Activity Report 2011

Section Contracts and Grants with Industry

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7. 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 Verbatim Analysis (license agreement and “CIFRE” PhD, see section 4.3), Kwaga (ARITT contract, see section 4.4), TNS-Sofres (see section 4.6), Lingua et Machina (DTI-funded engineer, see section 4.5) and soon Viavoo (a joint “CIFRE” PhD is about to start) and Diadeis (the “Investissements d’Avenir” project PACTE will start in early 2012, see section 4.7).
7. Contracts and Grants with Industry

7.1. National projects

7.1.1. QUAERO CTC and Corpus Projects (OSEO)

Participants: Kamil Adiloglu, Frédéric Bimbot, Laurence Catanese, Armando Muscariello, Alexey Ozerov, Gabriel Sargent, Emmanuel Vincent.

Main academic partners: IRCAM, IRIT, LIMSI, Telecom ParisTech

Quaero is a European research and development program with the goal of developing multimedia and multilingual indexing and management tools for professional and general public applications (such as search engines).

This program is supported by OSEO. The consortium is led by Thomson. Other companies involved in the consortium are: France Télécom, Exalead, Bertin Technologies, Jouve, Grass Valley GmbH, Vecsys, LTU Technologies, Siemens A.G. and Synapse Développement. Many public research institutes are also involved, including LIMSI-CNRS, INRIA, IRCAM, RWTH Aachen, University of Karlsruhe, IRIT, Clips/Imag, Telecom ParisTech, INRA, as well as other public organisations such as INA, BNF, LIPN and DGA.

METISS is involved in two technological domains: audio processing and music information retrieval (WP6). The research activities (CTC project) are focused on improving audio and music analysis, segmentation and description algorithms in terms of efficiency, robustness and scalability. Some effort is also dedicated on corpus design, collection and annotation (Corpus Project).

METISS also takes part to research and corpus activities in multimodal processing (WP10), in close collaboration with the TExMEX project-team.

7.1.2. ANR ECHANGE

Participants: Rémi Gribonval, Prasad Sudhakar, Emmanuel Vincent, Nancy Bertin, Valentin Emiya, Nikolaos Stefanakis.


The objective of the ECHANGE project (ECHantillonage Acoustique Nouvelle GEnération) is to setup a theoretical and computational framework, based on the principles of compressed sensing, for the measurement and processing of complex acoustic fields through a limited number of acoustic sensors.

7.1.3. DGCIS REV-TV

Participants: Yannick Benezeth, Frédéric Bimbot, Guylaine Le Jan, Grégoire Bachman, Nathan Souviraâ-Labastie.

Duration: 2.5 years (2010-2012). Partners: Technicolor (ex Thomson R&D), Artefacto, Bilboquet, Soniris, ISTIA, Télécom Bretagne, Cap Canal

The Rev-TV project aims at developing new concepts, algorithms and systems in the production of contents for interactive television based on mixed-reality.

In this context, the Metiss research group is focused on audio processing for the animation of an avatar (lip movements, facial expressions) and the control of interactive functionalities by voice and vocal noises.
7.2. European projects

7.2.1. FP7 FET-Open program SMALL

Participants: Rémi Gribonval, Ngoc Duong, Valentin Emiya, Jules Espiau de Lamaestre, Emmanuel Vincent, Nancy Bertin.

Duration: 2010-2012
Partners: Univ. Edimburg, Queen Mary Univ., EPFL, Technion Univ.

A joint research project called SMALL (Sparse Models, Algorithms and Learning for Large-scale data) has been setup with the groups of Pr Mark Plumbley (Centre for Digital Music, Queen Mary University of London, UK), Pr Mike Davies University of Edinburgh, UK), Pr Pierre Vandergheynst (EPFL, Switzerland) and Miki Elad (The Technion, Israel) in the framework of the European FP7 FET-Open call. SMALL was one of the eight selected projects among more than 111 submissions and began in February 2009.

The main objective of the project is to explore new generations of provably good methods to obtain inherently data-driven sparse models, able to cope with large-scale and complicated data much beyond state-of-the-art sparse signal modeling. The project will develop a radically new foundational theoretical framework for dictionary learning, and scalable algorithms for the training of structured dictionaries.

7.2.2. EUREKA Eurostars program i3DMusic

Participants: Emmanuel Vincent, Ngoc Duong, Rémi Gribonval, Laurent Simon.

Duration: 3 years, starting in October 2010.
Partners: Audionamix (FR), Sonic Emotion (CH), École Polytechnique Fédérale de Lausanne (CH)

A joint research project called i3DMusic (Real-time Interactive 3D Rendering of Musical Recordings) has been setup with the SMEs Audionamix and Sonic Emotion and the academic partner EPFL. This project aims to provide a system enabling real-time interactive respatialization of mono or stereo music content. This will be achieved through the combination of source separation and 3D audio rendering techniques. Metiss is responsible for the source separation work package, more precisely for designing scalable online source separation algorithms and estimating advanced spatial parameters from the available mixture.
7. Contracts and Grants with Industry

7.1. Introduction

Our policy in terms of technological and industrial partnership consists in favoring contracts that quite precisely fit our scientific objectives. We are involved in an ANR project about audiovisual speech synthesis, another about acoustic-to-articulatory inversion of speech (ARTIS), another about the processing of articulatory data (DOCVACIM) and in a national evaluation campaign of automatic speech recognition systems (ETAPE). We also coordinated until January 2009 the 6th PCRD project ASPI about acoustic-to-articulatory inversion of speech, and the Rapsodis ARC until October 2009.

In addition, we are involved in several regional projects.

7.2. Regional Actions

7.2.1. CPER MISN TALC

The team is involved in the management of the Contrat Plan Etat-Région (CPER) contract. In particular, Christophe Cerisara is co-responsible, with Claire Gardent, of the CPER MISN TALC, which objective is to leverage collaborations between regional academic and private partners in the domain of Natural Language Processing and Knowledge engineering. The TALC action involves about 12 research teams and 40 researchers for a budget of about 240,000 euros per year.

In addition to the co-management of this project, our team is also involved in two scientific collaborative operations:

- An operation about text-to-speech alignment, in collaboration with the TALARIS research team and the ATILF laboratory. This operation aims at proposing semi-supervised solutions to facilitate the transcription and processing of large bimodal text and speech corpora. The main outcomes of this operation are (1) the JTrans software described in section 5.6, and a concordancer that was developed in Java by two BSc students in the framework of their final year project.
- An operation about syntactic analysis of speech transcripts, in collaboration with the TALARIS research team and the ATILF laboratory. This operation aims at adapting state-of-the-art stochastic parsers to the specificities of manual and automatic transcriptions of speech, and at building a French treebank of broadcast news speech transcripts. The main outcome of this operation is the J-Safran software, described in section 5.5.

7.2.2. “Intonale”: Perception and production of prosodic contours in L1 and L2

This action, launched by the CCOSL, aims at developing collaboration between academic partners from Lorraine laboratories and universities. It has started in September 2009 and should last until the end of 2011. The speech team from LORIA is associated with the laboratory ATILF (Mathilde Dargnat). The project deals with the perception and production of prosodic contours in the first language (L1) and in a second language (L2). We have chosen two radically different languages with respect to prosody: French and English. We have collected a corpus recorded by 34 French speakers and made up of sentences with different modalities: assertions, questions, major and minor continuations. French speakers uttered these sentences both in French (their native language) and in English (the “targeted” non native language). The English part of the corpus is used by the project ALLEGRO, presented hereafter. The French part of the corpus is currently segmented, whilst its English part is segmented under the framework of the INTERREG project ALLEGRO. In order to record corpora in other languages, we improved the Corpus Recorder software (see 5.9). The previous corpus had also been recorded by native English speakers (French and English sentences).
7.3. National Contracts

7.3.1. ADT Handicom

An ADT (Action of Technological Development), was led from 2008 till 2010, managed by Agnès Piquard-Kipffer. The aim of this project is to provide help for improving French Language Acquisition for hard of hearing (HOH) children or for children with language disabilities.

A collection of three digital books has been written by Agnès Piquard-Kipffer and a web interface has been created in order to create others books for language impaired children.

A workflow which transforms a text and an audio source in a video of digital head has been developed. This workflow includes:

- An automatic speech alignment has been integrated. This process can retrieve from an acoustic signal and a text transcription, the length and the position of each phoneme and of each word. This allows a synchronization of the articulation of the head with acoustic signal and text display. This technology is a recognition engine, result of a previous work called ESPERE from EPI PAROLE.

- A Phonetic transcription designed in the EPI Parole has been integrated and adapted.

- A Speech synthesizer has been integrated. This technology can create an artificial voice from a text. It’s a part of tools provided to make a digital book. Several software programs are tested in order to find the best result.

- A French cued speech coding and talking head has been improved in order to generate videos on a server. The animation consists in animating a 3D talking head, in association with a 3D hand which can code cued speech. This technology was created from a previous RIAM project called LABIAO.

A digital book written in FLASH has been developed. It integrates videos of the digital head, which are synchronized with texts displayed for each page. Digital books can be created manually with a text editor (to create XML file) or automatically with software which can be easily used to add all necessary multimedia elements in pages.

