informatics *mathematics*

Inria

RESEARCH CENTER
Bordeaux - Sud-Ouest

FIELD

Activity Report 2018

Section Contracts and Grants with Industry

LFANT Project-Team (section vide)

CAGIRE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- EDF: "Advanced modelling of heat transfer for industrial configurations with or without accounting of the solid wall", contract associated to the PhD thesis of Gaëtan Mangeon

- EDF: "Hybrid RANS/LES modelling for unsteady loadings in turbulent flows", contract associated to the PhD thesis of Vladimir Duffal

- IFPEN: "3D simulation of non-reactive internal aerodynamics of spark-ignition engines using an hybrid RANS/LES method", contract associated to the PhD thesis of Hassan Al Afailal

- PSA: "Turbulence modelling in the mixed and natural convection regimes in the context of automotive applications", contract associated to the PhD thesis of Saad Jameel.

8.2. Bilateral Grants with Industry

- EDF (Cifre PhD grant): "Advanced modelling of heat transfer for industrial configurations with or without accounting of the solid wall", PhD student: Gaëtan Mangeon

- EDF (Cifre PhD grant): "Hybrid RANS/LES modelling for unsteady loadings in turbulent flows", PhD student: Vladimir Duffal

- IFPEN (PhD grant): "3D simulation of non-reactive internal aerodynamics of spark-ignition engines using an hybrid RANS/LES method", PhD sutdent: Hassan Al Afailal

- PSA (Cifre PhD grant): "Turbulence modelling in the mixed and natural convection regimes in the context of automotive applications", PhD student: Saad Jameel.

- Dassault Aviation (Cifre PhD grant): "Amélioration des modèles pour la turbulence. Applications à la prédiction des écoulements aérodynamiques.", PhD student: Gustave Sporschill.

CARDAMOM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- BGS IT&E, Flash flood simulations with a coupled model, Coordinator: M. Ricchiuto, 32 keuros total (2 consulting contracts from 2016 to 2019)
- THALES/16-12035, Activity around the numerical certification of debris codes, Coordinator: P.M. Congedo, 23 Keuros ;
- ArianeGroup, Activity around techniques for computing low-probabilities, Coordinator: P.M. Congedo, 20 Keuros ;
- CEA-CESTA, Coordinator: P.M. Congedo, 40 Keuros ;

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Naval Group
Participants: Huilong Zhang, Jonatha Anselmi, François Dufour, Dann Laneuville.

The increasing complexity of warfare submarine missions has led Naval Group to study new tactical help functions for underwater combat management systems. In this context, the objective is to find optimal trajectories according to the current mission type by taking into account sensors, environment and surrounding targets. This problem has been modeled as a discrete-time Markov decision process with finite horizon. A quantization technique has been applied to discretize the problem in order to get a finite MDP for which standard methods such as the dynamic and/or the linear programming approaches can be applied. Different kind of scenarios have been considered and studied.

7.1.2. Thales Optronique
Participants: Benoîte de Saporta, François Dufour, Tiffany Cerchi.

Maintenance, optimization, fleet of industrial equipements The topic of this collaboration with Université de Montpellier and Thales Optronique is the application of Markov decision processes to the maintenance optimization of a fleet of industrial equipments.

7.1.3. Lyre: ADEQWAT project
Participants: François Dufour, Alexandre Genadot, Jérôme Saracco.

Stochastic modelling, Optimization. This project has just started in November 2017. The topic of this collaboration with Lyre, l'Agence de l'eau Adour-Garonne and ENSEGID is the modeling of the uncertainties in the Water demand adequacy in a context of global climate change. A PhD thesis (2018-2021) is part of this project.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Preparation of the InnovationLab with I2S company, official starting scheduled after 1st 2019 COPIL in January 2019.

MEMPHIS Project-Team (section vide)

<div style="text-align:center">**REALOPT Project-Team**</div>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have an on-going contract with SNCF on scheduling of rolling-stock. The PhD thesis of Mohamed Benkirane is part of this contract.

Following the PhD thesis of Rodolphe Griset, our collaboration with EDF continues through a four months contract whose goal is to investigate the possibility of developing an operational prototype (called Fenix) for strategic planning of nuclear plant outages. Two scientific questions are raised. The first one concerns the new mechanisms of management of the power capacity market on the French power grid. The second one is about a new model of the stock variation during a refueling operation, which requires information of several previous production campaigns.

