UNIVERSITÉ CÔTE D'AZUR | INTERDISCIPLINARY INSTITUTE FOR ARTIFICIAL INTELLIGENCE 3IA CÔTE D'AZUR

Our website

COLLABORATE WITH 3IA CÔTE D'AZUR RESEARCHERS

Axis 1 – Core elements of AI

Charles BOUVEYRON
Université Côte d'Azur, 3IA Chairholder

Generative models for unsupervised and deep learning with complex data

We focus on learning problems that are made difficult by real-world constraints, such as unsupervised deep learning, choosing a deep architecture for a given situation, learning from heterogeneous data or in ultra-high-dimensional scenarios. We seek to develop deep generative models, encoding sparsity priors, to address those issues.
https://math.unice.fr/~cbouveyr/

Elena CABRIO
Université Côte d'Azur, 3IA Chairholder

AI and natural language

The goal of my research is to design debating technologies for advanced decision support systems, to support the exchange of information and opinions in different domains (as healthcare and politics), leveraging interdisciplinarity and advances in machine learning for Natural Language Processing.
https://www-sop.inria.fr/members/Elena.Cabrio/

Fabien GANDON
Inria, 3IA Chairholder

Combining artificial and augmented intelligence technics on and through the web

Formalizing knowledge-based models and designing algorithms to manage interactions between different forms of artificial intelligence (e.g. rule-based, connectionist, and evolutionary) and natural intelligences (e.g. individual user, and crowd) on the web.
http://www-sop.inria.fr/members/Fabien.Gandon/

Marco LORENZI
Inria, 3IA Chairholder

Interpretability and security of statistical learning in healthcare

Statistical learning in healthcare must ensure interpretability and compliance with secured data access. To tackle this problem, I will focus on 1) interpretable biomedical data modeling via probabilistic inference of dynamical systems, and 2) variational inference in federated learning for the modeling of multicentric brain imaging and genetics data.
https://marcolorenzi.github.io/

Pierre-Alexandre MATTEI
Inria, 3IA Chairholder

Deep learning for dirty data: a statistical perspective

The successes of machine learning remain limited to clean and curated data sets. By contrast, real-world data are generally much messier. We work on designing new machine learning models that can deal with "dirty" data sets that may contain missing values, anomalies, or may not be properly normalized. Collaborators include doctors and astronomers.
https://pamattei.github.io/

Emanuele NATALE
CNRS, 3IA Chairholder

Neural network sparsity and applications

We investigate interdisciplinary challenges spanning machine learning, computational neuroscience, and theoretical computer science. Our research addresses neural network sparsification, modeling brain organization, and understanding multi-agent systems. We develop algorithmic tools and mathematical frameworks to explore these areas, including the Assembly Calculus for cognitive processes and computational dynamics for distributed systems. We also apply our methodologies to theoretical biology, studying collective behaviors in biological systems.
https://www.i3s.univ-cotedazur.fr/~natale

Giovanni NEGLIA
Inria, 3IA Chairholder

PERUSALS: Pervasive Sustainable Learning Systems

PERUSALS (Pervasive Sustainable Learning Systems) seeks to identify design principles of Internet-scale distributed learning systems, with a focus on the tradeoff between performance (in particular training and inference times), economic and environmental costs, and privacy.
http://www-sop.inria.fr/members/Giovanni.Neglia/

Xavier PENNEC
Inria, 3IA Chairholder

Geometric statistics and geometric subspace learning

We study the impact of topology (singularities) and geometry (non-linearity) of the data and model spaces on statistical learning, with applications to computational anatomy and the life sciences. The tenet is that geometry is critical when learning with limited resources and real-world constraints such as small data and limited computational resources.
http://www-sop.inria.fr/members/Xavier.Pennec/

Jean-Charles REGIN
Université Côte d'Azur, 3IA Chairholder

Decision intelligence

We are designing explainable decision-making processes satisfying real world constraints in a multi-objective environment including incomplete, fuzzy or stochastic data.
http://www.constraint-programming.com/people/regin/

Samuel VAITER
CNRS, 3IA Chairholder

BOGL: Bilevel optimization for graph learning

The goal of the project BOGL is to bring together the methodology of bilevel optimization and graph machine learning. We seek to develop new algorithms to handle task on graphs such as graph classification, link prediction, community detection, taking into account the non-Euclidean aspects of the data.
https://samuelvaiter.com/

Vincent VANDEWALLE
Université Côte d'Azur, 3IA Chairholder

Finding structures in heterogeneous data

We study heterogeneous data both in their kind and in their distribution. Our ambition is to discover structures in the data that will help the user in understanding it and taking decisions. We focus on designing generative models able to reveal several clustering viewpoints and we will adapt them to the deep-learning setting. We collaborate with doctors and retailers.
https://vvandewa.github.io/

