Bull as a partner.
- ITEA 3 Quantex involves several industrial partners: Siemens, KPN, Atos-Bull.



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

## **CELTIQUE Project-Team (section vide)**

## CIDRE Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

- **HP (2013-2019): Embedded Systems Security** We aim at researching and prototyping low-level intrusion detection mechanisms in embedded system software. This involves mechanisms in continuation of previous work realized by our team as well as investigating new techniques more directly tied to specific HP device architectures. Our main objective is to monitor low-level software (firmware, OS kernels, hypervisors) thanks to a dedicated external co-processor. Ronny Chevalier is doing his PhD in the context of this project. Being under NDA, details about this research program cannot be provided.

## 8.2. Bilateral Grants with Industry

- **Orange Labs: Privacy-preserving location-based services** Solenn Brunet has completed her PhD thesis in November 2017 within the context of a CIFRE contract with Orange Labs Caen. Her PhD subject was about privacy-preserving services that are able to provide the service to the user while preserving his privacy. In particular, Solenn Brunet has designed new cryptographic primitives to build anonymous accreditation and she has used these primitives to provide data anonymization mechanisms in the context of e-voting and e-cash.
- **DGA: BGP-like Inter Domain routing protocol for tactical mobile ad hoc networks: feasibility, performances and quality of service** Florian Grandhomme has completed his PhD thesis in September 2017 in cooperation with DGA-MI. The subject of the PhD was to propose new secure and efficient algorithms and protocols to provide inter-domain routing in the context of tactical mobile ad hoc network. The proposed protocol handles context modification due to the mobility of MANET, that is to say split of a MANET, merge of two or more MANET, and also handles heterogeneity of technology and infrastructure. The solution is independent from the underlying intra-domain routing protocol and from the infrastructure: wired or wireless, fixed or mobile.
- **DGA: Visualization for security events monitoring** Damien Crémilleux has started his PhD thesis in October 2015 in the context of a cooperation with DGA-MI. The subject of the PhD is to define relevant representations to allow front-line security operators to monitor systems from a security perspective. A first proposal was made that led to a tool, VEGAS, that allows to monitor large quantities of alerts in real time and to dispatch these alerts in a relevant way to security analysts.
- **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.
- **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.

- **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.
- **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 CentraleSupélec 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.
- **ANSSI: Security of Low-level Components** Thomas Letan has started his PhD thesis in the context of a contract between CentraleSupélec and the French National Computer Security Agency (ANSSI). His work consists in using formal methods to specify hardware/software security mechanisms and to verify that they correctly enforce some security policies.

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

## CONVECS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Grants with Industry

### 7.1.1. *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 § 6.5.1), under the supervision of Xavier Etchevers (Orange Labs), Gwen Salaün (CONVECS), François Gaël Ottogalli (Orange Labs), and Jean-Marc Vincent (POLARIS project-team).

### 7.1.2. *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 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**

- CORSE is involved in a contract with **Kalray** which objective is the automatic integration of neural networks into the manycore architecture developed by Kalray.

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

- PSAIC Nano2017 is a bilateral Grant with STMicroelectronics. CORSE is involved in the development of trace analysis and hybrid compilation.
- DEMA Nano2017 is a bilateral Grant with STMicroelectronics. CORSE is involved in the development of debugging of multi-threaded applications.

## **DATASHAPE Project-Team**

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

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

- Collaboration with Sysnav, a French SME with world leading expertise in navigation and geopositioning in extreme environments, on TDA, geometric approaches and machine learning for the analysis of movements of pedestrians and patients equipped with inertial sensors (CIFRE PhD of Bertrand Beaufile).
- Collaboration with Fujitsu on TDA and Machine learning (started in Dec 2017).

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

- DATASHAPE and Sysnav have been selected for the ANR/DGA Challenge MALIN (funding: 700 kEuros) in September 2017.



**DATASPHERE Team (section vide)**

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

## GALLIUM Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *The Caml Consortium*

**Participants:** Xavier Leroy [ **contact** ], Damien Doligez, 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 Caml. 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 16 member companies:

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

For a complete description of this structure, refer to <http://caml.inria.fr/consortium/>. Xavier Leroy chairs the scientific committee of the Consortium.

### 8.1.2. *The OCaml Foundation*

**Participant:** Michel Mauny.

Throughout 2017, Michel Mauny has been preparing the project of an OCaml Foundation, which should support OCaml in a more efficient way than the existing Caml Consortium could do, thanks to the facilities and flexibility provided by the recently created Inria Foundation. The goal is to raise enough funds to effectively support the development and evolution of OCaml, and to animate and grow its user and teaching communities.

### 8.1.3. *Scientific Advisory for OCamlPro*

**Participant:** Fabrice Le Fessant.

OCamlPro is a startup company founded in 2011 by Fabrice Le Fessant to promote the use of OCaml in the industry, by providing support, services and tools for OCaml to software companies. OCamlPro performs a lot of research and development, in close partnership with academic institutions such as IRILL, Inria and Univ. Paris Sud, and is involved in several collaborative projects with Gallium, such as the Bware ANR, the Vocal ANR and the Secur-OCaml FUI.

Since 2011, Fabrice Le Fessant has been a scientific advisor at OCamlPro, as part of a collaboration contract for Inria, to transfer his knowledge on the internals of the OCaml runtime and the OCaml compilers. Fabrice has left Inria in October 2017 to join OCamlPro on a full-time position.

## **GAMBLE Project-Team**

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

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

A two-years licence and cooperation agreement was signed on April 1st, 2016 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 VEGAS and OURAGAN (Paris), and it is coordinated by Fabrice Rouillier (OURAGAN).

F. Rouillier and VEGAS 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.

## **GRACE Project-Team**

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

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

- **NOKIA BELL LABS**
  - New PhD student H. Khazaie is funded by ADR with NOKIA BELL LABS. The PhD topic is the security of distributed storage systems.
  - Post doctoral researcher N. Coxon is funded by ADR with NOKIA BELL LABS. The post doc topic is an information theoretically secure private information retrieval scheme.
- **SAFRAN Identity and Security (Ex Morpho and now Idemia)**
  - Post doctoral researcher W. George is funded by Idemia to design an identity management scheme based on Bitcoin's blockchain.

## **HYCOMES Project-Team**

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

## **6.1. GLOSE**

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. Control engineers favor Matlab/Simulink, mainly because of its toolboxes and ease of use. Computer scientists program or model real-time reactive software, either with a dedicated language, for instance SCADE, hierarchical state machines or sequence/activity diagrams (as in UML/SysML) or directly in C. 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?

The objective of the GLOSE project is to address these objectives, and propose both sound foundations and practical technological solutions to system level modeling and simulation. The GLOSE project has started in December 2017 and is funded by Safran, in the realm of the DESIR joint Safran-Academia research network. The academic teams contributing to GLOSE are the Hycomes, Diverse and Kairos Inria teams, and IRIT/CNRS in Toulouse.

## **KAIROS Team**

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

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

### **7.1.1. *IRT Saint-Exupery ATIPPIC project***

**Participants:** Robert de Simone, Julien Deantoni, Amin Oueslati.

We are collaborating here with Thales Alenia Space and some of their partners, with engineering forces put in secondment to the direct governance of IRT Saint-Exupery, on the topic of introducing COTS processor usage for satellite mission systems, with the corresponding methodological needs (sharing software tasks on a single (multi)processor, with safety-critical constraints against cosmic radiations). We attempt to make this a show-case study for our formal model-based design approach.

### **7.1.2. *GLoSE project of the SAFRAN DESIR research programme***

**Participants:** Robert de Simone, Julien Deantoni, Giovanni Liboni, Frédéric Mallet.

SAFRAN tech set up a collaborative research programme with the major French academic partners in the field of Embedded Systems and Data Analytics, named DESIR. Robert de Simone is Prime Investigator for the Embedded System side. Julien DeAntoni heads a specific research project of this programme, named GloSE (Globalization in Systems Engineering), on co-modeling and co-design to enable co-simulation using enhanced FMU/FMI interfaces. A new PhD thesis should start early next year under a related CIFRE grant, with Giovanni Liboni as PhD candidate (he was with us already as intern last Spring).

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



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

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

## PACAP Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Nano 2017 PSAIC*

**Participants:** Arif Ali Ana-Pparakkal, Erven Rohou.

Nano 2017 PSAIC is a collaborative R&D program involving Inria and STMicroelectronics. The PSAIC (Performance and Size Auto-tuning through Iterative Compilation) project concerns the automation of program optimization through the combination of several tools and techniques such as: compiler optimization, profiling, trace analysis, iterative optimization and binary analysis/rewriting. For any given application, the objective is to devise through a fully automated process a compiler profile optimized for performance and code size. For this purpose, we are developing instrumentation techniques that can be focused and specialized to a specific part of the application aimed to be monitored.

The project involves the Inria teams PACAP, AriC, CAMUS and CORSE. PACAP contributes program analyses at the binary level, as well as binary transformations. We will also study the synergy between static (compiler-level) and dynamic (run-time) analyses.

## 7.2. Bilateral Grants with Industry

### 7.2.1. *Intel research grant INTEL2014-8957*

**Participants:** André Seznec, Biswabandan Panda, Fernando Endo.

Intel is supporting the research of the PACAP project-team on “Mixing branch and value prediction to enable high sequential performance”.

### 7.2.2. *Intel research grant INTEL2016-11174*

**Participants:** André Seznec, Pierre Michaud, Kleovoulos Kalaitzidis, Niloofar Charmchi.

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

## **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).

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

## PESTO Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Scytl - Electronic Voting Systems

**Participants:** Véronique Cortier, Mathieu Turuani.

Since 2014, a collaboration agreement has been signed between Loria and Scytl, a Spanish company who is proposing solutions for the organization of on-line elections, including legally binding elections, in several countries. In this context, Scytl has signed a contract in 2016 with the Pesto team as well as the University of Birmingham (David Galindo) to design a formal proof of both verifiability and privacy of the protocol developed by Scytl, for a deployment in Switzerland. The result of the analysis will be presented at the conference EuroS&P'18 [23].

## 8.2. Canton of Geneva - Electronic Voting Systems

**Participants:** Véronique Cortier, Mathieu Turuani.

The canton of Geneva has signed a contract in October 2017 with Pesto and Caramba, as well as Manifold Security (Bogdan Warinschi and David Bernhard) to design a formal and cryptographic proof of individual and universal verifiability of the protocol developed by the canton of Geneva, for a deployment in Switzerland.

## 8.3. Docapost - Electronic Voting Systems

**Participant:** Véronique Cortier.

Docapost has 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.

**PI.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.



## **PRIVATICS Project-Team**

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

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

### **7.1.1. IPSec with *pre-shared key* for MISTIC security**

Title: IPSec with pre-shared key for MISTIC security.

Type: CIFRE.

Duration: Juillet 2014 - Juillet 2017.

Coordinator: Inria

Others partners: Privatics, Moais and Incas-ITSec.

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

## **SECRET Project-Team**

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

## **8.1. Bilateral Grants with Industry**

- **Thales** (02/14 → 01/17)  
*Funding for the supervision of Julia Chaulet's PhD.*  
30 kEuros.

## **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.
- With Daimler (subcontracting via iUTBS): We have bridged the gap between LET as it was originally proposed [59] and its current use in the automotive industry.

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

With Thales: Early Performance assessment for evolving and variable Cyber-Physical Systems. This CIFRE grant funds the PhD of Christophe Prévot.

With Orange: Programming IoT and software defined radio with dynamic dataflow models of computation. This CIFRE grant funds the PhD of Arash Shafiei.

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

## SUMO Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *ADR Softwarization of Everything*

Joint Nokia-Inria research lab: Several researchers of SUMO are involved in the joint research lab of Nokia Bell Labs France and Inria, in a common research team called "Softwarization of Everything". The objective of this joint team is to design programming and management methods for software defined networks. Several other Inria teams take part to this group: Convecs, Diverse, Spades. Within this team, 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 focus on control and diagnosis issues for such systems.

### 8.1.2. *Alstom P22*

Joint Alstom-Inria research lab: 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 project started in march 2014. A second phase of the project started in 2016, for a duration of three years. This covers in particular the CIFRE PhD of Karim Kecir.

## **TAMIS Team**

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

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

- CISCO (<http://www.cisco.com>) contract (2017–2022) to work on graph analysis of malware

## **8.2. 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
- Secure IC (<http://www.secure-ic.com/>), one CIFRE (2017–2020) to work on post-quantum cryptography

## TEA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Grants with Industry

### 8.1.1. *Mitsubishi Electric R&D Europe (2015-2018)*

Title: Analysis and verification for correct by construction orchestration in automated factories

Inria principal investigator: Jean-Pierre Talpin, Simon Lunel

International Partner: Mitsubishi Electric R&D Europe

Duration: 2015 - 2018

Abstract: The primary goal of our 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.



## TOCCATA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *ProofInUse Joint Laboratory*

**Participants:** Claude Marché [contact], Jean-Christophe Filliâtre, Andrei Paskevich.

ProofInUse is a joint project between the Toccata team and the SME AdaCore. It was selected and funded by the ANR programme “Laboratoires communs”, starting from April 2014, for 3 years <http://www.spark-2014.org/proofinuse>.

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 goal is now to promote and transfer the use of deduction-based verification tools to industry users, who develop critical software using the programming language Ada. The proof tools are aimed at replacing or complementing the existing test activities, whilst reducing costs.

## VERIDIS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Modeling a Distributed File System

**Participant:** Stephan Merz.

In a bilateral contract with Huawei R&D, we continued our work on modeling and verifying protocols underlying the Ceph distributed file system [66] in TLA<sup>+</sup>. We also provided email support to Huawei engineers who use TLA<sup>+</sup> for modeling the systems they develop.

## 8.2. Modeling a Distributed Development Process

**Participant:** Christoph Weidenbach.

On the basis of a bilateral contract with L4B (Logic 4 Business), we studied models for a distributed development process of a leading German car manufacturer.

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

## APICS Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts with Industry

### 6.1.1. Contract CNES-Inria-XLIM

This contract (reference Inria: 11282) accompanies the PhD of David Martinez and focuses 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 will be considered.

### 6.1.2. Contract BESA GmbH-Inria

This is a research agreement between Inria (Apics and Athena teams) and the German company BESA <sup>0</sup>, which deals with head conductivity estimation and co-advising of the doctoral work of C. Papageorgakis, see Section 5.1.3 . BESA is funding half of the corresponding research grant, the other half is supported by Region PACA (BDO), see Section 1 .

### 6.1.3. Contract Inria-SKAVENJI

This is a scientific consulting activity for the start-up company SKAVENJI. The latter develops an innovative and communicative device to facilitate the production and home consumption of small amounts of energy, produced by one or more local sources of renewable energy. Ongoing work consists in designing a simple controller improving the energy efficiency of the energy production while minimizing the number of charge and discharge cycles of the associated battery. The retained control strategy is based on consumption and production profiles.

---

<sup>0</sup><http://www.besa.de/>

## ASPI Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral grants with industry

See 4.1 .

### 6.1.1. Hybrid indoor navigation — PhD project at CEA LETI

**Participants:** François Le Gland, Kersane Zoubert–Oussen.

This is a collaboration with Christophe Villien (CEA LETI, Grenoble).

The issue here is user localization, and more generally localization-based services (LBS). This problem is addressed by GPS for outdoor applications, but no such general solution has been provided so far for indoor applications. The desired solution should rely on sensors that are already available on smartphones and other tablet computers. Inertial solutions that use MEMS (microelectromechanical system, such as accelerometer, magnetometer, gyroscope and barometer) are already studied at CEA. An increase in performance should be possible, provided these data are combined with other available data: map of the building, WiFi signal, modeling of perturbations of the magnetic field, etc. To be successful, advanced data fusion techniques should be used, such as particle filtering and the like, to take into account displacement constraints due to walls in the building, to manage several possible trajectories, and to deal with rather heterogeneous information (map, radio signals, sensor signals).

The main objective of this thesis is to design and tune localization algorithms that will be tested on platforms already available at CEA. Special attention is paid to particle smoothing and particle MCMC algorithms, to exploit some very precise information available at special time instants, e.g. when the user is clearly localized near a landmark point.

In some applications, real time estimation of the trajectory is not needed, and a post processing framework may provide a better estimation of this trajectory. In [57], we present and compare three different algorithms to improve a real time trajectory estimation. Actually, two different smoothing algorithms and the Viterbi algorithm are implemented and evaluated. These methods improve the regularity of the estimated trajectory by reducing switches between hypotheses.

Post processing indoor navigation is interesting, for example to develop crowdsourcing analysis. The post processing framework allows to provide a better estimation than in a real time framework. The main contribution of [17] is to present a piecewise parametrization using IMU (inertial measurement unit) and RSS (received signal strength) measurements only, which lead to an optimization problem. A Levenberg–Marquardt algorithm improved with simulated annealing and an adjustment of RSS measurements data leads to a good estimation (55% of the error less than 5 meters) of the trajectory.

### 6.1.2. Bayesian tracking from raw data — CIFRE grant with DCNS Nantes

**Participants:** François Le Gland, Audrey Cuillery.

This is a collaboration with Dann Laneuville (DCNS Nantes).

After the introduction of MHT (multi-hypothesis tracking) techniques in the nineties, multitarget tracking has recently seen promising developments with the introduction of new algorithms such as the PHD (probability hypothesis density) filter [50], [56] or the HISP (hypothesised filter for independent stochastic populations) filter [40]. These techniques provide a unified multitarget model in a Bayesian framework [54], which makes it possible to design recursive estimators of a *multitarget probability density*. Two main approaches can be used here: sequential Monte Carlo (SMC, also known as particle filtering), and Gaussian mixture (GM). A third approach, based on discretizing the state-space in a possibly adaptive way, could also be considered despite its larger computational load. These methods are well studied and provide quite good results for *contact output*

data, which correspond to regularly spaced measurements of targets with a large SNR (signal-to-noise ratio). Here, the data is processed (compared with a detection threshold) in each resolution cell of the sensor, so as to provide a list of detections at a given time instant. Among these methods, the HISP filter has the best performance/computational cost ratio.

However, these classical methods are unefficient for targets with a low SNR, e.g. targets in far range or small targets with a small detection probability. For such targets, preprocessing (thresholding) the data is not a good idea, and a much better idea is to feed a tracking algorithm with the raw *sensor output* data directly. These new methods [24] require a precise modeling of the sensor physics and a direct access to the radar (or the sonar) raw data, i.e. to the signal intensity level in each azimuth/range cell. Note that these new methods seem well suited to new types of sensors such as lidar, since manufacturers do not integrate a detection module and do provide raw images of the signal intensity level in each azimuth/range cell.

The objective of the thesis is to study and design a tracking algorithm using raw data, and to implement it on radar (or sonar, or lidar) real data.

## **BIPOP Project-Team**

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

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

- CIFRE PhD Thesis with Schneider Electric (Rami Sayoud), starting 01 January 2018.
- SAFRAN contract (August-December 2017) on the simulation of a weaving machine (F. Bertails-Descoubes)

## **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 student: 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.



## **CARDAMOM Project-Team**

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

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

- THALES, Activity around the numerical certification of debris codes, Coordinator: P.M. Congedo, 23 Keuros ;
- ArianeGroup, Activity around techniques for computing low-probabilities, Coordinator: P.M. Congedo, 20 Keuros ;
- CEA-CESTA, Coordinator: P.M. Congedo, 40 Keuros ;
- An open-source consortium have been created around the Mmg platform. There are 3 members for 2017 :
  - SAFRAN Tech, silver member, 20Keuros ;
  - "Environnement des codes" laboratory, CEA-Cesta, silver member, 3Keuros ;
  - Coria laboratory, INSA Rouen, silver member, 3Keuros.

