IDC PERSPECTIVE

Realize the Transformative Power of AI for Healthcare with NetApp Solutions

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EXECUTIVE SNAPSHOT

FIGURE 1

Executive Snapshot: AI for Healthcare and NetApp Solutions' Value Proposition

This IDC Perspective covers the artificial intelligence (AI) opportunity for healthcare, the current adoption trends and challenges, and the value proposition and success stories of NetApp solutions for the healthcare AI use cases.

Key Takeaways

- AI-powered technologies present opportunities to reimagine healthcare delivery along every step of the care continuum.
- Clinical data sets are complex, large, and distributed across environments. The NetApp AI Control Plane is NetApp's full-stack AI data and experiment management solution. It provides extreme scalability, streamlined deployment, and nonstop data availability — when and where you need it.
- NetApp AI solutions have successfully accelerated AI algorithms and applications design and deployments for leading healthcare organizations globally and delivered scalable, consistent, and high-performing architecture.

Recommended Actions

- **Establish infrastructure strategy:** Healthcare organizations need to have an infrastructure strategy in place to develop an effective clinical artificial intelligence program.
- **Ensure strong data governance:** AI technology runs on data from internal and external IT systems, and patient data needs protection as it flows in and out of AI algorithms.
- **Establish a realistic operating budget:** Clinical AI technology implementation requires extensive resources if organizations wish to use the systems to improve outcomes and lower costs.
- **Develop a health IT technology strategy:** Healthcare organizations will first need a plan to invest in the actual clinical AI technology, which includes all the hardware and software needed to properly run and connect to data sources that will power the technology.

Source: IDC, 2020

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SITUATION OVERVIEW

By 2024, with proactive, hyperspeed operational changes and market reactions, artificial intelligence (AI)-powered enterprises will respond to customers, competitors, regulators, and partners 50% faster than their peers. These digital transformation (DX) initiatives will be supported by AI capabilities providing timely critical insights, richer and immersive user experiences, and improved business outcomes. IDC forecasts that global AI spending will reach $97.6 billion by 2023, driven mostly by deployments in banking, retail, healthcare, and manufacturing.

AI for Healthcare

AI has countless applications in healthcare — whether it's being used to discover links between genetic codes, streamline radiology and pathology diagnosis to power surgical robots, or even maximize hospital efficiency. Advancements in AI tools and technologies hold great promise to virtually all segments of the healthcare industry.

The use cases for AI are broad in healthcare and are maturing at different paces. Anecdotally, the closer the use case gets to clinical processes, the greater the barriers to adoption. Some of the barriers are cultural where physician leadership is skeptical, the organization is risk averse, or regulatory bodies have been slow to approve AI-enabled solutions. In the past 24 months, some of the early successes from academic medical research have begun to be operationalized and adopted across a broader spectrum of hospitals. AIdoc's (www.aidoc.com) AI-assisted radiology solution is an example of successful adoption. In use by 300 customers, the solution helps radiologists identify critical findings and optimize their workflow. Aidoc's clients have quantified both clinical and financial benefits from the use of the solution. Successes such as this will open the door for more rapid adoption of AI in clinical practice, but it will be an incremental process driven by the rate of benefits uncovered and operationalized. The field of imaging is perhaps the most advanced in its adoption of AI solutions.

AI-driven operational efficiency and predictive analytics represent the majority of use case adoption in healthcare today. Many healthcare organizations are finding that AI is more easily adopted when embedded in solutions as the shortage of skilled data scientists, engineers, and data experts holds many organizations back. Healthcare is ripe for the application of AI in the low-value, repetitive tasks for which AI-driven automation is well suited. Appointment scheduling, staffing, and referrals are all processes that benefit from the application of AI for process improvement. Predictive analytics becomes more precise with AI as new data sources are taken into consideration.

While using AI in clinical practice is in its early stages, there have been some exciting use cases. A Stanford University study tested an AI algorithm to detect skin cancers against dermatologists, and it performed at the level of humans.

