



CNRS THEMATIC REPORTS

**ARTIFICIAL
INTELLIGENCE
AT CNRS**

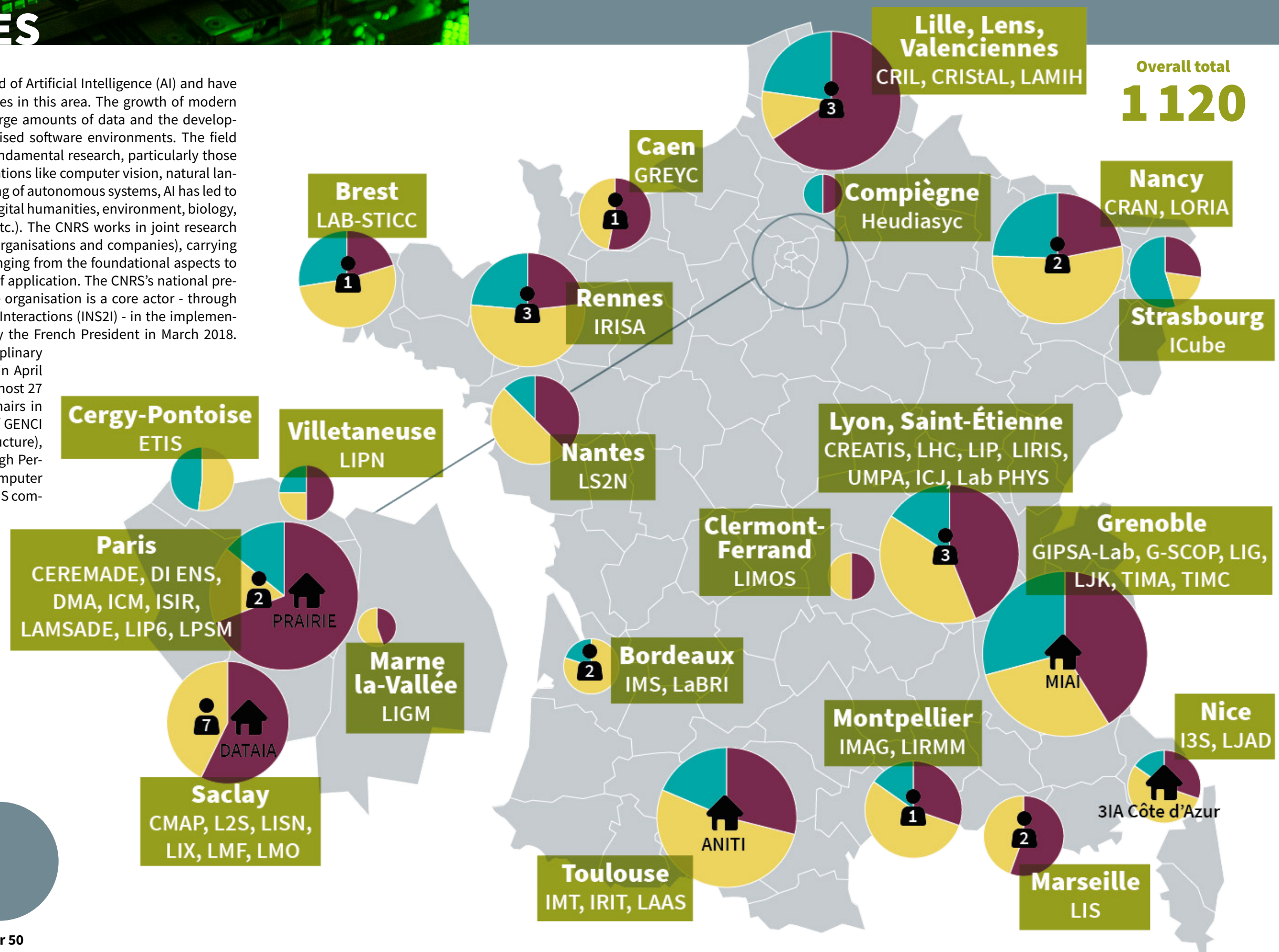
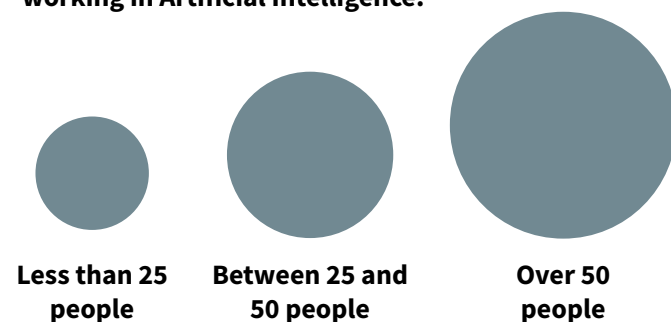
ARTIFICIAL INTELLIGENCE LABORATORIES

