Activity Report 2019

Section Contracts and Grants with Industry

CEDAR Project-Team (section vide)

GRAPHIK Project-Team (section vide)

<p style="text-align:center; color:red;">**LACODAM Project-Team**</p>

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. BARIER™ 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 developped. 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.

<p style="text-align:center">**LINKS Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

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 (section vide)

MOEX Project-Team (section vide)

ORPAILLEUR Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. AGREV-3

Participant: Jean-François Mari.

The AGREV 3 project (for "Agriculture Environment Vittel") is part of "Agrivair" –a subsidiary of Nestlé Waters– in actions to protect the natural resources of natural mineral water. We used ARPEnTAge to mine survey data about the Vittel-Contrexéville territory, which is suspected of groundwater quality risks [8]. This allowed us to locate regions having the same behavior. In addition, this provided a more contrasted simulation by eliminating the influence of stable zones (forests, permanent grasslands) and a more precise definition of a "neutral" model.

8.1.2. Hydreos

Participants: Nicolas Dante, Jean-François Mari, Amedeo Napoli.

Hydreos is a state organization, so-called "Pôle de compétitivité", aimed at monitoring and evaluating the quality of water and its delivery (http://www.hydreos.fr/fr). Actually, data about water resources rely on many agronomic variables, including land use successions. The data to be analyzed are obtained by surveys or by satellite images and describe the land use at the level of the agricultural parcel. Then there is a search for detecting changes in land use and for correlating these changes to groundwater quality. Accordingly, one main challenge in our participation in Hydreos is to process and analyze space-time data for reaching a better understanding of the changes in the organization of a territory. The systems ARPEnTAge and CarottAge are used in this context, especially by agronomists of INRA (ASTER Mirecourt http://www6.nancy.inra.fr/sad-aster).

On other aspects, we tested new deep graph convolutional learning over data provided by the SEDIF "Syndicat des eaux d'Île-de-France" to predict the likelihood of water leaks in a network of pipes and compared it with a master thesis where spatial point process techniques were used (master thesis of Nicolas Dante, M2 IMSD Nancy).

8.1.3. The Smart Knowledge Discovery Project

Participants: Laureline Nevin, Amedeo Napoli.

The SKD project for "Smart Knowledge Discovery" aims at analyzing complex industrial data for troubleshooting and decision making, and is funded by "Grand Est Region". We are working on exploratory knowledge discovery with the Vize company, which is based in Nancy and specialized in visualization-based data mining. The data which are under study are provided by the Arcelor-Mittal Steel Company and are related to the monitoring of rolling mills. Data are complex time series and the problem is related to a so-called "predictive maintenance", or how to anticipate problems in the furnaces and avoid their stop. In this way, one main objective of SKD is to combine sequence mining and visualization tools for recognizing temperature problems in the furnaces, and thus preventing the occurrences of defects in the outputs of the rolling mills.

<p style="text-align:center;color:red;">**PETRUS Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

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

Partners: PETRUS (Inria-UVSQ), Hippocad (SME)
End 2016, the Yvelines district lauched a public call for tender to deploy an industrial solution aiming at covering the whole distinct (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 Petus 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.

7.2. Bilateral Grants with Industry

7.2.1. 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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Juliette Achddou's PhD research is set up as a CIFRE contract and supervision agreement between her employer, the Numberly company, and École normale supérieure.

We are in the process of finalizing a contract with Neo4j, the leading company in the field of graph databases, to work towards the creation of a new standard for graph languages called GQL, building on Neo4j's Cypher query language. On this, we do not start from scratch. In a joint effort between the Neo4j's Cypher group and the Edinburgh database group led by Leonid Libkin, a formal specification of the core querying and update features of Cypher was produced. Starting in 2020, Libkin will chair a working group on the formal semantics of GQL. In addition to Valda, it will involve researchers from Edinburgh, Santiago, Warsaw, and other universities in Paris (Marne-la-Vallee and Paris-Diderot). The project is supported by a grant from Neo4j.

<p style="text-align:center">WIMMICS Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. PREMISSE Collaborative Project

Participants: Molka Dhouib, 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). 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.

8.1.2. HealthPredict Collaborative Project

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

Partner: Synchronext.

This collaborative project with the Synchronext company started in april 2017, funded by the ANRT (CIFRE PhD). Synchronext is a startup aiming at developing Semantic Web business solutions. The aim of this project is to design a digital health solution for the early management of patients through consultations with their general practitioner and health care circuit. The goal is to develop a predictive Artificial Intelligence interface that allows to cross the data of symptoms, diagnosis and medical treatments of the population in real time to predict the hospitalization of a patient.