## COMMANDS Project-Team

# Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Safety Line

In the framework of an Ilab with startup Safety Line (<http://www.safety-line.fr>), we design tools for the optimization of fuel consumption for civil planes. A first part is devoted to the identification of the aerodynamic and thrust characteristics of the plane, using recorded data from hundreds of flights. As an illustration, Fig. 1 shows the drag and lift coefficients for a Boeing 737, as functions of Mach and angle of attack. Latest results have been presented by Cedric Rommel at [15].

A second part is optimizing the fuel consumption during the climb and cruise phases. Fig. 2 shows a simulated climb phase, along with recorded data from the actual flight. This collaboration relies significantly on the toolboxes BOCOP and BOCOPHJB developed by Commands since 2010. The resulting commercial tool OptiClimb is currently under testing in several airplane companies, totalling about a hundred actual optimized flights per day. Recent improvements include better atmosphere models and more accurate data for temperature and wind, as well as a first demonstrator for cruise flight optimization, see Fig. 3 .

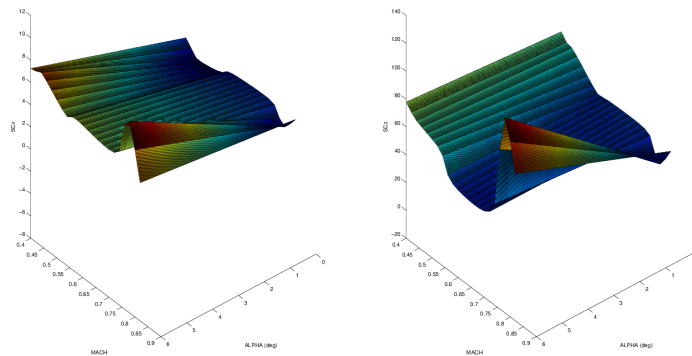


Figure 1. Lift and drag aerodynamic forces for a Boeing 737.

### 8.1.2. IFPEN

This study is presently conducted in the framework of the PhD of Arthur Le Rhun, started in Fall 2016. The main axis is to design a traffic model suitable for optimizing the fuel consumption of a hybrid vehicle following a given route. The first step was to develop a new traffic model in which the consumption is inferred only on the functioning points in the (speed,torque) plane. More precisely, we are interested in the probability distribution of these functioning points when considering a space/time subdivision into road segments and timeframes (see Fig.4 ). In order to reduce the huge number of distributions obtained, we perform a clustering step using k-means (Fig.5 ). Since the objects to be clustered are distributions, we choose to use the Wasserstein distance based on optimal transport. The task of computing these Wasserstein barycenters was done by Sinkhorn iterations, and we also developed a variant of stochastic gradient that scales better for huge data sets.

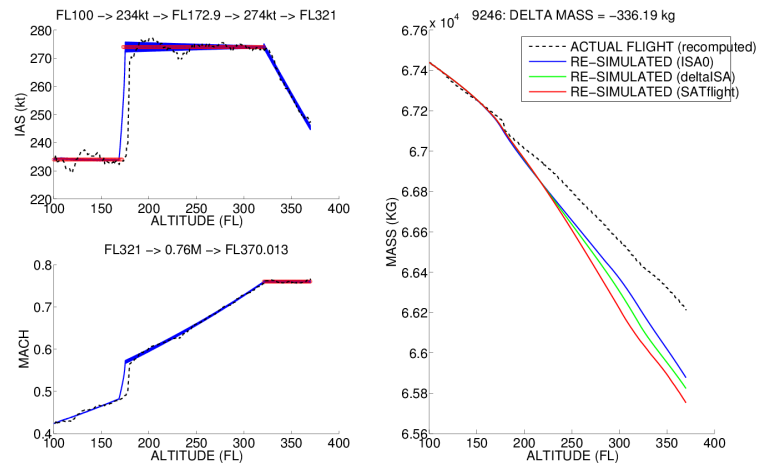


Figure 2. Simulated climb phase vs actual flight data

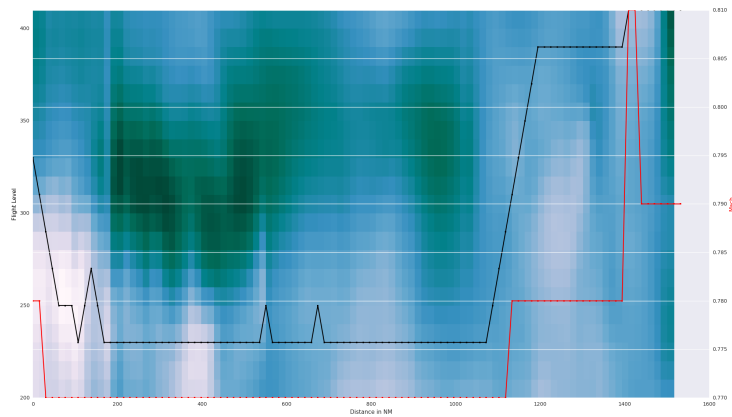


Figure 3. Simulated cruise flight (altitude in black, mach speed in red, wind speed in background)

In order to obtain the data for our traffic analysis, we work with a traffic simulator called SUMO, with the LUST scenario modeling the city of Luxembourg (<http://sumo.dlr.de>).

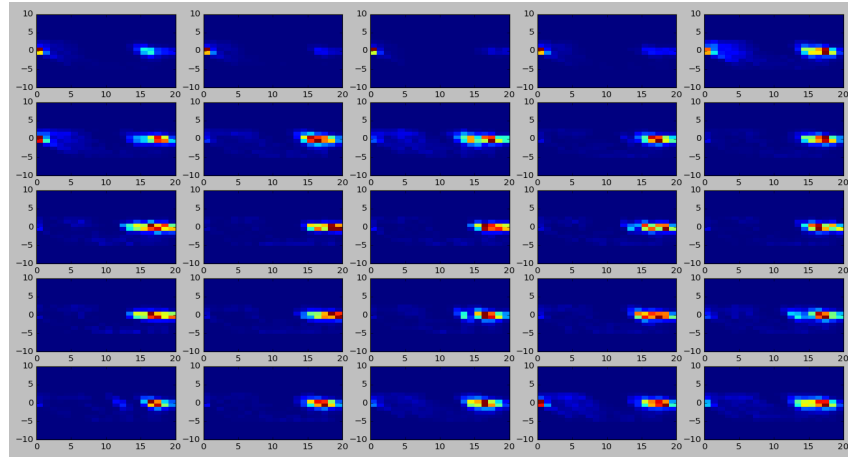


Figure 4. Distributions for all timeframes for a given road segment

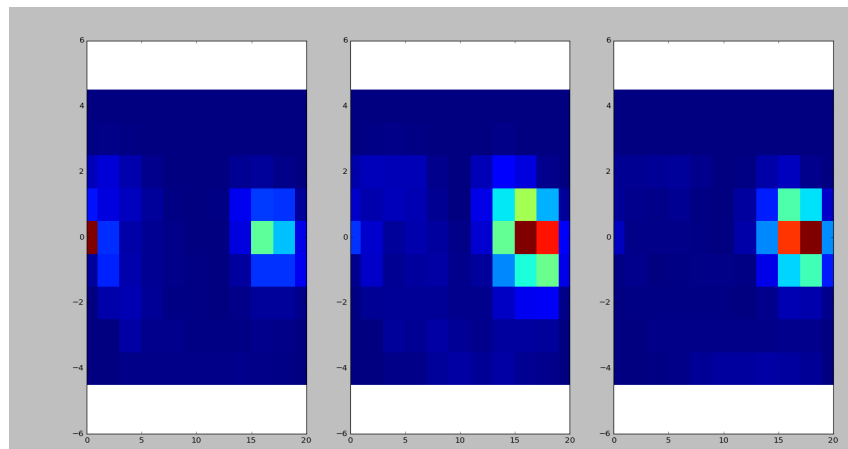


Figure 5. Barycenters after clustering ( $k=3$ )

**CQFD Project-Team**

## 8. Bilateral Contracts and Grants with Industry

### 8.1. Bilateral Contracts with Industry

#### 8.1.1. DCNS

**Participants:** Huilong Zhang, Jonatha Anselmi, François Dufour, Dann Laneuville.

The increasing complexity of warfare submarine missions has led DCNS 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.

#### 8.1.2. Thales Optronique

**Participants:** Benoîte de Saporta, François Dufour, Alizée Geeraert.

Maintenance, impulse control, failure, optimization. The objective of this grant in collaboration with Thales Optronique was to optimize the maintenance of a multi-component equipment that can break down randomly. The underlying problem was to choose the best dates to repair or replace components in order to minimize a cost criterion that takes into account costs of maintenance but also the cost associated to the unavailability of the system for the customer. This industrial process has been modeled by a piecewise deterministic Markov process (PDMP) and the maintenance problem has been formalized as an impulse control problem. We have applied an approximation method based on a quantization technique of the post jump location and inter-arrival time Markov chain naturally embedded in the PDMP, and a path-adapted time discretization grids to get an approximation of the value function. We have shown the existence of control strategies that can outperform reference control policies used by Thales Optronique. It remains to provide the explicit form of such strategies. This is actually the objective of a new collaboration with Thales Optronique that started in October 2017 funded by the Fondation Mathématique Jacques Hadamard.

#### 8.1.3. Lyre: ADEQWAT project

**Participants:** François Dufour, Alexandre Genadot, Jérôme Saracco.

Stochastic modelling, Optimization. This project has just started in November 2017. The topic of this collaboration with Lyre, l'Agence de l'eau Adour-Garonne and ENSEGID is the modeling of the uncertainties in the Water demand adequacy in a context of global climate change. A PhD thesis (2018-2021) is part of this project.

## **DEFI Project-Team**

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

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

- A CIFRE PhD thesis started January 2015 with Dassault Aviations. The student is M. Aloïs Bissuel who is working on "linearized Navier-Stokes equations for optimization, fluttering and aeroacoustic".
- A CIFRE PhD thesis started December 2015 with Safran Tech. The student is Mrs Perle Geoffroy who is working on "topology optimization by the homogenization method in the context of additive manufacturing".
- A CIFRE PhD thesis started 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 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 November 2017 with EDF. The student is H. Girardon who is working on "level set method for eddy current non destructive testing".

## **7.2. 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 Tandem. This three years project started in December 2012 and has been extended to September 2017 involves Bull-Amesys (coordinator), BOWEN (ERTE+SART), Ecole Polytechnique (CMAP), Inria, LEAT et VSM. It aims at constructing a radar system on a flying device capable of real-time imaging mines embedded in dry soils (up to 40 cm deep). We are in charge of numerical validation of the inverse simulator.
- FUI project Saxsize. This three years project started in October 2015 and 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.

## **DISCO Project-Team**

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

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

A collaboration with SNCF on the supervision and rescheduling of a mixed CBTC traffic on a suburban railway line is currently undergoing (CIFRE).

A collaboration with EDF on the control of renewable energy parks is undergoing (financial support of a PhD student).

A collaboration with CEA and ADEME on the modelling and control of district heating networks is undergoing (financial support of a PhD student).

**DOLPHIN Team**

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

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

The Dolphin team has many bilateral contracts and grants with industry:

1. Beckman (2015-2018): the goal of this contract concerns the strategic and operational planning for medical laboratories (Phd of Sohrab Faramarzi).
2. PIXEO (2014-2018): the objective of this bilateral project is the predictive models and knowledge extraction for insurance web comparator (Phd of A-L. Bedenel).
3. Alicante (2014-2017): the objective of this CIFRE contract is the design of new optimization methods to extract knowledge from hospital data (Phd of M. Vandromme - defended in June 2017).
4. ONERA and CNES (2016-2020): this collaboration deals with the multi-disciplinary and multi-objective design of aerospace vehicles (Phd of J. Pelamatti and A. Hebbal).
5. Intel (2017) Bilateral academic and research partnership between Université Lille 1 and Intel. In this context, Intel provides Lille 1 with training (Dec 14<sup>th</sup>) and technical support help for the dissemination of its activities related to High Performance Computing.
6. Strat&Logic (2012-2017): the objective of this CIFRE contract is the optimization of economic decisions in a competitive business management simulator (Phd of S. Dufourny - Defended in October 2017).



## **ECUADOR Project-Team**

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

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

- Ecuador and Lemma have a bilateral contract to share the results of Stephen Wornom, Lemma engineer provided to Inria and hosted by Inria under a Inria-Lemma contract.
- Ecuador and EDF had a three months contract to study the adjoint differentiation of the hydrology code Mascaret.

## **GAMMA3 Project-Team**

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

## **5.1. Bilateral Contracts with Industry**

- The Boeing Company,
- Safran-Tech,
- Projet Rapid (DGA) avec Lemma.

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

## **GEOSTAT Project-Team**

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

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

- Three year contract with I2S company on the transfert of award winning H. Badri PhD results (AFRIF PhD price in 2016). The contract is being transformed in 2018 in the form of an Inria Innovation Lab. The Innovation Lab is focused on non convex optimization methods in image processing and digital acquisition devices. People involved in GEOSTAT: H. Yahia, N. Brodu, K.Daoudi, M. Martin, A. Zebadua.

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

- Transfert in the analysis of hearbeat data. Discussion and collaboration with Cardiologs company <https://cardiologs.com/>.
- Contacts for a partnership strategy on heartbeat database utilization with Parly II Hospital (F. Halimi).
- Patent 185 "Dispositif analyseur de rythme cardiaque" extended for France in 2018.

## I4S Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Contracts with SVS*

**Participants:** Laurent Mevel, Michael Doehler.

I4S is doing technology transfer towards SVS to implement I4S technologies into ARTEMIS Extractor Pro. This is done under a royalty agreement between Inria and SVS .

In 2014, the damage detection toolbox has been launched [http://www.svibs.com/products/ARTEMIS\\_Modal\\_Features/Damage\\_Detection.aspx](http://www.svibs.com/products/ARTEMIS_Modal_Features/Damage_Detection.aspx).

In 2015, SVS and Inria have earned an Innobooster grant to help transfer algorithms in 2016 Artemis Extractor Pro.

In 2016, uncertainty quantification for modal analysis has been launched.

In 2017, a new Innobooster grant has been obtained for the uncertainty analysis of mode shapes in Artemis.

### 8.1.2. *Contract with SNCF: DEMETER*

**Participants:** Vincent Le Cam, Quentin Bossard, Mathieu Le Pen.

IFSTTAR's engineers Arthur Bouche and Laurent Lemarchand are contributing to this project.

**DEMETER is one of the major projects for I4S in terms of strategy, scientific and technological impact.**

DEMETER is a meta project whose global objective is the validation of the contribution of the Internet of Things (IOT) applied to the health monitoring of railway items. SNCF and IFSTTAR have signed a roadmap for safety relevant items, where wireless monitoring and smart algorithms could bring strong improvements to SNCF in terms of real-time maintenance or predictive maintenance. Those items are, amongst others:

- Crossing engine motor monitoring
- Needle motor monitoring
- Axel counter monitoring
- Train detection pedal monitoring

In each case, a prototype of a specific wireless and smart sensor is designed (that may or may not use PEGASE 2 platform), installed along railway lines in service and data are transmitted wirelessly to the cloud supervisor at IFSTTAR for evaluation in SHM algorithms.

In particular, during 2017 SNCF and IFSTTAR have performed following common works:

- finalization of the TRAIN PEDAL DETECTION instrumentation with smart sensors using new wireless and industrial IOT protocols: LoRa and Sigfox. A specific pedal is now subject of in situ test led by SNCF
- axel counter monitoring has been the major R&D subject of 2017: 2 entire and specific smart sensors have been designed, programmed and installed at Chevilly specific SNCF testbench (e.g. with real train passages). Specific algorithms (such as PID and Pattern Recognition) have been modeled and programmed into PEGASE2 platform for these new sensors.

For the future, new projects related to

- water-level monitoring around railways has been setup
- ballast vibration monitoring of railways has been setup
- "unshunting of electrical lines at train passage" detection around railways

have been initiated with SNCF R&D department.

### **8.1.3. *Contracts with SDEL-CC (VINCI Group)***

**Participants:** Vincent Le Cam, Mathieu Le Pen.

This work was done in collaboration with Laurent Lemarchand, and Arthur Bouche at IFSTTAR, SII, Nantes. Following a 2016 contract, a new contract was signed in 2017 until end 2018, with the company SDEL-CC, a 100% daughter of the VINCI Group, Energy department. The project exploits the unique time stamp capacity of the PEGASE 2 platform up to 50 nanoseconds, independently of distances in the network of PEGASE2 nodes. The synchronization capacity is employed to design a sensor prototype based on PEGASE 2 to time-stamp the current wave after a lightning impact on a high-voltage line. By knowing the exact time, the wave can be seen at each extremity of the electrical line to localize accurately the lightning impact point.

During 2017, a real high-voltage electrical line has been instrumented: at each end of the line, 2 sensors have been set up and data are sent in real time to a cloud platform. Furthermore, the software of the platform was optimized: at the embedded level (i.e. on PEGASE 2 wireless system) with new algorithms to correct time synchronization up to some 10 nanoseconds, at the cloud level with a specific QT C++ Interface to display results (i.e. lightning localization on electrical line) and to transform raw data into ComTrade standard representation

Discussions are ongoing with SDEL-CC to transform the prototype into a future product. In 2017 it has to be mentioned that the project has been submitted to VINCI International challenges (over 150 000 collaborators) and has been awarded with The Best Vinci Innovation Award.

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

### **8.2.1. *PhD project with EDF – Electrical device ageing monitoring***

**Participants:** Nassif Berrabah, Qinghua Zhang.

A joint PhD project between Inria and EDF (Electricité de France) was started in December 2014 and finished in November 2017 with Nassif Berrabah's PhD thesis defense. The purpose of this study is to develop methods for the monitoring of electrical instruments in power stations, in order to prevent failures caused by ageing or accidental events. This project has been funded by EDF and by the ANRT agency. The main outcome of this project is an efficient reflectometry-based method for resistive fault detection, localization and quantification, capable of dealing with both distributed and localized faults, with associated data processing tools taking into account practical constraints in industrial applications. These results have led to a patent jointly filed by EDF and Inria.

---

**INOCS Team**

## 8. Bilateral Contracts and Grants with Industry

### 8.1. Bilateral Contracts with Industry

Fluxys (2016-2018). Study of optimization problems arising in the management of gas networks.

HappyChic (2017). Study of optimization problems arising in the warehouse management context.

Keolis (2017). Study of optimization problems arising in the management of mediation officers in public transportation.

### 8.2. Bilateral Grants with Industry

PARROT (Planning Adapter performing ReRouting and Optimization of Timing), part of BEWARE Fellowships Academia funded by the COFUND program of the European Union (FP7 - Marie Curie Actions). INFRABEL is the industrial partner of this project (2014-2018).

Design and Pricing of Electricity Services in a Competitive Environment within the Gaspard Monge Research Program (PGMO) funded by the Fondation Mathématiques Jacques Hadamard. EDF is the industrial partner (2015-2018).

BENMIP: A generic bender decomposition-based (mixed) integer programming solver within the Gaspard Monge Research Program (PGMO) funded by the Fondation Mathématiques Jacques Hadamard (2015-2017).

Robust Energy Offering under Market Equilibrium Constraints within the Gaspard Monge Research Program (PGMO) funded by the Fondation Mathématiques Jacques Hadamard. EDF is the industrial partner (2017-2018).

