



RESEARCH CENTER
Sophia Antipolis - Méditerranée

FIELD

Activity Report 2012

Section Contracts and Grants with Industry

Edition: 2013-04-24

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AOSTE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Thales ARCADIA/Melody

Participants: Frédéric Mallet, Robert de Simone.

In the remote context of ARTEMIS CESAR [8.3.1.1](#) we conducted a specific study of the functional expressiveness of the ARCADIA/Melody environment, developed and deployed internally inside several Thales divisions. A questionnaire was designed by us, according to the various semantic variation points that we identified into this Model-Driven Engineering (MDE) environment. It was then sent to potential users for feedback, and reporting was done together with colleagues from Thales TRT (R&D division) to their management. As a result a number of non-trivial redesign decisions were taken. Our findings were presented through a number of focused meetings held at Thales in the Saclay technopark. While most work was performed at this stage on purely data-flow functional description diagrams, there is an interest inside the company to extend this type of critical survey analysis to extended description models, including event-based control and modes.

GALAAD Project-Team (section vide)

GEOMETRICA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Geometry Factory

The initial development phase of the CGAL library has been made by a European consortium. In order to achieve the transfer and diffusion of CGAL in the industry, a company called GEOMETRY FACTORY has been founded in January 2003 by Andreas Fabri (<http://www.geometryfactory.com>).

The goal of this company is to pursue the development of the library and to offer services in connection with CGAL (maintenance, support, teaching, advice). GEOMETRY FACTORY is a link between the researchers from the computational geometry community and the industrial users.

It offers licenses to interested companies, and provides support. There are contracts in various domains such as CAD/CAM, medical applications, GIS, computer vision...

GEOMETRY FACTORY is keeping close contacts with the original consortium members, and in particular with GEOMETRICA.

In 2012, GEOMETRY FACTORY had the following new customers for CGAL packages developed by GEOMETRICA: Archivideo (GIS, 2D Constrained Delaunay), Gamesim (games, 2D Constrained Delaunay), Medicm (medical imaging, 2D Constrained Delaunay, BE), Tecosim(CAD/CAM, 3D Delaunay, Germany). Midland Valley (Surface mesher, UK)

Moreover, research licenses (in-house research usage for all of CGAL) have been purchased by: ROI Bologna (medical imaging, Italy), Technicolor (France), U Southampton (medical imaging, UK), ZIB (medical imaging, Germany).

7.1.2. Astrium

Participants: Pierre Alliez, Florent Lafarge, Sven Oesau.

The main goal of this collaboration is to develop indoor models more accurate, meaningful and complete than existing methods. The conventional way for modeling indoor scenes is based on plane arrangements. This type of representation is particularly limited and must be improved by developing more complex geometric entities adapted to a detailed and semantized description of scenes.

- Starting date: April 2012

- Duration: 3 years

7.2. National Initiatives

7.2.1. ADT CGALmesh

Participants: Pierre Alliez, Mariette Yvinec, Clement Jamin, Jean-Daniel Boissonnat.

In collaboration with Jane Turnois from Geometry Factory.

CGALmesh is an Inria technological development action started in March 2009, in collaboration with Geometry Factory. Building upon components from CGAL, we are implementing a generic mesh generation framework for surfaces and 3D domains. We primarily target applications which involve data acquired from the physical world: geology, medicine, 3D cartography and reverse engineering. In 2012 we devised a new parallel 3D mesh generation and optimization algorithm for multi-core architectures with shared memory, and an algorithm for anisotropic mesh generation.

- Starting date: March 2009

- Duration: 3 years

7.2.2. ANR Présage

Participants: Olivier Devillers, Marc Glisse, Ross Hemsley, Monique Teillaud, Rémy Thomasse.

Web site: <http://webloria.loria.fr/~goaoc/ANR-Presage/>

We participate in the PRÉSAGE project funded by the ANR. The project involves:

- the Inria VEGAS team,
- Univeristy of Rouen, and
- the GEOMETRICA team.

This project brings together computational and probabilistic geometers to tackle new probabilistic geometry problems arising from the design and analysis of geometric algorithms and data structures. We focus on properties of discrete structures induced by or underlying random continuous geometric objects. This raises questions such as:

- What does a random geometric structure (convex hulls, tessellations, visibility regions...) look like?
- How to analyze and optimize the behavior of classical geometric algorithms on *usual* inputs?
- How can we generate randomly *interesting* discrete geometric structures?

- Starting date: 31 December 2011

- Duration: 4 years

- Year publications: [55], [50], [57].

7.2.3. ANR GIGA

Participants: Pierre Alliez, Jean-Daniel Boissonnat, Frédéric Chazal, David Cohen-Steiner, Mariette Yvinec, Steve Oudot, Marc Glisse.

GIGA stands for Geometric Inference and Geometric Approximation. GIGA aims at designing mathematical models and algorithms for analyzing, representing and manipulating discretized versions of continuous shapes without losing their topological and geometric properties. By shapes, we mean sub-manifolds or compact subsets of, possibly high dimensional, Riemannian manifolds. This research project is divided into tasks which have Geometric Inference and Geometric Approximation as a common thread. Shapes can be represented in three ways: a physical representation (known only through measurements), a mathematical representation (abstract and continuous), and a computerized representation (inherently discrete). The GIGA project aims at studying the transitions from one type to the other, as well as the associated discrete data structures.

Some tasks are motivated by problems coming from data analysis, which can be found when studying data sets in high dimensional spaces. They are dedicated to the development of mathematically well-founded models and tools for the robust estimation of topological and geometric properties of data sets sampled around an unknown compact set in Euclidean spaces or around Riemannian manifolds.

