



RESEARCH CENTER

FIELD

Perception, Cognition and Interaction

Activity Report 2016

Section Contracts and Grants with Industry

Edition: 2017-08-25

DATA AND KNOWLEDGE REPRESENTATION AND PROCESSING

1. CEDAR Team (section vide)	5
2. DAHU Project-Team	6
3. EXMO Project-Team (section vide)	7
4. GRAPHIK Project-Team	8
5. LACODAM Team	9
6. LINKS Project-Team (section vide)	10
7. MAGNET Project-Team	11
8. ORPAILLEUR Project-Team (section vide)	12
9. SMIS Project-Team	13
10. TYREX Project-Team (section vide)	14
11. WIMMICS Project-Team	15
12. ZENITH Project-Team	16

INTERACTION AND VISUALIZATION

13. ALICE Project-Team (section vide)	17
14. AVIZ Project-Team (section vide)	18
15. EX-SITU Team	19
16. GRAPHDECO Project-Team	20
17. HYBRID Project-Team	21
18. ILDA Project-Team	22
19. IMAGINE Project-Team (section vide)	23
20. MANAO Project-Team	24
21. MAVERICK Project-Team (section vide)	25
22. MIMETIC Project-Team	26
23. MINT Project-Team	27
24. Mjolnir Team	28
25. POTIOC Project-Team	29
26. TITANE Project-Team	30

LANGUAGE, SPEECH AND AUDIO

27. ALPAGE Project-Team	31
28. MULTISPEECH Project-Team	32
29. PANAMA Project-Team	33
30. SEMAGRAMME Project-Team (section vide)	34

ROBOTICS AND SMART ENVIRONMENTS

31. CHROMA Team	35
32. DEFROST Team	36
33. FLOWERS Project-Team	37
34. HEPHAISTOS Project-Team	38
35. LAGADIC Project-Team	39
36. LARSEN Team (section vide)	40
37. PERVASIVE INTERACTION Team	41

38. RITS Project-Team	42
VISION, PERCEPTION AND MULTIMEDIA INTERPRETATION	
39. AYIN Team (section vide)	43
40. LINKMEDIA Project-Team	44
41. MAGRIT Project-Team	45
42. MORPHEO Project-Team	46
43. PERCEPTION Project-Team	47
44. SIROCCO Project-Team	48
45. STARS Project-Team	51
46. THOTH Project-Team	52
47. WILLOW Project-Team	54

CEDAR Team (section vide)

DAHU Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The CIFRE scholarship of David Montoya started in 2014, with Sinovia, Cofely Ineo (group GDF Suez). The topic is on analysis of multimodal itineraries and the integration of itinerary data with other personal data.

EXMO Project-Team (section vide)

GRAPHIK Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. UMR IATE / UMR STLO / Régilait

Participants: Patrice Buche, Jérôme Fortin, Alain Gutierrez.

In the framework of a contract between INRA IATE and STLO (Rennes) research units and Régilait, two master students have been recruited in 2016. Marine Damblon, food engineer from Polytech Montpellier, has created a knowledge base which represents the causal links between a food descriptor (mouillabilité des poudres de lait) and actions which can be undertaken by operators to control food quality on the line. Justine Flore Tchouanguem participated to the development of the new CoGui-Capex version presented in section 5.4 . CoGui-Capex prototype has been successfully evaluated by Régilait and is considered to be used in production conditions in its milk powder factory in Macon. Marine Damblon has been recruited by Régilait for that. This collaboration will be extended in 2017 and a new master student should be recruited.

LACODAM Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *SocTrace: analysis of SOC traces*

Participant: Alexandre Termier.

SoCTrace is a FUI project led by STMicroelectronics, with the companies ProbaYes and Magilem, University Grenoble Alps and Inria Rhône-Alpes. Its goal is to provide an integrated environment for storing and analyzing execution traces. In this project, we are working on data mining techniques for analyzing the traces, and on the use of ontologies to enable querying traces with a higher level of abstraction.

8.1.2. *ITRAMI: Interactive Trace Mining*

Participant: Alexandre Termier.

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

8.2. Bilateral Grants with Industry

Maël Guillemé has obtained a CIFRE PhD grant with the Energiency startup, supervised by V. Masson and L. Rozé. The goal of Maël Guillemé's thesis is to propose new approaches for improving industrial energy performance and aims at integrating both numerical and symbolic attributes. A master 2 internship explored in 2016 a first approach based on an algorithm proposed by Shokoohi and al, but with several improvements: avoid data normalisation, detect patterns as fast as possible, enhance functions like distance and score.

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

LINKS Project-Team (section vide)

MAGNET Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Cifre Clic and Walk (2013-2016)

Participants: MIKAELA KELLER [correspondent], PAULINE WAUQUIER, MARC TOMMASI.

