



RESEARCH CENTER

FIELD

**Perception, Cognition and Interaction**

Activity Report 2013

# Section Contracts and Grants with Industry

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

## **DREAM Project-Team**

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

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

### **7.1.1. *ManageYourSelf: diagnosis and monitoring of embedded platforms***

**Participants:** Marie-Odile Cordier, Sophie Robin, Laurence Rozé.

ManageYourSelf is a project that deals with the diagnosis and monitoring of embedded platforms, in the framework of a collaboration with Telelogos, a French company expert in mobile management and data synchronization. ManageYourSelf aims to perform diagnostic and repair on a fleet of mobile smartphones and PDAs. The idea is to embed on the mobile devices a rule-based expert system and its set of politics, for example "if memory full 'then delete (directory). recognition is performed, using the parameters of the phones as the fact base. Of course, it is impossible to foresee all the rules in advance. Upon detection of a non anticipated problem, a report containing all the system's information prior to the problem is sent to a server. The learning step was first implemented using decision trees, the aim being to characterize the faults and consequently update the global knowledge base and its distributed instances. An incremental version of this learning step has been studied in order to get an on-line process [36]. This means being able to learn new faults characterizations and add new preventive rules, and also forget no longer needed ones.

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

## GRAPHIK Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. ABES

**Participants:** Michel Leclère, Michel Chein, Madalina Croitoru, Léa Guizol.

Collaboration with ABES. Funding of half a PhD grant (Léa Guizol, started in October 2011). See Section 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 into a real-world application and strengthen GraphIK's involvement in agronomy applications. A master degree internship in collaboration with CTFC was done by Awa Diattara (University Gaston Berger of Saint-Louis, Sénégal) in 2012. Awa Diattara came back as engineer to complete her work for a six month period in 2013.

This collaboration should be strengthened in 2014 in a enlarged project involving different traditional food chains (CNAOL, Conseil National des Appellations d'Origine Laitière).

## 7.3. Panzani

**Participants:** Patrice Buche, Jérôme Fortin, Laureline Estival, Bernard Cuq.

We have initiated a national collaboration with Panzani. The objective of this collaboration is to test and get new feedbacks about the platform for expert knowledge management. A master degree internship in collaboration with Panzani was done by an agronomy student, Laureline Estival (Agrosup Dijon), in 2013. This internship enabled us to validate the interest of our tool for Panzani and thus ensure that our developments and software could deal with several types of applications while being usable by non computer sciences experts.

Laureline Estival has continued her work, financed by Panzani, as an engineer to complete the knowledge base for a six month period in 2013-14.



## **LINKS Team**

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

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

Innovimax, Cifre and Engineer (2010-2014) The PhD thesis of Tom SEBASTIAN within the QUIXPROC project is supervised by J. NIEHREN in cooperation with M. ZERGAOUI the head of the INNOVIMAX company. The software development in this context is supported by D. DEBARBIEUX, a senior engineer co-funded by INNOVIMAX and INRIA.

## MAGNET Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

First, we are involved in the HERMES project along a collaboration with the SEQUELINRIA team and with a consortium of companies. In that collaboration, the envisioned applications is the design of recommender systems for commercial data. One objective is to provide social recommendations, that is to take into accounts in the recommendations, social relationships between users and the content of messages posted by users in forums.

Second, we start a one to one cooperation with the CLIC AND WALK company along the PhD thesis of PAULINE WAUQUIER. The company makes marketing surveys by consumers (called clicwalkers). The goal of the company is to understand the community of clicwalkers (40 thousands in one year) and its evolution with two objectives: the first one is to optimize the attribution of surveys to clicwalkers, and the second is to expand company's market to foreign countries. Social data can be obtained from social networks (G+, Facebook, ...) but there is no explicit network to describe the clicwalkers community. But users activity in answering surveys as well as server logs can provide traces of information diffusion, geolocalisation data, temporal data, sponsorship,... We will study the problem of adaptive graph construction from the clicwalkers network. Node (users) classification and clustering algorithms will be applied. For the problem of survey recommendations, the problem of teams constitution in a bipartite graphs of users and surveys will be studied. Random graph modeling and generative models of random graphs will be one step towards the prediction of the evolution of clicwalkers community.

Third, we have started a transfer collaboration with the MUSIC STORY company. In a first phase, we have considered the question of collecting musical metadata from heterogeneous sources. We have proposed machine learning methods and similarity measures for curating metadata. The MUSIC STORY company has close industrial collaborations with the DEEZER company. Current discussions between MAGNET and these two companies are open on social recommender systems for music.

Last, we work with physicians at the Lille hospital (CHRU) on the detection of brain anomalies related to epilepsy. Hence, we will use connectome data which is an approximate map of neural connections at different scales. The connectome can be modeled by a weighted graph. Available data include graphs constructed at different times for a given patient, also graphs for healthy patients and epileptic patients. One objective of the research project is to study how the connectome together with other signals, like functional magnetic resonance imaging (FRMI), MEG and EEG can be efficiently combined in order to detect abnormal brain regions. We will consider diffusion algorithms in graphs to test whether diffusion processes in the brain can be explained with the connectome. We will also consider learning algorithms related to information diffusion in order to enhance graph construction.

## 7.2. Bilateral Grants with Industry

### 7.2.1. Cifre SAP (2011-2014)

**Participants:** Thomas Ricatte, Gemma Casas Garriga, Marc Tommasi, Rémi Gilleron [correspondent].

GEMMA GARRIGA, and MARC TOMMASI supervise the PhD thesis (Cifre) of Thomas Ricatte together with Yannick Cras from SAP.

### 7.2.2. Cifre Clic and Walk (2013-2016)

**Participants:** Pauline Wauquier, Marc Tommasi, Mikaela Keller [correspondent].

MIKAELA KELLER and MARC TOMMASI supervise the PhD thesis (Cifre) of PAULINE WAUQUIER on graph-based recommendation together with Guillaume André from Clic and Walk.