Diagnosis through imaging, with its emphasis on identifying subtle patterns that can be hard to detect with the human eye, makes for an ideal starting point. Already, the reliability of many new AI-driven diagnostic systems is striking. The FDA's approval of IDx-DR was chiefly based on a clinical study of retinal images from 900 diabetic patients at 10 primary care sites, during which the system was able to detect more than mild diabetic retinopathy with an impressive 87.4% accuracy.

Machine learning (ML) algorithms are increasingly rapid and accurate in analyzing medical data. Diagnostic medical specialties such as radiology, which deal more with the interpretation of data than with direct patient interactions, are the first to see artificial intelligence integrated into their practice. It is also hoped that AI can help improve the next generation of pathology tools that don't rely on tissue

samples. Image analysis is very time consuming for human providers. An MIT-led research team developed a machine learning algorithm that can analyze 3D scans up to 1,000 times faster than what is possible today. This near-real-time assessment can provide critical input for surgeons who are operating. In addition, AI image analysis could support remote areas that don't have easy access to healthcare providers and even make telemedicine more effective as patients can use their camera phones to send in pics of rashes, cuts, or bruises to determine what care is necessary.

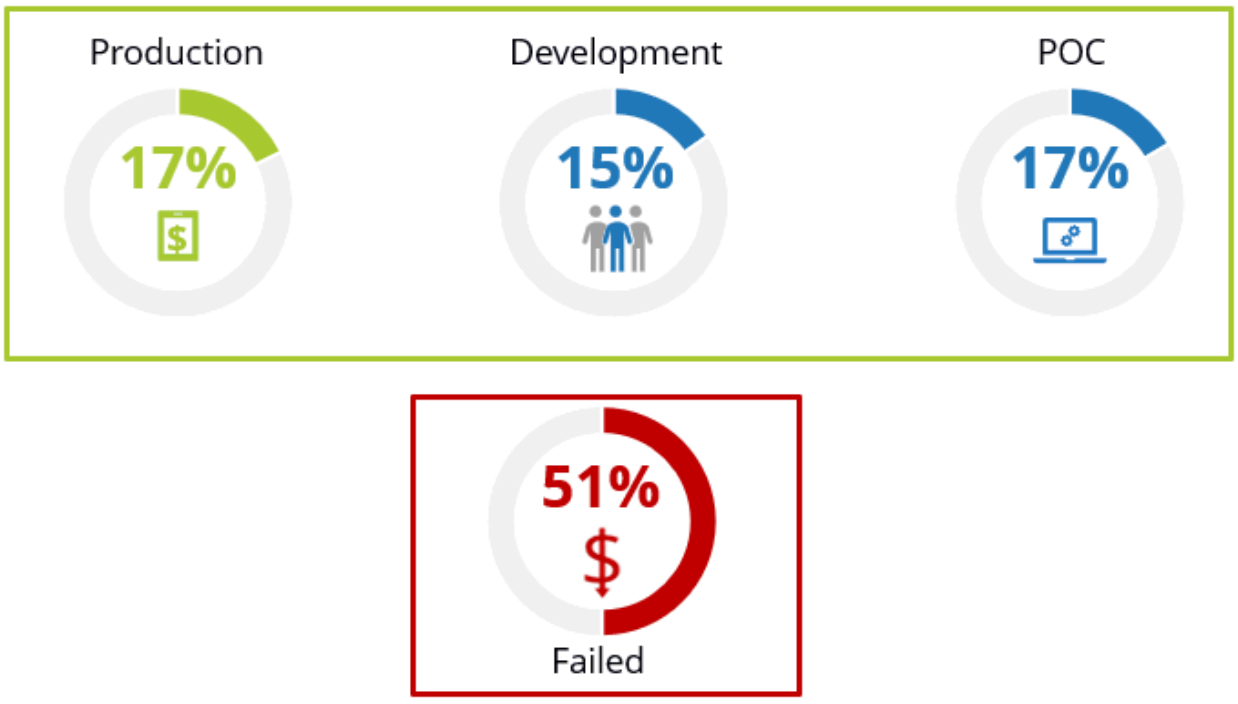
Another way AI can impact healthcare is to automate administrative tasks. It is expected that this could result in significant savings for the healthcare industry as machines can help doctors, nurses, and other providers save time on tasks. AI technologies such as voice-to-text transcriptions could help order tests, prescribe medications, and write chart notes. One example of using AI to support administration tasks is a partnership between the Cleveland Clinic and IBM that uses IBM's Watson to mine big data and help physicians provide a personalized and more efficient treatment experience.

