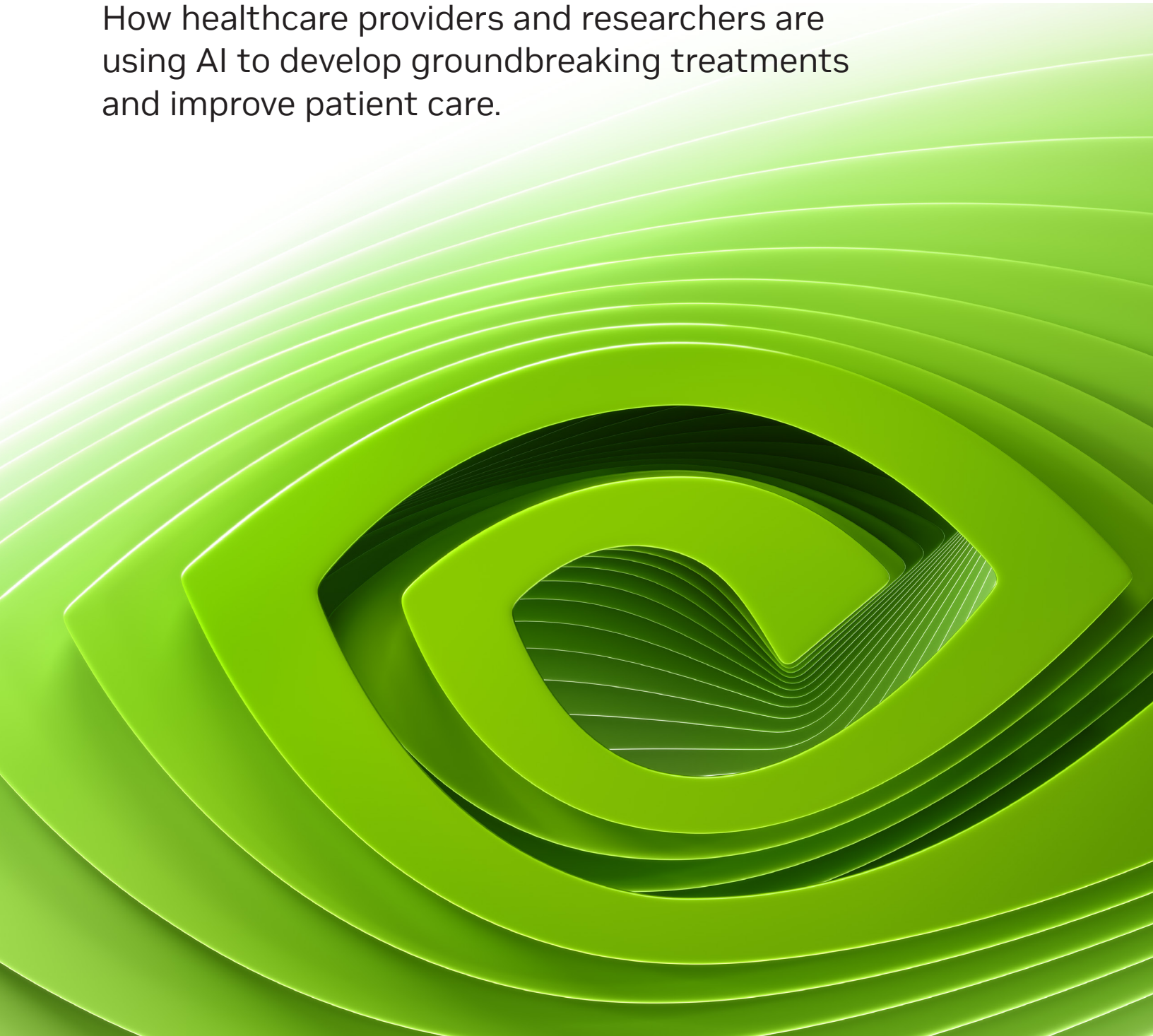
Industry Brief

Enhancing Drug Discovery and Patient Care With AI

How healthcare providers and researchers are using AI to develop groundbreaking treatments and improve patient care.



AI Is Powering Research and Expanding Care Options

Today, radiologists use AI to identify abnormalities in medical images, doctors use it to analyze electronic health records to uncover patient risk factors, and researchers use it to expedite the drug discovery pipeline.

