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ACADEMY OF EXCELLENCE

NETWORKS, INFORMATION, AND DIGITAL SOCIETY

Activity Report 2021

ACADEMY OF EXCELLENCE

"NETWORKS, INFORMATION AND DIGITAL SOCIETY"

ACTIVITY REPORT

2021

> INTRODUCTION

The Academy of Excellence "Networks, Information and Digital Society" (RISE) unites 190 researchers and faculty from 10 different digital science laboratories. Its objectives are to support the emergence of innovative and ambitious research projects, to encourage transdisciplinarity and to strengthen the outreach of Université Côte d'Azur, both locally and internationally.

The researchers of the RISE Academy community cover a wide spectrum of expertise ranging from electronics to information technologies, including networks, digital sciences, management, economics and digital law. Among these themes, the Academy has three main research goals:

- To design and experiment with the communication networks of the future. High-performance networking combined with security and energy efficiency aspects. Virtualized distributed applications designed for the processing of large volumes of distributed data.
- To develop digital sciences to model, simulate and experiment. Modeling and simulation of problems in the physical, biological, and medical fields. Extraction from large databases of structured information and knowledge open to semantic processing and interpretation.
- To improve understanding of the transformation brought about by the digitization of society. Especially the impact of technological innovation and the role of physical artifacts in this transformation as well as the impact of its use on e-learning, on society and on citizens.

The year 2021 was disrupted by the health crisis due to the Covid-19 pandemic, but it was also marked by the end of the probationary period that led to the permanent extension of the IDEX UCA^{JEDI} program. Despite these exceptional conditions, the RISE Academy was able to maintain its course by pursuing actions aimed at increasing its excellence and scientific competitiveness in the themes within its scope and by playing a key role in encouraging the emergence of ambitious and disruptive projects.

> RISE ACADEMY ACTIONS IN 2021

FUNDING FOR POSTDOCTORAL FELLOWSHIPS

The RISE Academy used its 2021 resources to contribute to scientific excellence within its scope through the funding of postdoctoral fellowships.

> 2 post-doctoral researchers recruited and one co-funded

> Call for postdoctoral proposals

As part of the call for postdoctoral projects launched in 2021, two postdoctoral researchers were recruited and will begin their contract in February 2022. The main selection criteria concerned the candidate's scientific excellence, the originality and quality of the submitted research project, and coherence of the research topic with the research themes of the RISE Academy.

Vinay Kumar Bindiganavile Ramadas defended his doctoral thesis in December 2021 at the Indian Institute of Science. His one-year contract has started on February 1, 2022, to work on geometric random graphs and more specifically on the detection of communities on these graphs. This topic with potential repercussions in several fields of application includin collaborative networks and ad hoc networks is central to the themes of the RISE Academy and breaks with existing work. Vinay Kumar is supervised by Konstantin Avrachenkov from project-team Inria NEO.

The second successful candidate in this call, Anaïs Ollagnier, will continue her research with the Wimmics Inria/I3S team under the supervision of Serena Villata and Elena Cabrio. Her research addresses the detection of hate speech towards communities on social networks. In addition to the excellence of this candidate's profile, this highly transdisciplinary research project that combines computer science, sociology and language studies caught the attention of the RISE Academy. The obvious societal impact of this project also meets one of the objectives of the RISE Academy, which is to improve the understanding of the transformation brought by the "digitalization" of society.

> Co-funding of a postdoctoral fellowship « Make Our Planet Great Again »

The RISE Academy has contributed €20K in co-funding to allow a postdoctoral student to join the "Make Our Planet Great Again" project. Effrosyni Doutsi was recruited to work on energy-efficient neuromimetic video compression systems, under the supervision of Marc Antonini (I3S-CNRS).

