Accelerating scientific breakthroughs with AI

How CRIANN drives important research discoveries through GPU-powered supercomputing

In Normandy, the supercomputing institute CRIANN is driving innovation with public and private sector research partners. By expanding its computing capacity, CRIANN advances its AI capabilities to transform image recognition, improve energy efficiency on devices, and more. These discoveries promise to make a substantial impact on industries as diverse as telecommunications, autonomous vehicles, and healthcare.

Unlocking important discoveries

The Normandy region of France is a hotbed of collaboration and innovation. It's where academia meets commerce, bringing organizations together to collaborate on research spanning AI, fintech, e-health, smart city, and more. Centre Régional Informatique et d'Applications Numériques de Normandie (CRIANN) is at the core of this dynamic ecosystem, providing computing capabilities to support these research initiatives.

The public supercomputing institute drives pioneering studies that lead to significant discoveries in sustainability, drug development, resource optimization, and other transformative fields.

"We have two main activities," says Marie-Sophie Cabot, head of high-performance computing at CRIANN. "One is to interconnect universities and public organizations through our network, and the other is focused on high-performance computing for research. We also support open industrial projects and our region's economic development."

CRIANN

Industry: Research

Country: France

Vision

Foster research excellence to drive discoveries with meaningful societal impact

Strategy

Provide cutting-edge digital infrastructure to optimize research efficiency and advance scientific insights

Outcomes

- Enhances user experience and energy efficiency through advanced image classification
- Improves AI adaptability to support automotive and telecommunications industries
- Supports faster drug discovery and development
- Enables scientific breakthroughs with a 10x boost in GPU capacity

Advancing research insights and driving innovation

Collaboration with universities and other institutions has yielded insights into climate change impacts, advanced materials development, and accelerated the discovery of vital drugs, among other key areas.

For example, through GPU-powered supercomputing resources, CRIANN supported the development of a drug candidate for ovarian cancer in collaboration with researchers at the University of Caen Normandy's Centre d'Études et de Recherche sur le Médicament de Normandie (CERMN). This promising treatment showed improved antitumor effects on resistant ovarian cancer cells, potentially enabling consistent and effective therapy.

Another team of CERMN researchers screened millions of molecules to study their interactions with COVID 19–related proteins, leading to the discovery of potential drug candidates for combatting the virus.

Supercharging research

As research trends evolved and new technologies emerged, CRIANN recognized the need to expand its computational capacity. This expansion was essential to address the growing demand for new research workloads, particularly in AI, and more computing power.

"We've noticed a growing need for advanced computing in various fields, from fluid mechanics to materials design as well as machine learning," explains Cabot. "Also, more computing laboratories reached out to us after we acquired our previous machine with GPUs. So that's become an important activity we need to support."

Built in partnership with Hewlett Packard Enterprise and NVIDIA®, CRIANN's new supercomputing infrastructure features an expanded number of computing nodes, significantly increased GPU capacity, and cutting-edge technology to speed up modeling, simulations, and research applications.

"We can now support research across multiple distributed nodes, which simplifies complex scaling beyond single-node GPU usage," says Cabot. "Research teams are taking on larger projects and expanding their scope by training machine learning models."

Transforming image recognition

For example, the GREYC Laboratory at the University of Caen Normandy made a breakthrough in improving how computers understand images, especially on devices like smartphones and wearables. Their innovation enables fast recognition of simple images while maintaining accuracy with complex ones, potentially enhancing user experience and optimizing computer resources, including energy.

In this study, researchers at the GREYC Laboratory introduced "adaptive inference", where a computer intelligently decides which parts of its "brain" to activate when analyzing visual data. For straightforward images, it takes shortcuts, but for difficult ones, it thinks harder.

"Our research aimed to create a flexible approach for image classification on devices with limited resources," explains Alexis Lechervy, lecturer and head of the master's degree in computer science / images and multimedia data (M2 IDM) at the University of Caen Normandy. "We designed neural networks that can adjust their structure and parameters based on the available computational resources."

