Revolutionizing healthcare with artificial intelligence

Breakthrough results for prediction and prevention

Contents

Artificial intelligence (AI) has already had a profound effect on many industries, but for the healthcare sector, this collection of technologies is proving to be nothing short of transformative. Today, the ability of computers to exhibit intelligence and gain a better understanding of the world through complex algorithms and massive data sets is improving nearly every stage of the healthcare spectrum. From disease detection to diagnosis, treatment, recovery, and follow-up care, innovations in AI are completely redesigning the entire healthcare model, dramatically altering the way modern care is delivered, and ushering in a new era of precision medicine.

Recent technological advancements and the introduction of new computing capabilities have brought the industry to a tipping point where today's healthcare professionals can extract insights from data in a way that was never before possible. For years, doctors and researchers were forced to absorb volumes of information manually before they could properly diagnose and treat a patient, simply because they lacked the capabilities and tools to analyze it. Today, high performance computing (HPC) and massive parallelization are driving a paradigm shift where physicians can sift through this data more quickly and convert it into evidence-based knowledge that can be integrated into care delivery. This explosion of computing power is enabling professionals to diagnose patients faster and more accurately, develop innovative new drugs and treatments, reduce medical and diagnostic errors, predict adverse reactions, and lower the costs of healthcare delivery for both providers and patients.

Deep learning is a form of AI-based analytics that relies on large artificial neural networks (ANNs) that become increasingly able to learn and make decisions as they are exposed to more data – much like how the human brain reacts to and learns from life experiences. For the healthcare industry, techniques like deep learning promise to automate certain functionalities or tedious tasks that add only to cognitive burden but not to quality of care, allowing domain specialists to focus more on the critical areas of their work. These types of systems also alleviate information overload for physicians, helping them to more quickly process vast quantities of patient data to arrive at more accurate diagnoses quickly and dramatically improve quality of care. Deep learning is already showing promise in areas such as medical imaging, electronic health records (EHRs), and genomics, but there are undoubtedly a multitude of yet-to-be-discovered applications that promise novel approaches to solving many of the well-documented problems affecting modern healthcare.

Harnessing the superior parallel processing power of GPUs

Graphics processing units (GPUs) have become a critical enabler of today's deep learning and AI healthcare workloads, and GPU-accelerated systems can aid in designing more sophisticated neural networks that can be applied to a broadening range of healthcare and medical research applications. Compared to CPU-only systems, GPU-accelerated computing is proven to deliver greater performance, better energy efficiency, higher accuracy, and up to 3-8X faster time-to-compute for even the most demanding workloads. Particularly in the healthcare industry, organizations that fail to leverage the superior parallel processing power of GPUs will be quickly surpassed by their competitors in terms of productivity, performance, and competitive advantage.

Deep learning workloads are highly compute-intensive, so powerful technology tools and modern IT infrastructures are a prerequisite for healthcare providers looking to augment their current capabilities with AI. These high-level techniques require not only extreme, massively parallel processing performance for training deep neural networks, but also cost-effective compute platforms for inference. This means that customers still operating with legacy IT infrastructures or limited technology capabilities are typically locked out from using AI and deep learning, and are left to continuously struggle with poor performance, low efficiency, and slow time-to-value.

Amplifying human imagination and intelligence

NVIDIA has a long history of bringing new technologies to market that ignite the next era of computing. Their invention of the first GPU in 1999 inspired the growth of the PC gaming market, redefined modern computer graphics, and revolutionized parallel computing. In 2006, the CUDA® programming model and Tesla® GPU platform brought the parallel-processing capabilities of GPUs to general-purpose computing. And today, NVIDIA's GPUs enable a powerful new approach to computing in a wide range of industries, allowing businesses to accelerate their applications, run faster and utilize more granular simulations, and build a new breed of machines that are able to perceive and understand the world just as humans can. NVIDIA's mission is to use these

newfound capabilities to dramatically amplify human imagination and intelligence in order to address the world's most daunting and complex challenges.

As AI and deep learning applications proliferate through a variety of industries, enterprises are increasingly adopting NVIDIA's GPU computing platform to generate insights from troves of untapped data. NVIDIA®'s Volta® GPU architecture was created to support the next generation of AI and HPC workloads, and democratize deep learning so its capabilities can be realized by companies in nearly every industry. Volta® is the seventh generation of NVIDIA's revolutionary GPU architecture, which is built with 21 billion transistors to deliver performance equivalent to 100 CPUs for deep learning. Volta® pairs CUDA® cores and Tensor® Cores within a unified architecture, cramming all the performance of an AI supercomputer into a single GPU. The Tesla® V100 chip, NVIDIA's first GPU based on the new Volta® architecture, delivers tremendous speed and scalability for AI inferencing and training. The Tesla® V100 GPU surpasses previous generations of NVIDIA GPUs with groundbreaking technologies that enable it to shatter the 100 teraflops barrier of deep learning performance.

The NVIDIA Deep Learning GPU Training System (DIGITS™) allows data scientists and researchers to more easily design and train a highly accurate deep neural network (DNN) for image classification, segmentation and object detection tasks. DIGITS™ simplifies common deep learning tasks such as managing data, designing, and training neural networks on multi-GPU systems, monitoring performance in real time with advanced visualizations, and selecting the best performing model from the results browser for deployment. To help data scientists focus on designing and training networks rather than programming and debugging, the DIGITS™ platform is also completely interactive.