### 8.3. Inria Innovation Lab

COLINOCS is an Inria Innovation Lab between Colisweb, a start-up company addressing last-mile delivery and INOCS, which was created at the end of 2016. This collaboration roots back to 2015, when a bilateral contract was devoted to optimization problems arising in courier scheduling. The main objective of this Innovation Lab is to model and solve optimization problems related to revenue management, transport mutualization, a better visibility on their activities for the couriers. See also: <https://www.inria.fr/innovation/transfert-technologique/labos-communs-inria-pme/inria-innovation-labs/colinocs>

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



## **MATHERIALS Project-Team**

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

## **8.1. Contracts and grants with Industry**

Many research activities of the project-team are conducted in close collaboration with private or public companies: CEA, SANOFI, IRDEP, EDF, IFPEN. 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**

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

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

- Consortium PREMIA, Natixis - Inria
- Consortium PREMIA, Crédit Agricole CIB - Inria

## **7.2. Bilateral Contracts with Industry**

- Chair Ecole Polytechnique-ENPC-UPMC-Société Générale "Financial Risks" of the Risk fondation . Participants: A. Alfonsi, B. Jourdain, B. Lapeyre
- AXA Joint Research Initiative on Numerical methods for the ALM, from September 2017 to August 2020, Participant: A. Alfonsi.

## **MCTAO Project-Team**

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

## **7.1. Bilateral Contract with Industry: CNES - Inria - UB Contract**

Contract number: 130777/00. Call Number: R-S13/BS-005-012

"Perturbations and averaging for low thrust" (Poussée faible et moyennation).

Research contract between CNES and MCTAO (both the Inria and the Université de Bourgogne parts). It run from 2014 till mid-2017. It concerned averaging techniques in orbit transfers around the earth while taking into account many perturbations of the main force (gravity for the earth considered as circular). The objective was to validate numerically and theoretically the approximations made by using averaging, and to propose methods that refine the approximation. It has co-funded the PhD thesis of Jérémy Rouot (defended in October, 2016, also co-funded by Région PACA) and fully funded the postdoc of Florentina Nicolau and 2016 [9], [8] and the postdoc of Lamberto dell'Elce this year.

**MEMPHIS Project-Team**

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

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

Ongoing contract with the society VALOREM.

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

## MISTIS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

**CIFRE PhD with SCHNEIDER (2015-2018).** F. Forbes and S. Girard are the advisors of a CIFRE PhD (T. Rahier) with Schneider Electric. The other advisor is S. Marié from Schneider Electric. The goal is to develop specific data mining techniques able to merge and to take advantage of both structured and unstructured (meta)data collected by a wide variety of Schneider Electric sensors to improve the quality of insights that can be produced. The total financial support for MISTIS is of 165 keuros.

**PhD contract with EDF (2016-2019).** S. Girard is the advisor of a PhD (A. Clément) with 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 was of 140 keuros

**Contract with VALEO.** S. Girard and A. Clément 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 was of 15 keuros.

**Contract with PIXYL** P. Rubini was hired for 18 months for a software valorization task regarding brain MRI segmentation. The financial support for MISTIS was of 63.5keuros

## MODAL Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Florimond Desprez

**Participant:** Guillemette Marot.

Florimond Desprez is a company which breeds plant varieties and produces seeds, spreading its innovations across the different sectors of agriculture. This 2 months contract aimed at selecting candidate markers explaining the relationship between genotypes, organoleptic and nutritional qualities of chicory. It is a joint work with Quentin Grimonprez (InriaTech engineer).

## 8.2. Arcelor-Mittal

**Participants:** Christophe Biernacki, Vincent Vandewalle.

Arcelor-Mittal is a leader company in steel industry. This 11 months contract (which began in 2016) aims at optimizing predictive maintenance from mixed data (continuous, categorical, functional) provided by multiple sensors disseminated in steel production lines. Several thousands of sensors are simultaneously involved in this study, most of them providing functional (chronological) values.

It is a joint work with Quentin Grimonprez and Vincent Kubicki (InriaTech engineers).

## 8.3. Alstom

**Participants:** Christophe Biernacki, Benjamin Guedj, Vincent Vandewalle.

Alstom is a world leader company in integrated transport systems. This 10 months contract aims at optimizing predictive maintenance in rail switches from complex data, in particular chronological ones.

It is a joint work with Etienne Goffinet (InriaTech engineer).

## 8.4. Vallourec

**Participant:** Christophe Biernacki.

Vallourec is a world leader in premium tubular solutions for the energy markets and for other demanding industrial applications. This 9 months contract (which began in 2016) aims at predicting quality of tubular connections from mixed data (continuous, categorical, functional).

It is a joint work with Etienne Goffinet and Vincent Kubicki (InriaTech engineers).

## 8.5. Running Care

**Participant:** Christophe Biernacki.

Running Care is a young company providing sport and medical coaching, and personalized healthy advices, for injury prevention. It is based on a mobile and watch app that collects sports and medical data to make them smart. This 8 months contract aims at predicting injury risks for the runner based on past runs and planned ones. It uses also many other available information that the runner can provide through the app.

It is a joint work with Quentin Grimonprez (InriaTech engineer).

## **MOKAPLAN Project-Team**

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

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

### ***7.1.1. Optimal Transport applied to altimetric data dynamic interpolation***

(S. Legrand V. Duval L. Chizat J-D. Benamou).

This collaboration between CLS and and funded by CNES intends to test on Column of Tropospheric Humidity data Optimal transportation interpolation techniques for balanced and unbalanced data.



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

**NANO-D Project-Team (section vide)**

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

## **NON-A Project-Team**

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

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

Contract with Neotrope (Tourcoing, France), Technologies & Augmented Human UX. Subject: De-correlation of GSR measurements with acceleration, from March 2016 to September 2016, D. Efimov, R. Ushirobira.

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

Project of Autonomous control of clinic table with La Maison Attentive, 2016.

## **8.3. Bilateral Grants with Industry**

Collaboration with Safran Electronics & Defense (Massy-Palaiseau) in the framework of the CIFRE PhD thesis of Guillaume Rance on robust stabilization of gyrostabilized platforms (2014-2018).

## POEMS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

Contract POEMS-DGA

**Participants:** Eric Lunéville, Marc Lenoir, Séphanie Chaillat, Nicolas Kielbasiewicz, Nicolas Salles.

Start : 2015, End : 2018. Administrator : ENSTA.

This contract is in partnership with François Alouges and Matthieu Aussal (CMAP, Ecole Polytechnique) and concerns the improvement of Boundary Element Methods for wave propagation problems.

Contract POEMS-CEA-LIST

**Participants:** Marc Bonnet, Laure Pesudo.

Start : 12/01/2014, End : 11/31/2017. Administrator : CNRS.

This contract is about the coupling between high frequency methods and integral equation

Contract POEMS-EDF

**Participants:** Stéphanie Chaillat, Marc Bonnet, Zouhair Adnani.

Start : 12/01/2014, End : 11/31/2017. Administrator : CNRS.

This contract is about fast solvers to simulate soil-structure interactions.

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

## **RANDOPT Team**

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

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

- CIFRE-DGA with Thales, for the PhD of Konstantinos Varelas (2017—2020)
- contract with Storengy to finance a part of the PhD of Cheikh Touré (2017—2020)

## **RAPSODI Project-Team**

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

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

C. Cancès supervises the PhD Thesis of Nicolas Peton at IFPEN since October 15, 2015. The bilateral contract enters the framework agreement between Inria and IFPEN.



## REALOPT Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Collaboration with EDF on robust maintenance planning

Our project with EDF concerns the optimization of the long term energy production planning, allowing for nuclear power plants maintenance. The challenges are to handle the large-scale instance of a five year planning and to handle the stochastic aspects of the problem: the stochastic variation of the electricity demand, the production capacity and the duration of maintenance period. The key decisions to be optimized are the dates of outages (for maintenance) and the level refuelling that determines the production of the year to come. We previously developed a column generation approach based on extended formulation which enables to solve within a few minutes a deterministic instance of the problem, which is within the time frame of the operational tools currently used by EDF. We now investigate stochastic and robust versions of the problem, where the duration of maintenance operations and the power demand are uncertain. Our approaches shall be evaluated on real life instances within a rolling horizon framework.

## 8.2. Collaboration with ERTUS on phytosanitary treatment planning

In planning winery operations (most importantly phytosanitary treatments on the wine tree) under weather forecast uncertainty, one searches for solutions that remain feasible and “cheap” in case of perturbation in the data. We consider the planning and scheduling of the operations that arise over a one-year horizon. More precisely, the operations to be scheduled include tasks related to soil care, or grape tree care: cutting, line building, thinning out leaves, ..., and chemical treatments. The latter are a main focus of our study since one of the principal goals of better planning is to reduce the amount of chemical treatments by selecting the appropriate products and schemes, but also by spacing out treatments while guarantying a disease free vineyard with some confidence. Each of the scheduled tasks requires its own resource, so the planning also triggers equipment and raw products selection decisions. The objective is to minimize both equipment and product costs augmented by an evaluation of the hazard of chemical product use. The planning should be “robust” to seasonal variations on the proper time frame for scheduling tasks.

## 8.3. Collaboration with St-Gobain Recherche on glass cutting

Through the PhD of Quentin Viaud, we study a hard glass-cutting problem. The objective is to minimize the quantity of trim loss when rectangular pieces are cut from large rectangles. This first study has shown that our methodologies are able to cope with this problem for medium-size instances. Solving the problem with large instances is a scientific challenge that we will address in the a follow-up contract.

## 8.4. Collaboration with SNCF on timetable and rolling stock rotation planning

Our projet with SNCF concerns the optimisation of timetable and rolling stock rotation planning. The railway production planning process combines heterogeneous resources and is usually decomposed into different sequential sub-problems, beginning by line planning, timetabling, rolling stock rotations and crew scheduling. Our goal is to solve the timetable and rolling stock problems in an integrated manner. Given a line planning and service requirement constraints, the problem is to produce a timetable for a set of trains and the objective is to minimize the cost of the railcars used. An originality of our approach is to deal with railcars composed of multiple units, which can be coupled or decoupled at some stations. The PhD thesis of Mohamed Benkirane is funded by this project.

## SELECT Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Contract with NEXTER

**Participants:** Gilles Celeux, Florence Ducros, Patrick Pamphile.

SELECT has a contract with Nexter regarding modeling the reliability of vehicles.

## 7.2. Bilateral Grants with Industry

Benjamin Auder and Jean-Michel Poggi are participants in the grant PGMO-IRSDI, in the *Research Initiative In Industrial Data Science* context, on the subject: Disaggregated Electricity Forecasting using Clustering of Individual Consumers.

**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: Mar. 2018 – Feb. 2021

Abstract: 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, Alessandro Lazaric, Michal Valko.

#### 8.1.2. *OtherLang*

- contract with “OtherLang”; PI: Romaric Gaudel  
Title: Tool to support foreign language practice  
Duration: 2 months

Abstract: OtherLang develops an application to learn a foreign language by reading documents and interacting wit other people. During the time-line of the contract, SequeL brought his knowledge about Recommender Systems which may be used either to recommend documents to users or to recommend users to users.

**Participants:** Romaric Gaudel, Philippe Preux.

#### 8.1.3. *Sidexa*

- contract with “Sidexa”; PI: Jérémie Mary and then Philippe Preux  
Title: vision applied to the segmentation and recognition of car body parts parts  
Duration: 3 months

Abstract: We investigate deep learning to perform car body segmentation. The result being very good, a second contract will follow up this one in 2018.

**Participants:** Jérémie Mary, Philippe Preux.

#### 8.1.4. *Renault*

- contract with “Renault”; PI: Philippe Preux  
Title: State of the art in reinforcement learning regarding autonomous car control and path planning.  
Duration: 3 months (Jan–Mar 2017)

Abstract: This work has consisted in surveying the litterature related to autonomous car control, and reinforcement learning.

**Participants:** Alexis Martin, Odalric Maillard, Philippe Preux.

- contract with Renault; PI: Philippe Preux

Title: Control of an autonomous vehicle

Duration: 3 years (12/2017–11/2020)

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 Maillard, Philippe Preux.

#### 8.1.5. Critéo

- contract with “Criteo”; PI: Philippe Preux

Title: Computational advertizing

Duration: 3 years (12/2017–11/2020)

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

**Participants:** Philippe Preux, Kiewan Villatel.

#### 8.1.6. Orange Labs

- contract with “Orange Labs”; PI: Philippe Preux

Title: Sequential Learning and Decision Making under Partial Monitoring

Duration: Oct. 2014 – Sep. 2017

Abstract: This contract comes along the CIFRE grant on the same topic. In applications such as recommendation systems, or computational advertising, the return collected from the user is partial: (s)he clicks on one item, or no item at all. We study this setting in which only a “partial” information is gathered in particular how to learn to behave optimally in such a setting.

**Participants:** Pratik Gajane, Philippe Preux.

#### 8.1.7. Orange Labs

- contract with “Orange Labs”; PI: Olivier Pietquin

Title: Inter User Transfer in dialogue systems

Duration: 3 years

Abstract: This contract comes along the CIFRE grant on the same topic. The research aims at developing new algorithms to learn fast adaptation strategies for dialogue systems when a new user starts using them while we collected data from previous interactions with other users. Especially, it addresses the cold-start problem encountered when a new user faces the system, before samples can be collected to optimize the interaction strategy.

**Participants:** Merwan Barlier, Nicolas Carrara, Olivier Pietquin.

#### 8.1.8. 55

- contract with “55”; PI: Jérémie Mary

Title: Novel Learning and Exploration-Exploitation Methods for Effective Recommender Systems

Duration: Oct. 2015 – Sep. 2018

Abstract: This contract comes along the CIFRE grant on the same topic. In this Ph.D. thesis we intend to deal with this problem by developing novel and more sophisticated recommendation strategies in which the collection of data and the improvement of the performance are considered as a unique process, where the trade-off between the quality of the data and the performance of the recommendation strategy is optimized over time. This work also consider tensor methods (one layer of the tensor can be the time) with the goal to scale them at RS level.

## **SIERRA Project-Team**

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

## **7.1. 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/>.

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

- A. d’Aspremont: AXA, "mécénat scientifique, chaire Havas-Dauphine", machine learning.
- F. Bach: Gift from Facebook AI Research.

## **SPHINX Project-Team**

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

## **8.1. Bilateral Grants with Industry**

From February 2018, T. Chambrion will be the advisor of Ayoub Lasri for a PhD thesis (CIFRE label pending) on the stabilization of the Mosel river funded by *Voies Navigables de France*. This thesis is part of an international cooperation with BAW (the German counterpart of VNF, based in Karlsruhe) and Universität Stuttgart started in November 2017.

## TAU Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

- **Thales Research & Technology** 2014-2017 (30 kEuros), related to Nacim Belkhir's CIFRE PhD  
Coordinator: Marc Schoenauer  
Participants: Johann Dréo, Pierre Savéant, Nacim Belkhir
- **ESA Tender** 2016-2017 (52 kEuros)  
Coordinator: Bart Boonacker (TNO)  
Participant: Marc Schoenauer, Dejan Tusar
- **Réseau Transport d'Electricité** 2015-2018 (72 kEuros), related to Benjamin Donnot's CIFRE PhD  
Coordinator: Olivier Teytaud (until May 2016), now Isabelle Guyon  
Participants: Benjamin Donnot, Antoine Marot, Marc Schoenauer
- **Therapixel** 2017 (6 mois, 3 kEuros), on the topic of 3D medical image non-rigid registration with neural networks  
Coordinators: Guillaume Charpiat, Olivier Clatz  
Participant: Priyanka Mandikal (master internship)
- **Myndblue**, 2017-2018 (1 an, 50kEuros) related to consulting activities with DMH (Digital for Mental Health).  
Coordinator: Aurélien Decelle  
Participants: all TAU members
- **La Fabrique de l'Industrie** 2017-2018 (1 an, 30kEuros) A COMPLETER (Michèle ?)
- **Renault (POC)** 2017-2018 (125 kEuros), *Clusterisation et optimisation de scenarii pour la validation des véhicules autonomes*  
Coordinator: Marc Schoenauer and Philippe Reynaud (Renault)  
Participants: Guillaume Charpiat, Raphaël Jaiswal (engineer), Marc Schoenauer
- **Renault (CIFRE)** 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: Hiba Hage and Yves Tourbier (Renault)  
Participants: Guillaume Charpiat, Marc Nabhan (PhD), Marc Schoenauer
- **RESTO** 2017 (14k Euros), *REseaux et Simulations : usages Technologiques et Opinions multiples sur les plateformes numériques dans les marchés de la restauration*, funded by Mission Interdisciplinarité of CNRS. Supported the internship of J. Posada.  
Coordinator: Paola Tubaro  
Participants: Philippe Caillou (with partners at Telecom ParisTech and Université Paris-Dauphine).
- **OPLa** 2017-2018, Organizing Platform Labor (27k euros), funded by Force Ouvrière.  
Coordinator: A.A. Casilli (Telecom ParisTech)  
Participants: Paola Tubaro
- **DiPLab** 2017-2018, Digital Platform Labor (24k euros), funded by MSH Paris-Saclay.  
Coordinators: Paola Tubaro (avec A.A. Casilli, Telecom ParisTech)

## **TOSCA Project-Team**

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

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

- M. Deaconu is involved in a bilateral contract with Venathec. She is supervising, with E. Vincent (EPI Multispeech), the Ph.D. thesis of B. Dumortier on the acoustic control of wind farms noise.

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

- 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.
- M. Bossy is the Coordinator of the TER project from the PGMO (FMJH) granted with the SME METIGATE, on the statistical description of coupled regional temperatures. D. Talay also participates to this project.
- M. Bossy is the Coordinator of the SPARE projet at UCA-JEDI on Monte Carlo approaches for the simulation of particles transport in a flow, with EDF and Observatoire de la Côte d'Azur.
- M. Bossy is the Coordinator of the POPART Industrial partnership projet at UCA-JEDI on the modeling of fiber transport in turbulent flow. This partnership is granted by EDF and by UCA, and in collaboration with Observatoire de la Côte d'Azur.



## **TROPICAL Team**

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

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

- Yield management methods applied to the pricing of data traffic in mobile networks. CRE (research contract) with Orange Labs (Orange Labs partner: Mustapha Bouhtou).
- Decentralized mechanisms of operation of power systems: equilibria and efficiency. A collaboration started on this topic at the fall, Nadia Oudjane, Olivier Beaude, and Riadh Zorgati from EDF-labs. This leads to the PhD work of Paulin Jacquot, supervised by Stéphane Gaubert (CIFRE PhD).

## ABS Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts with Industry

In this section, we describe the collaboration between ABS and MS Vision (<http://msvision.eu/>), a company based in the Netherlands. MSVision was created in 2004 and currently involves 20 employees; it is a worldwide leader in delivering tailored hardware solutions to the mass spectrometry community. As detailed below, the collaboration aims at strengthening the offer of the company on the algorithmic and software sides.

This collaboration is funded by the Instituts Carnots (<http://www.instituts-carnot.eu/en>).

### 6.1.1. Context

Protein complexes underlie most biological functions, so that studying such complexes in native conditions (intact molecular species taken in solution) is of paramount importance in biology and medicine. Unfortunately, the two leading experimental techniques to date, X ray crystallography and cryo electron microscopy, involve aggressive sample preparation (sample crystallization and sample freezing in amorphous ice, respectively) which may damage the structures and/or create artifacts. These experimental constraints legitimate the use of mass spectrometry (MS) to study biomolecules and their complexes under native conditions, using electrospray ionization (ESI), a soft ionization technique developed by John Fenn (Nobel prize in chemistry, 2002). MS actually delivers information on the masses of the molecular species studied, from which further information on the stoichiometry, topology and contacts between subunits can be inferred. Thanks to ESI, MS is expected to play a pivotal role in biology to unravel the structure of macromolecular complexes underlying all major biological processes, in medicine and biotechnology to understand the complex patterns of molecules involved in pathways, and also in biotechnologies for quality checks.