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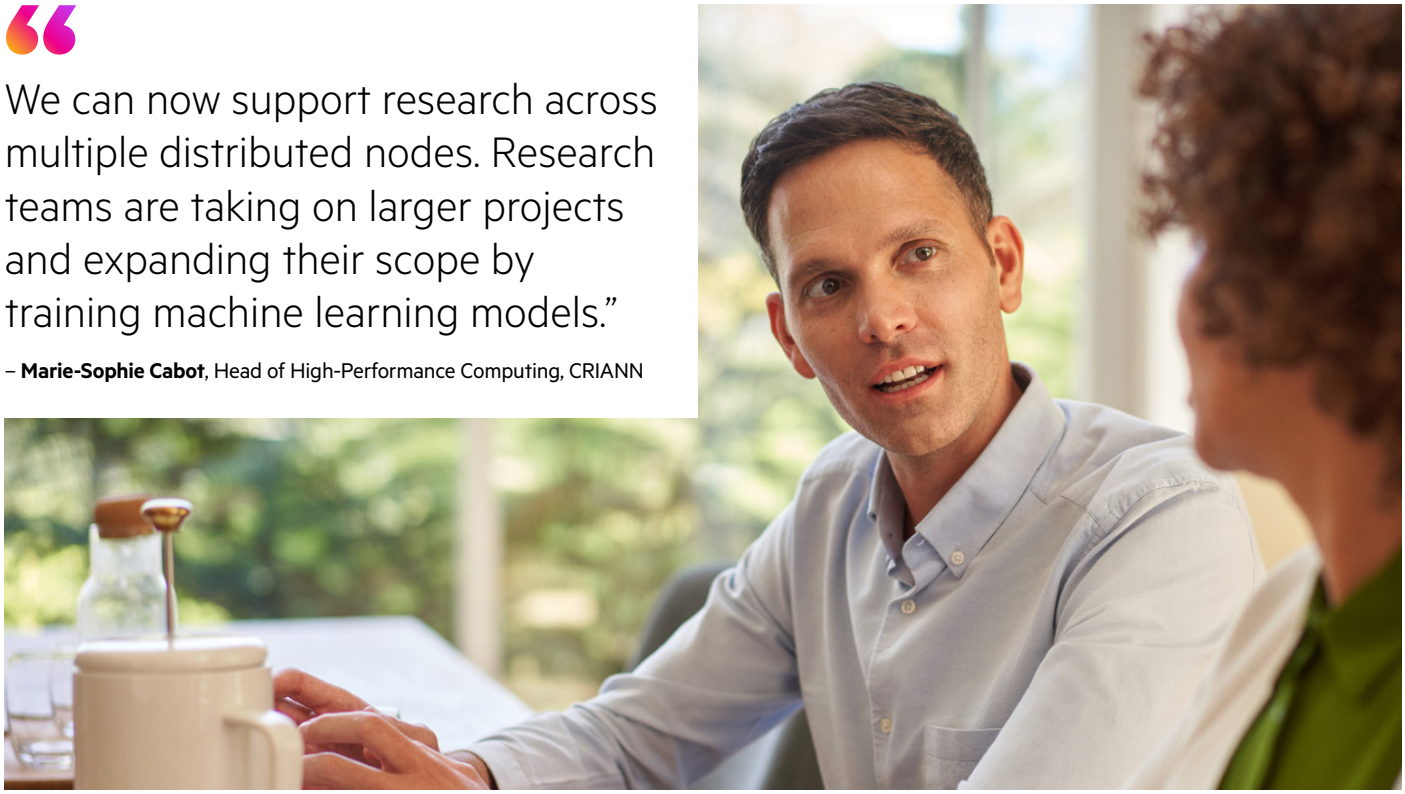

He adds that this approach is more adaptable across various computing scenarios without the cost and time needed to retrain separate models.

"In traditional methods, creating different models for varying device capabilities is both time consuming and costly. Our approach is like a smartphone adjusting screen brightness in response to ambient lighting, conserving battery power. It adapts to the device's abilities and the image complexity for efficient classification."

Enhancing user experience and energy efficiency in devices

The technology offers substantial potential benefits. Faster and more accurate image recognition on devices can enhance user experience while also conserving power to prolong device battery life and reduce energy consumption. Lechervy's team achieved high-performance image classification while emphasizing efficiency in the use of computing power on devices.

"End users and society can benefit greatly from this innovation. It saves energy in straightforward tasks and makes advanced AI available on older phones, even if it's slightly less powerful. This helps promote sustainability and widens the reach of AI across various devices."

This adaptability has a wide range of applications. Beyond making devices smarter at understanding and responding to images, it can improve the capabilities of robots in industries such as healthcare and manufacturing to interpret their surroundings effectively.

Ultimately, this innovation can provide users with more capable and efficient technology.

"Although not yet at an industrial stage, it's a stepping stone for AI developers," notes Lechervy. "They can use neural networks that adjust to different phone generations, saving them from making separate models for each one. This represents a major advantage, given the costs associated with deep learning model training."

