# Activity Report 2012

# Section highlights of the Team

# ALPAGE Project-Team

## 2.2. Highlights of the Year

- A statistical parsing architecture for Italian using MELT in a pre-processing step has obtained the best results in the EVALITA shared task on Italian parsing [35] (cf. 5.7 ).

- Two different instances of Alpage parsing architectures were ranked 2nd and 3rd at the SANCL shared task on parsing user-generated content, organized by Google [38] (cf. 5.7  and 6.4 ).

- Release of two freely available out-of-domain treebanks for French: the SequoiaBank focusing on well-edited texts such as Wikipedia, Europarl, ...; the French Social Media Bank, focusing on noisy user-generated content (Facebook, Twitter, ...), the latter being the first available dataset for Facebook in any language – cf 6.4 .

<span style="color:red">**METISS Project-Team**</span>

## 2.2. Highlights of the Year

The 2nd Prize of the Rennes 1 Foundation was given to Ngoc Duong for his PhD co-supervised by Emmanuel Vincent and Rémi Gribonval.

For his contributions to the field, Emmanuel Vincent was awarded the 2012 SPIE ICA Unsupervised Learning Pioneer Award and gave a keynote at the SPIE DSS conference [49].

Emmanuel Vincent defended his Habilitation à Diriger des Recherches [31].

Reaching the end of its maximum lifespan, the Metiss project-team terminated at the end of the year 2012 and led to the creation of a new project-team Panama, headed by Rémi Gribonval.

# PAROLE Project-Team

## 2.2. Highlights of the Year

The movie "Je peux voir les mots que tu dis" (ADT Handicom) won the award for the best documentary at the "festival universitaire pédagogique" in Lyon, April 2012

# SEMAGRAMME Team  (section vide)

# ALICE Project-Team

## 2.2. Highlights of the Year

Sylvain Lefebvre received an ERC Starting grant for his project ShapeForge. The project will start in December 2012, for five years, and is funded for 1.3M euros.

# AVIZ Project-Team

## 2.3. Highlights of the Year

AVIZ has received two best paper honorable mentions at the VisWeek 2012 conference [] , [] .

AVIZ has also received a best poster award [39] and best poster honorable mention [40] .

Tobias Isenberg has been recruited as Senior Researcher and will broaden the scope of AVIZ in the direction of Scientific Visualization and Non-Photorealistic Rendering (NPR) for interactive visualization.

AVIZ has started to port its visualizations for standard Web platforms and collaborate with industry to deploy it in various domains. For example, the French Open Data Provider "Data Publica" has deployed ScatterDice to visualize employment data in France: http://labs.data-publica.com/emploi.

BEST PAPERS AWARDS :

[] **IEEE Transactions on Visualization and Computer Graphics**. L. MICALLEF, P. DRAGICEVIC, J.-D. FEKETE.

[] **IEEE Transactions on Visualization and Computer Graphics**. L. YU, K. EFSTATHIOU, P. ISENBERG, T. ISENBERG.

# IMAGINE Team

## 2.2. Highlights of the Year

- CNRS Silver medal awarded to Marie-Paule Cani.

- We organized the International conference EXPRESSIVE 2012 (CAe, SBIM, NPAR) in Annecy in June 2012 and gathered 85 participants. The local and conference chair were respectively Jean-Claude Léon and Marie-Paule Cani (http://cae-sbim-npar-2012.inrialpes.fr/).

- Two publications were accepted at SIGGRAPH 2012: [1], [8], and one extra publication as a TOG paper [4].

# IN-SITU Project-Team

## 2.3. Highlights of the Year

- INSITU had 4 full papers and 2 notes accepted at the most prestigious conference in our field, ACM CHI 2012, including a Best Paper Award and an Honorable Mention Award.

- Wendy Mackay was awarded a five-year Advanced Grant by the European Research Council (ERC).

- Ilaria Liccardi was awarded a three-year Marie Curie grant by the European Research Council, to work with Wendy Mackay and Prof. H. Abelson at M.I.T.

BEST PAPERS AWARDS :

[24] **CHI '12: Proceedings of the SIGCHI Conference on Human Factors and Computing Systems**. E. GHOMI, G. FAURE, S. HUOT, O. CHAPUIS, M. BEAUDOUIN-LAFON.

