Hosting Offers Inria: MSCA Postdoctoral Fellowships 2024 Call

What are the MSCA Postdoctoral Fellowships?

MSCA Postdoctoral fellowships support the career development of researchers for enhancing their individual competence diversification in terms of skills at multidisciplinary level and intersectoral experience. The MSCA-PF grant provides a competitive salary plus mobility and family allowances if applicable, as well as research, training and networking costs. This call to interest concerns the European Postdoctoral Fellowships (12 to 24 months of duration in Europe + optional placement in private sector in Europe of 6 months). More information: MSCA-PF

What are the eligibility criteria?

- Candidates must hold a PhD at the call deadline (11 Sept. 2024) and have 8 years maximum of full-time research experience after the PhD.
- "Mobility rule": candidates must NOT have resided or carried out their main activity (work, studies, etc.) in the country of the beneficiary for more than 12 months in the 36 months immediately before the call deadline (exceptions exist for European nationals).
- Candidates can be from any nationality.
- Although not an eligibility criterion, a good track record is recommended.
- An additional layer is at Inria institutional level regarding security procedures in recruitment, which must be approved by our Defence Security Officer.

What is needed to apply?

The MSCA PF programme requires candidates to write their own research project, in synergy with a supervisor at a European host institution. The proposal is a ten pages document describing the scientific idea, its expected impacts and implementation pathway, with an additional 5 pages for the candidate's CV. At Inria, we provide extensive support to good quality candidates in the form of preliminary meetings, group training to better understand the programme and the grant proposal requirements, and one-to-one review sessions by specialised staff in the late stage.

I'm interested. What should I do?

1- Check our list of *hosting offers*, when a domain fits your profile or seems complimentary to your expertise, go to the research team webpage and look for more info.
2- Once you think you have an interesting research project idea that fits the domains described in one of our *hosting offers*, write it down in 4-5 lines and email the indicated contact persons (even better if you can add a CV or a link to your profile).
3- That's it for now! Based on the info you provided we will get back to you regarding the next steps.

When should I do that? The earliest the better! If we had to give an indication, early Spring.

What's in it for me?

Selected candidates will have access to privileged grant writing training sessions and one-to-one proposal review sessions in the last phase with our experienced European Officers. The sessions will take place on the following dates (all times CET): 1- Understanding the call -- Thu 4 April 10:00-12:30, online; 2- Grant proposal writing guide -- Thu 16 May 09:00-16:30, online; 3- Fine-tune your proposal & joint writing sessions – 27-28 June 2 full days, in-person (Lyon, France) // online for candidates outside of France. Online events to present the offers and Inria's support will take place in March: Fri 8 March 13:00 CET; Wed 27 March 13:00 CET (same content for both, approx. 45 minutes duration). Register here for the info sessions (March) & training sessions (April, May, June)

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Rennes Centre

Inria MSCA-PF 2024 hosting offer Rennes #1: avatars, augmented reality, human-computer interaction

[KEYWORDS] avatars, augmented reality, human-computer interaction

[RESEARCH INTERESTS] How users could interact effectively in the context of augmented shared realities? We envision the avatar, i.e., the user's virtual representation, as a vehicle to enable such interactions. However, this question raises multi-disciplinary research challenges regarding human-computer interaction, multi-sensory rendering algorithms and perception, as the avatar should support interaction with real and virtual content.

[TEAM NAME] Hybrid

[DESCRIPTION] The research activity of Hybrid team belongs to the field of Extended Reality and 3D interaction with Virtual Environments. Our objective is to invent 3D interactive techniques with virtual environments exploiting both the body and brain of the user. We focus on novel user inputs in virtual reality such as coming from full-body tracking or brain-computer interfaces. Applications of our research program are for industry (virtual prototyping), medicine (surgical simulation, rehabilitation and re-education), design (architectural mock-up), art or videogames and entertainment. Hybrid was created in January 2013.

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Inria MSCA-PF 2024 hosting offer Rennes #2: Walk-Based Multimodal and Explainable Knowledge Graph Embeddings

[KEYWORDS] Knowledge Graph Embeddings; Random walks; Link prediction; Inductive Learning

[RESEARCH INTERESTS] Knowledge Graph Embeddings (KGEs) are a popular representation for large knowledge graphs because their latent nature makes them suitable for modern machine learning algorithms. Despite their popularity, KGEs are not free of limitations: they are usually black boxes, and they cannot be trivially extended to handle other data modalities such as text, videos, or images. These two observations limit their applicability to arbitrary knowledge graphs and use cases. In this project we aim to tackle these two limitations. We envision to exploit the semantic power of LLMs to make knowledge graphs more operable with arbitrary textual content and assistants. We expect to extrapolate the same techniques to other data modalities. To make the embeddings interpretable we envision to embed "reasoning schemes", e.g., paths or rules in the embeddings, which will guide training and serve as explanations. As an initial use case we plan to test our techniques on citation networks for the answer of complex queries on professional and scientific profiles. Further uses cases will be identified on the way. [TEAM NAME] LACODAM

[DESCRIPTION] The objective of the LACODAM team is to facilitate the process of making sense out of (large) amounts of data. This can serve the purpose of deriving knowledge and insights for better decision-making. Our approaches are mostly dedicated to provide novel tools to data scientists, that can either perform tasks not addressed by any other tools, or that improve the performance in some area for existing tasks (for instance reducing execution time, improving accuracy or better handling imbalanced data). Our main research areas are pattern mining, interpretable machine learning, and semantic web.)

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Inria MSCA-PF 2024 hosting offer Rennes #3: Explainable AI, Pattern mining, Neural Network debugging, Counterfactual explanations, Post-hoc explanations

[KEYWORDS] Explainable AI, Pattern mining, Neural Network debugging, Counterfactual explanations, Post-hoc explanations

[RESEARCH INTERESTS] We would like to explain (and potentially act on) the bad decisions (e.g. misclassifications) taken by neural networks. One axis could be to use/learn/construct global (counter-factual) explanations to identify particular problems in the data related to groups of examples (i.e. misclassified examples from the same class) that could, in turn, be used to improve the accuracy of the system. Another axis could be to use data mining tools to extract meaningful pattern in trained networks (i.e. activation maps per layer) and try to understand if parts of the network can be responsible for particular mistakes.

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Inria MSCA-PF 2024 hosting offer Rennes #4: brain-computer interfaces and neuro-feedback for rehabilitation

[KEYWORDS] brain-computer interfaces and neuro-feedback for rehabilitation

[RESEARCH INTERESTS] Brain-computer interfaces rely on measuring directly the cerebral activity of the users for interacting with automated systems. Such "mental" interfaces can be used for brain rehabilitation, eg after stroke, by providing direct "neurofeedback". This is raising strong challenges in terms of real-time brain signal processing (EEG data), and novel human-computer interaction schemes exploiting for instance multi-sensory feedbacks.

[TEAM NAME] HYBRID

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Inria MSCA-PF 2024 hosting offer Rennes #5: Network Neutrality, Search Neutrality, CDNs, Monitoring, statistical tests

[KEYWORDS] Network Neutrality, Search Neutrality, CDNs, Monitoring, statistical tests

[RESEARCH INTERESTS] According to network neutrality principles all data packets are supposed to be treated the same at each node of the network, without any distinction of their type, terminal, origin or destination. Our goal is to develop measurement tools allowing to detect if a non-neutral behaviour can be highlighted, this for the various actors of the Internet network: network access providers first, the main target of the network neutrality debate, but not only. Indeed, a packet-focused neutrality can be circumvented by applying a service differentiation at another level: it could for example be the case by choosing the data cached at the edge of the network to provide a better quality of service, or even at the search engine level. An implicit goal will then be to define a neutral (or fair) behaviour for each actor, to define the associated metrics, and to set up corresponding measurement techniques.

[TEAM NAME] ERMINE

[DESCRIPTION] The ERMINE team designs and analyses procedures and policies for efficiently managing network operations, but also works on the required measurement and monitoring of performance metrics. Our specific and original management activity will focus on network economics, regulation, and automated decision making. In terms of needed measurement, we make use of standard modelling and performance analysis techniques, but also carry out direct measurements to be analysed statistically. Our activity is a trade-off between methodological/mathematical developments and practical implementations.

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Inria MSCA-PF 2024 hosting offer Rennes #6: deep learning accelerators, hardware security, fault attacks, countermeasures, fault tolerance

[KEYWORDS] deep learning accelerators, hardware security, fault attacks, countermeasures, fault tolerance

[RESEARCH INTERESTS] Are Deep Learning Training Accelerators Secure? Recent studies show how to use side-channels to guess key parameters or inputs from DL models running on accelerators. For example, input images of a model were estimated from power traces. However, this project goes further than current practice by studying if private information can be retrieved during the training phase or if it is possible to disrupt the training quality by attacking the accelerators. Our objective is to study training-time hardware attacks and required countermeasures, focusing on fault injections in edge devices and remote side-channel attacks to cloud accelerators.

[TEAM NAME] TARAN

[DESCRIPTION] TARAN has recognized experience in computing architectures and design tools for domain-specific hardware architectures. TARAN explores efficient hardware accelerator architectures for DNN inference and training on resource-constrained embedded systems (e.g., on-board satellite, IoT devices) and in accelerated clouds using FPGA and ASIC technologies. TARAN has also expertise in analytical and simulation-based methods for evaluating the accuracy of reduced-precision computation and the reliability of hardware designs.

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Inria MSCA-PF 2024 hosting offer Rennes #7: Fine-grain recognition, Patrimonial archives, Computer vision, Deep learning, recent neural architectures

[KEYWORDS] Fine-grain recognition, Patrimonial archives, Computer vision, Deep learning, recent neural architectures

[RESEARCH INTERESTS]

Despite significant visual variations, the project explores the fine-grain recognition of similar images in patrimonial archives. It aims to structure large image collections to facilitate curatorial exploration. Computer vision based on deep learning is best for this task. Research involves challenging a few neural architectures (VGG, ResNet, ViT, …), a few recent image representations (AILIR, IRT, Selective Local Features, PWA, …), in order to establish strengths and weaknesses of existing solutions against in vitro and in vivo large scale image datasets, on task and domain changes in a continuous learning setting. New contributions are expected from the observed

weaknesses.

[TEAM NAME] Linkmedia

[DESCRIPTION] Linkmedia is concerned with the processing of extremely large collections of multimedia material. Getting rich, meaningful and deep insight from these collections, however, remains today hardly achievable because of the heterogeneity (and semantic) gap between modalities, because of the scale of the collections, because of the complex, hidden and implicit relationships between the items they contain, etc. To that end, Linkmedia contributes multimedia analytics algorithms to automatically process collections, eventually producing knowledge usable by humans. This involves a lot of deep learning, computer vision and NLP. Linkmedia is a joint team where Inria, CNRS, Univ. Rennes 1 and Insa researchers collaborate.