8.1.3. Joint Lab EduMICS

Participants: Olivier Corby, Catherine Faron Zucker, Géraud Fokou Pelap, Fabien Gandon, Alain Giboin.

Partner: Educlever.

EduMICS (Educative Models Interactions Communities with Semantics) is a joint laboratory (LabCom) between the Wimmics team and the Educlever company that ended in early 2019. The aim of EduMICS was to develop research and technologies with the ultimate goal to adapt educational progressions and pedagogical resource recommendation to learner profiles.

8.1.4. Curiosity Collaborative Project

Participants: Catherine Faron Zucker, Oscar Rodríguez Rocha.

Partner: TeachOnmars.

This collaborative project with the TeachOnmars company started in October 2019. TeachOnMars is developping a platform for mobile learning. The aim of this project is to develop an approach for automatically indexing and semantically annotating heterogeneous pedagogical resources from different sources to build up a knowledge graph enabling to compute training paths, that correspond to the learner's needs and learning objectives.

8.2. Bilateral Grants with Industry

Accenture gifts (June 2017 - January 2022): Wimmics has received two gifts from Accenture. Together with additional funds from another project these gifts have been used to fund the Engineer position and then the PhD Grant (June 2017 - January 2022) of Nicholas Halliwell on a topic agreed with Accenture: "interpretable and explainable predictions"

ZENITH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. SAFRAN (2018-2019)

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).

8.2. INA (2019-2022)

Participants: Quentin Leroy, Alexis Joly.

The PhD of Quentin Leroy is funded in the context of an industrial contract (CIFRE) with INA, the French company in charge of managing the French TV archives and audio-visual heritage. The goal of the PhD is to develop new methods and algorithms for the interactive learning of new classes in INA archives.

ALICE Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- *Company:* Polygonal Design
  Duration: 01/02/2018 – 01/08/2020
  Participants: Bruno Lévy and Laurent Alonso
  Amount: 38k euros
  Abstract: The goal of this project is to provide a scientific and technical expertise to Polygonal Design. In particular this concerns the Unfold3d software, developed and marketed by the company. This software is built based on our algorithms developed in 2002–2006.

AVIZ Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Participants: Yuheng Feng, Jean-Daniel Fekete, Alejandro Ribs. Project title: *Visual Sensitivity Analysis for Ensembles of Curves*: The goal of this project is to investigates new progressive methods to compute PCA over large amounts of time-series in interactive time.

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.

7.2. Bilateral Grants with Industry

- As part of a long standing collaboration with Adobe, this year Julien Philip interned with Michael Gharbi (San Francisco). This follows previous internships of J. Delanoy with Aaron Hertzmann (San Francisco) and Theo Thonnat with Sylvain Paris (Boston),
- 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*
Participant: Anatole Lécuyer.

Mensia Technologies was an Inria start-up company created in November 2012 as a spin-off of Hybrid team. Mensia was focused on wellness and healthcare applications emerging from the BCI and Neurofeedback technologies. The Mensia startup benefited from the team's expertise and of valuable and proprietary BCI research results. Mensia was 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 contract between Hybrid and Mensia started in November 2013 and ended in August 2019 with the closing of the company. The contract supported the transfer of several softwares designed by Hybrid team (eg, OpenViBE and StateFinder) to Mensia Technologies for medical and multimedia applications of Mensia.

8.1.2. *Orange Labs*
Participants: Anatole Lécuyer [contact], Hakim Si-Mohammed, Ferran Argelaguet.

This four months contract between Hybrid and Orange labs (Jan - April 2019) covered the design of a proof of concept of a smart home system controlled using a brain computer interface in and augmented reality context.

8.2. Bilateral Grants with Industry

8.2.1. *Orange Labs*
Participants: Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton [contact].

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".

In the context of this collaboration the following patent has been filled:
- "Dispositif d'affichage portatif de contenu 3D, système et procédé correspondants" (FR1914557), Guillaume Bataille, Bruno Arnaldi, Valérie Gouranton, Jérémy Lacoche. Filed in Dec. 2019.

8.2.2. *InterDigital*
Participants: Nicolas Olivier, Ferran Argelaguet, Anatole Lécuyer [contact].

This grant started in February 2019. It supports Nicolas's Olivier CIFRE PhD program with InterDigital company on "Avatar Stilization". This PhD is co-supervised with the MimeTIC team.

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, June 2016-August 2019.

IMAGINE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts 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.

<div align="center">**LOKI Project-Team**</div>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A research agreement between Synaptics Incorporated (San Jose, California) and Inria/Loki has been signed in September 2019, for a duration of nine months. The goal is to conduct joint studies on the impact of touchpads' characteristics (size, resolution) on the quality of interaction and users' performance.