[25] **CHI'12 - 30th International Conference on Human Factors in Computing Systems - 2012**. C. LIU, S. HUOT, J. DIEHL, W. E. MACKAY, M. BEAUDOUIN-LAFON.

[29] **MobileHCI '12: Proceedings of the 14th international conference on Human-computer interaction with mobile devices and services**. D. SPELMEZAN.

# MANAO Team

## 2.1. Highlights of the Year

The main event of this year is the creation of the team *MANAO*. This is a big step for defining a new research domain, at the frontier of optical science and computer graphics.

The second hightlight is shared with our partners of the ANR SeARCH project (see Section 6.2.1 ). The results of our collaborative work on the Alexandria lighthouse was one of the key event of the exhibition dedicated to lighthouses at the "musée de la marine" in Paris (cf. Figure 1 ). These results were possible thanks to the new visualization and re-assembly tools developed in our team, using data from the new acquisition process developed by our partners Archéovision and CEAlex.



*Figure 1. Participation to the "PHARE" exhibition at Musée de la marine in Paris. With our partners of the ANR SeARCH project, we have reproduced and provided a first-time-seen reconstructed statue of Isis (left) which was standing in front of the Alexandria lighthouse (1/5 scale).*

This year was also very successful in terms of publications. We managed to publish 6 papers in major journals and conferences (2 at TOG/SIGGRAPH [16], [21], 2 at IEEE TVCG [17], [19] and finally 2 at Computer Graphics Forum [15], [18]). They cover the whole range of our project, from material properties [19] to geometry analysis [15], [18], shading analysis [21], content creation [16] and, augmented reality [17]. These publications have received a lot of attention as proved by the two interviews [24], [25] and the 3rd best paper award at the national conference on computer graphics [22].

<span style="color:red">**MAVERICK Team**</span>

## 2.3. Highlights of the Year

BEST PAPER AWARD :

[16] **High Performance Graphics**. E. HEITZ, F. NEYRET.

# MIMETIC Team

## 2.2. Highlights of the Year

- Franck Multon co-organized (with Pr. Qunsheng Peng) the 3rd sino-French symposium on computer graphics and virtual reality in QingDao, China, June 18-21 2012 in coordination with the 17th National Chinese Conference on CAD&CG and the Ninth National Conference on Intelligent CAD and Digital Entertainment

- Organization of the 5th international conference on Motion in Games in Rennes, France, November 15-17, 2012. http://mig2012.inria.fr/.

- HDR defense of Benoit Bideau entitled "Biomécanique du mouvement et interactions sportives", Nov 19th, 2012.

# MINT Project-Team

## 2.2. Highlights of the Year

- F. Giraud, M. Amberg, B. Lemaire-Semail, G. Casiez, P. Olivo and N. Roussel's demonstration of transparent tactile devices was nominated for the best demonstration award by the HAPTICS 2012 conference (Vancouver, March 4-7);

- About 500 people participated in FITG 2012, the third *Forum on Tactile and Gestural Interaction* co-organized by N. Roussel in cooperation with Plaine Images (November 13-14) in Tourcoing;

- equipex IrDIVE has been funded by french ministry of research, and started officially 1st of january 2012 (scientific coordinator Yann Coello, Pr. psychology of university Lille 3, ends in 2020); it gathers 3600 Keuros from ANR, associated to 3000 Keuros of FEDER funds; this platform is associated to a pluridisciplinary scientific project, that associates Lille 1 and Lille 3 universities, and gathers computer scientists, psychologists, and historians of arts. L. Grisoni is responsible for the art-science activity in this initiative.

# POTIOC Team  (section vide)

# REVES Project-Team

## 2.2. Highlights of the Year

An image from the paper Optimizing Environment Maps for Material Depiction – by Emmanuelle Chapoulie and Adrien Bousseau – was selected to appear on the front cover of the 8 issues of the journal Computer Graphics Forum 2012.

Jorge Lopez Moreno was honored with the Outstanding Doctoral Thesis Award at Universidad de Zaragoza.