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Inria MSCA-PF 2024 hosting offer Rennes #8: robotics, microrobotics, haptics, shared control, medical robotics

[KEYWORDS] robotics, microrobotics, haptics, shared control, medical robotics

[RESEARCH INTERESTS] Research aims to enhance human control of small-scale untethered robot swarms for applications in drug delivery and embovascular medical procedures. Current systems lack intuitive human control, sensory feedback, and visualization. This study seeks to develop cognitive interfaces and AI-powered shared control for users to manage multi-robot systems effectively. Objectives include cognitive shared-control methods, AI-driven trajectory planning, haptic communication techniques, stability measures, and evaluating the system in diverse scenarios, from assembly tasks to endovascular medical procedures such aneurysm coiling.

[TEAM NAME] RAINBOW

[DESCRIPTION] The team is internationally recognized for its scientific activity in the field of shared control, multi-robots, haptics, sensor-based control, visual tracking, and visual servoing. The position is open in the framework of the collaborative European project RĚGO (rego-project.eu), which aims at developing an innovative set of AI-powered, microsized, untethered, stimuli-responsive swarms of robots. The project is composed of eight international partners from four EU countries. The work will be carried out in collaboration with one or more of the above laboratories and might include a visiting period in one of these labs.

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Inria MSCA-PF 2024 hosting offer Rennes #9: Distributed systems, Cloud-Edge Computing, Computing Continuum, Optimization, Urgent Science

[KEYWORDS] Distributed systems, Cloud-Edge Computing, Computing Continuum, Optimization, Urgent Science
[RESEARCH INTERESTS] Research Distributed systems are progressively moving towards a full IoT-Edge-Cloud Computing Continuum. At the same time, Urgent computing focuses on time-critical decisions that improve lives, monitor civil infrastructures, respond to extreme events, and accelerate science. Urgent services are typically sensitive to latency and response time, and are among the best candidates for the Computing Continuum. However, managing such services requires novel programming models and resource management approaches. This line of research seeks methods and optimizations that combine system states, decision variables, external events, and objective functions in order to realize the potential of the Computing Continuum for Urgent applications.

[TEAM NAME] Inria STACK
[DESCRIPTION] The STACK team addresses challenges related to the management and advanced usages of the Cloud to IoT continuum (infrastructures on the Cloud, Fog, Edge, and IoT). More specifically, the team is interested in delivering appropriate system abstractions to operate and use massively geo-distributed infrastructures, from the lowest to the highest levels of abstraction (i.e. system to application development, respectively), and addressing crosscutting dimensions such as energy or security. These infrastructures are critical for the emergence of new kinds of applications related to the digitalization of the industry and the public sector (a.k.a. the Industrial Internet, smart cities, e-medecine, etc.).

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Sophia Centre

Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #1: Healthcare, personalized medicine, data analysis

[KEYWORDS] **Healthcare, personalized medicine, data analysis**

[RESEARCH INTERESTS] **The team's main themes are causal inference, missing data management, and conformal prediction. Many topics are possible in these domains, such as challenges when combining clinical trial data and observational data (extending finite sample results with continuous data, relaxing strong overlap assumptions, determining optimal adjustement set), developing methods of treatment regime dynamics with missing data, distributional shift with missing data, coupling missing outcome and missing covariates, matching with missing values.**

[TEAM NAME] PREMEDICAL (precision medicine by data integration and causal learning).

[DESCRIPTION] Premedical is a joint team with Inserm (national research center for health) and is composed of statisticians, machine learners, biostatisticians and also clinicians. It provides a unique opportunity for interdisciplinary reasearch. The spectrum of skills is quite wide and we have more theoretical and more applied profiles but the methodological and theoretical developments are motivated by practice and the ultimate goal is to transfer and implement the methods developed to improve patient care. The inserm component, name Idesp team, is a specialist in respiratory diseases such as asthma and is internationally recognized for its work on the exposome and has numerous heterogeneous data. Premedical has two main research axes: 1) Personalized medicine by optimal prescription of treatment. 2) Personalized medicine by integration of different data sources.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #2: computational nanophotonics, metaphotonics, plasmonics

[KEYWORDS] : computational nanophotonics, metaphotonics, plasmonics

[RESEARCH INTERESTS] : Innovative Deep Learning modeling approches for nanophotonics leveraging physics-based neural networks

[NAME] : Atlantis

[DESCRIPTION]: Atlantis is a joint project-team between Inria and the Jean-Alexandre Dieudonné Mathematics Laboratory at Université Côte d'Azur.

The team gathers applied mathematicians and computational scientists who are collaboratively undertaking research activities aiming at the design, analysis, development

and application of innovative numerical methods for systems of partial differential equations (PDEs) modelling nanoscale light-matter interaction problems.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #3: dynamical systems, biological models, oscillations, synchronization, control, hybrid systems

[KEYWORDS] dynamical systems, biological models, oscillations, synchronization, control, hybrid systems

[RESEARCH INTERESTS] Systems with periodic oscillations are present throughout living systems and play fundamental roles, for instance, in cell development (cell cycle), regulation (circadian clocks), or cell signalling (calcium oscillations). Several questions then arise related to the coupling, synchronization, and mutual control of two or more oscillators. For a network of several oscillators, it becomes important to characterize its dynamical behaviour, the robustness of the original periodic solution, or the emergence of new asymptotic behaviour and patterns, such as new steady states or new synchronization patterns in the network. We also apply techniques of control theory and hybrid systems.

[TEAM NAME] Macbes

[DESCRIPTION] The team apply and develop methodologies of control theory and computational biology to specific applications in biology and ecology.

[LINK] https://team.inria.fr/macbes/team-members/

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #4: optimal control, astrodynamics, formation flying, orbit transfer, collision avoidance, KAM theory

[KEYWORDS] optimal control, astrodynamics, formation flying, orbit transfer, collision avoidance, KAM theory

[RESEARCH INTERESTS] Nonlinear control for space mechanics. This research will be devoted to theoretical and methodological progresses in control of artificial satellite trajectories with focus on low-thrust orbital transfer and formation flying. The first question that will be tackled concerns the possibility to leverage on resonances (between mean satellite motion and angles introduced by some orbital perturbations) to enhance the performance of the manoeuvres. In addition, the optimal deployment of large constellations (with several hundred or thousands of satellites) will be studied with special care on guaranteeing collision avoidance between agents.

[TEAM NAME] MCTAO

[DESCRIPTION] MCTAO is a joint team with INRIA and Université Côte d'Azur, specialized in control theory and applications. We are mostly concerned with nonlinear finite dimensional continuous time systems. There is a stress on optimal control; we are also interested in stabilisation, observers, path planning, controllability and structural questions. We are interested in solving important methodological problems, and conducting meaningful transfer on real life problems. Recent or current application domains are: space mechanics, navigation, quantum systems, biological models, models of neuronal activity; these are conducted with industrial partners or specialists of other fields.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #5: optimal control, dynamical systems, bacterial growth, cellular dynamics, resource allocation, turnpike

[KEYWORDS] optimal control, dynamical systems, bacterial growth, cellular dynamics, resource allocation, turnpike

[RESEARCH INTERESTS] Optimal control for bacterial growth modelling and control. Understanding the growth of microorganisms, such as bacteria, is an important challenge. It can for instance be the building block for industrial applications where a metabolite of interest needs to be produced. A recent and surprisingly effective approach relies on so-called self-replicator models based on resource allocation principles. In such low dimensional dynamical systems, the control is the allocation plus, in refined models, an external control aimed at changing the behaviour of the microorganism after some genomic engineering. The analysis uses both optimal control theory and numerical simulations, in relation with experimental results in collaboration with colleagues in

Grenoble and the Maximic ANR project. Typical structures of optimised allocation processes mix bang and singular controls, and often exhibit turnpike phenomena.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #6: Nonlinear control, optimal control, controllability, flatness, observers

[KEYWORDS] Nonlinear control, optimal control, controllability, flatness, observers

[RESEARCH INTERESTS] Topics in geometric nonlinear control There is a possibility for a post-doc on general progress in geometric control theory, that will be made more precise with the right candidate. Here are examples of topics. 1. Open questions on observer construction or output feedback stabilization under weak observability conditions. 2. Geometric conditions for dynamic feedback linearizability, also known as flatness, in small dimension. 3. Averaging methods for optimal control.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #7: Neural engineering, Direct electrical stimulation, Electrophysiology, Evoked Potentials, Neurosurgery

[KEYWORDS] Neural engineering, Direct electrical stimulation, Electrophysiology, Evoked Potentials, Neurosurgery

[RESEARCH INTERESTS] Before the resection of brain tumours, the neurosurgeon has substantial imaging data allowing to plan his gesture upstream. However, during the surgery itself, imaging becomes ineffective due to brain shift. Direct electrical stimulation (DES) of the brain is used in awake patients cooperating with the neurosurgeon to determine functional areas. When patients are under anaesthesia this possibility no longer exists. We have planned to use the electrophysiology evoked by DES during brain surgery to determine the location the tumour and the anatomical connectivity on-line in order to guide the surgery in awake patients or under general anaesthesia.

[TEAM NAME] CAMIN

[DESCRIPTION] CAMIN research is dedicated to the design and development of realistic neuroprosthetic solutions in interaction with clinical partners. Our efforts are focused on the objective of having a clinical impact: improvement of patient functional evaluation or/and quality of life

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #8: Machine Learning, Information Theory, Game Theory, decision-making

[KEYWORDS] Machine Learning, Information Theory, Game Theory, decision-making

[RESEARCH INTERESTS] This project studies the fundamental limits on the influence that decision makers involved on common decision making can exert on each other via revealing, hiding or distorting information. The focus is on the case in which the benefit obtained by an individual decision maker depends upon the decisions of all involved individuals. This situation arises in most decision making processes involving humans, machines or humans and machines: (a) federated machine learning; (b) Marketing policies that propose goods to potential customers; and (c) Stock traders that follow different sources of information to buy, sell and trade shares.