## MAIA Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Inria-EDF Strategic action MS4SG

**Participants:** Vincent Chevrier, Julien Vaubourg.

*Laurent Ciarletta and Yannick Presse (Madynes team, LORIA) are external collaborators.*

The MS4SG (multi-simulation for smart grids) project is granted as a strategic action between Inria and EDF. This project is joint between the Inria teams Madynes and MAIA, and EDF R&D.

Smart grids are electric supply grids endowed with smart capabilities because of the use of information and communication technologies. This perspective of smart grids corresponds to new challenges ; in particular one must re-think the way electricity is supplied to customers and the power supply network is regulated.

The simulation approach can deal with the supervision and regulation of these systems. Such an approach implies to integrate simulators coming from different domains: electrical networks, communication networks and information systems. As these domains can influence each other, smart grids can be considered as a kind of complex system and we are faced with multi-modeling and multi-simulation issues; in particular we must deal with the fact that the models used in the different simulators are not of the same kind (heterogeneous simulations) and that we must link and re-use existing simulators that were designed to work alone on their own.

The aim of the project is to provide primitives based on AA4MM in order to enable the multi-modeling and the multi-simulation of smart grids.

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

## ORPAILLEUR Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. The BioIntelligence Project

**Participants:** Mehwish Alam, Yasmine Assess, Aleksey Buzmakov, Melisachew Chekol, Adrien Coulet, Marie-Dominique Devignes, Amedeo Napoli [contact person], Nicolas Pépin-Hermann, Malika Smaïl-Tabbone.

The objective of the “BioIntelligence” project is to design an integrated framework for the discovery and the development of new biological products. This framework takes into account all phases of the development of a product, from molecular to industrial aspects, and is intended to be used in life science industry (pharmacy, medicine, cosmetics, etc.). The framework has to propose various tools and activities such as: (1) a platform for searching and analyzing biological information (heterogeneous data, documents, knowledge sources, etc.), (2) knowledge-based models and process for simulation and biology in silico, (3) the management of all activities related to the discovery of new products in collaboration with the industrial laboratories (collaborative work, industrial process management, quality, certification). The “BioIntelligence” project is led by “Dassault Systèmes” and involves industrial partners such as Sanofi Aventis, Laboratoires Pierre Fabre, Ipsen, Servier, Bayer Crops, and two academics, Inserm and Inria. An annual meeting of the project usually takes place in Sophia-Antipolis at the beginning of July.

Two theses related to “BioIntelligence” are currently in preparation within the Orpailleur team. A first thesis is related to the mining of complex biological data using FCA and RCA techniques [37], [44]. The objective is to take advantage of Linked Open data in biology for helping the biologist querying complex data. There are needs to integrate data and knowledge from several web resources. Practical experiments will be led on biological data (clinical trials data and cohort data) also in accordance with ontologies lying at the NCBO BioPortal.

A second thesis is based on an extension of FCA involving Pattern Structures on complex data such as sequences and graphs [42], [41]. The idea is to extend the formalism of pattern structures to these complex data for being able to classify complex structures such as patient trajectories or molecular structures. The classification results (e.g. concept lattices) are expected to help practitioners in information retrieval tasks and specific problem solving.

## 7.2. The Quaero Project

**Participants:** Victor Codocedo [contact person], Ioanna Lykourantzou, Amedeo Napoli.

The Quaero project (<http://www.quaero.org>) is a program aimed at promoting research and industrial innovation on technologies for automatic analysis and classification of multimedia and multilingual documents. The partners collaborate on research and the realization of advanced demonstrators and prototypes of innovating applications and services for access and usage of multimedia information, such as spoken language, images, video and music.

In this framework, the Orpailleur team is working on information retrieval, document annotation and recommendation. The objective is to define methods and algorithms for achieving these complex tasks, based on KDDK techniques and especially the FCA technology.

A thesis is in preparation in the context of the Quaero project, where information retrieval and document annotation are especially studied, namely information retrieval guided by domain knowledge and classification of documents w.r.t. their annotations using FCA and pattern structures [48]. In addition, a related work was carried out on the reengineering of relational data within a concept lattice [58].

## SMIS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

The SMIS project has a long lasting cooperation with Gemalto, the world's leading providers of microprocessor cards. Gemalto provides SMIS with advanced hardware and software smart card platforms which are used to validate numbers of our research results. In return, SMIS provides Gemalto with requirements and technical feedbacks that help them adapting their future platforms towards data intensive applications. While no bilateral contract exists between Gemalto and SMIS, we are partners in several projects. Meanwhile, we are developing partnerships with SMEs capable of building ad-hoc hardware prototypes conforming to our own design.

## 7.2. DMSP3 Yvelines District Grant (Nov 2013 - Nov. 2014)

Partners: Inria-SMIS (coordinator), Gemalto, UVSQ, Santeos.

SMIS funding: 75k€.

[http://www-smis.inria.fr/\\_DMSP/accueil.php](http://www-smis.inria.fr/_DMSP/accueil.php)

Electronic Health Record (EHR) projects have been launched in most developed countries to increase the quality of care while decreasing its cost. Despite their unquestionable benefits, patients are reluctant to abandon their control of highly sensitive data to a distant server. The objective of the DMSP project is to complement a traditional EHR server with a secure and mobile personal medical folder (1) to protect and share highly sensitive data among trusted parties and (2) to provide a seamless access to the data even in disconnected mode. The DMSP architecture builds upon the technology designed in the PlugDB project (see above). This architecture has been designed and developed under grant DMSP1 ended in 2010. It has been experimented in the context of a medical-social network providing care and services at home for elderly people. The experiment in the field, founded by grant DMSP2, lasted from September 2011 to December 2012 with volunteer patients and practitioners in the Yvelines district. The goal of grant DMSP3 (Nov 2013 - Nov 2014) is to correct the imperfections observed during DMSP2 and port our prototype in an open hardware platform with the final objective to set up a technology transfer.

**TYREX Team (section vide)**

## **WIMMICS Project-Team**

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

## **7.1. Alcatel Lucent Bell Labs**

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*.