Some tasks are motivated by problems coming from data generation, which can be found when studying data sets in lower dimensional spaces (Euclidean spaces of dimension 2 or 3). The proposed research activities aim at leveraging some concepts from computational geometry and harmonic forms to provide novel algorithms for generating discrete data structures either from mathematical representations (possibly deriving from an inference process) or from raw, unprocessed discrete data. We target both isotropic and anisotropic meshes, and simplicial as well as quadrangle and hexahedron meshes.

This project coordinated by GEOMETRICA also involves researchers from the Inria team-project ABS, CNRS (Grenoble), and a representative from the industry (Dassault Systèmes).

- Starting date: October 2009.

- Duration: 4 years.

7.2.4. *DIGITEO Chair C3TTA: Cell Complexes in Computational Topology: Theory and Applications*

Participants: Claire Caillerie, Frédéric Chazal, David Cohen-Steiner, Marc Glisse, Steve Oudot, Amit Patel.

The primary purpose of this project is to bring about a close collaboration between the chair holder Dr Vin de Silva and Digiteo teams working on the development of topological and geometric methods in Computer Science. The research program is motivated by problems coming from the increasing need of studying and analyzing the (often huge) data sets that are now available in many scientific and economic domains. Indeed, due to the improvements of measurement devices and data storage tools, the available data about complex shapes or complex systems are growing very fast. These data being often represented as point clouds in high dimensional (or even infinite dimensional) spaces there is a considerable interest in analyzing and processing data in such spaces. Despite the high dimensionality of the ambient space, one often expects them to be located around an unknown, possibly non linear, low dimensional shape. It is then appealing to infer and analyze topological and geometric characteristics of that shape from the data. The hope is that this information will help to process more efficiently the data and to better understand the underlying complex systems from which the data are generated. In the last few years, topological and geometric approaches to obtain such information have encountered an increasing interest. The goal of this project is to bring together the complementary expertises in computational topology and geometry of the involved Digiteo teams and in applied geometry and algebraic topology of V. de Silva to develop new topological approaches to the previous mentioned domain. The project intends to develop both the theoretical and practical sides of this subject. The other partners of the project are the Ecole Polytechnique (L. Castelli-Alvardi and F. Nielsen) and the CEA (E. Goubault).

- Starting date: January 2009.

- Duration: 3 years.

7.2.5. *GDR ISIS young researcher project on "scene analysis from Lidar"*

Participant: Florent Lafarge.

The GDR ISIS young researcher project on "scene analysis from Lidar" consists in reconstructing in 3D large-scale city models from airborne Lidar scans. This project is in collaboration with Clément Mallet and Bruno Vallet from MATIS Laboratory, IGN [<http://www.ign.fr>].

- Starting date: January 2010

- Duration: 3 years

7.2.6. *Grand emprunt Culture 3D Clouds*

Participants: Pierre Alliez, Florent Lafarge, Thijs van Lankveld.

Culture 3D Clouds is a cloud computing platform for 3D scanning, documentation, preservation and dissemination of cultural heritage. The motivation stems from the fact that the field of 3D scanning artifacts heritage evolves slowly and only provides resources for researchers and specialists. The technology and equipment used for 3D scanning are sophisticated and require highly specialized skills. The cost is thus significant and limits the widespread practice. Culture 3D Clouds aims at providing the photographers with a value chain to commercialize 3D reproductions demand for their customers and expand the market valuation of business assets (commercial publishers, general public).

- Starting date: September 2012

- Duration: 3 years

7.3. European Initiatives

7.3.1. *FP7 Projects*

7.3.1.1. *CG-Learning*

Title: Computational Geometric Learning

Type: COOPERATION (ICT)

Defi: FET Open

Instrument: Specific Targeted Research Project (STREP)

Duration: November 2010 - October 2013

Coordinator: Friedrich-Schiller-Universität Jena (Germany)

Others partners: National and Kapodistrian University of Athens (Greece), Technische Universität Dortmund (Germany), Tel Aviv University (Israel), Eidgenössische Technische Hochschule Zürich (Switzerland), Rijksuniversiteit Groningen (Netherlands), Freie Universität Berlin (Germany)

See also: <http://cgl.uni-jena.de/>

Abstract: The Computational Geometric Learning project aims at extending the success story of geometric algorithms with guarantees to high-dimensions. This is not a straightforward task. For many problems, no efficient algorithms exist that compute the exact solution in high dimensions. This behavior is commonly called the curse of dimensionality. We try to address the curse of dimensionality by focusing on inherent structure in the data like sparsity or low intrinsic dimension, and by resorting to fast approximation algorithms.

7.3.1.2. ERC IRON

Title: Robust Geometry Processing

Type: IDEAS

Instrument: ERC Starting Grant (Starting)

Duration: January 2011 - December 2015

Coordinator: Pierre Alliez, Inria Sophia Antipolis - mediterrane (France)

See also: <http://www-sop.inria.fr/geometrica/collaborations/iron/>

Abstract: The purpose of this project is to bring forth the full scientific and technological potential of Digital Geometry Processing by consolidating its most foundational aspects. Our methodology will draw from and bridge the two main communities (computer graphics and computational geometry) involved in discrete geometry to derive algorithmic and theoretical contributions that provide both robustness to noisy, unprocessed inputs, and strong guarantees on the outputs. The intended impact is to make the digital geometry pipeline as generic and ironclad as its Digital Signal Processing counterpart.

