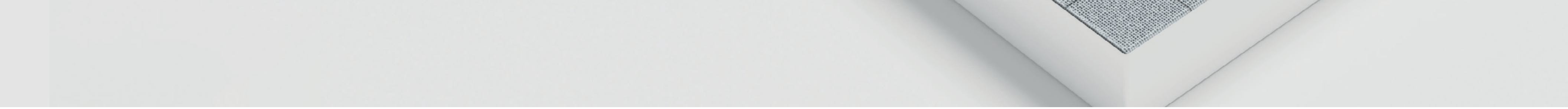
NVIDIA DGX and NVIDIA NeMo

Generative AI in Practice: Examples of Successful Enterprise Deployments



Generative AI and Large Language Models Are Transforming Industry and Society

While traditional AI approaches are based on rules and patterns, **generative AI** uses neural networks to identify the patterns and structures within existing data to generate new and original content. Generative AI is being widely used in applications such as text generation for marketing collateral, real-time translation services, dynamic coding, image creation for gaming characters, and accelerated drug discovery for healthcare. It's unlocking new opportunities to enhance business processes, improving productivity and efficiency.

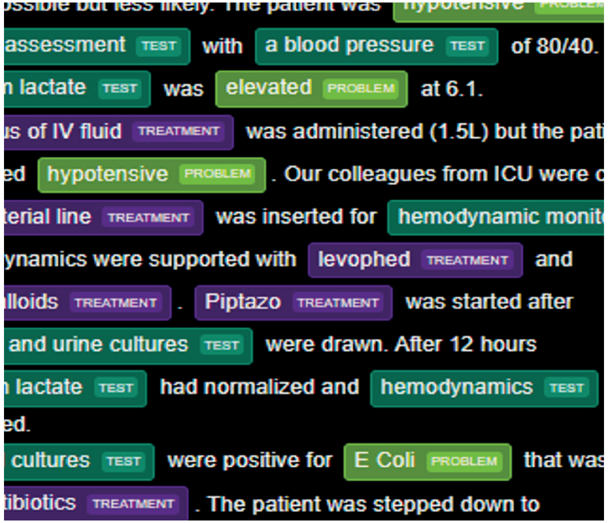
One of the most popular and advanced applications of generative AI is language. **Large language models** (LLMs) represent a major advancement in artificial intelligence, promising better human and computer interactions. LLM sizes have been increasing 10X every year for the last few years[1], and as these models grow in complexity and size, so do their capabilities. For example, **OpenAI's GPT-4**, or the fourth-generation Generative Pretrained Transformer, can generate creative and technical content in the user's writing style, accept visual inputs and generate analyses, create long-form content, and extend conversations with the ability to follow users' intentions—all while being truthful and safe.

Enterprises are now starting to realize the benefits of LLMs, which promise flexible models for few-shot learning. This means models can perform tasks they weren't explicitly trained for, which is important in fields where data is scarce or impossible to obtain (i.e., due to expensive labeled data or privacy concerns) or where the capital and operating expense of training and managing the number of models is insurmountable. Today, we're seeing broader adoption of customized LLMs that are tailored to understand an enterprise's unique vocabulary, their customer relationships, and the datasets on which their business runs. In the case studies that follow, we'll explore how various organizations built mission-critical LLMs, powered by NVIDIA DGX™ systems and the NVIDIA NeMo™ framework, which is part of **NVIDIA AI Enterprise** and included with every DGX system, enabling them to simplify their business and increase customer satisfaction, while achieving the fastest and highest return.

[1] Julien Simon. Large Language Models: A New Moore's Law? Hugging Face. October 26, 2021.

KT, South Korea's leading mobile operator, wanted to improve their GiGa Genie smart speaker and AI Contact Center (AICC) customer services platform. The AI-powered speaker can control TVs, offer real-time traffic updates and complete a slew of other home-assistance tasks based on voice commands, while their AICC service offers AI voice agents and other customer service-related applications. KT needed to master the highly complex Korean language as well as English for integration with Amazon Alexa, and scale their services to support over 22 million subscribers. KT trained billion-parameter large language models using NVIDIA DGX SuperPOD and NVIDIA NeMo framework and **achieved 2X faster training** on LLMs vs other frameworks. 3D parallelism techniques in NVIDIA NeMo enabled fast training with the highest throughput, while hyperparameter tools sped model development. KT plans to develop APIs for other tasks like document summarization and classification, emotion recognition, and filtering of inappropriate content.

The University of Florida's academic health center, UF Health, has teamed up with NVIDIA to develop a transformer model that generates synthetic clinical data. Trained on a decade of data representing more than 2 million patients, SynGatorTron is a language model that can create synthetic patient profiles that mimic the health records from which it has learned. The 5-billion-parameter model is the largest clinical language generator to date. SynGatorTron was developed using the NVIDIA NeMo framework and trained on HiPerGator-AI, the university's in-house NVIDIA DGX SuperPOD system. Using this synthetic data, researchers can create tools, models, and tasks with no privacy concerns. These AI-generated records can then be used to supplement and balance out real healthcare datasets used to train other neural networks, so they better represent the population. As 80 percent of information in electronic health records (EHRs) are unstructured in clinical notes, LLM models can be used to easily surface relevant clinical data used in downstream diagnostic and predictive tasks. These models also improve the patient experience through smarter chatbots and reduce physician burnout through improved transcription and summarization tools, faster documentation, and better decision-support systems.



