



RESEARCH CENTER

FIELD

Perception, Cognition and Interaction

Activity Report 2018

Section Contracts and Grants with Industry

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CEDAR Project-Team (section vide)

GRAPHIK Project-Team (section vide)

LACODAM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **AdvisorSLA 2018 - Inria**

Participants: E. Bourrand, L. Galárraga, E. Fromont, A. Termier

Contract amount: 7,5k€

Context. AdvisorSLA is a French company headquartered in Cesson-Sévigné, a city located in the outskirts of Rennes in Brittany. The company is specialized in software solutions for network monitoring. For this purpose, the company relies on techniques of network metrology. AdvisorSLA's customers are carriers and telecommunications/data service providers that require to monitor the performance of their communication infrastructure as well as their QoE (quality of service). Network monitoring is of tremendous value for service providers because it is their primary tool for proper network maintenance. By continuously measuring the state of the network, monitoring solutions detect events (e.g., an overloaded router) that may degrade the network's operation and the quality of the services running on top of it (e.g., video transmission could become choppy). When a monitoring solution detects a potentially problematic sequence of events, it triggers an alarm so that the network manager can take actions. Those actions can be preventive or corrective. Some statistics gathered by the company show that only 40% of the triggered alarms are conclusive, that is, they manage to signal a well-understood problem that requires an action from the network manager. This means that the remaining 60% are presumably false alarms. While false alarms do not hinder network operation, they do incur an important cost in terms of human resources.

Objective. We propose to characterize conclusive and false alarms. This will be achieved by designing automatic methods to “learn” the conditions that most likely precede the fire of each type of alarm, and therefore predict whether the alarm will be conclusive or not. This can help adjust existing monitoring solutions in order to improve their accuracy. Besides, it can help network managers automatically trace the causes of a problem in the network. The aforementioned problem has an inherent temporal nature: we need to learn which events occur before an alarm and in which order. Moreover, metrology models take into account the measurements of different components and variables of the network such as latency and packet loss. For these two reasons, we resort to the field of multivariate time sequences and time series. The fact that we know the “symptoms” of an alarm and whether it is conclusive or not, allows for the application of supervised machine learning and pattern mining methods.

Additional remarks. This is a pre-doctoral contract signed with AdvisorSLA to start the work for the PhD of E. Bourrand (Thèse CIFRE) while the corresponding administrative formalities are completed.

- **ATERMES 2018-2021 - Univ Rennes 1**

Participants: H. Zhang, E. Fromont

Contract amount: 45k€

Context. ATERMES is an international mid-sized company, based in Montigny-le-Bretonneux with a strong expertise in high technology and system integration from the upstream design to the long-life maintenance cycle. It has recently developed a new product, called BARIERTM (“Beacon Autonomous Reconnaissance Identification and Evaluation Response”), which provides operational and tactical solutions for mastering borders and areas. Once in place, the system allows for a continuous night and day surveillance mission with a small crew in the most unexpected rugged terrain. BARIERTM is expected to find ready application for temporary strategic site protection or ill-defined border regions in mountainous or remote terrain where fixed surveillance modes are impracticable or overly expensive to deploy.

Objective. The project aims at providing a deep learning architecture and algorithms able to detect anomalies (mainly the presence of people or animals) from multimodal data. The data are considered “multimodal” because information about the same phenomenon can be acquired from different types of detectors, at different conditions, in multiple experiments, etc. Among possible sources of data available, ATERMES provides Doppler Radar, active-pixel sensor data (CMOS), different kind of infra-red data, the border context etc. The problem can be either supervised (if label of objects to detect are provided) or unsupervised (if only times series coming from the different sensors are available). Both the multimodal aspect and the anomaly detection one are difficult but interesting topics for which there exist few available works (that take both into account) in deep learning.

- **PSA - Inria**

Participants: E. Fromont, A. Termier, L. Rozé, G. Martin

Contract amount: 15k€

Context. Peugeot-Citroën (PSA) group aims at improving the management of its car sharing service. To optimize its fleet and the availability of the cars throughout the city, PSA needs to analyze the trajectory of its cars.

Objective. The aim of the internship is (1) to survey the existing methods to tackle the aforementioned need faced by PSA and (2) to also investigate how the techniques developed in LACODAM (e.g., emerging pattern mining) could be serve this purpose. A framework, consisting of three main modules, has been developed. We describe the modules in the following.

- A town modelisation module with clustering. Similar towns are clustered in order to reuse information from one town in other towns.
- A travel prediction module with basic statistics.
- A reallocation strategy module (choices on how to relocate cars so that the most requested areas are always served). The aim of this module is to be able to test different strategies.

Additional remarks. This is a pre-doctoral contract to start the work for the PhD of G. Martin (Thèse CIFRE) while the corresponding administrative formalities are completed.

LINKS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Posos. A. Lemay is directing an internship of a master student (*projet de fin d'étude*) in cooperation with the POSOS company from Amiens. The goal of this collaboration is to work on efficient schema for a large pharmaceutical Knowledge Base.

Strapdata. C. Paperman is actively collaborating with the Strapdata company on efficient distributed graph database using an Apache novel technology to query distributed graph *Gremlin* that could benefit of the main product of Strapdata: Elassandra as a *database backend*.

MAGNET Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Coreference resolution

Along a collaboration with Orange, we developed a Natural Language Processing library for co-reference resolution. The library is based on a previous work (CorTeX) and was extended in several ways. It handles the French language, it includes new features based on vectorial representations of words (word embeddings) and it is more scalable. PASCAL DENIS is the local PI at Inria of this project.

8.2. Privacy preserving data mining for Mobility Data

JAN RAMON is the local PI at Inria for the ADEME-MUST project (Méthodologie d'exploitation des données d'usage des véhicules et d'identification de nouveaux services pour les usagers et les territoires). We study machine learning and data mining methods for knowledge discovery from mobility data, which are time-stamped signals collected from cars, for example, GPS locations, accelerations and fuel consumption. We aim to discover knowledge that helps us to address important questions in the transportation system such as road safety, traffic congestion, parking, ride-sharing, pollution and energy consumption. As the mobility data contains a lot of personal information, for instance, driving styles and locations of the users, we hence also study methods that allow the users to keep their personal data and only exchange part of them to collaboratively derive the knowledge.

The project has four partners, including, Xee company, CEREMA, i-Trans and Inria. The Xee company is responsible for recruiting drivers and collecting the data. CEREMA and i-Trans function as domain experts who help us to form the questions and verify the analytical results. MAGNET is responsible for developing and applying data mining methods for analyzing the data. The developed methods and the discovered knowledge from the project will be transferred to Metropole Lille and ADEME.

8.3. Predictive justice

Claim assistance is a French company that develops assistance for conflict resolution. The main service is RefundMyTicket⁰. In the general project of partial automation of analysis of complains, we have provided consulting and supervision. The general approach was to be able to analyze, parse and reason on legal texts. We have developed strategies based on natural language processing in the specific domain of legal texts. Techniques include learning representation and structured prediction among others.