Distinct research communities work in the field of Artificial Intelligence (AI) and have contributed in various ways to recent successes in this area. The growth of modern AI was brought about by the availability of large amounts of data and the development of computing architectures and specialised software environments. The field has also benefited from recent advances in fundamental research, particularly those made in machine learning. Beyond AI's applications like computer vision, natural language processing or the localisation and piloting of autonomous systems, AI has led to repercussions in many other sectors (health, digital humanities, environment, biology, observation of the universe and the planet, etc.). The CNRS works in joint research units with its partners (universities, schools, organisations and companies), carrying out research into the whole spectrum of AI ranging from the foundational aspects to its societal impacts through its various fields of application. The CNRS's national presence and broad thematic coverage mean the organisation is a core actor - through its Institute of Information Sciences and their Interactions (INS2I) - in the implementation of the national AI strategy launched by the French President in March 2018. The CNRS is a partner in the four interdisciplinary Artificial Intelligence Institutes (3IA) selected in April 2019. Joint research units involving the CNRS host 27 of the 40 individual research and teaching chairs in AI announced in December 2019. On behalf of GENCI (the Very Large Computing Research Infrastructure), the CNRS also hosts the Jean Zay AI - HPC (High Performance Computing) converged supercomputer inaugurated in January 2020 at its national IDRIS computing centre at Paris-Saclay University.

Research themes:

- Fundamental themes
- Integration
- Applications
- PIA Institutes
- Chairs

Number of researchers and academics working in Artificial Intelligence:



Cartography of CNRS Artificial Intelligence Laboratories

WHAT AI RESEARCHERS SAY



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"My research interests have essentially focused on the structure and interpretation of a text using formal methods. I am coordinating the ANITI project based around integrative programmes which aim to address issues raised by several AI application areas (certification of critical systems, fairness and acceptability, emerging industrial applications)."

Nicholas Asher

CNRS senior researcher at the IRIT laboratory, beneficiary of an ERC Advanced Grant in 2010, winner of the CNRS silver medal in 2019, scientific director of the Interdisciplinary Institute in Artificial Intelligence (3IA) ANITI at Toulouse.

"Developing efficient sampling algorithms of high-dimensional probability distributions for machine learning using repulsive stochastic processes, a tool from statistical physics."

Rémi Bardenet

CNRS researcher at the CRISTAL laboratory in Lille, beneficiary of an ERC Starting Grant in 2019, winner of the CNRS bronze medal in 2021, ANR AI Chair.



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"Developing new AI approaches for next generation microscopic image processing and analysis."

Laure Blanc-Féraud

CNRS senior researcher at the I3S laboratory, former director of the ISIS Research Network, Chair at the Interdisciplinary Institute in Artificial Intelligence (3IA) in Côte d'Azur.

"The work of the Multidisciplinary Institute in Artificial Intelligence (MIAI) ranges from hardware architecture to software at the core of Artificial Intelligence. Its working programme is structured around two main themes: AI for the future and AI for humans and the environment. This is a multidisciplinary programme in which data specialists, computer scientists, mathematicians, seismologists, doctors, sociologists, lawyers and philosophers collaborate with our partner companies."

Éric Gaussier

Professor at the University of Grenoble-Alpes, former director of the Interdisciplinary Institute of Artificial Intelligence (3IA) MIAI in Grenoble.



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"Integrating the notions of fairness which are studied in social choice using machine learning to achieve trusted AI and exploiting recent progress in preference learning to define collective decisions which are both efficient and fair."

Jérôme Lang

CNRS senior researcher at the LAMSADE laboratory, winner of the CNRS silver medal in 2018, Chair of the Prairie Institute.

"Developing fast computational algorithms and applying these advances to machine learning, computer vision and also in the field of neuroscience to democratise optimal transport."

Gabriel Peyré

CNRS senior researcher at the DMA ENS laboratory, beneficiary of an ERC Starting Grant in 2011 and Consolidator Grant in 2016, winner of the CNRS silver medal in 2021, deputy scientific director of the Prairie Institute.