### 6.1.2. Specific goals

A mass spectrometer delivers a mass spectrum, i.e. an histogram representing the relative abundance of the ions (ionized proteins or protein complexes in our case), as a function of their mass-to-charge ( $m/z$ ) ratio. Deconvoluting a mass spectrum means transforming it into a human readable mass histogram. Due to the nature of the ESI process (i.e. the inclusion of solvent and various other molecules) and the intrinsic variability of the studied biomolecules in native conditions, the interpretation of such spectra is delicate. Methods currently used are of heuristic nature, failing to satisfactorily handle the aforementioned difficulties. The goal of this collaboration is to develop optimal algorithms and the associated software to fill the critical gap of mass spectra deconvolution. The benefits for the analyst will be twofold, namely time savings, and the identification of previously undetected components. Upon making progress on the deconvolution problem, the collaboration will be expanded on the geometric and topological modeling of large macro-molecular assemblies, a topic to which ABS recently made significant contributions [2], [3].

## **AIRSEA Project-Team**

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

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

Contract with IFPEN (Institut Français du pétrole et des énergies nouvelles), for the supervision of Adrien Hirvoas. Research subject: Sensitivity of a floating offshore wind turbine to uncertain parameters and identification of observable variables for data assimilation.

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 is funded by OQUAIDO.

A 1-year contract with NOVELTIS on the thematic "Développement de démonstrateurs avec AGRIF": see [6.1](#)

A 3-year contract named ALBATROS with Mercator-Ocean on the topic « Interaction océan, vagues, atmosphère à haute résolution ».

**AMIBIO Team (section vide)**

## **ANGE Project-Team**

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

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

A contract has been made (120.000 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.

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).

The ANR project ESTIMAIR includes the SME NUMTECH for a commercial deployment of the project results.

The EIT Digital project Env&You involves the SME NUMTECH and the startup Ambiciti, whose products rely on the results of this European project.

## **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".

J. Thorey's PhD thesis was funded by EDF R&D (CIFRE). The title of PhD thesis was: "Ensemble forecasting using sequential aggregation for photovoltaic power applications".

## ARAMIS Project-Team

## 8. Bilateral Contracts and Grants with Industry

### 8.1. Bilateral Contracts with Industry

#### 8.1.1. *Air-Liquide Medical Systems*

**Participants:** Mario Chavez [Correspondant], Xavier Navarro.

Project title: Real-time characterisation of respiratory states from EEG

Funded in 2014

Amount: 370 K€

Coordinator: Thomas Similowski

Other partners: UPMC, Inserm UMR 1158

Abstract: The project aims at developing a real-time brain computer interface (BCI) for the monitoring of respiratory states from scalp EEG data of healthy volunteers and patients, recorded at the laboratory, hospital ward, operating room or intensive care units.

### 8.2. Bilateral Grants with Industry

#### 8.2.1. *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

Funded 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.

## ASCLEPIOS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. CIFRE PhD Fellowships

#### 7.1.1.1. Neurelec/Oticon Medical

**Participants:** Thomas Demarcy [correspondent], Hervé Delingette, Nicholas Ayache, Dan Gnansia [Oticon Medical].

The work of Thomas Demarcy, *Segmentation and anatomic variability of the cochlea and other temporal bone structures from medical images*, is supported by a PhD fellowship from the Neurelec/Oticon Medical company.

#### 7.1.2. Microsoft Research

Microsoft Research is funding through the Inria-Microsoft joint lab the projects "4D Cardiac MR Images"<sup>0</sup> and "Medilearn"<sup>0</sup> 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.

#### 7.1.3. Spin-off company Therapixel

Therapixel<sup>0</sup> is a spin-off of the Asclepios (Inria Sophia Antipolis) and Parietal (Inria Saclay) project teams founded in 2013. Therapixel makes surgical information systems. It relies on depth sensing, advanced software processing and innovative user interfaces to provide touchless control of the computer. This technology allows for a direct control of the computer, which sterility constraints made impractical in the past. In 2015, Therapixel obtained the CE marking of its product on touchless visualization of medical images.

#### 7.1.4. Spin-off company inHEART

inHEART<sup>0</sup> is a spin-off of the Asclepios 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.

#### 7.1.5. 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

---

<sup>0</sup><http://www.msr-inria.fr/projects/4d-cardiac-mr-images>

<sup>0</sup><http://www.msr-inria.fr/projects/medilearn>

<sup>0</sup><http://www.therapixel.com/>

<sup>0</sup><http://www.inheart.fr/>

## **ATHENA Project-Team**

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

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

- The **Olea Medical** company from La Ciotat (FR) funds 50% of the PhD of Marco Pizzolato, supervised by Rachid Deriche, which is funded by the PACA Region for the remaining 50%.
- The dMRI Library has been transferred to the **Olea Medical** company.
- The **BESA** company (Brain Electrical Source Analysis) from Germany funds 50% of the PhD of Christos Papageorgakis, co-supervised by Maureen Clerc (ATHENA) and Juliette Leblond (APICS), which is funded by the PACA Region for the remaining 50%.
- The **Neurelec company** (Cochlear Implants) supports a CIFRE PhD funding for Kai Dang, supervised by Maureen Clerc.



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

## BIGS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Bilateral Contracts with Industry*

#### 7.1.1.1. *Transgene 1. (2016-2017)*

Participants: A. Gégout-Petit, A. Muller-Gueudin, Y. Shi

Transgene (Euronext: TNG), part of Institut Mérieux, is a publicly traded French biopharmaceutical company focused on discovering and developing targeted immunotherapies for the treatment of cancer and infectious diseases. B. Bastien, head of the biostatistics team appeals to BIGS to select covariates among genomics, proteomics expressions linked to the success of a treatment of the lung cancer. This subject was the purpose of the master thesis of Y. Shi and a paper on the subject is in preparation.

#### 7.1.1.2. *Transgene 2. (2016-2017)*

Participants: T. Bastogne, L. Batista, P. Vallois

Transgene (Euronext: TNG), part of Institut Mérieux, is a publicly traded French biopharmaceutical company focused on discovering and developing targeted immunotherapies for the treatment of cancer and infectious diseases. B. Bastien, head of the biostatistics team appeals to BIGS to model data collected in vivo for growth tumor and to measure the effect of the treatment on the dynamics of the tumor.

#### 7.1.1.3. *SAFRAN Aircraft Engines (2016-2019)*

Participants: R. Azaïs, A. Gégout-Petit, F. Greciet

SAFRAN Aircraft Engines designs and products Aircraft Engines. For the design of pieces, they have to understand mechanism of crack propagation under different conditions. It appeals to BIGS for modeling crack propagation with Piecewise Deterministic Markov Processes (PDMP). It is the subject of F. Greciet PhD, granted by ANRT. F. Greciet presented her work during a Fédération Charles Hermite Journey on November the 23th. She was laureat of "Mathématiques, oxygène du monde numérique" poster challenge [52].

#### 7.1.1.4. *CYBERNANO (2014-2017)*

Participants: T. Bastogne, L. Batista, P. Guyot

Cybernano is a start-up founded in 2013 by one BIGS member: T. Bastogne. Cybernano develops computational services to analyze high-content data in cell biology for applications in oncology, cardiotoxicity and virology. After the end of his PhD (2017), L. Batista became chief technical officer of Cybernano. A EuroStars project proposal was submitted in Sep. 2017 in which Cybernano will be the leader and BIGS a scientific partner (Eurostars is a H2020 programme that supports research-performing small and medium enterprises).

## **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.

## **BIOVISION Team**

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

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

### **8.1.1. ARVIP: Augmented reality for visually impaired people**

Participants: Josselin Gautier, Pierre Kornprobst, Frédéric Dosière [Bosch Visiontec], David Coupé [Bosch Visiontec]

Duration: August 2017 to March 2018

In Biovision, we want to develop new augmented reality systems for low-vision people, to facilitate scene interpretation by enhancing important scene characteristics. Research and investigations are conducted using automotive industry HW solutions, thanks to a partnership with Bosch Visiontec. Our goal is to investigate how such hardware could be used to design efficient vision aid systems. The case-study that we are considering is the one of improving the social interaction which is amongst the first reported needs. We are studying methods to selectively enhance faces in real time, thus allowing low-vision people to better capture faces and emotions of their interlocutors. This work is also conducted in collaboration with Centre hospitalier Pasteur 2 (service d'ophtalmologie, Nice, France) and "27Delvalle" (Centre d'Innovation Santé de la ville de Nice, France) in order to have feedback on our prototype as we develop it.

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

## CAMIN Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

- FUI MMCD (Multifunctions Modular Cockpit Display) [2014-2018] Labels : Pegase, ASTech  
The MMCD project (Multi Functions Modular Cockpit Display) aims at designing a mechatronic architecture that is modular, certifiable and evolutive in terms of embedded GPU. This project will contribute to Avionics 2020 by developing a mock-up of new cockpit display system, allowing easy to manage GPU evolution.  
Our contribution concerns formal design and prototyping of embedded supervisory functions, using the HILECOP methodology and tool.
- collaboration contract with FEETME<sup>0</sup> company.
- collaboration contract with Innopsys<sup>0</sup> company.
- collaboration contract with NEURORESP<sup>0</sup> company (CIFRE PhD thesis).

---

<sup>0</sup><http://www.feetme.fr>

<sup>0</sup><https://www.innopsys.com/en>

<sup>0</sup><http://neuroresp.com/>

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

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



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

## **COFFEE Project-Team**

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

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

- Contract with Andra financing the two years postdoctoral position of Nabil Birgle (april 2016- march 2018) and dealing with domain decomposition algorithms to couple the non-isothermal liquid gas Darcy flow and the free gas flow occurring at the interface between the nuclear waste repository and the ventilation galleries. Supervision Roland Masson from LJAD-Inria and Laurent Trenty from Andra.
- 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.

## **DRACULA Project-Team**

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

## **6.1. Bilateral Contracts with Industry**

The industrial connections of the Dracula team have been made through the "Modeling of the immune response" project. Contacts have been established with both large pharmaceutical companies (Sanofi-Pasteur and Merial) and SMEs (AltraBio and the CosmoTech). The now finished ANR PrediVac project included the two aforementioned SMEs and therefore strengthened the ties between Dracula and its industrial local ecosystem. The same consortium applied to ANR grants on close research topics in 2017. Furthermore, the ties with CosmoTech have been strengthened through a joint CIFRE PhD (A. Bonnafox).

## **6.2. Bilateral Grants with Industry**

- A recent cooperation has been initiated with the start up "Neolys Diagnostics" about radiotherapy effects on healthy cells and tumor cells. A PhD student, Aurélien Canet, has started his doctorate studies in January 2016 paid for one half by the start up and for the other half by the labex Milyon. Aurélien Canet is co-supervised by Larry Bodgi (from Neolys), Nicolas Foray (from Inserm) and Laurent Pujo-Menjouet.
- Celine Vial is scientific responsible of a contract with the European Consortium Eurokin and in collaboration with IFP "Energies nouvelles" on the topic: "Design experiments, sensibility and uncertainty analysis and kriging".

## DYLISS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

**Participants:** Olivier Dameron, Anne Siegel, Méline Wery.

Our software *AskOmics* was considered as relevant by the SANOFI bio-medical company in order to facilitate the integration and the query of the data produced by their scientists. A former Ph.D. of Dyliss who designed the first prototypes of *AskOmics* was recruited by SANOFI. Since then, SANOFI is included in the developer's team of *AskOmics* and a joint Dyliss–SANOFI CIFRE Ph.D. thesis started about the integration of complementary reasoning features to SPARQL queries in Oct. 2017.

## **ERABLE Project-Team**

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

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

ERABLE was awarded a PhD grant by the ANRt together with the Maat Pharma company. The PhD scholarship was granted to Marianne Borderes, who will be co-supervised starting from January 2018 by Marie-France Sagot and Susana Vinga (IST, Lisbon, Portugal) together with Lilia Boucinha from Maat Pharma.

## FLUMINANCE Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Contract CERSAT/IFREMER

**Participants:** Etienne Mémin, Valentin Resseguier.

*duration 39 months.* This partnership between Inria and Ifremer funded the PhD of Valentin Resseguier, which aimed to study image based data assimilation strategies for oceanic models incorporating random uncertainty terms. The goal targeted will consist in deriving appropriate stochastic version of oceanic model and on top of them to devise estimation procedures from noisy data to calibrate the associated subgrid models.

### 8.1.2. Contract inter Carno IFREMER Inria

**Participants:** Etienne Mémin, Thibaut Tronchin.

*duration 36 months.* This contract was centred on the elaboration of an image-based tools for the analysis of the hydraulic load of an immersed body. This project took place within an inter Carnot cooperation between Ifremer and Inria.

### 8.1.3. 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.

### 8.1.4. 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.

### 8.1.5. ANDRA project

**Participants:** Yvan Crenner, Benjamin Delfino, Jean-Raynald de Dreuz, Jocelyne Erhel.

Contract with ANDRA (National Agency for Nuclear Waste)

Duration: three years from November 2015.

Title: reactive transport in fractured porous media

Coordination: Jocelyne Erhel.

Partners: Geosciences Rennes.

**Abstract:** Even in small numbers, fractures must be carefully considered for the geological disposal of radioactive waste. They critically enhance diffusivity, speed up solute transport, extend mixing fronts and, in turn, modify the physicochemical conditions of reactivity around possible storage sites. Numerous studies in various fields have shown that fractures cannot be simply integrated within an equivalent porous medium with a simple enhancement of its petro-physical properties (porosity and permeability). We propose a combined numerical and experimental approach to determine the influence on reactivity of typical fracture patterns found in some radioactive waste applications.

**8.1.6. IFPEN project**

**Participants:** Bastien Hamlat, Jocelyne Erhel.

Contract with IFPEN (Institut Français du Pétrole et Energies Nouvelles)

Duration: three years from October 2016.

Title: Fully implicit Formulations for the Simulation of Multiphase Flow and Reactive Transport

Coordination: Jocelyne Erhel.

Abstract: Modeling multiphase flow in porous media coupled with fluid-rock chemical reactions is essential in order to understand the origin of sub-surface natural resources and optimize their extraction. This project aims to determine optimal strategies to solve the coupled transport and chemical reaction equations describing the physical processes at work in reactive multiphase flow in porous media. Three different formulations show great potential to accurately solve these equations. Two are fully implicit (“Reactive Coats” and “Semi-smooth Newton”) and one is an operator splitting approach. These formulations are still incomplete at the moment. The work will focus on extending the existing formulations to more complex physical phenomena, study their stability, convergence and theoretical equivalence. Another objective is to provide practical solutions to efficiently solve the resulting non-linear systems.

## **GALEN Project-Team**

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

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

Contract with General Electric Healthcare

Project title: Optimization methods for breast tomosynthesis

Duration: 2017-2020

Responsible: J.-C. Pesquet



## GENSCALE Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Processing in memory*

**Participants:** Charles Deltel, Dominique Lavenier.

The UPMEM company is currently developing new memory devices with embedded computing power (<http://www.upmem.com/>). GenScale investigates how bioinformatics algorithms can benefit from these new types of memory (see section New Results).

## 8.2. Bilateral Grants with Industry

### 8.2.1. *Enancio Start-Up*

**Participants:** Jennifer Del Giudice, Stephane Picq, Guillaume Rizk.

After 2 years of development the EnginesOn project has led to the creation of Enancio in August 2017 (<http://www.enancio.fr>). Enancio main focus is to give the biologist all the resources needed to decipher the information held on a biological molecule such as DNA, without worrying about the informatics behind it. The start-up provides a software platform available through the net with analysis workflows that have been conceived and validated by the field experts, solutions to handle massive data, and health data certified computational infrastructure. Simplification, optimization and faster execution of analyses workflows are the main focuses of the company. Enancio workflows uses the GATB-core library developed by GenScale.

### 8.2.2. *Rapsodyn project*

**Participants:** Dominique Lavenier, Claire Lemaitre, Sebastien Letort, Pierre Peterlongo.

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, in collaboration with Biogemma's bioinformatics team, to elaborate advanced tools dedicated to polymorphism detection and analysis.

## IBIS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. BGene

**Participants:** Johannes Geiselmann, Corinne Pinel.

BGene is a start-up company of Université Grenoble Alpes in the field of DNA engineering. BGene proposes efficient and custom-made modifications of bacterial genomes, leaving no scars or antibiotics resistance genes. The company has know-how and expertise at all stages of the development process, including the *in-silico* design of a desired construction, the choice of the appropriate genetic tools, and the delivery of the finished product. Former IBIS-member Caroline Ranquet and Johannes Geiselmann are co-founders of BGene, together with Marie-Gabrielle Jouan (Floralis, Université Grenoble Alpes). For more information on BGene, see <http://www.bgene-genetics.com/>.

## 7.2. Genostar

**Participants:** Hidde de Jong, Michel Page.

Genostar, an Inria start-up created in 2004, provides bioinformatics solutions for the comparative analysis of bacterial genomes, proteomes and metabolomes. Genostar's software suite performs the annotation of sets of genomic sequences, *i.e.*, the identification of the coding sequences and other features, followed by the prediction of the functions of the gene products. The modules which make up the software suite were originally developed within the Genostar consortium and the HELIX project team at Inria Grenoble - Rhône-Alpes. The software suite also includes the modeling and simulation tool GNA developed by members of IBIS. Unfortunately after the retirement of its CEO, former IBIS member François Rechenmann, Genostar ceased its activity.

**LEMON Team (section vide)**

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

## **M3DISIM Project-Team**

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

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

Technical contract with CEA-LIST on coupling strategies between subdomains for transient elastodynamics (8keuros)

Contract with the Sensome startup. Aims: feasibility of the measurement of blood clots mechanical properties. (1.6keuros)

## MAGIQUE-3D Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Contracts with TOTAL

- Depth Imaging Partnership (DIP)  
Period: 2014 May - 2019 April , Management: Inria Bordeaux Sud-Ouest, Amount: 120000 euros/year.
- Approximations hybrides par éléments finis discontinus pour l'élasto-acoustique  
Period: 2016 November - 2018 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros.
- Méthodes d'inversion sismique dans le domaine fréquentiel  
Period: 2014 October - 2017 December , Management: Inria Bordeaux Sud-Ouest, Amount: 180000 euros.
- Portage de méthodes numériques de simulation de phénomènes complexes sur des architectures exascales  
Period: 2016 January - 2017 December , Management: Inria Bordeaux Sud-Ouest, Amount: 150000 euros.
- Utilisation d'images 3D DRP à différentes échelles et résolutions pour vérifier l'applicabilité des problèmes acoustiques  
Period: 2017 November - 2019 October, Management: Inria Bordeaux Sud-Ouest, Amount: 170000 euros.
- Petrophysics in pre-salt carbonate rocks  
Period: 2017 December - 2019 November, Management: Inria Bordeaux Sud-Ouest, Amount: 190000 euros.

## **MAMBA Project-Team**

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

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

**Industrial contract with SANOFI** on the modelling of employees population dynamics and turnover.

**MATHNEURO Team (section vide)**



## MIMESIS Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

MIMESIS has active bilateral collaborations with following industrial partners:

**InSimo:** A startup providing biomedical simulation software which are able to reproduce the behavior of organs, tissues and surgical procedures in a realistic and interactive way. Created in January 2013 as a spin-off forces by former members of team SHACRA (the predecessor of MIMESIS). Currently, we collaborate on simulations of eye surgery as well as on preparation of projects aiming at validation of algorithms and codes of simulation framework SOFA.