Data (audio source and text) are provided from a web interface. This web site allows users to create digital books. Through this interface, the books can be easily modified, shared and read. This website has been developed with Symfony (PHP 5 web framework) and AJAX (Dojo toolkit API) technologies. A linguistical study and a case study analysis of the current version of the talking head and of the digital books were conducted in collaboration (for feasability studies), both with the Speech Therapy School of Nancy (with 8 students : Floriane Jacques, Amélie Dumont, Sophie Bardin, Elodie Racine, Claire Nostrenoff, Anaïs Laurenceau, Hélène Thiollier and Marie Gabet) and with National Education with two schools and specialized teachers (Hélène Adam-Piquard and Sylvie Nussbaum).

7.3.2. ANR DOCVACIM

This contract, coordinated by Prof. Rudolph Sock from the Phonetic Institute of Strasbourg (IPS), addresses the exploitation of X-ray moving pictures recorded in Strasbourg in the eighties. Our contribution is the development of tools to process X-ray images in order to build articulatory model [ 35 ]. This year we incorporated tools to withdraw jumps in X-ray films, which are due to the driving of the film during recording. We also developed an analysis procedure to delineate velum contours and to analyze its deformations.

7.3.3. ANR ARTIS

This contract started in January 2009 in collaboration with LTCI (Paris), Gipsa-Lab (Grenoble) and IRIT (Toulouse). Its main purpose is the acoustic-to-articulatory inversion of speech signals. Unlike the European project ASPI the approach followed in our group will focus on the use of standard spectra input data, i.e. cepstral vectors. The objective of the project is to develop a demonstrator enabling inversion of speech signals in the domain of second language learning.
This year the work has focused on the development of the inversion infrastructure using cepstral data as input. We checked that the codebook represents the articulatory to acoustic mapping correctly and we also developed the optimization of the bilinear transform in order to make the comparison of natural and synthetic spectra possible.

7.3.4. **ANR ViSac**

This ANR Jeunes Chercheurs started in 2009, in collaboration with Magrit group. The main purpose of ViSac (Acoustic-Visual Speech Synthesis by Bimodal Unit Concatenation) is to propose a new approach of a text-to-acoustic-visual speech synthesis which is able to animate a 3D talking head and to provide the associated acoustic speech. The major originality of this work is to consider the speech signal as bimodal (composed of two channels acoustic and visual) "viewed" from either facet visual or acoustic. The key advantage is to guarantee that the redundancy of two facets of speech, acknowledged as determining perceptive factor, is preserved.

Currently, we designed a complete system of the text to acoustic-visual speech synthesis based on a relatively small corpus. The system is using bimodal diphones (an acoustic component and a visual one) and it is using unit selection techniques. Although the database for the synthesis is small, however the first results seem to be very promising. The developed system can be used with a larger corpus. We are trying to acquire/analyze an 1-2 hours of audiovisual speech. With a larger corpus, the quality of the synthesis will be obviously much better.

The next year, we will mainly evaluate the system using both subjective and objective perceptual evaluation.

7.4. **Grants with Industry**

7.4.1. **Timecode**

We begin a collaboration with the Timecode company that works in dubbing (recording and replacing voices on a motion picture or television soundtrack). We want to use tools developped in our team to speed up the process of making a rythmo band (or "lip-sync band"). The band is actually a clear 35 mm film leader on which the dialogue is written, along with numerous additional indications for the actor (laughs, cries, length of syllables, mouth sounds, breaths, mouth openings and closings, etc.). The rythmo band is projected in the studio and scrolls in perfect synchronization with the picture. We have designed a tool for automatic alignment of the rythmo band and the audio file.
Sémagramme Team (section vide)
TALARIS Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Industry

Participants: Nicolas Cherpeau, Romain Merland, Jeanne Pellerin.

The Ph.D. theses of Romain Merland, Nicolas Cherpeau and Jeanne Pellerin are funded by the Gocad consortium.
ARTIS Project-Team

7. Contracts and Grants with Industry

7.1. GARDEN

Participants: Olivier Hoel, Isabelle Delore, Frank Rochet, Nicolas Holzschuch, Mahdi Mohammad-Bagher, Cyril Soler [contact].

The GARDEN project a cooperative research work with the video game company EDEN Games in Lyon. This cooperation is funded by the french “Fonds de Compétitivité des Entreprises”, the “Pole de Compétitivité” Imaginove in Lyon, the Région Rhône-Alpes, the city of Lyon and the Grand Lyon urban area. The research themes for ARTIS are real time rendering of complex materials, vegetation and human bodies for video games. This project started in March 2009, for 24 months.
AVIZ Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts and Grants with Industry


Participants: Adrien Bernhardt, Marie-Paule Cani, Jean-Claude Léon.

We extended the Aestem Studio software to cover the needs of the company Axiatec, which sells 3D printers in France. The goal is to provide 3D modeling system based on a very intuitive sketch-based technique, in order to enable the general public to model 3D shapes. Our extensions included the introduction of texturing methods and of interactive editing mechanisms, in addition to an eraser tool enabling to carve the surface through sketching.

7.1.2. EADS - Idealization of components for structural mechanics (05/2011 - 04/2014)

Participants: Jean-Claude Léon, Stefanie Hahmann.

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. Some results from the homology computation topic may be used in the present context. An ongoing publication should address the description of the various stages of a component shape transformation in the context of assemblies.
IN-SITU Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. Luxology

We have signed a non-disclosure agreement to access the beta version of Luxology’s Modo software, a leading program for 3D content creation. This will allow us to study the latest versions of the Software Development Kit and potentially port our techniques to the Modo environment in the future.

7.1.2. Google

Google fund us for the development of a BLAS interface on top of the Eigen library.

7.2. National Initiatives

7.2.1. ALTA

**Grant:** ANR Program "Blanc" (Research National Agency)
**Dates:** 2011 - 2015
**Partners:** ARTIS [leader], REVES, IPARLA
**Overview:** The project ALTA aims at analyzing the light transport equations and at using the resulting representations and algorithms for more efficient computation. We target lighting simulations, either offline, high-quality simulation or interactive simulations.

7.2.2. SeARCH

**Grant:** ANR Program "Contenus et Interactions" (Research National Agency)
**Dates:** 2009 - 2012
**Partners:** IPARLA [leader], Ausonius (CNRS - Université de Bordeaux), CEAlex (CNRS - Alexandrie - Egypte), ESTIA (Bidart - France)
**Overview:** The SeARCH project [35] is particularly motivated by a concrete archeological context: one of the partners is the Centre d’études Alexandrines (CEAlex, USR 3134) that works on the reconstruction of the lighthouse of Alexandria and its surrounding statues. Most of the fragments of the lighthouse and the statues are underwater. Some of the fragments, especially from the statues, have already been lifted to the surface. The SeARCH project strives to develop semi-automatic techniques for the virtual reassembly of 3D objects. The first involved step is the digital acquisition of the fragments, on-site, and under aggravated circumstances, combined with some post-processing steps of the acquired fragments. The second step is the reassembly of the fragments that should not only be as automatic as possible, but should also allow taking into account the long-year work experience of the cultural heritage professionals by new efficient interaction and visualization techniques.

7.2.3. InSTInCT

**Grant:** ANR Program "Contenus et Interactions" (Research National Agency)
**Dates:** 2009 - 2012
**Partners:** IPARLA [leader], Alcove (Inria - Lille Nord Europe), Immersion, Cap Sciences
Overview: The InSTInCT project focuses on the design, development, and evaluation of new simple and efficient touch-based interfaces, with the goal of bringing widespread visibility to new generations of interactive 3D applications, aimed in particular at general public audiences. To this goal, we propose a pluridisciplinary approach allowing to address all aspects of the problem, from technical to end-usage challenges. Within the project we will first focus on bringing new hardware technologies leveraging a broad set of modalities and inputs (finger orientation, haptic feedback, etc). Second, we will propose new touch-based interaction techniques dedicated to interactive 3D tasks (manipulation, navigation, volume exploration). Third, we will aim at exporting the concept of touch-based 3D interaction to spawn new uses, targeting the full range of professional to general public applications. A fundamentally original aspect of the InSTInCT project, is to include broad experimental campaigns in the real-life conditions of Cap Science exhibits, from the earliest project stages. These test campaigns will be used to guide developments and will allow true-to-life and wide scale evaluation of the 3D interfaces we propose.

7.2.4. Animaré

Grant: ANR Program “Jeune Chercheur” (Research National Agency)
Dates: 2008 - 2011
Partners: IPARLA [leader], ARTIS (Inria Rhone Alpes)

Overview: Expressive Rendering is a recent branch of Computer Graphics that offers promising novel styles, and is increasingly used in many application domains such as video games or movie production. At the present time, only expert artists are able to create compelling animations, and still, this is an extremely time-consuming process, with many constraints that strongly limit creativity. The reason is that current models are not sophisticated enough to provide intuitive manipulations and versatile styles. The motivation behind this project is to overcome these limitations both for 2D and 3D animation systems.