## **7.3. SynchroNext**

Catherine Faron Zucker, Elena Cabrio and Fabien Gandon constructed a scientific collaboration project with the SynchroNext company which led to the acceptance of a CIFRE PhD Thesis by the ANR. Amine Hallili started his PhD Thesis in November 2013.



## **ZENITH Project-Team**

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

## **7.1. Microsoft (2013-2017)**

**Participants:** Ji Liu, Esther Pacitti, Patrick Valduriez.

This joint project is on advanced data storage and processing for cloud workflows with the Kerdata team in the context of the Joint Inria – Microsoft Research Centre. The project 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 will be performed using synthetic benchmarks and real-life applications from bioinformatics: first on the Grid5000 platform in a preliminary phase, then on the Microsoft Azure cloud environment.

## **7.2. EDF R&D (2013-2014)**

**Participants:** Tristand Allard, Florent Masegla, Esther Pacitti.

This project aims at developing new data mining techniques for P2P networks. The main goal is to preserve data privacy, while achieving good performance of analysis processes on the tackled data. More precisely, each participant in the P2P network has its own individual data (e.g. results of experiments for a scientific partner) and all the participants would like to acquire knowledge computed on the whole dataset (i.e. the union of all the individual data on the peers). Meanwhile, participants want a guarantee that no other participant will be able to see their data. The P2P protocol we are developing will then be able to extract knowledge from the whole set of distributed data, while avoiding centralization, and guaranteeing data privacy for all peers.

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

## AVIZ Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Google Research Award

**Participants:** Jean-Daniel Fekete [correspondant], Petra Isenberg, Jeremy Boy, Heidi Lam.

Offering data access to the public is a strong trend of the recent years. Several free data providers or repositories are now online (e.g. <http://data.gov.uk>, <http://stats.oecd.org>, <http://publicdata.eu>, <http://opendata.paris.fr>, <http://www.google.com/publicdata>, <http://www.data-publica.com>), offering a rich set of data to allow citizens to build their own understanding of complex political and economic information by exploring information in its original form. However, these initiatives have had little impact directly on the public since working with this open data is often cumbersome, requires additional data wrangling, and the spreadsheets themselves take a long time to understand before useful further work can be done with them. This proposal focuses on public data visualization to offer more engaging environments for exploration of public data and to enable stronger democratic discourse about the data contents.

The goal of this proposed research project is to bridge the gap between generic visualization sites for public data and engaging content-specific visualization of this data which can be used and individually adapted to tell a story about public data. Through the design and deployment of rich and engaging interactive visualizations from public data sources we want to truly reach the goal of the public data movement: empowering the citizens and social actors by allowing them to better understand the world they are living in, to make informed decisions on complex issues such as the impact of a medical treatment on a dangerous illness or the tradeoffs offered of power plant technologies based on facts instead of assumptions.

For more information, see <http://peopleviz.gforge.inria.fr/trunk>.

## HYBRID Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Grants with Industry

### 7.1.1. Orange Labs

**Participants:** Pierre Gaucher, Anatole Lécuyer.

This grant started in October 2012 and supported Pierre Gaucher's CIFRE PhD program on "Novel 3D interaction techniques based on pseudo-haptic feedback".

### 7.1.2. Technicolor

**Participants:** Fabien Danieau, Anatole Lécuyer.

This grant started in January 2011 and supported Fabien Danieau's CIFRE PhD program on "Improving audiovisual experience with haptic feedback".

## 7.2. Bilateral Contracts with Industry

### 7.2.1. Mensia Technologies

**Participants:** Jozef Legény, Jussi Lindgren, Anatole Lécuyer.

**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 contract between Hybrid and Mensia started in November 2013 and supported the transfer of several softwares designed by Hybrid team ("OpenViBE", "StateFinder") related to our BCI activity and our OpenViBE software (section 5.1 ) to Mensia Technologies for 5 years, for future multimedia or medical applications of Mensia.

### 7.2.2. MBA Multimedia

**Participants:** Ferran Argelaguet Sanz, Maud Marchal, Anatole Lécuyer.

This contract started in June 2013 and supported the transfer of several softwares designed by Hybrid team ("3D Cursors", "Elastic Images") in the frame of the W3D project (section 8.1.2 ) to MBA Multimédia company for future applications in the field of multimedia and web design based mainly on HTML5 and Word Press software.

### 7.2.3. Polymorph Studio

**Participants:** Ferran Argelaguet Sanz, Maud Marchal, Anatole Lécuyer.

This contract started in June 2013 and supported the transfer of several softwares designed by Hybrid team ("3D Cursors", "Pseudo-haptik", "Elastic Images") in the frame of the W3D project (section 8.1.2 ) to Polymorph Studio company for future applications in the field of multimedia and web design based mainly on Unity3D software.

## IMAGINE Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts and Grants with Industry

### 6.1.1. *EADS - Idealization of components for structural mechanics (06/2011 - 06/2014)*

**Participants:** Flavien Boussuge, Stefanie Hahmann, Jean-Claude Léon.

Cifre PhD in partnership with EADS IW to generate the shape of mechanical components through dimensional reduction operations as needed for mechanical simulations, e.g. transformations from volume bodies to shells or plates forming surface models, usually non-manifold ones. The topic addressed covers also the shape detail removal process that takes place during the successive phases where subsets of the initial shape are idealized. Mechanical criteria are taken into account that interact with the dimensional reductions and the detail removal processes. The goal is to define the transformation operators such that a large range of mechanical components can be processed as automatically and robustly as possible. Two major results have been obtained to generate construction graphs from CAD models and use a construction graph to generate a dimensionally reduced model suited for Finite Element Analyses.