[TEAM NAME] NEO

[DESCRIPTION] The team is positioned at the intersection of Operations Research, Network and Data Sciences. By using the tools of Stochastic Operations Research, we model situations arising in several application domains. The aim is to understand the underlying rules and their effects in order to influence and control the creation and the evolution of complex networks

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Inria MSCA-PF 2023 hosting offer Sophia-Antipolis #9: Numerical probability analysis, stochastic analysis; Probabilistic methods for fluid mechanics

[KEYWORDS] Numerical probability analysis, stochastic analysis; Probabilistic methods for fluid mechanics ; Stochastic Lagrangian method for particles and flows ; Stochastic particle algorithms and related Monte Carlo methods ;Discretisation schemes for SDEs ;Probabilistic interpretation of PDEs

[RESEARCH INTERESTS] Numerical probability analysis, stochastic analysis; Probabilistic methods for fluid mechanics ; Stochastic Lagrangian method for particles and flows ; Stochastic particle algorithms and related Monte Carlo methods ;Discretisation schemes for SDEs ;Probabilistic interpretation of PDEs

[TEAM NAME] CALISTO

[DESCRIPTION] Turbulence modelling and particle dynamics are at play in numerous situations in which inertial/deformable/active particles are transported by a flow. This subject is of importance in many industrial and environmental situations as well as in health-related issues, and raises challenges in physical sciences, mathematics and numerical methods. The CALISTO project team brings together a unique synergy between physics, mathematics and computational approaches for solving complex environmental simulation models of particle-laden flows. Adopting a combination of microscopic and macroscopic descriptions, CALISTO’s strategy relies on an original and coherent methodology, mathematical frameworks supporting stochastic modelling, as well as sophisticated numerical methods in the field of computation al probability.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #10: Brain Computer Interfaces, P300 Speller, Classification techniques, Metric Learning, Symmetric Positive Definite Matrices, Electroencephalography

[KEYWORDS] Brain Computer Interfaces, P300 Speller, Classification techniques, Symmetric Positive Definite Matrices, Electroencephalography

[RESEARCH INTERESTS] Brain Computer Interfaces often need a calibration step specific to a subject or even to a session for a subject. This calibration procedure is tedious and classifiers are not always reliable enough given the limited amount of data that can be acquired due to time constraints. In particular, the Cronos research team has developed a P300 speller application that is tested on subjects that have the SLA disease. We are looking for improving this system by using a lower number of electrodes (and eventually dry ones). But reducing the number of electrodes or using dry electrodes has an impact on the accuracy/speed of the speller, so that we need to stuCRONOS

[DESCRIPTION] Our objective is to provide tools for exploring the functioning of the brain, with an emphasis on signal and image recording from diffusion magnetic resonance imaging, magnetoencephalography and electroencephalography with application to brain computer interfaces

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #11: Statistical learning, probabilistic modelling, Healthcare, Medical Imaging, Security, Federated learning

[KEYWORDS] Statistical learning, probabilistic modelling, Healthcare, Medical Imaging, Security, Federated learning

[RESEARCH INTERESTS] The research project focuses on the study of statistical learning methods to tackle the problem of modelling heterogeneous and secured data in biomedical applications. There are two main research axes: - Federated learning (FL) methods for the modelling of multicentric healthcare data with various degree of heterogeneity (across clients' features, labels, and with missing data). - Interpretable data modelling approaches for heterogeneous and high-dimensional biomedical data. The methodological framework draws from the domains statistical learning, Bayesian modelling, and optimization methods. The project has a strong applicative component, with collaborations with clinical partners and translation of computational methods on real life data.

[TEAM NAME] EPIONE

[DESCRIPTION] The longstanding research activity of EPIONE revolves around the analysis and treatment of biomedical data, with a focus in machine learning, medical imaging, computational anatomy and computational physiology. Over the past twenty years the group developed innovative approaches in image processing, statistical learning and patient-specific biophysical modelling, with translation to the clinical domain, and to the creation of several biotech start-ups. The group is currently composed by 6 permanent researchers, several postdoc fellows and research engineers, and by more than 20 PhD students

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #12: Federated Learning, Distributed Machine Learning, Inference Serving Systems, Caching networks

[KEYWORDS] Federated Learning, Distributed Machine Learning, Inference Serving Systems, Caching networks.

[RESEARCH INTERESTS] Performance evaluation of distributed systems, in particular cache networks and large-scale learning systems. The research is characterized by the application of different mathematical tools (Markov processes, control theory, continuous optimization, fluid models, game theory)..

[TEAM NAME] NEO

[DESCRIPTION] The team is positioned at the intersection of Operations Research and Network Science. By using the tools of Stochastic Operations Research, we model situations arising in several application domains, involving networking in one way or the other.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #13: Semantic Slam, Localisation, Machine Learning

[KEYWORDS] Semantic Slam, Localisation, Machine Learning

[RESEARCH INTERESTS] The objective is to build accurate and composite models of large-scale environments that mix metric, topological and semantic information. Ensuring the consistency of these various representations during the robot exploration and merging/sharing observations acquired from different viewpoints by several collaborative robots or sensors attached to the infrastructure, are very difficult problems. This is particularly true when different sensing modalities are involved and when the environments are time-varying. A recent trend in Simultaneous Localization And Mapping is to augment low-level maps with semantic interpretation of their content.

[TEAM NAME] ACENTAURI

[DESCRIPTION] ACENTAURI is a robotics team led by Ezio MALIS that studies and develop intelligent, autonomous and mobile robots that can help humans in their day-to-day lives at home, at work or during their displacements. The team focuses on perception, decision and control problems for multi-robot collaboration by proposing an original hybrid model-driven / data driven approach to artificial intelligence and by proposing efficient algorithms. The team focuses on robotic applications in smart territories, smart cities and smart factories. In these applications several collaborating robots will help humans by using multi-sensor information eventually coming from infrastructure

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #14: Autonomous Driving, Situation awareness, Decision-making, Planning, Machine Learning

[KEYWORDS] Autonomous Driving, Situation awareness, Decision-making, Planning, Machine Learning

[RESEARCH INTERESTS] The long-term objective of this research axis is to design and develop a decision-making module that is able to} (i) plan the mission of the robots (global planning) , (ii) generate the sub-tasks (local objectives) necessary to accomplish the mission based on artificial Situation Awareness (SA) and (iii) plan the robot paths and/or sets of actions to accomplish each subtask (local planning) . Since we have to face uncertainties, the decision module must be able to react efficiently in real-time based on the available sensor information in order to guarantee the safety of humans and things.

[TEAM NAME] ACENTAURI

[DESCRIPTION] ACENTAURI is a robotics team led by Ezio MALIS that studies and develop intelligent, autonomous and mobile robots that can help humans in their day-to-day lives at home, at work or during their displacements. The team focuses on perception, decision and control problems for multi-robot collaboration by proposing an original hybrid model-driven / data driven approach to artificial intelligence and by proposing efficient algorithms. The team focuses on robotic applications in smart territories, smart cities and smart factories. In these applications several collaborating robots will help humans by using multi-sensor information eventually coming from infrastructure

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #15: cognitive vision systems, semantic interpretation

[KEYWORDS] cognitive vision systems, semantic interpretation

[RESEARCH INTERESTS] -

[TEAM NAME] STARS

[DESCRIPTION] The Stars research team focuses on the design of cognitive vision systems for Activity Recognition. More precisely, we are interested in the real-time semantic interpretation of dynamic scenes observed by video cameras and other sensors. We study long-term spatio-temporal activities performed by agents such as human beings, animals or vehicles in the physical world. The major issue in semantic interpretation of dynamic scenes is to bridge the gap between the subjective interpretation of data and the objective measures provided by sensors. To address this problem Stars develops new techniques in the field of cognitive vision, deep learning and cognitive

systems for physical object detection, activity understanding, activity learning, vision system design and evaluation. We focus on two principal application domains: visual surveillance and healthcare monitoring.

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Inria MSCA-PF 2024 hosting offer Sophia-Antipolis #16: Geometric modelling, geometry processing, AI for shape and scene analysis, remote sensing, urban modelling, computer vision, 3D object recognition

[KEYWORDS] Geometric modelling, geometry processing, AI for shape and scene analysis, remote sensing, urban modelling, computer vision, 3D object recognition

[RESEARCH INTERESTS] Geometric modelling, geometry processing, AI for shape and scene analysis, remote sensing, urban modelling, computer vision, 3D object recognition

[TEAM NAME] TITANE

[DESCRIPTION] Our overall objective is the computerized geometric modelling of complex scenes from physical measurements. On the geometric modelling and processing pipeline, this objective corresponds to steps required for conversion from physical to effective digital representations: analysis, reconstruction and approximation. The related scientific challenges include i) being resilient to defect-laden data due to the uncertainty in the measurement processes and imperfect algorithms along the pipeline, ii) being resilient to heterogeneous data, both in type and in scale, iii) dealing with massive data, and iv) recovering or preserving the structure of complex scenes. We define the quality of a computerized representation by its i) geometric accuracy, or faithfulness to the physical scene, ii) complexity, iii) structure accuracy and controllability, and iv) amenability to effective processing and high-level scene understanding.

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Bordeaux Centre

Inria MSCA-PF 2024 hosting offer Bordeaux #1: Multiphase compressible flow; multiscale; diffuse-interface method; discontinuous Galerkin method

[KEYWORDS] computational fluid dynamics, compressible flows, high order methods, multigrid methods.

[RESEARCH INTERESTS] Multigrid methods for high order methods for compressible flows. Understanding complex flows via computational fluid dynamics requires a fine tuning of numerical methods. In different flow regimes (low Mach number flows, diffusive flows, incompressible flows), for reaching a reasonable computational cost, it is often required to design efficient implicit methods. Then, solving the resulting large nonlinear system of equations becomes a challenging task especially in a parallel environment. A natural manner of tackling this problem relies on the development of multigrid methods, because they may lead to a linear complexity in the number of unknowns, and so are naturally scalable. We are interested in the development of fast, scalable and accurate multigrid methods for compressible flows.

[TEAM NAME] CAGIRE

[DESCRIPTION] CAGIRE brings together researchers from different backgrounds (turbulence and multiphase compressible modelling, applied mathematics, experimentation) who have gradually developed a common vision of what should be the CFD tools of the future. This objective is based on the strong motivation to be useful to industrial actors from different fields. The considered flows are turbulent and most often bounded by walls. Consequently, they are characterized by the simultaneous presence of a multiplicity of spatial and temporal scales, which represents a challenge in terms of physical modelling and simulation.

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Inria MSCA-PF 2024 hosting offer Bordeaux #2: HPC, numerical simulation, finite element method, task parallelism, programming model, scheduling

[KEYWORDS] HPC, numerical simulation, finite element method, task parallelism, programming model, scheduling

[RESEARCH INTERESTS] Team Storm at Inria in Bordeaux develops the StarPU task-based runtime system for high performance computing. StarPU automatically schedules applications on top of HPC supercomputer nodes equipped with accelerators, GPU and/or FPGA. As part of a collaboration with Simula in Norway, we are interested in investigating synergies between Simula's FEniCS programming environment for building Finite Element-based simulations, and our StarPU runtime. Potential topics to be explored include load balancing and scheduling algorithms, domain specific languages, compilation / code generation / vectorization, data layout and partitioning, performance modelling, energy optimization and green computing, fault tolerance.