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. V-MuST

Title: V-Must.net
Type: COOPERATION (ICT)
Defi: Virtual Museum Transnational network
Instrument: Network of Excellence (NoE)
Duration: February 2011 - January 2015
Coordinator: CNR (Italy)

See other partners and information: http://www.v-must.net

Abstract: The V-MuST network enables heritage professionals around the world to connect, collaborate and advance the development and use of virtual museums. A Virtual Museum is a personalized, immersive, interactive experience that aims to enhance our understanding of the past in museums or on the internet.
7. Contracts and Grants with Industry

7.1. ANR SignCom: Sign-Based Communication Between Real and Virtual Agents

Participants: Franck Multon [contact], Stéphane Donikian.

The SignCom project aims to improve the quality of real-time interaction between humans and virtual agents by exploiting natural communication modalities such as gestures, facial expressions, and gaze direction. Using structured and coded French Sign Language signs, the real and virtual humans are able to converse with each other. This project is funded by the ANR ("Audiovisuel et Multimédia" call in 2007) and is leaded by VALORIA (University Bretagne Sud). The partners are: IRIT-TCI in Toulouse, M2S Lab in University Rennes2, Polymorph company in Rennes and Websourd company in Toulouse.

MimeTIC was involved in three main parts:

- designing a database of motion capture data for French Sign Language gestures, according to a scenario defined by the other partners. This task involves gathering information from various devices so that the face, gingers and body motions are captured and gathered in a unique file. We thus have developed a specific experimental platform based on the Vicon-MX (product of Oxford Metrics) motion capture system, the 5-DT glove (product of Fifth Dimension Technologies), and FaceLAB (product of seeingmachines). We thus have developed specific algorithm to coordinate and make the fusion with all the data (which were recorded with various sampling frequencies). This work has been performed in close collaboration with M2S Lab. The resulting database if used both for gesture recognition and motion synthesis.

- developing a dialog manager which is able to use information provided by gesture recognition, analyze the sentence, find the relevant answer to the user and then call the motion synthesis module. This dialog manager is also used for integration of the contributions of the other partners.

- proposing an innovative gesture recognition that is able to address the intrinsic variability of gestures used in sign language: variability of the users and styles, but also variability in space and speed. We thus have proposed a machine-learning approach in three stages which enables us to recognize more than 90% of the 70 gestures involved in the scenario. This work has been performed in close collaboration with M2S Lab and State Key Lab in CAD&CG (Zheijiang University, China).

The SignCom project ends in December 2011.

7.2. ANR iSpace&time

Participants: Fabrice Lamarche [contact], Julien Pettré, Marc Christie, Carl-Johan Jorgensen.

The iSpace&Time project is founded by the ANR and gathers six partners: IGN, Lamea, University of Rennes 1, LICIT (IFSTAR), Telecom ParisTech and the SENSE laboratory (Orange). The goal of this project is the establishment of a demonstrator of a 4D Geographic Information System of the city on the web. This portal will integrate technologies such as web2.0, sensor networks, immersive visualization, animation and simulation. It will provide solutions ranging from simple 4D city visualization to tools for urban development. Main aspects of this project are:

- Creation of an immersive visualization based on panoramic acquired by a scanning vehicle using hybrid scanning (laser and image).

- Fusion of heterogeneous data issued by a network of sensor enabling to measure flows of pedestrians, vehicles and other mobile objects.
• Use of video cameras to measure, in real time, flows of pedestrians and vehicles.
• Study of the impact of a urban development on mobility by simulating vehicles and pedestrians.
• Integration of temporal information into the information system for visualization, data mining and simulation purpose.

The mimetic team is involved in the pedestrian simulation part of this project. This project started in 2011 and will end in 2013.

7.3. Biofeedback

Participants: Richard Kulpa [contact], Franck Multon, Anthony Sorel, Emmanuel Badier, Antoine Marin, Anne-Marie Burns.

The Biofeedback project aims at creating a training tool that can be used and configured by coaches in order to train athletes to repetitive motions such as katas in karate (figure 9). This project is funded by the DGCIS ("Serious Gaming" call) and is leaded by the M2S laboratory (University Rennes 2). The industrial partner of this project is the Artefacto society.

![Figure 9. Biofeedback project.](image)

The training platform proposed in the Biofeedback project allows the training of athletes to repetitive motions. Even if the application is made on Kata in Karate and Dance, all the system can be used in other sport applications. It is based on a virtual coach that shows the movement to perform but also evaluates the errors made by the trainee and then proposes different stages of learning to help the trainee to improve his skills.

The training platform allows then the capture the user’s movement, the visualization of his motion and finally to evaluate it to determine the errors made (temporal and spatial errors). The project is thus based on 4 parts:

• Motion capture. The goal is to propose a low-cost motion capture system. To be usable by a wider audience, the system must be cheap and easy to use without complex calibration.
• Avatar animation from low quality captured data. Real-time motion capture leads to motion artifacts. A real-time reconstruction of the movement is then necessary.
Gesture evaluation. Each gesture to learn is associated with a database of experts movements that defines the perfect movement and the acceptable variability around this movement. This expert motion is also associated with biomechanical rules that are used to evaluate the temporal and spatial errors done by the trainee. These errors are then used to provide a score to the training system to choose the next level of training.

Transfer from virtual to real. A scientific evaluation of the training in virtual environments has been done to determine if the progress made in such system is really useful in real practice.

The Biofeedback project ends in December 2011.

7.4. ANR Pedigree

Participants: Julien Pettré [contact], Samuel Lemercier.

Pedigree is a national project funded by the French Research Agency (ANR) over for three years (Jan. 2009 to Dec. 2011). The project is leaded by Pierre Degond, professor at the University Paul Sabatier in Toulouse (III). Partners are: Institut de Mathématiques de Toulouse (IMT), Toulouse III University, Centre de Recherche sur la Cognition Animale (CRCA), Toulouse UIII University, Laboratoire de Physique Théorique (LPT), Paris-XI University, and the Mimetic team at INRIA-Rennes. 2011 is the third and last year for the Pedigree project.

The goals of the present project are the experimental and theoretical study of the formation of spatio-temporal structures within moving human groups and the development of realistic mathematical and simulation models of crowds based on these experimental data. This year, we have focused our efforts on analyzing unidirectional flow data. Analysis was conducted both at the microscopic and the macroscopic levels: we studied how individual control their locomotion from the motion of the people they follow, we also characterized some emergent phenomenon such as the formation and the damping of stop-and-go waves that propagates through the pedestrians flows. This analysis was jointly performed with LPT. A microscopic model of leader-follower behaviors has been deduced and carefully validated from experimental data. Collaboratively with IMT, a dedicated calibration procedure was elaborated. Three publications were prepared on this topic: one on data reconstruction, one on data analysis in submission to Physical Review E, and one on modeling and applications in submission to the Eurographics 2012 conference.
MINT Team

7. Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. I-Lab Idées-3com (2009-2012)

Participants: Clément Moerman, Norbert Barichard, Samuel Degrande, Patricia Plénacoste, Damien Mar- chal, Laurent Grisoni [correspondant].

We have set up with Idées-3com small company a join research program, targeted toward new tools for retail. This program is supported by INRIA, with a 3 year young engineer contract. During this join project, we have proposed interaction systems that is based on mobile phone, and allows fast navigation into 3D virtual world. We also recently proposed a new navigation technique, that proposes nice properties, including fast and accurate control of transition position during navigation.

7.1.2. 3DTOUCH (STMicroelectronics, 2010-2011)

Participants: Michel Amberg, Géry Casiez, Frédéric Giraud, Betty Lemaire-Semail [correspondant], Paolo Olivo, Nicolas Roussel.

The goal of this project was to study the adaptation of the operating principles of the STIMTAC (i.e. piezoelectric cells bonded to a mechanical resonator) to off-the-shelf transparent touch sensors based on resistive and capacitive technologies.
REVES Project-Team

6. Contracts and Grants with Industry

6.1. Grants with Industry

6.1.1. Industrial Contracts and Donations

6.1.1.1. Technology Transfer with 3Delight

**Participants:** Ares Lagae, George Drettakis.

The Gabor noise technology transfer with 3Delight http://www.3delight.com/, developer of high performance rendering software, has been finalized.

6.1.1.2. Autodesk

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

Autodesk has offered a significant cash donation to REVES in support of our work on intrinsic images. We are in the process of establishing a working collaboration with the local office in Sophia-Antipolis on this topic and negotiating a technology transfer agreement for the RID system on single-lighting condition intrinsic images. Autodesk has also donated several licenses of Maya, 3DS Max and SketchBookPro.

6.1.1.3. 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.

6.1.1.4. NVIDIA

We have received several graphics cards as part of the professor partnership program.

6.2. National Initiatives

6.2.1. ARC NIEVE: Navigation and Interfaces in Emotional Virtual Environments

**Participants:** Peter Vangorp, Adrien David, George Drettakis, Gaurav Chaurasia, Emmanuelle Chapoulie.

The goal of this joint research project is to develop and evaluate improved interfaces for navigation in immersive virtual environments (VEs) such as the 4-wall stereoscopic ISpace system in the Immersive Space Gouraud-Phong.