7.4. International Initiatives

7.4.1. Inria Associate Teams

7.4.1.1. COMET

Title: Computational Methods for the analysis of high-dimensional data

Inria principal investigator: Steve Y. Oudot

International Partner:

Institution: Stanford University (United States)

Laboratory: Computer Science Department

Researcher: Leonidas J. Guibas

International Partner:

Institution: Ohio State University (United States)

Laboratory: Computer Science and Engineering

Researcher: Yusu Wang

Duration: 2011 - 2013

See also: <http://geometrica.saclay.inria.fr/collaborations/CoMeT/index.html>

CoMeT is an associate team between the Geometrica group at Inria, the Geometric Computing group at Stanford University, and the Computational Geometry group at the Ohio State University. Its focus is on the design of computational methods for the analysis of high-dimensional data, using tools from metric geometry and algebraic topology. Our goal is to extract enough structure from the data, so we can get a higher-level informative understanding of these data and of the spaces they originate from. The main challenge is to be able to go beyond mere dimensionality reduction and topology inference, without the need for a costly explicit reconstruction. To validate our approach, we intend to set our methods against real-life data sets coming from a variety of applications, including (but not restricted to) clustering, image or shape segmentation, sensor field monitoring, shape classification and matching. The three research groups involved in this project have been active contributors in the field of Computational Topology in the recent years, and some of their members have had long-standing collaborations. We believe this associate team can help create new synergies between these groups.

7.4.2. Visits of International Scientists

7.4.2.1. Exterior research visitors

Misha Belkin (Ohio State University).

Mikhail Bessmeltsev (University of British Columbia).

Mark Blome (Zuse-Institut Berlin).

Benjamin Burton (School of Mathematics and Physics, University of Queensland, Brisbane).

Dengfeng Chai (Zhejiang University).

Mathieu Desbrun (Caltech).

Paweł Dłotko (Jagiellonian University, Krakow).

Leo Guibas (Stanford University).

Sun Jian (Tsinghua University, Beijing).

Leif Kobbelt (RWTH Aachen).

Sylvain Lazard (EPI VEGAS).

Michael Lesnick (Stanford University).

Jeff Phillips (University of Utah).

Alla Sheffer (University of British Columbia).

Vin de Silva (Pomona College).

Gert Vegter (Johan Bernoulli Institute, Groningen University).

Yusu Wang (Ohio State University).

7.4.2.2. Visiting Phd students

Ricard Campos (six months)

Topic: Reconstruction of 3D underwater scenes

Institution: University of Girona (Spain)

Andrea Tagliasacchi (three months)

Topic: surface reconstruction through optimal transportation

Institution: Simon Fraser University (Canada)

MARELLE Project-Team (section vide)

APICS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contract CNES-Inria-Xlim

Contract (reference Inria: 7066, CNES: 127 197/00) involving CNES, XLim and Inria, focuses on the development of synthesis procedures for N -ports microwave devices. The objective is here to derive analytical procedures for the design of multiplexers and routers as opposed to the classical "black box optimization" which is usually employed in this field (for $N \geq 3$).

7.2. Contract CNES-Inria-UPV/EHU

Contract (reference CNES: RS10/TG-0001-019) involving CNES, University of Bilbao (UPV/EHU) and Inria whose objective is to set up a methodology for testing the stability of amplifying devices. The work at Inria concerns the design of frequency optimization techniques to identify the linearized response and analyze the linear periodic components.

CASTOR Team (section vide)

COFFEE Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- **ANDRA**

In 2011/12, S. Krell and T. Goudon, with A. Gloria, have worked on the development of homogenization methods for the simulation of the transport of radionuclides in porous media. A new numerical method has been proposed, based on Reduced Basis techniques which allows efficient computation of the (space-dependent) effective coefficients. In 2012/13 we start a new collaboration devoted to the modeling and simulation of ventilation devices in nuclear waste disposal. This is a long-term project (with the PhD of Y. Zhang) which aims at solving numerically systems of PDEs describing mass and heat transfer between porous media and ventilation channels. Generally speaking ANDRA has strong needs of numerical tools for simulating transient water/gas flows (with typical applications to understand gas flows emanating from corroded confining devices in nuclear waste disposal and mass/heat exchanges in circulation channels). The performances and flexibility of the commercial code Tough2 are definitely too restricted. It is likely that fostering the skills of several Inria teams working on these topics can be decisive to design new two-phase codes using modern schemes and complex meshes, with domain decomposition methods and parallel procedures.

- **CEA**

We work on the simulation of two-phase flows described by Eulerian/Lagrangian models. To this end, A. Champmartin develops a new semi-Lagrangian algorithm for fluid-kinetic coupling, in collaboration with CEA/DAM and the LRC Manon.

- **GDFSuez EP-Storengy - (Contract with UNS-CNRS)**

The collaboration is devoted to the control of rock permeability by polymer injections, and to the simulation of flows in tight rocks, with weak permeabilities. These questions lead to consider highly heterogeneous and fractured media; in turn simulations should use highly unstructured meshes. During her post-doc, C. Guichard develops new methods for diphasic flows in porous media, with application to tight gas and gas stockage.

- **TOTAL (Contract with UNS-CNRS)**

R. Masson is scientific consultant of the recently created team “Nouveau Simulateur de Réservoir”, led by B. Faissat. The team is concerned with the development of new research codes for oil recovery problems, based on FV methods. Through the post doc of W. Kherriji, we develop new domain decomposition algorithm for the simulation of oil recovery, with local refinement, both in time and space. C. Guichard works on Finite Volumes methods on unstructured meshes.

MCTAO Team

6. Bilateral Contracts and Grants with Industry

6.1. Thales Alenia Space - Inria

“Transfert orbital dans le problème des deux et trois corps avec la technique de propulsion faible”.

This contract starts October, 2012 for 3 years. It partially supports Helen Heninger’s PhD.

The goal is to improve transfer strategies for guidance of a spacecraft in the gravitation field of one central body (the two-body problem) or two celestial bodies (three-body problem).

6.2. CNES - Inria - UPV/EHU

Contract (reference CNES: RS10/TG-0001-019) ending May, 2013. It involves CNES, University of Bilbao (UPV/EHU) and Inria; its objective is to set up a methodology for testing the stability of nonlinear amplifying devices via frequency optimization techniques.