[TEAM NAME] STORM

[DESCRIPTION] The members of STORM are experts on code optimization, application tuning for parallel, heterogeneous architectures, scheduling of parallel tasks, mostly in the HPC field. All members of the team share a common expertise on parallel languages, parallel performance and on parallel architectures. The contributions of the team are also interfaced with compilers, for read-only memory optimization). Many of the optimizations proposed rely on static/dynamic code analysis and transformations, possibly resorting to auto-tuning. This expertise is recognized at the European level, through the participation to expert committees, and European PATC training programs on parallel tools for HPC.

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Grenoble and Lyon Centres

Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #1: Simulation, Optimization, and Machine Learning for Direct-to-Satellite Internet of Things

[KEYWORDS] Direct-to-Satellite IoT, Satellite Networks, Satellite Constellations, Low Power Wide Area Networks (LPWAN)

[RESEARCH INTERESTS] The primary focus is enabling Direct-to-Satellite IoT (DtS-IoT) for efficient data transfer services to IoT devices in remote areas where establishing terrestrial infrastructure is impractical. This research explores using low-Earth orbit satellites, like CubeSats, as mobile IoT gateways for data offloading. Key challenges include the complexities of long-distance transmissions, dynamic satellite channels, and constraints on device capabilities. Addressing these challenges necessitates revising and extending Low Power Wide Area Networks (LPWAN) protocols, integrating them with orbital mechanics principles to facilitate a globally integrated space-terrestrial IoT network. This research will leverage computational simulations, innovative optimization techniques, and machine learning methods to overcome these obstacles and advance the field of satellite-based IoT networking.

[TEAM NAME] AGORA

[DESCRIPTION] The postdoctoral position at Inria's AGORA research group, located at the La Doua Campus in Lyon, offers a unique opportunity to collaborate with esteemed experts such as Dr. Juan Fraire, Dr. Oana Iova, and Prof. Hervé Rivano. The appointee will use advanced software tools like FloRaSat, an Omnet++-based DtS-IoT simulator, enhancing their expertise in interplanetary communication systems, wireless sensor networks, and urban network planning. This role is enriched by AGORA's strong international and academic-industrial collaborations, including ties with IRIT/ENSEEIHT, i2CAT, Kineis, and Semtech. It offers the chance to delve into the Smart City domain, exploring technologies pivotal to wireless sensor networks and massive machine-to-machine communications. This position is a gateway to cutting-edge research and professional growth in IoT and smart city technologies.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #1: Models, Protocols, and Algorithms for the Interplanetary Connected Things Paradigm

[KEYWORDS] Interplanetary Networks, Direct-to-Satellite IoT, Delay-Tolerant Networks, Deep Space Links, High Latency Transport Protocols.

[RESEARCH INTERESTS] This interplanetary communication research seeks to address the critical challenges of IoT networking across deep space. The core objectives include optimizing mission design, enhancing remote asset

autonomy through machine learning, and refining network protocol architectures. This endeavor seeks to integrate Direct-to-Satellite IoT (DtS-IoT) access with deep-space Delay Tolerant Networking (DTN) backhaul, aiming to create dynamic, distributed networks of smaller, interconnected devices. The project aims to vastly improve data collection, expand coverage, and enhance the resilience of communication systems in deep space exploration. The research will leverage advanced informatics and innovative networking models and technologies, integrating cross-layer adaptation of LoRa/LoRaWAN, NB-IoT, and Bundle Protocol. This research is set to transform traditional paradigms of interplanetary missions, fostering a new domain of space informatics.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #3: Multi-robot systems, online path planning, aerial robotics, autonomous exploration and mapping

[KEYWORDS] Multi-robot systems, online path planning, aerial robotics, autonomous exploration and mapping

[RESEARCH INTERESTS] The main research objective will be focused on the design of new multi-robot planning solutions for the autonomous exploration and mapping of complex 3D structures. The challenge will be to overcome the limitations and simplified assumptions present in the current literature to propose efficient and applicable solutions to generate online feasible and safe trajectories for a team of cooperating aerial vehicles. Ideally, the obtained solutions will be initially tested in a realistic simulator and in a second phase on experimental platforms in real outdoor environments in collaboration with other team members working on related subjects.

[TEAM NAME] CHROMA

[DESCRIPTION] The overall objective of Chroma is to address fundamental and open challenges that lie at the intersection of the research fields “Mobile Robotics” and “Artificial Intelligence". Our goal is to design algorithms and develop models allowing mobile robots to navigate in dynamic and human-populated environments. Chroma is involved in all aspects pertaining to (multi)robot navigation tasks, including perception and motion-planning. Our approach for addressing this challenge is to bring together probabilistic methods, planning and learning

techniques and multi-agent decision models. Our main application domains concern autonomous vehicle driving, aerial robots and services robotics.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #4: fast and accurate numerical algorithms, floating-point arithmetic, symbolic error analysis

[KEYWORDS] fast and accurate numerical algorithms, floating-point arithmetic, symbolic error analysis

[RESEARCH INTERESTS] Computer arithmetic is currently undergoing a major evolution, with traditional IEEE floating-point being complemented with new formats and instructions, but also alternative number systems. Of particular importance is the advent of low-precision formats, mostly driven by efficiency needs in AI and HPC. By being increasingly supported by modern hardware, low-precision arithmetic brings obvious performance benefits, but it also makes accuracy much more difficult to guarantee. Our goal is to address this challenge by exploring new ways to perform accuracy analysis, with a focus on the systematic and, ideally, automatic exploitation of the structure of floating-point errors.

[TEAM NAME] ARIC

[DESCRIPTION] A key challenge in modelling and scientific computing is the simultaneous mastery of hardware capabilities, software design, and mathematical algorithms for enhancing the performances of computations. Thus, the objective of AriC is to improve computing at large, in terms of efficiency and reliability. We investigate the fine structure of floating-point arithmetic, controlled approximation schemes, fast algebraic algorithms, and new cryptographic applications, most of these themes being pursued in their interactions.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #5: symbolic and algebraic computation, computer algebra, algebraic complexity

[KEYWORDS] symbolic and algebraic computation, computer algebra, algebraic complexity

[RESEARCH INTERESTS] The research in computer algebra in AriC develops three main interconnected themes: the use of linear differential or difference equations as a data-structure and its application to combinatorics and special functions (D-finiteness); the design of fast algorithms for matrices of polynomials; the exploitation of structure in linear algebra in order to develop efficient algorithms for fundamental operations such as the computation of resultants or the composition of power series.

[TEAM NAME] ARIC

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #6: Image bioinformatics; Deep learning; Light-sheet microscopy; Mouse brain development

[KEYWORDS] Image bioinformatics; Deep learning; Light-sheet microscopy; Mouse brain development

[RESEARCH INTERESTS] In collaboration with team Morpheme (Inria Sophia-Antipolis) and the Fleischmann lab (Brown University), we are developing a scalable pipeline for analysis of three-dimensional images of the developing mouse brain. Current best-practice involves various manual steps, which limits us to 2-3 brain regions. Our goal is to scale to tens of brain regions. Thus we need to automatically map brains to reference shapes; use state-of-the-art nuclei detection methods (ObjMPP, StarDist); and accommodate for developmental changes. It requires evaluating computational costs and alleviating bottlenecks whilst maintaining accuracy and robustness. This project is part of work on gene regulation inference in brain development.

[TEAM NAME] BEAGLE

[DESCRIPTION] The expanded name for Beagle is “Artificial Evolution and Computational Biology”. Our research is at the interface between biology and computer science and aims at contributing new results in biology by modelling biological systems. In other words we are making artifacts – from the Latin artis factum: an entity made by human art rather than by Nature – and we explore them in order to understand Nature. Using computational

approaches, we study abstractions of cellular systems and processes in order to unravel their organizational principles.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #7: Computational evolution, genome architecture, robustness, evolvability, artificial life

[KEYWORDS] Computational evolution, genome architecture, robustness, evolvability, artificial life

[RESEARCH INTERESTS] The Beagle team develops and uses the aevol model (www.aevol.fr). Aevol is a digital genetics platform specifically designed to study the evolutionary dynamics of genomes and genome architecture. The objective of this project is to use – and if needed expand – aevol to unravel the links between selection for robustness (due eg to changes in mutation rates or population size) and genome architecture. We are particularly interested into linking the results of the models with population genetics approach on the one side and large-scale bioinformatics analyses.

[TEAM NAME] BEAGLE

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #8: Numerical modelling and simulation, Natural risk mountain, HPC

[KEYWORDS] Numerical modelling and simulation, Natural risk mountain, HPC

[RESEARCH INTERESTS] Non-smooth numerical methods based on MPM (Material point method) and "data-driven mechanics" techniques for the modelling and simulation of gravity flows in mountains (debris flows, avalanches, rock slides). The objective of this post-doc is to develop in a non-smooth framework robust and reliable simulation methods for complex flows related to natural gravity hazards. For debris flows, coupling with implicit DEM ("Discrete Element Method") will be done. The issue of high performance scientific computing (HPC) will be addressed for these methods.

[TEAM NAME] TRIPOP

[DESCRIPTION] The team is mainly concerned with the modelling, the mathematical analysis, the simulation and the control of nonsmooth dynamical systems. Nonsmooth dynamics concerns the study of the time evolution of systems that are not smooth in the mathematical sense, i.e., systems that are characterized by a lack of differentiability, either of the mappings in their formulations, or of their solutions with respect to time. The team is one of the few in the world that has brought together researchers in applied maths, control theory, computational mechanics and scientific computing in the field of nonsmooth dynamics

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #9: Data-driven modelling, uncertainties, calibration, data assimilation, reduced order models, substitution models, mountainous natural risk

[KEYWORDS] Data-driven modelling, uncertainties, calibration, data assimilation, reduced order models, substitution models, mountainous natural risk

[RESEARCH INTERESTS] To develop simplified models that can be used extensively for the development of methods of calibration and quantification of uncertainties allowing the joint use of data from various origins for gravitational risk in mountains. The following points will be developed: A) Statistical models integrating data from various sources and the hazard models developed. The identification of the parameters of these hazard models, in particular using Bayesian approaches, will also make it possible to calibrate and quantify the uncertainties associated with the hazard models. B) Model reduction approaches (POD, PGD,...) or construction of substitution models (Sparse Polynomial Chaos, Gaussian Processes,...) will be implemented to build simplified models usable in this context. C) Application of different data assimilation techniques (particle filters or variational filters) on the models described in the first axis and on the reduced order models. The calibrated models will be integrated in a global approach aiming at building quantitative risk analysis methods.