This year has been particularly productive for our group, with seven publications in the top journals of our field (ACM TOG, IEEE TVCG, CGF) [15], [20], [19], [14], [13], [17], [16]

# VR4I Team

## 2.2. Highlights of the Year

### 2.2.1. Best paper award

The paper "Combining Brain-Computer Interfaces and Haptics: Detecting Mental Workload to Adapt Haptic Assistance" [22] has obtained the best paper award at Eurohaptics 2012

### 2.2.2. Honorable mention

The paper "Efficient Collision Detection for Brittle Fracture" [23] has obtained the honorable mention at Symposium on Computer Animation (SCA-2012)

### 2.2.3. Inauguration of Immersia

The Immersia platform has been officially inaugurated the 20th of June 2012, by Bertrand Braunschweig, Inria Rennes, Bretagne Atlantique director, Claude Labit, vice-president of the Rennes 1 University scientific council, Antoine Petit, Inria deputy managing director, with Jean Le Traon, research and technology regional deputy director, Bernard Pouliquen, vice-president of the regional council, Clotilde Tascon-Mennetrier, vice-president of the general council, and Daniel Delaveau, Mayor of Rennes and president of Rennes Metropole. The platform is currently extended with the installation of the two lateral screens, improving the sensation of immersion in the VR applications.

# AXIS Project-Team

## 2.2. Highlights of the Year

- Y. Lechevallier was scientific chair of the most important francophon conference in Knowledge Management and Extraction (EGC) in 2012 [39].

- Creation of the association France Living Labs (May): the french network of living labs (labelled by ENoLL) has decided with a majority in 2011 (after the 5th wave) to create an association due to their growing number in order to promote the French Living Labs and to facilitate user-driven open innovation at a national level. ICT Usage Lab (cf. section 6.1.8 ) is co-founder of France Living Labs with 20 other founders such as CNED, competivness clusters (Cap Digital, Image et reseaux), Lorraine Smart cities living Lab, Universcience, Urban Living Lab, etc. (cf. section 6.2.4 ). ICT Usage Lab is represented officially by B. Trousse (Inria) as permanent representative and A. Zarli (CSTB) as suppleant in the administration council.

- B. Trousse was elected President of France Living Labs.

- This year, AxIS experiments its Action-Research approach with more than ten workshops with citizen and/or professionnals (in the context of three contracts TIC TAC, ELLIOT and ECOFAMILIES) and mainly for the two first steps of a living lab process - the co-creation and/or exploration steps. Such an experience was very fruitful to identify the main research problems in deploying a living lab process and in designing and evaluating user experience in order to support user behaviour changes (cf. section 5.5 ).

- The ACM SIGSOFT 2012 Impact Paper Award has been attributed to Th. Despeyroux and his co-authors for a paper published in 1989: "CENTAUR: the system" [72].

# DAHU Project-Team

## 2.2. Highlights of the Year

Serge Abiteboul has been professor at College de France till September 2012. He organized a course on Web data management.

# DREAM Project-Team  (section vide)

# EXMO Project-Team  (section vide)

<span style="color:red">GRAPHIK Project-Team</span>

## 2.5. Highlights of the Year

- Organization of ECAI 2012 (European Conference on Artificial Intelligence), one of the major conferences in AI, together with the Coconut team at LIRMM (see Sect. 9.1 ).

- Several keynote talks at international conferences and workshops: RuleML 2012, Effost 2012, Datalog 2.0 2012, MPREF 2012 (see Sect. 9.1 ).

- Three new ANR projects: ASPIQ, PAGODA and Qualinca, the latter being coordinated by GraphIK (see Sect. 8.1 ). The three projects tackle different aspects of ontology-based data management, with our rule-based framework as the kernel formalism.

BEST PAPER AWARD :

[31] **RR'2012: International Conference on Web Reasoning and Rule Systems**. M. KÖNIG, M. LECLÈRE, M.-L. MUGNIER, M. THOMAZO.

# MAIA Project-Team

## 2.2. Highlights of the Year

- A paper on non-stationary policies for infinite-horizon Markov decision processes written by Boris Lesner and Bruno Scherrer (see Section 6.1.9 for more details) was accepted at NIPS'2012 with a *full oral presentation* (1467 papers were submitted, 370 were accepted for publication, among which only 20 were selected for *full oral presentation*).