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SCIENTIFIC POLICY

AI is deemed an important subject in the CNRS Contract of Objectives and Performance for the 2019-2023 period. Firstly, AI is a priority theme in the area of digital technology with fundamental research questions which need to be taken addressed, particularly involving issues related to the energy footprint, reliability and explainability. AI also represents a societal challenge for all scientific disciplines aiming to master issues related to impacts on scientific discoveries, how organisations function or the transformation of society.

SCIENTIFIC LEADERSHIP

As well as structuring research forces in joint research units, the CNRS possesses scientific coordination tools for mobilising the different research communities on the national scale. As the name suggests Research Networks (Groupements de Recherche) facilitate the creation of federating networks and also act as forums for exchanges between scientists and industry, as foresight instruments and also as tools to support young researchers. Four such Research Networks are specifically linked to different aspects of AI.

The AI Research Network (AI)

This Research Network focuses on formal and algorithmic aspects such as learning, reasoning or planning and its mission is to create a new community capable of responding to future challenges in the field in interaction with the other Research Networks.

The ISIS Research Network (ISIS)

The ISIS Research Network works on information, signal, image and vision processing methods ranging from signal shaping to transmission and including modelling and analysis. It particularly uses machine learning techniques for this research.

The MaDICS Research Network (MaDICS)

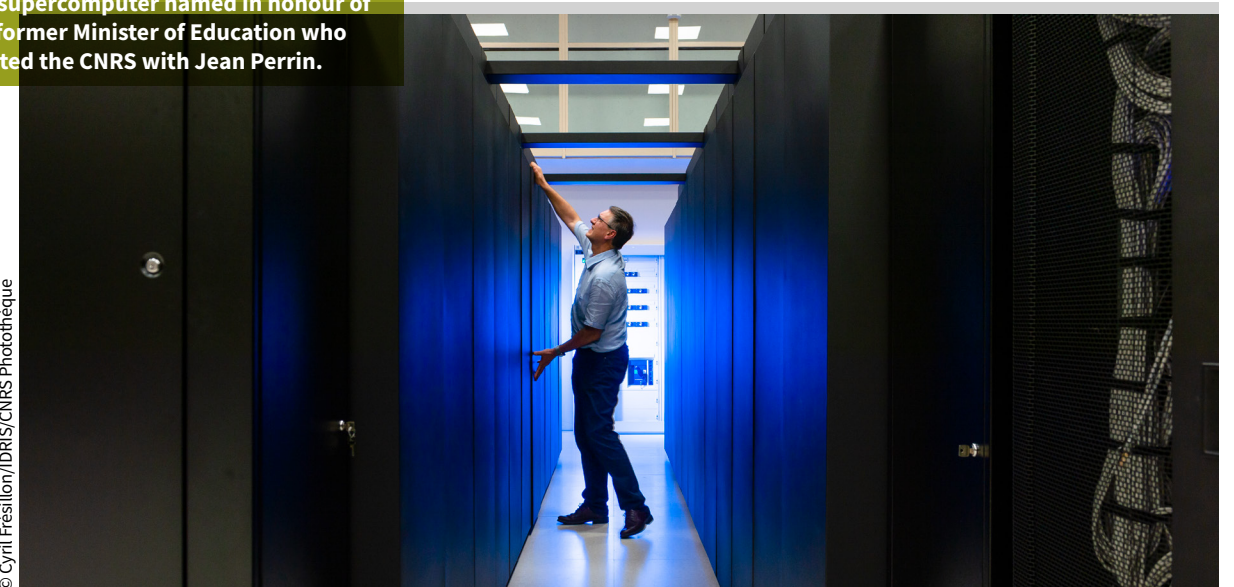
The MaDICS Research Network promotes interdisciplinary research positioned within a continuum "from data to knowledge and decision making". The masses of data in science are the starting point for the network's research.

The NLP Research Network (TAL)

The TAL Research Network deals with computer processing of all forms of natural language (written, oral, sign language). Its mission is to mobilise the top-level international scientific community on this strategic subject for digital sciences.

A corridor between two rows of the Jean Zay supercomputer named in honour of the former Minister of Education who created the CNRS with Jean Perrin.