This project is in collaboration with G. Cirio, M. Marchal, A. Lécuyer (VR4I, Rennes) and I. Viaud-Delmon (IRCAM).

There is evidence of significant overlap in brain structures related to spatial memory and orientation and those related to emotion. We will examine the influence of high-quality 3D visual and auditory stimuli on the emotions evoked by the virtual environment. Our study will focus on the phobia of dogs as a way to modulate emotion in audiovisual VEs (Figure 14).

Navigation in VEs involves the use of different views, i.e., egocentric (“first person”) and allocentric (“bird’s eye”) views during navigation tasks. We will study appropriate visual representations for each view (for example, the level of realism ranging from abstract map-like rendering for top-down views to photorealistic rendering for first-person views), and appropriate transitions between the different views.

We will develop an appropriate methodology to evaluate such navigation interfaces in stressful environments, based on the insights gained by the emotion modulation study in phobic settings. This novel methodology can be seen as a “stress-test” for navigation interfaces: if the navigation interfaces developed are successful even in stressful setups, they will definitely be successful under “normal conditions”.

Figure 14. A person immersed in a virtual environment where the behaviors of several dogs will evoke different levels of anxiety.

ARC NIEVE has resulted in several publications this year: [22], [20], [16], [17].

This is a joint research project with Isabelle Viaud-Delmon (IRCAM, CNRS), Anatole Lécuyer and Maud Marchal (VR4I / INRIA Rennes), and Jean-Christophe Lombardo (DREAM / INRIA Sophia Antipolis). Interact3D (Section 6.2.3) is associated with this ARC.

6.2.2. ANR ALTA

**Participants:** Emmanuelle Chapoulie, Adrien David, George Drettakis.

The ANR ALTA project started in October 2011, and focuses on the development of novel algorithms for realistic and efficient global illumination. The project is coordinated by the Grenoble INRIA group ARTIS (N.Holzschuch), and the Bordeaux INRIA group IPARLA (X. Granier) is also a partner.

Our participation will mainly be in the study of error bounds for these algorithms and the development of interactive global illumination solutions that can be used in Virtual Reality solutions, for example in the context of the immersive space.

6.2.3. ADT Interact3D

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

This ADT involves half time software development for ARC NIEVE, and the other half general support to the new Immersive Space Gouraud-Phong in Sophia-Antipolis (supervised by Jean-Christophe Lombardo of the DREAM service). The main contribution was the complete rewrite of our VR application environment with the development of the Imerse software. This platform will allow first experiments, and the development of a generic Virtual Reality framework addressing neuroscience/psychology applications. This generic platform is based on osgVR which aims at a high-quality context abstraction to be usable in several domains, as well as distributed rendering capacities. These improvements, deployable for a variety of applications to come, are tightly coupled with the current ARC NIEVE, thus contributing to its implementation. Future prospects for the ADT Interact 3D include developing novel multimodal interaction techniques for example for gesture-based interaction etc.

6.2.4. National French Bilateral Collaboration

We have ongoing collaborations with J. Thollot (INPG/INRIA Grenoble) [14], M. Hachet (IPARLA, Bordeaux) [22], and B. Galerne (ENST/ENS Cachan) and Sylvain Lefebvre (ALICE/Nancy) [19].
6.3. European Initiatives

6.3.1. FP7 Projet

6.3.1.1. VERVE

Title: VERVE:
Type: COOPERATION (ICT)
Defi: Services to promote E-inclusion using socially realistic virtual environments
Instrument: Integrated Project (IP)
Duration: October 2011 - September 2014
Coordinator: Trinity College - Dublin (Ireland)
Others partners: DFKI (Germany), CNRS, IRCAM, U. of Zaragoza (Spain), Testaluna (IT), KAINOS (UK)
See also: http://www.verveconsortium.eu/

Abstract: Social exclusion has many causes, but major factors are the fear and apathy that often accompany a disability. The European e-Inclusion policy stresses the importance of ICT in improving the quality of life in potentially disadvantaged groups, including older people and persons with disabilities. In this project, we will develop ICT tools to support the treatment of people who are at risk of social exclusion due to fear and/or apathy associated with a disability. These tools will be in the form of personalised VR scenarios and serious games specifically designed for therapeutic targets and made broadly available via a novel integration of interactive 3D environments directly into Web browsers. We will perform cutting edge research into rendering and simulating personalised and populated VR environments, 3D web graphics, and serious games. These technical efforts will be underpinned by our clinical/laboratory and industry partners, who will be fully involved throughout in the requirements, design and evaluation of VERVE, and liaison with the stakeholders (i.e., participants, carers/family, and health professionals). They will implement the VERVE interventions in three use-cases, each targeting a different group of participants: Fear of falling, Apathy related to cognitive decline and behavioural disturbances, and other emotional disturbances linked to anxiety. While developing clinical assessment methods and interventions for the first two patient groups is our primary focus, our results will be applicable to a much wider range of potentially disadvantaged individuals.
VR4I Team (section vide)
AXIS Project-Team (section vide)
DAHU Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. 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 is 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 and a learning step, using decision trees, aims at updating the global knowledge base and its distributed instances. We are currently working on an incremental version of this learning step. Another current issue is to deal with a dynamic set of attributes. The following website gives many details: http://www.irisa.fr/dream/ManageYourself.
7. Contracts and Grants with Industry

7.1. Alcatel Lucent Bell

Participants: Nicolas Marie, Fabien Gandon.

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

Participants: Corentin Follenfant, Olivier Corby.

We started a PhD Thesis (Cifre) with SAP Research on Semantic graphs for decisional information systems.
7. Contracts and grants with industry

7.1. Contracts with industry

7.1.1. Thesaurus alignment environment

Participants: Jérôme Euzenat [Contact], Jérôme David, Cássia Trojahn dos Santos.

Exmo has been subcontractor of the Mondeca company in a project for the OPOCE (the office for the official publications of the European Union) which developed a matching environment for thesauri. Exmo’s role has been to integrate the Alignment API technology within Mondeca’s thesaurus edition environment and the development and evaluation of new matchers adapted to thesauri matching. We have developed a special version of our matcher AROMA for this task, which uses a consensus-based matcher.

Concerned thesauri are large multilingual vocabularies expressed in SKOS, such as Eurovoc, GEMET and ETT.
7. Contracts and Grants with Industry

7.1. ABES

Collaboration with ABES. Funding of a 6-month engineer (Cécile Ochman) and half a PhD grant (Léa Guizol, started in October 2011). See Section 6.5.

7.2. CFTC

We have initiated a national collaboration with the technical center of Comptois’ 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 will be proposed on this project in 2012.
7. Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. DataPublica

**Participants:** Ioana Manolescu, Nathalie Pernelle, Chantal Reynaud, Fatiha Saïs, Brigitte Safar.

A collaboration has been initiated with the DataPublica start-up (F. Bancilhon, C. Frisch) and the Zenith INRIA team (ex-ATLAS) from Montpellier. DataPublica aims at drawing up a catalog of the public data sources of the French domain, and in particular those produced by public administration, mostly in Excel files. The contract with DataPublica aims at designing a semantic annotation tool for typing entities in columns of tables in the geographic domain.
6. Contracts and Grants with Industry

6.1. Contracts with Industry

6.1.1. Consulting for Core Security Technologies

Participant: Jörg Hoffmann.

Core Security Technologies is an U.S.-American/Argentinian company providing, amongst other things, tools for (semi-)automated security checking of computer networks against outside hacking attacks. For automation of such checks, a module is needed that automatically generates potential attack paths. Since the application domain is highly dynamic, a module allowing to declaratively specify the environment (the network and its configuration) is highly advantageous. For that reason, Core Security Technologies have been looking into using AI Planning techniques for this purpose. After consulting by Jörg Hoffmann (see also below), they are now using a variant of Jörg Hoffmann’s FF planner – developed during his PhD work at the University of Freiburg, Germany (cf. Section 4.1) – in their product. Core Security Technologies payed Jörg Hoffmann for the consulting as an Auto-Entrepreneur.
7. Contracts and Grants with Industry

7.1. Contracts with Industry


**Participants:** Jean-Baptiste Faddoul, Rémi Gilleron, Fabien Torre [correspondent].

Gilleron and Torre continue supervising the PhD thesis (Cifre) of Jean-Baptiste Faddoul together with B. Chidlovski from the Xerox’s European Research Center (XRCE).

7.1.2. Cifre Innovimax (2010-2013)

**Participants:** Tom Sebastian, Joachim Niehren [correspondent].

Niehren continue supervising the PhD thesis (Cifre) of Tom Sebastian on streaming algorithms for XSLT with M. Zergaoui from INNOVIMAX S.A.R.L. in Paris.

7.1.3. Cifre SAP (2011-2014)

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

Garriga and Gilleron continue supervising the PhD thesis (Cifre) of Thomas Ricatte together with TBA from SAP.