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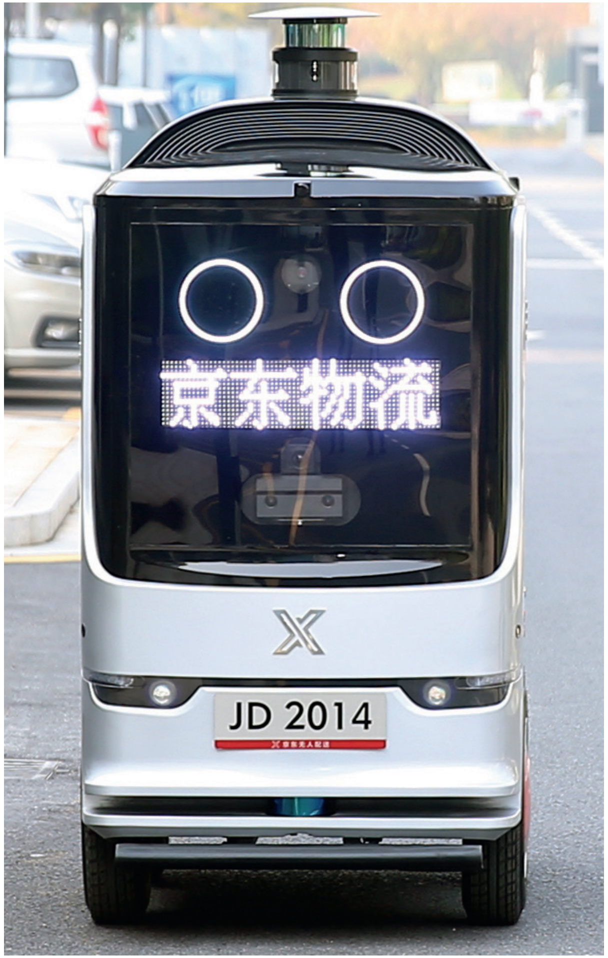
AI Sweden is the Swedish national center for applied artificial intelligence. AI Sweden is digitizing Sweden's history, as captured in the media and publications in the Swedish Royal Library, and building language models from this unstructured data that can be commercialized in enterprise applications. Their goal is to train large-scale Swedish LLM models and make them publicly accessible through open source, thereby accelerating LLM industry applications in Sweden. AI Sweden is addressing the problem of low-resource languages, or languages lacking many data resources, by combining datasets from morphologically similar languages. Using the Berzelius Supercomputer powered by DGX SuperPOD and NVIDIA NeMo framework, AI Sweden is able to train, serve, and leverage the power of a 100-billion-parameter model for Nordic languages (Swedish, Norwegian, Danish, and Icelandic languages) and push the boundaries of applied AI in businesses and the public sector.



JD.COM

JD.com is a leading supply chain-based technology and service provider and the largest online retailer in China. JD Explore Academy, their research and development division, is utilizing NVIDIA DGX SuperPOD™ to develop LLMs for the application of smart customer service, smart retail, smart logistics, IoT, healthcare, and more. They're training GPT-3-like, large-scale models to investigate how to transfer knowledge—both efficiently and securely—from large-scale datasets to the parameters of a pretraining model to improve downstream LLM tasks, like sentiment analysis, dialogue, and translation. JD was able to train their 5-billion-parameter model easily using NVIDIA NeMo framework's out-of-the-box recipes, which come with all the required hyperparameters so they don't need to tune them themselves. JD was able to achieve 8X faster training on DGX SuperPOD powered by DGX A100 systems versus a cluster of NVIDIA V100 Tensor Core GPU-based systems. This technology is helping JD develop the next generation of super deep learning technology, which links data across their various businesses like retail, healthcare, intelligent supply chain, digital intelligence, and industrial services.

A leading European telecommunications provider with over 80 million daily users across Europe and Asia wanted to improve customer loyalty and prevent churn. The company also offers services outside of their core network-related business, including finance and banking, cloud computing, and e-commerce. To lower costs and improve employee efficiency, the provider wanted to develop virtual assistants to support various functions (e.g., customer support, billing) and to support their various businesses beyond telecommunications (e.g., pay TV, banking). They leveraged NVIDIA DGX SuperPOD and NVIDIA NeMo framework to train an over-3-billion-parameter model and have deployed this into production. This technology enabled them to develop different chatbots with slightly different interfaces and domains. Using automatic speech recognition and synthesis, the provider created chatbots that sound human-like and can understand both vocabulary and intonation. There are 160 nationalities within their network, so they even developed a different model adapted to each region. Today, 80 percent of calls leverage this AI service. The provider is also able to develop custom LLM services to other verticals such as healthcare, where they're providing a mobile application for online consultation to a chain of clinics.

Deliver Enterprise-Grade, Superhuman Language and Visual Understanding

Generative AI can transform how enterprises operate by enabling unparalleled quality for language, audio, and visual-based services such as summary generation, auto completion, intent detection, automatic dialogue generation, translation, and many more. As LLMs are applied to new use cases, their complexity and size has increased exponentially.

LLMs require computing on a scale that goes beyond mainstream, commonplace NLP apps to state-of-the-art applications, customized for each enterprise and delivered at the speed of business. The NVIDIA DGX platform provides optimized AI software, infrastructure, and access to AI experts, so you can stand up your own world-class LLM architecture in record time.

> Learn how you can get started on your AI initiatives sooner with **NVIDIA DGX Cloud,** a high-performance, multi-node, AI-training-as-a-service solution.

> Learn more about **NVIDIA DGX SuperPOD**, the turnkey AI data center solution.

> Start using the **NVIDIA NeMo framework** to build state-of-the-art AI models.

Ready to Get Started?

Learn more about the NVIDIA DGX platform
www.pny.com/en-eu/

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