**Altran:** A global leader in innovation and high-tech engineering consulting, Altran accompanies supports its clients in the creation and development of their new products and services. We have a common history of successful collaboration via CIFRE Ph.D. thesis of Rosalie Plantefève. A new CIFRE Ph.D. will start on 01/01/2018 focusing on fusion of multisensor data in the context of intra-operative navigation of catheters.

**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.

**Renumics:** A German startup focusing on automation of computer aided engineering (CAE) using artificial intelligence in general and machine learning techniques in particular. In close collaboration with SOFA Consortium, MIMESIS is involved in preparation of projects aiming at validation of SOFA.

**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.

## MNEMOSYNE Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Contract with Algotech*

**Participants:** Frédéric Alexandre, Ikram Chraïbi Kaadoud, Nicolas Rougier, Thierry Viéville.

Algotech is a SME working in the domain of CADD software edition for electrical circuit diagram interpretation and design. Its activity is interesting for our team because they are also interested in the design, by learning, of perception (for diagram identification) and action aspects of loops (for diagram genesis) with the specificity of working at a small scale, considering the variety of items to be manipulated. This is consequently a very interesting benchmark for transferring our bio-inspired models to the domain of classical machine learning.

## **MONC Project-Team**

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

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

- Research contract between Roche and Monc team.

## **MORPHEME Project-Team**

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

## **6.1. Bilateral Contracts with Industry**

General Electric Healthcare: a 36 months (from feb. 2016 to jan. 2019) companion contract for the Cifre thesis of E. Poulain.

Bayer, Lyon: a 6 months (from jan. 2017 to jun. 2017) companion contract for the Master intership of S. Laroui.

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

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

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

## PARIETAL Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Grants with Industry

### 8.1.1. The Wendelin FUI project

The Wendelin project has been granted on December 3rd, 2014. It has been selected at the *Programme d'Investissements d'Avenir (PIA)* that supports "cloud computing et Big Data". It gives visibility and fosters the French technological big data sector, and in particular the scikit-learn library, the NoSQL "NEO" et the decentralized "SlapOS" cloud, three open-source software supported by the Systematic *pôle de compétitivité*.

Scikit-learn is a worldwide reference library for machine learning. Gaël Varoquaux, Olivier Grisel and Alexandre Gramfort have been major players in the design of the library and Scikit-learn has then been supported by the growing scientific Python community. It is currently used by major internet companies as well as dynamic start-ups, including Google, Airbnb, Spotify, Evernote, AWeber, TinyClues; it wins more than half of the data science "Kaggle" competitions. Scikit-learn makes it possible to predict future outcomes given a training data, and thus to optimize company decisions. Almost 1 million euros will be invested to improve the algorithmic core of scikit-learn through the Wendelin project thanks to the Inria, ENS and Institut Mines Télécom teams. In particular, scikit-learn will be extended in order to ease online prediction and to include recent stochastic gradient algorithms.

NEO is the native NoSQL base of the Python language. It was initially designed by Nexedi and is currently used and embedded in the main software of company information systems. More than one million euros will be invested into NEO, so that scikit-learn can process within 10 years (out-of-core) data of 1 exabyte size.

Paris13 university and the Mines Télécom institute will extend the SlapOS distributed mesh cloud to deploy Wendelin in *Big Data as a Service (BDaaS)* mode, to achieve the interoperability between the Grid5000 and Teralab infrastructures and to extend the cloud toward smart sensor systems.

The combination of scikit-learn, NEO and SlapOS will improve the predictive maintenance of industrial plants with two major use cases: connected windmills (GDF SUEZ, Woelfel) and customer satisfaction in car sale systems (MMC Rus). In both cases it is about non-personal, yet profitable big data. The Wendelin project actually demonstrates that Big data can improve infrastructure and everyday-life equipment without intrusive data collection. For more information, please see <http://www.wendelin.io>.

The project partners are:

- Nexedi (leader)
- GDF SUEZ
- Abilian
- 2ndQuadrant
- Institut Mines Télécom
- Inria
- Université Paris 13



**PLEIADE Team (section vide)**

## REO Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Air Liquide Santé International*

**Participants:** Céline Grandmont, Nicolas Pozin, Irene Vignon Clementel.

CIFRE convention and contract with Air Liquide Santé International (March 2014 - December 2017) in the context of the ANRT on “Multiscale lung ventilation modeling in health and disease”, for the PhD thesis of Nicolas Pozin.

### 8.1.2. *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.

### 8.1.3. *Kephalios & 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 Kephalios, 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 Kephalios and Epygon on the modeling and simulation of two medical devices for mitral valve repair.

### 8.1.4. *Instem/NOTOCORD*

**Participants:** Muriel Boulakia, Damiano Lombardi, Jean-Frédéric Gerbeau, Fabien Raphel, Eliott Tixier.

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).

## **SERENA Project-Team**

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

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

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

One contract with **CEA** accompanying the PhD thesis of Frédéric Marazzato.

One contract with **ANDRA** accompanying the PhD thesis of Sarah Ali Hassan (ended, Ph.D. defended in June 2017).

One contract with **IFP Energies Nouvelles**, in the framework of the **Inria–IFP Energies Nouvelles** “contrat cadre”.

Three-parts contract Inria–**EDF–Sciworks Technologies** (from April 2017) on “Form-L for the formalization of constraints of complex systems”.

## SERPICO Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Contract with Innopsys: Tissue microarrays (TMA) image analysis*

**Participants:** Charles Kervrann.

**Collaborators:** Vincent Paveau and Cyril Cauchois (Innopsys company).

A three-year contract has been established with Innopsys in 2013 to support the PhD thesis of Hoai-Nam Nguyen. The objective was to investigate and develop methods and algorithms dedicated to fluorescence images acquired by scanners and devices designed by the company. In this project, we focused on localization and segmentation of fluorescence tissue microarrays (TMA) cores in very large 2D images, de-arraying of digital images and correction of grid deformation adapted to devices, correction of scanning artifacts to improve image reconstruction and deconvolution of fluorescence TMA images. The algorithms are currently embedded into software and hardware products designed by Innopsys.

### 8.1.2. *Contract (CIFRE) with Technicolor: Semantically meaningful motion descriptors for video understanding*

**Participants:** Juan Manuel Perez Rua, Patrick Bouthemy.

**Collaborators:** Tomas Crivelli and Patrick Pérez (Technicolor).

A three-year contract has been established with Technicolor in January 2015 for a CIFRE grant supporting the PhD thesis of Juan Manuel Pérez Rúa. The purpose was to investigate new methods for extracting meaningful mid-level motion-related descriptors that may help for the semantic discovery of the content. First, we addressed the occlusion detection problem and proposed a novel approach where occlusion is formulated in terms of visual reconstruction. Contrary to the usual approaches, the proposed alternative does not critically depend on a pre-computed, dense displacement field, while being shown to be more effective. Second, we developed two hierarchical motion segmentation methods involving a compositional motion representation. The first one follows a frame-based labeling approach which amounts to minimizing a global energy function. The second one is trajectory-based and relies on tree-structured learning and sparse coding.

### 8.1.3. *Contract with OBSYS: microscope set-up control and inverse problems in microscopy*

**Participants:** Giovanni Petrazzuoli, Charles Kervrann.

**Collaborators:** Charles Gudeudry (OBSYS).

A two-year contract was established with OBSYS in 2016 for hiring an expert-engineer (12 months). The objective is to investigate and develop software for the control of a microscope set-up and the analysis of fluorescence images. Fast and robust algorithms have been especially developed to improve image reconstruction of 3D-TIRF microscope images. The algorithms will be embedded into platforms and devices designed by OBSYS. Giovanni Petrazzuoli has been hired in August 2017 on a full-time R&D engineer position in OBSYS (CDI). The collaboration with Inria will be pursued in 2018.

## 8.2. Bilateral grants with industry

### 8.2.1. *Fourmentin-Guilbert Foundation: Macromolecule detection in cryo-electron tomograms*

**Participants:** Emmanuel Moebel, Charles Kervrann.

**Collaborator:** Damien Larivière (Fourmentin-Guilbert Foundation).

A three-year contract was established with Fondation Fourmentin-Guilbert to partly support the PhD thesis of Emmanuel Moebel. The Fondation Fourmentin-Guilbert strives for building a virtual *E. coli* bacteria. Information about the position of macromolecules within the cell is necessary to achieve such a 3D molecularly-detailed model. The Fondation Fourmentin-Guilbert supports cutting-edge *in-situ* cryo-electron tomography combined with image processing at the Max-Planck Institute of Biochemistry to map the spatial distribution of the ribosomes, and obtain structural information on the complexes they form *in-situ* with cofactors and other ribosomes. The objective of the project is to explore novel methods from the field of 3D shape retrieval for identifying and counting macromolecules within a tomogram. This project is also supported by Région Bretagne.

## **SISTM Project-Team**

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

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

Implication in research for the development of vaccine has lead to a direct contracts with industry such Iliad Biotechnologies. This contract had been signed for the BPZE-1 pertussis vaccine trial. This study evaluates the safety and immunogenicity of a higher dose formulation of a new live attenuated vaccine, BPZE1, intended to prevent *Bordetella pertussis* nasopharyngeal colonization and pertussis disease, and investigates whether higher doses of BPZE1 induce the live vaccine to colonize subjects' nasopharynx. The study is a Phase Ib (high dose), single centre, dose-escalating, placebo-controlled study of the live attenuated *B. pertussis* strain BPZE1 given as a single intranasal dose to healthy adult volunteer.

## **8.2. Bilateral 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 BPZE-1 pertussis vaccine trial , which is presented in Section 'Bilateral Contracts with Industry', leads to collaboration with Iliad Biotechnologies.
- The Prevac trial vaccine trial leads to collaboration 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 rVSV $\Delta$ G-ZEBOV-GP (rVSV) vaccine with or without boosting, or placebo.

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

**TAPDANCE Team (section vide)**



## **TONUS Team**

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

## **8.1. Bilateral Grants with Industry**

We are involved in the PhD direction of Lucie Quibel in collaboration with EDF Chatou (CIFRE support). The objective is to design new Equations Of States (EOS) for the simulation of multiphase flows. The EOS cannot 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.

**VIRTUAL PLANTS Project-Team (section vide)**

## **VISAGES Project-Team**

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

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

### **8.1.1. Siemens**

In the context of the Neurinfo imaging platform, a master research agreement between Siemens SAS - Healthcare and University of Rennes 1 was signed in October 2011 for 5 years and renewed in 2016. This contract defines the terms of the collaboration between Siemens, Visages and the Neurinfo platform. From 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. Siemens currently provides research resources through the funding of a PhD student (Cédric Meurée: CIFRE Inria / Siemens grant).

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

The PhD of Cédric Meurée is funded by Siemens Healthineers under a CIFRE grant.

## **XPOP Project-Team**

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

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

Contract with Dassault Systèmes

## **AGORA Team**

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

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

- We have contracted bilateral cooperation with Rtone, an SME focusing on the connected objects area. This collaboration is associated with the CIFRE PhD grant for Alexis Duque, on the subject of Visible Light Communication.
- We have contracted bilateral cooperation with industrial and academic partners in the context of the PSPC Fed4PMR project (2015-2018). 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 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. The PhD thesis work of Alexis Duque and Amjed Belkhiri are also contributing in this structure.
- 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.

## **ALPINES Project-Team**

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

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

- Contract with Total, February 2015 - February 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 - February 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.

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

## ASCOLA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

**Participants:** Adrien Lebre [Contact point], Ronan-Alexandre Cherrueau, Alexandre Van Kempen.

During 2017, we agreed with Orange Labs (Lannion) to conduct a dedicated study on the evaluation of AMQP message bus alternatives within the OpenStack ecosystem. This bilateral contract (“Contrat de Recherche Externalisé”) officially started in Sept 2017 for one year. With the allocated budget ( 100K), we hired a new research engineer, Alexandre Van Kempen. Alexandre Van Kempen works with Ronan-Alexandre Cherrueau (Temporary Research Engineer, hired in the context of the MERCURY InriHub) and Matthieu Simonin (Permanent Research Engineer from the Rennes Bretagne Atlantique Center) on conducting this analysis. In addition to extending the EnOS framework previously presented, they are performing several experiments with the support of the OpenStack open-source community (in particular RedHat). The goal of the study is to identify major drawbacks of the default RabbitMQ solution with respect to the Fog/Edge requirements and evaluate whether some alternatives are available in the open-source ecosystem.



## AVALON Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Grants with Industry

### 7.1.1. IFPEN

We have a collaboration with IFPEN (<http://ifpenouvelles.com/>). IFPEN develops numerical codes to solve PDE with specific adaption of the preconditioning step to fit the requirement of their problems. With a PhD student (Adrien Roussel) we are studying the parallel implementation of multi-level decomposition domains on many-core architecture and GPGPU.

## COAST Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts with Industry

### 6.1.1. *Industrial funding Groupe Open (2016–2019)*

Groupe Open is a leading french company specialised in digital services and operations. The goal of the project is to propose an industrial composition model for APIs that takes into account the new constraints imposed by this new way to distribute and operate software. It will be based on a formal API contract along with trust and reputation attributes in order to allow consumers to anticipate risks regarding the quality and the safety of services. A PhD student is under recruitment for this project. Coast funding : 237,000 €

## 6.2. Bilateral Grants with Industry

### 6.2.1. *CIFRE Grant with Bonitasoft*

**Participants:** François Charoy, Samir Youcef, Guillaume Rosinosky.

Bonitasoft is a leading software company in the domain of open source Business Process Management Systems. The objective of this grant is to help Bonitasoft to support effective elastic BPM operation in the Cloud by leveraging the business knowledge, the process models and the execution history of process instances and correlate them with cloud resource consumption. Guillaume Rosinosky has been recruited as a PhD Student to work on this project. We will define models that will be validated based on a detailed analysis of existing use cases that we have started to collect from Bonitasoft and its clients.

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

## CTRL-A Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

Our cooperation with CEA (an EPIC, industrial and commercial public institution) concerns the LETI/LIST DACLE laboratory at Grenoble Minatéc; it is bilateral, currently involving the CEA PhD grant of Adja Sylla, to work with F. Pacull and M. Louvel on high-level programming on top of a rule-based middleware (See Sections 6.1.3 and 6.2.2.1 ).

## 7.2. Bilateral Grants with Industry

### 7.2.1. Orange

We have a cooperation with Orange labs, around a CIFRE PhD grant, on the topic of autonomic device management (see Section 6.2.2.2 ). This activity is part of the Inria/Orange joint laboratory.

### 7.2.2. Nokia / Bell labs

We are starting a research action with Nokia / Bell labs, around a PhD, co-advised with project-team Dyonisos at Inria Rennes, on the topic of the integration of FPGA-based accelerators in network nodes, and their reconfiguration management in coordination with higher level Software Defined Networks management. This activity is part of the Inria/ Nokia / Bell labs joint laboratory.

## DANTE Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *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.

## 8.2. Bilateral Grants with Industry

### 8.2.1. *Orange R&D*

**Participant:** Isabelle Guerin Lassous.

A contract has been signed between Inria and France Télécom for the PhD supervision of Laurent Reynaud. The PhD thesis subject concerns mobility strategies for fault resilience and energy conservation in wireless networks.

## **DATAMOVE Project-Team**

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

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

- **BULL-ATOS SE (2016-2019)**. Two PhD grants (Michael Mercier and Adrien Faure). Job and resource management algorithms.
- **CEA DAM (2016-2018)**. PhD grant support contract (PhD of Estelle Dirand, funded by CEA). In situ analysis for Molecular Simulations.

## DIANA Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

We have signed a bilateral contract for one year with Safran in order to build a network simulator specialised for aeronautical networks.

We are involved in an ADR "Rethinking the Network: Virtualizing Network Functions, from Middleboxes to Applications" with Nokia Bell Labs. The idea is to work on Unified control plane for fast NFV deployment.

## 7.2. Bilateral Grants with Industry

The ANSWER project is leaded 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. student to work 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 including a PhD thesis supervision (PhD of Corentin Hardy), done with Technicolor. The starting point of this thesis is 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.

## **8.2. Cifre contract on Throughput Prediction in Mobile Networks**

**Participants:** Yann Busnel

This is a Cifre contract (2015-2018) including a PhD thesis supervision (PhD of Alassane Samba), done with Orange, on cooperation in statistical approaches for the prediction of throughput without history. Throughput has a strong impact on user experience in cellular networks. The ability to predict the throughput of a connection, before it starts, brings new possibilities, particularly to Internet service providers. They could adapt contents to the quality of service really reachable by users, in order to enhance their experience.

## **8.3. Cifre contract on Mobile SDN architecture**

**Participants:** Yassine Hadjadj-Aoul, César Viho

This is a Cifre contract (2015-2018) including a PhD thesis supervision (PhD of Imad Alawe), done with TDF, on the proposition of a scalable SDN-based mobile network architectures for the future 5G network.

## **8.4. Cifre contract on Personalization for Cognitive Autonomic Networks in 5G**

**Participants:** César Viho

This is a Cifre contract (2017-2019) including a PhD thesis supervision (PhD of Illyne 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.

## **8.5. Bilateral Contract with Industry: ALSTOM-Inria Common Lab**

**Participants:** Bruno Tuffin, Gerardo Rubino

Bruno Tuffin is the co-director of ALSTOM-Inria common Lab.

The group currently manages a project with ALSTOM on system availability simulation taking into account logistic constraints. Current ALSTOM Transport and Power contracts, especially service-level agreements, impose stringent system availability objectives. Non-adherence to the required performance levels often leads to penalties, and it is therefore critical to assess the corresponding risks already at a tender stage. The challenge is to achieve accurate results in a reasonable amount of time. Monte Carlo simulation provides estimates of the quantities it is desired to predict (e.g., availability). Since we deal with rare events, variance reduction techniques, specifically Importance Sampling (IS) here, is used. The goal of the project is to establish the feasibility of IS for solving problems relevant to ALSTOM and to develop the corresponding mathematical tools.



## **8.6. Bilateral Contract with Industry: ADR Nokia Bell Labs**

**Participants:** Yassine Hadjadj-Aoul, Gerardo Rubino

Gerardo Rubino is the coordinator of the reasearch action, named “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.

## **DIVERSE Project-Team**

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

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

### **8.1.1. 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.

### **8.1.2. One Shot Software (OSS)**

- 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.

## **DYOGENE Project-Team**

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

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

### **8.1.1. CRE with Orange**

One year contract titled “Scheduling effect on the distribution of QoS over cells in 4G wireless cellular networks” between Inria and Orange Labs have been realized in 2017. It is a part of the long-term collaboration between TREC/DYOGENE, represented by B. Blaszczyzyn and Orange Labs, represented by M. K. Karray, for the development of analytic tools for the QoS evaluation and dimensioning of operator cellular networks. The developed solutions are implemented in Orange dimensioning toolbox *CapRadio* 6.2.1. Antoine Brochard was hired by Inria as a research engineer thanks to this contract.

### **8.1.2. 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. It aims 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.

### **8.1.3. Contract with the Ministry of Defense**

The contract supports a PhD student Alexandre Hollocou hired in 2015, co-advised by M. Lelarge.

### **8.1.4. 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.

### **8.1.5. CIFRE with Orange**

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

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

### **8.2.1. Google Tides**

Ana Busic and Sean Meyn received jointly in 2015 a Google Faculty Research Award for their research on Distributed Control for Renewable Integration in Smart Communities. The corresponding grant allowed us to cover some part of the scholarship of the PhD student **Sebastien Samain**. in 2017.