Deep learning platforms that accelerate real-time insights

NVIDIA firmly believes that GPU-accelerated computing is at the very epicenter of the modern healthcare revolution. To bring the transformative power of AI and deep learning to a broader base of customers, NVIDIA is partnering with some of the industry's largest enterprise technology providers. An expanded collaboration with worldwide server leader Hewlett Packard Enterprise (HPE) is geared to help enterprises quickly overcome the challenges of GPU computing, and allow them to more easily deploy, manage and optimize their GPU computing infrastructure. This partnership will guide customers through GPU technology integration with deep learning expertise, and drive unique customer value through joint innovation and solution design.

HPE offers a comprehensive set of computing innovations specifically targeted to accelerate deep learning analytics and insights. Building on a strong track record of comprehensive, workload-optimized compute solutions for AI and deep learning with its purpose-built HPE Apollo portfolio, HPE introduced a portfolio of new deep learning solutions that maximize performance, scale, and efficiency. HPE now offers greater choice for larger scale, dense GPU environments and addresses key gaps in technology integration and expertise with integrated solutions and services offerings.

The new HPE SGI 8600 server is the premier HPC platform for petaflops-scale deep learning environments. A liquid cooled, tray-based, and high-density clustered server, the 8600 now includes support for NVIDIA® Tesla® GPU accelerators with NVLink interconnect technology. The 8600 utilizes GPU-to-GPU communication which enables 10X the FLOPS per node compared to CPU-only systems, so it is designed to scale efficiently and enable the largest and most complex data center environments with unparalleled power efficiency. HPE's industry-leading Apollo 6500 platform is also an ideal choice for deep learning and HPC workloads. This server offers 8 GPUs, a high bandwidth fabric, a configurable GPU topology to match deep learning workloads, and a choice of high-speed, low latency fabrics. As part of their enhanced collaboration with NVIDIA, the HPE Apollo 6500 now includes interactive rendering from the data center with NVIDIA® Tesla® GPUs. Support for NVIDIA's next-generation Tesla® GPUs based on Volta® architecture will also be available in production quantities in HPE's Apollo 2000, Apollo 6500, and ProLiant DL380 servers.

Increasing the accessibility of GPU-powered deep learning

GPU-accelerated computing has become the most pervasive, accessible, and energy-efficient option for HPC and AI workloads, and therefore is currently the driving force behind many of the fastest supercomputers and most powerful data centers in the world. To help their customers explore the benefits of GPU computing without a large upfront investment, NVIDIA offers a free test drive of their Tesla® GPUs so customers can experience the fastest GPU accelerators in the industry first-hand. In addition, the NVIDIA® GPU-Ready Apps program offers quick start guides to help customers get up and running fast on GPUs using a simple set of instructions for a wide range of accelerated applications. HPE and NVIDIA are also making Volta®-based NVIDIA® Tesla® SXM2 GPU-powered Apollo 6500 systems available to select customers through an early access program.

To guide customers through the process of code modernization, provide a platform for benchmarking, and support proof of concept (POC) initiatives, HPE and NVIDIA recently announced that enhanced Centers of Excellence (CoEs) would be coming to Korea, Sydney, Grenoble, Bangalore, and Houston, Texas. These global centers will focus on helping customers enhance their deep learning, HPC, and advanced

visualization workloads with GPU acceleration, build and deploy modern infrastructures that leverage next-generation NVIDIA products, and support their most ambitious deep learning and AI business initiatives.

To further empower customers, the NVIDIA® Deep Learning Institute (DLI) offers training and educational workshops to help customers understand the potential of GPU-integrated compute for their data analytics workloads. Customers, developers, and partners can attend courses led by NVIDIA-certified HPE instructors to gain hands-on experience that will further their deep learning capabilities, as well as gain familiarity with reference solutions for using deep learning in real-world vertical applications.

Transitioning to powerful and scalable new IT solutions requires the help of a partner who can help customers more quickly achieve desired business outcomes and speed time-to-value. HPE Pointnext Services are a set of service offerings designed to enable and support AI and offer unparalleled deep learning expertise through a variety of advisory, professional, and operational services. Because AI and deep learning require highly scalable infrastructure, HPE also offers Flexible Capacity, a service that provides on-demand capacity to enable customers to add capacity in just minutes while paying only for what they use including servers, storage, networks, software, and services.

Conclusion

For companies in the healthcare industry, is has never been more crucial to invest in AI and deep learning tools that can accelerate real-time insights and intelligence. From medical imaging, to health records management, to drug discovery, AI innovations are quickly revolutionizing the healthcare field, making patient data more accessible for analysis and helping doctors increase their understanding of diseases. The results for both providers and patients are boundless, and include everything from reduced costs, to better quality of care, to the arrival of a new era of precision medicine. HPE and NVIDIA are working together to drive major improvements to system design, and offer the support and expertise that is needed to help the healthcare industry accelerate the adoption of innovative technologies that converge massive datasets into concise, actionable insight.

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