AI Adoption Trends and Challenges

AI is a true competitive differentiator; it improves business agility and accelerates time to market with newer products and services. According to IDC's *Global Artificial Intelligence Survey* conducted in May 2019, only 17% of all AI initiatives are in production, another 15% are in development, and 17% are in proof-of-concept stage (see Figure 2). In contrast, over half, or 51%, have failed.

FIGURE 2

Current Reality of AI Deployments



n = 2,473

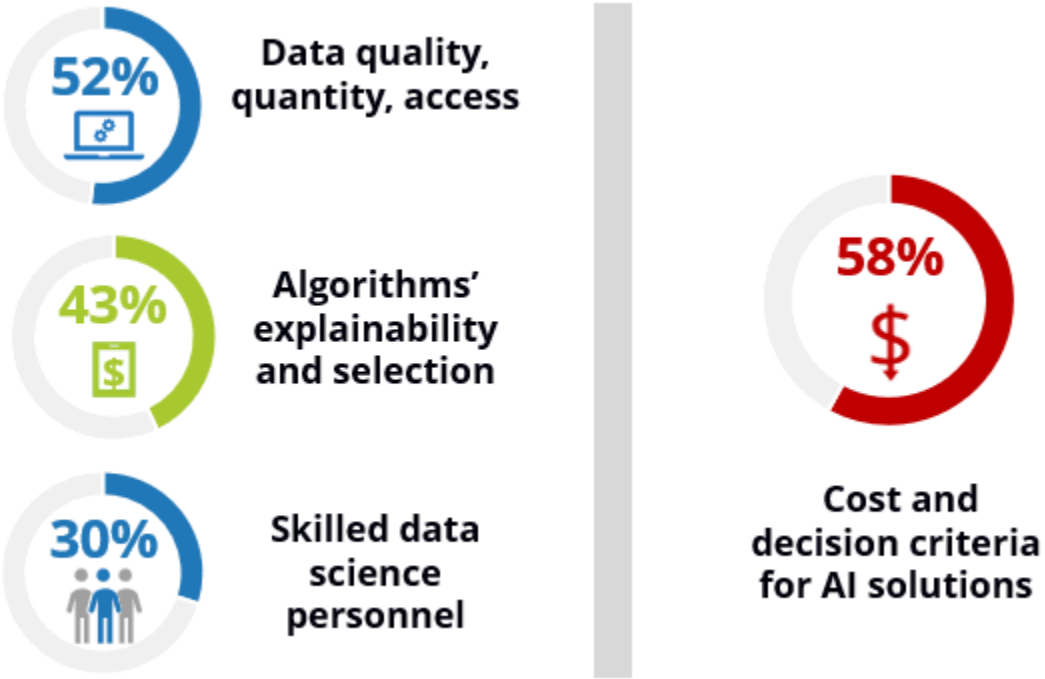
Base = all respondents

Source: IDC's *Global Artificial Intelligence Survey,* 2019

Cost and AI solution decision criteria challenges, data quality and access, trust issues, challenges with algorithm selection, and data science skills shortage are the key factors holding businesses back from implementing AI (see Figure 3).