⁰<https://www.refundmyticket.net>

MOEX Project-Team (section vide)

ORPAILLEUR Project-Team (section vide)

PETRUS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. OwnCare II-Lab (Jul 2017 - Dec 2020)

Partners: PETRUS (Inria-UVSQ), Hippocad (SME)

End 2016, the Yvelines district launched a public call for tender to deploy an industrial solution aiming at covering the whole district (10.000 patients). The Hippocad company, in partnership with Inria, won this call for tender with a solution called DomYcile in May 2017 and the project was launched in July 2017. DomYcile is based on a home box combining the PlugDB hardware/software technology developed by the Petrus team and a communication layer based on SigFox. Hippocad and Petrus then decided to launch a joint II-Lab (Inria Innovation Lab) named OwnCare. The objective is threefold: (1) build an industrial solution based on PlugDB and deploy it in the Yvelines district in the short-term, (2) use this Yvelines testbed to improve the solution and try to deploy it at the national/international level in the medium-term and (3) design flexible/secure/mobile personal medical folder solutions targeting individual uses rather than professional uses in the long-term. The DomYcile project with the Yvelines district has started in July 2017 and the II-Lab was officially created in January 2018.

8.2. Bilateral Grants with Industry

8.2.1. Cozy Cloud CIFRE - Tran Van contract (Oct 2014 -Feb 2018)

Partners: Cozy Cloud, PETRUS

Following a bilateral contract with Cozy Cloud (a French startup providing a personal Cloud platform), the CIFRE PhD thesis of Paul Tran Van capitalized 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 [14].

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

Partners: Cozy Cloud, PETRUS

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 clouds 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)

VALDA Project-Team (section vide)

WIMMICS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Joint Lab Inria - Qwant

Fabien Gandon is director of the joint Lab Inria - Qwant

8.1.2. Intelliquiz Carnot Project

Participants: Oscar Rodríguez Rocha, Catherine Faron Zucker.

Partner: Qwant/GAYAtch.

This project ended in March 2018. It was a joint project with GAYAtch (acquired by Qwant during the project) on the automatic generation of quizzes from the Web of Data. It is a continuation of a former collaborative project with GAYAtch on the recommendation of pedagogical resources based on ontology-based modelling and processing. We developed an approach to generate quizzes from DBpedia and we experimented it on the geographical domain for primary school students.

8.1.2.1. Joint Lab EduMICS

Catherine Faron Zucker is the scientific leader of the EduMICS (Educative Models Interactions Communities with Semantics) joint laboratory (LabCom, 2016-2018) between the Wimmics team and the Educlever company. Adaptive Learning, Social Learning and Linked Open Data and links between them are at the core of this LabCom. The purpose of EduMICS is both to develop research and technologies with the ultimate goal to adapt educational progressions and pedagogical resource recommendation to learner profiles. During the second year of the project, we continued the deployment of Semantic Web technologies within the industrial context of Educlever, showing the added value of Semantic Web modelling enabling ontology-based reasoning on a knowledge graph. To continue our collaboration, we submitted a project proposal to the call for projects *AAP Partenariat d'Innovation et Intelligence Artificielle*; we successfully passed the first phase.

8.1.3. PREMISSE Collaborative Project

Participants: Molka Dhoub, Catherine Faron Zucker, Andrea Tettamanzi.

Partner: SILEX France.

This collaborative project with the SILEX France company started in march 2017, funded by the ANRT (CIFRE PhD) and UCA (post-doc). SILEX France is developing a B2B platform where service providers and consumers upload their service offers or requests in free natural language; the platform is intended to recommend service providers to the applicant, which are likely to fit his/her service request. The aim of this project is to develop a solution to link together service providers and consumers.

8.1.4. Synchronext Collaborative Project

Participants: Raphaël Gazzotti, Catherine Faron Zucker, Fabien Gandon.

Partner: Synchronext.

This project is funded by the ANRT (CIFRE PhD). Synchronext is a startup aiming at developing Semantic Web business solutions. The goal of this project is to develop a NLP and semantic Web based artificial agent for online support in the insurance domain. The objective is to reduce the dropout rate of Internet users on FAQs and to reduce the number of incoming calls and e-mails. This will enable to customer advisers to focus on more difficult questions. As a first step, we are working on automatically categorizing online requests to properly rout them.

8.2. Bilateral Grants with Industry

8.2.1. Accenture

Wimmics received two grants from Accenture to support work on explainable AI. They will fund the PhD of Nicholas Halliwell on that topic.

ZENITH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. SAFRAN (2018)

Participants: Reza Akbarinia, Florent Masseglia.

SAFRAN and Inria are involved in the DESIR frame-agreement (Florent Masseglia is the scientific contact on "Data Analytics and System Monitoring" topic). In this context, SAFRAN dedicates 80K€ for a joint study of one year on time series indexing. The specific time series to be exploited are those of engine benchmarking with novel characteristics for the team (multiscale and multidimensional).

ALICE Project-Team (section vide)

AVIZ Project-Team (section vide)

EX-SITU Project-Team (section vide)

GRAPHDECO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Valentin Deschaintre has a CIFRE PhD fellowship on Material Acquisition using Machine Learning, in collaboration with Optis - Ansys, a company specialized in material acquisition and rendering.
- As part of a long standing collaboration with Adobe, Theo Thonnat interned with Sylvain Paris (Boston), Julien Philip works with Michael Gharbi (San Francisco) and J. Delanoy with Aaron Hertzmann (San Francisco).
- Adrien Bousseau and Bastien Wailly worked with the InriaTech engineers to implement a sketch recognition engine in the context of a collaboration with the start-up EpicNPoc.

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 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.

The on-going contract between Hybrid and Mensia started in November 2013 and supports the transfer of several softwares designed by Hybrid team (eg, OpenViBE and StateFinder) related to our BCI activity to Mensia Technologies for medical and multimedia 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 supported 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 supported 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 supported Anne-Solene Dris-Kerdreux's CIFRE PhD program with Vinci company on "Training in VR for construction applications".

8.2.4. Orange Labs

Participants: Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton.

This grant started in October 2017. It supports Guillaume Bataille's PhD program with Orange Labs company on "Natural Interactions with IoT using VR/AR".

ILDA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

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

IMAGINE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have on going contract with EDF R & D Saclay (Raphael Marc) on "Shape analysis of mechanical assemblies and their components". This has funded the work of Harold Vilmar until August 2018. The project has been renewed for 2019 and is funding the development of the AANALYSIS software (Jean-Claude Léon).

8.2. Bilateral Grants with Industry

We have an ongoing CIFRE PhD contract with PSA on the topic of aesthetic shape modeling in immersive virtual reality environments, which is funding the PhD of Youna Le Vaou.

LOKI Team (section vide)

MANAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE PhD contract with Thermo Fisher Scientific (2014-2018)

Participants: D. Murray & X. Granier

For this project, we aim at providing expressive rendering techniques for volumes.

8.1.2. CIFRE PhD contract with Imaging Optics (2017-2020)

Participants: C. Herzog & X. Granier

For this project, we aim at developing 3 dimensions X-rays imaging techniques for medical applications.