[TEAM NAME] TRIPOP

[DESCRIPTION] The team is mainly concerned with the modelling, the mathematical analysis, the simulation and the control of nonsmooth dynamical systems. Nonsmooth dynamics concerns the study of the time evolution of systems that are not smooth in the mathematical sense, i.e., systems that are characterized by a lack of differentiability, either of the mappings in their formulations, or of their solutions with respect to time. The team is one of the few in the world that has brought together researchers in applied maths, control theory, computational mechanics and scientific computing in the field of nonsmooth dynamics

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #10: Statistics, Extreme-value analysis, Dimension reduction

[KEYWORDS] Statistics, Extreme-value analysis, Dimension reduction

[RESEARCH INTERESTS] Design of new dimension reduction methods dedicated to extreme-value analysis in a risk assessment perspective.

[TEAM NAME] STATIFY

[DESCRIPTION] The STATIFY team specializes in the statistical modelling of systems involving data with a complex structure. The objective is to develop mathematically well-founded statistical methods to propose models that capture the variability of the systems under consideration, models that are scalable to process large dimensional data and with guaranteed good levels of accuracy and precision. STATIFY is a scientific project centred on statistics and wishing to have a strong methodological and application impact in data science.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #11: Bayesian inference, machine learning

[KEYWORDS] Bayesian inference, machine learning

[RESEARCH INTERESTS] The candidate will develop new methods for approximating the posterior distribution of non-linear models used to describe complex physical phenomena. He will employ modern tools from Bayesian inference and deep generative modelling and tailor them to scientific applications with experimental data. The methods developed in this project have the potential of being applied by scientists from several domains and, as such, the candidate will be encouraged to cooperate with different laboratories in Grenoble's scientific ecosystem. The candidate is expected to publish their findings in top machine-learning conferences and statistics journals. The position is meant to further the careers of early-career researchers who wish to pursue a career in academia.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #12: Bayesian inference, machine learning

[KEYWORDS] Bayesian inference, machine learning

[RESEARCH INTERESTS] The candidate will work on the project titled "A new Bayes-duality principle for adaptive, robust, and lifelong learning of AI". https://bayesduality.github.io/ The candidate will work on problems at the intersection of deep learning, Bayesian inference, optimization, and reinforcement learning. The candidate is expected to carry out research and publish their findings in top machine-learning conferences and statistics journals. The position is meant to further the careers of early-career researchers who wish to pursue a career in academia.

[TEAM NAME] STATIFY

[DESCRIPTION] The STATIFY team specializes in the statistical modelling of systems involving data with a complex structure. The objective is to develop mathematically well-founded statistical methods to propose models that capture the variability of the systems under consideration, models that are scalable to process large dimensional

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #13: prion dynamics, Alzheimer's disease, synchronicity, strains, ODE, PDE

[KEYWORDS] prion dynamics, Alzheimer's disease, synchronicity, strains, ODE, PDE

[RESEARCH INTERESTS] The neurodegenerative fatal diseases like prion or Alzheimer are still misunderstood. From the protein dynamics point of views, the object of the project here is to explore how the strain interact with each other and the cell itself and how it spreads in the brain.

[TEAM NAME] DRACULA

[DESCRIPTION] The Dracula project team is a multi-scale modelling team that deploys mathematical and computational approaches to biology. We apply our models to many applications among which: oncology, Alzheimer and amyloid diseases, normal and pathological hematopoiesis, immunology, modelling of single cell data. We use partial and ordinary differential equations for population dynamics.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #14: Hemoglobin production, modelling

[KEYWORDS] Hemoglobin production, modelling

[RESEARCH INTERESTS] Hemoglobin production in the bone marrow is regulated through kidneys and their release of EPO. When damaged or removed, patients under dialysis are required to receive synthetic EPO injections to keep the red blood cell level high enough (low level induces anemia, high level induces strokes). Controlling the doses amplitude and frequency becomes then of major challenge for clinicians for the patient's comfort. Modelling the process and its control is then the centre of this project.

[TEAM NAME] DRACULA

[DESCRIPTION] The Dracula project team is a multi-scale modelling team that deploys mathematical and computational approaches to biology. We apply our models to many applications among which: oncology, Alzheimer and amyloid diseases, normal and pathological hematopoiesis, immunology, modelling of single cell data. We use partial and ordinary differential equations for population dynamics.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #15: population dynamics, multi-scale models, PDE, ODE, gene regulatory network

[KEYWORDS] population dynamics, multi-scale models, PDE, ODE, gene regulatory network

[RESEARCH INTERESTS] The recent development of single cell analysis is giving very rich albeit noisy information. The understanding of the molecular heterogeneity of cell populations and their time-dependent evolution leads to the need for the development of new analysis and models. We are particularly interested in the domain of stochastic gene regulatory network inference, and their coupling with trajectory inference.

[TEAM NAME] DRACULA

[DESCRIPTION] The Dracula project team is a multi-scale modelling team that deploys mathematical and computational approaches to biology. We apply our models to many applications among which: oncology, Alzheimer and amyloid diseases, normal and pathological hematopoiesis, immunology, modelling of single cell data. We use partial and ordinary differential equations for population dynamics.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #16: sensitivity analysis, kernel embedding, model order reduction, hypoelliptic Fokker-Planck equations

[KEYWORDS] sensitivity analysis, kernel embedding, model order reduction, hypoelliptic Fokker-Planck equations

[RESEARCH INTERESTS] Many mathematical models involve input parameters, which are not precisely known. Global sensitivity analysis aims to identify the parameters whose uncertainty has the largest impact on the variability of a quantity of interest (QoI) - for instance by computing sensitivity measures. In this application, we are interested in QoIs defined as the solution of a hypoelliptic Fokker-Planck equation. The targeted application is the Fitzhugh-Nagumo model arising from neurosciences. We focus on Kernel-based sensitivity measures and propose model order reduction based on a stochastic Galerkin projection for a fast evaluation of these measures.

[TEAM NAME] AIRSEA

[DESCRIPTION] Big data (production, storage, transfer), Supervised and unsupervised learning, Bayesian methods, Kernel methods, Continuous Modeling (PDE, ODE), Stochastic Modeling, Multiscale modeling, Multiphysics modeling, Numerical analysis of PDE and ODE, Statistical methods, Optimization, High performance computing, Inverse problems, Data assimilation, Model reduction, Uncertainty Quantification, Fluid mechanics, Waves.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #17: Systems reconfiguration for resilience and cyber-security

[KEYWORDS] Systems reconfiguration for resilience and cyber-security

[RESEARCH INTERESTS] Cybersecurity is a very critical issue in the growing importance of numerical and computing infrastructures. Much research is devoted to defense mechanisms that detect intrusions and attacks, but a less thoroughly studied topic is that of the automated reaction to attacks, in order to use detection information to take the appropriate defense and repair actions, so that the system can protect itself against the attacks, and remain operational, possibly in a degraded mode. We propose to approach this self-protection capacity, in terms of Autonomic Computing, in a feedback loop, e.g., using models & control for discrete event systems.

[TEAM NAME] CTRL-A

[DESCRIPTION] CTRL-A works on self-adaptive computing systems, large (data centers) or small (embedded), required to react to the dynamical fluctuations of their environments and workloads. We study their automated administration, in an Autonomic Computing approach, involving self-administration feedback control loops. Our objective is to develop a novel framework for model-based design of controllers in Autonomic Computing. We contribute generic Software Engineering methods and tools for developers to design and integrate controllers, and we improve concrete usability of techniques from Control Theory, e.g., Discrete Event Systems, by specialists of concrete systems, typically for resource management and cyber-security.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #18: Self-adaptative resource management for data and computing centres, combining control and scheduling

[KEYWORDS] Self-adaptative resource management for data and computing centres, combining control and scheduling

[RESEARCH INTERESTS] Large-scale computing infrastructures are processing vaster amount of data or solving problems requiring vaster amount of computing power. Their behaviour has become more variable and difficult to model, e.g. wrt power consumption and application performance. Their management and configuration has to be automated, and performed at runtime in a feedback loop as in autonomic computing. We propose to analyse and design such autonomic managers in the context of High Performance Computing, and more particularly to consider, at the level of the RJMS (resources and jobs management system), to coordinate mechanisms from Control Theory and scheduling, applied to resource harvesting.

[TEAM NAME] CTRL-A

[DESCRIPTION] CTRL-A works on self-adaptive computing systems, large (data centers) or small (embedded), required to react to the dynamical fluctuations of their environments and workloads. We study their automated administration, in an Autonomic Computing approach, involving self-administration feedback control loops. Our objective is to develop a novel framework for model-based design of controllers in Autonomic Computing. We contribute generic Software Engineering methods and tools for developers to design and integrate controllers, and we improve concrete usability of techniques from Control Theory, e.g., Discrete Event Systems, by specialists of concrete systems, typically for resource management and cyber-security.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #19: multi-agent, agent-based simulation, methodology, open data, science, reproducibility, semantic web

[KEYWORDS] multi-agent, agent-based simulation, methodology, open data, science, reproducibility, semantic web

[RESEARCH INTERESTS] Methodology of reproducible multi-agent social simulations -- Knowledge evolution may be studied using multi-agent simulations and publishing results in the top multi-agent conferences. To report reproducible experiments, we took steps to automate the experiment design, processing, analysis and publication. This involves describing explicitly the hypotheses, initial conditions, processes, measures, graphic output and statistical tests.

[TEAM NAME] MOEX

[DESCRIPTION] Cultural evolution is the application of evolution theory to culture. It is now widely acknowledged in social sciences and the humanities. mOeX adopts a computational approach to the study of the cultural evolution of knowledge, determining, in silico, properties of knowledge that artificial agents may obtain. Our ambition is to understand and develop general mechanisms by which a society evolves its knowledge. We consider societies of independent agents representing knowledge and adapting it through interacting with each other. We study the global properties of this local adaptation both experimentally, through multi-agent simulations, and theoretically, through logical models.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #20: cultural evolution, knowledge, belief, evolutionary epistemology, behaviour, society, communication

[KEYWORDS] cultural evolution, knowledge, belief, evolutionary epistemology, behaviour, society, communication

[RESEARCH INTERESTS] A social science perspective on cultural knowledge evolution -- We are investigating the cultural evolution of knowledge and beliefs on a computational basis. We seek to cooperate with scientists trained in social sciences and the humanities offering their specific perspective on this work. Given the transverse position of cultural evolution in all SSH, this may be relevant to various fields. The research may concern social aspects of cultural evolution (sociology, epistemology) or focus on the motivation and individual knowledge and behaviour of agents (cognitive science, psychology) or taking an intermediary position linking knowledge and society (anthropology). Similarly we are open to experimental, observational or theoretical profiles. More details on https://moex.inria.fr/training/2021-PD-ssh-cke.html

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #21: Quantum information, causal structure, quantum computation, quantum control

[KEYWORDS] Quantum information, causal structure, quantum computation, quantum control

[RESEARCH INTERESTS] Both quantum computation and communication are generally considered within a fixed underlying causal framework. By exploiting quantum control systems, however, it is possible to consider more general situations, where the causal structure itself become quantum, leading to effects such as causal indefiniteness. This opens up new possibilities for quantum computation and communication that we are yet to fully understand. Research topics seeking to understand, model and exploit quantum causal structures for quantum information processing are welcome.