### 6.1.2. *EDF - Generating construction graphs of solids for physical simulation purposes (09/2013 - 09/2016)*

**Participants:** Jean-Claude Léon, Aarohi Johal.

Cifre PhD in partnership with EDF to generate a construction graph of a CAD solid model from its description as in a STEP file in collaboration with Georges-Pierre Bonneau (Maverick project). This is a most frequent requirement in an industrial context where construction trees are lost when transferring models between CAD and simulation software. It is also critical to describe variants of construction processes of a solid because different modifications or different applications require different construction processes whereas a CAD software could provide only the construction process used when initially generating a solid. This project builds upon the construction graph generation process set up for dimensional reduction of solids and on the symmetry analysis of solids that have been addressed in the past years.

### 6.1.3. *HAPTIHAND technology transfer project (Inria-HAPTION-Arts et Métiers ParisTech) (10/2012-08/2014)*

**Participants:** Maxime Borettaz, Thomas Dupeux, Jean-Claude Léon.

The objective is to transfer a device, named HandNavigator, that has been developed in collaboration with Arts et Métiers ParisTech/Institut Image, as add on to the 6D Virtuose haptic device developed by HAPTION. The purpose of the HandNavigator is to monitor the movement of a virtual hand at a relatively detailed scale (movements of fingers and phalanxes), in order to create precise interactions with virtual objects like object grasping. This includes monitoring the whole Virtuose 6D arm and the HandNavigator in a virtual environment, for typical applications of maintenance simulation and virtual assembly in industry. The project covers the creation of an API coupled to physical engine to generate and monitor a realistic and intuitive use of the entire device, the creation of physical prototypes incorporating multiple sensors for each user's finger. The physical prototypes have been developed using rapid prototyping technologies like the 3D printing device available from the Amigual4Home project (ANR-11-EQPX-0002).

## **IN-SITU Project-Team**

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

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

*Mix3D - CIFRE Funding for Justin Mathew PhD thesis “New visualization and interaction techniques in spatial composition for mixing audio interfaces in the context of 3D spatial audio.”, Coordinator: Stéphane Huot. Partners: Univ. Paris-Sud, ENS Louis-Lumière & DMS-Cinema. The project involves studying and designing new ‘physical’ and software interfaces for mixing spatial audio.*

## **MANAO Team**

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

## **6.1. CIFRE PhD contract with Technicolor**

**Participants:** C. Buron, G. Guennebaud and X. Granier

For this project, we aim to provide interactive generation and rendering for very large sceneries, based on grammars. We aim also to offer artist-friendly methods for controlling grammar behavior.

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



## MIMETIC Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Grants with Industry

### 7.1.1. Cifre Contract with Faurecia

**Participants:** Franck Multon [contact], Pierre Plantard.

This contract aims at developing new ergonomics assessments based on inaccurate Kinect measurements in manufactures on real workers. The main challenges are:

- being able to improve the Microsoft Kinect measurement in order to extract accurate poses from depth images while occlusions may occur,
- developing new inverse dynamics methods based on such inaccurate kinematic data in order to estimate the joint torques required to perform the observed task,
- and proposing a new assessment tool to translate joint torques and poses into potential musculoskeletal disorders risks.

Faurecia has developed its own assessment tool but it requires tedious and subjective tasks for the user, at specific times in the work cycle. By using Kinect information we aim at providing more objective data over the whole cycle not only for specific times. We also wish to make the user focus on the interpretation and understanding of the operator's tasks instead of taking time estimating joint angles in images.

This work is performed in close collaboration with an ergonomist in Faurecia together with the software development service of the company to design the new version of their assessment tool. This tool will be first evaluated on a selection of manufacture sites and will then be spread worldwide among the 270 Faurecia sites in 33 countries.

This contract enabled us to hire Pierre Plantard as a PhD student to carry-out this work in MimeTIC and M2S Lab. He started in January 2013 and will finish in December 2015.

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

**POTIOC Team (section vide)**

## REVES Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts with Industry

### 6.1.1. Autodesk

**Participants:** Adrien Bousseau, George Drettakis, Clement Riant, Sylvain Duchene.

We extended our technology transfer agreement with Autodesk concerning the RID technology on single-lighting condition intrinsic images. We transferred a first version of the software on Autodesk servers.

## 6.2. Bilateral Grants with Industry

### 6.2.1. Autodesk

**Participants:** Adrien Bousseau, George Drettakis, Clement Riant, Sylvain Duchene.

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.

### 6.2.2. Adobe

**Participants:** George Drettakis, Gaurav Chaurasia.

Adobe has offered a small donation in the context of the Halide project (Sec. 5.1.4). Adobe has also signed an evaluation license for the Vector Shade Trees software developed in the context of [14].

## TITANE Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Astrium*

**Participants:** Sven Oesau, Florent Lafarge, Pierre Alliez.

The main goal of this collaboration is to devise new algorithms for reconstructing 3D indoor models that are 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 devising more complex geometric entities adapted to a detailed and semantized description of scenes.

- Starting date: April 2012

- Duration: 3 years

### 7.1.2. *Geoimage*

**Participants:** Liuyun Duan, Florent Lafarge, Pierre Alliez.

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 DEMs. A key direction consists in incorporating semantic information directly during the image matching process. This semantic is related to the type of components of the scene, such as vegetation, roofs, building edges, roads and land.

- Starting date: November 2013

- Duration: 3 years

### 7.1.3. *Technicolor*

**Participants:** Xavier Rolland-Neviere, Pierre Alliez.

The goal of this Cifre Ph.D. thesis project is to devise a method for watermarking 3D models, with resilience to a wide range of attacks and poses.

- Starting date: October 2012

- Duration: 3 years

...

## **ALPAGE Project-Team**

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

## **7.1. Contracts with Industry**

Alpage has developed several collaborations with industrial partners. Apart from grants described in the next section, specific collaboration agreements have been set up with the following companies:

- Verbatim Analysis (license agreement, transfer agreement, “CIFRE” PhD, see section 4.3 ),
- Lingua et Machina (DTI-funded engineer, see section 4.4 ), Viavoo,
- Yseop (“CIFRE” PhD of Raphael Salmon which started in 2012 on automatic text generation)
- CEA-List (“CIFRE” PhD of Quentin Pradet on the development of lexical resources which help annotating semantic roles; e.g., development of a French VerbNet)

## PANAMA Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. Contract with Canon Research Centre France SAS

**Participants:** Joachim Thiemann, Nancy Bertin, Frédéric Bimbot.

*Duration:* 1.5 years (2012–2013).