MAVERICK Project-Team (section vide)

MFX Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

In 2018 we had several discussions and collaborations with industrial partners, one leading to an active R&D collaboration contract. All are confidential.

MIMETIC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. BPI-PCR Robo-KII

Participant: Armel Crétual [contact].

This contract has started in February 2017 and ended in October 2018. In M2S, it involved two permanent members of MimeTic team, Armel Crétual and Franck Multon, and two engineers, Antoine Marin (18 months grant) and Brice Bouvier (10 months grant).

This project was a collaboration between BA Healthcare and M2S lab. It aimed at developing a robotics platform to allow physicians to start gait rehabilitation as soon as possible, even before patients are able to maintain upright posture alone. The usual way to perform such rehab sessions is to make the patient walk on a treadmill benefiting from a harness to prevent patient from falling. The two main limits of this approach are that:

- only straightforward at constant speed gaits are feasible whereas falling risks are much higher when modifying speed or turning
- walking on a treadmill when motor abilities are very affected can be challenging and can generate strong apprehension.

In a previous project, Robo-K, ended in september 2016, BA Healthcare has developed a first prototype of a mobile robot which strongly modified the approach: the harness is mobile and follows the patient displacement. In this way, the patient walks on the ground at his/her desired speed and the physician can include curved trajectories in the rehab process.

The main novelty of Robo-KII project was to implement a biofeedback system onto the robotics platform to reinforce rehab sessions. Closely working with physicians from two PMR services, CHU Rennes and Kerpape center, we tested several parameters of the feedback to be given to the patients. In particular, in a clinical pre-test, we focused on the temporal aspect, i.e. providing the feedback at each gait cycle or only after one rehab exercise (up to 20 steps) to avoid dual tasks situation as patients in this early stage after stroke usually also suffer from cognitive issues.

8.1.2. Unity - Cinecast

Participants: Marc Christie [contact], Quentin Galvane.

Cinecast is a research collaboration between Unity and Inria Rennes. The collaboration is focused on automated cinematography and automated editing technologies for creating video casts of 3D game sessions. The project has started in July 2018 for one year, and with a budget of 45k€. The challenge consists in specializing the general editing techniques proposed in our Automated Editing paper (AAAI 2015), reducing the knowledge of the editing algorithm from the full sequence to only 3 seconds. A first demonstration of the results was presented at the Unite 2018 event in Los Angeles.

8.1.3. SolidAnim - Solidtrack

Participants: Marc Christie [contact], Xi Wang.

In the scope of the ANR project LabCom, the purpose of this research collaboration is to develop SLAM technologies which are robust to changes in the lighting conditions. The collaboration started in October 2018, with a budget of 180k€ for a duration of three years. The budget is mostly dedicated to hiring PhD student Xi Wang. The work is a co-supervision with Eric Marchand (from Rainbow team).

8.1.4. Cifre Faurecia - Monitoring de l'efficience gestuelle d'opérateurs sur postes de travail

Participants: Franck Multon [contact], Georges Dumont, Charles Pontonnier, Olfa Haj Mahmoud.

This Cifre contract has started in September 2018 for three years and is funding the PhD thesis of Olfa Haj Mamhoud. It consists in designing new methods based on depth cameras to monitor the activity of workers in production lines, compute the potential risk of musculoskeletal disorders, and efficiency compared to reference workers. It raises several fundamental questions, such as adapting previous methods to assess the risk of musculoskeletal disorders, as they generally rely on static poses whereas the worker is performing motion. Based on previous works in the team (previous Cifre PhD thesis of Pierre Plantard) we will provide 30Hz motion capture of the worker, that will enable us to evaluate various time-dependent assessment methods.

We will also explore how to estimate joint forces based and torques on such noisy and low-sampling motion data. We will then define a new assessment method based on these forces and torques.

The Cifre contracts funds the PhD salary and 30K€ per year for the supervision and management of the PhD thesis.

8.2. Bilateral Grants with Industry

8.2.1. Bilateral contract with Technicolor

Participant: Marc Christie.

Bilateral contract with Technicolor on empowering drones with cinematographics knowledge. Participants: Philippe Guillotel, Julien Fleureau, Quentin Galvane. Amount 25k€. Duration 24 months.

POTIOC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Ullo:

Duration: 2017-2019

Local coordinator: Martin Hachet

Following our work with the Introspectibles (Teegi, TOBE, Inner Garden), we are currently working with the ULLO company to bring these new interfaces to healthcare centers.

TITANE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Google Chrome University Research Programme

Participants: Pierre Alliez, Cédric Portaneri.

We developed a novel approach and software prototype for the compression of 3D models. Our main focus is on progressive compression of surface triangle meshes with color textures, with emphasis on fine grain, genericity and flexible metric. The proposed methodology is to turn the input models into a stream of refinements, in which both mesh and texture refinement details are multiplexed in accordance to rate-distortion principles. Fine grain is achieved through considering all components, local as well as non-local, from both the mesh and its textures: mesh complexity, vertex accuracy, texture definition and accuracy. We leveraged the recent advances on perceptual metrics to improve the visual appearance, and performed joint consolidation and encoding of the models to further optimize the rate-distortion tradeoffs and visual perception.

8.1.2. Dorea technology

Participants: Vincent Vadez, Pierre Alliez [contact].

In collaboration with SME Dorea Technology, our objective is to advance the knowledge on the thermal simulation of satellites, via geometric model reduction. The survival of a satellite is related to the temperature of its components, the variation of which must be controlled within safety intervals. In this context, the thermal simulation of the satellite for its design is crucial to anticipate the reality of its operation. The project started in August 2018, for a total duration of 3 years.

8.1.3. Luxcarta

Participants: Jean-Philippe Bauchet, Florent Lafarge [contact].

The goal of this collaboration is to design automated approaches for producing city models from the last generation of satellites. The models should conform to the level 2 (LOD2) of the popular CityGML format. The project started in October 2016, for a total duration of 3 years.

8.1.4. CNES and Acri-ST

Participants: Onur Tasar, Pierre Alliez, Yuliya Tarabalka [contact].

The aim is to devise efficient representations for satellite images. The project started in October 2017, for a total duration of 3 years.

8.1.5. CSTB

Participants: Hao Fang, Florent Lafarge [contact].

The goal of this recent collaboration is to develop methods for analyzing and exploring scale-spaces into urban 3D data. The project started in March 2016, for a total duration of 3 years.