Unleashing potential in telecom and autonomous vehicles

According to Lechervy, the potential applications of his team's research may well surpass what they currently envision.

"Consider applications in autonomous vehicles, for instance. The model could quickly generate initial predictions, such as preparing a braking mechanism in advance if danger is detected, before triggering the action if the threat is confirmed through further computations."

Lechervy particularly sees great potential for the telecommunications industry and AI service providers. AI algorithms capable of adapting to available computing resources can be valuable in addressing the challenges posed by the varying power of mobile devices and the changing availability of computing servers.

"Addressing energy consumption and the environmental impact of AI approaches are increasingly important to many stakeholders," he adds. "That's why proposing solutions to these challenges is a key priority to us."

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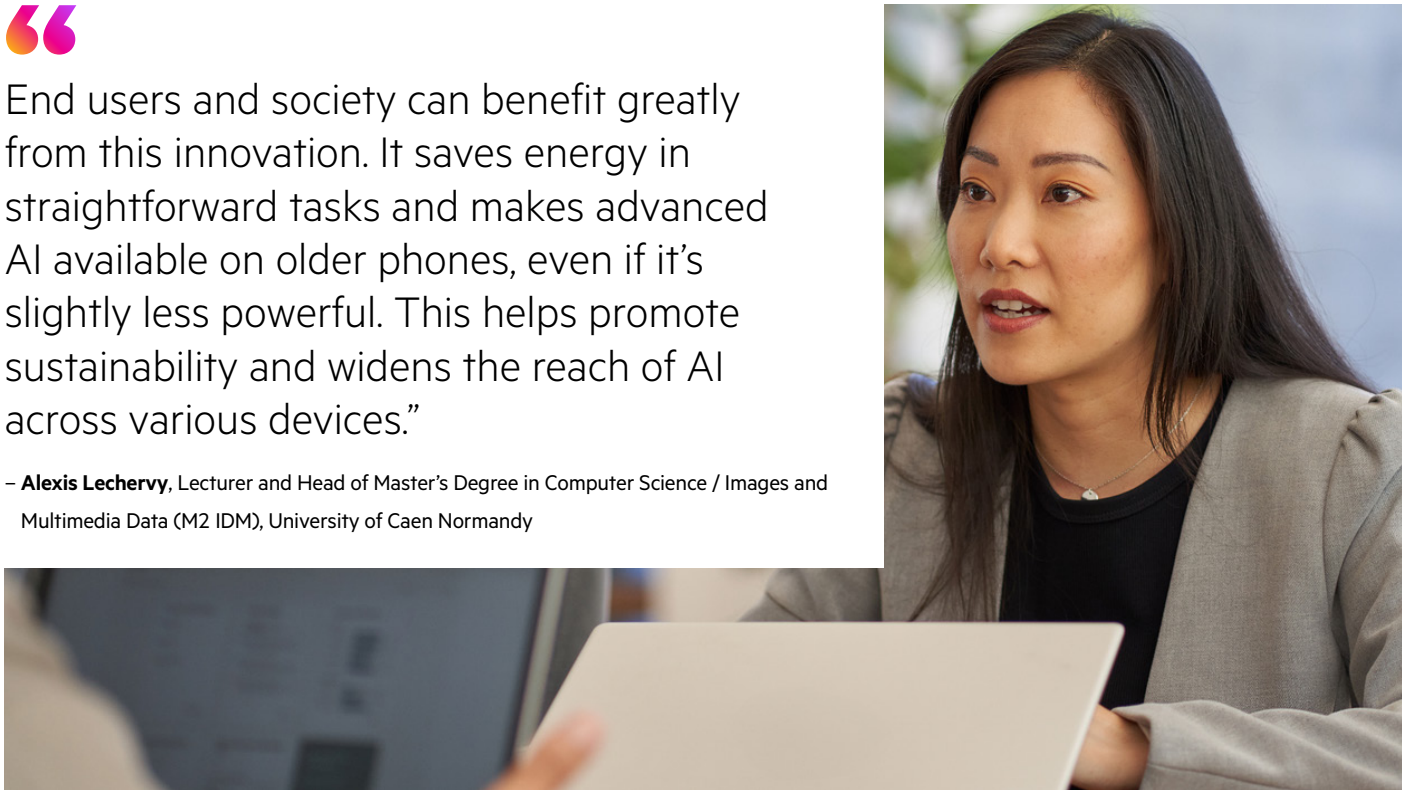