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

8.1.2. ADEME

ADEME project MUST: Méthodologie d'exploitation des données d'usage des véhicules et d'identification de nouveaux Services pour les usagers et les territoires. JAN RAMON is the local PI at Inria of this project.

ORPAILLEUR Project-Team (section vide)

SMIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Cozy Cloud bilateral contract (Dec 2014 - Nov. 2015)

Partners: Cozy Cloud, Inria-SMIS

SMIS funding: 50k€.

While this initial contract is over, we mention it to explain the increasing relationship being built between Cozy Cloud and our team. Cozy Cloud is a French startup providing a personal Cloud platform. The Cozy product is a software stack that anyone can deploy to run his personal server in order to host his personal data and web services. While centralizing all personal data in the holder's hand is a natural way to reestablish his control on his privacy, this represents an unprecedented threat in case of attacks by an intruder, especially for individuals who are not security experts. The objective of this bilateral contract is to address this issue by integrating the PlugDB solution into the Cozy stack. Roughly speaking, the Cozy data system will be modified in such a way to store only encrypted files and each file access will be intercepted and routed to PlugDB. PlugDB will act as a doorkeeper for the whole individual dataspace by managing the files' metadata, the access control rules defined on these metadata, the decryption keys and the user/application authentication.

7.1.2. Cozy Cloud CIFRE - Tran Van contract (Oct 2014 - Sept 2017)

Partners: Cozy Cloud, Inria-SMIS

SMIS funding: 30k€

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

7.1.3. Cozy Cloud CIFRE - Loudet contract (Apr 2016 - Apr 2019)

Partners: Cozy Cloud, Inria-SMIS

SMIS funding: 45k€

In relation with the bilateral contract mentioned above, a second CIFRE PhD thesis has been started by Julien Loudet. The objective is to allow for a secure execution of distributed queries on a set of personal clouds associated to users, depending on social links, user's localization or user's profile. The general idea is to build secure indexes, distributed on the users' personal cloud and to devise a secure execution protocol revealing solely the query result to the querier. Such highly distributed secure queries potentially enable new (social) applications fed by user's personal data which could be developed on the Cozy-PlugDB platform.

TYREX Project-Team (section vide)

WIMMICS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have CIFRE PhD funding with Synchronext for the design of a conversational agent assistant endowed with natural language and intuition.

We have CIFRE PhD funding with Educlever on the topic of semantic analysis of activities in a learning environment.

8.2. Bilateral Grants with Industry

8.2.1. *Semantic EDUCLLOUD Carnot Project*

Participants: Oscar Rodríguez Rocha, Catherine Faron-Zucker.

Partner : GAYAtech. This project was just accepted this year on the topic of *semantic Web for e-learning*. This is a joint project with Gayatech on the recommendation of pedagogical resources adapted to user profile and context in the EDUCLLOUD 06 Serious Game. To get help in his quests and various quiz testing his knowledge, the gamer can use external digital resources (books, video, TV, Web) and an in-game social network to work with his teacher and comrades. In this context, and to meet the needs of GAYATECH developing edutainment solutions, the Semantic EDUCLLOUD project aims to improve the recommendation of educational resources to learners in EDUCLLOUD 06, by using semantic Web and social Web models and techniques.

8.2.2. *Vigiglobe Carnot Project*

Participants: Elena Cabrio, Serena Villata.

Partner : Vigiglobe.

This project was just accepted this year on the topic of *Natural Language Argumentation on Twitter: Retrieval of Argumentative Structures and Reasoning*. this is a joint project with Vigiglobe on the natural language processing of argumentation on Twitter to retrieve argumentative structures and reason on them. The goal of the project is to : (1) Automate the selection and annotation of tweets, i.e., retrieval of those tweets that can be considered as arguments (2) Automate the assignment of labels to the type of relation holding between arguments - positive relation or negative relation. (3) Create an argumentation graph illustrating the relations between the arguments about a certain subject, and the further application of argumentation semantics to compute the set of "winning" arguments This graph-based visualization provides a summary of the ongoing discussion on Twitter.

ZENITH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Microsoft ZcloudFlow (2013-2017)

Participants: Jalexis Joly, Ji Liu, Esther Pacitti, Patrick Valduriez.

ZcloudFlow is a project in collaboration with the Kerdata team in the context of the Joint Inria–Microsoft Research Centre. It addresses the problem of advanced data storage and processing for supporting scientific workflows in the cloud. The goal is to design and implement a framework for the efficient processing of scientific workflows in clouds. The validation is performed using synthetic benchmarks and real-life applications from bioinformatics on the Microsoft Azure cloud with multiple sites.

8.2. Triton I-lab (2014-2016)

Participants: Benjamin Billet, Didier Parigot.

Triton is a common Inria lab (i-lab) between Zenith and Beepeers (<http://beepeers.com/>) to work on a scalable platform for developing social networks in mobile/Web environments. The main objective of this project is to design and implement a new architecture for Beepeers applications to scale up to high numbers of participants. The new platform relies on our SON middleware and NoSQL graph databases.