7.1.4. QuiXProc: INRIA Transfer Project with Innovimax (2010-2012)

**Participants:** Denis Debarbieux, Joachim Niehren [correspondent].

Niehren and Debarbieux continue an INRIA transfer project with Innovimax S.A.R.L in Paris, on the integration of XPath streaming algorithms into XProc, the XML coordination language of the W3C.
7. Contracts and Grants with Industry

7.1. The BioIntelligence Project

Participants: Mehwish Alam, Isiru Bayissa, Aleksey Buzmakov, Adrien Coullet, Marie-Dominique Devignes, Mehdi Kaytoue, Luis Felipe Melo, Amedeo Napoli [contact person], Chedy Raïssi, 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.

Three thesis related to “BioIntelligence” are beginning in the Orpailleur team. A first one is in concern with ontology re-engineering in the domain of biology. The objective is consider the content of the BioPortal ontologies and to design formal contexts with which we will be able to build a concept lattice, to be used as a support for an ontology schema. The formal concept is built according to external resources such as Wikipedia and domain knowledge as well.

A second thesis is related to the study of possible combination of mining methods on biological data. The mining methods which are considered here are based on FCA and RCA, itemset and association rule extraction, and inductive logic programming. These methods have their own strengths and provide different special capabilities for extending domain ontologies. A particular attention will be paid to the integration of heterogeneous biological data and the management of a large volume of biological data while being guided by domain knowledge lying in ontologies (linking data and knowledge units). 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 third thesis is based on an extension of FCA involving Pattern Structures on Graphs. The idea is to be able to extend the formalism of pattern structures to graphs and to apply the resulting framework on molecular structures. In this way, it will be possible to classify molecular structures and reactions by their content. This will help practitioners in information retrieval tasks involving molecular structures or the search for particular reactions.

7.2. The Quaero Project

Participants: Victor Codocedo [contact person], 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 participates in the task called “Formal Representation of Knowledge for Guiding Recommendation”, whose objectives are to define methods and algorithms for building a “discovery engine” guided by domain knowledge and able to recommend a user some content to visualize. Such a discovery engine has to extend capabilities of usual recommender systems with a number of capabilities, e.g. to select among a huge amount of items (e.g. movie, video, music) those which are of interest for a user according to a given profile. In addition, the discovery engine should take into account contextual information that can be of interest such as news, space location, moment of the day, actual weather and weather forecast, etc. This contextual information changes within time and extracted information has to be continuously updated. Finally, the system has be able to justify or explain the recommendations.

A thesis takes place in the context of the Quaero project. At the moment, document annotation is especially studied for enhancing recommendation but also information retrieval. Information retrieval guided by domain knowledge can be used for selecting resources of interest for these two tasks. Then knowledge discovery based on Formal Concept Analysis can be used for extracting patterns of interest w.r.t. the context and for enriching the domain and contextual knowledge base.

Finally, the discovery process has to be able to act as a classifier and as an inference engine at the same time for reasoning and classifying elements for recommendation and retrieval.
7. Contracts and Grants with Industry

7.1. Industrial collaborations

The SMIS project has a long lasting cooperation with Axalto, recently merged with Gemplus to form Gemalto, the world’s leading providers of microprocessor cards. Gemalto provides SMIS with advanced hardware and software smart card platforms which are essential to validate numbers of our research results. In return, SMIS provides Gemalto with application requirements and technical feedbacks that help them adapting their future platforms towards data intensive applications. SMIS has also a growing cooperation with Santeos, an Atos Origin company developing software platforms of on-line medical services. Santeos is member of the consortium selected by the French Ministry of Health to host the French DMP (the national Personal Medical Folder initiative). This cooperation helps us tackling one of our targeted applications, namely the protection of medical folders.

7.2. DMSP Yvelines District grant (Nov 2010 - Apr. 2012)

Partners: INRIA-SMIS (coordinator), Gemalto, UVSQ, Santeos
SMIS funding : 75k€
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). It is currently experimented in the context of a medical-social network providing care and services at home for elderly people. The experiment in the field started in September 2011 with a population of 120 volunteer patients and practitioners in the Yvelines district.
WAM Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. ANR OTMedia (2011-2013), 150 Keuros

Participants: Alexis Joly, Julien Champ.

The project OTMedia is with INA, AFP, Syllabs, LIA, and ELICO. The main objective is to create an integrated system allowing sociologists and decision makers to analyze information flows across different media sources including web sites, blogs, newspapers, radio and TV. Zenith addresses more specifically the research challenges related to the trans-media tracking of visual contents (images and videos).

7.2. CIFRE INA/INRIA (2011-2013)

Participants: Alexis Joly, Pierre Letessier.

This CIFRE contract with INA allows funding a 3-years PhD (Pierre Letessier). This PhD addresses research challenges related to content-based mining of visual objects in large collections.

7.3. PREDIT EPILOG (2009-2011, 60Keuros)

Participant: Patrick Valduriez.

The project EPILOG (Etude des technologies Pair-à-pair pour la collaboration Interentreprises dans la chaîne LOGistique) involves Euxenis SAS and RISC Solutions d’Assurances. The objective is to provide support for collaboration and supply chain management among partner enterprises in the retail industry The approach we validated in the project is P2P. We also addressed the research issues associated with the definition of the P2P network for supply chain management, with autonomous partners with various interests, the modeling of information exchanged during transactions and query processing in the P2P network.

7.4. Data Publica (2010-2011)

Participants: Emmanuel Castanier, Rémi Coletta, 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 though our WebSmatch technology 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.
7. Contracts and Grants with Industry

7.1. Industrial Contracts

7.1.1. DGA/Rapid CANARI
   Participants: Patrick Rives, Cyril Joly.
   This project aims at developing a full autonomous indoor mobile robot dedicated to survey missions. CANARI is a follow up to the previous Programme d’Etude Amont: PEA MiniROC funded by the DGA (Délégation Générale de l’Armement). The partners are a PME Robopec and the company ECA as in MiniROC. ARobAS is in charge of the development of SLAM aspects that rely on the C. Joly’s PhD thesis results.

7.1.2. Eco-Industrie program RAPACE
   Participants: Pascal Morin, Glauco Scandaroli.
   This project concerns the development of an aerial vehicle with Vertical Take-Off and Landing capabilities, and its automatic control from visual and inertial sensors. Our participation is more specifically dedicated to the problem of estimating the "pose" (i.e. position and orientation) of the vehicle from visual and inertial measurements, and to controlling the system from these measurements. Our partners are GEOCEAN (Aubagne), ACS (St Sulpice de Royan), AKA (Lisses), DELTY (Toulouse), HELICE (Paris), Ecole Centrale de Lille, Ecole Centrale de Marseille.
7. Contracts and Grants with Industry

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

Participants: Mireille Bossy, Odile Pourtallier.

Started in January 2009, 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. (see also INRIA -TOSCA Team report).

7.2. Airbus France

Participant: Yves Paepagay.

To improve the production of numerical (flight) simulators from models of aerodynamics, Airbus France is interested in methods and tools like those described in 6.3.2. 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 to enhanced the functionnalities 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, another contract licensing to Airbus a final and complete version of this prototype has been signed in 2011.

7.3. Thales Alenia Space

Participants: David Daney, 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 relative 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.
6. Contracts and Grants with Industry

6.1. 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 danger. 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.

6.1.2. Renault

[Jan 2010 - Feb 2013]

This contract is 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.

6.1.3. GRAAL

[January 2009 - January 2011]

The Graal project aims to produce a generic behaviour construction toolkit for video games and small autonomous robots. It is based on probabilist modelling techniques, and will last two years, starting in January 2009. It involves four partners:

- INRIA/e-Motion provides the core scientific basis for probabilist modelling and autonomous robot programming;
- ProBayes ("Born of INRIA" in 2003) builds upon its generic Bayesian inference engine ProBT, and its expertise of decision systems;
- POB-Technology develops small robots for education and entertainment, sold in high schools and universities all over the world;
- Ageod (in the project during its first year) developed simulation-like historic strategy games.

The goal of the project is the extension and application of Bayesian modelling techniques for industrial behaviour construction:

- programming and maintaining complex behaviours for virtual entities; - teaching simple behaviours to small robots;
- bringing behaviour modification into the hands of students and hobbyists;
- integrating probabilistic reasoning into the tools of industrial behaviour programmers.

The Graal project is funded as a FUI (Fonds Unitaire Interministériel) project by the French Ministère de l’Industrie, the Rhône-Alpes region, and the Greater Lyon metropolitan area. It is labelled and supported by the Imaginove (game and entertainment) and Minalogic (intelligent miniaturized products) clusters.
6.1.4. 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 project 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.

6.2. National Initiatives

6.2.1. ADT ArosDyn

[Nov 2008 - Nov 2011]

The Technology Development Action (ADT) ArosDyn, coordinated by the project team e-Motion, aims to develop an embedded software for robust analysis of dynamic scenes and assessment of risk during car driving. The system will be used in the scope of a Driver Assistance System. ADT ArosDyn is supported by the INRIA's Direction of Technological Development (D2T).

The principal participants of the project are the project-teams e-Motion, PERCEPTION, the SED of INRIA Grenoble Rhône-Alpes and the project-team EVOLUTION of INRIA Sophia-Antipolis. The spin-off company Probayes and the project-team PRIMA of INRIA Grenoble Rhône-Alpes help us on the development of some specialized modules.