8.2. Bilateral Grants with Industry

Géry Casiez and Mathieu Nancel have been awarded a Google Faculty Research Award for their project "Real-time Latency Measure and Compensation".

<p align="center">**MANAO Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. 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)

<p align="center" style="color:red">MFX Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Partnership with AddUp

- Company: AddUp.
- Duration: Started in 2019.
- Participants: Sylvain Lefebvre.
- Abstract: AddUp (https://www.addupsolutions.com/en/) is a French manufacturer of metal 3D printers for high-end industrial applications. We announced during FormNext 2019 (November) a partnership towards the creation of new software technologies.

8.1.2. Partnership with Black[Foundry]

- Company: Black[Foundry].
- Duration: January to June 2019.
- Participants: Samuel Hornus, Adrien Tétar.
- Abstract: Black[Foundry] is a company in Paris that specializes in font design. Inria signed a contract with the company to fund an internship on font rasterization on the GPU. An intern, Adrien Tétar, joined our team from January to June, and then spent 3 more weeks at the company offices in Paris. He was supervised by Samuel Hornus and Nicolas Rougier (Inria Bordeaux).

<p align="center" style="color:red">MIMETIC Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Cifre Faurecia - Monitoring of gestual efficiency at work*
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 10K€ per year for the supervision and management of the PhD thesis.

8.1.2. *Cifre InterDigitial - Adaptive Avatar Customization for Immersive Experiences*
Participants: Franck Multon [contact], Ludovic Hoyet, Nicolas Olivier.

This Cifre contract has started in February 2019 for three years and is funding the PhD thesis of Nicolas Olivier. The aim of the project is to design stylized avatars of users in immersive environment and digital arts such as videogames or cinema.

To this end, we will design a pipeline from motion and shape capture of the user to the simulation of the 3D real-time and stylized avatar. It will take hairs, eyes, face, body shape and motion into account. The key idea is to stylized both appaearance and motion to make avatar better correspond to the style of the movie of immersive experience. We will carry-out perceptual studies to better understand the expectation of the users when controlling stylized avatars, to maximize embodiment. The Cifre contracts funds the PhD salary and 15K€ per year for the supervision and management of the PhD thesis. This contract is also in collaboration with Hybrid team.

8.2. Bilateral Grants with Industry

8.2.1. *Collaboration with company SolidAnim (Bordeaux, France)*
Participants: Marc Christie [contact], Xi Wang.

Thsi contract started in November 2019 for three years. Its purpose is to explore novel means of performing depth detection for augmented reality applied to the film and broadcast industries. The grant serves to fund the PhD of Xi Wang.

POTIOC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Ullo:

Duration: 2017-2020

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.

AKIANI:

Duration: 2019-2020

Local coordinator: Fabien Lotte

InriaTech project on physiological computing and neuroergonomics.

<p align="center" style="color:red">TITANE Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Google X

Participants: Cédric Portaneri, Pierre Alliez.

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 control 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.

In collaboration with SME Dorea Technology, our objective is to advance the knowledge on the radiative 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. This CIFRE project started in August 2018, for a total duration of 3 years.

8.1.3. Luxcarta

Participants: Jean-Philippe Bauchet, Florent Lafarge.

The goal of this collaboration is to design automated approaches for producing city models from the last generation of satellites. In particular, this project investigates geometric representations for images and 3D data that are more compact and meaningful than traditional pixel and voxel grids, the intuition being to synthesize massive satellite data to reconstruct objects in 3D in a more scalable manner than existing methods. This CIFRE project started in October 2016, for a total duration of 3 years.

8.1.4. CNES and Acri-ST

Participants: Onur Tasar, Yuliya Tarabalka, Pierre Alliez.

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, Mulin Yu, Florent Lafarge.

This collaboration takes the form of two independent contracts. The first project investigated the automatic conversion of raw 3D data to polyhedral surfaces that approximate man-made objects at some key structural representation scales. This project started in March 2016, for a total duration of 3 years. The second project investigates the design of as-automatic-as-possible algorithms for repairing and converting Building Information Modeling (BIM) models of buildings in different urban-specific CAD formats using combinatorial maps. This project started November 2019, for a total duration of 3 years.

8.1.6. IRT Saint-Exupéry

Participants: Gaetan Bahl, Florent Lafarge.

This project investigates low-power deep learning architectures for detecting, localizing and characterizing changes in temporal satellite images. These architectures are designed to be exploited on-board satellites with low computational resources. The project started in March 2019, for a total duration of 3 years.

8.1.7. Dassault Systèmes

Participants: Julien Vuillamy, Pierre Alliez, Florent Lafarge.