On the Inria side, this contract concerns McTAO for 25% and APICS project-team for 75%.

NACHOS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. High order DGTD- \mathbb{P}_p Maxwell solver for numerical dosimetry studies

Participants: Stéphane Lanteri, Joe Wiart [WHIST Laboratory, Orange Labs, Issy-les-Moulineaux].

The objective of this research grant with the WHIST (Wave Human Interactions and Telecommunications) Laboratory at Orange Labs in Issy-les-Moulineaux is the adaptation of a high order DGTD- \mathbb{P}_p method on tetrahedral meshes developed in the team and its application to numerical dosimetry studies in the context of human exposure to electromagnetic waves emitted from wireless systems. These studies involve realistic geometrical models of human tissues built from medical images.

7.2. Seismic risk assessment by a discontinuous Galerkin method

Participants: Nathalie Glinsky, Stéphane Lanteri, Fabien Peyrusse.

The objective of this research grant with IFSTTAR <http://www.ifsttar.fr> (French institute of sciences and technology for transport, development and networks) and CETE Méditerranée is the numerical modeling of earthquake dynamics taking into account realistic physical models of geological media relevant to this context. In particular, a discontinuous Galerkin method will be designed for the solution of the elastodynamic equations coupled to an appropriate model of physical attenuation of the wave fields for the characterization of a viscoelastic material.

7.3. High order DGTD- \mathbb{P}_p Maxwell solver for electric vulnerability studies

Participants: Loula Fezoui, Stéphane Lanteri, Muriel Sesques [CEA/CESTA, Bordeaux].

The objective of this research grant with CEA/CESTA in Bordeaux is the development of a coupled Vlasov-Maxwell solver combining the high order DGTD- \mathbb{P}_p method on tetrahedral meshes developed in the team and a Particle-In-Cell method. The resulting DGTD- \mathbb{P}_p /PIC solver is used for electrical vulnerability assessment of the experimental chamber of the *Laser Mégajoule* system.

OPALE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

ArcelorMittal-Inria industrial contract n. 5013 : Opale started a thorough collaboration in optimal design of high performance steel with the mentioned world leader industrial. The aim of the collaboration is to develop and study new and efficient tools dedicated to multicriteria shape optimization of structures which undergo large non-linear elasto-plastic deformations.

The present contract has three years duration and funds the Ph.D. thesis of Aalae Benki and Research financial support.

SCIPORT Team (section vide)

TOSCA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- TOSCA Nancy had a bilateral contract with the SME Alphability on the evaluation of the Value at Risk with applications in portfolio management. This collaboration will be continued in 2013.

ABS Project-Team (section vide)

ASCLEPIOS Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Inria - Mauna Kea Technologies I-Lab SIWA

Participants: Nicholas Ayache, Xavier Pennec, Irina Vidal Migallon, Marzieh Kohandani Tafreshi, Barbara André [Mauna Kea technologies], Tom Vercauteren [Mauna Kea technologies], Julien Dauguet [Mauna Kea technologies].

The I-Lab SIWA (Stitching Images and Wisdom into the Atlas) aims at maturing two key image processing technologies into real products for confocal fibered-microscopy. The first axis on content-based image retrieval (CBIR) will develop efficient and friendly tools for helping the diagnosis and for user training. The second axis on image registration will develop near real-time and robust image registration tools for mosaicking, image stabilization and super-resolution.

The opening ceremony of the I-Lab SIWA took place on Friday, November 16, 2012 in the presence of Michel Cosnard (CEO of Inria) and Gérard Giraudon (head of Inria-SAM Center). Keynotes lectures by Asclepios members were given by Xavier Pennec and the two engineers dedicated to this project: Irina Vidal Migallon and Marzieh Kohandani Tafreshi. For more information, visit: <https://lisa.sophia.inria.fr/siwa-loasis-numerique-dinria-et-de-mauna-kea-706.html>

6.2. CIFRE PhD Fellowships

6.2.1. General Electric

The work of Thomas Benseghir, *3D/2D Coronary Registration for Interventional Cardiology Guidance*, is supported by a PhD fellowship from the General Electric company.

6.3. Other contracts

The contracts Cancéropôle PACA, Philips, and Siemens are described in our previous activity reports.

6.4. National initiatives

6.4.1. ANR KaraMetria

Participants: Xavier Pennec [correspondant], Vikash Gupta, Marco Lorenzi.

KaraMetria is the concatenation of Kara ("head", "brain" in ancient Greek), and Metria ("measure"). This ANR-funded project (2010-2012, <http://sites.google.com/site/karametria/>) aims at: developing an extensible image registration framework able to map anatomical descriptors (such as sulcal lines or white matter fibers) of the brain shape from one subject to another ; providing all necessary statistical tools to compare a subject with a group or compare groups of subjects based on the aforementioned registration framework ; and identifying biomarkers of certain brain pathologies and psychiatric disorders. In particular, we target the study of a population of depressive teenagers. This project is led in collaboration with the LNAO at CEA, the MAP5 laboratory from the University Paris Descartes, and the INSERM U797 unit.

6.4.2. Consulting for Industry

- Nicholas Ayache is scientific consultant for the company Mauna Kea Technologies (Paris).

6.4.3. Collaboration with national hospitals

Asclepios is collaborating with the following 3 IHU (University Hospital Institute) in France : the IHU-Strasbourg (Pr J. Marescaux and L. Soler) on image-guided surgery, the IHU-Bordeaux (Pr M. Haïssaguere and Pr P. Jaïs) on cardiac imaging and modeling and the IHU-Pitié Salpêtrière (Dr. O. Colliot and S. Durrleman) on neuroimaging.

We also have long term collaborations with the CHU Nice and Centre Antoine Lacassagne in Nice.