[TEAM NAME] QINFO

[DESCRIPTION] The new QINFO group at Inria, led by Omar Fawzi, is bi-localised between Grenoble and Lyon. Its research aims to use quantum information theory to understand the effects of noise on quantum information processing and design new and efficient methods to reduce its effect. This covers, e.g., the characterization of noisy quantum devices, quantum error correction and fault tolerance, and new models of computation in which the effects of noise can be more easily mitigated.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #22: HPC, programming models, task and dataflow, component models

[KEYWORDS] HPC, programming models, task and dataflow, component models

[RESEARCH INTERESTS] Extending existing HPC Programming models to offer a better code composability.

[TEAM NAME] AVALON

[DESCRIPTION] The long term goal of the Avalon team is to contribute to the design of programming models supporting a lot of architecture kinds, to implement it by mastering the various algorithmic issues involved, and by studying the impact on application-level algorithms.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #23: Sparse matrix computations, sparse tensor computations, algorithms, graphs, hypergraphs

[KEYWORDS] Sparse matrix computations, sparse tensor computations, algorithms, graphs, hypergraphs

[RESEARCH INTERESTS] We design, analyse and implement algorithms on sparse matrices, tensors, graphs and hypergraphs. Computations on sparse matrices and tensors form one side of our research. On the other side, we develop algorithms on graphs and hypergraphs to make these computations more efficient. We strive to achieve high performance on both sides of the spectrum. There are currently a few projects ongoing and new ones are being developed. A successful candidate will have opportunities to collaborate with experts in topics such as deep learning, low rank matrix and tensor factorizations, and algorithmic graph and hypergraph theory and experiments.

[TEAM NAME] ROMA

[DESCRIPTION] The ROMA team aims at designing models, algorithms, and scheduling strategies to optimize the execution of scientific applications on High-Performance Computing platforms. One of the research axes of ROMA covers sparse tensor and matrix computations, and associated graph and hypergraph models, and interacts with other axes.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #24: Multi-criteria scheduling algorithms, resilience, edge-cloud platforms

[KEYWORDS] Multi-criteria scheduling algorithms, resilience, edge-cloud platforms

[RESEARCH INTERESTS] We aim at designing multi-criteria scheduling for modern computing platforms. For instance, in edge-cloud platforms, jobs can either be executed locally at the edge of the network, or sent to a centralized cloud platform that can execute them at greater speed. Such jobs may come from e-health or flying drones applications. The problem is to decide where and when to schedule each job. While we have already studied how to minimize the maximum stretch incurred by any job, we plan to investigate other objective functions, such as the energy consumption or the reliability of the execution.

[TEAM NAME] ROMA

[DESCRIPTION] One of the research themes of ROMA is to focus on the design of scheduling strategies that finely take into account some platform characteristics beyond the most classical ones, namely the computing speed of processors and accelerators, and the communication bandwidth of network links. In the scope of this theme, when designing scheduling strategies, we focus either on the energy consumption of applications or on their memory behaviour. All optimization problems under study are multi-criteria. The work of ROMA also strongly focuses on resilience on failure-prone platforms.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #25: Expressive rendering, stylization, visualization, appearance edition, non photorealistic rendering

[KEYWORDS] Expressive rendering, stylization, visualization, appearance edition, non photorealistic rendering

[RESEARCH INTERESTS] As images result from the complex combination of light, material and object surface properties, coherently modifying their appearance in a plausible or stylized way is a very challenging task. We aim at providing intuitive and controllable tools that help users to create and edit images obtained from 3D inputs.

[TEAM NAME] MAVERICK

[DESCRIPTION] The Maverick project-team aims at producing representations and algorithms in the field of Computer Graphics, and more precisely of Photorealistic rendering (efficient accurate light transport & materials), Real-time rendering (high visual complexity in real time), Expressive rendering (automatic or authored stylization, scientific visualization), or transversely, Surface appearance (physical material models, procedural or authored textures, smart brushes), Natural phenomena (simulating light and generating/synthesizing/authoring/rendering elements in natural scenes).

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #26: Photorealistic rendering, materials, BRDF, phase function, light transport

[KEYWORDS] Photorealistic rendering, materials, BRDF, phase function, light transport

[RESEARCH INTERESTS] Efficient physically-accurate rendering is still a challenge: more work is needed to tackle complex light transport modalities (e.g. with transparent or diffusive materials; study of intrinsic properties of linear operators involved in the formalism of light transport; dimensionality reduction techniques; connections to Monte-Carlo approximations of very large matrices), as well as for quality material models (from acquisition and editing to formalization and representation).

[TEAM NAME] MAVERICK

[DESCRIPTION] The Maverick project-team aims at producing representations and algorithms in the field of Computer Graphics, and more precisely of Photorealistic rendering (efficient accurate light transport & materials), Real-time rendering (high visual complexity in real time), Expressive rendering (automatic or authored stylization, scientific visualization), or transversely, Surface appearance (physical material models,

procedural or authored textures, smart brushes), Natural phenomena (simulating light and generating/synthesizing/authoring/rendering elements in natural scenes).

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #27: realtime rendering, LOD, GPU, antialiasing, filtering, Proland, Gigavoxels

[KEYWORDS] realtime rendering, LOD, GPU, antialiasing, filtering, Proland, Gigavoxels

[RESEARCH INTERESTS] Outdoor scenes can be both ultra-large and ultra-detailed, overwhelming both the computation and memory budget. GPUs come with constraints, but also very efficient patterns to be better exploited. We seek to study more representations and algorithms able to manage high complexity at high quality in real-time.

[TEAM NAME] MAVERICK

[DESCRIPTION] The Maverick project-team aims at producing representations and algorithms in the field of Computer Graphics, and more precisely of Photorealistic rendering (efficient accurate light transport & materials), Real-time rendering (high visual complexity in real time), Expressive rendering (automatic or authored stylization, scientific visualization), or transversely, Surface appearance (physical material models, procedural or authored textures, smart brushes), Natural phenomena (simulating light and generating/synthesizing/authoring/rendering elements in natural scenes).

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #28: procedural texture, texture synthesis, vector texture, volumetric texture, animated texture

[KEYWORDS] procedural texture, texture synthesis, vector texture, volumetric texture, animated texture

[RESEARCH INTERESTS] Outdoor scenes can be both ultra-large and ultra-detailed, overwhelming both the computation and memory budget. GPUs come with constraints, but also very efficient patterns to be better exploited. We seek to study more representations and algorithms able to manage high complexity at high quality in real-time.

[TEAM NAME] MAVERICK

[DESCRIPTION] Textures are a key enrichment of surfaces and volumes in details, in both realistic and expressive rendering. A lot more work is required in efficient versatile procedural textures, reproduction of target property or aspects (realistic or artistic), easy editing, including paradoxical requirement when used in painterly rendering or to represent animated fluids, or inverse texture synthesis (to find the procedural process able to reproduce a target texture).

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #29: Goal-Oriented Communications, Molecular communications

[KEYWORDS] Goal-Oriented Communications, Molecular communications

[RESEARCH INTERESTS] I am interested in communication systems that are codesigned with other decision making processes, often known as goal-oriented communications. For example, sensor networks that communicate data for control or biological systems that exchange information via chemical signals (also known as molecular communications) to function. The main tools are drawn from information theory and statistical signal processing. Current models of interest arise in wireless random access systems, decentralized estimation, molecular communication systems, feedback control systems.

[TEAM NAME] MARACAS

[DESCRIPTION] Communication is fundamental to control of Cyber Physical Systems, distributed computation, the organization of large numbers of machines, as well as human-to-human interactions. In MARACAS, we develop theory, algorithms, and experimentation for reliable communication systems to support these aims. We contribute to the development of 5G and beyond, as well as emerging applications including vehicular communications, Cyber Physical systems, and molecular communications. We draw on tools from information theory, statistical signal processing and machine learning. We also host the FIT/CorteXlab testbed.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #30: privacy, data security, information law, user consent

[KEYWORDS] privacy, data security, information law, user consent

[RESEARCH INTERESTS] The PRIVATICS team focusses on privacy and personal data protection, from many different angles: privacy leaks on the web, in smartphones, in IoT connected devices, in wireless networks (Wifi, BLE, UWB, LoraWan), pseudonymisation techniques, privacy preserving ML, end-user information and consent management, automated decision systems understandability, privacy regulation. This list is of course non exhaustive.

[TEAM NAME] PRIVATICS

[DESCRIPTION] Since its creation in 2014, the PRIVATICS project-team of Inria is working on privacy protection in the digital world: on one side, it aims at understanding the privacy research domain and its evolution, both from theoretical and practical aspects, and on the other side with a strong interest in designing and developing privacy-enhancing technologies, tools and systems. The approach taken in PRIVATICS is fundamentally inter-disciplinary and covers theoretical, legal, economical, sociological and ethical aspects by the means of enriched collaborations with the members of these disciplines.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #31: Sketch-based modelling, AI and Animation, Virtual Cinematography, Virtual Actors, Virtual Storytelling, Computer Theater, Computational Aesthetics

[KEYWORDS] Sketch-based modelling, AI and Animation, Virtual Cinematography, Virtual Actors, Virtual Storytelling, Computer Theater, Computational Aesthetics

[RESEARCH INTERESTS] Authoring and Directing Story Worlds. In August 2017, the motto for the ACM Siggraph conference became “Enabling Everyone to Tell Their Stories”. Indeed, narrative contents such as interactive games and animated movies are a major application domain for computer graphics, with implications in entertainment, education, cultural heritage, scientific communication and professional training. In those applications, the creation of 3-D content cannot be limited to the production of shapes and motions; it should also include the necessary steps to organize shapes and motions into compelling stories, using adequate staging, directing and editing. As a result, it becomes essential to conduct research in authoring and directing animated story worlds.

[TEAM NAME] ANIMA

[DESCRIPTION] An important goal in Computer Graphics is to enable artists to “tell their stories”. Towards this goal, the ANIMA team focuses on developing computer tools for authoring and directing animated movies, interactive games and mixed-reality applications, using virtual sets, actors, cameras and lights. This includes dedicated user interfaces for communicating the story; high-level geometric, physical and semantic models that can be manipulated in real-time under the user’s artistic control; and new interaction models for controlling the virtual actors and cameras to communicate the desired story while maintaining the coherence of the story world.

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #32: embedded system, CPS, causality, accountability, explanation, certification

[KEYWORDS] embedded system, CPS, causality, accountability, explanation, certification

[RESEARCH INTERESTS] The objective of this position is to develop techniques to build accountable cyber-physical systems in the sense that a causal explanation of their behaviours can be constructed automatically. We are looking for candidates with a strong background informal methods and at least one of the following domains: - causality, program analysis, static analysis, hybrid systems, runtime verification, or - certification, Coq.