This project investigates algorithms for reconstructing city models from multi-sourced data. 3D objects are reconstructed by filtering, parsing and assembling planar shapes. The project started in April 2018, for a total duration of 3 years.

<p style="text-align:center;color:red;font-weight:bold;">ALMANACH Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Ongoing contracts:

Verbatim Analysis   Verbatim Analysis is an Inria start-up co-created in 2009 by Benoît Sagot. It uses some of ALMAnaCH's free NLP software (SxPipe) as well as a data mining solution co-developed by Benoît Sagot, VERA, for processing employee surveys with a focus on answers to open-ended questions.

opensquare   was co-created in December 2016 by Benoît Sagot with 2 senior specialists of HR (human resources) consulting. It is dedicated to designing, carrying out and analysing employee surveys as well as HR consulting based on these results. It uses a new employee survey analysis tool, *enqi*, which is still under development. This tool being co-owned by opensquare and Inria, both parties have signed a Software Licence Agreement in exchange for a yearly fee paid by opensquare to ALMAnaCH based on its turnover. Benoît Sagot currently contributes to opensquare, under the "Concours scientifique" scheme.

Facebook   A collaboration on text simplification ("français Facile À Lire et à Comprendre", FALC) is ongoing with Facebook's Parisian FAIR laboratory. It involves a co-supervised (CIFRE) PhD thesis in collaboration with UNAPEI, the largest French federation of associations defending and supporting people with special needs and their families. This collaboration, is part of a larger initiative called Cap'FALC involving (at least) these three partners as well as the relevant ministries. Funding received as a consequence of the CIFRE PhD thesis: 60,000 euros

Bluenove   A contract with this company has been signed in 2018, which initiated a collaboration for the integration of NLP tools within Bluenove's platform Assembl, dedicated to online employee and citizen debating forums. It involved 12 months of fixed-term contracts (a post-doc, who worked at ALMAnaCH in 2018-2019). Funding received: 77,137 euros

Active collaborations without a contract:

Science Miner   ALMAnaCH (following ALPAGE) has collaborated since 2014 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 for 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 to provide a scholarly dashboard on scientific papers available from the HAL national publication repository.

Software Heritage   , whose goal is to collect and preserve software in source code form. ALMAnaCH's collaboration with Software Heritage, on large-scale programming language identification, also involves Qwant, who provided some funding to Software Heritage.

Fortia Financial Solutions   ALMAnaCH members led a proposal for the creation of an ANR LabCom with this French FinTech company on the analysis of (raw, PDF) financial documents from investment funds. The proposal was rejected, but future collaboration is still planned.

Hyperlex   A collaboration was initiated in 2018 on NLP and information extraction from raw legal documents (mostly PDF format), involving especially Éric de La Clergerie, who is now a part-time employee of the company.

Ongoing discussions that should/could be formalised in the form of a contract in 2020:

Winespace   : information extraction from wine descriptions to develop a wine recommendation system

Newsbridge   : automatic extraction of short summaries of filmed events (e.g. sport events) based on social media coverage analysis

INPI   : Patent classification

Cour de cassation   (in the context of the LabIA): retrieval of relevant jurisprudence

DGCCRF   (in the context of the LabIA): automatic identification of illicit clauses in B-to-C commercial contracts

COML Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- **Facebook AI Research Grant** (2019, PI: E. Dupoux, 350K€) - Unrestricted Gift - The aim is to help the development of machine learning tools geared towards the psycholinguistic research community.
- **Google Research Award** (2019, PI E. Dunbar, 37K€) - Unrestricted Gift - Develop a first version of a universal synthesizer which can be tuned to specific dialects with sparse data.

<p style="text-align:center; color:red;">**MULTISPEECH Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. 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: We developed a software suite for voice processing in the multimedia creation chain. The software was designed for sound engineers, and relied on the team's expertise in speech enhancement, robust speech and speaker recognition, and speech synthesis.

8.1.2. Honda Research Institute Japan

Company: Honda Research Institute Japan (Japan)

Duration: Aug 2018 – Mar 2019

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

Abstract: This was a follow-up contract targeting 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. Dassault and Thalès - Man Machine Teaming Initiative

Company: Dassault and Thalès (France)

Duration: Apr 2019 - Sept 2020

Participants: Irène Illina, Dominique Fohr, Ismael Bada, Stephane Level

Abstract: The primary goal of the project is to develop a new approach that allows coupling speech enhancement with semantic analysis for improving speech recognition robustness.

8.2. Bilateral Grants with Industry

8.2.1. Orange

Company: Orange SA (France)

Duration: Nov 2016 – Oct 2019

Participants: Lauréline Perotin, Romain Serizel, Emmanuel Vincent

Abstract: This CIFRE contract funded the PhD thesis of Lauréline Perotin. Our goal was to develop deep learning based speaker localization and speech enhancement algorithms for robust hands-free voice command. We were especially targeting difficult scenarios involving several simultaneous speakers.