*Research axis:* 3.2.2

*Partner:* Canon Research Centre France SAS

This contract aims at transferring some of the research done within METISS/PANAMA to products developed by Canon Inc. Two patents were filed [50], [51]. Final internal report was delivered in October 2013.

### 7.1.2. Contract with Studio MAIA

**Participants:** Nancy Bertin, Frédéric Bimbot, Jules Espiau de Lamaestre, Jérémy Paret, Nathan Souviraà-Labastie.

*Duration:* 3 years (2012–2014).

*Research axis:* 3.2.2

*Partners:* Studio MAIA (*Musiciens Artistes Interprètes Associés*), Imaging Factory

This contract aims at transferring some of the research done within PANAMA towards new services provided by MAIA Studio.

More specifically, the main objective is to adapt source separations algorithms and some other advanced signal processing techniques elaborated by PANAMA in a user-informed context.

The objective is twofold:

- partial automation of some tasks which the user previously had to accomplish manually
- improved quality of separation and processing by exploiting user inputs and controls

The resulting semi-automated separation and processing will feed an integrated software used for the professional remastering of audiovisual pieces. A first version of PANAMA tools were integrated in the software developed by Imaging Factory and delivered to MAIA in December 2013.

## 7.2. Bilateral Grants with Industry

### 7.2.1. CIFRE contract with Technicolor R&I France on Compressive Sensing for the manipulation of large multimedia databases

**Participants:** Rémi Gribonval, Anthony Bourrier.

*Duration:* 3 years (2011-2014)

*Research axis:* 3.1.2

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

*Funding:* Technicolor R&I France, ANRT

The objective of this thesis is to explore, both numerically and theoretically, the potential of compressive sensing for the manipulate of large (audiovisual) databases. A particular objective is to propose learning techniques that can work on strongly compressed versions of a large corpus of data while maintaining the ability to infer essential characteristics of the distribution of the items in the corpus.

## **PAROLE Project-Team**

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

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

Our policy in terms of technological and industrial partnership consists in favoring contracts that quite precisely fit our scientific objectives.

A three-day consulting contract was conducted with Technicolor (Rennes) in December 2013.

E. Vincent is involved through his former team (PANAMA) in an 18-month bilateral research contract with Canon Research Centre France (Rennes) which ended in July 2013 and in a 30-month bilateral research contract with the SME Studio MAIA (Boulogne-Billancourt).



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

## **COPRIN Project-Team**

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

## **7.1. 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.

## **7.2. 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 [6.2.1](#) .

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 fonctionnalités and performances of the existing pieces of software belonging to Airbus and to turn them into a prototype that integrate and showcase our results. Final version of the resulting modeling and simulation environment has been licensed to Airbus through three successive transfer agreement signed in 2010, 2011, and 2012.

Enhancements and extensions developed in 2013 have also been licensed to Airbus this year. Transfer of know-how for industrialization and maintenance has been covered by a consulting contract.

## **IMARA Project-Team**

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

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

- Valeo – "Driver Monitoring". Objective: achieve the state of the art of existing devices, algorithms and systems performing driver monitoring in real-time with embedded sensors.
- ADM Concept – "TRANS'YVES: Valet de Parking Automatisé". Two objectives: realize the control boards of the steering and the acceleration pedal of an automated vehicle, realize the automated valet using a single camera for vehicle guidance in a parking.
- AXTER Automation – "Laser-based navigation in industrial plants". Confidential.
- Valeo – "V50 project". Objective: dealing with intersection by an automated vehicle using on-board perception. This is the framework of the PhD thesis of Guillaume Tréhard.

## E-MOTION Project-Team

# 6. Bilateral Contracts and Grants with Industry

## 6.1. Bilateral Contracts with Industry

### 6.1.1. *Toyota Motors Europe*

[Feb 2006 - Feb 2009] [Dec 2010 - Dec 2014]

The contract with Toyota Motors Europe is a joint collaboration involving Toyota Motors Europe, Inria and ProBayes. It follows a first successful short term collaboration with Toyota in 2005.

This contract aims at developing innovative technologies in the context of automotive safety. The idea is to improve road safety in driving situations by equipping vehicles with the technology to model on the fly the dynamic environment, to sense and identify potentially dangerous traffic participants or road obstacles, and to evaluate the collision risk. The sensing is performed using sensors commonly used in automotive applications such as cameras and lidar.

This collaboration has been extended for 4 years 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.

### 6.1.2. *Renault*

[Jan 2010 - Feb 2013]

This contract was linked to the PhD Thesis of Stephanie Lefèvre. The objective is to develop technologies for collaborative driving as part of a Driving Assistance Systems for improving car safety. Both vehicle perception and communications are considered in the scope of this study. An additional short-term contract (3 months) has also been signed in november 2012.

### 6.1.3. *PROTEUS*

[November 2009 - October 2013]

PROTEUS (“Robotic Platform to facilitate transfer between Industries and academics”) is an ANR project involving 6 industrial and 7 academic partners. This projects aims to develop a software platform which helps to share methods and softwares between academics and industries in the field of mobile robotics.

The project works on three main aspects :

- Specification of different scenarios and its associated formalism.
- Definition of a domain specific language (DSL) to specify and execute the given scenarios.
- Setting up 4 robotic challenges to evaluate the capacity and the usability of the platform.

The contribution of *e-Motion* to PROTEUS is first to provide its expertise on mobile robotics to develop the DSL and next to provide a simulation environment with its platform “CycabTK”.

Juan Lahera-Perez has been recruited as engineer to work on this project with Amaury Nègre.