FIGURE 3

Top Factors Holding Back AI Deployments



n = 2,473

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Source: IDC's *Global Artificial Intelligence Survey,* 2019

While advances in AI are happening at an incredible speed, today various machine learning and deep learning methods at best can reach artificial narrow intelligence (ANI) in various fields. The medical limitations of present-day ANI must be acknowledged. In the case of image recognition and using machine learning and deep learning algorithms for the purposes of radiology, there is the risk of feeding the computer not only with thousands of images but also underlying bias. For example, the images tend to originate from one part of the United States or the framework for conceptualizing the algorithm itself incorporates the subjective assumptions of the working team. Moreover, the forecasting and predictive abilities of many smart algorithms are anchored in previous cases, and they might be useless in novel cases of drug side effects or treatment resistance. On the other hand, streamlining and standardizing medical records in such a way that algorithms can make sense of them mean another huge limitation in introducing ANI to hospital departments for doing administrative tasks. There

are many hospitals where doctors still scribble their notes on patients' files. How should the computer make sense of such notes if even the person who wrote that cannot read it two weeks later?

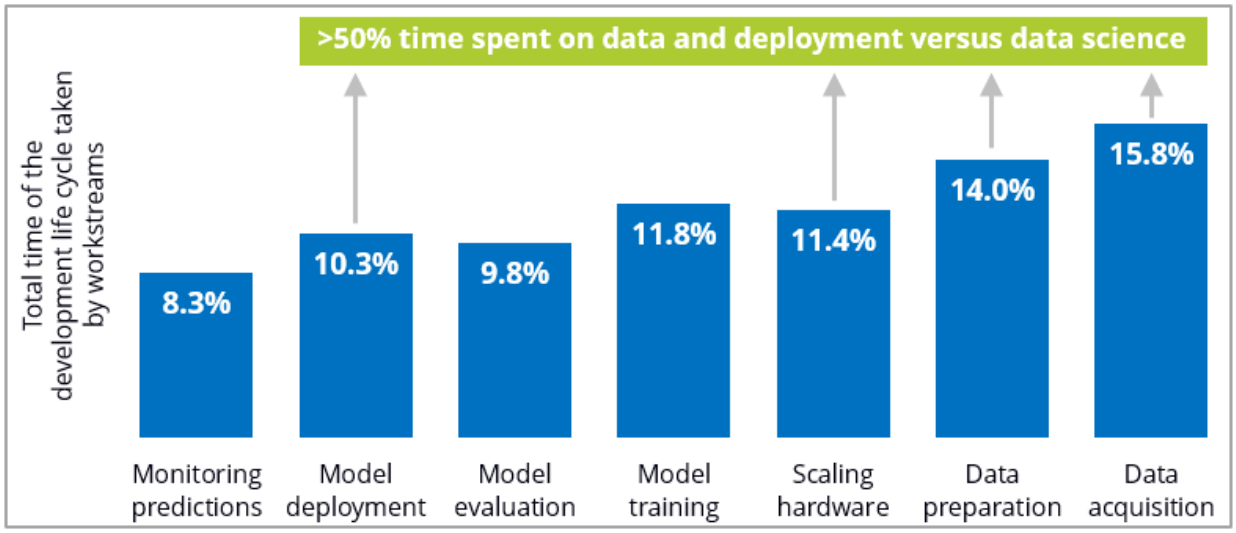
While medical and technological limitations of AI as well as ANI might be easier to overcome, there are serious ethical and legal issues that need attention. Who is to blame if a smart algorithm makes a mistake and does not spot a cancerous nodule on a lung x-ray? To whom could someone turn when AI comes up with a false prediction? Who will build in safety features so that AI will not turn on humans? What will be the rules and regulations to decide on safety? These complex ethical and legal questions should be answered if we want to reach the stage of artificial general intelligence (AGI) safely and securely. Moreover, ANI and, at a certain point, AGI should be implemented cautiously and gradually to give time and space for mapping the potential risks and downsides. Independent bioethical research groups, as well as medical watchdogs, should monitor the process closely. This is exactly what the Open AI Foundation does on a broader scale. It is a nonprofit AI research company discovering and enacting the path to safe artificial general intelligence. Its work is invaluable, as it is doing long-term research and may help in setting up ethical standards on how to use AI on micro and macro levels.