The robustness of the analysis methods is based on the Bayesian fusion of sensor data. The applied algorithms provide to detect and track in real time multiple moving objects in various traffic scenarios. The perception of traffic environment relies on the processing of range and visual information gathered by a laser scanner and a stereo vision camera. These two types of sensors possess complementary technical features. They ensure the detection of objects in various traffic scenarios. The proprioceptive perception makes use of the inertial and odometry sensors. The system is implemented onto our experimental vehicle Lexus which has been provided by Toyota.

6.2.2. AEN PAL

[Nov 2009 - Nov 2013]

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. European Initiatives

6.3.1. Collaborations in European Programs

6.3.1.1. BACS project

Program: FP6-IST-027140
Project acronym: BACS
Project title: Bayesian Approach to Cognitive Systems
Duration: January 2006 - February 2011
Coordinator: Agostino Martinelli, Pierre Bessière
Other partners: LPPA, ETHZ (suisse)
Abstract: Despite very extensive research efforts contemporary robots and other cognitive artifacts are not yet ready to autonomously operate in complex real world environments. One of the major reasons for this failure in creating cognitive situated systems is the difficulty in the handling of incomplete knowledge and uncertainty. In this project we are investigating and applying Bayesian models and approaches in order to develop artificial cognitive systems that can carry out complex tasks in real world environments. We are taking inspiration from the brains of mammals including humans and applying our findings to the developments of cognitive systems. The conducted research results in a consistent Bayesian framework offering enhanced tools for probabilistic reasoning in complex real world situations. The performance is demonstrated through its applications to drive assistant systems and 3D mapping, both very complex real world tasks. P. Bessière, C. Laugier and R. Siegwart edited a book titled “Probabilistic Reasoning and Decision Making in Sensory-Motor Systems” [34] which regroups 12 different PhD theses defended within the BIBA and BACS European projects. See: [33], [36], [37], [42], [62], [63], [74], [89], [82].

6.3.1.2. Intersafe 2 project

Project acronym: Intersafe 2
Project title: Intersafe 2
Duration: September 2008 - September 2011
Coordinator: M. Parent and O. Aycard
Abstract: The INTERSAFE-2 project aims to develop and demonstrate a Cooperative Intersection Safety System (CISS) that is able to significantly reduce injury and fatal accidents at intersections. The novel CISS combines warning and intervention functions demonstrated on three vehicles: two passenger cars and one heavy goods vehicle. Furthermore, a simulator is used for additional R&D. These functions are based on novel cooperative scenario interpretation and risk assessment algorithms.

6.3.1.3. sFly project

Program:FP7-ICT-2007-3.2.2
Project acronym:sFly
Project title:Swarm of Micro Flying Robot
Duration: January 2009 - December 2011
Coordinator: A. Martinelli

Abstract: sFly is an European research project involving 4 research laboratories and 2 industrial partners. This project will focus on micro helicopter design, visual 3D mapping and navigation, low power communication including range estimation and multi-robot control under environmental constraints. It shall lead to novel micro flying robots that are:

- Inherently safe due to very low weight (\(<500g\)) and appropriate propeller design;
- Capable of vision-based fully autonomous navigation and mapping;
- Able of coordinated flight in small swarms in constrained and dense environments.

The contribution of e-Motion to sFly focuses on autonomous cooperative localization and mapping in open and dynamic environments. It started on 01/01/09. For the moment, Alessandro Renzaglia (PhD student) and Agostino Martinelli work on this project. A new Postdoc will be recruited for the project as well quickly.

6.3.1.4. HAVEit project

Program:ICT-212154
Project acronym:HAVEit
Project title:Highly Automated Vehicles for Intelligent Transport
Duration: February 2008 - January 2011
Coordinator: F. Nashashibi and T. Fraichard

Abstract: HAVEit aims at the realization of the long-term vision of highly automated driving for intelligent transport. The project will develop, validate and demonstrate important intermediate steps towards highly automated driving.

HAVEit will significantly contribute to higher traffic safety and efficiency usage for passenger cars, buses and trucks, thereby strongly promoting safe and intelligent mobility of both people and goods. The significant HAVEit safety, efficiency and comfort impact will be generated by three measures:

- Design of the task repartition between the driver and co-drivingsystem (ADAS) in the joint system.
- Failure tolerant safe vehicle architecture including advanced redundancy management.
- Development and validation of the next generation of ADAS directed towards higher level of automation as compared to the current state of the art.

The contribution of e-Motion to HAVEit focuses on safe driving.

6.3.2. Major European Organizations with which you have followed Collaborations
Department of Electrical & Computer Engineering: University of Thrace, Xanthi (Greece)
Subject: 3D coverage based on Stochastic Optimization algorithms

BlueBotics: BlueBotics Company, Lausanne (Switzerland)
Subject: Implementation of self-calibration strategies for wheeled robots and SLAM algorithms for industrial purposes

Autonomous System laboratory: ETHZ, Zurich (Switzerland)
Subject: Vision and IMU data Fusion for 3D navigation in GPS denied environment.

6.4. International Initiatives

6.4.1. “ict-PAMM”
[September 2011- September 2013]
ict-PAMM is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministry of Foreign Affair and INRIA. This project aims at conducting common research activities in the areas of robotic mobile service and robotic assistance of human in different contexts of human life. French partners are INRIA-emotion from Grenoble, INRIA-IMARA from Rocquencourt and Institut Blaise Pascal from Clermont-Ferrand. Asian Partners are IRA-Lab from Taiwan, ISRC-SKKU from Suwon in Korea, ITS-Lab from Kumamoto in Japan and Mica Institute from Hanoi in Vietnam.

6.4.2. “Predimap”
[September 2011- September 2013]
Predimap is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministry of Foreign Affair and INRIA. This project aims at conducting common research activities in the area of perception in road environment. The main objective is the simultaneous use of local perception and Geographical Information Systems (GIS) in order to reach a global improvement in understanding road environment. Thus the research topics included in the project are: local perception, precise localization, map-matching and understanding of the traffic scenes. French partners are Inria-emotion from Grenoble, Heudiasyc team from CNRS/UTC, and Matis team from IGN. Foreign partners are Peking University and Shanghai Jiao Tong University in China, CSIS lab from Tokyo University in Japan and AIT Geoinformatics Center in Thailand.

6.4.3. “PRETIV”
[November 2011- October 2014]
Multimodal Perception and REasoning for Transnational Intelligent Vehicles” (PRETIV) is a three-year ANR project accepted in the framework of the Blanc International II Programme with participants from France (e-Motion of INRIA, Heudiasyc of CNRS, PSA Peugeot Citroen DRIA in Velizy) and China (Peking University, PSA Peugeot Citroen Technical Center in Shanghai). The project aims at developing of an online multimodal perception system for a vehicle and offline reasoning methods, dealing with incompleteness and uncertainties in the models and sensor data, as well as at conducting experiments in typical traffic scenarios in France and China to create an open comparative dataset for traffic scene understanding. The perception system will incorporate vehicle localization, mapping of static environmental objects, detecting and tracking of dynamic objects in probabilistic frameworks through multimodal sensing data and knowledge fusion. The reasoning methods are based on sensor data to learn semantics, activity and interaction patterns (vehicle - other objects, vehicle - infrastructure) to be used as a priori information to devise effective online perception algorithms toward situation awareness. The comparative dataset will contain experimental data of typical traffic scenarios with ground-truth, which will be used to learn country-specific traffic semantics and it will be open to the public.

6.4.4. Visits of International Scientists
John-David Yoder from Ohio Northern University visited us 12 months.
6.4.4.1. Internship

Procopio Stein, PhD at LAR (Laboratório de Automação e Robótica) at UA (Universidade de Aveiro) is in our team for November 2011 to April 2012.

6.4.5. Participation In International Programs

Submission of an international program with Taiwan called I-Rice. Partners for this proposition of an international center are IRA-lab (Taiwan university), LAAS, INRIA and UPMC. Topics are related to Cognitive Systems and Robotics. Project under evaluation (hearing step).

Submission of an ANR Blanc GeoProb in collaboration with the spinoff Probayes (Mexico). Project on complementary list.
FLOWERS Project-Team

7. Contracts and Grants with Industry

7.1. Contracts with Industry

Honda: Alexander Gepperth conducted a 6-month research contract with Honda Research Institute America, Inc. on pedestrian pose classification in 2011.

7.2. Grants with Industry

7.2.1. Pal Robotics:

Freek Stulp is collaborating with Pal Robotics in Barcelona to implement and evaluate the use of Dynamic Motion Primitives on the commercial mobile platform 'REEM'. A particular focus of this project is to compare the respective advantages of motion primitives and sampling-based motion planning approaches in the context of human-robot interaction. We intend to submit this work to the International Journal of Robotics Research, for a special issue on “Motion Planning for Physical Robots”. Pal Robotics is supporting Freek Stulp by co-financing travel costs for regular project meetings in Barcelona.