- The Cartomatic projet which was part of the French robotics contest Defi CAROTTE organized by the General Delegation for Armaments (DGA) and French National Research Agency (ANR), has won the third and final edition of the contest. The aim of the Cart-O-matic project was to design and build a multi-robot system able to autonomously map an unknown building and to recognize various objects inside. The scientific issues of this project deal with Simultaneous Localization And Mapping (SLAM), multi-robot collaboration, and object recognition and classification. The research teams involved in this project have developed innovative approaches to each of these fields.

- The paper "MOMDPs: a Solution for Modelling Adaptive Management Problems", cosigned by Olivier Buffet has won the best paper award in this year's Special Track on Computational Sustainability and Artificial Intelligence at the Association for the Advancement of Artificial Intelligence (AAAI-12) conference in Toronto.

- Emil Keyder, Joerg Hoffmann and Patrik Haslum (ANU/NICTA) won the best paper award of the International Conference on Automated Planning and Scheduling (ICAPS-12) for their paper "Semi-Relaxed Plan Heuristics" [24].

# MOSTRARE Project-Team  (section vide)

# OAK Team

## 2.1. Highlights of the Year

Our best results of the year appeared in extremely visible and selective venues: automated recommendation of materialized XML views in ACM SIGMOD conference [18], XML query-update independence [6] and RDF materialized view selection in the VLDB 2012 conference, and scalable duplicate detection in IEEE TKDE [8].

On the national scientific stage, our team has invested significant effort in the recently accepted LabEx DigiCosme proposal, where I. Manolescu is coordinating the "Scalable and secure data management" task, and in the national database conference where I. Manolescu has been the Program Committee chair, while Nicole Bidoit and François Goasdoué were part of the Program Committee.

Significant prototype development effort was invested in particular leading to the ACM CIKM Amada [10] and Nautilus [15] software demonstrations.

## ORPAILLEUR Project-Team

## 2.2. Highlights of the Year

A best paper award was granted to a paper published in the proceedings of ICCBR-2012 (the international conference on case-based reasoning) [41] . This paper presents an approach for adapting cases in the formalism of qualitative algebras, with an application in a temporal algebra, dedicated to adaptation of cooking recipe preparations, and an application in a spatial algebra, dedicated to the allocation of crops in a farmland. BEST PAPERS AWARDS :

[41] **International Conference for Case-Based Reasoning**. V. DUFOUR-LUSSIER, F. LE BER, J. LIEBER, L. MARTIN.

# SMIS Project-Team  (section vide)

# WAM Project-Team  (section vide)

# WIMMICS Team

## 2.2. Highlights of the Year

Fabien Gandon was general co-chair of the most important academic conference about the Web: WWW 2012, Lyon.

Best poster award at ISWC 2012 for Serena Villata and Fabien Gandon, *Towards Licenses Compatibility and Composition in the Web of Data* [75].

Minister of Culture signed the Sematicpedia Convention with Inria and Wikimedia France thanks to the DBpedia.fr project we initiated.

Serena Villata was recruited on a research position at Inria.

Fabien Gandon was appointed Advisory Committee Representative of Inria at W3C

# ZENITH Project-Team

## 2.2. Highlights of the Year

Patrick Valduriez has been elected ACM Fellow (2013).

At the 2012 competition of the Ontology Alignment Evaluation Initiative (http://oaei.ontologymatching.org), our YAM++ ontology matching tool ranked first at the Large Biomedical Ontologies (largebio) track.

Members of the team have published the first textbook on P2P data management [9]. in the series Synthesis Lectures on Data Management by Morgan & Claypool Publishers.

# COPRIN Project-Team  (section vide)

<p align="center" style="color:red">**E-MOTION Project-Team**</p>

## 2.2. Highlights of the Year

*Awards*:

- Stéphanie Lefevre has received the Best student paper award at IEEE Intelligent Vehicle conference 2012. The research work has been done in the scope of the PhD thesis of Stéphanie Lefevre (Cooperation Renault) supervised by Christian Laugier and Javier Ibanez-Guzman. Paper reference: S. Lefevre, C. Laugier, I. Ibanez-Guzman. "Risk assessment at road intersections: Comparing Intention and Expectation", in IEEE Intelligent Vehicle Symposium, Alcalia de Henares, Spain, June 2012.