Driven by the need for improved diagnostic accuracy, speed, and workflow efficiency, IDC predicts that care providers will see a 60 percent increase in AI solution adoption by 2025.[1]

Popular use cases in healthcare and life sciences include generative AI for drug discovery, computer vision for imaging and diagnostics, and speech AI to support patient experiences.

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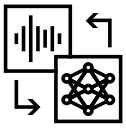
Top Use Cases for AI

Imaging Diagnostics



Clinical Notes and Transcription

Accelerated Drug Discovery

Multilingual Care

Condensing Drug Discovery Timelines With Generative AI

Each step in traditional drug discovery has a high attrition rate, leading to an average investment of **more than 10 years and over $2 billion to discover a new drug**. Often, it takes screening millions of compounds to find the most successful drug candidate.

Generative AI is helping to condense the drug discovery cycle by reducing the time and resources needed to bring new drugs to market. Researchers are now using generative AI models to read a protein's amino acid sequence and accurately predict the structure of target proteins in seconds, rather than weeks or months. Generative AI methods are also transforming the screening of large databases for potential drugs and testing their binding properties to specific proteins in the body.

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There's been a surge in biomolecular generative AI research using large language models (LLMs). These models have the potential to revolutionize numerous areas of drug discovery. For example, neural net potentials are making molecular simulations faster and more accurate. Protein structure prediction models are predicting 3D protein structures at experimental accuracy levels. And AI models are now able to generate small molecules conditioned on the active site of proteins.

For the first time, synthetic medical data generated by AI is allowing developers to create large and diverse datasets to train medical algorithms without compromising protected patient data. Synthetic data also enables controlled, reproducible experiments for algorithm testing and validation.

To improve the safety of clinical trials, AI can compare all available data on a potential drug candidate against previously approved drugs from similar classes and identify potential side effects or adverse events ahead of human testing.

Generative AI and advancements in computing are expected to drive breakthroughs in medical research and accelerate the delivery of new drugs to market.

Enhancing Medical Imaging With Computer Vision

Medical imaging is a critical diagnostic tool that requires precision and privacy. Historically, radiologists have had to manually interpret images and clinical notes. To incorporate AI into the process, researchers and AI practitioners have had to manually label images to create training data for medical algorithms.

Today, developers can use AI to build applications that support image de-identification to protect patient data and image labeling to speed data readiness. Deep learning frameworks have also improved AI medical imaging deployment, helping researchers use computer vision to perform accurate early detection, classify medical images, interpret x-rays and CT scans, and conduct advanced 3D automated segmentation. Image models can be connected to multimodal patient information systems to give doctors a 360-degree view of patient history, risk factors, and diagnostic images.

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Cryogenic electron microscopy (cryo-EM), a Nobel Prize-winning technique for visualizing high-resolution 3D structures of biological molecules, has been significantly advanced by high-performance computer vision and machine learning algorithms. The technique enables researchers to study complex molecular protein structures at near-atomic resolution. Researchers can extract information from large numbers of noisy 2D microscope images and then compute and refine 3D structures of target proteins in near-native states, improving the speed and precision of structure-based drug design.

From early detection systems that can diagnose disease more efficiently to robotics tools that can improve precision during surgery, computer vision holds great potential both for patients and providers.

Supporting Medical Professionals and Improving Patient Experiences With Speech AI

Multilingual automated speech recognition (ASR) and natural language processing (NLP) models can now capture, recognize, understand, and summarize key details in medical settings. This can ease the burden of manual note-taking, has the potential to improve clinical outcomes, and can accelerate insurance and billing processes.

NVIDIA researchers have created state-of-the-art pretrained models with **speech-to-text functionality that can extract clinical information** from doctor-patient conversations. The model can identify clinical words—including symptoms, medication names, diagnoses, and recommended treatments—

and automatically update medical records. Relieved of administrative tasks, physicians can focus on patient care to deliver superior experiences. This type of automated medical charting can also accelerate insurance and billing processes with ready-made documentation.

Speech AI and translation are expanding self-service options in healthcare in many languages. Online, patients can interact with medical center chatbots to get information on their symptoms and schedule appointments. On site, **speech recognition powers zero-touch check-ins at self-service kiosks** and voice-enabled avatars can direct patients when the doctor is ready to see them.