8.2.2. Invoxia

Company: Invoxia SAS (France)

Duration: Mar 2017 – Apr 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 Jouvet, Irène 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 (section vide)

<p align="center" style="color:red">SEMAGRAMME Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Industry Partner

As a follow-up to a Cifre PhD thesis [34] on the use of Abstract Categorial Grammars in an industrial context, the team worked on a common road-map with the Yseop company and proposed common master internships as a first step towards formalizing the partnership.

After a master internship supervised by Bruno Guillaume, a discussion opened on the use of Abstract Categorial Grammars in the industrial context. C&S - Communication and Systems - has tool specifications that need to be verified, which can be achieved through semantic representation. A Cifre PhD thesis is currently being prepared for early 2020.

<p style="text-align:center">**Auctus Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral collaboration with SAFRAN EP

An industrial collaboration has been initiated with SAFRAN EP (Villemur-sur-Tarn) on the analysis of manual industrial activities for the improvment of working conditions in highly demanding tasks. Vincent Padois and Jean-Marc Salotti have supervised the internship of Gaëlle Lannuzel who was focusing on knot tying activities for electrical cables. A CIFRE PhD thesis is being discussed to pursue this work.

8.2. Bilateral collaboration with SUEZ

A contract has been signed with Suez (see 7.12) for a 6-month internship under Auctus supervision (David Daney and jean-Marc Salotti). The objective was the development of a new method to improve strenuous manual activities and an implementation of the method for the specific activity of pipe cover raising. This study has been performed by Nina Doctor, ENSC student (recruitment February - September 2019).

8.3. Bilateral collaboration with PSA

An industrial collaboration has been initiated with PSA on the synthesis and dynamic analysis of shared workspaces for safety in collaborative robotics. A CIFRE PhD thesis has been approved by ANRT and will start in February 2020.

CHORALE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. AXYN (2017 - 2021)

Participants: Patrick Rives and Paolo Salaris
This contract (30k€) is linked to the PhD Thesis of Dyanna Hassan (Cifre Thesis). The objective is to develop assistive navigation techniques.

7.1.2. Renault (2018 - 2021)

Participant: Philippe Martinet (in collaboration with A. Spalanzani and C. Laugier from CHROMA)
This contract (CHROMA 45k€, CHORALE (15k€ for supervision)) is linked to the PhD Thesis of Luiz Guardini (Cifre Thesis). The objective is to develop contextualized emergency trajectory planning with minimum criticality by employing dynamic probabilistic occupancy grid.

7.2. Bilateral Grants with Industry

7.2.1. AXYN (2017 - 2021)

Phd Student: Dayanna Hassan
Dayanna Hassan is employed by AXYN (Cifre Thesis).
Title of the PhD: Plate-forme robotisée d'assistance aux personnes à mobilité réduite

7.2.2. Renault (2018 - 2021)

Phd Student: : Luiz Guardini
Luiz Guardini is employed by Renault (Cifre Thesis).
Title of the PhD: Autonomous car driving: use of dynamic probabilistic occupancy grids for contextualized planning of emergency trajectory with minimal criticity

<p style="text-align:center;color:red;font-weight:bold;">CHROMA Project-Team</p>

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 Erkent, 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.

<p style="text-align:center">**DEFROST Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We would like to acknowledge FACEBOOK company for the donation of $25,000 for our research (department FACEBOOK Reality Labs).

8.2. Bilateral Grants with Industry

We received an industry grant (CIFRE) with Robocath to work on autonomous catheter navigation. This grant will fund a PhD student for 3 years, starting in February 2019.

We have an ongoing bilateral project with the company InSimo on the simulation of suture.

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. *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.

8.2.2. *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.

8.2.3. *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.

8.2.4. *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.

8.2.5. *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.

8.2.6. *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.

8.2.7. *Explainable continual learning for autonomous driving*
Participants: Natalia Díaz Rodríguez [correspondant], Adrien Bennetot.

Financing of the CIFRE PhD grant of Adrien Bennetot by Segula Technologies.

<p style="text-align:center">**HEPHAISTOS Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *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.

<p style="text-align:center; color:red;">**LARSEN Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. *Cifre with Diatelic Pharmagest*
Participants: François Charpillet, Yassine El Khadiri.

We have a long term collaboration with Diatelic compagny which is a start-up created among other by François Charpillet in 2002. Currently we have a collaboration through a Cifre PhD whose the objective is to work on daily activity recognition for monitoring elderly people at home. The work will be included in a product that will be launched next year (carelib solution).