- Christian Laugier has received the IEEE/RSJ IROS Harashima Award for innovative technologies 2012 for his "contributions to embedded perception and driving decision for Intelligent Vehicles".

*New major partnerships*:

- The e-Motion project-team has won (in cooperation with the CNRS laboratories LAAS and ISIR) a major partnership with Taiwan in the scope of the call for "International Excellence Laboratories" (I-RiCE program) launched by the National Science Council (NSC) of Taiwan. The laboratory is hosted by the National University of Taiwan, it is supported for 5 years, and the collaborative research is focusing on Human centered Robotics.

- Establishment of a new strategic partnership focusing onto the "software / hardware integration for a robust and efficient perception in dynamic environments". A first long term project named "Perfect" involving the CEA LETI and ST-Microelectronics has been launched in the scope of the IRT (Technological Research Institute) Nano. A more focused project involving the CEA LETI and several regional companies (Probayes, Calao, Delta Drone, ST-Ericson, Semitag) has been recently submitted.

- Toyota has renewed his long-term collaborative research agreement with the e-Motion project-team for 4 years (including a PhD grant for addressing the "Autonomous Driving" topic).

# FLOWERS Project-Team

## 2.2. Highlights of the Year

### 2.2.1. Ergo-Robots: Large-scale life-long learning robot experiment

The FLOWERS team, in collaboration with University Bordeaux I/Labri, has participated as a central actor of the exhibition "Mathematics: A Beautiful Elsewhere" at Fondation Cartier pour l'Art Contemporain in Paris. This installation, called "Ergo-Robots/FLOWERS Fields" was made in collaboration with artist David Lynch and mathematician Mikhail Gromov (IHES, France), and shows computational models of curiosity-driven learning, human-robot interaction as well as self-organization of linguistic conventions. This exhibition, at the crossroads of science and art, allowed to disseminate our work towards the general public, explaining concepts related to learning mechanims in humans and robots to a large audience (80000 visitors). This was also an opportunity for experimenting and improving our technologies for life-long robot learning experimentation. For one of the first times in the world outside the laboratory, we demonstrated how it is possible to achieve experimentation with learning robots quasi-continuously for 5 months. This opens novel stimulating scientific perspectives in the field of developmental robotics. This experimentation was presented through large audience radios, magazines and newspapers (France Inter, France Culture, RFI, Sciences et Avenir, Tangente, Financial Times, Daily Telegraph, Libération, ...).
More information available at: http://flowers.inria.fr/ergo-robots.php and http://fondation.cartier.com/.

### 2.2.2. MACSi: Integrated system for curiosity-driven visual object discovery on ICub robot

In the frame of the MACSi ANR project conducted together with ISIR (UPMC - Paris) a complete cognitive architecture for humanoid robots interacting with objects and caregivers in a developmental robotics scenario has been integrated on the iCub robot [43]. The architecture is foundational to the MACSi project and to several research axis of FLOWERS: it is designed to support experiments to make a humanoid robot gradually enlarge its repertoire of known objects and skills combining autonomous learning, social guidance and intrinsic motivation. This complex learning process requires the capability to learn affordances, i.e. the capacity for the robot to predict which actions are possible on scene elements. Several papers presenting the general framework for achieving these goals, focusing on the elementary action, perception and interaction modules have been published. This architecture is an important milestone of the project, enabling future experiments on object learning and recognition, object categorization and interaction between autonomous exploration and social guidance.

### 2.2.3. Algorithmic architecture for learning inverse models in high-dimensional robots

Through the design of the SAGG-RIAC algorithmic architecture, and its publication in a major robotics journal [22], we have produced a highly-efficient system for intrinsically motivated goal exploration mechanism which allows active learning of inverse models in high-dimensional redundant robots. Based on active goal babbling, this allows a robot to efficiently and actively learn distributions of parameterized motor skills/policies that solve a corresponding distribution of parameterized tasks/goals. We have conducted experiments with high-dimensional continuous sensorimotor spaces in three different robotic setups: 1) learning the inverse kinematics in a highly-redundant robotic arm, 2) learning omnidirectional locomotion with motor primitives in a quadruped robot, 3) an arm learning to control a fishing rod with a flexible wire. We showed that 1) exploration in the task space can be a lot faster than exploration in the actuator space for learning inverse models in redundant robots; 2) selecting goals maximizing competence progress creates developmental trajectories driving the robot to progressively focus on tasks of increasing complexity and is statistically significantly more efficient than selecting tasks randomly, as well as more efficient than different standard active motor babbling methods; 3) this architecture allows the robot to actively discover which parts of its task space it can learn to reach and which part it cannot.