ALICE Project-Team (section vide)

AVIZ Project-Team (section vide)

EX-SITU Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

MultiHub (Microsoft donation, 2015-2016) – ExSitu was one of the ten academic institutions world wide awarded a hardware and monetary grant by Microsoft Research as part of its request for proposal to expand the potential applications of the Surface Hub across all aspects of society (<http://research.microsoft.com/en-us/projects/surface-hub/>). The goal of the MultiHub project is to enable interaction in the large, where groups of experts can interact with rich content and complex data while collaborating both locally and remotely in interactive, multi-surface environments. ExSitu was awarded two 55" Surface Hubs and \$19,000 in cash.

GRAPHDECO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Optis*

Participants: Valentin Deschaintre, Adrien Bousseau, George Drettakis.

Valentin Deschaintre is starting a CIFRE PhD in collaboration with Optis, a company specialized in material acquisition and rendering.

7.2. Bilateral Grants with Industry

7.2.1. *Technicolor*

Participants: George Drettakis, Adrien Bousseau.

We have initiated a collaboration with Technicolor on the use of deep learning for computational photography and video tasks. This will involve the use of our synthetic ground truth data generation platform (see Sec. 5.4) to tasks such as color grading and white balance. This is a collaboration with P. Pérez and E. Reinhard of Technicolor.

HYBRID Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Mensia Technologies

Participants: Anatole Lécuyer, Jussi Tapio Lindgren.

Mensia Technologies is an Inria start-up company created in November 2012 as a spin-off of Hybrid team. Mensia is focused on wellness and healthcare applications emerging from the BCI and Neurofeedback technologies. The Mensia startup should benefit from the team's expertise and of valuable and proprietary BCI research results. Mensia is based in Rennes and Paris. Anatole Lécuyer and Yann Renard (former Inria expert engineer who designed the OpenViBE software architecture and was involved in team projects for 5 years) are co-founders of Mensia Technologies together with CEO Jean-Yves Quentel.

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

8.2. Bilateral Grants with Industry

8.2.1. Technicolor

Participants: Antoine Costes, Anatole Lécuyer, Ferran Argelaguet.

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

8.2.2. Realyz

Participants: Guillaume Cortes, Anatole Lécuyer.

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

8.2.3. VINCI Construction

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

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

ILDA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Tecknowmetrix (TKM): ANRT/CIFRE PhD (Hugo Romat), 3 years, starting June 2016.

IMAGINE Project-Team (section vide)

MANAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- CIFRE PhD contract with Technicolor (2014-2018)
Participants: A. Dufay, X. Granier, and R. Pacanowski
For this project, we aim at providing interactive previsualization of complex lighting with a smooth transition to the final solution.
- CIFRE PhD contract with FEI (2014-2018)
Participants: D. Murray, and X. Granier
For this project, we aim at providing expressive rendering techniques for volumes.

MAVERICK Project-Team (section vide)

MIMETIC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Cifre Faurecia

Participants: Franck Multon [contact], Pierre Plantard.

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

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

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

This work is performed in close collaboration with an ergonomist in Faurecia together with the software development service of the company to design the new version of their assessment tool. This tool will be first evaluated on a selection of manufacturing sites and will then be spread worldwide among the 300 Faurecia sites in 33 countries.

This contract enabled us to hire Pierre Plantard as a PhD student to carry-out this work in MimeTIC and M2S Lab. He started in January 2013, finished at the beginning of 2016, and defended his PhD in July 2016. This contract was the opportunity to demonstrate the impact of MimeTIC's work about in-site motion capture on ergonomic assessment, as a decision-support system for ergonomists. The software Kimea is one of the results of this collaboration. It is currently spread in the factories of Faurecia around the world, which demonstrates the maturity of this work for industrial transfer. The method has been published with ergonomic validation in the famous journal *Applied Ergonomics* (see Highlight section).

MINT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Hap2U SME is licenced two patents of MINT team.

Mjolnir Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **Mock-up of a tool for dynamic media pre-production:** we are currently working with the HCOP holding company on the design of new tools for the pre-production of dynamic medias such as videos, e-learning animations, etc. This work involves interviews of professional video producers, the identification of opportunities for tools that could help them, and the production of descriptions and mock-ups of these tools.
- **Recognition and interpretation of piano fingering:** we have started a new collaboration with **Hugues Leclère**, concert pianist and professor at the “Conservatoire à rayonnement régional de Paris”. Our objective is to investigate new sensing technology and interpretation algorithms for accurate live recognition of piano fingerings. Ultimately, this technology would ease the transcription of fingerings directly onto scores during play and support both the learning and training of piano fingerings, given appropriate visualization and interaction techniques that we will investigate in a second phase of this collaboration.