8.1.2. *Cifre with PSA*
Participants: François Charpillet, Julien Uzzan.

This work is done in collaboration with François Aioun, Thomas Hannagan and Franck Guillemard from PSA.

The subject of the thesis is : « Reinforcement learning for the autonomous vehicle in urban-like environments ». This PhD started in January on the Vélizy site where he stayed for 3 months and the he moved to Inria Nancy in the LARSEN team and we started working on applications of deep reinforcement learning algorithms for autonomous vehicles. The first one was a decision-making problem for autonomous driving on highways using the Deep Q-Networks algorithm. The aim was to build a controler outputing high level decisions (like changing to left/right lane, braking...) to navigate on highways and interacting with many other actors. Even though the results were convicing for simple simulations like a basic overtaking or just following a leader car, the performances on the general case were lackluster, so this is still an ongoing work. The other application we worked on later this year is a longitudinal control application. The aim was to create a controller able to drive behind a leader, but this time, the controller is low-level, meaning that it has to output direct commands, like an acceleration. More recently, we have been testing a idea meant to enhance the performances of the deep reinforcement learning algorithm by adding noise to the observations during training in order to obtain a safer and more cautious controller.

8.1.3. *Cifre with SAFRAN*
Participants: François Charpillet, Nicolas Gauville, Christophe Guettier.

The thesis began on May 6, 2019 after a "prethesis" of 6 month and is related to the Furious Project. The objective is to propose new Coordination mechanisms for a group of autonomous robotic evolving in an unknown environment for search and rescue (Robot Search and Rescue). The thesis is a continuation of a previous work made during the Cartomatic project which won in 2012 the French robotics contest Defi CAROTTE organized by the General Delegation for Armaments (DGA) and French National Research Agency (ANR).

8.1.4. *Cifre iFollow*
Participants: Francis Colas, Jérôme Truc, Cédric Pradalier, Nirmal Giftsun.

Cédric Pradalier is co-supervisor at GeorgiaTech Lorraine and Nirmal Giftsun 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.

This year, Jérôme Truc set up a simulated warehouse environment modeled on an actual warehouse from a logistic partner of iFollow. In this environment, he tested and compared several behaviors for a cart robot helping an order picker.

For personal reasons, Jérôme Truc had to resign from his PhD in July 2019.

PERVASIVE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CIFRE Doctoral Contract with eLichens

The main topic of the project is to develop cloud-based services for Building Management System (BMS) framework. The aim is to develop predictive algorithms to control Heat Ventilation and Air Conditioning (HVAC) systems addressing two main goals:

1. Improve the well-being of the occupants keeping different variables as temperature, humidity, CO_2, air quality measures inside a pre established optimal range;

2. Saving costs optimizing energy consumption

This research is supervised by Patrick Reignier.

RAINBOW Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. 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 (see Sect. 5.4.3). Each module is rent 40 days during a 3-year period in the context of the IRT B<>com NeedleWare project (see Section 7.2.3).

7.2. Bilateral Grants with Industry

7.2.1. Creative

Participants: Benoît Antoniotti, François Chaumette, Eric Marchand.

No Inria Rennes 13996, duration: 36 months.

This project funded by Creative started in March 2019. It supports Benoît Antoniotti's Ph.D. about visual exploration (see Section 6.2.9).

7.2.2. IRT JV Perform

Participant: François Chaumette.

No Inria Rennes 14049, duration: 36 months.

This project funded by IRT Jules Verne in Nantes started in January 2018. It is achieved in cooperation with Stéphane Caro from LS2N in Nantes to support Zane Zake's Ph.D. about visual servoing of cable-driven parallel robots (see Section 6.2.8).

7.2.3. IRT B<>com NeedleWare

Participants: Hadrien Gurnel, Alexandre Krupa.

No Inria Rennes 9072, duration: 36 months.

This project started in October 2016. It supports Hadrien Gurnel's Ph.D. about the study of a shared control strategy fusing haptic and visual control for assisting manual steering of needles for biopsy or therapy purposes in a synergetic way (see Section 6.4.3). This year, we published [43] [44] in the scope of this project.

<p style="text-align:center">**RITS Project-Team**</p>

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 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.

<p style="text-align:center">**LINKMEDIA Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE PhD: Incremental dynamic construction of knowledge bases from text mining

Participants: Guillaume Gravier, Cyrielle Mallart, Pascale Sébillot.

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.

8.1.2. CIFRE PhD: Embedding heterogeneous data for directory search

Participants: Vincent Claveau, Guillaume Gravier, 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.

8.1.3. CIFRE PhD: Few shot learning for object recognition in aerial images

Participants: Yannis Avrithis, Yann Lifchitz.