> RISE Academy / DS4H Graduate school call for research proposals

The RISE Academy and the Digital Systems for Humans Graduate School (EUR DS4H) issued a joint call for proposals aimed at supporting a research project with an excellent scientific quality, both in terms of originality and technical feasibility. The winner of the call will receive funding for 36 months of doctoral research from EUR DS4H and 12 months of postdoctoral research from the RISE Academy.

The **CubAnt project** submitted by Fabien Ferrero, of the Electronics, Antennas and Telecommunications Laboratory (LEAT) was awarded the grant. The CubAnt project aims to develop an intelligent, reliable and efficient UHF antenna for a 1U to 3U CubeSat by combining an advanced antenna design, an innovative multi-port feeding mechanism and optimized modeling. This project should contribute to the launch of the first UCA satellite, Nice Cube, in 2025, that will serve as a technological platform to demonstrate and promote the innovations developed at Université Côte d'Azur. The thesis completed as part of this project focuses on the design of a reconfigurable and integrated antenna for a CubeSat. The postdoctoral research project should involved the development of a flexible, robust, and low-energy front-end system for CubeSat. Due to the difficulty of recruiting, this project finally benefited only from the doctoral thesis funding.

EQUIPMENT FUNDING

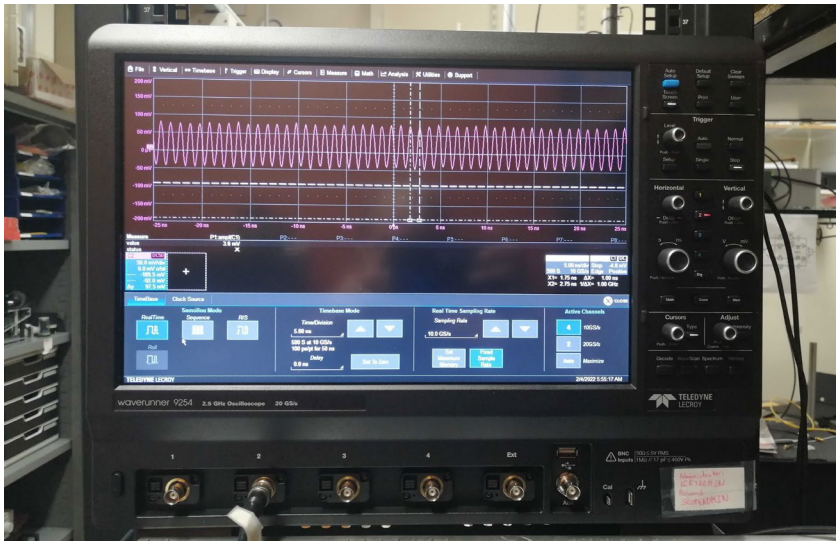
To help upgrade the scientific and technical equipment of its laboratories and thereby maintain the scientific competitiveness of the research teams within the scope of the RISE Academy, a call for proposals was issued in April 2021 with the aim of funding new equipment.

> Eight teams shared a budget of €117,081

> Project « High-throughput Hybrid Quantum Information » (IQHYD)

The High-throughput Hybrid Quantum Information (IQHYD) project from Institut de Physique de Nice aims to create a hybrid network capable of processing quantum information at high speed. The ultimate goal is to create the telecommunication networks of the future capable of preventing security problems within a quantum Internet. The IQHYD project proposes innovative solutions for generating, distributing and detecting the photonic states needed for setting up such a network. This includes the characterization of photonic states that allow high-speed quantum communications.

The funding granted by the RISE Academy served for the purchase of a **high-bandwidth oscilloscope** for analyzing the signals generated by the precision detectors used for detecting photonic states.



> Project « SophiaNode : programmable 5G platform »

The project SophiaNode: programmable 5G platform from project-team Inria DIANA is part of the implementation of a European research infrastructure in the digital field called SLICES. The aim of this platform is to provide the infrastructure for experimenting with future-generation cellular wireless communication protocols and for testing and developing new applications that require bandwidth and/or require very low latency times.