POTIOC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Interactive Collaboration in Virtual Reality for Aerospace Scenarii:

Duration: 2014-2017

PhD Thesis of Damien Clergeaud

Partners: Airbus Group

The Airbus company regularly uses virtual reality for design, manufacturing and maintenance. We work with them on collaborative interaction in order to enable an efficient collaboration between operators immersed in the virtual environment from remote locations and with heterogeneous equipment. More precisely, we have developed tools to point and manipulate objects, to remotely visualize the virtual environment, to be aware of remote manipulations and to describe tools and components trajectories (see Section [7.5](#)).

TITANE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Geoimage*

Participants: Liuyun Duan, Florent Lafarge.

The aim of this collaboration is to devise a new type of 2.5D representation from satellite multi-view stereo images which is more accurate, compact and meaningful than the conventional digital elevation models (DEMs). A key direction consists in incorporating semantic information directly during the image matching process. This semantic is related to the type of components of the scene, such as vegetation, roofs, building edges, roads and land.

- Starting date: November 2013 - Duration: 4 years

8.1.2. *CSTB 1*

Participants: Sven Oesau, Florent Lafarge.

The goal of this collaboration was to consolidate and integrate research codes developed in Titane on urban semantization and reconstruction into the CSTB reconstruction platform.

- Starting date: September 2015 - Duration: 6 months

8.1.3. *CSTB 2*

Participants: Hao Fang, Florent Lafarge.

The goal of this recent collaboration is to develop methods for analyzing and exploring scale-spaces into urban 3D data.

- Starting date: March 2016 - Duration: 3 years

8.1.4. *Luxcarta*

Participants: Jean-Philippe Bauchet, Florent Lafarge.

The goal of this recent collaboration is to design automatic approaches for producing LOD2 city models from the last generation of satellites.

- Starting date: October 2016 - Duration: 3 years

8.2. Bilateral Grants with Industry

8.2.1. *CNES Toulouse*

Participants: Emmanuel Maggiori, Yuliya Tarabalka [PI].

Hierarchical approaches for object-oriented classification of multi-source images. Contract 150490/00.

- Starting date: November 2015

- Duration: 2 years

ALPAGE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

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

- Verbatim Analysis (license agreement, transfer agreement, “CIFRE” PhD (contract ended in Dec 2014), see section 5.20),
- Yseop (“CIFRE” PhD of Raphael Salmon started in 2012 about automatic text generation)
- Agence France-Presse (on-going discussions aimed at a renewal of a long-lasting collaborations, involving several joint projects and a CIFRE PhD)

MULTISPEECH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Venathec

Company: **Venathec SAS**

Other partners: **ACOEM Group, GE Intelligent Platforms** (contracted directly with Venathec)

Duration: June 2014 - August 2017

Supported by: Bpifrance

Abstract: The project aims to design a real-time control system for wind farms that will maximize energy production while limiting sound nuisance. This will leverage our know-how on audio source separation and uncertainty modeling and propagation.

PANAMA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Licensing agreement contract with Cedar Audio Limited*

Participants: Nancy Bertin, Srdan Kitic, Rémi Gribonval.

This contract aimed at licensing an audio desaturation (declipping) software developed in the team.

8.2. Bilateral Grants with Industry

8.2.1. *CIFRE contract with Technicolor R&I France on Very large scale visual comparison*

Participants: Rémi Gribonval, Himalaya Jain.

Duration: 3 years (2015-2018)

Research axis: **3.1.2**

Partners: Technicolor R&I France, Inria-Rennes

Funding: Technicolor R&I France, ANRT

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

SEMAGRAMME Project-Team (section vide)

CHROMA Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Toyota Motors Europe*

[2006 - 2017]

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

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

This collaboration has been extended for 4 years and Toyota provides us with an experimental vehicle Lexus equipped with various sensing and control capabilities. Several additional connected technical contracts have been signed also.

8.1.2. *Renault*

[2010 - 2017]

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

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

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

8.2. Bilateral Grants with Industry

8.2.1. *INSA-VOLVO Chair PhD grant*

[Oct 2016 - Oct 2019]

This grant is linked to the PhD Thesis of Guillaume Bono, funded by the INSA-VOLVO Chair. The objective is to deal with Global-local Optimization Under Uncertainty for Goods Distribution Using a Fleet of Autonomous Vehicles.

DEFROST Team

8. Bilateral Contracts and Grants with Industry

8.1. A.I. Mergence

A.I. Mergence is a startup company based in Paris. The transfer contract was about building a soft robot prototype. The aim of the demonstration was to show that we can improve the appearance and user interaction. They have a usage of our license for 12 months. Amount of the contract: 1500 euros.

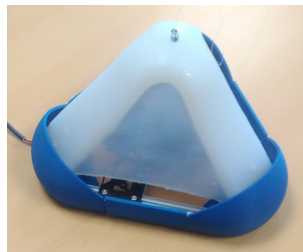


Figure 5. Prototype for A.I. Mergence

8.2. TruPhysics

TruPhysics is a German startup, using SOFA for the simulation of industrial robots. We did an expertise and research contract on modeling grasping tasks in SOFA with a deformable gripper. Amount of the contract: 7940 euros.