### 6.1.4. *IRT-Nano Perfect (2012-2014, and 2015-2017)*

Perfect is a project supported by ANR in the scope of the IRT (Technological Research Institute) Nano-electronic driven by the CEA (Nuclear Energy Agency). The partners of the project are the CEA-LETI LIALP laboratory, ST-Microelectronics and Inria. The goal of this project is to propose integrated solutions for “Embeeded Bayesian Perception for dynamic environments” and to develop integrated open platforms. During the first phase of the project (2012-2014), the focus is on the domain of transportation (both vehicle and infrastructure); health and smart home sectors will also be considered in the second phase (2015-2017).

## 6.2. Bilateral Grants with Industry

A Postdoc in Collaboration with the University of California Berkeley, Inria and Renault (Inria@SiliconValley fellowship) started in January 2013 on the topic of “Safety applications at road intersections for connected vehicle”.

## 6.3. National Initiatives

### 6.3.1. Inria Large Initiative Scale PAL (*Personaly Assisted Living*)

[Nov 2010 - Nov 2014]

The objective of this project is to create a research infrastructure that will enable experiments with technologies for improving the quality of life for persons who have suffered a loss of autonomy through age, illness or accident. In particular, the project seeks to enable development of technologies that can provide services for elderly and fragile persons, as well as their immediate family, caregivers and social groups.

The Inria Project-Teams (IPT) participating in this Large-scale initiative action Personally Assisted Living (LSIA Pal) propose to work together to develop technologies and services to improve the autonomy and quality of life for elderly and fragile persons. Most of the associated project groups already address issues related to enhancing autonomy and quality of life within their work programs. This goal of this program is to unite these groups around an experimental infrastructure, designed to enable collaborative experimentation.

Working with elderly and fragile to develop new technologies currently poses a number of difficult challenges for Inria research groups. Firstly, elderly people cannot be classified as a single homogeneous group with a single behavior. Their disabilities may be classified as not just physical or cognitive, motor or sensory, but can also be classified as either chronic or temporary. Moreover, this population is unaccustomed to new technologies, and can suffer from both cognitive and social inhibitions when confronted with new technologies. None-the-less, progress in this area has enormous potential for social and financial impact for both the beneficiaries and their immediate family circle.

The spectrum of possible actions in the field of elderly assistance is large. We propose to focus on challenges that have been determined through meetings with field experts (medical experts, public health responsible, sociologists, user associations...). We have grouped these challenges into four themes: monitoring services, mobility aids, transfer and medical rehabilitation, social interaction services. These themes correspond to the scientific projects and expectations of associated Inria projects. The safety of people, restoring their functions in daily life and promoting social cohesion are all core motivations for this initiative.

e-Motion concentrates his work on mobility aids using the wheelchair.

### 6.3.2. ADT P2N

[Oct 2013 - Sept 2015]

The ADT P2N (Autonomous Navigation: From Perception to Navigation) involving e-Motion and Lagadic was accepted in 2012 for Lagadic and extended to emotion (with an IJD) in 2013. The ADT is dedicated to the development of a common software integrating perception and navigation methods developed in both teams. Demos will be done on various mobile robotic platforms such as wheelchairs, caddy...

## FLOWERS Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. *Advanced platform for Urban Mobility (PAMU)*

**Participant:** David Filliat.

Development of a planning algorithm on a autonomous electric car for Renault SAS. We developed a planning module in order to produce global plans to reach a goal specified in a digital map and to perform local reactive planning to avoid dynamic obstacles. This module is integrated in the PAMU autonomous vallet parking developed by Renault with several academic partners.

## 7.2. Bilateral Grants with Industry

### 7.2.1. *Development of an Contextual electronic copilot for driving assistance*

**Participant:** David Filliat.

Financing of the CIFRE PhD grant of Alexandre Armand by Renault SAS with the goal of developing an Contextual electronic copilot for driving assistance based on the learning of the behavior of the driver.

## LAGADIC Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Bilateral Contracts with Industry

### 7.1.1. Foundation EADS

**Participants:** Antoine Petit, Eric Marchand.

*no. Inria Rennes 5605, duration: 36 months.*

This contract ended in December 2013. It supported Antoine Petit's Ph.D. about 3D model-based tracking for applications in space (see Section 6.1.1 ).

### 7.1.2. 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. (see Section 6.3.2 ).

### 7.1.3. ECA Robotics

**Participants:** Romain Drouilly, Patrick Rives.

*no. Inria Sophia 7030, duration: 36 months.*

This project started in May 2012. It 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.

## **AYIN Team**

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

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

### **7.1.1. EADS foundation Paris**

**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). This contract finished at the end of March 2013. Contract #4643.

### **7.1.2. ASTRIUM EADS Toulouse**

**Participants:** Paula Craciun, Josiane Zerubia [PI].

Automatic object tracking on a sequence of images taken from a geostationary satellite. Contract #7363.

### **7.1.3. CNES Toulouse**

**Participants:** Ihsen Hedhli, Josiane Zerubia [PI].

Multi-sensor change detection. Application to risk management after the Haiti earthquake. Contract #8361.

### **7.1.4. CNES Toulouse**

**Participants:** Aurélie Boisbunon, Josiane Zerubia [PI].

Parameter estimation for automatic object change detection in a sequence of very high resolution optical images.



## **LEAR Project-Team**

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

## **7.1. MBDA Aerospatiale**

**Participants:** Albert Gordo, Michael Guerzhoy, Cordelia Schmid, Franck Thollard.

The collaboration with the Aerospatiale section of MBDA has been on-going for several years: MBDA has funded the PhD of Yves Dufurnaud (1999-2001), a study summarizing the state-of-the-art on recognition (2004), a one year transfer contract on matching and tracking (11/2005-11/2006) as well as the PhD of Hedi Harzallah (2007-2010). From September 2010 to 2013, we conducted a three-year contract on object localization and pose estimation based on shape representation.

## **7.2. MSR-Inria joint lab: scientific image and video mining**

**Participants:** Anoop Cherian, Zaid Harchaoui, Yang Hua, Cordelia Schmid.

This collaborative project, which started in September 2008, brings together the WILLOW and LEAR 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. Yang Hua is funded by this project.