ATHENA Project-Team (section vide)

BIOCORE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Microalgae for biofuel production

Biocore takes part in a project for assessment of microalgal biofuel productivity whose other partners are Alpha Biotech, EADS and PSA Peugeot Citroen.

DEMAR Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- An industrial technological transfer contract is ongoing with the MXM company that develops cochlear implant and artificial lens implant. MXM can perform also Ethylene Oxyde sterilization necessary for all our experimental setups used during surgery. Two DSU prototypes (named Stim'3D and Stim'nD), one miniaturized DSU (named USR24*1000) and an external controller have been developed within this frame. The associated programming environment (SENIS Manager, cf. section 5.1.2) has also been developed in this context.
- The contract with Vivaltis company that is specialized in the development of external stimulators, has been completed. We jointly developed a new advanced external FES system dedicated to clinical rehabilitation; this first wireless external stimulation architecture is now CE marked, and commercialized by Vivaltis.

This work has been awarded by the 1st Prize 2012 of the FIEEC-OSEO on Applied Research.

MODEMIC Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. CAFE

Participants: Céline Casenave, Jérôme Harmand, Alain Rapaport.

The objective of the CAFE European project is to provide new paradigms for the smart control of food processes, on the basis of four typical processes in the areas of bioconversion, separation, preservation and structuring, see details in <http://www.cafe-project.org>. The novelty of the project lies in the capacity of combining PAT (Process Analytical Technology) and sensing devices with models and simulation environment with the following objectives:

1. to extract as much as possible information from the process/plant in the form of precise estimations of unmeasured variables defining, in particular, product quality, and of physical parameters changing as the process dynamics does or difficult to know beforehand;
2. to save and encode the information in a reliable and usable way, basically via physical/deterministic models;
3. to develop control methods to keep uniform quality and production, despite the variability in the raw material and/or to respond to sudden changes in the demand.

MODEMIC is involved in the wine making supervision part (see Section 6.2.4) and in the ice cream crystallization control part (see Section 6.2.5).

7.2. DIMIMOS

Participants: Jérôme Harmand, Alain Rapaport.

DIMIMOS is an ANR SYSTERRA 2008 project of 4 years headed by the UMR Microbiologie du Sol et de l'Environnement (INRA Dijon).

This fundamental research project aims at better understanding the functional microbial soil ecosystems with respect to the turnover of soil organic matter (SOM). More specifically, we aim at evaluating the role of the microbial diversity in transforming SOM, in order to better manage the carbon in its biochemical global cycle within agro-ecosystems. This project must deliver new insights for managing agricultural productivity (allow better agricultural practices) while maintaining a high quality of soil over the long term.

For the final stage of the project, the theoretical results obtained in Section 6.1.7 need to be confronted with the data provided by the partners.

7.3. DISCO

Participants: Fabien Campillo, Chloé Deygout, Bart Haegeman, Jérôme Harmand, Annick Lesne, Claude Lobry, Alain Rapaport, Tewfik Sari.

DISCO (Multi-scale modelling bioDIversity Structure COupling in biofilms) is a three years project funded by the ANR SYSCOMM since the end of 2009, that aims at developing and studying computational and mathematical models of biofilm dynamics, taking into account the biodiversity (distribution of bacteria species) and spatial structure; see details in <https://sites.google.com/site/anrdisco/>.

Several “go back” between simulation models and experiments in plug-flow reactors performed at IRSTEA Antony have been conducted during the two postdoctoral years of C. Deygout hired by the project. A first paper on the simulation of a multi-scale model has been published [17] and a second one on the confrontation with experiments is in preparation (see Section 6.2.2).

At a macro-scale, the team has studied several extensions of the chemostat model dedicated to microbial ecosystems with biofilm (see Section 6.1.1 and the publication [21]).

A new collaboration has been launched with the HBAN team at IRSTEA Antony, within this project, about the modelling of cellulose degradation. Cellulose is typically available in small balls (but ten times larger than the average size of microorganisms) that are first converted by enzymatic activity into carbon substrate that can then be assimilated by the microorganisms. Some of the microorganisms are attached to these balls, creating a particular aggregates structure.

An IBM for the degradation of one cellulose bead (dozens of micrometers in diameter) by cellulolytic bacteria has been developed. Our aim is to determine the macroscopic degradation behavior. The initial stages of the degradation process may involve a very limited number of bacteria that cannot be properly modelled by classical models based on deterministic equations (see Section 6.2.3 and communications [44] and [43]).

The duration of the project has been extended by the ANR to May 2013, in order for the team to prepare a final restitution at Paris in spring 2013.

7.4. MODECOL

Participant: Fabien Campillo.

The ANR SYSCOMM Project MODECOL (January 2009/June 2012) involves three Inria project-teams (MODEMIC, MAESTRO and TOSCA) with the UMR Ecobio (Ecosystèmes, Biodiversité, Evolution, Rennes), the University of La Rochelle and the Universities of Houston and Berkeley. The aim of the Inria component is to propose individual-based models for terrestrial prairial plant communities' dynamics in the context of water purifying from nitrate and pesticides. The results of the Inria component have been published [13] This year was also dedicated to the edition of a special issue of Ecological Modelling on "Modelling clonal plant growth" [22]. See <http://www-sop.inria.fr/members/Fabien.Campillo/software/ibm-clonal/> for more details.

MORPHEME Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. Galderma Sophia-Antipolis

Participants: Sylvain Prigent, Xavier Descombes.

Contribution of multi and hyperspectral imaging to skin pigmentation evaluation. Contract #4383.

In collaboration with Joisane Zerubia from Ayin team.

6.2. Bilateral Grants with Industry

6.2.1. CNES Toulouse and TAS Cannes

Participants: Mikael Carlavan, Laure Blanc-Féraud.