So while IDx-DR has huge clinical potential as an enabler of quicker and more accessible diagnosis for diabetes' most feared complication, it's not necessarily the technology itself that represents the major milestone. Rather, the road map for ongoing innovation is the true revolution; as machine learning algorithms continue to evolve and deepen, the medical tech industry — and, increasingly, regulators — is opening up to the exciting and possibly intimidating prospect that smart software might be able to take over some tasks that previously required expert human input.

In another IDC study, businesses report spending more than 50% of their time on data preparation and deployment, as opposed to actual data science (see Figure 4). Scaling infrastructure and performance inhibit realization of business value.

FIGURE 4

Data and Deployment Tasks Are Time Consuming



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Source: IDC's *Global Artificial Intelligence Survey,* 2019

Considering NetApp Solutions for AI-Powered Healthcare Use Cases

Artificial intelligence and machine learning are quickly becoming foundational to business decision making. Data is foundational to AI. The development of AI solutions that deliver meaningful and actionable insights in real-world conditions require high-quality and quantity of data. Clinical data sets are complex and large. As noted previously, AI initiatives demand a scalable, high-performing architecture to handle the data and performance challenges of AI.

NetApp AI solutions are based on the following key building blocks: ONTAP software enables **AI, machine learning,** and deep learning both on-premises and in the hybrid cloud, and AFF all-flash systems accelerate **AI, machine learning,** and deep learning workloads and remove performance bottlenecks.

Empower Data Scientists and Engineers with the NetApp AI Control Plane

AI services will run from edge to core to cloud and hybrid and multicloud deployments as the new norm. As AI initiatives move from pilot to production, organizations need an enterprise-grade architecture to bring the latest cloud-native DevOps and AI technologies together in an MLOps pipeline. Containers are quickly becoming an essential tool for enabling AI applications, offering developers a way to build and deploy lightweight, portable cloud applications for AI and ML. With an MLOps pipeline, data engineers and architects can optimize their use of DevOps methodologies and cloud-native AI technologies to save time and money and get the resources they need to be successful.

Containerized applications can get complicated, however. You might require hundreds or thousands of separate containers in production. This is where container runtime environments, such as Docker, benefit from the use of other tools to orchestrate or manage all the containers in operation. One of the most popular tools for this purpose is Kubernetes, a container orchestrator that automates deployment, management, and scaling functions for containerized applications.

Kubeflow, originally developed by Google, is an open source AI and ML toolkit for Kubernetes that makes deployments of AI/ML workflows on Kubernetes simple, portable, and scalable. Kubeflow abstracts away the intricacies of Kubernetes, allowing data scientists to focus on what they know best — data science. As enterprise IT departments standardize on Kubernetes, Kubeflow has been gaining significant traction.

AI applications' scalability, data availability, and deployment difficulties are some of the major challenges that healthcare providers face as they look to optimize their AI solutions. There are many AI and DevOps frameworks in the marketplace that attempt to tackle AI solutions' scalability and deployment difficulty hurdles. Most of these frameworks, however, fail to address the problems of data availability and data mobility. Many feature proprietary data platforms that lack proven enterprise-class reliability and don't scale across different sites and regions.

Because many of the most powerful AI and DevOps tools, including Kubernetes and Kubeflow, come from the start-up and web-scale world, many of them are open source or bespoke, which can be difficult for enterprises to implement and manage at scale. They can waste valuable time and effort performing tedious routine tasks and troubleshooting issues and need a solution that can improve reliability, break down data silos, and accelerate innovation.