8.3. InSimo

InSimo is a French startup, based in Strasbourg, that was created by members of the team in 2013. The goal of InSimo is to create a new generation of surgical simulators with high quality biomechanics. We have signed a contract to work on the simulation of suture during the years 2016-2017. Amount of the contract: 33000 euros.

FLOWERS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Autonomous Driving Commuter Car*

Participants: David Filliat [correspondant], Emmanuel Battesti.

We further developed a planning algorithm for a autonomous electric car for Renault SAS in the continuation of the previous PAMU project. We improved our planning algorithm in order to go toward navigation on open roads, in particular with the ability to reach higher speed than previously possible, deal with more road intersection case, and with multiple lane roads (overtake, insertion...).

8.2. Bilateral Grants with Industry

8.2.1. *Curiosity and visual attention*

Participants: David Filliat [correspondant], Celine Craye.

Financing of the CIFRE PhD grant of Celine Craye by Thales S.A. with the goal of developing a mechanism of visual attention guiding the exploration of a robot.

8.2.1.1. *Adaptive device for disease awareness and treatment adherence of asthma in children*

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

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

HEPHAISTOS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Airbus

8.1.1. Airbus

Participant: Yves Papegay.

Research activities on MOSELA environment, section 7.3.2 , have been covered by a contract with Airbus company.

8.1.2. GénérationRobot

Participant: Jean-Pierre Merlet.

- we have got a grant from the company GénérationRobot to develop a pedagogical cable-driven parallel robot as a direct consequence from our research work, see section 7.1.1 .

8.1.3. Ellcie-Healthy

Participants: Alain Coulbois, Jean-Pierre Merlet.

- we have got a grant from the company Ellcie-Healthy to evaluate connect objects that are developed by this company.

LAGADIC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Technicolor

Participants: Salma Jiddi, Eric Marchand.

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

This project funded by Technicolor started in October 2015. It supports Salma Jiddi's Ph.D. about augmented reality (see Section 7.1.7).

8.1.2. Realyz

Participant: Eric Marchand.

no Inria Rennes 10822, duration: 36 months.

This project funded by Realyz started in October 2015. It is realized in cooperation with Anatole Lecuyer, Hybrid group at Irisa and Inria Rennes-Bretagne Atlantique to support Guillaume Cortes Ph.D. about motion capture.

8.1.3. Pôle Saint Hélier

Participants: Louise Devigne, Marie Babel.

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

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

8.1.4. Axyn

Participants: Dayana Hassan, Paolo Salaris, Patrick Rives.

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

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

LARSEN Team (section vide)

PERSVASIVE INTERACTION Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

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

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

7.1.2. IRT Silver Economy

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

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

RITS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

VALEO Group: a very strong partnership is under reinforcement between VALEO and Inria. Several bilateral contracts were signed to conduct joint works on Driving Assistance, some of which VALEO is funding. This joint research includes:

- The PhD thesis of Pierre de Beaucorps and the post-doc of Thomas Streubel under the framework of VALEO project “Daring”
- *SMART* project: on the *Design and development of multisensor fusion system for road vehicles detection and tracking*. This project funds the internship of Alfredo Valle Bario.
- A CIFRE like PhD thesis is ongoing between VALEO and Inria (M. Maximilian JARITZ), dealing with multisensor processing and learning techniques for free navigable road detection.
- VALEO is currently a major financing partner of the “GAT” international Chaire/JointLab in which Inria is a partner. The other partners are: UC Berkeley, Shanghai Jiao-Tong University, EPFL, IFSTTAR, MPSA (Peugeot-Citroën) and SAFRAN.
- Technology transfer is also a major collaboration topic between RITS and VALEO as well as the development of a road automated prototype.
- Finally, Inria and VALEO are partners of the CAMPUS project (PIA french project) including SAFRAN, Invia and Gemalto. The aim of the project is the development of autonomous vehicles and the realization of two canonical uses-cases on highways and urban like environments.

TATA Motors European Technical Centre (TMETC): a new partnership was born in 2016 with the aim of developing a highly automated vehicle. Technology transfer from Inria to TATA Motors includes localization and mapping as well as control-command codes.

Renault Group: Collaboration between Renault and RITS re-started in 2016 and is expected to know a major growth in 2017. Three different research teams in Renault are now working separately with RITS on different topics.

A first concrete action was the beginning of a CIFRE PhD thesis funded by Renault and the French ANRT. The thesis deals with the accurate localization of an autonomous vehicle on a highway using mainly on-board low-cost perception sensors.