The RISE Academy contributed to the development of the SophiaNode platform via the purchase of the **programmable switch** needed to obtain the bandwidth required for the deployment of the various 5G+ scenarios.

> Project « Federated Learning » (FLE)

The Federated Learning project from project-team Inria NEO aims to develop algorithms to distribute learning in such a way as to guarantee the efficient use of all available resources, while maintaining the quality of the final model. This project is perfectly in line with the ambitions of the RISE Academy: it aims to develop skills in digital sciences through the implementation of tools that extract, from large masses of data, structured information and knowledge open to semantic processing and interpretation.

To help develop these algorithms, the RISE Academy has provided funding for the purchase of a **GPU node**.

> Project « Software Defined Network » (SDN)

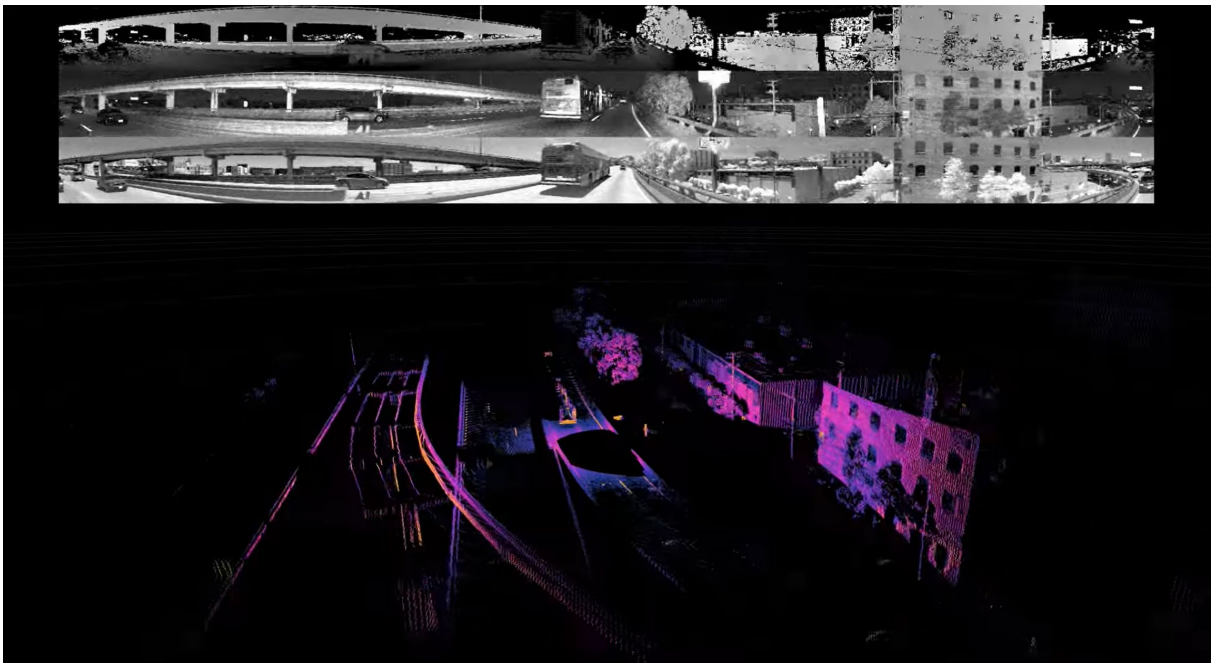
The RISE Academy has contributed to the purchase of a **smart switch** (SDN) and a **server** with a 4th generation PCI bus for the purpose of updating the network configuration of the SDN cluster of the Computer Science, Signals and Systems laboratory of Sophia Antipolis (I3S) and to achieve a 100 Gbps configuration on two ports simultaneously.

These new high-performance and flexible devices will be used for tests that allow traffic control at any level of the network: server OS core, SDN network card or SDN switch. This update will address the problems that arise when designing communication networks for the future.

