STIC AmSud

2022 call for proposal approved projects

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5G & B5G Technology based on artificial intelligence for Underground Vehicles Communications with OWC/RF

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Compact MOSFET model for instruction and design of wireless autonomous chips in advanced processes

NetConHybSDP
Networked control of hybrid systems by semidefinite programming with applications in industry 4.0

PAMUNE
Patient Multilayer Networks from structured and unstructured clinical data

RAMONaaS
Resource Allocation Methods for Optical Networks as a Service

B5Go

5G & B5G Technology based on artificial intelligence for Underground Vehicles Communications with OWC/RF

STIC AmSud

This project aims to strengthen scientific collaboration between research teams from Chile, Ecuador and France; promote the participation, human capital training and formation of young researchers and scientific results diffusion; around the field of wireless communications based on 5G &B5G as an enabling technology for future underground wireless vehicular communications networks. It is built around scientific researchers from South America and France, working multidisciplinary on different applications of 5G & B5G communications systems using OWC/RF, such as high data rate wireless communications networks, indoor positioning and vehicular communications. This project is built around a first kick-off meeting in Nancy.

During the execution of the project, it is expected to carry out the mobility of doctoral students and several postdoctoral researchers, as well as scientific transfer with companies related to mining, mobile telephony, the vehicle industry, among others. As far as possible, dissemination activities will be carried out for academic training. In the intermediate stage, meetings will be held in Ecuador and Chile, and a final meeting is proposed in Nancy, France, to summarize the team's results to be shown in the final report and to promote the results in a scientific workshop. We also hope to develop other collaborations and joint project applications.

Project coordinators

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Secretaría de Educación Superior, Ciencia, Tecnología e Innovación

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Agencia Nacional de Investigación y Desarrollo

MINISTÈRE DE L'EUROPE ET DES AFFAIRES ÉTRANGÈRES

CAMA

Consensus Cellular Automata Algorithms and Tie-Majority Classification

Given a set of binary opinions of individuals {0, 1} in a grid of one and two dimensions, we propose to develop procedures that lead to consensus states, that is, that all individuals have the same opinion (0* or 1*). For this purpose, we will work in the context of cellular automata, redefining rules (essentially, related with the majority function which select at each step the most 2 represented state), neighborhoods and iteration modes that allow, at least partially, to reach consensus (convergence to the fixed points 0* or 1*). In two dimensions, by using the asynchronous update (i.e., a site is updated at each step) we will characterize neighborhoods and local functions such that consensus is reached. Furthermore, we will compare the quality of these processes according to the classical CA problem of density, by which a given binary initial condition is subjected to a local rule until reaching a consensus fixed point, a*, where a is the most represented state in the initial condition). Also, taking into account the two principles of the definition of a local majority function used for the previous developments (what to do in cases of a tie and what to do when there is a majority), reclassify ECAs (the three-neighborhood, onedimensional elementary cellular automata with next-nearest left and right neighbors) and extend the rules thus presented to two-dimensional grids, in order to study their computational complexity. Both problems, that of consensus and that of characterization, will be addressed both theoretically and through large-scale computational simulations.

Project coordinators

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CONN-COMA

Study of the functional and structural connectomes for the prediction and neurological evolution of anoxo ischemic coma patients

STIC AmSud

Approximately two thirds of patients admitted to the hospital in a state of coma as a consequence of a cardiac arrest (CA) die before the end of their hospitalization. Their treatment crucially depends on an early and reliable evolution that can be generated between ICU. However, between 50% and 77% of patients are considered to be in a “gray zone” of neurological prognosis. The development and validation of new neurological prediction models based on the state of anoxic-ischemic coma is undoubtedly a high priority research topic. This project involves multimodal neuroimaging in acute hypoxic ischemic patients. We will analyze how dynamical-connectivity based brain states index the state of consciousness. Our results will improve the treatment of hypoxic-ischemic coma patients, and pave the way for a real time detection of covert conciousness in acute patients and their prognosis

Project coordinators

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Ministerio de Ciencia, Tecnología e Innovación Argentina

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GreenSE4IoT-22

Towards Energy-efficient Software for Distributed Systems

Energy efficiency has already been considered for many years at the hardware level. However, powerful and cheaper computing resources have led to less 3 resource optimization in software. Considering the planet resource limits and the increasing role of distributed systems such as the Internet of things (IoT), there is an urgent need to design software with energy awareness as a requirement. In practice, this means to consider energy-efficiency in software quality attributes at design time and then to implement architectural tactics enforcing them. Moreover, usage conditions varying a lot at runtime, dynamic reconfiguration would enable additional energy savings.

Recently, Green IT distinguishes between "Green by IT" and "Green in IT". "Green by IT" considers ICT as a means to optimize the consumption of natural resources (e.g. Smart Home), while "**Green in IT**" intends to lower the impact of ICT on natural resources. Consequently**, Green in Software Engineering** (GreenSE) corresponds to the sub-part of "Green in IT" which is focusing on methodologies and mechanisms to limit the environmental impact of software products.

In this recent research context, a **first goal (G1)** is to provide an approach that allows to include the energy-awareness for the building of distributed systems such as IoT middleware. It thus allows designers and architects to make decisions much more energy-friendly when the architecture of distributed systems should be decided at design-time. In addition to design-time, such energy-awareness should also be considered at runtime when usage conditions are established. Hence, a **second goal (G2)** is to explore dynamic adaptation solutions able to detect and alleviate undesired/unexpected scenarios, for instance rebound effects, at runtime. The two goals are divided into sub-goals that were detailed in the previous section. For this project in collaboration **we mainly focus on G1**.