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COMPUTING

The CNRS and its partners are well aware that modern AI computing is a crucial issue and thus took proactive action to provide France with an infrastructure dedicated to AI. The result was the Jean Zay supercomputer now installed at IDRIS, the CNRS's national computing centre. It is one of the most powerful supercomputers in Europe with a capacity extended to 28.3 petaflops in 2022 and with a specific architecture (converged CPU/GPU nodes). It was designed to respond to the requirements of both Artificial Intelligence and High-Performance Computing. As well as providing computing resources, GENCI has set up Dynamic Access - an innovative resource allocation procedure for the AI research community. A network of engineers coordinated by the CNRS and the National Institute for Research in Digital Science and Technology (Inria) supports researchers seeking to appropriate the supercomputer and in their development of algorithms and libraries.

INTERNATIONAL

The development of international research cooperation is one of the main priorities of CNRS scientific policy. The CNRS possesses specific international cooperation tools which it makes available to its partners (universities, schools, companies) to enhance scientific excellence, share knowledge, attract talent and stimulate innovation. The CNRS also has structured

initiatives underway in the field of AI with its International Research Laboratories (IRLs) in Singapore and Japan. It is also developing new projects in Australia, Canada and within the framework of the CNRS's participation in the CREATE (Campus for Research Excellence and Technological Enterprise) programme in Singapore.

Singapore - IPAL IRL

The CNRS's partners in the IPAL IRL are the A-STAR Institute and the National University of Singapore. The 2021-2025 IPAL project directed by Christophe Jouffrais particularly focuses on the themes of trusted AI, natural language processing and human augmentation.

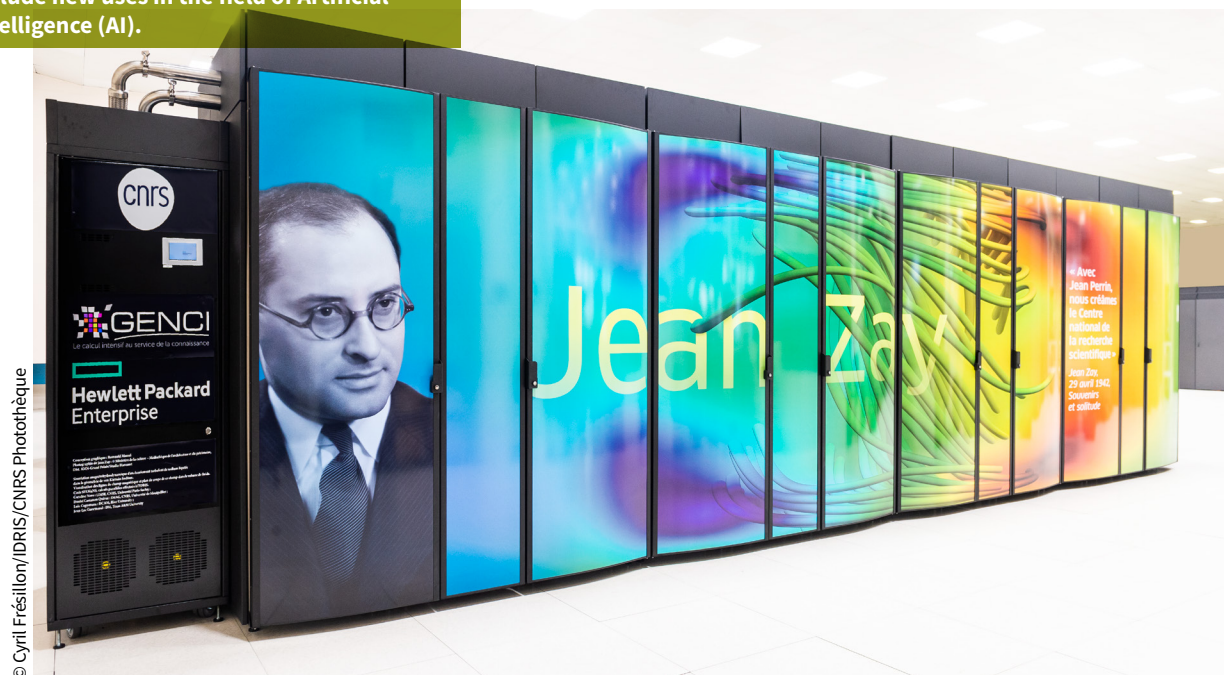
Japan - JFLI IRL

The CNRS's partners in the JFLI IRL in Tokyo are the National Institute of Informatics, the University of Tokyo and Keio University. The 2021-2025 JFLI project directed by Philippe Codognot features an increased focus on AI which is complementary to the JFLI's recognized research areas (foundations of computer science, networks and security, quantum computing).