AYIN Team (section vide)

LINKMEDIA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Teddy Furon spent 20 % of his time during 6 months to transfer research result to IRT B-com

Ph. D. contract with Alcatel-Lucent Bell Labs (Raghavendran Balu) in the framework of the joint Inria-Alcatel Lucent lab.

MAGRIT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The partnership with GE Healthcare started in 1993. In the past few years, it bore on the supervision of CIFRE PhD fellows on the topic of using a multi-modal framework and augmented reality in interventional neuroradiology. A new PhD thesis -Charlotte Delmas- started in April 2013 with the aim to perform 3D reconstruction of tools in interventional neuroradiology. Our goal is to help clinical gesture by providing the physician with a better understanding of the relative positions of the tools and of the pathology.

MORPHEO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. QuickCSG Contract with undisclosed industrial partner

QuickCSG software was licensed in October 2015 to an industrial partner whose name is contractually kept undisclosed for a finite time period. Integration of QuickCSG into the partner's software is continuing and is scheduled to be sold with this industrial partner's products. An additional support contract has been signed with this partner for the purpose of the transfer.

PERCEPTION Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- In December, PERCEPTION started a one year collaboration with the **Digital Media and Communications R&D Center, Samsung Electronics** (Seoul, Korea). The topic of this collaboration is *multi-modal speaker localization and tracking* (a central topic of the team) and is part of a strategic partnership between Inria and Samsung Electronics.
- Over the past six years we have collaborated with Aldebaran Robotics (now SoftBank). This collaboration was part of two EU STREP projects, HUMAVIPS (2010-2012) and EARS (2014-2016). This enabled our team to establish strong connections with SoftBank, to design a stereoscopic camera head and to jointly develop several demonstrators using three different generations of the NAO robot.
Website: <https://team.inria.fr/perception/nao/>
- In 2015 we started a collaboration with Xerox Research Center India (XRCI), Bangalore. This three-year collaboration (2015-2017) is funded by a grant awarded by the **Xerox Foundation University Affairs Committee (UAC)** and the topic of the project is *Advanced and Scalable Graph Signal Processing Techniques*. The work is done in collaboration with EPI MISTIS and our Indian collaborators are Arijit Biswas and Anirban Mondal.

SIROCCO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Consulting contract with Enensys technologies

Participant: Aline Roumy.

- Title : Matrix inversion for video streaming.
- Research axis : REF AT 7.4. Distributed processing and robust communication
- Partners : Enensys, Inria-Rennes.
- Funding : Enensys.
- Period : Apr. 2016 - May 2016.

This contract with Enensys technologies aimed at studying solutions for reducing the complexity of matrix inversion used for encoding data in the context of video streaming. First a bibliographical study has been carried out related to the problem of matrix inversion in a finite field, then a novel solution has been proposed together with some recommendations regarding the algorithmic implementation.

8.1.2. Google faculty research award

Participants: Christine Guillemot, Xiaoran Jiang, Mikael Le Pendu.

- Title : Light fields low rank and sparse approximation
- Research axis : **7.3.2**
- Partners : Inria-Rennes.
- Funding : Google.
- Period : Oct.2015-Sept.2016.

The goal of the project was to study low-rank and sparse approximation models for light fields compression. A homography-based low-rank approximation has been developed showing significant PSNR-rate gains compared to a direct encoding of light field views with HEVC-inter coding.

8.1.3. CIFRE contract with Envivio/ Ericsson on LDR compatible HDR video coding

Participants: Christine Guillemot, David Gommelet, Aline Roumy.

- Title : LDR-compatible coding of HDR video signals.
- Research axis : § **7.3.5** .
- Partners : Envivio.
- Funding : Cifre Envivio.
- Period : Oct.2014-Sept.2017.

The goal of this Cifre contract is to design solutions for LDR-compatible coding of HDR videos. This involves the study of rate-distortion optimized tone mapping operators taking into account constraints of temporal coherency to avoid the temporal flickering which results from a direct frame-by-frame application of classical tone mapping operators. The goal is also to design a coding architecture which will build upon these operators, integrating coding tools tailored to the statistics of the HDR refinement signals.

8.1.4. CIFRE contract with Harmonic on image analysis for HDR video compression

Participants: Maxime Rousselot, Olivier Le Meur.

- Title : image and video analysis for HDR video compression
- Partners : Harmonic, Univ. Rennes 1
- Funding: Harmonic, ANRT
- Period: April 2016-April 2019

This project (in collaboration with Rémi Cozot, FRVSense) aims to investigate two main axes. First, we want to assess whether the representation of High Dynamic Range signal has an impact on the coding efficiency. We will focus mainly on the Hybrid Log-Gamma (HLG) and Perceptual Quantizer (PQ) OETF (Opto-Electronic Transfer Function) approaches. The former defines a nonlinear transfer function which is display-independent and able to produce high quality images without compromising the director's artistic intent. The latter approach is based on Just Noticeable Difference curve. If it turns out that this representation has an impact, the coding strategy should be adjusted with respect to the representation. In addition, specific preprocessing tools will be defined to deal with the limitations of PQ and HLG approaches.