### 2.2.4. Formalization of several links between intrinsic motivation architectures and statistical machine learning

We incorporated several key concepts of intrinsically motivated developmental learning, especially measures of learning progress for curiosity-driven exploration, in several standard machine learning formalisms. First, we introduced and formalized a general class of learning problems for which a developmental learning strategy is optimal [47]. This class of learning problems characterizes problems where the issue of life-long multitask learning under bouded ressources is crucial. Within this formalization, we related the SAGG-RIAC architecture [22] with multi-armed bandits formalisms [47] allowing to study the properties of problems where there several discrete choices to make to accelerate learning. Third, we also included empirical measures of learning progress in standard reinforcement learning problem allowing to automatically choose the best exploration strategy [42] and to extend Rmax approaches, for exploration in model-based RL, to non-stationary problems [46].

### 2.2.5. Bridging black-box optimization and RL for skill learning in robots

In this year, we have made substantial advances in understanding of the relationship between black-box optimization and reinforcement learning for direct policy search, and the application of such methods to robotics manipulation, as well as their use for modelling human behavior. The key discovery has been that black-box optimization and reinforcement learning have converged towards a same set of algorithmic properties, such as parameter perturbation and reward-weighted averaging, allowing for a direct comparison and integration of such algorithms (see "Relationship between Black-Box Optimization and Reinforcement Learning" below). On the one hand, this has enabled us to exploit principles from black-box optimization, such as covariance matric adaptation, in the context of reinforcement learning. The resulting algorithm ($PI^2$-CMAES) enables adaptive exploration and life-long learning in robots [63], and in reaching experiments leads to proximo-distal maturation as an emergent property [60] (see "Emergent Proximo-Distal Maturation through Adaptive Exploration" below). On the other hand, it has allowed us to demonstrate that black-box optimization outperforms reinforcement learning for a particular class of policies [69]. This is an important result, as these types of policies are typically used for robotic skill learning. Therefore, more efficient and robust black-box optimization algorithms may be applied to learning with such policies, *without* compromising convergence speed and cost of the final solution.

### 2.2.6. Algorithm for learning sequences of motion primitives

As for applications, we have also extended policy improvement algorithms to work with sequences of motion primitives, enabling 11-DOF manipulation robots to learn how to grasp under uncertainty through fine manipulation, and perform extended pick-and-place tasks [31] (see "Reinforcement Learning with Sequences of Motion Primitives for Robust Manipulation" below). We have also shown that learning variable impedance control is able to mimic the behavior of humans when exposed to force fields (see "Model-free Reinforcement Learning of Impedance Control in Stochastic Environments" below) .

### 2.2.7. Algorithms for autonomous dimensionality reduction

In 2012, we have made significant progress in incremental online learning algorithms capable of finding latent variables in high-dimensional sensory spaces, by either using the principle of multimodal correspondence[24] or weak, self-generated supervision[40]. These advances will be key in further extending the applicability of key artificial curiosity algorithms for learning with high-dimensional sensori spaces.

The following paper obtained the Best Paper Award in the category "Computational Models of Cognitive Development" at the IEEE ICDL-Epirob international conference: [53]

BEST PAPERS AWARDS :

[53] **ICDL-Epirob - International Conference on Development and Learning, Epirob**. C. MOULIN-FRIER, P.-Y. OUDEYER.

# IMARA Project-Team

## 2.2. Highlights of the Year

Gérard Le Lann has been awarded the Willis Lamb Prize by the French Académie des Sciences in November 2012, for his work on distributed, resilient, and real-time systems and networks.