## **7.3. MSR-Inria joint lab: structured large-scale machine learning**

**Participants:** Julien Mairal, Zaid Harchaoui.

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.

## **7.4. Xerox Research Center Europe**

**Participants:** Zeynep Akata, Zaid Harchaoui, Cordelia Schmid.

The collaboration with Xerox started in October 2009 with a co-supervised CIFRE scholarship (2009-2012) on cross-modal information retrieval. A second three-year collaborative project on large scale visual recognition started in 2011. The goal is to design algorithms for large-scale image classification possibly in the presence of missing labels. The joint PhD student Zeynep Akata is supported by a CIFRE grant obtained from the ANRT. She graduated in early January 2014.

## **MAGRIT Project-Team**

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

## **7.1. Bilateral Grants 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. A new PhD thesis -Charlotte Delmas- started in April 2013 with the aim to perform 3D reconstruction of tools in interventional neuroradiology. Our goal is to help clinical gesture by providing the physician with a better understanding of the relative positions of the tools and of the pathology.

## **MORPHEO Team**

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

## **7.1. Contract with Technicolor**

A three year collaboration with Technicolor has started in 2011. The objective of this collaboration is to consider the capture and the interpretation of complex dynamic scenes in uncontrolled environments. A co-supervised PhD student (Abdelaziz Djelouah) is currently active on this topic [5] [10].

**PERCEPTION Team (section vide)**

## **Prima Project-Team**

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

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

**Participants:** Lucas Nacsa, James Crowley [correspondant].

PRIMA is currently working with Schneider Electric on algorithms image processing in a new generation of infrared visual sensors. The objective is to develop an integrated visual sensor with very low power consumption. Such systems can be used to estimate temperature in different parts of a room, as well as to provide information about human presence.

## **SIROCCO Project-Team**

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

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

### **7.1.1. *Contract with Astrium on compression of satellite images***

**Participants:** Jeremy Aghaei Mazaheri, Christine Guillemot, Claude Labit.

- Title : Compression of satellite images.
- Research axis : § 6.3.3 .
- Partners : Astrium, Inria-Rennes.
- Funding : Astrium.
- Period : Oct.11-Sept.14.

This contract with Astrium addresses the problem of sparse representation and dictionary learning for efficient sparse coding of video signals captured from a geostationary satellite. The goal is to develop a compact spatio-temporal representation taking advantage of the high redundancy present in the video which is of very high resolution and characterized by low motion. Different methods for learning tree-structured dictionaries have been studied. The tree-structured dictionaries are well-tailored to the characteristics of the signals to be processed at each iteration of the greedy matching pursuit algorithms, while allowing efficient encoding of the produced sparse vectors. Adaptive tree-structures have been developed and the use of such dictionaries in HEVC-based intra coding has been investigated. First tests have also been carried out to know to which extent the learned dictionaries can allow detecting the modulation transfer function (MTF) used to characterize the quality of electro-optical imaging systems on board remote sensing satellites.

### **7.1.2. *Collaboration with Alcatel on robust video compression***

**Participants:** Marco Bevilacqua, Christine Guillemot, Ronan Le Boulch, Aline Roumy.

- Title: Self adaptive video codec
- Research axis: 6.2.3
- Funding: Joint research laboratory between Inria and Alcatel
- Period: Oct. 2010 - Dec. 2013.

In the framework of the joint research lab between Alcatel-Lucent and Inria, we participate in the ADR (action de recherche) Selfnets (or Self optimizing wireless networks). The objective is, jointly with the Alcatel Lucent team, to develop video representations and compression tools allowing smooth network adaptation on one hand and loss resilience on the other hand. In that context, the PhD thesis of M. Bevilacqua focuses on the development and study of image and video super-resolution as a tool for constructing scalable representations, hence enabling network adaptation of transmitted video streams. Single-image super-resolution algorithms have been developed, using different methods (neighbor embedding, local learning with regression), and dictionaries learned from external training images or learned on a multi-resolution pyramid constructed from the input low resolution image. These methods have been extended to video super-resolution, the dictionary being constructed from key frames.

### **7.1.3. *Contract with EutelSat on video traffic analysis***

**Participants:** Laurent Guillo, Aline Roumy.

- Title : Bit rate statistical analysis of HEVC encoded video in a broadcast transmission.
- Partners : EutelSat, Inria-Rennes.
- Funding : EutelSat.
- Period : Aug.12-Feb.13.

This contract with Eutelsat (starting in August 2012) is a consulting contract and aims at analyzing the variation of the video traffic, when the video is encoded by HEVC. Indeed, the main characteristic of satellite broadcasting, as proposed by Eutelsat, is to provide a nearly constant video quality, which is obtained by variable video traffic (bit rate). Then, to address this variability issue, statistical multiplexing is used to share the resource among the users. However, statistical multiplexing needs a precise analysis of this variability. In this contract, we therefore analyze this variability, when the video is compressed with the upcoming video compression standard HEVC.

#### **7.1.4. Contract with SHOM (Service Hydrographique et Océanographique de la Marine)**

**Participants:** Alan Bourasseau, Olivier Le Meur.

- Title: Oceanographic data compression
- Partners: SHOM, Alyotech, Univ. Rennes 1
- Funding: SHOM
- Period: 09/2012-02/2013.

The project consists in developing lossless and lossy compression algorithms for oceanographic data in partnership with ALYOTECH. The SIROCCO team contributes on the design and development of compression algorithms for this specific type of data, based on diffusion methods. The main constraint is the limited bandwidth used by the navy to transmit the data, i.e. an emitted message must be smaller than 4 kilo bytes. In 2013, the obtained quality versus rate performances has been assessed against those given by state of the art solutions (HEVC-Intra and JPEG-2000).

## **7.2. Grants with Industry**

### **7.2.1. CIFRE contract with Orange on Generalized lifting for video compression**

**Participants:** Christine Guillemot, Bihong Huang.

- Title : Generalized lifting for video compression.
- Research axis : § 6.3.5 .
- Partners : Orange Labs, Inria-Rennes, UPC-Barcelona.
- Funding : Orange Labs.
- Period : Apr.2012-Mar.2015.