Duration: 3 years, started in March 2018
Partner: Safran Tech

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.

MAGRIT Team (section vide)

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

1. The Morpheo Inria team and Microsoft research set up a collaboration on the capture and modelling of moving shapes using multiple videos. Two PhD works are part of this collaboration with the objective to make contributions on 4D Modeling. The PhDs take place at Inria Grenoble Rhône-Alpes and involve visits and stays at Microsoft in Cambridge (UK) and Zurich (CH). The collaboration is part of the Microsoft Research - Inria Joint Centre.

2. The Morpheo Inria team has another collaboration with Facebook reality lab in San Francisco. The collaboration involves one PhD who is currently at the Inria Grenoble Rhône-Alpes working on the estimation of shape and appearance from a single image. The collaboration started in 2019.

PERCEPTION Project-Team (section vide)

<p style="text-align:center">**SIROCCO Project-Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CIFRE contract with InterDigital on neural networks for video compression

Participants: Xuan Hien Pham, Christine Guillemot.

- Title : Neural networks for video compression
- Partners : InterDigital (Ph. Bordes, F. Galpin), Inria-Rennes.
- Funding : InterDigital, ANRT.
- Period : Jan.2019-Oct.2021.

The goal of this Cifre contract is to first investigate novel optical flow estimation methods using deep neural networks. Based on the optical flow methods, the next step will be to design temporal prediction schemes based on convolutional neural networks (CNN) for video compression. The methods will be assessed in the context of the VVC (Versatile Video Coding) standard.

8.1.2. CIFRE contract with Orange labs. on compression of immersive content

Participants: Patrick Garus, Christine Guillemot, Thomas Maugey.

- Title : Compression of immersive content
- Research axis : 7.1.3
- Partners : Orange labs. (J. Jung), Inria-Rennes.
- Funding : InterDigital, ANRT.
- Period : Jan.2019-Dec.2021.

The goal of this Cifre contract is to develop novel compression methods for 6 DoF immersive video content. This implies investigating depth estimation and view synthesis methods that would be robust to quantization noise. This also implies developing the corresponding coding mode decisions based on rate-distortion criteria.

Stars Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts and Grants with Industry

Stars team has currently several experiences in technological transfer towards industrials, which have permitted to exploit research result:

7.1.1. Ekinnox

is a spin-off project of the Stars team which aims at improving the rehabilitation process for caregivers and patients. Thanks to a computer vision based system (camera combined with algorithms detecting human motion), Ekinnox provides a simple and efficient tool to quantify and visualize the performance of patients (e.g. gait parameters computation such as side-by-side video comparison, automatic sequencing of video or 3D display) during their rehabilitation process. This company was created at the beginning of 2017.

7.1.2. Toyota

is working with Stars on action recognition software to be integrated on their robot platform. This project aims at detecting critical situations in the daily life of older adults alone at home. 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 that potential dangerous situations will be detected and reported to caregivers if necessary. The system is intended to work with a Partner Robot - HSR - (to send real-time information to the robot) to better interact with the older adult.

7.1.3. Vedecom

is interested in developing algorithms for people detection for self-driving cars. Among many challenges in pedestrian detection, the ones of interest are a) Scale- handling, b) Occlusion-handling and c) Cross-dataset generalization. Each of the aforementioned challenges is critical to enable modern applications like self-driving vehicles become safe enough for active deployment. To improve the performance of contemporary pedestrian detectors, one of our first major idea is to use multiple layers of a CNN simultaneously. Towards this, we proposed a new pedestrian detection system called Multiple-RPN. Another recent work is adding pseudo-segmentation information to pedestrian detection. The proposed features of our system perform close to the best performing detectors today.

7.1.4. Kontron

has a collaboration with Stars, which runs from April 2018 until April 2021 to embed CNN based people tracker within a video-camera. Their system uses Intel VPU modules, such as Myriad X (MA2485), based on OpenVino library.

7.1.5. The company ESI

(European System Integration) has a collaboration with Stars, which runs from September 2018 until March 2022 to develop a novel Re-Identification algorithm which can be easily set-up with low interaction for video-surveillance applications. ESI provides software solutions for remote monitoring stations, remote assistance, video surveillance, and call centers. It was created in 1999 and ESI is a leader in the French remote monitoring market. Nowadays, ensuring the safety of goods and people is a major problem. For this reason, surveillance technologies are attracting growing interest and their objectives are constantly evolving: it is now a question of automating surveillance systems and helping video surveillance operators in order to limit interventions and staff. One of the current difficulties is the human processing of video, as the multiplication of video streams makes it difficult to understand meaningful events. It is therefore necessary to give video surveillance operators

suitable tools to assist them with tasks that can be automated. The integration of video analytics modules will allow surveillance technologies to gain in efficiency and precision. In recent times, deep learning techniques have been made possible by the advent of GPU processors, which offer significant processing possibilities. This leads to the development of automatic video processing.