## EVA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. CNES contract

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

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

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:

- Avoiding collisions on shared slots: see the PEMWN 2017 conference.
- Building an IEEE 802.15.4e TSCH network: see the EUCASS 2017 publication.
- Increasing the reliability of an IEEE 802.15.4e TSCH network: see the NCA 2017 publication.
- Scheduling transmissions in an IEEE 802.15.4e TSCH network: see the VTC-Fall 2017 publication.

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

## **FUN Project-Team**

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

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

- Evolution

**Participants:** Gabriele Sabatino, Nathalie Mitton [correspondant].

This collaboration aims to set up a full RFID system on the basis of AspireRFID middleware and pre-existing RFID modules issued from FUN research in the Evolution company facility and to integrate them with their IS.

## **GANG Project-Team**

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

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

### **7.1.1. *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 Nidhi Hegde. An ADR (joint research action) is dedicated to content centric networks and forwarding information verification. The PhD thesis of Leonardo Linguaglossa was funded by this contract.

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

## **HIEPACS Project-Team**

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

## **8.1. Bilateral Grants with Industry**

Airbus Group Innovations research and development contract:

- Design and implementation of linear algebra kernel for FEM-BEM coupling (A. Falco (PhD); Emmanuel Agullo, Luc Giraud, Guillaume Sylvand).
- Design and implementation of FMM and block Krylov solver for BEM applications. The HiBOX project is led by the SME IMACS and funded by the DGA Rapid programme (C. Piacibello (Engineer), Olivier Coulaud, Luc Giraud).



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

## INFINE Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

1. Participation to Microsoft Research & Inria Joint Centre, which funds two PhD students (Lennart Gulikers and Remi Varloot).
2. Fujitsu has funded further development of RIOT and sponsored the RIOT Summit 2017.
3. Cisco Systems Silicon Valley has sponsored the RIOT Summit 2017.
4. In the framework of the joint research lab between Nokia Bell Labs and Inria, we participate in the ADR (action de recherche) Network Information Theory.

## 7.2. GranData

- Participants: Aline Carneiro Viana, Guangshuo Chen, Adriano Di Luzio

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. Its products integrates and analyzes diverse data traces (e.g., telco, social media, or mobile data) to generate behavioral insights and deliver targeted mobile marketing. Part of the thesis of Eduardo Mucelli analysis data traffic using telco traces provided by GranDats. While this collaboration allow us collaborating with machine learning experts, GranData has the opportunity to get our expertise in mobility analysis.

## KERDATA Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Huawei: HIRP Low-Latency Storage for Stream Data (2016–2017)*

**Participants:** Alexandru Costan, Ovidiu-Cristian Marcu, Gabriel Antoniu.

The goal of this project is to explore the plausible paths towards a dedicated storage solution for low-latency stream storage. Such a solution should provide on the one hand traditional storage functionality and on the other hand stream-like performance (i.e., low-latency I/O access to items and ranges of items).

We have investigated the main requirements and challenges, evaluated the different design choices (e.g., a standalone component vs. an extension of an existing Big Data solution like HDFS) and proposed a new converged architecture for smart storage.

### 7.1.2. *Total: In situ Visualization with Damaris (2017-2018).*

**Participants:** Hadi Salimi, Matthieu Dorier, Gabriel Antoniu, Luc Bougé.

The goal of this expertise contract is to 1) disseminate the usage of Damaris for engineers at Total; 2) to realize a feasibility study for the usage of Damaris for in situ analysis of data for Total's HPC simulations.

## **MADYNES Team**

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

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

- Xilopix (Epinal, France):
  - Pay-per-use contract for the use of Grid'5000
  - Support contract for their use of Grid'5000 (define experimental requirements and plans)

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

- CIFRE, Thales TRT (Paris, France):
  - CIFRE PhD (Florian Greff, supervised by Ye-Qiong Song and Laurent Ciarletta)
  - Dynamic reconfiguration and graceful degradation of distributed real-time applications over mesh networks
- CIFRE, Thales (Palaiseau, France):
  - CIFRE PhD (Pierre-Olivier Brissaud, supervised by Isabelle Chrisment and Jérôme François)
  - Anomaly detection in encrypted network traffic
- CIFRE, Orange Labs (Issy-Les-Moulineaux, France):
  - CIFRE PhD (Maxime Compastie, supervised by Olivier Festor and Rémi Badonnel)
  - Software-Defined Security for Distributed Cloud Infrastructures
- CIFRE, Orange Labs (Issy-Les-Moulineaux, France):
  - CIFRE PhD (Paul Chaignon, supervised by Olivier Festor and Jérôme François)
  - Monitoring of Software-Defined Networks
- CIFRE, Xilopix (Epinal, France):
  - CIFRE PhD (Abdulqawi Saif, supervised by Ye-Qiong Song and Lucas Nussbaum)
  - Open Science for the scalability of a new generation search technology
- CIFRE, Cynapsys Technologies (Paris, France):
  - CIFRE PhD (Haftay Gebreslasie Abreha, supervised by Michael Rusinowitch, Adel Bouhoula and Abdelkader Lahmadi)
  - Compressed and Verifiable Filtering Rules in Software-defined Networking

**MIMOVE Team**

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

### **8.1. Bilateral Grants with Industry**

“Monitoring and diagnosis of Internet QoE”, Google Faculty Award to R. Teixeira (Inria) and D. Choffnes (Northeastern University), 2017.

## MYRIADS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. *Technicolor (2016-2017)*

**Participant:** Guillaume Pierre.

Our collaboration with Technicolor has focused on the design of a scalable and elastic virtual customer premises equipment based on Network Function Virtualization, Software-Defined Networking and Cloud technologies. In 2017 we completed the system design and started implementing the system. The collaboration completed successfully in June 2017. However, the vCPE project within which this collaboration took place was unfortunately interrupted by Technicolor before we could write a paper about this work.

## 8.2. Bilateral Grants with Industry

### 8.2.1. *Thales Research and Technology (2016-2018)*

**Participants:** Baptiste Goupille-Lescar, Christine Morin, Nikos Parlavantzas.

Our collaboration with Thales Research and Technology focuses on the development of distributed Cyber-Physical Systems, such as those developed by Thales to monitor and react to changing physical environments. These systems need to be highly adaptable in order to cope with the dynamism and diversity of their operating environments. Notably, they require distributed, parallel architectures that support dynamic sets of applications, not known in advance, while providing strong QoS guarantees. The objective of this collaboration is to explore adaptive resource management mechanisms for such systems that can adapt to changes in the requirements and in the availability of resources. This contract funds Baptiste Goupille-Lescar's PhD grant.

### 8.2.2. *Nokia (2015-2018)*

**Participant:** Christine Morin.

Together with CIDRE Inria project-team we are involved in a collaboration with Nokia on security policy adaptation driven by risk evaluation in modern communication infrastructures. To address the need for efficient security supervision mechanisms, approaches such as attack graphs generation, coupled to a risk-based assessment have been used to provide an insight into a system's threat exposure. In comparison to static infrastructures, clouds exhibit a dynamic nature and are exposed to new attack scenarios due to virtualization. The goal of this collaboration is thus to revisit existing methods in the context of clouds. This contract funds Pernelle Mensah's PhD grant. Pernelle is a member of CIDRE project-team.

## 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 six ADRs (Action de Recherche/Research Action) in its second phase (starting October 2012). NEO members participate in one ADR (see §8.1.1 );
- Inria-Orange Labs joint laboratory;
- Inria-ALSTOM joint laboratory: the joint laboratory consists of four projects. NEO members participated in project P11.

### 8.1.1. ADR “Network Science” (June 2013 – March 2017)

**Participants:** Konstantin Avrachenkov [coordinator], Giovanni Neglia.

- Contractor: Nokia Bell Labs (<http://www.bell-labs.com>)
- Collaborators: Philippe Jacquet (coordinator), Alonso Silva.

“Network Science” aims at understanding the structural properties and the dynamics of various kind of large scale, possibly dynamic, networks in telecommunication (e.g., the Internet, the web graph, peer-to-peer networks), social science (e.g., community of interest, advertisement, recommendation systems), bibliometrics (e.g., citations, co-authors), biology (e.g., spread of an epidemic, protein-protein interactions), and physics. The complex networks encountered in these areas share common properties such as power law degree distribution, small average distances, community structure, etc. Many general questions/applications (e.g., community detection, epidemic spreading, search, anomaly detection) are common in various disciplines and are being analyzed in this ADR “Network Science”. In particular, in the framework of this ADR we were interested in efficient network sampling. Related publication: [20]

## 8.2. Bilateral Grants with Industry

### 8.2.1. 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 and Lorenzo Maggi

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 is 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.

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



## **POLARIS Team**

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

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

- ULTRON, bilateral contract with Huawei over 18 months, supporting two postdoctoral researchers, Amélie Heliou and Luigi Vigneri.
- Inria/Orange Labs Laboratory. Polaris is involved in this partnership with Orange Labs by supervising two PhD students members of this common laboratory: Bruno Donnassolo (supervised by Arnaud Legrand, Panayotis Mertikopoulos, and Ilhem Fajjari) and Umar OzeerX (supervised by Jean-Marc Vincent and Gwenn Salaün).
- Cifre contract with Schneider Electric. The PhD thesis of Benoit Vinot (supervised by Nicolas Gast and Florent Cadoux (G2Elab)) is supported by this collaboration.
- A common laboratory between Inria and the Alcatel Lucent-Bell Labs was created in early 2008 and consists on three research groups (ADR). POLARIS leads the ADR on self-optimizing networks (SELFNET). The researchers involved in this project are Bruno Gaujal and Panayotis Mertikopoulos.

## **RAP2 Team**

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

## **5.1. Bilateral Contracts with Industry**

- Contrat de recherche externalisé avec ORANGE SA "Scheduling Global OS". Duration three years 2014-2017.
- PhD grant CJS (Contrat Jeune Scientifique) Frontières du vivant of INRA for Renaud Dessalles.
- PhD grant from Fondation Sciences Mathématiques de Paris for Wen Sun.
- PhD grant from Brazilian Government for Guilherme Thompson.
- CELTIC+ Contract "SENDATE".

## **REGAL Project-Team**

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

## **6.1. Bilateral Contracts with Industry**

Regal has two CIFRE contracts with Scality SA:

- Vinh Tao is advised by Marc Shapiro and Vianney Rancurel. He works on highly available geo-replicated file systems, building on CRDT technology. He defended his thesis in December 2017.
- Dimitrios Vasilas is advised by Marc Shapiro and Brad King. He works on secondary indexing in large-scale storage systems under weak consistency.

Regal 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.

Regal has one contract 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.

## RMOD Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. BlockChain

Participants: Henrique Rocha, Marcus Denker, Stéphane Ducasse  
From 2016, ongoing.

We started a new collaboration with a local startup (UTOCAT) about tools and languages in the context of Blockchain systems. The collaboration started with a 2 month exploration phase involving an engineer at Inria Tech. A postdoc started in 2017.

### 8.1.2. Pharo Consortium

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

The Pharo Consortium was founded in 2012 and is growing constantly. By the end 2017, it has 27 company members, 14 academic partners. Inria supports the consortium with one full time engineer starting in 2011. In 2018, the Pharo Consortium will join InriaSoft.

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

## 8.2. Bilateral Grants with Industry

### 8.2.1. Worldline CIFRE

Participants: Vincent Blondeau, Anne Etien, Nicolas Anquetil  
From 2014 to 2017.

We are working on improving the testing behavior of the developers.

The PhD started in October 2014 and finished in 2017: Vincent Blondeau, *Test Selection Practices in a Large IT Company*, CIFRE WorldLine, November 8th, University Lille 1 (France),

### 8.2.2. Thales CIFRE

Participants: Brice Govin, Anne Etien, Nicolas Anquetil, Stéphane Ducasse  
From 2015, ongoing.

We are working on large industrial project rearchitecturization. PhD in progress: Brice Govin, *Support to implement a rejuvenated software architecture in legacy software*. CIFRE Thale started Jan 2015.

### 8.2.3. Remodularization of Architecture

Participants: Anne Etien, Nicolas Anquetil, Stéphane Ducasse  
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 JS since GWT will not be backward supported anymore in the next versions. An internship and a PhD CIFRE thesis will successively start in 2018.

## ROMA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. MUMPS Consortium

In 2017, in the context of the MUMPS consortium (<http://mumps-consortium.org>), we worked in close collaboration with Toulouse INP to:

- sign or renew membership contracts with EDF, Altair, Michelin, LSTC, FFT-MSc, and with the Lawrence Berkeley National Laboratory, on top of the ongoing contracts with ESI-Group, Safran, Siemens and Total,
- organize point-to-point meetings with several members,
- provide technical support and scientific advice to members,
- provide experimental releases to members in advance,
- organize the third consortium committee meeting, at Altair (Grenoble).

Three engineers have been funded by the membership fees in 2017, for software engineering and software development, performance study and tuning, business development and management of the consortium. Half a year of a PhD student was funded by the membership fees (see Section 9.1 ). On top of their membership, an additional contract was signed with Michelin to provide a new functionality and study how to best exploit MUMPS recent features in their computing environment.

## 8.2. The XtremLogic Start-Up

XTREMLOGIC is a spin-off of Inria founded 6 years ago by Alexandru Plesco and Christophe Alias.

XTREMLOGIC leverages the results obtained in both HPC and polyhedral compilation communities to synthesize energy-efficient circuits for FPGA. The circuits commercialized by XTREMLOGIC target markets including HPC, data centers and artificial intelligence. The compiler technology transferred to XTREMLOGIC is the result of a tight collaboration between Christophe Alias and Alexandru Plesco.

XTREMLOGIC won several awards and grants: Rhône Développement Initiative 2015 (loan), “concours émergence OSEO 2013” at Banque Publique d’Investissement (grant), “most promising start-up award” at SAME 2013 (award), “lean Startup award” at Startup Weekend Lyon 2012 (award), “excel&rate award 2012” from Crealys incubation center (award).

## **SOCRATE Project-Team**

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

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

### **7.1.1. Research Contract with Orange Labs (2015-2017)**

The goal of this project “PERformances Théoriques des réseaux cellulaires pour la 5G” No. F05151 (50KEuro) is to develop a theoretical approach allowing to study the energy efficiency spectral efficiency tradeoff for 5G networks, by revisiting information theory for dense networks and short packets transmissions.

### **7.1.2. Research Contract with Bosch (2016-2017)**

This contract between Bosch and two project-teams (AriC and Socrate) focusses on the evolution of high-performance embedded controllers.

### **7.1.3. Research Contract with Sigfox (2015-2017)**

A collaboration with Sigfox to work on extension of SigFox network to multi-base station case: cifre grant.

### **7.1.4. Research Contract with Atlantic**

Socrate has a collaborative contract with Atlantic, around wireless communications in HVAC systems.

## SPIRALS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. ip-label

**Participant:** Romain Rouvoy [correspondant].

A software exploitation license of the APISENSE<sup>®</sup> 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. Scalair

**Participants:** Yahya Al-Dhuraibi, Philippe Merle [correspondant].

This collaboration (2015–18) aims at proposing a framework to deal with elasticity in cloud computing environments. This framework must cover all kinds of resources, IaaS, PaaS, SaaS, must provide a solution for interoperability between different clouds and virtualization technologies, and must enable the specification and composition of reactive and predictive strategies.

This collaboration is conducted in the context of the ongoing PhD thesis of Yahya Al-Dhuraibi.

## 8.3. Davidson

**Participants:** Romain Rouvoy [correspondant], 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 will start in January 2018 in the context of this collaboration.

## 8.4. Orange Labs

**Participants:** Philippe Merle [correspondant], Lionel Seinturier.

This collaboration (2017–18) aims at defining a computational model for software infrastructures layered on top of virtualized and interconnected cloud resources. This computational model will provide application programming and management facilities to distributed applications and services. This computational model will define a pivot model that will enable the interoperability of various existing and future standards for cloud systems such as OCCI and TOSCA. This pivot model will be 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 [73], on cloud systems [67], and on the Alloy specification language [66].

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

## **STORM Project-Team**

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

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

- HiBOX project, with Airbus and IMACS (2013-2017).



## **TACOMA Team**

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

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

**Project:** SIMHet

**Partner:** YoGoKo

**Starting:** Nov 2015; **Ending :** October 2018

**Contact:** JM Bonnin

**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.

## **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. CEA**

CEA is funding the PhD thesis of Hugo Taboada on specialized thread management in the context of multi programming models, and the PhD thesis of Rémi Barat on multi-criteria graph partitioning.

### **8.1.3. Bull/Atos**

Bull/ATOS is granting the CIFRE PhD thesis on Nicolas Denoyelle on advanced memory hierarchies and new topologies.

### **8.1.4. EDF**

EDF is granting the CIFRE PhD thesis of Benjamin Lorendeau on new programming models and optimization of Code Saturn.

## **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. More precisely, our goal is to develop optimizations for a software TDMA hypervisor developed by Thales that provides full time-isolation of tasks. The PhD of Cédric Courtaud is supported by a CIFRE fellowship with Thales Research.
- OSADL, 2016-2017, development of the Prequel patch query language, 20 000 euros. OSADL is an organization headquartered in Germany that promotes and supports the use of open source software in the automation and machine industry. The project is in the context of the OSADL project SIL2LinuxMP bringing together various companies in automotive and embedded systems with the goal of developing methodologies for certifying the basic components of a GNU/Linux-based RTOS.

## **ALICE Project-Team**

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

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

We developed a collaboration with a local company regarding additive manufacturing technologies. This contract allowed us to host two interns (Mélanie Siret and Jimmy Etienne), both supervised by Sylvain Lefebvre. The topic is confidential.

## ALMANACH Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Industrial Collaborations

- **Verbatim Analysis:** this Inria start-up was co-created in 2009 by BS. It uses some of ALPAGE/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. A new Inria startup, **opensquare**, was co-created in December 2016 by BS with 2 senior specialists of HR 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.
- **Facebook:** A collaboration on text simplification ("français Facile À Lire et à Comprendre", FALC) is starting with Facebook's Parisian FAIR laboratory. It should start with 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 (the CIFRE application has just been submitted). This collaboration is expected to be part of 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 initiates a collaboration in 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 an engineer and 12 months for a research engineer).
- **Science Miner:** ALMANACH (following 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.
- **Konverso:** A collaboration with this start-up is starting, focused on chatbots and text generation. One of our objectives with this collaborations is to initiate a larger initiative involving ALMANACH and several small companies, whose goal will be the development of open-source, NLP-enhanced chatbot modules. This is because such developments are complex and would benefit from such a mutualisation initiative. In turn, an open-source chatbot engine would allow startups and ALMANACH to more rapidly develop and deploy high-performance application-specific chatbots. The first concrete outcome of this collaboration is our joint submission to the call for projects published by the DILA (French government agency) for exploring the relevance of deploying a chatbot on the public information platform service-public.fr.
- There exists at least one formal collaboration between a company and EPHE involving future ALMANACH members. It involves **Insight-Signals**, an EPHE start-up that "designs data analytics and decision support systems that integrate the complexity of humans' behaviour and their interactions".
- **Trooclick:** A direct and active collaboration with this company is now strengthened by the "RAPID" ANR project VerDI on the automatic detection of omissions in news reports and other types of texts. This project will come to an end in February 2018.
- ALMANACH members have recently initiated discussions with other companies (Fujitsu, HyperLex, Fortia Financial Solutions...), 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 (Google, Toyota, Samsung...).