Speech AI and translation will play an increasingly important role in medical care, including in clinical note analysis for risk factor prediction and diagnosis, translation services in multilingual care centers, medical dictation and transcripts, and automation of administrative tasks.

Speech AI can relieve physicians of administrative tasks, letting them focus on patient care instead.

A Spotlight on AI Use Cases in Healthcare and Life Sciences

Global leader in biotechnology, Amgen, is using **NVIDIA BioNeMo™**, a generative AI platform for drug discovery, to slash the time it takes to customize models for molecule screening and optimization from three months to just a few weeks. This type of trainable foundation model lets scientists create variants for research into specific diseases and develop target treatments for rare conditions.

With NVIDIA BioNeMo, **Amgen is slashing the time it takes to customize models** for molecule screening and optimization.

Atlas Meditech, a brain-surgery intelligence platform, has adopted Project **MONAI**, an open-source medical imaging framework, and **NVIDIA Omniverse™**, a 3D development and deployment platform, to build AI-powered decision-support and high-fidelity surgery rehearsal platforms. Atlas Meditech offers case studies, surgical videos, and 3D models of the brain to more than a million online users. Teams can create custom virtual representations of individual patients' brains onscreen or in an immersive environment, so surgeons can practice on a virtual brain that matches the shape, size, and lesion position of their patient.

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Artisight, an AI platform for healthcare, uses **speech recognition** to power zero-touch check-ins and **speech synthesis** to notify patients in the waiting room when the doctor is available. Over 1,200 patients per day use Artisight kiosks, which streamlines registration processes at hospitals and clinics, improves patient experiences, eliminates data entry errors, and boosts staff productivity.

Driving Drug Discovery and Improved Care Experiences With AI and Accelerated Computing

As AI is integrated into more areas of biomedical research and patient care and as AI models grow in size, complexity, and diversity, energy-efficient computing is becoming critical to healthcare and life sciences use cases.

To efficiently manage large-scale datasets and deliver real-time performance for AI in production, hospitals and research institutes must shift from legacy infrastructure to accelerated computing.

NVIDIA AI Enterprise is an end-to-end, cloud-native software platform that accelerates the data science pipeline and streamlines development and deployment of production-grade AI applications, including generative AI, computer vision, speech AI, and more. Care providers and medical researchers can leverage the security, support, and stability provided by NVIDIA AI Enterprise to improve productivity of AI teams, reduce total cost of AI infrastructure, and ensure a smooth transition from pilot to production.

NVIDIA Clara™, available with enterprise support through NVIDIA AI Enterprise, is a suite of computing platforms, software, and services that power AI solutions for healthcare and life sciences, from imaging and instruments to genomics and drug discovery. With the **Clara for Medical Devices platform**, developers can build and deploy software-defined AI medical devices with speed and safety. **Clara for Biopharma** accelerates drug discovery with a collection of frameworks, applications, generative AI solutions, and pretrained models. **Clara for Genomics** powers unprecedented speed and accuracy in precision genomics analysis by reducing time to discovery and treatment identification. With NVIDIA MONAI, the enterprise distribution of the open-source **Project MONAI**, **Clara for Medical Imaging** provides domain-specific containers, AI models, and cloud APIs that accelerate medical imaging workflows such as AI-assisted annotation and automated training of 3D segmentation models. To quickly develop federated learning applications, NVIDIA FLARE™ offers a privacy-preserving paradigm that achieves accurate, generalizable models.

Accelerating and optimizing the drug discovery process with AI can have far-reaching impacts on research, available treatments, and patient outcomes. With pretrained, GPU-accelerated models, libraries, and frameworks, medical researchers and developers are using AI to drive faster drug discovery, more accurate diagnoses, improved patient outcomes, and more cost-effective medical care.

NVIDIA's accelerated computing platform offers a comprehensive suite of products and services to power next-generation data science and AI workloads.

Ready to Get Started?

To learn how AI is reshaping healthcare and life sciences, visit **www.nvidia.com/healthcare**

1. IDC, "IDC FutureScape: Worldwide Healthcare Industry 2024 Predictions," US50105223, October 2023.

Partner Logo

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