7.1.6. Fantastic Sourcing

is a French SME specialized in micro-electronics, it develops e-health technologies. Fantastic Sourcing is collaborating with Stars through the UCA Solitaria project, by providing their Nodeus system. Nodeus is a IoT (Internet of Things) system for home support for the elderly, which consists of a set of small sensors (without video cameras) to collect precious data on the habits of isolated people. Solitaria project performs a multi-sensor activity analysis for monitoring and safety of older and isolated people. With the increase of the ageing population in Europe and in the rest of the world, keeping elderly people at home, in their usual environment, as long as possible, becomes a priority and a challenge of modern society. A system for monitoring activities and alerting in case of danger, in permanent connection with a device (an application on a phone, a surveillance system ...) to warn relatives (family, neighbours, friends ...) of isolated people still living in their natural environment could save lives and avoid incidents that cause or worsen the loss of autonomy. In this R&D project, we propose to study a solution allowing the use of a set of innovative heterogeneous sensors in order to: 1) detect emergencies (falls, crises, etc.) and call relatives (neighbours, family, etc.); 2) detect, over short or longer predefined periods, behavioural changes in the elderly through an intelligent analysis of data from sensors.

7.1.7. Nively

is a French SME specialized in e-health technologies, it develops position and activity monitoring of activities of daily living platforms based on video technology. Nively's mission is to use technological tools to put people back at the center of their interests, with their emotions, identity and behavior. Nively is collaborating with Stars through the UCA Solitaria project, by providing their MentorAge system. This software allows the monitoring of elderly people in nursing homes in order to detect all the abnormal events in the lives of residents (falls, runaways, strolls, etc.). Nively's technology is based on RGBD video sensors (Kinects type) and a software platform for event detection and data visualization. Nively is also in charge of Software distribution for the ANR Activis project. This project is based on an objective quantification of the atypical behaviors on which the diagnosis of autism is based, with medical (diagnostic assistance and evaluation of therapeutic programs) and computer scientific (by allowing a more objective description of atypical behaviors in autism) objectives. This quantification requires video analysis of the behavior of people with autism. In particular, we propose to explore the issues related to the analysis of ocular movement, gestures and posture to characterize the behavior of a child with autism. Thus, Nively will add autistic behavior analysis software to its product range.

More bilateral Grants with industries is available at: http://www-sop.inria.fr/members/Francois.Bremond/topicsText/researchProje

<div align="center" style="color:red">**THOTH Project-Team**</div>

8. Bilateral Contracts and Grants with Industry

8.1. 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.

8.2. Facebook

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

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. Lina Mezghani is the new PhD student in this collaboration since 2019.

8.3. NAVER LABS Europe

Participant: Karteek Alahari.

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. A new CIFRE PhD contract was submitted to ANRT for approval in October 2019.

8.4. Valeo AI

Participants: Karteek Alahari, Florent Bartoccioni.

This collaboration started in 2019 with the arrival of PhD student Florent Bartoccioni. Despite the progress seen in computer vision, artificial systems lack the capability to address the large disparity between human and machine-based scene understanding. For example, at any road intersection most people have the ability to accurately forecast or anticipate events in this scenario, such as changes in colour of the traffic lights, when and how pedestrians are likely to cross the street. This apparently natural human behaviour is not replicable by state-of-theart computer vision methods, which are ill-equipped to make such forecasts. The goal of this collaborative PhD is to address this forecasting problem.

8.5. Criteo

Participant: Julien Mairal.

This collaboration started in April 2019, with the arrival of a master student, Houssam Zenati, who will pursue a CIFRE PhD starting in 2020. The goal of this collaboration is to develop machine learning techniques for counterfactual loss optimization, which is a fundamental problem in machine learning related to causal inference. The goal is to learn stochastic policies, based on offline logged data. The problem is important for web advertising, which is the main activity of the Criteo company, but the potential scope of application is much larger, with possible applications in medicine and experimental sciences.

8.6. Google

Participants: Karteek Alahari, Minttu Alakuijala, Valentin Gabeur, Julien Mairal.

This collaboration started in February 2019, with the arrival of two CIFRE PhD students, Minttu Alakuijala and Valentin Gabeur, who are respectively working on visual models for robotics, and 3D human pose estimation.

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: Yana Hasson, Ivan Laptev, Jean Ponce, Josef Sivic, Dimitri Zhukov, Cordelia Schmid [Inria Thoth].

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 it 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: 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.