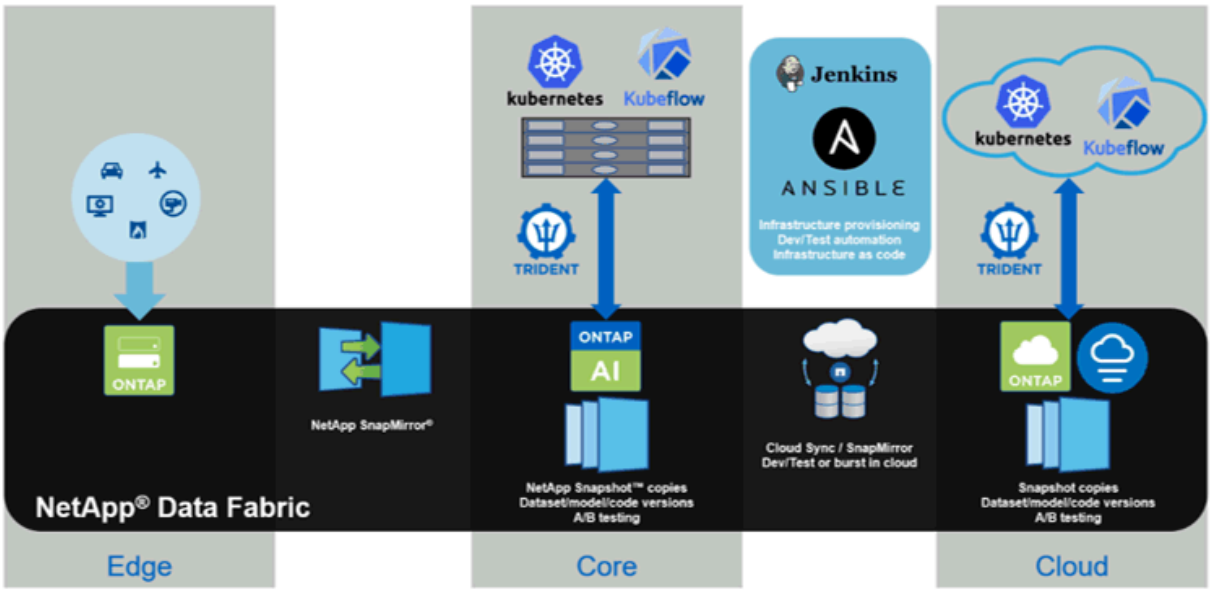
The NetApp AI Control Plane is NetApp's full-stack AI data and experiment management solution (see Figure 5). It provides extreme scalability, streamlined deployment, and nonstop data availability — when and where you need it. The NetApp AI Control Plane integrates Kubernetes and Kubeflow with a data fabric enabled by NetApp, which provides uncompromising data availability and portability — from edge to core to cloud.

Using NetApp Trident, NetApp's open source, persistent storage provisioner for Kubernetes, data volumes stored within your data fabric can be presented to Kubernetes workloads in an enterprise-class, Kubernetes- and cloud-native format.

With Trident, your machine learning developers and data scientists can create, manage, and interact with persistent storage volumes in the standard Kubernetes format that they are already familiar with. At the same time, they can take advantage of NetApp advanced data management capabilities and a data fabric that is powered by NetApp technology. Perhaps best of all, NetApp AI Control Plane is built completely on open source components, so you can implement the solution today on any NetApp storage in your environment.

FIGURE 5

NetApp AI Control Plane Architecture



Source: NetApp, 2020

Using NetApp Solution for AI for Radiology/Pathology — An Example Case Study

King's College London is a public research university located in London, the United Kingdom, and a worldwide leading medical research institution (see Figure 6).

The institution was confronted with the business challenge to transform clinical care for 8 million patients. It needed to build an AI platform to allow specialists in the United Kingdom's National Health Service (NHS) to automate radiology interpretation.

FIGURE 6

Case Study

Source: NetApp, 2020

King's AI platform solution was powered by NVIDIA DGX-2 systems, NVIDIA Clara AI toolkit, and NetApp cloud-connected storage. NetApp's offering was selected because of the support for extreme performance and nondisruptive scale out as well as proven data services for demanding environments. NetApp solution enabled the hospital setting to aggregate data at scale from multiple sources within the hospital in a way that is safe and privacy preserving. Medical data is very large and complex. To enable fast decisioning and retrieval of clinical data many times, King's AI platform solution needed high-performance and safe storage offering.

To learn more about the solution, go to **youtu.be/g0SR5w-AYyE**.