Optimization of the compression-restoration chain for satellite images.

NEUROMATHCOMP Project-Team (section vide)

VIRTUAL PLANTS Project-Team (section vide)

FOCUS Project-Team (section vide)

INDES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts and Grants with Industry

7.1.1. Collaboration with Xiring

In 2011, Tamara Rezk collaborated with a french company based in Paris, Xiring. She visited the company several times in 2011 to carry out this collaboration.

7.1.2. Microsoft Research and Inria Joint Lab

Since 2007, Tamara Rezk is part of the Secure Distributed Computations and their Proofs project of the MSR-Inria lab in Saclay. She travelled several times in 2011 to visit the lab and continue with several collaborations concerning the project.

LOGNET Team

6. Bilateral Contracts and Grants with Industry

6.1. Quantaflow

Participants: Petar Maksimovic [contact], Luigi Liquori, Sebastien Thuriiez [Quantaflow SRL].

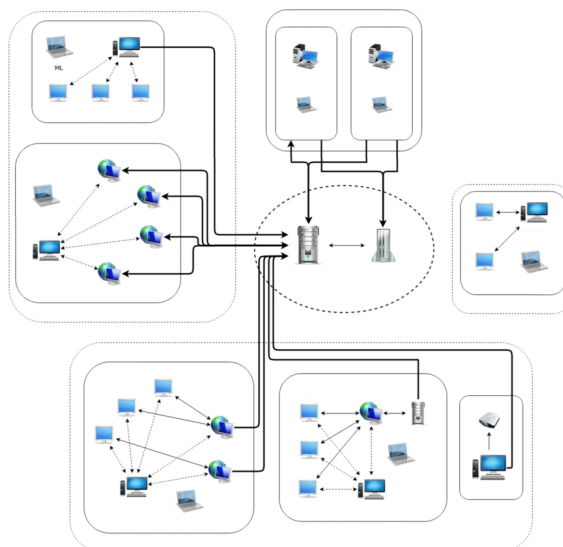


Figure 14. The Quantaflow Network

Quantaflow designs, manufactures and markets hardware, services, and software for professional and autonomous counting and tracking of the flow of people, in the setting of centralized data-gathering, and all for the purposes of security or marketing.

Given the complementarity of their competences, the Parties have decided to form a collaboration in order to formalize a communication protocol that Quantaflow wishes to use with its new equipment.

The main objective of this undertaking was the development of a secure protocol for message exchange between all of the actors in the Quantaflow network see Fig reffig:quantaflow, and has incorporated the following topics:

- Protocol design, in particular:
 - Analysis of use-case scenarios
 - Design of mechanisms for determining device presence in a network
 - Design of protocol messages
 - The flow of protocol messages
- Protocol security, in particular:
 - Message encryption
 - Message authentication
- Cryptography, in particular:
 - Symmetric and public-key cryptography
 - Key storage and management

while the specifics of the work involved are protected by a non-disclosure agreement. This study has been conducted under an NDA and it is released in [24], [25].

6.2. myMed

Participants: Luigi Liquori, myMed Team.

Because of the rich founding of the interreg myMed contract we have started few collaborations under the form of “Contrat de prestations”. Without going too much into détails

- Ludotic: “IHM for myMed”.
- VuLog: info-mobility solutions for myMed (stopped because bad results of the collaboration).
- David Da Silva, “autoentrepreneur”, “conception et implémentation de 3 social application myMed”.
- Sony Marcarelli “ “autoentrepreneur”, “porting of the social applications the Apple Store”.
- GIR MARALPIN: “mounting a critical mass for myMed in the euroregion AlpMed”.

MAESTRO Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

MAESTRO members are involved in the INRIA/ALCATEL-LUCENT BELL LABS joint laboratory and participate in several ADRs (Action de Recherche/Research Action). The joint laboratory consists of three ADRs in its first phase (2008–2012) and six ADRs in its second phase (starting October 2012).

6.1.1. ADR “*Semantic Networking*” (January 2008 – April 2013)

Participants: Sara Alouf, Eitan Altman, Konstantin Avrachenkov, Oussama Habachi, Philippe Nain, Marina Sokol.

Coordinators are Isabelle Guérin Lassous (INRIA project-team RESO) for INRIA and Ludovic Noirie for ALCATEL-LUCENT.

The new paradigm of “semantic networking” for the networks of the future brings together “flow-based networking”, “traffic-awareness” and “self-management” concepts to get “plug-and-play” networks. The natural traffic granularity is the flow. MAESTRO’s task is to elaborate on the scheduling of flows in routers having in mind the fairness among flows with different round-trip times. Three joint INRIA/ALCATEL-LUCENT patents have been filed already, one in 2009 (inventors for INRIA: S. Alouf, K. Avrachenkov, D. Carra, P. Nain) and two in 2010 (inventors for INRIA: S. Alouf, K. Avrachenkov, A. Blanc).

6.1.2. ADR “*Self-Organized Networks in Wireless*” (October 2012 –)

Participants: Eitan Altman, Majed Haddad, Manjesh Kumar Hanawal.

Coordinators are Bruno Gaujal (head of INRIA project-team MESCAL) for INRIA and Laurent Rouillet for ALCATEL-LUCENT.

This ADR is a follow-up of the ADR “Self Optimizing Wireless Networks” from the first phase. Two joint INRIA/ALCATEL-LUCENT patents have been filed during the first phase, one in 2011 (inventors for INRIA: E. Altman, S. Ramanath) and one in 2012 (inventors for INRIA: E. Altman).

Many key features in mobile access networks rely on user velocity information in order to reinforce the perception of performance stability during mobility. Based on the analytical framework elaborated during the first phase that show the need for an efficient method of user speed estimation, the first objective of the research activity (strongly supported by the Wireless Business Unit) is to devise a procedure for user speed estimation or classification.