Serena VILLATA
CNRS, 3IA Chairholder

Artificial argumentation for humans

The goal of my research is to design and create intelligent machines with the ability to communicate with, collaborate with, and augment people more effectively. To achieve this challenging goal, intelligent machines need to understand human language, emotions, intentions, behaviors, interact at multiple scales, and be able to explain their decisions.
https://webusers.i3s.unice.fr/~villata/Home.html

Mathieu CARRIERE
Université Côte d'Azur, 3IA Fellow

TopMoDaL: Multiparameter topological data analysis for Machine Learning Models and data sets

The central tenet of the TopMoDaL project is that multiparameter topological data analysis (mTDA) has the potential to become an important asset for most standard machine learning (ML) models and pipelines. The aim of the project is to drastically improve the predictive and/or generative powers of ML models by providing both new descriptors and new regularization and monitoring tools from mTDA, that can be applied on many types of complex data.
https://www-sop.inria.fr/members/Mathieu.Carriere/

Frédéric GIROIRE
CNRS, 3IA Fellow

Integrating AI into Network Solutions: Exploring Privacy, Security, and Energy Efficiency

One of the main objectives of my research project for the next few years is to explore how artificial intelligence techniques can be used to revisit classical and current network problems. I have a special interest for privacy and security, in particular of federated learning models (related to the emerging topic AI for cybersecurity), and for the study of energy efficiency and frugality of information systems (related to the emerging topic AI for the environment). https://www-sop.inria.fr/members/Frederic.Giroire/

Axis 2 – AI for integrative computational medicine

Nicholas AYACHE
Inria, 3IA Chairholder

AI for e-patients and e-medicine

We design and exploit modern AI methods: (i) to personalize the parameters of advanced models of the e-patient, (ii) to drive e-medicine algorithms on personalized e-patients (i.e., digital twins) for automated diagnosis, prognosis and therapy, in an efficient, robust, safe and explainable manner.
http://www-sop.inria.fr/members/Nicholas.Ayache/ayache.html

François BREMOND
Inria, 3IA Chairholder

Video analytics for human behavior understanding

Video analytics enables us to measure objectively the behavior of humans by recognizing their everyday activities, their emotion, eating habits and lifestyle. Human behavior can be modeled by learning from a large quantity of data from a variety of sensors to improve and optimize, for instance, the quality of life of people suffering from behavior disorders.
http://www-sop.inria.fr/members/Francois.Bremond/

Hervé DELINGETTE
Inria, 3IA Chairholder

Joint biological and imaging biomarkers in oncology

We exploit joint information from imaging and biological data to improve the diagnosis and treatment planning, focusing on lung cancer. This approach relies on methods involving unsupervised deep learning, uncertainty quantification, sparse Bayesian feature selection and the handling of confounding factors.
http://www-sop.inria.fr/members/Herve.Delingette/

Olivier HUMBERT
Université Côte d'Azur / CHU Nice, 3IA Chairholder

Comprehensive omics profiling for precision medicine in oncology

I am combining various patient extracted "omics" data, including multimodal imaging features, for integrative and data-driven computational medicine. I focus on challenging fields in oncology such as (i) radiogenomics and outcome-focused research in metastatic breast cancer and (ii) the accurate prediction of response to immunotherapy.
http://ibv.unice.fr/research-team/humbert/

Juliette RAFFORT-LAREYRE
CHU Nice, 3IA Chairholder

Applications of AI for patients with vascular diseases

Our team develops AI-derived applications for patients with vascular diseases including aortic aneurysm. We aim to create aid-decision support systems to enhance evidence-based decision and precision medicine through a translational approach including: identification of biomarkers, automatization of vascular imaging analysis, development of predictive scores using machine learning.
https://www.linkedin.com/in/juliette-raffort-lareyre-a7546bb8/

Maxime SERMESANT
Inria, 3IA Chairholder

AI and biophysical models for computational cardiology

The application of AI in healthcare is challenging due to its lack of robustness and explainability. This project aims to introduce physiological priors in AI through biophysical models. This can be done by reformulating problems through such models, by learning spatiotemporal dynamics from biophysics or by augmenting features and data with such simulations.
https://team.inria.fr/epione/en/team/maxime-sermesant/

Vicente ZARZOSO
Université Côte d'Azur, 3IA Chairholder

Ablation: Artificial Intelligence for patient-centered atrial fibrillation ablation

Atrial fibrillation is the most common sustained arrhythmia in clinical practice and remains the last great frontier of cardiac electrophysiology. The project aims to put forward new AI techniques to help cardiologists perform more effective patient- tailored catheter ablation procedures to treat this challenging cardiac condition.
https://www.i3s.unice.fr/~zarzoso/