> Project Sophia360

The RISE Academy has been asked to contribute to the development of a new autonomous vehicle prototype with a capacity for perception and high-performance calculation that will offer greater precision when the autonomous vehicle interacts in urban areas in the presence of people.

Funding was provided for a **LIDAR 360° OS2-128 sensor** for the instrumentation of the vehicle. This sensor will contribute to the goal of the Sophia360 project from project-team Inria ACENTAURI which is to map Sophia Antipolis in 3D. The long-term goal is to create annotated databases at the scale of the technology hub and a wider map of the region for autonomous navigation and for the analysis of road user behavior.



> Project « Neuromorphic Information Processing Platform » (NIPP)

The NIPP project from I3S Laboratory, in association with the LEAT, aims to set up a shared platform for processing neuromorphic information. The equipment funded by the RISE Academy (**neuromorphic computer, event sensors, host server and PoE network switch**) will contribute to the development of new information processing paradigms, which mimick the biological functioning of the retina by generating events asynchronously when significant changes occur in the pixel intensity of the image.

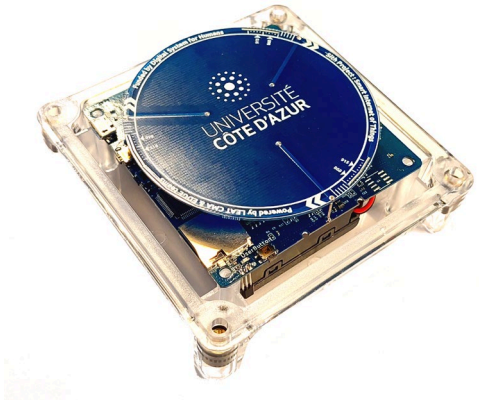
Combined with the neuromorphic computer, also operating on an asynchronous basis, the equipment will allow high-efficiency calculations while reducing energy consumption.

The main application targeted by the platform will be the high-level understanding of visual information, which is one of the most complex and richest types of unstructured data.

> Project « Smart Internet of Things » (SITH)

With the significant rise of connected objects, the Smart Internet of Things project from the LEAT seeks to develop solutions to integrate intelligence into end devices using low-power microcontroller units. This involves solving real-time computing, power consumption and memory footprint issues on these resource-constrained devices.

In order to support its deployment on a network of microcontroller-based devices and carry out a detailed study of the models and their implementation on low-power devices, the RISE Academy contributed to the purchase of a large quantity of **communicating sensor nodes** with Edge AI capabilities.



> Project « Internationalization, Competitiveness and Networks » (INCORE)

The Internationalization, Competitiveness and Networks project from the GREDEG aims to develop research based on very large databases that allow scrutiny of ongoing industrial restructuring and the resilience of our industries to different shocks (competitiveness shock, technological shocks, and today's pandemic) at both a very detailed level (companies, workers, products, patents, etc.) and on a large scale.

This econometric research is associated with the modeling of complex systems which make it possible to understand the effects of the propagation of shocks in interdependent economic systems.

To move ahead with this research, the RISE Academy has provided funding for the purchase of **individual licenses** for specific data analysis and modeling software for the team's researchers.

SCIENTIFIC OUTREACH

To encourage scientific and personal interaction within its community and to create opportunities for sharing intellectual achievements, the RISE Academy has organized and funded several scientific events within its scope.

> 10 scientific events in 2021

> Quantum@UCA Day

As soon as the sanitary conditions allowed gatherings again, the RISE Academy organized a one-day scientific event on an emerging theme for Université Côte d'Azur: quantum research. The "Quantum Photonics and Information" team of Sébastien Tanzilli is one of the university's research team, and it is already strongly established and recognized in the field of quantum communications. The university therefore wants to develop this strategic theme by involving researchers from other laboratories. The RISE Academy plays a key role in promoting this university strategy.