[TEAM NAME] SPADES

[DESCRIPTION] SPADES develops formal methods for embedded systems design by focusing on three key questions: - How to build networked embedded systems as adaptive modular structures? - How to program systems with resource and behavioral constraints on multicore architectures? - How to program reliable and fault-tolerant embedded systems with different levels of criticality?

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Inria MSCA-PF 2024 hosting offer Grenoble-Lyon #33: Machine Learning, Physics-Informed Models, Generalization Guarantees, Mutual Information, Diffusion models

[KEYWORDS] Machine Learning, Physics-Informed Models, Generalization Guarantees, Mutual Information, Diffusion models

[RESEARCH INTERESTS] Physics-informed Machine Learning (PiML) designs machine learning approaches that combine both the information of available knowledge in physics and data. It allows to develop efficient and consistent solutions for modelling of complex and partially known tasks in physics. The area is very active, but theoretical foundations still require further research. We propose to investigate the interest of information theory and mutual information frameworks to develop new theoretical foundations and principled algorithms. One objective is to study the derivation of generalization bounds that can embed the physical knowledge available. Another is to investigate complexity measures or particular quantities for assessing generalization (Rademacher complexity, Lyapunov coefficients, topological information, ...). The last one is to design new algorithms, notably diffusion models based on mutual information for the modelling of self-organization processes studied in the team.

[TEAM NAME] MALICE

[DESCRIPTION] MALICE aims to combine interdisciplinary skills in statistical learning and laser-matter interaction to foster the development of new methodological contributions at the interface between Machine Learning and Surface Engineering. Its members have complementary backgrounds in computer science, applied mathematics and optimization while benefitting from the expertise of physicists of the Hubert Curien lab in modelling ultrashort laser-matter interaction. Surface engineering raises numerous machine learning challenges: (i) a limited access to training data and the availability of only partial knowledge (typically in the form of PDEs), (ii) the need of deriving theoretical guarantees for Physics-informed learning models trained from both data and physical knowledge and (iii) a strong necessity to transfer knowledge from one learned dynamical system to another. On the other hand, the advances carried out in machine learning allow to better understand the physics underlying the mechanisms of laser/radiation-matter interaction, enabling to address numerous societal challenges in the fields of space, nuclear, defense, energy or health.

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Lille Centre

Inria MSCA-PF 2024 hosting offer Lille #1: health, agriculture and ecology, sustainable development

[KEYWORDS] health, agriculture and ecology, sustainable development

[RESEARCH INTERESTS] the research topic of Scool is the study of the sequential decision-making problem under uncertainty. Most of our activities are related to either bandit problems, or reinforcement learning problems. Through collaborations, we are working on their application in various fields, mainly: health, agriculture and ecology, sustainable development.

[TEAM NAME] SCOOL

[DESCRIPTION] Scool is doing research on the general problem of sequential decision making under uncertainty. Research activities span the whole spectrum from fundamental research to applications. Favoured domains of application are health and sustainable development.

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Inria MSCA-PF 2024 hosting offer Lille #2: distributed systems, multi-party interaction, structured interaction, formal methods, BIP, choreography

[KEYWORDS] distributed systems, multi-party interaction, structured interaction, formal methods, BIP, choreography

[RESEARCH INTERESTS] Coordination frameworks, such as BIP and JavaBIP, implement the coordination semantics using centralised engines orchestrating the execution of system components—a significant bottleneck for large systems. Previous attempts at the distributed implementation of BIP systems only partially address this problem. Most importantly, they disregard the inherent structure of BIP connectors considering only sets of flat interactions, defined by a list of components that must all participate in the synchronisation. Eliminating structure from BIP connectors may lead to exponential explosion of the number of such flat interactions. New protocols are needed that would take into account the connector structure, if necessary, relaxing the atomicity of interactions. Beyond BIP, the results could be applied to horeography composition.

[TEAM NAME] SPIRALS

[DESCRIPTION] Spirals is conducting research activities in the domains of distributed systems and software engineering. Spirals aims at introducing more automation in the adaptation mechanisms of software systems, in particular, transitioning from adaptive systems to self-adaptive systems. In this context, Spirals targets three properties: self-healing, self-optimization, and self-protection. With self-healing, Spirals aims at studying and tailoring data mining solutions for the design and implementation of software systems. With self-optimization, Spirals aims at sharing, collecting, and analysing distributed behaviours and data to continuously tailor, optimize,

and keep under working conditions software systems. With self-protection, Spirals aims at automating as much as possible the security of software systems with respect to moving threats.

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Inria MSCA-PF 2024 hosting offer Lille #3: Human-Computer Interaction, Interaction Techniques, Engineering of Interactive Systems

[KEYWORDS] Human-Computer Interaction, Interaction Techniques, Engineering of Interactive Systems

[RESEARCH INTERESTS] We are open to applicants interested in various domains of HCI that could contribute to our team project: e.g., study and design of new interaction techniques and modalities in various applicative and technological contexts (creativity support, mediated collaboration, virtual and augmented reality, etc.), study of the discoverability of the functionalities of an interactive system and acquisition of digital expertise, new software technologies (programming languages, software architectures, toolkits) to design and support advanced interaction.

[TEAM NAME] LOKI

[DESCRIPTION] Our research aims at producing original ideas, fundamental knowledge and practical tools to inspire, inform and support the design of human-computer interactions. We favour the vision of computers as tools to empower people. We are focusing on how such tools can be designed and engineered by investigating how interactive systems has to be revisited along three levels of dynamics of interaction: micro-dynamics (low-level problems such as transfer functions, latency compensation, tactile feedback), meso-dynamics (augmenting the interaction bandwidth and vocabulary) and macro-dynamics (real-time activity monitors and better system adaptability for skills acquisition).

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Inria MSCA-PF 2024 hosting offer Lille #4: Dissipative PDE systems, high-order time-integration scheme, entropy dissipation, Numerical analysis, Simulation

[KEYWORDS] Dissipative PDE systems, high-order time-integration scheme, entropy dissipation, Numerical analysis, Simulation

[RESEARCH INTERESTS] Design, analysis and implementation of high-order time-discretization methods preserving the entry structure of dissipative PDE systems

[TEAM NAME] RAPSODI

[DESCRIPTION] The activity of the team is devoted to the design, the analysis, and the efficient implementation of numerical schemes for dissipative models arising in physics or biology. We particularly focus our attention on the preservation of some physical characteristics at the discrete level: positivity, mass conservation, growth of physical entropies, asymptotic behaviours… We also aim at optimizing the computational cost at a fixed accuracy, by developing high-order schemes, or by means of a posteriori error control. Finally, we adapt the algorithms to the potential industrial constraints, so that they can be incorporated in existing codes.

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Inria MSCA-PF 2024 hosting offer Lille #5: Partial differential equations, Corrosion, Free boundary problem, Numerical analysis, Simulation

[KEYWORDS] Partial differential equations, Corrosion, Free boundary problem, Numerical analysis, Simulation

[RESEARCH INTERESTS] Numerical modelling of corrosion at oxide scale: Corrosion is an irreversible process describing the alteration of a metal by oxidation. We aim to develop numerical methods describing the motion evolution of the oxide layer (geometry, density of charge carriers) that are consistent with thermodynamics. We are interested in the mathematical analysis of the model (PDEs), in its numerical analysis and in its efficient simulation.

[TEAM NAME] RAPSODI

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physical entropies, asymptotic behaviours… We also aim at optimizing the computational cost at a fixed accuracy, by developing high-order schemes, or by means of a posteriori error control. Finally, we adapt the algorithms to the potential industrial constraints, so that they can be incorporated in existing codes.

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MSCA Postdoctoral Fellowships Offers for 2024 at Inria Nancy Centre

Inria MSCA-PF 2024 hosting offer Nancy #1: Gene regulatory networks, Single-cell dynamics, Probabilistic graphical models, Bayesian inference

[KEYWORDS] Gene regulatory networks, Single-cell dynamics, Probabilistic graphical models, Bayesian inference

[RESEARCH INTERESTS] Cells with the same DNA and placed in the same environment can have very different expression levels of their genes, which is at the basis of cellular decision-making processes such as differentiation. A key driver of this variability is the presence of inherently stochastic phenomena at the transcriptional level, highlighting the importance of a probabilistic description of gene expression profiles. In this context, we are interested in reconstructing causal gene regulatory networks from particular dynamic graphs that describe the evolution of statistical dependencies between genes over time.

[TEAM NAME] BIGS

[DESCRIPTION] The BIGS (Biology, Genetics and Statistics) team focuses mainly on stochastic modelling and statistics for methodological purposes, but also aims at a better understanding of biological systems and health phenomena. Its attention is directed towards (1) stochastic modelling, (2) estimation and control of stochastic processes, (3) algorithms and estimation for graph data, and (4) regression and machine learning.

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Inria MSCA-PF 2024 hosting offer Nancy #2: formal verification, model checking, theorem proving, distributed algorithms, TLA

[KEYWORDS] formal verification, model checking, theorem proving, distributed algorithms, TLA

[RESEARCH INTERESTS] We are interested in the formal verification of distributed algorithms expressed at a high level of abstraction in the TLA+ formalism. In particular, our research group contributes to the development of TLAPS, the TLA+ Proof System, an interactive proof assistant that uses different automatic theorem provers, including SMT solvers and superposition-based systems, as back-end provers. Topics of particular interest include (1) efficient encodings of set theory for automatic theorem provers, (2) the integration of symbolic model checking and theorem proving, and (3) the certification of results obtained by an automatic back-end prover through a skeptical proof assistant.

[TEAM NAME] VeriDis

[DESCRIPTION] The VeriDis project aims to exploit and further develop the advances and integration of interactive and automated theorem proving applied to the area of concurrent and distributed systems. The goal of our project is to assist algorithm and system designers to carry out formally proved developments, where proofs of relevant properties as well as bugs can be found fully automatically. We believe that a substantially higher degree of automation can be achieved in system verification over what is available in today's verification tools.

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Inria MSCA-PF 2024 hosting offer Nancy #3: Formal methods, Model checking, Automata theory, security, opacity

[KEYWORDS] Formal methods, Model checking, Automata theory, security, opacity

[RESEARCH INTERESTS] The pervasiveness of cyber-physical systems is highly increasing, raising many safety and security concerns. Formal methods aim at tackling those problems through the verification of formal properties on a model abstracting the real system.

A well-known formal model to reason about timed systems is timed automata, an extension of finite-state automata with continuous clocks measuring time. Our main objective is to study security properties such as opacity for timed automata while including features such as control, parameters and probabilities.
This research has theoretical aspects, as well as applications to cybersecurity.