8.1.5. CIFRE contract with Technicolor on image collection analysis

Participants: Dmitry Kuzovkin, Olivier Le Meur.

- Title : Spatiotemporal retargeting and recomposition based on artistic rules
- Partners : Technicolor, Univ. Rennes 1
- Funding: Technicolor, ANRT
- Period: Nov. 2015 – Nov. 2018

The goal of the project (in collaboration with Rémi Cozot, FRVSense) is to take advantage of the huge quantities of image and video data currently available - captured by both amateur and professional users - as well as the multiple copies of each scene that users often capture, to improve the aesthetic appeal of content. Additionally, given Technicolor's unique position, we propose to take advantage of insights as well as content from professional artists and colorists to learn how different content types can be enhanced.

8.1.6. CIFRE contract with Technicolor on light fields editing

Participants: Christine Guillemot, Matthieu Hog.

- Title : Light fields editing
- Research axis : [7.1.2](#)
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2015-Sept.2018.

Editing is quite common with classical imaging. Now, if we want light-fields cameras to be in the future as common as traditional cameras, this functionality should also be enabled with light-fields. The goal of the PhD is to develop methods for light-field editing, and the work in 2016 has focused on the design of fast semi-supervised segmentation algorithms with coherence constraints across sub-aperture images (see [7.1.2](#)).

8.1.7. CIFRE contract with Technicolor on light fields compressed representation

Participants: Christine Guillemot, Fatma Hawary.

- Title : Light fields compressed representation
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Feb.2016-Jan.2019.

The goal of this PhD is to study reconstruction algorithms from compressed measurements based on the assumption of sparsity in the Fourier domain. The goal is to apply these algorithms to scalable compression of light fields.

8.1.8. CIFRE contract with Technicolor on cloud-based image compression

Participants: Jean Begaint, Christine Guillemot.

- Title : Cloud-based image compression
- Research axis : **7.3.6**
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Nov.2015-Oct.2018.

The goal of this Cifre contract is to develop a novel image compression scheme exploiting similarity between images in a cloud. The objective will therefore be to develop rate-distortion optimized affine or homographic estimation and compensation methods which will allow us to construct prediction schemes and learn adapted bases from most similar images retrieved by image descriptors. One issue to be addressed is the rate-distortion trade-off induced by the need for transmitting image descriptors.

STARS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **Toyota Europ:** this project with Toyota runs from the 1st of August 2013 up to 2017 (4 years). It aims at detecting critical situations in the daily life of older adults living home alone. We believe that a system that is able to detect potentially dangerous situations will give peace of mind to frail older people as well as to their caregivers. This will require not only recognition of ADLs but also an evaluation of the way and timing in which they are being carried out. The system we want to develop is intended to help them and their relatives to feel more comfortable because they know potentially dangerous situations will be detected and reported to caregivers if necessary. The system is intended to work with a Partner Robot (to send real-time information to the robot) to better interact with older adults.
- **LinkCareServices:** this project with Link Care Services runs from 2010 upto 2015. It aims at designing a novel system for Fall Detection. This study consists in evaluating the performance of video-based systems for Fall Detection in a large variety of situations. Another goal is to design a novel approach based on RGBD sensors with very low rate of false alarms.

THOTH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. MSR-Inria joint lab: scientific image and video mining

Participants: Cordelia Schmid, Karteek Alahari, Yang Hua.

This collaborative project, which started in September 2008, brings together the WILLOW and Thoth project-teams with researchers at Microsoft Research Cambridge and elsewhere. It builds on several ideas articulated in the “2020 Science” report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project focuses on fundamental computer science research in computer vision and machine learning, and its application to archeology, cultural heritage preservation, environmental science, and sociology.

8.2. MSR-Inria joint lab: structured large-scale machine learning

Participants: Julien Mairal, Alberto Bietti, Hongzhou Lin.

Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challenges faced by machine learning in the “big data” era: structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites and four MSR sites and started at the end of 2013.

8.3. Amazon

Participants: Grégory Rogez, Cordelia Schmid.

We received an Amazon Faculty Research Award end of 2016. The objective is 3D human action recognition from monocular RGB videos. The idea is to extend our recent work on human 3D pose estimation [19] to videos and to develop an approach for action recognition based on temporal pose based on appropriate 3D features.

8.4. Google

Participants: Karteek Alahari, Cordelia Schmid.

We received a Google Faculty Research Award in 2015. The objective is to interpret video semantically in the presence of weak supervision. We will focus on answering questions such as *who* is in the scene, *what* they are doing, and *when* exactly did they perform their action(s). We propose to develop models for detection and recognition of objects and actions learned from minimally annotated training data.

8.5. Facebook

Participants: Cordelia Schmid, Jakob Verbeek, Karteek Alahari, Julien Mairal.