ALMAnaCH Team

7. Bilateral Contracts and Grants with Industry

7.1. Industrial Collaborations

- **Verbatim Analysis:** this Inria start-up was co-created in 2009 by BS. It uses some of ALMAnaCH's free NLP software (SxPipe) as well as a data mining solution co-developed by BS, VERA, for processing employee surveys with a focus on answers to open-ended questions.
- **opensquare** A new Inria startup, opensquare, was co-created in December 2016 by BS with 2 senior specialists in HR consulting. opensquare designs, carries out and analyses employee surveys and offers HR consulting based on these results. It uses a new employee survey analysis tool, *enqi*, which is still under development.
- **Facebook:** A collaboration on text simplification ("français Facile À Lire et à Comprendre", FALC) is ongoing with Facebook's Parisian FAIR laboratory. In particular, a co-supervised (CIFRE) PhD thesis started in 2018 in collaboration with UNAPEI, the largest French federation of associations defending and supporting people with special needs and their families. This collaboration is expected to pave the way for a larger initiative involving (at least) these three partners as well as the relevant ministries.
- **Bluenove:** A contract with this company has been signed, which defines the framework of our collaboration on the integration of NLP tools (e.g. chatbot-related modules) within Bluenove's platform Assembl, dedicated to online citizen debating forums. It involves a total of 24 months of fixed-term contracts (12 months for a post-doc, currently working on the project, and 12 months for a research engineer, which is still to be recruited).
- **Science Miner:** ALMAnaCH (previously ALPAGE) has been collaborating since 2014 years with this company founded by Patrice Lopez, a specialist in machine learning techniques and initiator of the GROBID and NERD (now entity-fishing) suites. Patrice Lopez provides scientific support on the corresponding software components in the context of the Parthenos, EHRI and Iperion projects, as well as in the context of the Inria anHALytics initiative, aiming at providing a scholarly dashboard on the scientific papers available from the HAL national publication repository.
- **Hyperlex** A collaboration was initiated in 2018 on NLP for legal documents, involving especially EVdLC.
- ALMAnaCH members led a proposal for the creation of an ANR LabCom with Fortia Financial Solutions, a company specialized in *Financial Technology*, namely the analysis of financial documents from investment funds. The proposal has been rejected. Meanwhile, this project is currently being extended toward a FUI with Systran, the market leader in specialized machine translation systems, and the BNP as industrial partner. The funding requested will cross the 3 millions euros bar.
- ALMAnaCH members have recently initiated discussions with other companies (Louis Vuitton, Suez...), so that additional collaborations might start in the near future. They have also presented their work to companies interested in knowing more about the activities of Inria Paris in AI and NLP.

COML Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- Google Faculty Award - 100K€
- Facebook AI Research Grant - 350K€

MULTISPEECH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Dolby

Company: Dolby (Spain)

Duration: Sep – Dec 2018

Participants: Antoine Liutkus (Inria Zenith), Emmanuel Vincent

Abstract: This contract aims to evaluate the feasibility of state-of-the-art source separation technology and related technologies for four use cases, and to identify those which could be commercially exploited, possibly after a follow-up R&D phase.

8.1.2. Honda Research Intitute Japan (first contract)

Company: Honda Research Intitute Japan (Japan)

Duration: Feb – Mar 2018

Participants: Aditya Nugraha, Romain Serizel, Emmanuel Vincent

Abstract: This contract targets collaborative research on multichannel speech and audio processing and eventual software licensing in order to enable voice-based communication in challenging noisy and reverberant conditions in which current hands-free voice-based interfaces perform poorly.

8.1.3. Honda Research Intitute Japan (second contract)

Company: Honda Research Intitute Japan (Japan)

Duration: Aug 2018 – Mar 2019

Participants: Nancy Bertin (CNRS - IRISA), Antoine Deleforge, Diego Di Carlo

Abstract: This is a follow-up contract, which also targets collaborative research on multichannel speech and audio processing and eventual software licensing in order to enable voice-based communication in challenging noisy and reverberant conditions in which current hands-free voice-based interfaces perform poorly.

8.1.4. Studio Maia

Company: Studio Maia SARL (France)

Other partners: Imaging Factory

Duration: Jul 2017 – March 2019

Participants: Yassine Boudi, Vincent Colotte, Mathieu Hu, Emmanuel Vincent

Abstract: This Inria Innovation Lab aims to develop a software suite for voice processing in the multimedia creation chain. The software is aimed at sound engineers and it will rely on the team's expertise in speech enhancement, robust speech and speaker recognition, and speech synthesis.

8.2. Bilateral Grants with Industry

8.2.1. Orange

Company: Orange SA (France)

Duration: Nov 2016 – Nov 2019

Participants: Laureline Perotin, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Laureline Perotin with Orange Labs. Our goal is to develop deep learning based speaker localization and speech enhancement algorithms for robust hands-free voice command. We are especially targeting difficult scenarios involving several simultaneous speakers.

8.2.2. Invoxia

Company: Invoxia SAS (France)

Duration: Mar 2017 – Mar 2020

Participants: Guillaume Carbajal, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Guillaume Carbajal. Our goal is to design a unified end-to-end deep learning based speech enhancement system that integrates all steps in the current speech enhancement chain (acoustic echo cancellation and suppression, dereverberation, and denoising) for improved hands-free voice communication.

8.2.3. Ministère des Armées

Company: Ministère des Armées (France)

Duration: Sep 2018 – Aug 2021

Participants: Raphaël Duroselle, Denis Jovet, Irina Illina

Abstract: This contract corresponds to the PhD thesis of Raphaël Duroselle on the application of deep learning techniques for domain adaptation in speech processing.

8.2.4. Facebook

Company: Facebook AI Research (France)

Duration: Nov 2018 – Nov 2021

Participants: Adrien Dufraux, Emmanuel Vincent

Abstract: This CIFRE contract funds the PhD thesis of Adrien Dufraux. Our goal is to explore cost-effective weakly supervised learning approaches, as an alternative to fully supervised or fully unsupervised learning for automatic speech recognition.

PANAMA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Contract with 5th dimension on "dynamic separation of localized sound sources"*

A first phase of this contract, in collaboration with InriaTech, involved porting in C++ a subset of our source localization library Multichannel BSS Locate. A second phase will involve further investigations on the interplay between localization and separation, using the FASST library, with support from LABEX AMIES.

8.1.2. *Contract with Honda on "multichannel speech and audio processing"*

This is a follow-up contract, which targets collaborative research on multichannel speech and audio processing and eventual software licensing in order to enable voice-based communication in challenging noisy and reverberant conditions in which current hands-free voice-based interfaces perform poorly.

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 was 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.

8.2.2. *CIFRE contract with Facebook Artificial Intelligence Research, Paris on Deep neural networks for large scale learning*

Participants: Rémi Gribonval, Pierre Stock.

Duration: 3 years (2018-2021)

Research axis: [3.1.2](#)

Partners: Facebook Artificial Intelligence Research, Paris; Inria-Rennes

Funding: Facebook Artificial Intelligence Research, Paris; ANRT

The overall objective of this thesis is to design, analyze and test large scale machine learning algorithms with applications to computer vision and natural language processing. A major challenge is to design compression techniques able to replace complex and deep neural networks with much more compact ones while preserving the capacity of the initial network to achieve the targeted task. An avenue primarily envisioned to achieve this goal is to rely on structured linear layers.