BEST PAPER AWARD :

[36] **ICVES 2012 - IEEE International Conference on Vehicular Electronics and Safety**. H. LI, F. NASHASHIBI.

# LAGADIC Project-Team

## 2.2. Highlights of the Year

- Marie Babel and Alexandre Krupa have defended their HdR in June 2012 [10] and December 2012 [13] respectively.

- Our paper [38] related to visual servoing based on dense ultrasound images (see Section 6.4.1 ) has been selected as one of the three finalists for the Best Oral Presentation in the Hamlyn Symposium on Medical Robotics'2012.

# AYIN Team

## 2.2. Highlights of the Year

- Yuliya Tarabalka was recruited as Inria CR2 to the AYIN team in September 2012.
- Yuliya Tarabalka received Best Reviewer Award of Transactions on Geoscience and Remote Sensing in July 2012.
- A new book was published: *Zoltan Kato and Josiane Zerubia. Markov Random Fields in Image Segmentation. Collection Foundation and Trends in Signal Processing. Now editor, World Scientific, 168 pages, September 2012.*
- A patent on skin care was deposited in collaboration with Galderma and the Morpheme research team in November 2012.

# IMEDIA2 Team  (section vide)

# LEAR Project-Team

## 2.2. Highlights of the Year

- **Excellent results at TrecVid MED.** This year we participated for the second time in the Multimedia Event Detection (MED) track of TrecVid, one of the major benchmarks in automatic video analysis. In this task 25 event categories (from "making a sandwich" to "attempting a bicycle trick") have to be detected in a video corpus of 4,000 hours. We ranked first out of 13 participants on the ad-hoc event category task, and 2-nd out of 17 participants for the pre-specified event category task.

- **ERC advanced grant.** In 2012 Cordelia Schmid was awarded an ERC advanced grant for the ALLEGRO project on Active Large-scale LEarninG for visual RecOgnition. The aim of ALLEGRO is to automatically learn from large quantities of data with weak labels. In 2012 C. Schmid was also nominated IEEE fellow.

- **Inria Visual Recognition and Machine Learning Summer School**. This year we co-organized the third edition of the Inria Visual Recognition and Machine Learning Summer School in Grenoble. It attracted a total of 182 participants (48 from France, 94 from Europe and 40 from America and Asia).

# MAGRIT Project-Team  (section vide)

<span style="color:red">**MORPHEO Team**</span>

## 2.2. Highlights of the Year

### *2.2.1. Equipement d'Excellence - Kinovis*

The Kinovis project has been granted 2 million Euros by the French government within the "Equipement d'Excellence 2012" call for proposals. Kinovis is a collaboration between Inria Grenoble Rhône-Alpes and the University Joseph Fourier and is lead by the Morpheo team. This equipment project will implement 2 acquisition platforms for the capture and the analysis of moving animals and humans. At Inria Grenoble Rhône-Alpes a large platform equipped with 50 cameras will be set up. This platform will be used to capture large and complex scenes, e.g. multiple moving humans. At the Laboratory of Anatomy of Grenoble Hospital (LADAF - UJF), a dual Xray imaging system will be installed, coupled with a multiple views camera system, with the objective to investigate how the motion of laboratory animals such as mice and complex articulation such as hands, knees or feet for humans, relates to their anatomical structures.

# PERCEPTION Team

## 2.2. Highlights of the Year



*Figure 1. Audio-visual interaction between a person and the humanoid robot NAO developed under the HUMAVIPS project.*

### 2.2.1. The European project Humavips – Humanoids with Auditory and Visual Abilities in Populated Spaces

HUMAVIPS (http://humavips.inrialpes.fr) is a 36 months FP7 STREP project coordinated by Radu Horaud and which started in 2010. The project addresses multimodal perception and cognitive issues associated with the computational development of a social robot. The ambition is to endow humanoid robots with audiovisual (AV) abilities: exploration, recognition, and interaction, such that they exhibit adequate behavior when dealing with a group of people. Research and technological developments emphasize the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior.

### 2.2.2. Collaboration with SAMSUNG – 3D Capturing and Modeling from Scalable Camera Configurations

In 2010 started a multi-year collaboration with the Samsung Advanced Institute of Technology (SAIT), Seoul, Korea. Whithin 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. In 2012 we developed a novel TOF-stereo algorithm.