The collaboration started in 2016. The topics include image retrieval with CNN based descriptors, weakly supervised semantic segmentation, and learning structure models for action recognition in videos. In 2016, Pauline Luc started her PhD funded by a CIFRE grant, jointly supervised by Jakob Verbeek (Inria) and Camille Couprie (Facebook). THOTH has been selected in 2016 as a recipient for the Facebook GPU Partnership program. In this context Facebook will donate a state-of-the-art server with 8 GPUs.

8.6. MBDA

Participants: Jakob Verbeek, Julien Bardonnnet.

Since 2004 we have collaborated with MBDA on a variety of subjects, namely object detection, tracking and matching. Several PhD students have been funded by MBDA, and code has been transferred which is integrated in products. Our collaboration resulted in 2010 in the award of the MBDA prize for innovation. Since May 2015 we have one engineer funded by MBDA working on incremental learning of object detection models. The goal is to take pre-existing vehicle models, and to quickly adapt them to new images of these vehicles when they are acquired in the field.

8.7. Xerox Research Center Europe

Participants: Mattis Paulin, Karteek Alahari, Vladyslav Sydorov, Cordelia Schmid, Julien Mairal, Jakob Verbeek.

The collaboration with Xerox has been on-going since October 2009 with two co-supervised CIFRE scholarships (2009–2012; 2011-2014). Starting June 2014 we signed a third collaborative agreement for a duration of three years. The goal is to develop approaches for deep learning based image description and pose estimation in videos. Jakob Verbeek (Inria) and Diane Larlus (XRCE) jointly supervise a PhD-level intern for a period of 6 months in 2016-2017.

WILLOW Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Facebook AI Research Paris: Weakly-supervised interpretation of image and video data (Inria)

Participants: Jean Ponce, Minsu Cho, Ivan Laptev, Josef Sivic.

We will develop in this project (Facebook gift) new models of image and video content, as well as new recognition architectures and algorithms, to address the problem of understanding the visual content of images and videos using weak forms of supervision, such as the fact that multiple images contain instances of the same objects, or the textual information available in television or film scripts.

8.2. Google: Learning to annotate videos from movie scripts (Inria)

Participants: Josef Sivic, Ivan Laptev, Jean Ponce.

The goal of this project is to automatically generate annotations of complex dynamic events in video. We wish to deal with events involving multiple people interacting with each other, objects and the scene, for example people at a party in a house. The goal is to generate structured annotations going beyond simple text tags. Examples include entire text sentences describing the video content as well as bounding boxes or segmentations spatially and temporally localizing the described objects and people in video. This is an extremely challenging task due to large intra-class variation of human actions. We propose to learn joint video and text representations enabling such annotation capabilities from feature length movies with coarsely aligned shooting scripts. Building on our previous work in this area, we aim to develop structured representations of video and associated text enabling to reason both spatially and temporally about scenes, objects and people as well as their interactions. Automatic understanding and interpretation of video content is a key-enabling factor for a range of practical applications such as content-aware advertising or search. Novel video and text representations are needed to enable breakthrough in this area.

8.3. Google: Structured learning from video and natural language (Inria)

Participants: Simon Lacoste-Julien, Ivan Laptev, Josef Sivic.

People can easily learn how to change a flat tire of a car or assemble an IKEA shelve by observing other people doing the same task, for example, by watching a narrated instruction video. In addition, they can easily perform the same task in a different context, for example, at their home. This involves advanced visual intelligence abilities such as recognition of objects and their function as well as interpreting sequences of human actions that achieve a specific task. However, currently there is no artificial system with a similar cognitive visual competence. The goal of this proposal is to develop models, representations and learning algorithms for automatic understanding of complex human activities from videos narrated with natural language.

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

Participants: Leon Bottou [Facebook], Ivan Laptev, Maxime Oquab, Jean Ponce, Josef Sivic, Cordelia Schmid [Inria Lear].

This collaborative project brings together the WILLOW and LEAR project-teams with MSR researchers in Cambridge and elsewhere. The concept builds on several ideas articulated in the “2020 Science” report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project we propose will focus on fundamental computer science research in computer vision and machine learning, and its application to archaeology, cultural heritage preservation, environmental science, and sociology, and it will be validated by collaborations with researchers and practitioners in these fields.

In October 2013 a new agreement has been signed for 2013-2016 with the research focus on automatic understanding of dynamic video content. Recent studies predict that by 2018 video will account for 80-90% of traffic on the Internet. Automatic understanding and interpretation of video content is a key enabling factor for a range of practical applications such as organizing and searching home videos or content aware video advertising. For example, interpreting videos of "making a birthday cake" or "planting a tree" could provide effective means for advertising products in local grocery stores or garden centers. The goal of this project is to perform fundamental computer science research in computer vision and machine learning in order to enhance the current capabilities to automatically understand, search and organize dynamic video content.