Project coordinators

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LAFe

Learning Analytics solutions to support On time Feedback

Feedback given to students by instructors is essential to guide students and help them improve from their mistakes. However, in higher education, instructors feel unable to give quality and timely feedback due to work overload and lack of time. In this context, this project proposes the creation of a consortium with the knowledge to design and develop explainable and comprehensive dashboards for supporting both students and instructors in the feedback process. Furthermore, the consortium will stimulate scientific collaboration and knowledge exchange among the participating institutions.

Project coordinators

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LAGOON

Learning and control on complex networks

Through the creation and consolidation of strong research and formation exchanges between Argentina, France and Uruguay, the LAGOON project will contribute to the fields of learning applied to network structures. Some of the challenges this project will address are:

- Stochastic matching problems on random graphs,
- Graph detections and representation learning,
- Boosting exploration mechanisms for reinforcement learning on models with sparse and rare rewards
- Distance learning algorithms based on Euclidean percolation.

Project coordinators

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LINT

Leveraging federated mobility learning for tactile Internet services

The Tactile Internet requires ultra-low latency and high availability of cloud-like resources. Multi-Access Edge Computing (MEC) addresses this requirement, serving users with MEC hosts nearby. Nevertheless, user mobility hinders this strategy, increasing the host-user distance over time. LINT (Leveraging federated mobility learning for Tactile Internet's services) aims to predict user trajectories with federated learning, using them to optimally allocate MEC resources, while preserving user privacy.

Project coordinators

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MOS2CHIP

Compact MOSFET model for instruction and design of wireless autonomous chips in advanced processes

In this project we will use our teaching experience in transistor physics, chip design, and engineering to develop tools and methods for the rapid instruction of engineers in chip design. Since the MOS transistor is the basic building block of integrated circuits, we will focus on the models of transistors and on the improvement of truly compact models for transistors. A seven-parameter model is currently studied in a collaboration among UFSC, Grenoble Alpes University and STMicroelectronics to supplement an available four-parameter transistor model, customized for very-low voltage simulations. A five-parameter model will be explored as candidate for standard voltage circuits. We will use parameter extraction procedures that were recently improved to optimize the matching between the simplified and the design kit models. For some key digital, analog and RF circuits, a comparison between the results obtained for the full design kit model with those that employ the simplified transistor model, will give a means to validate the design procedure.

Project coordinators

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NetConHybSDP

Networked control of hybrid systems by semidefinite programming with applications in industry 4.0

This project focuses on stability analysis, control and estimator design for hybrid systems operating in Industry 4.0 networks. The aim is to develop methods and algorithms that are able to cope with challenges such as fault detection, monitoring, effects of sampling, quantization, limitations of bandwidth and signal magnitude, presence of uncertainties, time-delays, nonlinear behaviors and packet losses. In the search for nonconservative results, semidefinite programming tools, that can be accurately and efficiently solved, are used.

Project coordinators

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PAMUNE

Patient Multilayer Networks from structured and unstructured clinical data

Clinical data offer an unprecedented source of information to understand human health better. However, such data are challenging to analyze. They usually contain information at different heterogeneous levels (demographics, diagnoses, medications, genomics, relapses, among others). Moreover, the information can be in a numerical format but also in free text. Finally, even once the information is extracted, integrating the different layers of data remains problematic. The PaMuNe project aims to tackle these different challenges thanks to a combination of expertise in clinical natural language processing and network science. We will first develop pipelines to process clinical information and extract knowledge from structured and unstructured data. All the extracted knowledge will be integrated in a patient multilayer network framework. This will allow applying the toolbox of graph theory to explore the networks and identify subgroups of homogeneous patients. We will develop our approaches using an in-house Chilean dataset of bone marrow transplants. This will allow us to group patients alike and inform decision-makers about possible medication strategies or expecting relapses.

Project coordinators

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RAMONaaS

Resource Allocation Methods for Optical Networks as a Service

Today, optical fibers are the most promising media allowing high bit-rate and low-latency connectivity of mobile equipment. In addition to the mobile backhaul, other interfaces connecting different mobile network equipment have been defined by 3GPP and other specification groups such as O-RAN and the eCPRI Consortium allowing for different functional splitting of the radio access network. Such a plurality of interfaces compels every network segment, including the optical lastmile, to face unprecedented transmission constraints with the arrival of 5G. In addition, 5G is expected to offer a wide variety of services to endusers with very heterogeneous needs in terms of speed, availability, latency, and number of connected devices. This project has the objective to provide the network with tools for performing dynamic resource allocation, responding to the needs of B5G traffic, and making it possible to deploy on-demand slices and providing the optical access network with the means to be operated through the paradigm of Network as a Service (NaaS). Our main goal is to implement cooperation between the radio/mobile and optical transmission entities (either virtual or hardware based) so that transmission of mobile services through an optical network can be optimized and end-to-end 5G/beyond-5G key performance indicators can be respected. Thanks to the abstraction of the optical network and easy configuration of optical transmission equipment, classes of services could be dynamically set so that the optical networks can be adapted to the needs of different mobile services. This would allow optical fiber to be more than a simple "pipe", while extending the notion of slicing to the optical network. Other project goals consist of leveraging on virtualized optical access topologies so that the optical network demarcation nodes can be used to host virtual functionalities (radio access network, radio core, multi- access edge computing, etc.). Last but not least, we intend to provide traffic mathematical modeling and advanced Artificial Intelligence and Machine-Learning (AIML) approaches that would allow automatic service scheduling optimization.

Project coordinators

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