### *2.2.3. Book on Time-of-Flight Cameras*

A book on Time-of-Flight Cameras was published in 2012 in the collection *Springer Briefs in Computer Science*. The book stems from the scientific collaboration between the PERCEPTION team and SAIT. The book describes a variety of recent research into time-of-flight imaging. Time-of-flight cameras are used to estimate 3D scene-structure directly, in a way that complements traditional multiple-view reconstruction methods. The first two chapters of the book explain the underlying measurement principle, and examine the associated sources of error and ambiguity. Chapters three and four are concerned with the geometric calibration of time-of-flight cameras, particularly when used in combination with ordinary colour cameras. The final chapter shows how to use time-of-flight data in conjunction with traditional stereo matching techniques. The five chapters, together, describe a complete depth and colour 3D reconstruction pipeline. This book will be useful to new researchers in the field of depth imaging, as well as to those who are working on systems that combine colour and time-of-flight cameras. The publisher's url of the book is http://www.springer.com/computer/image+processing/book/978-1-4471-4657-5#.



*Figure 2. The mixed TOF-stereo multiple-camera system developed in collaboration with Samsung Electronics. Left: Geometric calibration of the camera system. Right: Live 3D display.*

# PRIMA Project-Team

## 2.2. Highlights of the Year

Publication of a special issue on motion safety in the Autonomous Robot journal edited by Thierry Fraichard and James Kuffner [30].

# SIROCCO Project-Team

## 2.6. Highlights of the Year

- The paper "Hybrid template and block matching algorithm for image intra prediction" by Safa Cherigui, Christine Guillemot, Dominique Thoreau, Philippe Guillotel and Patrick Perez has received one of the three best student paper awards at IEEE-ICASSP, Kyoto, March 2012 [21].

- The paper "Map-aided locally linear embedding methods for image prediction" by Safa Cherigui, Christine Guillemot, Dominique Thoreau, Philippe Guillotel and Patrick Perez has been among the 11 finalists (out of 500 student papers) for the best student paper award at IEEE Intl. Conf. on Image Processing, ICIP, Oct. 2012.

# STARS Team

## 2.2. Highlights of the Year

Stars designs cognitive vision systems for activity recognition based on sound software engineering paradigms.

This year, we have designed several novel algorithms for activity recognition systems. In particular, we have extended an efficient algorithm for detecting people in a static image based on a cascade of classifiers. We have also proposed a new algorithm for re-identification of people through a camera network. This algorithm outperforms state-of-the-art approaches on several benchmarking datasets (e.g. Ilids). We have realized a new algorithm for the recognition of short actions and validated also its performance on several benchmarking databases (e.g. ADL). We have improved a generic event recognition algorithm by handling event uncertainty at several processing levels. We have extended an original work on learning techniques such as data mining in large multimedia databases based on offline trajectory clustering. We have designed a generic controller algorithm, which is able to automatically tune the parameters of tracking algorithms.

We have also continued a large clinical trial with Nice Hospital to characterize the behaviour profile of Alzheimer patients compared to healthy older people.

We have organized a summer school which was held at Inria in October 2012, entitled "Human Activity and Vision Summer School", with many prestigious researchers (e.g. M. Shah).

# TEXMEX Project-Team

## 2.2. Highlights of the Year

- The project-team has participated to three tasks in the MediaEval'2012 evaluation campaign. We have obtained the best results for the Placing Task in the run without external data.
- We have obtained top results the ETAPE named entities evaluation campaign. Our system was rank first, significantly outperforming the concurrent submitted systems.

## WILLOW Project-Team

## 2.2. Highlights of the Year

+   I. Laptev was awarded a Junior ERC Grant, starting in Jan 2013.

+   J. Sivic and I. Laptev (together with C. Schmid, Inria Grenoble) co-organized one week summer school on visual recognition and machine learning http://www.di.ens.fr/willow/events/cvml2012/. The school has attracted 181 participants from 34 countries.

+   J. Ponce became a senior member of the Institut Universitaire de France.

+   J. Ponce was awarded a US patent for the PMVS software developed in collaboration with Yasutaka Furukawa.