Maria A. ZULUAGA
EURECOM, 3IA Chairholder

Learning-based Models in Medical Imaging: Closing the Gap towards Clinical Translation

We aim to close the gap hindering the translation of AI systems into clinical practice. To this end, we develop novel AI tools for healthcare that 1) learn incrementally as data become available, 2) generalize across multi-modal data and 3) perform quality control of a model and can generate alerts when a decreased in performance is detected.
https://www.eurecom.fr/fr/people/zuluaga-maria

Marc-Olivier GAUCI
Université Côte d'Azur / CHU Nice, 3IA Fellow

Global approach to research, development, and global deployment of digital solutions in surgery, with osteoarticular surgery and traumatology as a use case

The theme developed by Dr. Gauci revolves around computational and augmented medicine & surgery using artificial intelligence tools and the reuse of healthcare data. Digital surgery merges two complementary aspects: 1/ Computational surgery, which is fed by patient and imaging data, enabling the creation of 3D/4D geometric and biomechanical models to simulate and plan surgery before it is performed. 2/Augmented surgery, which is based on a more or less complex digital model and enables planning to be applied using intraoperative assistance and guidance tools such as 3D printing (model, instrumentation, implant), navigation, robotics or mixed reality including collaborative cloud platform.
https://institut-universitaire-locomoteur.chu-nice.fr/docteur-gauci-marc-olivier-1997/

Jean-Pierre MERLET
Inria, Emeritus 3IA Chairholder

Non-invasive assessment of disabilities

We use mathematical/AI methods for (i) designing non-intrusive and affordable monitoring/assistance devices that are adaptable to the user's/doctor's needs, (ii) deducing medically pertinent health-indicators from the data, taking into account measurement errors, and (iii) detecting rare events that may be the sign of emerging pathology.
https://www-sop.inria.fr/members/Jean-Pierre.Merlet/merlet.html

Axis 3 –AI for computational biology and bio-inspired AI

Pascal BARBRY
CNRS, 3IA Chairholder

Human lung atlas

The project elaborates on state-of-the-art approaches in genomics and cell biology to describe complex biological samples at the single-cell resolution. Multidimensional biological experiments result in large scale descriptions of DNA, RNA and protein expressions that can be integrated in time and space. The project aims at: (1) developing novel data-mining approaches based on machine learning and AI: (2) apply them to the study of the normal and pathological lung, in the context of serious threats that touch this organ (COVID-19, asthma, cystic fibrosis, cancer, etc.).
https://www.ipmc.cnrs.fr/cgi-bin/site.cgi?page=barbry

Laure BLANC-FERAUD
CNRS, 3IA Chairholder

Imaging for biology

Recent advances in microscope technology provide outstanding images that allow biologists to address fundamental questions. This project aims at developing new AI methods and algorithms for (i) novel acquisition setups for super resolution imaging, and (ii) extraction of valuable quantitative information from these large heterogeneous datasets.
https://www.i3s.unice.fr/~blancf/

Frédéric CAZALS
Inria, 3IA Chairholder

AIMS: Artificial intelligence for molecular studies

By learning essential features of proteins and their complexes, we shall deliver biologically relevant information for large molecular systems on biologically relevant time scales, leveraging our understanding of biological functions at the atomic level, and providing key inputs for protein design and engineering, and protein interaction networks.
https://team.inria.fr/abs/team-members/homepage-frederic-cazals/

Benoît MIRAMOND
Université Côte d'Azur, 3IA Chairholder

Bio-inspired AI from neurosciences to embedded autonomous devices

The research project seeks to draw on the structure and function of the biological brain to develop more energy-efficient AI methods and algorithms. The scientific approach ranges from neural dynamics to the emerging cognitive properties of these networks and ultimately to the design of embedded neuromorphic electronic circuits. The project will focus on building bridges between the NeuroMod neuroscience institute and the 3IA Cote d'Azur institute.
http://sites.unice.fr/site/bmiramond/Perso/

Ellen Van Obberghen-Schilling
Inserm, Emeritus 3IA Chairholder

AI-powered analysis of the tumor microenvironment

Our project will integrate tissue imaging modalities and artificial intelligence-based analysis tools for a deeper understanding and control of cancer, targeting tumor microenvironment and on the role of the extracellular matrix (ECM) in carcinoma progression, spread and response to therapy.
https://www.linkedin.com/in/ellen-van-obberghen-schilling-151b162b/

Axis 4 - AI for smart and secure territories

Pierre ALLIEZ
Inria, 3IA Chairholder

3D modeling of large-scale environments for the smart territory

We are exploring the generation of 3D models from raw measurement data such as 3D point clouds. We explored a progressive shape reconstruction method, a supervised learning approach to detect sharp features in 3D point clouds and a novel clustering method for variational shape reconstruction method based on quadric error metrics. We are currently exploring a novel approach with capability to embed a differentiable version of 3D Voronoi diagrams - via a deep learning architecture - into a generative deep network.
https://team.inria.fr/titane/pierre-alliez/