7.2.2. Fondation Cartier pour l’Art Contemporain:

The team has been collaborating with Fondation Cartier pour l’Art Contemporain in the context of the elaboration of the exhibition “Mathematical: A Beautiful Elsewhere” (http://fondation.cartier.com), to be held from October 2011 to March 2012, as well as with artist David Lynch, to build the robotic installation/experiment Ergo-Robots/FLOWERS Fields. This robotic installation illustrates, as well as allows to experiment in a realistic setup on the long term, computational models of curiosity-driven learning, human-robot interaction and language formation. Fondation Cartier participated to the funding of this experiment/installation. A dedicated web page is available at: http://flowers.inria.fr/ergo-robots.php
IMARA Project-Team

7. Contracts and Grants with Industry

7.1. Contracts with Industry

This year began a true cooperation between IMARA team and the Valeo Group. A first direct contract has been signed in order to tighten our collaboration on vision and image processing technique within the AMARE project. Later on, Valeo has expressed its wish to collaborate more closely with IMARA in the domain of autonomous navigation and low speed driving in urban areas. A “Chaire” is expected to be signed between Valeo Group, INRIA and Mines ParisTech in order to formalize these collaborations.
LAGADIC Project-Team

7. Contracts and Grants with Industry

7.1. Dassault Aviation

Participants: Laurent Coutard, François Chaumette.

no. Inria 5140, duration : 36 months.

This contract supports Laurent Coutard’s Ph.D. about automatic aircraft landing on carrier by visual servoing (see Section 6.2.4 ).

7.2. Fondation EADS

Participants: Antoine Petit, Eric Marchand.

no. Inria 5605, duration : 36 months.

This contract supports Antoine Petit’s Ph.D. about 3D model-based tracking of satellites (see Section 6.1.1 ).

7.3. Orange Labs

Participants: Pierre Martin, Eric Marchand.

duration : 36 months.

This contract is devoted to support the Cifre convention between Orange Labs and Université de Rennes 1 regarding Pierre Martin’s Ph.D. (see Section 6.1.4 ).
7. Contracts and Grants with Industry

7.1. Industrial contracts

7.1.1. Galderma Sophia-Antipolis

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

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

7.1.2. LIRA Consortium

**Participant:** Josiane Zerubia [PI].

This consortium has been created in October 2011 between Philips, Fraunhofer Institutes and INRIA. It deals with skin care based on (cosmeto) dermatological imagery.

7.1.3. EADS Foundation

**Participant:** Josiane Zerubia [PI].

Detection of objects in infrared imagery using phase field higher-order active contours. Contract # 4643.

7.1.4. DGA/MRIS Bagneux

**Participants:** Aurélie Voisin, Marc Berthod, Josiane Zerubia [PI].

Development of advanced image-processing and analysis methods as a support to multi-risk monitoring of infrastructures and urban areas. Grant from the French Defense Agency, DGA.

7.1.5. CNES Toulouse - TAS Cannes

**Participants:** Mikael Carlavan, Laure Blanc-Féraud [Ariana PI].

Optimization of the compression-restoration chain for satellite images. Grant from CNES and TAS.

7.1.6. FUI Gyrovision, Salon de Provence

**Participants:** Daniele Graziani, Laure Blanc-Féraud [Ariana PI].

Airbone devices for survey and detection. In collaboration with ATE (PI), Dronexplorer, Nexvision, Coreti. This project has been labelled by the ‘pôles Pegase’.

7.1.7. ISA/DIBE

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

Development of stochastic models for environmental risk management using high resolution SAR data. In collaboration with G. Moser and S.Serpico[PI], from the University of Genoa (DIBE) and the Italian Space Agency (ISA).
IMEDIA Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Start-up Milpix

Participants: Hervé Jégou [INRIA Rennes], Cordelia Schmid.

In 2007, the start-up company MILPIX has been created by a former PhD student of the LEAR team, Christopher Bourez. The start-up exploits the technology developed by the LEAR team. Its focus is on large-scale indexing of images for industrial applications. Two software libraries were licensed to the start-up: BIGIMBAZ and OBSIDIAN.

7.2. MBDA Aerospatiale

Participants: Florent Dutrech, Frédéric Jurie [University of Caen], Cordelia Schmid.

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). In September 2010 started a new three-year contract on object localization and pose estimation. The PhD of Florent Dutrech is funded by this contract.

7.3. MSR-INRIA joint lab: scientific image and video mining


This collaborative project, starting 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. The PhD student Adrien Gaidon is funded by this project.

7.4. Xerox Research Center Europe


In a collaborative project with Xerox, starting October 2009, we work on cross-modal information retrieval. The challenge is to perform information retrieval and document classification in databases that contain documents in different modalities, such as texts, images, or videos, and documents that contain a combination of these. The PhD student Thomas Mensink is supported by a CIFRE grant obtained from the ANRT for the period 10/09 – 09/12. A second three-year collaborative project on large scale visual recognition started in 2011. The PhD student Zeynep Akata is supported by a CIFRE grant obtained from the ANRT for the period 01/11 – 01/14.

7.5. Technosens

Participants: Guillaume Fortier, Cordelia Schmid, Jakob Verbeek.

In October 2010 we started an 18 month collaboration with Technosens (a start-up based in Grenoble) in applying robust face recognition for application in personalized user interfaces. During 18 months an engineer financed by INRIA's technology transfer program, implements and evaluates our face recognition system on Technosens hardware. Additional development aims at dealing with hard real-world conditions.
MAGRIT Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Technicolor

**Participants:** Abdelaziz Djelouah, Jean-Sébastien Franco, Edmond Boyer.

A three year collaboration with Technicolor has started in 2011. The objective of this collaboration is to develop new gesture interfaces. Such interfaces should go beyond the Microsoft Kinect capabilities and be able to capture and interpret complex dynamic scenes in uncontrolled environments. A PhD co-supervised has started on this topic.
7. Contracts and Grants with Industry

7.1. Contract with Samsung Electronics

We continued a 12 months collaboration with the Samsung Advanced Institute of Technology (SAIT), Seoul, South Korea. Within this project we develop a methodology able to combine data from several types of visual sensors (2D high-definition color cameras and 3D range cameras) in order to reconstruct, in real-time, an indoor scene without any constraints in terms of background, illumination conditions, etc. The final software package was successfully installed in October 2011 at Samsung.
7. Contracts and Grants with Industry

7.1. European and National Projects

7.1.1. FUI 3Dlive

Participants: Frédéric Devernay, Matthieu Volat, Sylvain Duchène, Vijay Ch. A. V.

3Dlive (http://3dlive-project.com) is a collaborative project, supported by French Ministry of Industry, and involving 3 industry and research clusters: Images & Réseaux (Brittany and Pays-de-la-Loire regions), Imaginove (Rhône-Alpes region), Cap Digital (Paris region).

There are eight partners:

- **R&D/industry:**
  - Orange Labs (project leader),
  - Technicolor (3D R&D),
  - Thomson Video Networks (encoders),
  - Thales Angenieux (optics).

- **Small companies:**
  - AMP (TV shooting),
  - Binocle (specific 3D HW & SW manufacturer).

- **University labs:**
  - INRIA/PRIMA,
  - Institut Telecom.

The objectives of this project are to create expertise in France for the live filming and transmission of 3D stereo contents, and to help French industry and universities to be major global 3D actors.

The role of PRIMA within this project is to develop new algorithms for real-time processing of stereoscopic video streams. This includes:

- stereoscopic video rectification and geometric adjustments.
- view interpolation, and extraction of stereoscopic metadata for the adaptation of the stereoscopic content to the projection screen.

These algorithms rely on view- and scale- invariant feature extraction, feature matching, dense stereoscopic reconstruction, and computer graphics techniques (matting, and accelerated processing and rendering using the GPU).

3Dlive won the Loading the Future trophy from the Images & Réseaux cluster in 2011.

7.1.2. OSEO Project MinImage: Embedded Integrated Vision Systems

Start Date: 1 march 2008
Duration: 60 months
The consortium consists of:

- STMicroelectronics
- Saint-Gobain Recherche
- CEA-LETI and LIST
- Varioptic
- INRIA Grenoble Rhone-Alpes Research Centre
- DxO

The goal of the MinImage project is to develop integrated micro-cameras for portable telephones. This is a 141 Million Euro development program provided with 70 Million Euros of Aide by OSEO/AII. The program includes major development efforts in micro-electronics, optics, image processing, and image analysis.

Within the MinImage program, PRIMA has created a fast integer-coefficient $O(N)$ algorithm for computing scale and orientation normalized Gaussian derivatives that is suitable for implementation as a dedicated image processing component within an CMOS integrated vision system. The PRIMA feature extraction engine is currently under evaluation for use in the next generation integrated vision systems for mobile devices sold by ST Microelectronics.

Within MinImage, we have achieved video rate calculation an image pyramid with exactly scale invariant impulse responses using an integer coefficient $O(N)$ algorithm suitable for embedded computer vision. Our software implementation software provides a practical method for obtaining invariant image features from very large retinas for detection, tracking and recognition at video rates. This method is at the core of the real time embedded image description system for mobile applications being developed by ST Microelectronics and the CEA.