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

**CEDAR Team (section vide)**

## **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, Laetitia Matignon.

This collaboration has been built inside the INSA-VOLVO Chair, led by Prof. Didier Remond. In this context, the Chair funds the PhD Thesis of Guillaume Bono (2016-19). 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 a platoon of autonomous vehicles. This Post-Doc will start on February 2018.

### **8.1.2. Toyota Motor Europe (2006 - 2018)**

**Participant:** Christian Laugier.

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 is on the process to be extended 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 been signed also.

## **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 2018 – 2020, with objective to address the open problem of emergency obstacle avoidance in complex traffic situations (for ADAS applications).

### **8.2.2. IRT Nanoelec – Perfect project (2012 - 2020)**

**Participants:** Christian Laugier, Jerome Lussereau, Jean-Alix David.

Perfect is a project supported by ANR in the scope of the IRT (Technological Research Institute) Nanoelecronic driven by the CEA (Nuclear Energy Agency). The partners of the project are the CEA-LETI LIALP laboratory, ST-Microelectronics, Schneider Electric and Inria. The goal of this project is to propose integrated solutions for *Embedded Bayesian Perception for Dynamic Environment* and to develop integrated open platforms. The focus is on the application domain of autonomous mobile robots and vehicles, while considering both vehicle and infrastructure issues.



### 8.2.3. *FUI Tornado (2017 – 2020)*

**Participants:** Anne Spalanzani, Christian Laugier, Olivier Simonin, Jerome Lussereau, Jean-Alix David.

The project Tornado is coordinated by Renault. The academic partners of the project are Inria Grenoble-Rhône Alpes, UTC, Institut Pascal, University of Pau, IFSTTAR. The industrial and application partners are Renault, EasyMile, Neavia, Exoskills, 4D-Virtualiz, MBPC and Rambouillet Territoires. The objective of the project is to demonstrate the feasibility of a mobility service systems operating in the commercial zone of Rambouillet and on some public roads located in its vicinity. Several autonomous cars (Autonomous Renault Zoe) and one automatic Shuttle provided by EasyMiles will be customized and used. The *IRT Nanoelec* is also involved in the project as a subcontractor, for testing the perception, decision-making, navigation and controls components developed in the project.

### 8.2.4. *Cooperation with EasyMile (2017 – 2020)*

**Participants:** Christian Laugier, Jerome Lussereau, Jean-Alix David.

A first successful Proof of Concept (PoC) of the implementation of our *CMCDOT* embedded system on the EV10 automatic Shuttle of EasyMile, has been performed during the first trimester of 2017. This work has been done in the scope of the Project Perfect of IRT Nanoelec, and it has conducted to very encouraging results. A multiannual workplan has been prepared in the scope of the IRT Nanoelec for transferring and adapting our technology to the EasyMile shuttles.

## **COML Team**

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

## **8.1. Bilateral Grants with Industry**

- Grant from MSR (Zero Resources Challenge, 2017) - 5K€
- AWS Grant (Zero Resources Challenge, 2017) - 20K€

## **DEFROST Project-Team**

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

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

TDR group is a robotics integrator specialized on optimizing production chains, usually multiplexing robots to perform several activities. Hence, their interest in graspers and the time invested in this activity has been growing within the last years. To improve this aspect, we have been developing together a concept of "universal grasper", based on soft robotics technology and capable of grasping an object with an arbitrary shape, and partially misplaced or misoriented. The prototype developed complies with the specifications and allows for scalability, with flexibility between grasping force and shape tolerance, and the ability for replacing objects without the need of an external vision system. Relying in SOFA for physical simulation, we could validate the different prototypes proposed, put in place test scenarios and put in place a design tool to test generic, application-specific prototypes. A patent redaction is ongoing.

**EX-SITU Project-Team (section vide)**

## 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 further developed a planning algorithm for a autonomous electric car for Renault SAS in the continuation of the previous PAMU 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. *Adaptive device for disease awareness and treatment adherence of asthma in children*

**Participants:** Manuel Lopes [correspondant], Alexandra Delmas, Pierre-Yves Oudeyer.

Financing of the CIFRE PhD grant of Alexandra Delmas by Itwell with the goal of developing a tool for self-learning for patients to improve their compliance to treatment.

## GRAPHDECO Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Optis*

**Participants:** Valentin Deschaintre, Adrien Bousseau, George Drettakis.

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

### 7.1.2. *Adobe*

**Participants:** Adrien Bousseau, Johana Delanoy.

As part of a long standing collaboration with Adobe, J. Delanoy interned at Adobe Research with A. Hertzman, (San Fransisco). Adobe provides research and software donations as part of this collaboration.

### 7.1.3. *Technicolor*

**Participants:** George Drettakis, Adrien Bousseau.

We have initiated a collaboration with Technicolor on the use of deep learning for computational photography and video tasks. This involves the use of our synthetic ground truth data generation platform for graphics and vision tasks.

## **GRAPHIK Project-Team**

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

## **8.1. Bilateral Grants with Industry**

- Régilait contract: In the framework of a contract between INRA IATE and STLO (Rennes) research units, a master student from Toulouse University has been recruited in 2017. He developed a new version of the CoGui-Capex software tool, based on Cogui, which permits to navigate and reason in decision-support trees that link food descriptors and the actions that can be undertaken by some operators. The final delivery (December 2017) will be evaluated by Régilait till mid-2018.

## **HEPHAISTOS Project-Team**

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

## **8.1. Airbus**

**Participant:** Yves Papegay.

Results of research activities on MOSELA environment have been transferred by a contract with Airbus company.

## **8.2. Ellicie Healthy**

**Participants:** Alain Coulbois, Jean-Pierre Merlet.

A contract has been granted for the evaluation of the performances of connected glasses that are developed by this company.



## HYBRID Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Mensia Technologies

**Participants:** Anatole Lécuyer, Jussi Tapio Lindgren.

**Mensia Technologies** is an Inria start-up company created in November 2012 as a spin-off of Hybrid team. Mensia is focused on wellness and healthcare applications emerging from the BCI and Neurofeedback technologies. The Mensia startup should benefit from the team's expertise and of valuable and proprietary BCI research results. Mensia is 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 together with CEO Jean-Yves Quentel.

The on-going contract between Hybrid and Mensia started in November 2013 and supports the transfer of several softwares designed by Hybrid team ("OpenViBE", "StateFinder") related to our BCI activity to Mensia Technologies for multimedia or medical applications of Mensia.

## 8.2. Bilateral Grants with Industry

### 8.2.1. Technicolor

**Participants:** Antoine Costes, Anatole Lécuyer, Ferran Argelaguet.

This grant started in December 2015. It supports Antoine Costes's CIFRE PhD program with Technicolor company on "Haptic Texturing".

### 8.2.2. Realyz

**Participants:** Guillaume Cortes, Anatole Lécuyer.

This grant started in December 2015. It supports Guillaume Cortes's CIFRE PhD program with Realyz company on "Improving tracking in VR".

### 8.2.3. VINCI Construction

**Participants:** Anne-Solène Dris-Kerdreux, Bruno Arnaldi, Valérie Gouranton.

This grant started in November 2015. It supports Anne-Solene Dris-Kerdreux's CIFRE PhD program with Vinci company on "Training in VR for construction applications".

### 8.2.4. Orange Labs

**Participants:** Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton.

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".

## **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, starting June 2016.

## **IMAGINE Project-Team**

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

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

### **7.1.1. CIFRE SILEANE (2015 - 2018)**

**Participants:** Frédéric Devernay, Romain Brégier.

### **7.1.2. CIFRE PSA (2017 - 2020)**

**Participants:** Stefanie Hahmann, Jean-Claude Léon, Youna Le Vaou.

## LACODAM Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. ITRAMI: Interactive Trace Mining

**Participant:** Alexandre Termier.

ITRAMI is a Nano2017 project. Such projects are designed to support joint research efforts between STMicroelectronics and academic partners in the domain of embedded systems. Alexandre Termier is the PI of this project whose goal is to design novel data mining methods for interactive analysis of execution traces. Such methods aim at considerably reducing the time that STMicroelectronics developers spend at understanding, debugging and profiling applications running on STMicroelectronics chips. The work is done at University Grenoble Alps, in collaboration with LACODAM researchers. Two contractual staff members are working on the project in Grenoble: Willy Ugarte as postdoc, and Soumaya Ben Alouane as engineer.

### 8.1.2. Hyptser: Hybrid Prediction of Time-Series

**Participants:** Thomas Guyet, Vincent Lemaire [Orange Labs], Simon Malinowski [LinkMedia].

HYPTSER is a project funded by the Gaspard Monge Program for Optimisation and Operational Research (PGMO). It is dedicated to the development of innovative methods for predictions in time series. In the field of machine learning, *ensemble methods* have gained popularity in the last years. These methods combine several algorithms that solve the same task in order to improve the performance of the outcome. Two main families of ensemble methods can be found in the literature : The first family makes use of different models and combine their results a posteriori. The methods Bagging and Boosting are examples of methods in this family [26], [34]. The second family is based on a smart selection of the local algorithms in order to create a global hybrid algorithm. Logistic Model Tree [30] or Extreme Learning Machine Tree [36] are examples of such hybrid algorithms. In this project, starting at the end of 2017 for one year, we envision to explore the second family of methods in order to analyze how efficiently hybrid models can perform on the task of time series prediction. We plan to apply these methods to predict resource usage for cloud computing (CPU, memory) so as to minimize their infrastructure.

### 8.1.3. Particular Contract of the Strategic Action EDF/Inria

**Participants:** Manel Boumghar [EDF R&D], Laurent Pierre [EDF R&D], Thomas Guyet, René Quiniou.

The analysis of customer pathways has become a strategic issue for many businesses. The interaction traces left by clients when connecting to the customer services can be combined with data from other communication channels (phone, web form, e-mail, mail, fax, SMS, shop, etc.) and allow to analyse the customer pathways in details.

Pattern mining tools are able to extract the frequent customer behaviors in very large databases of client pathways. Nevertheless, taking into account the duration and the delay between the customer actions in the mining remains a challenge. The objective of this one-year contract was to design and develop a frequent mining tool that accounts for temporal patterns with negations for analysis of multichannel customer pathways. In this line, we developed and implemented the NTGSP algorithm [17].

## 8.2. Bilateral Grants with Industry

Maël Guillemé has obtained a CIFRE PhD grant with the Energiency startup, supervised by V. Masson and L. Rozé. The goal of Maël's thesis is to propose new approaches to improve industrial energy performance by integrating both numerical and symbolic attributes. An M2 internship from 2016 explored an approach based on an algorithm proposed by Shokoohi and al., and proposed several improvements: avoid data normalisation, detect patterns as fast as possible, enhance functions like distance and score.

Another CIFRE thesis has started, this time with the Amossys company, which specializes in cyber-security. This is the PhD of Alban Siffer, located in the EMSEC team of IRISA and co-supervised between EMSEC (P.A. Fouque) and LACODAM (A. Termier, C. Largouët). The goal of this PhD is to propose new methods for intrusion detection in networks. The novel insight is to consider only IP flow as input (metadata of packets and not packet contents) and detect intrusion via unusual traffic patterns.

On October 2017, Colin Leverger started a thesis funded by Orange and co-supervised between Orange Labs (R. Marguerie), LACODAM (A. Termier, T. Guyet) and LinkMedia (S. Malinowski). The goal of this thesis is to propose new methods to forecast time series in order to support capacity planning tasks.

Elisa Fromont is still involved in the supervision of two PhD students through her former employer: the University of Saint-Etienne. One of the students is Guillaume Metzler, who works with the sponsorship of the Blitz company on bank fraud detection. On the other hand, Kevin Bascol (financed by a FUI project) works in collaboration with Bluecime (Grenoble) and works on improving ski-lift security.

## LAGADIC Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Robocortex

**Participants:** Souriya Trinh, Fabien Spindler, François Chaumette.

*no Inria Rennes 11369, duration: 20 months.*

This contract with the Inria Robocortex start up in Sophia-Antipolis started in September 2016. It is devoted to provide our expertise in visual tracking for an application specified by Dassault Aviation.

### 8.1.2. ABB

**Participants:** Souriya Trinh, Fabien Spindler, François Chaumette.

*no Inria Rennes 12597, duration: 8 months.*

This contract with ABB in Barcelona started in September 2017. It is devoted to provide our expertise in visual tracking and visual servoing for an industrial application.

### 8.1.3. 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 Lagadic medical robotic platform. Each module is rent 40 days during a 3-year period in the context of the IRT b<>com NeedleWare project (see Section 9.1.7 ).

## 8.2. Bilateral Grants with Industry

### 8.2.1. Technicolor

**Participants:** Salma Jiddi, Eric Marchand.

*no Univ. Rennes 1 15CC310-02D, duration: 36 months.*

This project funded by Technicolor started in October 2015. It supports Salma Jiddi's Ph.D. about augmented reality (see Section 7.1.9 ).

### 8.2.2. Realyz

**Participant:** Eric Marchand.

*no Inria Rennes 10822, duration: 36 months.*

This project funded by Realyz started in October 2015. It is achieved in cooperation with Anatole Lécuyer from Hybrid group at Irisa and Inria Rennes-Bretagne Atlantique to support Guillaume Cortes Ph.D. about motion tracking in virtual reality.

### 8.2.3. Pôle Saint Hélier

**Participants:** Louise Devigne, Marie Babel.

*no Insa Rennes 2015/0890, duration: 36 months.*

This project started in November 2015. It addresses the following two issues. First, the idea is to design a low-cost indoor / outdoor efficient obstacle avoidance system that respects the user intention, and does not alter user perception. This involves embedding innovative sensors to tackle the outdoor wheelchair navigation problem. The second objective is to take advantage of the proposed assistive tool to enhance the user Quality of Experience by means of biofeedback as well as the understanding of the evolution of the pathology.

#### **8.2.4. Axyn**

**Participants:** Dayana Hassan, Paolo Salaris, Patrick Rives.

*no Inria Sophia 10874-1, duration: 36 months.*

The objective of this project that started in November 2016 is to explore new methodologies for the interaction between humans and robots, autonomous navigation and mapping and to transfer the results obtained on the robotic platform developed by AXYN for assisting disabled/elderly people at home or in hospital structures. Cost limits, good accessibility to aged people, robustness and safety related to the applications are at the heart of the project. This contract (ANRT-CIFRE) support Dayana Hassan's Ph.D (see Section 7.5.6 ).

## LARSEN Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Cifre Diatelic-Pharmagest

**Participants:** François Charpillat, Yassine El Khadiri, Cedric Rose, Gabriel Corona.

Cedric Rose and Gabriel Corona are from Diatelic.

The ageing of the population and the increase in life expectancy will confront modern societies with an unprecedented demographic transformation. The placement of older people in a nursing home (EPHAD) is often only a choice of reason and can be rather poorly experienced by people. One answer to this societal problem is the development of Smart home technologies that facilitate elderly to stay in their homes longer than they can do today. This new collaboration with Diatelic a subsidiary of the Pharmagest group is supported through a PhD thesis (Cifre) which started in June 2017. The objective is to enhance the CareLib solution developed by Diatelic and Larsen Team through a previous collaboration (Satelor project). The Carelib offer is a solution, consisting of

- a connected box (with touch screen),
- a 3D sensor (capable (1) to measure characteristics of the gait such as the speed and step length, (2) to identify Activities of Daily Life and (3) to detect emergency situation such as Fall,
- universal sensors (motion, ...) installed in each part of the housing.

The objective of the PhD program is to provide personalized follow-up by learning life habits, the main objective being to track the Activities of Daily Life (ADL) and detect emergency situations needing external interventions (E.G fall detection). This year we have developed an algorithm capable to detect sleep-wake cycles using only motion sensors. The approach is based on bayesian inference. The algorithms have been evaluated using publicly available dataset and Diatelic's own dataset.



## **LINKMEDIA Project-Team**

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

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

Quai des Apps: one-shot 2-day contract for scientific counseling on visual image retrieval.

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

## **MAGNET Project-Team**

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

## **8.1. Product Name Disambiguation**

Optimix is a company that provides marketing campaign optimization services and pricing policies for companies. One of the OptiMix tools offers a competitive price comparison. In this collaboration with Magnet, the objective was to use machine learning approaches and natural language processing for product names disambiguation.

## **8.2. Coreference resolution**

In an ongoing collaboration with Orange, we develop a Natural Language Processing library for co-reference resolution. The library is based on a previous work (CorTeX) and will be extended in several ways. It will handle French language, it will include new features based on vectorial representations of words (word embeddings) and it will be more scalable. PASCAL DENIS is the local PI at Inria of this project.

## **8.3. Privacy preserving data mining for Mobility Data**

JAN RAMON is the local PI at Inria for the ADEME-MUST project (Méthodologie d'exploitation des données d'usage des véhicules et d'identification de nouveaux services pour les usagers et les territoires). We study machine learning and data mining methods for knowledge discovery from mobility data, which are time-stamped signals collected from cars, for example, GPS locations, accelerations and fuel consumption. We aim to discover knowledge that helps us to address important questions in the transportation system such as road safety, traffic congestion, parking, ride-sharing, pollution and energy consumption. As the mobility data contains a lot of personal information, for instance, driving styles and locations of the users, we hence also study methods that allow the users to keep their personal data and only exchange part of them to collaboratively derive the knowledge.

The project has four partners, including, Xee company, CEREMA, i-Trans and Inria. The Xee company is responsible for recruiting drivers and collecting the data. CEREMA and i-Trans function as domain experts who help us to form the questions and verify the analytical results. MAGNET is responsible for developing and applying data mining methods for analyzing the data. The developed methods and the discovered knowledge from the project will be transferred to Metropole Lille and ADEME.

In [17], we presented our preliminary idea for a decentralized and privacy-aware machine learning method for predicting traversal time in the Data Mining with Secure Computing workshop held in conjunction with the 2017 European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD-2017).

## **MAGRIT Project-Team**

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

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

The partnership with GE Healthcare started in 1993. In the past few years, it bore on the supervision of CIFRE PhD fellows on the topic of using a multi-modal framework and augmented reality in interventional neuroradiology. The PhD thesis of Charlotte Delmas started in April 2013 and ended in November 2017 and was supervised by M.-O. Berger and E. Kerrien. In her work, C. Delmas developed methods to reconstruct the micro-tools in 3D from fluoroscopy imaging. This will help clinical gesture by providing the physician with a better understanding of the relative positions of the tools and of the pathology.

## **MANAO Project-Team**

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

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

### **8.1.1. CIFRE PhD contract with Technicolor (2014-2018)**

**Participants:** A. Dufay, X. Granier & R. Pacanowski

For this project, we aim at providing interactive previsualization of complex lighting with a smooth transition to the final solution.

### **8.1.2. CIFRE PhD contract with Thermo Fisher Scientific (2014-2018)**

**Participants:** D. Murray & X. Granier

For this project, we aim at providing expressive rendering techniques for volumes.

### **8.1.3. 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.

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

## **MIMETIC Project-Team**

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

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

### **8.1.1. BPI-PCR Robo-KII**

**Participant:** Armel Crétual [contact].

This contract has started in February 2017 and will last in October 2018. In M2S, it involves two permanent members of MimeTic team, Armel Crétual and Franck Multon, and two engineers, Antoine Marin (18 months grant) and Brice Bouvier (10 months grant).

This project is a collaboration between BA Healthcare and M2S lab. It aims at developing a robotics platform to allow physicians to start gait rehabilitation as soon as possible, even before patients are able to maintain upright posture alone. The usual way to perform such rehab sessions is to make the patient walk on a treadmill benefiting from a harness to prevent patient from falling. The two main limits of this approach are that:

- only straightforward at constant speed gaits are feasible whereas falling risks are much higher when modifying speed or turning
- walking on a treadmill when motor abilities are very affected can be challenging and can generate strong apprehension.