SEMAGRAMME Project-Team (section vide)

AUCTUS Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral contract with AIO, motion analysis issues

In partnership with the SME AIO, we are co-developing a **Numii** product (presented at CES 2018, 2019) capable of associating a score based on ergonomic indices with a gesture. The work focused on the software architecture, different given fusion filter, task classification, and on the gesture evaluation indices. Models and algorithms are generic for different types of sensors.

8.2. Bilateral contract with VINCI Energies

A contract has been signed with VINCI Energies for a study entitled: “Pré-étude pour la conception d’un système d’assistance aux opérateurs du bâtiment”. The objective was to carry out an ergonomic analysis of the work station for operators working in the building construction domain. Operators such as electricians or plumbers were typically concerned. They indeed have to work regularly on an elevated deck with arms above shoulders, which is a well-known cause of musculoskeletal disorders. Different solutions have been proposed and investigated. A specific exoskeleton was finally chosen and its performance and acceptability are currently evaluated by VINCI Energies. This study has been performed with the help of a student named Virginie Roupenel through an internship that was funded by CEGELEC, a partner from VINCI Energies. Remarkably, the student used the system that we developed for real time analysis of operator moves.

8.3. Bilateral contract with AIO, ergonomic issues

AIO was working on a project called Kombos (now called NUMII). The objective of the project is to design an automatic system that analyses operator moves in real time and determines ergonomic scores, which are then sent to a server and stored in a database. One of the main problems was to find a strategy to decompose a sequence of moves in elementary moves that could be automatically assessed according to standard ergonomic scores. After discussion, AIO decided to contract with us (under the direction of Jean-Marc Salotti) a study on ergonomic issues. They provided a short video of an operator manipulating tubes and they requested an ergonomic analysis in order to determine the best decomposition of the operator’s activity into elementary movements. We subcontracted ergonomic studies to ERSYA, a company that is specialized in that domain and added our expertise on human system interactions to provide technical complements.

8.4. Bilateral contract with Orange

The Orange company is lacking feedback for the customers interacting with the website and the chat bot dedicated to customer assistance. In order to better understand the sentiment, feelings and satisfaction of the customer, Orange and us agreed on a research work carried out by a PhD student under the direction of Jean-Marc Salotti. Nicolas Simonazzi has been recruited and he started his PhD work in May 2018. He already performed a state of the art on chat bots, sentiment analysis and online assistance tools. He is currently designing an experiment with a simplified chat bot with the objective of testing emotional changes and observing changing behaviors.

8.5. Bilateral contract with CATIE

A bilateral contract has been signed with CATIE (Centre Aquitain des Technologies de l’Information et de l’Electronique) for the study of the links between electric consumption and human systems interactions in buildings of the tertiary sector. The study started in September 2017 and is carried out under the supervision of Jean-Marc Salotti. A large amount of data has been collected (electric consumption, temperature, human presence, etc.) and is currently analyzed. The objective is to help predicting energy consumption in the following days for different parts of the buildings.

Chroma Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. VOLVO-Renault Trucks Group (2016-2019)

Participants: Olivier Simonin, Jilles Dibangoye, Guillaume Bono, Mohamad Hobballah, Laetitia Matignon.

This collaboration has been built inside the INSA-VOLVO Chair, led by Prof. Didier Remond (INSA). In this context, the Chair funds the PhD Thesis of Guillaume Bono (2016-19) in Chroma. The objective is to study how machine learning techniques can deal with optimization of goods distribution using a fleet of autonomous vehicles. In the following of the first results, VOLVO proposed to extend our collaboration by funding a Post-doc position concerning good distribution with platoons of autonomous vehicles. This is the Post-Doc of Mohamad Hobballah, started on February 2018.

8.1.2. Toyota Motor Europe (2006 - 2018)

Participants: Christian Laugier, David Sierra González, Özgür Ercent, Jilles Dibangoye, Christian Wolf.

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 in 2018 for 4 years (period 2018-2021) and Toyota provides us with an experimental vehicle Lexus equipped with various sensing and control capabilities. Several additional connected technical contracts have also been signed, and an exploitation licence for the *CMCDOT* software has been bought by Toyota in 2018.

8.2. Bilateral Grants with Industry

8.2.1. Renault (2015 - 2018)

Participants: Mathieu Barbier, Christian Laugier, Olivier Simonin.

This contract was linked to the PhD Thesis of Mathieu Barbier (Cifre Thesis). The objective is to develop technologies for collaborative driving as part of a Driving Assistance Systems for improving car safety in road intersections. Both vehicle perception and communications are considered in the scope of this study. Some additional short-term contracts (about 3 months) and an evaluation license for the team *CMCDOT* software have also been signed during this period. *We are on the process of signing a new PhD research agreement for the period 2019 – 2021, with objective to address the open problem of emergency obstacle avoidance in complex traffic situations (for ADAS or AD applications).*

8.2.2. IRT Nanoelec – Security of Autonomous Vehicles project (2018 - 2020)

Participants: Christian Laugier, Lukas Rummelhard, Jerome Lussereau, Jean-Alix David, Thomas Genevois, Nicolas Turro [SED].

Security of Autonomous Vehicles is a project supported by ANR in the scope of the program PULSE of IRT Nanoelec. The objective of this project is to integrate, develop and promote technological bricks of context capture, for the safety of the autonomous vehicle. Building on *Embedded Bayesian Perception for Dynamic Environment*, Bayesian data fusion and filtering technologies from sets of heterogeneous sensors, these bricks make it possible to secure the movements of vehicles, but also provide them with an enriched and useful representation for autonomy functions themselves. In this context, various demonstrators embedding those technology bricks are developed in cooperation with industrial partners.

8.2.3. *FUI Tornado (2017 – 2020)*

Participants: Rabbia Asghar, Anne Spalanzani, Christian Laugier, Olivier Simonin.

The project Tornado is coordinated by Renault. The academic partners of the project are Inria Grenoble-Rhône Alpes, UTC, Institut Pascal, University of Pau, IFSTTAR. The industrial and application partners are Renault, Easymile, Neavia, Exoskills, 4D-Virtualiz, MBPC and Rambouillet Territoires. The objective of the project is to demonstrate the feasibility of a mobility service systems operating in the commercial zone of Rambouillet and on some public roads located in its vicinity. Several autonomous cars (Autonomous Renault Zoe). The *IRT Nanoelec* is also involved in the project as a subcontractor, for testing the perception, decision-making, navigation and controls components developed in the project.

8.2.4. *FUI STAR (2018 – 2021)*

Participants: Andres Gomez Hernandez, Olivier Simonin, Christian Laugier.

The Project STAR is coordinated by IVECO. The academic partners of the projects are Inria Grenoble-Rhône, IFSTTAR, ISAE-Supaéro. The industrial and application partners are IVECO, Easymile, Transpolis, Transdev and Sector Groupe. The goal of the project is to build an autonomous bus that will operate on a safe from other vehicle lane but not from pedestrian. Inria is involved in helping design situation awareness perception, specially in special case like docking at the bus stop and handling dynamicity of any obstacle. The *IRT Nanoelec* is also involved in the project as a subcontractor, for testing the perception, decision-making, navigation and controls components developed in the project.