The Quantum@UCA Day was organized in a hybrid format on July 12, 2021. It involved about 40 researchers from different Université Côte d'Azur teams with links to quantum research. The objective of the event was to make an inventory of the teams working on the subject at Université Côte d'Azur and to find new teams potentially interested in developing other aspects of research relating to this field.

> Forum Numerica Scientific Seminars

In 2021, the RISE Academy continued to regularly organize the Forum Numerica, one-hour scientific seminars where researchers from Université Côte d'Azur, France and abroad give presentations in various fields of digital sciences.

Six Forum Numerica seminars were organized in 2021. These regularly scheduled events help maintain scientific interaction and collaboration within the entire community of RISE Academy researchers.

- Erwan Le Merrer (Inria Rennes-Bretagne Atlantique) : The Bouncer and the Boundary: Modern Decision-Making Algorithms and Their Explanations,, 14/01/21
- Erol Gelenbe (Institute of Theoretical and Applied Informatics, Polish Academy of Sciences) : The Cognitive Packet Network for QoS, Energy and Security, 28/01/21
- Jean-Pierre Darnis (Centre de la Méditerranée Moderne et Contemporaine, Université Côte d'Azur) : La souveraineté technologique européenne, émergence d'un concept et présentation des enjeux, 22/04/21
- Isabelle Mejean (Centre for Economic Policy and Research, Sciences Po Paris) : Firm-to-firm trade networks, 16/09/21
- Dr Pedro Casas (Austrian institute of Technology) : AI4SEC - Enhancing Cybersecurity through AI/ML, 28/09/21
- Pr J.-S. Bergé (Institut Universitaire de France) : The role of a priori in various disciplines: proposal for a dialogue between law and computer science, 23/11/21

> Support for the organization of conferences

As part of its recurring Scientific event actions, the RISE Academy contributed funds for three conferences in 2021 and one conference scheduled for 2022:

- Conference on creativity in the field of teaching and mediation, in Nice, March 2021.
- International Symposium on Biomedical Imaging, in Nice, April 2021.
- The French Computer Graphics Days, in Nice, November 2021.
- Web Audio Conference, in Cannes, July 2022.

> KEY FIGURES

OVERVIEW		
Number of laboratories	**10**	
Number of researchers/faculty	**190**	
Number of research projects funded in 2021	**11**	**257 081 €**
Number of scientific events funded within the "Scientific Event" category	**4**	**10 000 €**
Number of Forum Numerica seminars	**6**	**-**
Number of scientific days	**1**	**-**

BREAKDOWN PER ACTION				
Project Name	**Project Leader**	**Leader Laboratory**	**Amount**	**Funded Action**
RISE Post-doc-2021 Call			**Total Amount = 120 000 €**	
Clustering in Random Geometric Graphs	Konstantin Avrachenkov	Inria	60 000 €	One-Year Post-doc
Vers une caractérisation du discours de haine porté à l'égard de communautés sur les réseaux sociaux	Serena Villata	I3S	60 000 €	One-Year Post-doc
Post-doc co-funding			**Montant total = 20 000 €**	
MOPGA	Marc Antonini	I3S	20 000 €	Post-doc
RISE Equipment-2021 Call			**Montant total = 117 081 €**	
IQHYD	Jean Etesse	INPHYNI	19 875 €	Purchase of equipment
SophiaNode	Thierry Turletti	Inria	13 500 €	Purchase of equipment
FLE	Giovanni Neglia	Inria	19 055 €	Purchase of equipment
SDN	Guillaume Urvoy-Keller	I3S	10 566 €	Purchase of equipment
Sophia360	Philippe Martinet	Inria	17 855 €	Purchase of equipment
NIPP	Jean Martinet	LEAT	19 870 €	Purchase of equipment
SITH	Laurent Rodriguez	LEAT	8 860 €	Purchase of equipment
INCORE	Flora Bellone	GREDEG	7 500 €	Purchase of equipment

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