This contract with Orange labs. (started in April. 2012) concerns the PhD of Bihong Huang and aims at modelling the redundancy which remains in spatial and temporal prediction residues. The analysis carried out in the first year of the PhD has shown that this redundancy (hence the potential rate saving) is high. In 2013, different methods have been investigated to remove this redundancy, such as generalized lifting and different types of predictors. The generalized lifting is an extension of the lifting scheme of classical wavelet transforms which permits the creation of nonlinear and signal probability density function (pdf) dependent and adaptive transforms. This study is also carried out in collaboration with UPC (Prof. Philippe Salembier) in Barcelona.

### **7.2.2. CIFRE contract with Orange on 3D quality assessment**

**Participants:** Darya Khaustova, Olivier Le Meur.

- Title : Objective Evaluation of 3D Video Quality.
- Research axis : § 6.1.3 .
- Partners : Orange Labs, Inria-Rennes.
- Funding : Orange Labs.
- Period : Dec.2011-Nov.2014.

This contract with Orange labs. (starting in Dec. 2011) concerns the PhD of Darya Khaustova and aims at developing a video quality metric for 3D content. The usage of 3D video is expected to increase in the next years. In order to ensure a good QoE (Quality of Experience), the 3D video quality must be monitored and accurately measured. The goal of this thesis is to study objective measures suitable for estimating 3D video quality. A comparison with ground truth as well as with the state-of-the-art 2D metrics should be carried out. To be as effective as possible, the feature of the human visual system should be taken into account.

### **7.2.3. CIFRE contract with Technicolor on High Dynamic Range (HDR) video compression**

**Participants:** Mikael Le Pendu, Christine Guillemot.

- Title : Floating point high dynamic range (HDR) video compression
- Research axis : § 6.3.4 .
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Dec.2012-Nov.2015.

High Dynamic Range (HDR) images contain more intensity levels than traditional image formats, leading to higher volumes of data. HDR images can represent more accurately the range of intensity levels found in real scenes, from direct sunlight to faint starlight. The goal of the thesis is to design a visually lossless compression algorithm for HDR floating-point imaging data. The first year of the thesis has been dedicated to the design of a quantization method converting the floating point data into a reduced bit depth representation, with minimal loss. The method leads to a bit rate saving of 50% compared to the existing Adaptive LogLuv transform.

### **7.2.4. CIFRE contract with Technicolor on sparse modelling of spatio-temporal scenes**

**Participants:** Martin Alain, Christine Guillemot.

- Title : Spatio-temporal analysis and characterization of video scenes
- Research axis : § 6.1.4 .
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2012-Sept.2015.

A first CIFRE contract has concerned the Ph.D of Safa Cherigui from Nov.2009 to Oct.2012, in collaboration with Dominique Thoreau (Technicolor). The objective was to investigate texture and video scene characterization using models based on sparse and data dimensionality reduction techniques, as well as based on epitomes. The objective was then to use these models and methods in different image processing problems focusing in particular on video compression. While, the first PhD thesis has focused on spatial analysis, processing, and prediction of image texture, a second CIFRE contract (PhD thesis of Martin Alain) has started in Oct. 2012 to push further the study by addressing issues of spatio-temporal analysis and epitome construction, with applications to temporal prediction, as well as to other video processing problems such as denoising and super-resolution.

### **7.2.5. CIFRE contract with Thomson Video Networks (TVN) on Video analysis for HEVC based video coding**

**Participants:** Nicolas Dhollande, Christine Guillemot, Olivier Le Meur.

- Title : Coding optimization of HEVC by using pre-analysis approaches.
- Research axis : § 6.3.5 .
- Partners : Thomson Video Networks, Univ. Rennes 1.
- Funding : Thomson Video Networks (TVN).
- Period : Nov.2012-Sept.2015.



This contract with TVN (started in Oct. 2012) concerns the PhD of Nicolas Dhollande and aims at performing a coding mode analysis and developing a pre-analysis software. HEVC standard is a new standard of compression including new tools such as advanced prediction modes. Compared to the previous standard H.264, HEVC's complexity is three to four times higher. The goal of this thesis is to infer the best coding decisions (prediction modes...) in order to reduce the computational complexity of HEVC thanks to a pre-analysis step. The pre-analysis is expected to provide useful estimates of local video characteristics which will then help selecting the prediction and transform partitions as well as a number of other parameters such as the quantization parameters or the prediction modes.

## **STARS Project-Team**

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

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

- **Toyota europ:** this project with Toyota runs 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 we want to develop 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 the older adult.
- **LinkCareServices:** this project with Link Care Services runs from 2010 upto 2014. It aims at designing a novel system for Fall Detection. This study consists in evaluating the performance of video-based systems for Fall Detection in a large variety of situations. Another goal is to design a novel approach base on RGBD sensors with very low rate of false alarms.

## **TEXMEX Project-Team**

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

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

- CIFRE Ph. D. thesis of Ludivine Kuznik with Institut National de l'Audiovisuel
- CIFRE Ph. D. thesis of Bingqing Qu with Institut National de l'Audiovisuel
- CIFRE Ph. D. thesis of Mohamed-Haykel Boukadida with Orange Labs
- CIFRE Ph. D. thesis of Cédric Penet with Technicolor

## **WILLOW Project-Team**

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

## **7.1. EADS (ENS)**

**Participants:** Jean Ponce, Josef Sivic, Andrew Zisserman.

The WILLOW team has had collaboration efforts with EADS via tutorial presentations and discussions with A. Zisserman, J. Sivic and J. Ponce at EADS and ENS, and submitting joint grant proposals. In addition, Marc Sturzel (EADS) is doing a PhD at ENS with Jean Ponce and Andrew Zisserman.

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

**Participants:** Leon Bottou [MSR], 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 2013-2016 with the research focus on automatic understanding of dynamic video content. Recent studies predict that by 2014 video will account for more than 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.

## **7.3. 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.