ADVICE FOR THE TECHNOLOGY BUYER

AI will be a true differentiator for healthcare organizations. Organizations that master AI will take off; those that don't will dwindle.

To exploit the power of AI for healthcare, while ensuring it is used in an ethical way, IDC advises healthcare organizations should:

- **Establish infrastructure strategy:** Healthcare organizations need to have an infrastructure strategy in place to develop an effective clinical artificial intelligence program. To successfully implement the technology into health systems, organizations must build a powerful AI infrastructure of people, policies, resources, and technology. In terms of the human infrastructure needed for clinical AI programs, clinicians are also needed to understand patient needs and keep the group focused on achieving their desired clinical results.
- **Ensure strong data governance:** AI technology runs on data from internal and external IT systems, and patient data needs protection as it flows in and out of AI algorithm. Therefore,

organizations need data governance policies in place for the clinical AI program to be effective.

- **Establish a realistic operating budget:** Clinical AI technology implementation requires extensive resources if organizations wish to use the systems to improve outcomes and lower costs. Healthcare leaders and clinicians need training as well as resources for planning, testing, implementation, evaluation, and reengineering of processes to achieve expected goals. Budgeting resources and allocating enough time for each component of clinical AI technology implementation is key.
- **Develop a health IT technology strategy:** Healthcare organizations will first need a plan to invest in the actual clinical AI technology, which includes all the hardware and software needed to properly run and connect to data sources that will power the technology. Clinical data is complex and large. Ensure you invest in scalable and high-performant infrastructure that can support unpredictable and exponential data growth along with flexible data management from on-premises to hybrid and multicloud instances.
- **Agree on roles and responsibilities:** While companies are well versed in establishing an ethics and compliance program, few ethics and compliance officers will have the necessary understanding of AI. Therefore, new alliances will need to be forged between these professionals and their technology counterparts to agree on roles and responsibilities. Hospitals and health systems should assign responsibilities to a group of leaders who will oversee the execution of AI projects. In addition, the organizations must assemble a team of AI experts who are knowledgeable about the steps needed to translate insights from clinical AI technologies to actionable steps for frontline providers at the point of service.
- **Be proactive and conduct risk assessments:** AI is an emerging technology; regulations and standards are currently vague. Businesses need to assess their AI/ML risks such as privacy, discrimination, and black box and build their high-risk mitigation plan. Compliance programs will need to include a combination of nontechnical and technical measures. Nontechnical measures include initiatives to safeguard against discrimination and unconscious bias, whereas technical measures involve ensuring compliant algorithms.
- **Integrate third parties:** Development of products and services incorporating AI is rarely managed by companies all by themselves. Exploit partnerships with healthcare domain experts with AI specialization to realize faster time to value.

LEARN MORE

Related Research

- *IDC FutureScape: Worldwide Artificial Intelligence 2020 Predictions* (IDC #US45576319, October 2019)
- *Market Analysis Perspective: Worldwide Artificial Intelligence, 2019* (IDC #US45524919, September 2019)
- *Worldwide Artificial Intelligence Forecast, 2019-2023* (IDC #US45332319, July 2019)
- *Artificial Intelligence Global Adoption Trends and Strategies* (IDC #US45120919, June 2019)
- *Explainable Artificial Intelligence: Feasible, Plausible, or Just a Pipe Dream* (IDC #US44587318, January 2019)
- *Ethics Considerations in Artificial Intelligence* (IDC #US44587118, January 2019)

Synopsis

This IDC Perspective covers the AI opportunity for healthcare, the current adoption trends and challenges, and the value proposition and success stories of NetApp solutions for the healthcare AI use cases.

"Artificial intelligence (AI) has the potential to transform healthcare. With the right infrastructure, partnerships with vendors, and clinician and patient buy-in, it can help prevent disease, detect important changes in patients' medical conditions, diagnose patients more accurately and faster, and tailor treatment plans to individual patients," says Ritu Jyoti, program vice president, Artificial Intelligence research.

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