We also have a new contract with RTE to develop strategies inspired from stochastic gradient methods to speed-up Benders' decomposition.

CARMEN Project-Team (section vide)

MAGIQUE-3D Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with TOTAL

- Depth Imaging Partnership (DIP)

  Period: 2014 May - 2019 April , Management: Inria Bordeaux Sud-Ouest, Amount: 120000 euros/year.

- Approximations hybrides par éléments finis discontinus pour l'élasto-acoustique

  Period: 2016 November - 2018 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros.

- FWI (Full Waveform Inversion) dans le domaine temporel utilisant des méthodes numériques hybrides pour la caractérisation de milieux élasto-acoustiques. Period: 2017 October - 2020 December , Management: Inria Bordeaux Sud-Ouest, Amount: 180000 euros.

- Utilisation d'images 3D DRP à différentes échelles et résolutions pour vérifier l'applicabilité des problèmes acoustiques Period: 2017 November - 2019 October, Management: Inria Bordeaux Sud-Ouest, Amount: 170000 euros.

- Petrophysics in pre-salt carbonate rocks

  Period: 2017 December - 2019 November, Management: Inria Bordeaux Sud-Ouest, Amount: 190000 euros.

MNEMOSYNE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Contract with Algotech
Participants: Frédéric Alexandre, Ikram Chraibi Kaadoud, Nicolas Rougier, Thierry Viéville.

Algotech is a SME working in the domain of CADD software edition for electrical circuit diagram interpretation and design. Its activity is interesting for our team because they are also interested in the design, by learning, of perception (for diagram identification) and action aspects of loops (for diagram genesis) with the specificity of working at a small scale, considering the variety of items to be manipulated. This is consequently a very interesting benchmark for transfering our bio-inspired models to the domain of classical machine learning. Particularly, during the PhD of Ikram Chraibi Kaadoud (defended this year), we have worked on the extraction of implicit knowledge, from the learning of sequences, extracted from diagrams.

8.1.2. Contract with CEA Cesta
Participants: Frédéric Alexandre, Guillaume Padiolleau.

In the context of the PhD of Guillaume Padiolleau, we are working with the CEA on possible interactions between model-based and model-free approaches of reinforcement learning, based on cognitive consideration. Particularly, to decrease the complexity of exploration of a large data space in model-free approaches, we aim at considering introducing a priori knowledge coming from a model and we also propose to consider motivation as another way to orient the search in the learning space. This is applied in the robotic domain to manipulations by a robotic arm.

8.1.3. Contract with Ubisoft
Participants: Frédéric Alexandre, Pramod Kaushik.

Together with the Inria Project-team Flowers, we are working with the video game editor Ubisoft to define original bio-inspired learning methods, to qualify the behavior of human players observed during runs of games. Such learning algorithms will be specifically considered in the PhD of Pramod Kaushik.

MONC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Research contract between the pharmaceutical company Roche and the MONC team.

PLEIADE Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Contracts and Grants with Industry

Implication in research for the development of Ebola vaccine has lead to several indirect contracts with industry:

- The EBOVAC1, EBOVAC2 and EBOVAC3 project, collaboration with Janssen from Johnson et Johnson.

- The Prevac trial vaccine trial leads to collaboration with Merck and Janssen. The purpose of this study is to evaluate the safety and immunogenicity of three vaccine strategies that may prevent Ebola virus disease (EVD) events in children and adults. Participants will receive either the Ad26.ZEBOV (rHAd26) vaccine with a MVA-BN-Filo (MVA) boost, or the rVSVΔG-ZEBOV-GP (rVSV) vaccine with or without boosting, or placebo. The Prevac-UP project is set as a continuation of Prevac trial in the same framework.

HIEPACS Project-Team (section vide)

PHOENIX-POST Team (section vide)

STORM Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Intel

INTEL granted $30k and provided information about future many-core platforms and memory architectures to ease the design and development of the HWLOC software with early support for next generation hardware.

8.1.2. Bull/Atos

Bull/ATOS granted the CIFRE PhD thesis on Nicolas Denoyelle on advanced memory hierarchies and new topologies.

8.1.3. EDF

With Yvan Fournier from EDF R&D we co-advise the PhD thesis of Benjamin Lorendeau under a CIFRE funding.

8.1.4. CEA

CEA/DAM granted the CIFRE PhD thesis of Hugo Taboada on non-blocking MPI collectives.

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

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.

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

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.

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MANAO Project-Team

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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.

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

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.