DEFROST Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

TDR group is a robotics integrator specialized on optimizing production chains, usually multiplexing robots to perform several activities. Hence, their interest in graspers and the time invested in this activity has been growing within the last years. To improve this aspect, we have been developing together a concept of “universal grasper”, based on soft robotics technology and capable of grasping an object with an arbitrary shape, and partially misplaced or misoriented. The prototype developed complies with the specifications and allows for scalability, with flexibility between grasping force and shape tolerance, and the ability for replacing objects without the need of an external vision system. Relying in SOFA for physical simulation, we have validated a prototype, and realize it. An industrial version of the prototype has been realized this year. It will be commercialized next year.

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 developed planning algorithms for a autonomous electric car for Renault SAS in the continuation of the previous ADCC 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 (roundabouts), and with multiple lane roads (overtake, insertion...).

8.2. Bilateral Grants with Industry

8.2.1. *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.

8.2.2. *Perception Techniques and Sensor Fusion for Level 4 Autonomous Vehicles*

Participants: David Filliat [correspondant], Vyshakh Palli-Thazha.

Financing of the CIFRE PhD grant of Vyshakh Palli-Thazha by Renault.

8.2.3. *Incremental Methods of Deep Learning for detection and classification in an robotics environment*

Participants: David Filliat [correspondant], Timothée Lesort.

Financing of the CIFRE PhD grant of Timothée Lesort by Thales.

8.2.4. *Exploration of reinforcement learning algorithms for drone visual perception and control*

Participants: David Filliat [correspondant], Florence Carton.

Financing of the CIFRE PhD grant of Florence Carton by CEA.

8.2.5. *Incremental learning for sensori-motor control*

Participants: David Filliat [correspondant], Hugo Caselles Dupré.

Financing of the CIFRE PhD grant of Hugo Caselles-Dupré by Softbank Robotics.

8.2.6. *Curiosity-driven Learning Algorithms for Exploration of Video Game Environments*

Participant: Pierre-Yves Oudeyer [correspondant].

Financing of a postdoc grant for a 2 year project with Ubisoft and Région Aquitaine.

8.2.7. *Intrinsically Motivated Exploration for Lifelong Deep Reinforcement Learning in the Malmo Environment*

Participants: Pierre-Yves Oudeyer [correspondant], Remy Portelas.

Financing of the PhD grant of Rémy Portelas by Microsoft Research.

HEPHAISTOS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Symbolic tools for modeling and simulation

Participant: Yves Papegay.

This activity is the main part of a long-term ongoing collaboration with Airbus whose goal is to directly translate the conceptual work of aeronautics engineers into digital simulators to accelerate aircraft design.

An extensive modeling and simulation platform - MOSELA - has been designed which includes a dedicated modeling language for the description of aircraft dynamics models in term of formulae and algorithms, and a symbolic compiler producing as target an efficient numerical simulation code ready to be plugged into a flight simulator, as well as a formatted documentation compliant with industrial requirements of corporate memory.

Technology demonstrated by our prototype has been transferred : final version of our modeling and simulation environment has been delivered to Airbus in November 2012 and developer level know-how has been transferred in 2013 to a software company in charge of its industrialization and maintenance.

Since 2014, we are working on several enhancements and extension of functionalities, namely to enhance the performances and the numerical quality of the generated C simulation code, ease the integration of our environment into the airbus toolbox, help improving the robustness of the environment and the documentation.

LARSEN Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Cifre Diatelic-Pharmagest

Participants: François Charpillat, Yassine El Khadiri, Cedric Rose, Gabriel Corona.

Cedric Rose and Gabriel Corona are from Diatelic.

The ageing of the population and the increase in life expectancy will confront modern societies with an unprecedented demographic transformation. The placement of older people in a nursing home (EPHAD) is often only a choice of reason and can be rather poorly experienced by people. One answer to this societal problem is the development of Smart home technologies that facilitate elderly to stay in their homes longer than they can do today. This new collaboration with Diatelic a subsidiary of the Pharmagest group is supported through a PhD thesis (Cifre) which started in June 2017. The objective is to enhance the CareLib solution developed by Diatelic and Larsen Team through a previous collaboration (Satelor project). The Carelib offer is a solution, consisting of

- a connected box (with touch screen),
- a 3D sensor (capable (1)to measure characteristics of the gait such as the speed and step length, (2) to identify Activities of Daily Life and (3) to detect emergency situation such as Fall),
- universal sensors (motion, ...) installed in each part of the housing.

The objective of the PhD program is to provides personalized follow-up by learning life habits, the main objective being to track the Activities of Daily Life (ADL) and detect emergency situations needing external interventions (E.G fall detection). This year we have developed an algorithm capable to detect sleep-wake cycles using only motion sensors. The approach is based on bayesian inference. The algorithms have been evaluated using publicly available dataset and Diatelic's own dataset.

8.2. Cifre iFollow

Participants: Francis Colas, Jérôme Truc, Cédric Pradalier, Susana Sanchez Restrepo.

Cédric Pradalier is co-supervisor at GeorgiaTech Lorraine and Susana Sanchez Restrepo is at iFollow.

iFollow is a startup, located in Paris area, providing solutions for shopping carts. Their first market of interest is logistics, wherein they develop robots for alleviating the workload of order pickers. Their second, longer-term, target is retail, with the development of intelligent shopping carts to help persons with disabilities.

The aim of this Cifre program is to endow the robots with more intelligent behaviors. In warehouses, the aim will be to improve the autonomy of the robots to better assist the pickers, leveraging the knowledge of the current order being prepared. In supermarket, the shopping carts should learn to properly interact with other carts and people while positioning themselves to better serve its current user.

The PhD thesis of Jérôme Truc has started in September with bibliography work on human detection and pose estimation, as well as socially acceptable motion planning.

PERVASIVE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Pervasive has a contract with Orange Labs, Meylan, for supervision of the doctoral research of Julien Cumin for Learning daily routines by observing activity in a smart home

Members of the Pervasive interaction team are work 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 Amiqual4home.

8.1.1. Toutilo project

Participants: Stan Borkoski, Dominique Vaufreydaz, Joelle Coutaz, James Crowley, Giovanni Balestrieri, Anthony Chavoutier

Partners: Inria, Touti Terre

Touti Terre is a pioneer startup in the use of agricultural robotics for market gardening, developing innovative solutions to make working the land easier and farms sustainable. The Toutirobo-2 Inria innovation lab proposes the design of an overall IT solution for their cobot solution: the Toutilo robot. This project aims at providing significant time and productivity gains for its users. Thanks to the support of the experimentation and prototyping platform Amiqual4Home, members of the Pervasive team contribute to this project on several innovation topics: farm and vehicle management, autonomous guidance, navigation and planning, and interaction systems adapted to farm jobs. boisi

8.1.2. IRT Silver Economy

Participants: James Crowley, 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.

RAINBOW Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Robocortex

Participants: Fabien Spindler, François Chaumette.

no Inria Rennes 11369, duration: 20 months.