6.2. Bilateral Grants with Industry

6.2.1. CRE “*Content-Centric Networking*” (October 2010 – December 2012)

Participants: Sara Alouf, Konstantin Avrachenkov, Nicaise Choungmo Fofack, Philippe Nain, Giovanni Neglia.

Contractor: Orange Labs (<http://www.orange.com/en/innovation>)

Participants: Bruno Kauffmann, Luca Muscariello, Alain Simonian.

The objective of this grant (CRE) is to develop mathematical models for the analysis of Content-Centric Networks (CCN). This research focuses on routing and caching policies.

P. Nain is responsible for INRIA. This work is done in collaboration with C. Barakat (PLANETE, INRIA).

6.2.2. CRE “*Self Optimization in Networks*” (October 2009 – September 2012)

Participants: Eitan Altman, Richard Combes.

Contractors are

- Orange Labs (<http://www.orange.com/en/innovation>). Participant: Zwi Altman,
- Univ. Pierre and Marie Curie (UPMC, <http://www.upmc.fr>). Participant: Sylvain Sorin.

This grant (CRE) from Orange Labs is related to a Cifre thesis allocated to R. Combes, whose advisors are E. Altman, S. Sorin (UPMC) and Z. Altman (Orange Labs).

MASCOTTE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Contract APRF (région PACA/FEDER) RAISOM with 3-Roam and Avisto, 05/2009 - 04/2012

Participants: Jean-Claude Bermond, David Coudert, Alvinice Kodjo, Stéphane Pérennes, Issam Tahiri.

On Wireless IP Service Deployment optimization and monitoring.

(<http://www-sop.inria.fr/mascotte/projets/raisom/>)

7.2. Bilateral Grants with Industry

7.2.1. Contract CIFRE with Orange Labs, 11/2009 - 12/2012

Participants: Jean-Claude Bermond, Mikaila Toko Worou.

"Convention de recherche encadrant une bourse CIFRE" on the topic *Outils algorithmiques pour la détection des communautés*.

7.2.2. Contract CIFRE with Orange Labs, 02/2011 - 01/2014

Participants: Jean-Claude Bermond, Sébastien Félix.

"Convention de recherche encadrant une bourse CIFRE" on the topic *Smart Transports: optimisation du trafic dans les villes*.

7.2.3. Contract CIFRE with KONTRON, 11/2011 - 10/2014

Participants: Michel Syska, Mohamed Amine Bergach.

"Convention de recherche encadrant une bourse CIFRE" on the topic *Graphic Processing Units for Signal Processing* with joint supervision with AOSTE project.

OASIS Project-Team (section vide)

PLANETE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

Industrial contract with Alcatel Lucent - Bell Labs (2008-2012):

The goal of this study is the use of AL-FEC techniques in broadcasting systems and in particular on the optimization of FEC strategies for wireless communications. Two persons are working in the context of this contract: Ferdaouss Mattoussi works on the design, analysis and optimization of a Generalized LDPC AL-FEC scheme, and Rodrigue Imad work focuses on Unequal Erasure Protection capabilities (UEP) and file bundle protection systems.

AXIS Project-Team (section vide)

AYIN Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts and Grants with Industry

7.1.1. Galderma Sophia-Antipolis

Participants: Sylvain Prigent, Xavier Descombes [Morpheme PI], Josiane Zerubia [AYIN PI].

Contribution of multi and hyperspectral imaging to skin pigmentation evaluation. Contract #4383.

7.1.2. ISA/DITEN

Participants: Aurélie Voisin, Vladimir Krylov, Josiane Zerubia [AYIN PI].

Development and validation of multitemporal image analysis methodologies for multirisk monitoring of critical structures and infrastructures. In collaboration with Gabriele Moser and Sebastiano Serpico[PI], from the University of Genoa (DITEN) and the Italian Space Agency (ISA).

7.1.3. EADS foundation

Participants: Ikhlef Bechar, Josiane Zerubia [PI].

Detection of objects in infrared imagery using phase field higher-order active contours. In collaboration with Ian Jermyn from the University of Durham (Dept of Mathematical Sciences).

7.1.4. Astrium/EADS

Participants: Paula Craciun, Josiane Zerubia [PI].

Automatic object tracking on a sequence of images taken from a geostationary satellite. In collaboration with Pierre Del Moral from Inria Bordeaux (ALEA team) and Ecole Polytechnique (CMAPX) Palaiseau.

COPRIN Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Airbus France

Participant: Yves Papegay.

To improve the production of numerical (flight) simulators from models of aerodynamics, Airbus France is interested in methods and tools like those described in 6.3.1 .

Following the contracts signed in 2003, 2005 and 2007 with the aircraft maker, and a consulting contract in 2008 to study the possible development of an industrial tool, we have initiated in 2009 a 2-years collaboration (extended in 2012) to enhanced the fonctionnalities and performances of the existing pieces of software belonging to Airbus and to turn them into a prototype that integrate and showcase our results.

Following a first transfer agreement signed in 2010, and another contract licensing to Airbus a second version of this prototype in 2011, a last agreement to be signed in November 2012 will license the final and tested version [34].

7.2. Thales Alenia Space

Participants: David Daney [correspondant], Thibault Gayral, Jean-Pierre Merlet.

Thales Alenia Space, in partnership with the Coprin team, is studying a new concept of active space telescope. Based on a parallel architecture, its structure allows not only the telescope deployment in space but also the accurate positioning of the secondary mirror with respect to the primary one in order to improve the provided images quality. The deployment and re-positioning concepts were validated thanks to a first prototype, and the telescope performances improvement is currently under study. A first study brought to light the front-seat role of mechanical joints on the structure accuracy. However, in order to deal with the required optical accuracy and space constraints, those mechanical joints had to be replaced by flexible ones. A new prototype was then designed and built in order to validate its ability to ameliorate its images quality using flexible joints. The goal of this project is to self-calibrate the mechanical structure of the telescope: using only proprioceptive information, parameters of the robot model will be identified. Thus, a space telescope based on this concept will be able to reach its final orbit, and then to improve its image accuracy thanks to an autonomous procedure.