[TEAM NAME] MOSEL-VeriDis

[DESCRIPTION] The VeriDis project aims to exploit and further develop the advances and integration of techniques to formally verify systems. On the one hand, the team is concerned with developing efficient model checking techniques, notably for quantitative systems (probabilistic automata, timed automata…). On the other hand, the team develops interactive and automated theorem proving applied to the area of concurrent and distributed systems. VeriDis is a team of LORIA (Université de Lorraine, Inria, CNRS), a large laboratory (> 500 members) recognized internationally.

[LINK] https://www.loria.fr/en/research/teams/mosel-veridis/

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Inria MSCA-PF 2024 hosting offer Nancy #4: Multimodal speech, gesture generation, human-machine interaction, machine learning

[KEYWORDS] Multimodal speech, gesture generation, human-machine interaction, machine learning

[RESEARCH INTERESTS] We are interested in studying multimodal speech communication in an Interactional context. Our group is interested in studying the multimodal components (prosody, facial expressions, gestures) used during interaction, both by the speaker and by the interlocutor (the listener). We consider the simultaneous generation of speech and gestures by the speaker. We also consider generating regulatory gestures by the listener, such as signs of understanding, follow-up or approval (mainly head nods, hand and arm gestures, and facial expressions). Modeling and integrating these gestures in a virtual assistant or in a robot and synchronizing them with speech will make the spoken communication more realistic in the context of human-machine interaction.

[TEAM NAME] MULTISPEECH

[DESCRIPTION] The Multispeech project-team considers speech as a multimodal signal with different modalities: acoustic, facial, articulatory, gestural, etc. We focus on the analysis and synthesis of these modalities and on their multimodal dependencies in the context of human-human or human-computer interaction. In particular, we are interested in designing machine learning models and techniques to extract information about the linguistic content, the speaker identity and states, and the speech environment, and to synthesize multimodal speech using limited amounts of labeled data.
The team has three main research axes:
(1) Data-efficient and privacy-preserving learning,
(2) Extracting information from speech signals,
(3) Multimodal speech: generation and interaction.

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Inria MSCA-PF 2024 hosting offer Nancy #5: Multimodal speech, spoken language understanding, dialog manager, NLP, human-machine interaction

[KEYWORDS] Multimodal speech, spoken language understanding, dialog manager, NLP, human-machine interaction

[RESEARCH INTERESTS] Our mid-term goal is to develop an embodied voice assistant that displays realistic spoken communication skills and is easy to use by developers. This calls for research on the following topics:
1) low-resource spoken language understanding (SLU)
We aim to enable developers to quickly set up an SLU system for a new language and domain, with as little data and human input as possible. To do so, we seek to reuse SLU datasets and models for other languages and domains by means of interactive data augmentation and transfer learning.
2) multimodal SLU and dialog management (DM)
In addition to the linguistic facet of human-machine dialog, we aim to analyze speech, facial movements, and gestures to characterize the speaker's intention (e.g., irony), the listener's reaction, and the way the speaker adapts his/her speech according to the listener's reaction. This implies that we break the classical DM scheme to dynamically account for the listener's reaction while the speaker is talking.

[TEAM NAME] MULTISPEECH

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content, the speaker identity and states, and the speech environment, and to synthesize multimodal speech using limited amounts of labeled data.
The team has three main research axes:
(1) Data-efficient and privacy-preserving learning,
(2) Extracting information from speech signals,
(3) Multimodal speech: generation and interaction.

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Inria MSCA-PF 2024 hosting offer Nancy #6: DNN-based hate speech detection using speech signal and text data

[KEYWORDS] DNN-based hate speech detection using speech signal and text data.

[RESEARCH INTERESTS] Hate speech expresses an antisocial behavior. In many countries, online hate speech is punishable by the law. Manual analysis of such content and its moderation are impossible. An effective solution to this problem would be the automatic detection of hate comments. Until now, for hate speech detection, only the text documents have been used. We would like to advance the knowledge about hate speech detection by exploring a new type of document: audio documents.
We would like to develop a new methodology to automatically detect hate speech, based on Machine Learning and Deep Neural Networks using text and audio.

[TEAM NAME] MULTISPEECH

[DESCRIPTION] The Multispeech project-team considers speech as a multimodal signal with different modalities: acoustic, facial, articulatory, gestural, etc. We focus on the analysis and synthesis of these modalities and on their multimodal dependencies in the context of human-human or human-computer interaction. In particular, we are interested in designing machine learning models and techniques to extract information about the linguistic content, the speaker identity and states, and the speech environment, and to synthesize multimodal speech using limited amounts of labeled data.
The team has three main research axes:
(1) Data-efficient and privacy-preserving learning,
(2) Extracting information from speech signals,
(3) Multimodal speech: generation and interaction.

[LINK] https://team.inria.fr/multispeech/

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Inria MSCA-PF 2024 hosting offer Nancy #7: Machine learning, robotics, teleoperation, environmental awareness, adaptive behavior

[KEYWORDS] Machine learning, robotics, teleoperation, environmental awareness, adaptive behavior

[RESEARCH INTERESTS] We are interested in developing intuitive teleoperation for humanoid robots, so that an operator can remotely command the robot to realize a huge variety of complex loco-manipulation tasks (open doors, use appliance, sort objects, repair items, etc).
To do so, we are interested in advancing in the following skills:
1) anticipating the human operator to predict their goals and desired trajectories;
2) learning to transition optimally between teleoperation and autonomy, beyond the classic shared control mechanisms;
3) learning to execute tasks from teleoperated demonstrations;
4) execute complex dynamic tasks without haptic feedback;
5) teleoperating the robot with multimodal interfaces/channels;
6) increasing the operator awareness with more robots, more sensors, or digital twins.
We are seeking motivated and creative collaborators that are motivated to realize experiments with our humanoid robots Talos and Tiago.

[TEAM NAME] LARSEN

[DESCRIPTION] The team Larsen was created in INRIA Nancy on January 1st, 2015.
The team Larsen's vision is to have robots outside of the research labs and manufacturing industries. To reach this goal, the team Larsen is developing methods to endow robots with long-term autonomy and interaction skills, grounded on physical and social interaction, machine learning, and planning under uncertainty. Experiments, especially in service and assistive robotics, are at the core of our methodology.
The team is involved in the European project euROBIN, leading a team participating to a personal robotics competition, where bimanual robots and humanoid robots (Tiago, Talos) must solve every year more and more challenging interaction and manipulation tasks in a house environment.

[LINK] https://team.inria.fr/larsen/

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Inria MSCA-PF 2024 hosting offer Nancy #8: Machine learning, robotics, exoskeletons, adaptive behavior

[KEYWORDS] Machine learning, robotics, exoskeletons, adaptive behavior

[RESEARCH INTERESTS] We are interested in anticipatory adaptive control for active exoskeletons. We seek to model the user's behaviors and movements, considering the context in which the motions are executed, and to use these contextual models to improve the control of the exoskeleton. The objective is to increase user acceptance, reduce the metabolic cost, improve transparency and performance in the assistance.
One the one side, we look for collaborators interested into developing contextual prediction models from wearable and vision sensors, using machine learning techniques. The objective is to have models that run in real-time on wearable computers embedded in the exoskeleton.
On the other side, we look for collaborators that are interested into developing ethically aligned shared control techniques that rely on AI models that are intuitive for the user to tune and understand, making the algorithms usable in realistic settings. The goal is to validate these control techniques with experiments with human participants.

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Inria MSCA-PF 2024 hosting offer Nancy #9: mathematical modelling, data assimilation, data analysis, brain activity

[KEYWORDS] mathematical modelling, data assimilation, data analysis, brain activity

[RESEARCH INTERESTS] We are interested in developing neurostimulation techniques in order to improve the cure of patients suffering from mental disorders. To this end, our aim is to develop dynamic neural models and merging these data to experimentally observed data, such as EEG or BOLD responses. This merge may utilize diverse optimization techniques, such as data assimilation. The latter permits to estimate model parameters adaptively in non-stationary signals, i.e. online in time. A prominent example for a data assimilation technique is Kalman filtering.
More detailed, we are looking for collaborators, who are interested in neural population models describing macroscopic brain activity in pathological brain states under neurostimulation. The mathematical analysis of such models typically yields important insights into the origin of the brain activity. Moreover, the merge with experimental data demands a certain understanding of data analysis techniques to prepare the experimental data and identify correctly good biomarkers. It would be advantageous if the future colleague has some fundamental expertise in this respect. Finally, the perfect future collaborator has already some expertise in parameter estimation techniques, especially in data assimilation.

[TEAM NAME] MIMESIS

[DESCRIPTION] The MIMESIS research team works on a set of scientific challenges in the field of scientific computing, data assimilation, machine learning, and control with the objective of creating real-time digital twins in the medical context. Our main application domains are surgical training, surgical guidance during complex interventions and pre-clinical research in neurostimulation.

[LINK] https://mimesis.inria.fr

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Inria MSCA-PF 2024 hosting offer Nancy #10: distributed systems, collaborative systems, replication, trust, security, user studies

[KEYWORDS] distributed systems, collaborative systems, replication, trust, security, user studies

[RESEARCH INTERESTS] Our vision is to move away from centralized authority-based collaboration towards large scale trustworthy peer-to-peer collaboration where control over the data is given to users who can decide with whom to share their data. Collaboration involves humans and agents that complete joint activities.

Particular topics include:

1. Replication algorithms that maintain consistency of the shared data in the face of concurrent modifications such as CRDTs (Conflict-Free Replicated Data Type – types of data replicated without conflict)
2. Trust assessment of users/agents according to their past behavior in the collaboration.
3. Security mechanisms for distributed collaborative systems without a central authority including an access control to the shared documents, an end-to-end encryption of data and a key management suitable for user dynamic groups
4. Study of long term collaboration in application domains such as software engineering based on collaboration traces and user interviews.

[TEAM NAME] COAST

[DESCRIPTION] Team COAST works on distributed collaborative systems that enable distributed group work using computer technologies. Designing such systems require an expertise in distributed systems and computer-supported cooperative work. Besides theoretical and technical aspects of distributed systems, design of distributed collaborative systems must take into account the human factor to offer suitable solutions for users. Currently the team coordinates one project with HIVE company (https://www.hivenet.com/) that aims to propose an alternative peer-to-peer cloud which provides both computing and data storage via a peer-to-peer network rather than from a centralised set of data centers. It also coordinates one of the axes of the PEPR project eNSEMBLE (https://www.lri.fr/~mbl/eNSEMBLE/home.html). In order to support French and European sovereignty over digital services infrastructure, eNSEMBLE will redesign the entire stack of digital services from the underlying infrastructure to user interface by integrating open and interoperable collaborative functionalities.

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