In a previous project, Robo-K, ended in september 2016, BA Healthcare has developed a first prototype of a mobile robot which strongly modified the approach: the harness is mobile and follows the patient displacement. In this way, the patient walks on the ground at his/her desired speed and the physician can include curved trajectories in the rehab process.

The main novelty of Robo-KII project is to implement a biofeedback system onto the robotics platform to reinforce rehab sessions. Closely working with physicians from two PMR services, CHU Rennes and Kerpape center, we intend to define the optimal feedback to be given to the patients and to measure the corresponding gait parameters thanks to depth cameras mounted on the robot.

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

**Participants:** Marc Christie, Christophe Lino.

Bilateral contract with Technicolor on empowering drones with cinematographics knowledge. Participants: Philippe Guillotel, Julien Fleureau, Quentin Galvane. Amount 25k€. Duration 24 months.

## **MINT2 Team**

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

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

- Hap2U SME is licensed two patents of MINT team.
- An InriaTech contract has been made with GoTouchVR SME for contributing to the company SDK.



## **Mjolnir Team**

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

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

- **Mock-up of a tool for dynamic media pre-production:** we did work with the HCOP holding company on the design of new tools for the pre-production of dynamic media such as videos, e-learning animations, etc. This work involved interviews of professional video producers, the identification of opportunities for tools that could help them, and the production of descriptions and mock-ups of these tools.

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

## **MORPHEO Project-Team**

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

## **8.1. Bilateral Grants with Industry**

The Morpheo Inria team and Microsoft research set up a collaboration on the capture and modelling of moving shapes using multiple videos. Two PhD proposals will be part of this collaboration with the objective to make contributions on 4D Modeling. The PhDs will take place at Inria Grenoble Rhône-Alpes and will involve regular visits and stays at Microsoft in Redmond (USA) and Cambridge (UK). At Microsoft, Steve Sullivan, Andrew Fitzgibbon, Jamie Shotton and Marta Wilczkowiak will be participating to the project.

## **8.2. Bilateral Contracts with Industry**

A collaboration with the French Start up Holooh started in 2017. Holooh aims at producing high quality holograms for VR and AR applications, especially for the fashion and music domains. Holooh's objective is to set up a multi-camera studio in Paris for that purpose. Edmond Boyer is involved in the collaboration.

## MULTISPEECH Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. Orange

Company: Orange SA (France)

Duration: Nov 2016 – Nov 2019

Participants: Laureline Perotin, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Laureline Perotin with Orange Labs. Our goal is to develop deep learning based speaker localization and speech enhancement algorithms for robust hands-free voice command. We are especially targetting difficult scenarios involving several simultaneous speakers.

### 8.1.2. Invoxia

Company: Invoxia SAS (France)

Duration: Mar 2017 – Mar 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.

### 8.1.3. Studio Maia

Company: Studio Maia SARL (France)

Other partners: Imaging Factory

Duration: Jul 2017 – Dec 2018

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

Abstract: This Inria Innovation Lab aims to develop a software suite for voice processing in the multimedia creation chain. The software is aimed at sound engineers and it will rely on the team's expertise in speech enhancement, robust speech and speaker recognition, and speech synthesis.

### 8.1.4. Samsung

Company: Samsung Electronics Co., Ltd (South Korea)

Duration: Jan – Nov 2017

Participants: Aditya Nugraha, Romain Serizel, Emmanuel Vincent

Abstract: This project aimed to transfer a modified version of dnnsep for hands-free voice command applications. We changed the type of multichannel filter used and modified the software so that it runs online in real time.

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

## PANAMA Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Grants with Industry

### 8.1.1. CIFRE contract with Technicolor R&I France on Very large scale visual comparison

**Participants:** Rémi Gribonval, Himalaya Jain.

*Duration:* 3 years (2015-2018)

*Research axis:* 3.1.2

*Partners:* Technicolor R&I France; Inria-Rennes

*Funding:* Technicolor R&I France; ANRT

The grand goal of this thesis is to design, analyze and test new tools to allow large-scale comparison of high-dimensional visual signatures. Leveraging state of the art visual descriptors, the objective is to obtain new compact codes for visual representations, exploiting sparsity and learning, so that they can be stored and compared in an efficient, yet meaningful, way.

## **PERCEPTION Project-Team**

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

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

From December 2016 to November 2017 the PERCEPTION team had a collaborative project with Samsung's Digital Media and Communication R&D Center. The collaboration was fully funded by Samsung Electronics. The topic of this collaboration was *multi-modal approach to human-robot interaction*.

## PERVASIVE INTERACTION Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Learning daily routines by observing activity in a smart home.*

Members of the Pervasive interaction team are working with Orange Labs on techniques for observing activity and learning routines in a smart home. Activity is observed by monitoring use of electrical appliances and Communications media (Telephone, Television, Internet). Activities are described using Bayesian Situation Modeling techniques demonstrated in earlier projects. A log of daily activities is used to discover daily routines expressed as temporal sequences of contexts, where each context is expressed as a network of situations. Experiments will be performed using the Smart home living lab that has been constructed as part of the EquipEx Amiqua4home.

### 7.1.2. *IRT Silver Economy*

Participants: James Crowley, Pierre Baret, Maxime Belgodere Partners: CEA, Schneider Electric.

Members of the Pervasive Interaction team are working with the CEA and Schneider Electric to develop environmental sensors that can detect when a hospital patient or elderly person has fallen and is unable to get up. The project uses an infrared Bolometric image sensor to observe human activity. Image processing and fall detection logic are to be performed by an embedded image processor on board.



## **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)

Funding: to be determined

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

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

### **7.2.1. Cozy Cloud CIFRE - Tran Van contract (Oct 2014 -Feb 2017)**

Partners: Cozy Cloud, PETRUS (Inria-UVSQ)

SMIS funding: 30k€

In relation with the bilateral contract mentioned above, a CIFRE PhD thesis has been started by Paul Tran Van. The objective is to capitalize on the Cozy-PlugDB platform to devise new access and usage control models to exchange data among devices of the same user (devices may have different levels of trustworthiness) and among different users thanks to a user-friendly sharing model (see the work on the SWYSWYK - Share What You See with Who You Know - model presented above).

### **7.2.2. Cozy Cloud CIFRE - Loudet contract (Apr 2016 - Apr 2019)**

Partners: Cozy Cloud, Inria-SMIS

SMIS funding: 45k€

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.

## **POTIOC Project-Team**

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

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

### **Interactive Collaboration in Virtual Reality for Aerospace Scenarii:**

Duration: 2014-2017

PhD Thesis of Damien Clergeaud

Partners: Airbus Group

Local coordinator: Pascal Guitton

The Airbus company regularly uses virtual reality for design, manufacturing and maintenance. We work with them on collaborative interaction in order to enable an efficient collaboration between operators immersed in the virtual environment from remote locations and with heterogeneous equipment. More precisely, we have developed tools to point and manipulate objects, to remotely visualize the virtual environment, to be aware of remote manipulations and to describe tools and components trajectories

## 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 and the post-doc of Thomas Streubel under the framework of VALEO project “Daring”
- *SMART* project: on the *Design and development of multisensor fusion system for road vehicles detection and tracking*. This project funds the internship of Alfredo Valle.
- 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 begun on November 2017 (Imane MATHOUT).

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

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

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

## **SIROCCO Project-Team**

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

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

### **8.1.1. CIFRE contract with Envivio/ Ericsson on LDR compatible HDR video coding**

**Participants:** Christine Guillemot, David Gommelet, Aline Roumy.

- Title : LDR-compatible coding of HDR video signals.
- Partners : Envivio.
- Funding : Cifre Envivio/Ericsson.
- Period : Oct.2014-Sept.2017.

The goal of this Cifre contract is to design solutions for LDR-compatible coding of HDR videos. This involves the study of rate-distortion optimized tone mapping operators taking into account constraints of temporal coherency to avoid the temporal flickering which results from a direct frame-by-frame application of classical tone mapping operators. The goal is also to design a coding architecture which will build upon these operators, integrating coding tools tailored to the statistics of the HDR refinement signals.

### **8.1.2. CIFRE contract with Harmonic on image analysis for HDR video compression**

**Participants:** Maxime Rousselot, Olivier Le Meur.

- Title : image and video analysis for HDR video compression
- Partners : Harmonic, Univ. Rennes 1
- Funding: Harmonic, ANRT
- Period: April 2016-April 2019

This project (in collaboration with Rémi Cozot, FRVSense) aims to investigate two main axes. First, we want to assess whether the representation of High Dynamic Range signal has an impact on the coding efficiency. We will focus mainly on the Hybrid Log-Gamma (HLG) and Perceptual Quantizer (PQ) OETF (Opto-Electronic Transfer Function) approaches. The former defines a nonlinear transfer function which is display-independent and able to produce high quality images without compromising the director's artistic intent. The latter approach is based on Just Noticeable Difference curve. If it turns out that this representation has an impact, the coding strategy should be adjusted with respect to the representation. In addition, specific preprocessing tools will be defined to deal with the limitations of PQ and HLG approaches.

### **8.1.3. CIFRE contract with Technicolor on image collection analysis**

**Participants:** Dmitry Kuzovkin, Olivier Le Meur.

- Title : Spatiotemporal retargeting and recomposition based on artistic rules
- Partners : Technicolor, Univ. Rennes 1
- Funding: Technicolor, ANRT
- Period: Nov. 2015 – Nov. 2018

The goal of the project (in collaboration with Rémi Cozot, FRVSense) is to take advantage of the huge quantities of image and video data currently available - captured by both amateur and professional users - as well as the multiple copies of each scene that users often capture, to improve the aesthetic appeal of content. Additionally, given Technicolor's unique position, we propose to take advantage of insights as well as content from professional artists and colorists to learn how different content types can be enhanced.

#### **8.1.4. CIFRE contract with Technicolor on light fields editing**

**Participants:** Christine Guillemot, Matthieu Hog.

- Title : Light fields editing
- Research axis : 7.1.5
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2015-Sept.2018.

Editing is quite common with classical imaging. Now, if we want light-fields cameras to be in the future as common as traditional cameras, this functionality should also be enabled with light-fields. The goal of the PhD is to develop methods for light-field editing, and in 2017 we have introduced the concept of super-ray which is a grouping of rays within and across views, and developed a fast algorithm for super-ray construction (see section 7.1.5 ).

#### **8.1.5. CIFRE contract with Technicolor on light fields compressed representation**

**Participants:** Christine Guillemot, Fatma Hawary.

- Title : Light fields compressed representation
- Research axis : 7.2.5
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Feb.2016-Jan.2019.

The goal of this PhD is to study reconstruction algorithms from compressed measurements based on the assumption of sparsity in the Fourier domain. The goal is to apply these algorithms to scalable compression of light fields.

#### **8.1.6. CIFRE contract with Technicolor on cloud-based image compression**

**Participants:** Jean Begaint, Christine Guillemot.

- Title : Cloud-based image compression
- Research axis : 7.2.1
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Nov.2015-Oct.2018.

The goal of this Cifre contract is to develop a novel image compression scheme exploiting similarity between images in a cloud. The objective will therefore be to develop rate-distortion optimized affine or homographic estimation and compensation methods which will allow us to construct prediction schemes and learn adapted bases from most similar images retrieved by image descriptors. One issue to be addressed is the rate-distortion trade-off induced by the need for transmitting image descriptors.

## **STARS Project-Team**

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

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

- **Toyota Europ:** this project with Toyota ran from the 1st of August 2013 up to 2017 (4 years). It aims at detecting critical situations in the daily life of older adults living home alone. We believe that a system that is able to detect potentially dangerous situations will give peace of mind to frail older people as well as to their caregivers. 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 is intended to help them and their relatives to feel more comfortable because they know potentially dangerous situations will be detected and reported to caregivers if necessary. The system is intended to work with a Partner Robot (to send real-time information to the robot) to better interact with older adults.

## **THOTH Project-Team**

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

## **8.1. MSR-Inria joint lab: scientific image and video mining**

**Participants:** Cordelia Schmid, Karteek Alahari.

This collaborative project, which started in September 2008, brings together the WILLOW and Thoth project-teams with researchers at Microsoft Research Cambridge and elsewhere. It builds on several ideas articulated in the “2020 Science” 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 focuses on fundamental computer science research in computer vision and machine learning, and its application to archeology, cultural heritage preservation, environmental science, and sociology.

## **8.2. MSR-Inria joint lab: structured large-scale machine learning**

**Participants:** Julien Mairal, Alberto Bietti, Hongzhou Lin.

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 and four MSR sites and started at the end of 2013.

## **8.3. Amazon**

**Participants:** Grégory Rogez, Cordelia Schmid.

We received an Amazon Faculty Research Award end of 2016. The objective is 3D human action recognition from monocular RGB videos. The idea is to extend our recent work on human 3D pose estimation published at NIPS 2016 to videos and to develop an approach for action recognition based on temporal pose based on appropriate 3D features.

## **8.4. 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 2017. Funding will be provided on an annual basis, every year, as long as we are part of the network.

## **8.5. Facebook**

**Participants:** Cordelia Schmid, Jakob Verbeek, Karteek Alahari, Julien Mairal.

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). 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.



## 8.6. Xerox Research Center Europe

**Participants:** Cordelia Schmid, Vasileios Choutas, Philippe Weinzepfel [Naver].

The collaboration with Xerox 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 (Inria) 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 and the collaboration is still on-going, see next paragraph.

## 8.7. Naver

**Participants:** Karteek Alahari, Vladyslav Sydorov, Cordelia Schmid, Julien Mairal, Jakob Verbeek.

A one-year research contract on action recognition in videos started in Sept. 2017. The approach developed by V. Choutas implements pose-based motion features, which are shown to be complementary to state-of-the-art I3D features.

## **TITANE Project-Team**

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

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

### **8.1.1. Google**

**Participants:** Pierre Alliez, Cedric Portaneri.

We aim to develop 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 will be 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 will leverage the recent advances on perceptual metrics to improve the visual appearance, and perform joint consolidation and encoding of the models to further optimize the rate-distortion tradeoffs and visual perception.

- Starting date: January 2017 - Duration: 1 year

### **8.1.2. Geoimage**

**Participants:** Liuyun Duan, Florent Lafarge.

The aim of this collaboration is to devise a new type of 2.5D representation from satellite multi-view stereo images which is more accurate, compact and meaningful than the conventional digital elevation models (DEMs). A key direction consists in incorporating semantic information directly during the image matching process. Such a semantic information is related to the type of components of the scene, such as vegetation, roofs, building edges, roads and land.

- Starting date: November 2013 - Duration: 4 years

### **8.1.3. CSTB**

**Participants:** Hao Fang, Florent Lafarge.

The goal of this recent collaboration is to develop methods for analyzing and exploring scale-spaces into urban 3D data.

- Starting date: March 2016 - Duration: 3 years

### **8.1.4. Luxcarta**

**Participants:** Jean-Philippe Bauchet, Florent Lafarge.

The goal of this recent collaboration is to design automated approaches for producing city models from the last generation of satellites. The models should conform to the level 2 (LOD2) of the popular CityGML format.

- Starting date: October 2016 - Duration: 3 years

### **8.1.5. CNES**

**Participants:** Emmanuel Maggiori, Yuliya Tarabalka.

The objective of the project was to devise hierarchical approaches for object-oriented classification of multi-source images. Multi-source images are generated from a scene observed by different types of sensors.

- Starting date: November 2015 - Duration: 2 years

#### **8.1.6. CNES and Acri-ST**

**Participants:** Onur Tasar, Yuliya Tarabalka.

The aim is to devise efficient representations for satellite images.

- Starting date: October 2017 - Duration: 3 years

...

## **TYREX Project-Team**

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

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

Transfer contract

Partner: **Oppidoc** startup

Coordinator: Pierre Genevès

Abstract: the goal of this project is to investigate the integration of advanced static analyses in Oppidoc's flagship product, Oppidum, which is a software framework for constructing web sites with forms for the collaborative edition and publishing of structured documents.

**Valda Team (section vide)**

## **WILLOW Project-Team**

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

## **8.1. 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. 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.

## **8.3. 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 shelf 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.

## **8.4. 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 Science” 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.

## WIMMICS Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Contracts with Industry

### 8.1.1. PREMISSE Collaborative Project

**Participants:** Molka Dhoub, 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) and UCA (post-doc). SILEX France is developing a B2B (business to business) 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. Synchronext Collaborative Project

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

Partner: Synchronext.

This project is funded by the ANRT (CIFRE PhD). Synchronext is a startup aiming at developing Semantic Web business solutions. The goal of this project is to develop a NLP and semantic Web based artificial agent for online support in the insurance domain. The objective is to reduce the dropout rate of Internet users on FAQs and to reduce the number of incoming calls and e-mails. This will enable to customer advisers to focus on more difficult questions. As a first step, we are working on automatically categorizing online requests to properly rout them.

## 8.2. Bilateral Grants with Industry

### 8.2.1. Intelliquiz Carnot Project

**Participants:** Oscar Rodríguez Rocha, Catherine Faron Zucker.

Partner: GAYAtch/QWANT.

This project started in March 2017. It is a joint project with Gayatech (now acquired by QWANT) on the automatic generation of quizzes from the Web of Data. It is a continuation of a former collaborative project with GAYAtch on the recommendation of pedagogical resources based on ontology-based modelling and processing.

Based on example quizzes extracted from the famous game *Les Incollables* card game, we are proposing an approach to develop quizzes from a domain ontology and we are experimenting on the geographical domain for primary school students.

### 8.2.2. Inria LabCom EduMICS

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

Partner: Educlever.

EduMICS (Educative Models Interactions Communities with Semantics) is a joint laboratory (LabCom, 2016-2018) between the Wimmics team and the Educlever company. Adaptive Learning, Social Learning and Linked Open Data and links between them are at the core of this LabCom. The purpose of EduMICS is both to develop research and technologies with the ultimate goal to adapt educational progressions and pedagogical resource recommendation to learner profiles.



During the first year of the project we worked on developing light-weight ontologies and thesaurus to capture the Educlever ontological knowledge and we annotated the pedagogical resources of the Educlever solution. Then we developed a benchmark and showed that Semantic Web solutions can be deployed within their industrial context. In the continuation of this first step of the project, we will show the added value of Semantic Web modelling enabling ontology-based reasoning on the acquired knowledge graph.

## **ZENITH Project-Team**

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

## **8.1. Microsoft ZcloudFlow (2013-2017)**

**Participants:** Ji Liu, Esther Pacitti, Patrick Valduriez.

ZcloudFlow is a project in collaboration with the Kerdata team in the context of the Joint Inria–Microsoft Research Centre. It addresses the problem of advanced data storage and processing for supporting scientific workflows in the cloud. The goal is to design and implement a framework for the efficient processing of scientific workflows in clouds. The validation is performed using synthetic benchmarks and real-life applications from bioinformatics on the Microsoft Azure cloud with multiple sites.

## **8.2. Triton I-lab (2014-2017)**

**Participants:** Benjamin Billet, Didier Parigot.

Triton is a common Inria lab (i-lab) between Zenith and Beepeers (<http://www.beepeers.com>) to work on a scalable platform for developing social networks in mobile/Web environments. The main objective of this project is to design and implement a new architecture for Beepeers applications to scale up to high numbers of participants. The new platform relies on our SON middleware and NoSQL graph databases.

## **8.3. SAFRAN (2018)**

**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).