Summit

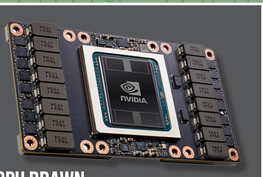
A SUPERCOMPUTER SUITED FOR AI

WHAT MAKES A SUPERCOMPUTER SMART?

In the case of the Oak Ridge Leadership Computing Facility's newest leadership-class system, Summit, the answer is in the architecture. Summit, an IBM AC922 system, links more than 27,000 NVIDIA Volta GPUs with more than 9,000 IBM Power9 CPUs to provide unprecedented opportunities for the integration of artificial intelligence (AI) and scientific discovery.

Applying AI techniques like deep learning to automate, accelerate, and drive understanding at supercomputer scales will help scientists achieve breakthroughs in human health, energy, and engineering and answer fundamental questions about the universe.

The arrival of AI supercomputing and Summit means science has never been smarter.

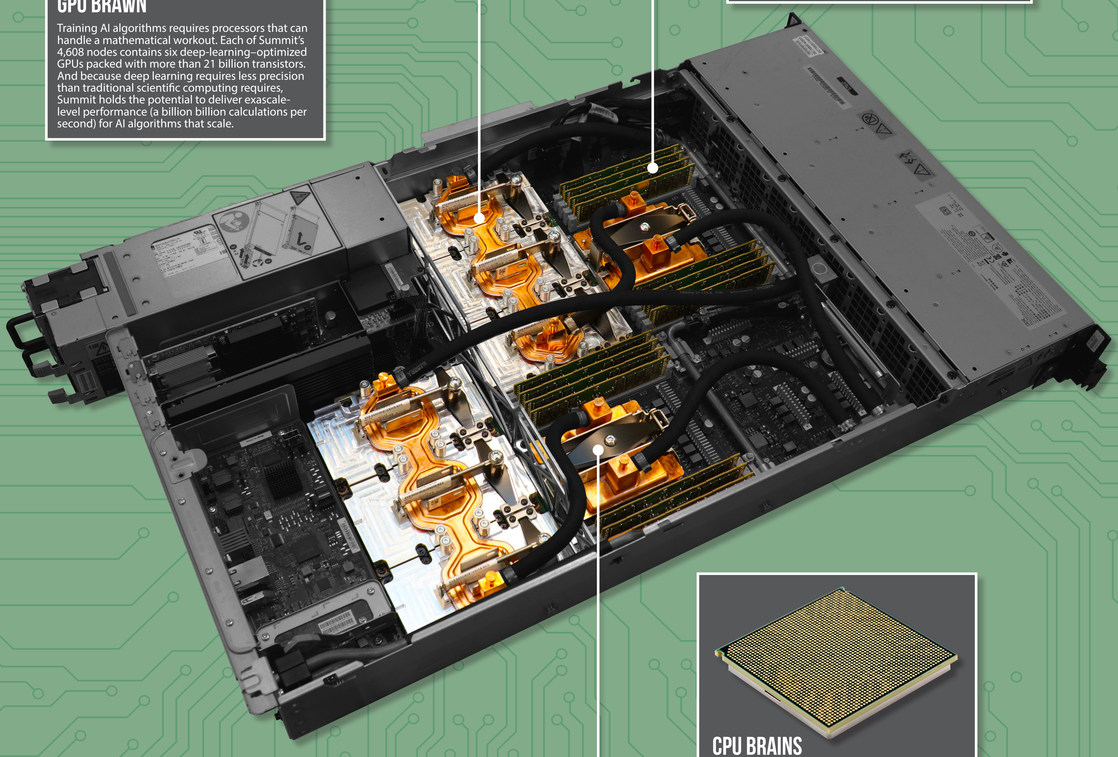


GPU BRAWN

Training AI algorithms requires processors that can handle a mathematical workout. Each of Summit's 4,608 nodes contains six deep-learning–optimized GPUs packed with more than 21 billion transistors. And because deep learning requires less precision than traditional scientific computing requires, Summit holds the potential to deliver exascale-level performance (a billion billion calculations per second) for AI algorithms that scale.

MEMORY WHERE IT MATTERS

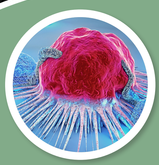
Like real estate, the value of a supercomputer's memory is closely tied to location. Summit's sizable local memory, including high-bandwidth memory on each GPU, gives AI researchers a convenient launching point for data-intensive tasks. Minimal data movement means researchers can run deep-learning networks faster and achieve greater accuracy.



CPU BRAINS

The versatility of Summit's 22-core Power9 CPUs (two CPUs per node) gives scientists a processor that can manipulate and move data efficiently. The latter task is facilitated by NVLink high-bandwidth technology built into all of Summit's processors that supplies the next-generation "data superhighways" needed to keep pace with high-speed computation.

SCIENCE CHALLENGES FOR A SMART SUPERCOMPUTER



COMBATING CANCER

Through the development of scalable deep neural networks, scientists at the US Department of Energy and the National Cancer Institute are making strides in improving diagnosis and treatment of this disease. The arrival of Summit gives researchers a powerful boost in the fight against cancer.

PREDICTING FUSION ENERGY

Obtaining the long-sought benefits of fusion energy—the same energy that powers the Sun—depends on reliable fusion reactors. Predictive AI software is already contributing to this goal by helping scientists anticipate disruptions to the volatile plasmas inside experimental reactors. Summit's arrival allows researchers to take this work to the next level and further integrate AI with fusion technology.

DECIPHERING HIGH-ENERGY PHYSICS DATA

Physicists possess truckloads of data from large, high-energy experiments, such as the Large Hadron Collider in Switzerland. With AI supercomputing, physicists can lean on machines to identify important pieces of information—data that is too massive for any single human to handle and that could change our understanding of the universe.

IDENTIFYING NEXT-GENERATION MATERIALS

Deep learning on Summit could help scientists identify materials for next-generation technologies—better batteries, more resilient building materials, and more efficient semiconductors. By training AI algorithms to predict materials' properties based on detailed experimental images, researchers could definitively answer longstanding questions about materials' behaviors at atomic scales.

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