Elena DI BERNARDINO
Université Côte d'Azur, 3IA Chairholder

Territorial Security through environmental risks management

This project deals with risk assessments related to environmental extreme events. Analyses and predictions of floods, summer heatwaves, and storms are significant questions facing statisticians and risk assessors. Such environmental risks are the result of a long chain of casualties, involving several aleas, often correlated, with complex spatio-temporal dependent structures among extremes. Our contributions in the prevention and management of environmental risks, will be twofold: 1/ Proposing novel and realistic definitions of risks indicators in environmental contexts. 2/ Studying in-depth their statistical inference, i.e. specifying more accurately the associated uncertainties. In this project, the skills required to handle the modeling of these uncertainties are stochastic processes and random fields, spatio-temporal models, multivariate extreme theory, as well as practical expertise on spatial and environmental data gathered from firms in 3IA Côte d'Azur
https://math.unice.fr/~elenadb/

David GESBERT
EURECOM, 3IA Chairholder

Internet of Learning Thing, a machine learning approach to future IoT networks

In this chair, we develop cooperative forms of decision making, that can be implemented on distributed IoT devices, and not relying on the assumption that all data is centralized in the cloud. IoT devices can learn to coordinate with each other in their usage of the wireless spectrum, energy, and other resources while dealing with arbitrary noise uncertainties in their observation data. Cooperative machine learning will bring a profound evolution in IoT system design, both at the level of radio access, as well as in the manner services will be orchestrated and how resources will be allocated.
https://www.eurecom.fr/cm/gesbert

Paola GOATIN
Inria, 3IA Chairholder

Data driven traffic management

This project aims at contributing to the transition to intelligent mobility management practices through an efficient use of available resources and information, fostering data collection and provision. We focus on improving traffic flow on road networks by using advanced mathematical models and statistical techniques leveraging the information recovered by real data. We are committed in creating a network of local stakeholders sharing knowledge and expertise.
http://www-sop.inria.fr/members/Paola.Goatin/

Ezio MALIS
Inria, 3IA Chairholder

Autonomous robotic systems in dynamic and complex environments, including collaboration between robots and interaction with humans

His research program revolves around the themes of robust perception for the reliable interaction of autonomous robotic systems with complex dynamic environments. My objective is the design of a system composed of several robots, endowed with autonomy, which uses information from heterogeneous sensors in order to evolve in a complex dynamic environment for monitoring applications. My research is therefore in line with the 3IA institute's Axis 4 - AI for smart and secure territories and also connected with the emerging topics of interest AI for earth observation and AI for the environment.
https://team.inria.fr/acentauri/ezio-malis/

Melek ÖNEN
EURECOM, 3IA Chairholder

Privacy-preserving machine learning

Machine learning has become popular due to cloud computing technology and the increasing number of datasets. Outsourcing computations poses a risk to data privacy. Therefore, our goal is to explore privacy-preserving variants of machine learning techniques while leveraging novel cryptographic methods.
https://www.eurecom.fr/fr/people/onen-melek

Paolo PAPOTTI
EURECOM, 3IA Chairholder

Large Language Models for structured data

We focus on addressing the limitations of Large Language Models (LLMs) in handling structured data, which hinders their adoption for data-centric tasks like analyzing large tabular datasets. We aim to develop novel frameworks and architectures for encoding structured data into LLMs, thereby enabling complex table understanding capabilities in pre-trained models.
http://www.eurecom.fr/~papotti/

Cédric RICHARD
Université Côte d'Azur, 3IA Chairholder

Distributed dark fiber optic sensing for smart cities monitoring

Optical fiber, in addition to being a means of transmitting information, is also a material that is very sensitive to environmental variations. When a laser light pulse travels through an optical fiber, it interacts with tiny impurities in the material and optical backscattering occurs. The round-trip time of the light provides the locations of interactions and allows us to infer a backscattering profile along the fiber. Processing this response provides estimates of the local variations in temperature, deformation or acoustic pressure along the fiber. This technique, called Distributed Fiber Optic Sensing (DFOS), is currently experiencing growing interest. The goal of our project is to develop a breakthrough framework for smart cities monitoring based on DFOS over existing dark fibers, and Artificial Intelligence.
http://www.cedric-richard.fr/

Marina TELLER
Université Côte d'Azur, 3IA Chairholder

DL4T: Deep law for tech

The DL4T team is building the legal framework for deep technologies. Starting from the observation that law is often perceived as a force of resistance to innovation, we want to position our research upstream of technology, to support the emergence of technical standards and to promote a convergence between law and AI.
https://droit.univ-cotedazur.fr/dl4t-1