7.3. Collaboration with ADEME: carbon value and carbon tax in the context of renewable energies deployment

Participants: Odile Pourtallier, Mireille Bossy.

Started in January 2009 and finished in October 2012, this collaboration financed by the French Environment and Energy Management Agency (ADEME), involves the Centre for Applied Mathematics (CMA), at Mines ParisTech, COPRIN and TOSCA teams at Inria. It focuses on a short term carbon value derived from the so-called financial *carbon market*, the European Union Emission Trading Scheme (EU ETS), which is a framework for GHG emissions reduction in European industry.

The objective of this project is to study the compatibility and complementarity of a carbon tax and a target for renewable energy deployment [32], see also Inria -TOSCA Team report.

GRAPHIK Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. ABES

Participants: Michel Leclaire, Michel Chein, Madalina Croitoru, Léa Guizol.

Collaboration with ABES. Funding of half a PhD grant (Léa Guizol, started in October 2011). See Sect. 6.3 .

7.2. CTFC

Participants: Patrice Buche, Jérôme Fortin, Awa Diattara.

We have initiated a national collaboration with the technical center of Comtois' cheese (CTFC : Centre Technique des Fromages Comtois). The objective of this collaboration is to design and test a platform for expert knowledge management. This will allow us to validate the integration of our theoretical tools on a new real-world application and strengthen GraphIK's involvement in agronomy applications. A master degree internship in collaboration with CTFC is done by Awa Diattara (University Gaston Berger of Saint-Louis, Sénégal).

7.3. INA

Participants: Michel Leclaire, Michel Chein, Marie-Laure Mugnier, Akila Ghersedine.

Funding of a PhD CIFRE-grant (Akila Ghersedine, started in May 2012). The objective of the collaboration is to propose automatic (or semi-automatic) technics for enriching authorities. An authority is a record that describes a named entity used in document metadata (e.g. a person, a domain). The elaboration of a solution requires addressing different problems: extraction of knowledge from textual metadata, entity resolution which is the core problematic of the Akila Ghersedine's thesis subject, and authority fusion.

LAGADIC Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Dassault Aviation

Participants: Laurent Coutard, François Chaumette.

no. Inria Rennes 5140, duration : 36 months.

This contract that started in 2009 supported Laurent Coutard's Ph.D. about automatic aircraft landing on carrier by visual servoing (see Section 6.2.6).

7.1.2. Fondation EADS

Participants: Antoine Petit, Eric Marchand.

no. Inria Rennes 5605, duration : 36 months.

This contract that started in March 2011 supports Antoine Petit's Ph.D. about 3D model-based tracking for applications in space (see Section 6.1.1).

7.1.3. Orange Labs

Participants: Pierre Martin, Eric Marchand.

no URI 10CC310-03, duration : 36 months.

This contract started in February 2010. It is devoted to support the Cifre convention between Orange Labs and Université de Rennes 1 regarding Pierre Martin's Ph.D (see Section 6.3.3).

7.1.4. Astrium EADS

Participants: Tawsif Gokhool, Patrick Rives.

no. Inria Sophia 7128, duration : 36 months.

The objective of this project that started in February 2012 is to investigate the general problem of visual mapping of complex 3D environments that evolve over time. This contract supports Tawsif Gokhool's Ph.D.

7.1.5. ECA Robotics

Participants: Romain Drouilly, Patrick Rives.

no. Inria Sophia 7030, duration : 36 months.

This project that started in May 2012 aims at specifying a semantic representation well adapted to the problem of navigation in structured environment (indoors or outdoors). This contract is devoted to support the Cifre Convention between ECA Robotics and Inria Sophia Antipolis regarding Romain Drouilly's Ph.D.

REVES Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Grants with Industry

6.1.1. Industrial Contracts and Donations

6.1.1.1. Autodesk

Participants: Pierre-Yves Laffont, Adrien Bousseau, George Drettakis.

We signed a technology transfer agreement with Autodesk RID technology on single-lighting condition intrinsic images. Autodesk has offered a significant research donation to REVES in support of our work on intrinsic images. Autodesk has also donated several licenses of Maya, 3DS Max and SketchBookPro.

6.1.1.2. Adobe

Participants: Pierre-Yves Laffont, Adrien Bousseau, George Drettakis.

In the context of our collaboration with Adobe (project with S. Paris and F. Durand from MIT), we have received a cash donation in support of our research and software donations of Adobe CS6 Creative Suite.

STARS Team (section vide)

WIMMICS Team

7. Bilateral Contracts and Grants with Industry

7.1. Alcatel Lucent Bell

We initiated a Research Contract (CRE) and CIFRE PhD Thesis (2011-2013) on Social objects, object-centered sociality, and object-centered social networks to propose mobile context-based notification application in a semantic and pervasive Web. This work will explore spreading algorithms in typed graphs.

7.2. SAP

We have a PhD Thesis (Cifre) with SAP Research on *Usage semantics of analytics and Business Intelligence tools*.

ZENITH Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Data Publica (2010-2013)

Participants: Emmanuel Castanier, Patrick Valduriez.

Data Publica (<http://www.data-publica.com>) is a startup providing a web portal for open data which can be public, private, free or charged. We collaborate with Data Publica through our WebSmach tool on technologies for automatic schema extraction and matching from high numbers of data sources. A first contribution has been the development of an Excel extraction component based on machine learning techniques.