Canada - ILLS IRL

The ILLS IRL in Montreal opened in 2022. Its partners are McGill University and the ETS in association with MILA. It is directed by Pablo Piantadina and its scientific project is focused on AI and its applications to autonomous systems.

The Jean Zay supercomputer enables the traditional uses of High-Performance Computing (HPC) to be broadened to include new uses in the field of Artificial Intelligence (AI).



INNOVATION

Increasing the transfer of knowledge to companies and to society as a whole as well as the economic impact of these transfers is a priority for CNRS. The field of AI offers numerous opportunities for interaction between laboratories and the economic sphere.

38% of the 1400 start-ups which derive from CNRS joint research units are in the information and communication technologies sector and a significant proportion of these involve the use of AI technologies.

KAYRROS

Kayrros was co-founded in 2016 by Alexandre d'Aspremont (CNRS senior researcher at DI ENS - CNRS/ENS/Inria) and was awarded a European Innovation Council (EIC) 'Accelerator' grant in September 2019. This company develops innovative data analysis techniques and particularly radar imagery to extract quantitative information for the energy sector like the real-time status of worldwide oil stocks.

Joint laboratories run with companies represent an integrated model of partnership research based on a shared long-term governance and scientific programme.

BEHAVIORS.AI

The joint Behaviors.ai laboratory is a partnership between the LIRIS (Computer Science Laboratory for Image Processing and Information Systems - CNRS/INSA Lyon/University of Lyon/École Centrale de Lyon) in Lyon and the Hoomano SME. It receives funding from the National Research Agency's LabCom programme and explores AI-based developmental learning. This enables a robot to improve its learning as it interacts with users and to adopt social behaviour which is adapted to its human interlocutors.

The CNRS Innovation Medal

The CNRS honours scientific research that is at the origin of an outstanding innovation with its Innovation Medal which was created in 2011. In 2017, Daniel Le Berre, professor at Artois University and a member of the Computer Science Research Lab (CRIL - CNRS/Artois University) was awarded the Innovation Medal for having developed the Sat4j free software for the satisfiability of logical formulas. This software provides a set of tools for reasoning in Boolean variables for the Java language.

THE LABORATORIES' PARTNERS

Aix-Marseille University	Institut Polytechnique de Paris
Artois University	Paris-Saclay University
Bordeaux INP	Sorbonne University
CentraleSupélec	Toulouse 1 Capitole University
CY Cergy Paris University	Université Bretagne Occidentale
École Centrale de Lille	University of Caen Normandy
École Centrale de Lyon	Université Clermont Auvergne
École Centrale de Nantes	Université Côte d'Azur
École des Mines de Saint-Étienne	University of Bordeaux
École des Ponts ParisTech	Université de Bretagne-Sud
ENGEEES (National School for Water and Environmental Engineering)	University of Grenoble-Alpes
ENIB (Brest Graduate School of Engineering)	Université Gustave Eiffel
ENS	University of Lille
ENS Lyon	Université de Lorraine
ENS Rennes	Université de Lyon
ENS Paris Saclay	University of Montpellier
ENSEA	University of Nantes
ENSICAEN (National Graduate School of Engineering of Caen)	Université de Rennes 1
ENSTA Bretagne	University of Strasbourg
Grenoble-INP (Institute Of Engineering)	University of Technology of Compiègne
IMT Atlantique	University of Toulon
INP Toulouse	Université Lumière Lyon 2
Inria	Université Paris-Dauphine PSL
INSA Lyon	Université Polytechnique Hauts-de-France
INSA Rennes	Université Sorbonne Paris Nord
INSA Strasbourg	Université Toulouse 2 Jean Jaurès
	Université Toulouse 3 Paul Sabatier

Cover photo: Compute nodes of the Jean Zay supercomputer named after the Minister of National Education and Fine Arts who was responsible for the creation of the CNRS, along with Jean Perrin. This converged supercomputer was capable of performing 13.9 million billion operations per second (petaflops) in its initial configuration installed in summer 2019 and two successive extensions have increased its capacity to 28.3 petaflops in 2022. It enables the traditional uses of high-performance computing (HPC) to be broadened to include new uses in the field of Artificial Intelligence (AI). This HPE SGI 8600 supercomputer was designed by Hewlett Packard Enterprise before being acquired by Genci (Very Large Computing Research Infrastructure) in 2019 and is operated by IDRIS on the Plateau de Saclay.

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