John-Alexandre Ruiz-Hernandez has recently demonstrated that the steerable scale invariant Gaussian derivative features outperform the popular “Integral Images” method for face detection using a cascade of linear classifiers popularized by Viola and Jones. We are currently extending these results other applications such as gender recognition, character recognition and place recognition. Key results in this area include

1. Fast, video rate, calculation of scale and orientation for image description with normalized chromatic receptive fields.
2. Real time indexing and recognition using a novel indexing tree to represent multi-dimensional receptive field histograms.
3. Robust visual features for face tracking, bodies, and other objects.
7. Contracts and Grants with Industry

7.1. Contracts with Industry

The Pulsar team has strong collaborations with industrial partners through European projects and national grants. In addition we have also:

- a contract with Thales ThereSIS to support two studies on video event recognition and on event discovery;
- a contract with Link Care Services to study fall detection for older people with dementia.

7.2. Grants with Industry

contract with Keeneo (bought by Digital Barrier) for the PhD fellowship CIFRE (Conventions Industrielles de Formation par la Recherche) of Malik Souded on people tracking though a camera network.
7. Contracts and Grants with Industry

7.1. 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.
- Partners: Astrium, Inria-Rennes.
- Funding: Astrium.

This contract with Astrium (starting in Oct. 2011) addresses the problem of compression of video signals captured from a geostationary satellite. The focus will be on the spatio-temporal modelling of scenes captured by the satellite in order to develop a compact representation taking advantage of the high redundancy present in the video of very high resolution and characterized by low motion.

7.1.2. Collaboration with Alcatel on robust video compression

Participants: Marco Bevilacqua, Christine Guillemot, Laurent Guillo, Aline Roumy, Velotiaray Toto-Zaratosa.

- Title: Self adaptive video codec
- Funding: Joint research laboratory between INRIA and Alcatel

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). More precisely, we collaborate with the Alcatel-Lucent team on an adaptive video codec. The goal is to design a video codec, which is able to adapt to the existing underlying transport network and/or to the complexity constraint of the encoder. Therefore the video codec has to include:

- Means at the encoder to adapt dynamically the output bitrate to the estimated channel throughput and to the effective transport QoS while maintaining the video quality requirements.
- Means at the decoder to be resilient to any remaining packet losses.

7.2. Grants with Industry

7.2.1. CIFRE contract with Orange on 3D scene analysis

Participants: Christine Guillemot, Mouid Keskes, Olivier Le Meur.

- Title: 3D scenes analysis.
- Research axis: § 6.1.2.
- Partners: Orange Labs, Inria-Rennes.
- Funding: Orange Labs.

This contract with Orange labs. (starting in Dec. 2011) aims at extracting, identifying and removing objects in a 3D unconstrained environment. To reach this objective, several views of the same scene will be used. Spatio-temporal segmentation of 3D video content will be developed.
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.11-Nov.14.

This contract with Orange labs. (starting in Dec. 2011) aims at developping 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 Thomson/Technicolor on sparse modelling of spatio-temporal scenes**  
**Participants:** Safa Cherigui, Christine Guillemot.  
- **Title:** Sparse modeling of spatio-temporal scenes  
- **Research axis:** § 6.1.4.  
- **Partners:** Thomson, Irisa/Inria-Rennes.  
- **Funding:** Thomson, ANRT.  
- **Period:** Nov.09- Oct.12.

This CIFRE contract concerns the Ph.D of Safa Cherigui. The objective is to investigate texture and scene characterization methods and models based on concepts of spatio-temporal epitomes and/or signatures for different image processing problems focusing in particular on video compression and editing. A novel method has been developed for constructing the epitome representation of an image. The epitome has been used for image compression showing significant performance gain with respect to H.264 Intra prediction modes.
7. Contracts and Grants with Industry

7.1. Contracts with industry

7.1.1. Pôle de compétitivité

Participants: Patrick Gros, Sébastien Campion.

The French government organized in 2005 competitiveness poles (pôles de compétitivité) in France to strengthen ties in given regions between industries (big and small companies), research labs (both public and private ones) and teaching institutions (universities and schools of engineering). In 2011, the pole actively prepared a proposal to build an “IRT” (Institut de Recherche Technologique), a new tool proposed by the government to foster innovation and transfer between academic and industrial partners. Texmex is involved in this project, and is responsible for one of its experimental platform. Until Oct 1st, Patrick Gros was also deputy member of the executive committee and the project selection committee.

7.2. Grants with industry

7.2.1. Contract with Technicolor

Participants: Guillaume Gravier, Patrick Gros, Cédric Penet.

Duration: 36 months, since September 15th 2010.

C. Penet’s Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between Technicolor and TExMEX. The aim of this work is to study and develop techniques based on stochastic models to analyze the content of movies. The application developed in Technicolor consists in detecting violent scenes in movies in order to facilitate parental supervision.

7.2.2. Contract with Orange Labs

Participants: Pascale Sébillot, Khaoula Elagouni.

Duration: 36 months, since October 2009.

K. Elagouni’s Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between Orange Labs and TExMEX. The aim of the work is to investigate a more semantic approach to describe multimedia documents based on textual material found inside the images.

7.2.3. Contract with INA (Institut national de l’audiovisuel)

Participants: Guillaume Gravier, Ludivine Kuznik, Pascale Sébillot.

Duration: 36 months, since April 2011.

Ludivine Kuznik’s Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between INA and TExMEX within the OSEO/QUAERO project. The aim of the work is to investigate a more semantic approach to structure and navigate very large collections of TV archives.

7.3. European initiatives

7.3.1. Quaero


Quaero is a large research and applicative program in the field of multimedia description (ranging from text to speech and video) and search engines. It groups 5 application projects, a joint Core Technology Cluster developing and providing advanced technologies to the application projects, and a Corpus project in charge of providing the necessary data to develop and evaluate the technologies. The large scope of QUÆRO’s ambitious objectives allows it to take full advantage of Texmex’s many areas of research, through its tasks on: Indexing Multimedia Objects, Term Acquisition and Recognition, Semantic Annotation, Video Segmentation, Multi-modal Video Structuring, Image and video fingerprinting.

In 2011, the Quaero team of TEXMEX was mainly affected by the leave of Mathieu Ben, our technical coordinator and of Stacy Payne our financial coordinator. S. Payne was replaced by Carryn Hayward. Among the key fact of our participation this year is our participation to Trecvid.

7.3.2. IET ICT Labs - Opensem project
Participants: Morgan Bréhinier, Sébastien Campion, Guillaume Gravier, Teddy Furon, Patrick Gros, Hervé Jégou.

Duration: 1 year, starting January 2011.

OpenSEM is a project of the EIT KIC ICT Labs grouping 5 academic partners: TU Delft (The Netherlands), VTT (Finland), TU Berlin (Germany), Institut Eurecom (France) and INRIA Rennes.

The project (See http://www.opensem.eu) builds a virtual center of excellence in order to speed up and maximize the potential for innovation in semantic media:

- Maximizing the open dissemination and impact of existing knowledge, tangible results (software, tools, demonstrations, field trial results), and rich social content (multimedia, plus metadata such as tag and ratings, plus social network information).
- Driving the immediate potential for the triple synergy between content-based analysis, user-based collaborative analysis and social networks and community building through large scale benchmarking competitions (MediaEval).

Participation to the project includes contributing software and demonstration to the OpenSEM portal as well as organizing and participating to the MediaEval 2011 benchmark initiative. As a particularly visible action, we developed the Texmix demo interface that allows the demonstration, on a corpora of news reports provided by INA, the work that was developed in the team on topic segmentation, keyword extraction, image retrieval, named entity extraction and classification. This demo was demonstrated during the fall Quaero plenary and during the INRIA-industry special day on future TV.

7.3.3. FIIA: Forensic image identifier and analyzer
Participants: Laurent Amsaleg, Ewa Kijak.


FIIA is an innovative software service for the Forensic market that automatically identifies and analyzes the content of images on web sites and seized computers. The service saves time and money, gathers better evidence, and builds stronger court cases. We are in charge of helping with the technology needed to identify the logos from terrorist organizations that are inserted in images or videos. Challenges are related to the poor resolution and small size of logos as well as to the very strict efficiency constraints that the logo detector must match.
7. 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: Jean Ponce, Andrew Zisserman, Josef Sivic, Ivan Laptev.

This collaborative project, already mentioned several times in this report, 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.

7.3. DGA: CrowdChecker (ENS and E-vitech)

Participants: Jean Ponce, Josef Sivic, Ivan Laptev.

CrowdChecker (DGA) is a joint DGA project with industrial partner E-vitech. This contract belongs to our video understanding research program. It aims at real-time characterization of a crowd seen from a camera mounted 3 to 10 meters over the ground. It includes segmentation of the crowd, clustering by movement, detection of abnormal behaviors (persons, for instance, crossing the crowd flow, or having unusual speed), tracking people. Several parts of computer vision and machine learning are involved: crowd optical flow estimation, image processing, crowd feature extraction, statistical learning from video database, etc.

7.4. PersonSpace (INRIA and Technicolor-R&D)

Participant: Ivan Laptev.

PersonSpace is a CIFRE PhD contract with Technicolor-R&D. The project addresses the problem of human pose estimation and human action recognition in still images. We investigate a subspace spanned by images and videos of people and explore the structure of this subspace to formulate useful constraints for automatic interpretation of person images.