This contract with the Inria Robocortex start up in Sophia-Antipolis ended in May 2018. It is devoted to provide our expertise in visual tracking for an application specified by Dassault Aviation.

8.1.2. ABB

Participants: Souriya Trinh, Fabien Spindler, François Chaumette.

no Inria Rennes 12597, duration: 8 months.

This contract with ABB in Barcelona started in September 2017. It is devoted to provide our expertise in visual tracking and visual servoing for an industrial application.

8.1.3. IRT b<>com

Participants: Hadrien Gurnel, Fabien Spindler, Alexandre Krupa.

no Inria Rennes 11774, duration: 36 months.

This contract started in October 2016 and concerns the leasing to IRT b<>com of two modules of the Rainbow medical robotic platform. Each module is rent 40 days during a 3-year period in the context of the IRT b<>com NeedleWare project (see Section 9.1.6).

8.2. Bilateral Grants with Industry

8.2.1. Pôle Saint Hélier

Participants: Louise Devigne, Marie Babel.

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

This project started in November 2015 and supports Louise Devigne PhD about wheelchair navigation assistance. The idea is first to design a low-cost indoor / outdoor efficient obstacle avoidance system that respects the user intention, and does not alter user perception. 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.

8.2.2. 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 7.1.4).

8.2.3. Realyz

Participant: Eric Marchand.

no Inria Rennes 10822, duration: 36 months.

This project funded by Realyz started in October 2015. It is achieved in cooperation with Anatole Lécuyer from Hybrid group at Irisa and Inria Rennes-Bretagne Atlantique to support Guillaume Cortes Ph.D. about motion tracking in virtual reality.

RITS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. 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 under the framework of Valeo project “Daring”
- A CIFRE like PhD thesis is ongoing between Valeo and Inria (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 PIA French project CAMPUS (Connected Automated Mobility Platform for Urban Sustainability) 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.

Renault Group: Collaboration between Renault and RITS re-started in 2016. Different research teams in Renault are now working separately with RITS on different topics.

- A CIFRE like PhD thesis is ongoing between Renault and Inria (Farouk GHALLABI) The thesis deals with the accurate localization of an autonomous vehicle on a highway using mainly on-board low-cost perception sensors.
- Another CIFRE PhD thesis is ongoing since November 2017 (Imane MAHTOUT).

AKKA Technologies: Collaboration with AKKA since 2012 (for the Link & Go prototype).

- Inria and AKKA Technologies are partners in the VALET projects (ANR projects).
- A CIFRE PhD thesis (Luis ROLDAO) dealing with 3D-environment modeling for autonomous vehicles begun in October 2017.

LINKMEDIA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Few shot learning for object recognition in aerial images (CIFRE PhD)*

Participants: Yannis Avrithis, Yann Lifchitz.

Duration: 3 years, started in March 2018

Partner: Safran

This is a CIFRE PhD thesis project aiming to study architectures and learning techniques most suitable for object recognition from few samples and to validate these approaches on multiple recognition tasks and use-cases related to aerial images.

7.1.2. *Incremental dynamic construction of knowledge bases from text mining (CIFRE PhD)*

Participants: Guillaume Gravier, Pascale Sébillot, Cyrielle Mallart.

Duration: 3 years, started in Dec. 2018

Partner: Ouest France

In the context of a newspaper, the thesis explores the combination of text mining and knowledge representation techniques to assist the extraction, interpretation and validation of valuable pieces of information from the journal's content so as to incrementally build a full-scale knowledge base. This thesis is in close relation with the iCODA Inria Project Lab, with direct contribution to the project's results.

7.1.3. *Embedding heterogeneous data for directory search (CIFRE PhD)*

Participants: Guillaume Gravier, Vincent Claveau, François Torregrossa.

Duration: 3 years, started in Dec. 2018

Partner: SoLocal

The thesis aims at learning how to jointly exploit heterogeneous sources of information (e.g., names, activity sector, user profiles, queries, etc.) in the design of neural network embeddings for information retrieval and language understanding. Applications cover natural language query analysis and personalized information retrieval in Pagesjaunes' directory.

7.1.4. *Active learning on adaptive representations for object detection in high-resolution imaging (CIFRE PhD)*

Participants: Ewa Kijak, Mathieu Laroze.

Duration: 3 years, started in Jun. 2016

Partner: Wipsea

Wipsea is a Rennaise startup, created in 2013 whose core business is image analysis for ecology. WIPSEA helps biologists, Unmanned Aerial Vehicle (UAV) companies and environmental consultants to automatically process automatically captured pictures by proposing image-processing algorithms that detect and characterize all kinds of animals such as dugongs, whales, elephants, and orangutans... The main objective of the thesis is to develop a detection method to optimize the interaction between the expert and the system in order to converge as quickly as possible to an object detection solution adapted to a given task.

MAGRIT Project-Team (section vide)

MORPHEO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A collaboration with the French Start up Holooh started in 2017 and was pursued in 2018. Holooh aims at producing high quality holograms for VR and AR applications, especially for the fashion and music domains. Holooh's objective is to set up a multi-camera studio in Paris for that purpose. Edmond Boyer is involved in the collaboration.

8.2. Bilateral Grants with Industry

The Morpheo Inria team and Microsoft research set up a collaboration on the capture and modelling of moving shapes using multiple videos. Two PhD proposals will be part of this collaboration with the objective to make contributions on 4D Modeling. The PhDs will take place at Inria Grenoble Rhône-Alpes and will involve regular visits and stays at Microsoft in Redmond (USA) and Cambridge (UK). At Microsoft, Steve Sullivan, Andrew Fitzgibbon and Marta Wilczkowiak will be participating to the project.

PERCEPTION Project-Team (section vide)

SIROCCO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE contract with Technicolor on light fields editing

Participants: Christine Guillemot, Matthieu Hog.

- Title : Light fields editing
- Research axis : [7.1.1](#)
- Partners : Technicolor (N. Sabater), Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2015-Sept.2018.

Editing is quite common with classical imaging. Now, if we want light-field 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 thesis is to develop methods for light-field editing, and in 2018 we have extended our concept of super-rays initially introduced for static light fields to video light fields (see Section [7.1.1](#)). Super-rays group rays within and across views, emitted by the same set of 3D points in the space. A method for dynamic tracking of super-rays with scene flow estimation has been developed. We have further explored a novel way, using recurrent neural networks and in particular long short term memory (LSTM) networks, to solve the problem of view synthesis (see Section [7.3.1](#)).

8.1.2. CIFRE contract with Technicolor on light fields compressed representation

Participants: Christine Guillemot, Fatma Hawary.

- Title : Light fields compressed representation
- Research axis : [7.2.2](#)
- Partners : Technicolor (G. Boisson), Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Feb.2016-Jan.2019.

The goal of this PhD thesis is to study reconstruction algorithms from compressed measurements. The goal is to apply these algorithms to scalable compression of light fields. Methods of sparse light field recovery have been developed, based on the assumption of sparsity in the Fourier domain, and using orthogonality constraint in the Fourier transform domain. The method has been further improved by introducing a refinement of the basis functions with non integer frequencies.