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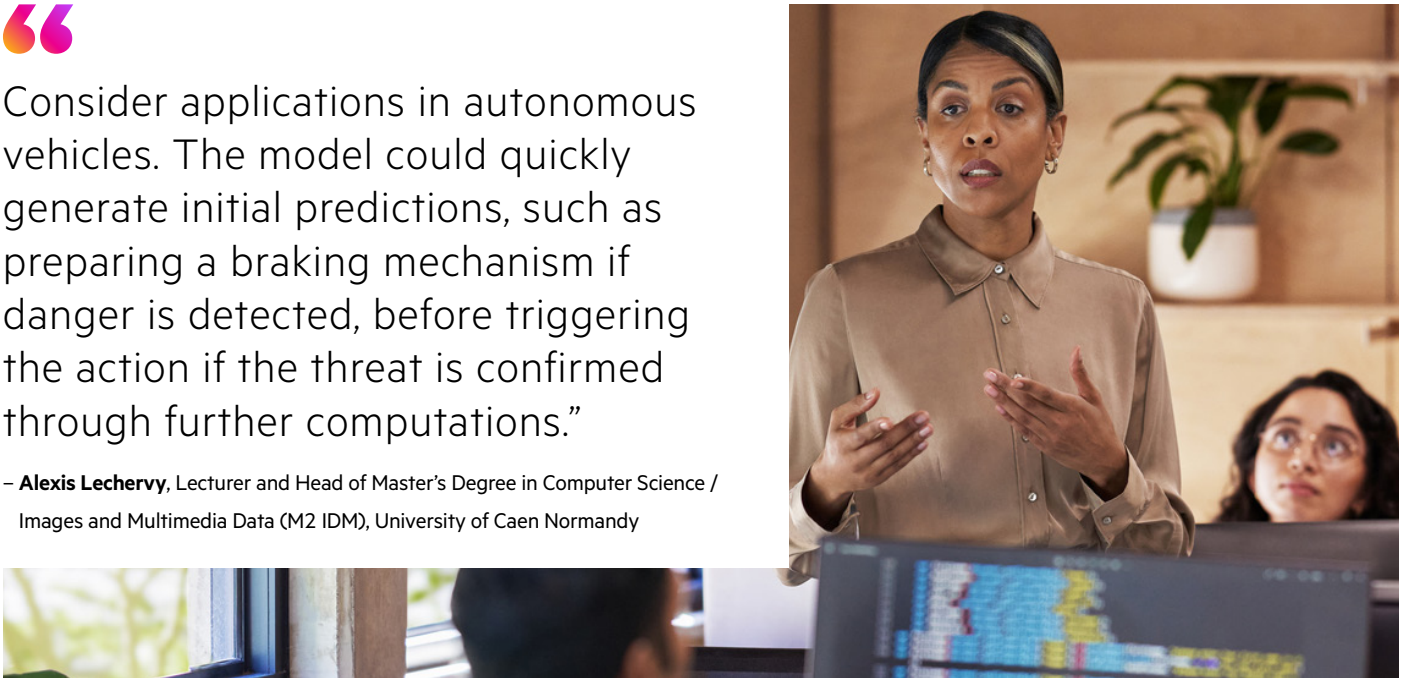

Expanding research capabilities

CRIANN's enhanced supercomputing infrastructure comprises HPE Apollo 6500 Systems with NVIDIA A100 Tensor Core GPUs for AI and molecular dynamics workloads, alongside HPE Cray XD2000 for tasks as diverse as fluid dynamics, chemistry, biology, and materials science. The new setup also integrates HPE Machine Learning Development Environment Software to help researchers collaborate and accelerate the development and training of accurate models using the NVIDIA software ecosystem.

CRIANN plans to soon leverage HPE Superdome Flex 280 for research that demands extensive shared memory capabilities. "We expect it to be particularly relevant to research teams studying the mechanical behavior of complex materials," says Cabot.

With its new infrastructure, the center has increased its GPU capacity by 10x and CPU performance by 3.5x while almost doubling overall memory capacity.

"The surge in GPU power means researchers can do more complex simulations and data-intensive AI tasks," notes Cabot. "With our new infrastructure enhancing AI capabilities, we look forward to driving research across various fields and workloads and supporting a wider community of researchers."

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Solution

Hardware

- HPE Apollo 6500 with NVIDIA A100 Tensor Core GPUs
- HPE Cray XD2000 with AMD EPYC Genoa 9654
- Cray ClusterStor E1000 Storage Systems
- HPE Superdome Flex 280
- HPE Slingshot Interconnect

Software

- HPE Machine Learning Development Environment Software
- HPE Performance Cluster Manager

Services

- HPE Services

Key partners

- Module-IT

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