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

Participants: Jean Begaint, Christine Guillemot.

- Title : Cloud-based image compression
- Research axis : [7.2.6](#)
- Partners : Technicolor (Ph. Guillotel, F. Galpin), 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. A region-based geometric and photometric alignment algorithm has been developed and validated for still image compression with an inter-coding set-up using similar images in the cloud as reference frames. This model has been further validated in the context of temporal prediction in a video compression scheme (see Section 7.2.6). Neural network based frame interpolation techniques have also been investigated, showing promising performance gains compared to the state of the art.

8.1.4. DGA contract on deep learning for image compression

Participants: Thierry Dumas, Christine Guillemot, Aline Roumy.

- Title : Deep learning for image compression
- Research axis : 7.2.5
- *Partners:* Inria-Rennes (Sirocco team)
- *Funding:* DGA/Ministry of defense
- Period : Oct.2015-Sept.2018.

This project funded by the DGA/Ministry of Defense concerns the PhD thesis of T. Dumas. The goal was to study deep learning architectures for image compression. Autoencoders have been studied to jointly learn transforms and quantizers with rate-distortion optimization criteria. A set of neural network architectures called Prediction Neural Networks Set (PNNS), based on both fully-connected and convolutional neural networks, has also been developed for intra image prediction (see Section 7.2.5).

STARS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- *Toyota*: (Action Recognition System): This project runs from the 1st of August 2013 up to 2019. It aimed at detecting critical situations in the daily life of older adults living home alone. The system is intended to work with a Partner Robot (to send real-time information to the robot) to better interact with the older adult. The funding was 106 Keuros for the 1st period and more for the following years.
- *Gemalto*: This contract is a CIFRE PhD grant and runs from September 2018 until September 2021 within the French national initiative SafeCity. The main goal is to analyze faces and events in the invisible spectrum (i.e., low energy infrared waves, as well as ultraviolet waves). In this context models will be developed to efficiently extract identity, as well as event - information. These models will be employed in a school environment, with a goal of pseudo-anonymized identification, as well as event-detection. Expected challenges have to do with limited colorimetry and lower contrasts.
- *BluManta*: This contract is a CIFRE PhD grant and runs from August 2018 to August 2021. The aim is to develop an end-to-end 3D face analysis model, involving a unified deep neural network in charge of (a) creating a depth map, (b) extracting embeddings, (c) embeddings similarity estimation. This model will be targeted for high accuracy in tasks such as face authentication.
- *Kontron*: This contract is a CIFRE PhD grant and runs from April 2018 until April 2021 to embed CNN based people tracker within a video-camera.
- *ESI*: This contract is a CIFRE PhD grant and runs from September 2018 until March 2022 to develop a novel Re-Identification algorithm which can be easily set-up with low interaction.

THOTH Project-Team

8. Bilateral Contracts and Grants with Industry

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

Participants: Julien Mairal, Alberto Bietti.

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. Alberto Bietti visited MSR New York in 2018.

8.2. Amazon

Participants: Grégory Rogez, Cordelia Schmid.

We received an Amazon Faculty Research Award in 2018. The objective is 3D human action recognition from monocular RGB videos. The idea is to extend our recent work on human 3D pose estimation to videos and to develop an approach for action recognition based on temporal pose based on appropriate 3D features.

8.3. Intel

Participants: Cordelia Schmid, Karteek Alahari.

The Intel Network on Intelligent Systems in Europe brings together leading researchers in robotics, computer vision, motor control, and machine learning. We are part of this network and have participated in the annual retreat in 2018. Funding will be provided on an annual basis, every year, as long as we are part of the network.

8.4. Facebook

Participants: Cordelia Schmid, Jakob Verbeek, Julien Mairal, Karteek Alahari, Pauline Luc, Alexandre Sablayrolles, Mathilde Caron.

The collaboration started in 2016. The topics include image retrieval with CNN based descriptors, weakly supervised object detection and semantic segmentation, and learning structured 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 AI Research). THOTH has been selected in 2016 as a recipient for the Facebook GPU Partnership program. In this context Facebook has donated two state-of-the-art servers with 8 GPUs. In 2017, Alexandre Sablayrolles started his CIFRE grant, jointly supervised by Cordelia Schmid, and Herve Jegou and Matthijs Douze at Facebook AI Research. In 2018, Mathilde Caron started as a CIFRE PhD student, jointly supervised by Julien Mairal, and Armand Joulin and Piotr Bojanowski at Facebook AI Research.

8.5. NAVER LABS Europe

Participants: Cordelia Schmid, Karteek Alahari, Julien Mairal, Jakob Verbeek, Vasileios Choutas, Nieves Crasto.

This collaboration started when NAVER LABS Europe was Xerox Research Centre Europe, and 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 and Diane Larlus (XRCE) jointly supervise a PhD-level intern for a period of 6 months in 2016–2017. XRCE then became Naver in 2017. A one-year research contract on action recognition in videos started in Sep 2017. The approach developed by Vasileios Choutas implements pose-based motion features, which are shown to be complementary to state-of-the-art I3D features. Nieves Crasto’s internship in 2018 was jointly supervised by Philippe Weinzaepfel (NAVER LABS), Karteek Alahari and Cordelia Schmid.

WILLOW Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

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

Participants: Guilhem Cheron, 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 Sciencea 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 2013-2017 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.

In 2018 a new agreement has been signed with a new focus on video understanding for personal assistants. The scientific objectives are to develop models, representations and learning algorithms for (i) automatic understanding of task-driven complex human activities from videos narrated with natural language in order to (ii) give people instructions in a new environment via an augmented reality device such as the Microsoft HoloLens. Besides the clear scientific interest of automatically understanding human activities in video streams, the main high-impact motivation of this project is to develop virtual assistants that may guide a child through simple games to improve his/her manipulation and language skills; help an elderly person to achieve everyday tasks; or facilitate the training of a new worker for highly-specialized machinery maintenance.

8.1.2. *Louis Vuitton/ENS chair on artificial intelligence*

Participants: Ivan Laptev, Jean Ponce, Josef Sivic.

The scientific chair Louis Vuitton - École normale supérieure in Artificial Intelligence has been created in 2017 and inaugurated on April 12, 2018 by the ENS Director Marc Mézard and the LV CEO Michael Burke. The goal of the chair is to establish a close collaboration between LV and ENS in the area of Artificial Intelligence. The chair enjoys the generous annual contribution of 200K Euros provided by LV in support of research activities in statistical learning and computer vision. In particular, the chair supports the costs of researchers, students, missions, computational resources as well as seminars and meetings, including the two days of meeting annually organized by LV and ENS. During 2018 ENS and LV have organized several joint meetings with the participation of researchers from SIERRA and WILLOW teams. The chair has also supported the hiring of one PhD student at the WILLOW team, missions to conferences and international research labs as well as data collection for research projects.

8.2. Bilateral Grants with Industry

8.2.1. 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.

8.2.2. 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.

8.2.3. 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.