



Accelerate innovation in Healthcare & Life Sciences with machine learning on AWS

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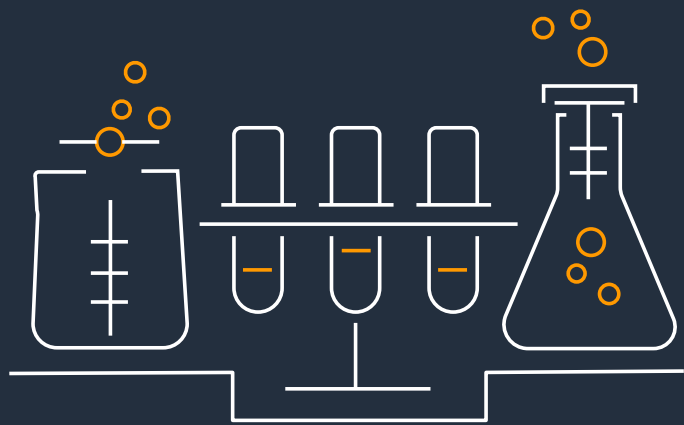
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Explore the frontier of healthcare and life sciences

Innovations made in healthcare and life sciences (HCLS) have the potential to dramatically change lives and positively impact future generations. New technologies transform how scientists and care providers approach problems, helping them uncover all-new ways to create solutions while reducing the time to innovative breakthroughs by several magnitudes.

Today, many scientific and medical communities are using Artificial Intelligence and Machine Learning (AI/ML) to explore the latest frontier of disease management and patient care. By applying cloud compute power to the ever-growing volumes of data and using self-learning models to continuously iterate and test new ideas, scientists can more easily identify solutions and bring them to market.

With AI/ML, healthcare and life science professionals can speed the development of new therapies, personalize the patient experience, and improve health outcomes—propelling the field to a new level of excellence.



Fast forward to a new era of healthcare and life sciences with AI/ML

Artificial Intelligence and Machine Learning offer scientists, healthcare providers, and their affiliated institutions unique opportunities to innovate. These technologies help great minds keep pace with their fields and their own ideas by imbuing everyday tasks with speed, agility, and experimental intelligence.



Scientific discoveries

Scientists and research technicians designing a new drug or treatment must test thousands—even hundreds of thousands—of possible molecular structures to find the few worth developing. Today this is done in the lab through delicate, hands-on experimentation. By adopting an AI/ML approach, scientists can move the rote work from the lab table to the computer processor. They can model how a disease spreads and use AI/ML capabilities to generate and test millions of different possible scenarios in minutes.



Treatment plans

Health practitioners creating individualized treatment plans for patients must rely on their own experience or published case studies to find comparable scenarios. Outside of those channels, any industry knowledge amassed by other providers is unavailable to a practitioner. Using AI/ML on anonymized patient data, healthcare providers can understand which treatments are more likely to yield positive results for a subset of patients. Similarly, by building AI/ML support into diagnostic tools like CT scans, providers can more easily make sense of what they see.



Business investments

Marketing and business development teams at healthcare and life sciences organizations need to know which opportunities to invest in and when. Today, business and operational decision makers rely on available research about industry trends and their own previous experience with similar ventures to help planning. By applying AI/ML, they can harness diverse data sets that take into account external factors and feedback to inform funding and marketing decisions.

In order for organizations to embrace this new way of problem solving, they must be able to:

- Access AI/ML services and tools that can be applied to their unique scenario
- Handling and getting access to tremendous volumes of data in a variety of different formats
- Achieve the required level of security and compliance demanded by their industry
- Incorporate AI/ML applications into existing workflows and demonstrate value

In short, they need the AWS cloud.



Bring the best of AI/ML to your business with AWS

At Amazon Web Services (AWS), our comprehensive cloud platform provides a secure place where HCLS organizations like yours can create innovative solutions with previously unattainable precision, supported by the reliability of the cloud.

Ready-to-use AI/ML services available as building blocks

AWS has the broadest and deepest set of machine learning and AI services. Choose from pre-trained AI services for computer vision, language, recommendations, and forecasting; use Amazon SageMaker to quickly build, train, and deploy machine learning models at scale; or build custom models with support for all the popular open-source frameworks. Our capabilities are built on the most comprehensive cloud platform, optimized for machine learning with high-performance compute.

AWS provides AI/ML services and tools as building blocks, allowing you to create solutions that work with your data and your business.



ML Services
Build, train, and deploy ML fast



AI Services
Easily add intelligence to your applications



Frameworks
Choice and flexibility with broadest framework support



Compute
Fastest and lowest-cost compute options



Analytics and Security
Comprehensive capabilities, no compromise



Learning Tools
Get deep on ML with AWS DeepRacer and DeepLens



Scalable, flexible platform for handling lots of data and data types

Building a modern data platform on AWS enables you to collect data of all types, store it in a central, secure repository, and analyze it with purpose-built tools. AWS offers a collection of managed services to build and manage big data platforms. Setting up and managing data lakes involves a lot of manual and time-consuming tasks such as loading, transforming, securing, and auditing access to data. AWS Lake Formation automates many of those manual steps and reduces the time required to build a successful data lake from months to days. The Amazon S3-based data lake solution uses Amazon S3 as its primary storage platform. Amazon S3 provides an optimal foundation for a data lake because of its virtually unlimited scalability. You can seamlessly and non-disruptively increase storage from gigabytes to petabytes of content, paying only for what you use. Amazon Dynamo DB is a key-value and document database that delivers single-digit millisecond performance at any scale. It's a fully managed, multi-regional, multi-master database with built-in security, backup and restore, and in-memory caching for internet-scale applications. DynamoDB can handle more than 10 trillion requests per day and can support peaks of more than 20 million requests per second. It can keep up with your data, no matter the variety, velocity, or volume.



Highly secure environment for achieving HIPAA compliance

With more than 100 HIPAA-eligible services, AWS gives you options about how to customize and implement a secure and compliant solution that meets your needs. AWS offers the most comprehensive capabilities to support your machine learning workloads, including 99.999999999% durability and unmatched availability using Amazon S3 and Amazon S3 Glacier for storage as well as the deepest set of security and encryption capabilities.





CHOC Children's advances population health using data science and AWS

CHOC Children's, one of the nation's leading children's hospitals, collaborated with Cerner to develop a cloud-based, machine learning solution called HealthDataLab, which was built and deployed on AWS. Using Amazon EMR for big data analytics, and Amazon S3 for object storage, HealthDataLab helps data science teams build and run sophisticated predictive models aimed at improving patient outcomes.

Data intelligence for smarter healthcare

[Children's Hospital of Orange County](#) (CHOC Children's) is using predictive analytics tools built on Amazon Web Services (AWS) to help improve care, support advanced clinical decision-making, and save lives. The organization collaborated with [Cerner](#), a [Select Technology Partner](#) in the [AWS Partner Network](#) (APN), in the creation of Cerner HealthDataLab¹, a big data analytics ecosystem.

Using HealthDataLab, CHOC Children's improved its "area under the curve" (AUC) for 30-day hospital readmissions from 0.79 to 0.82². AUC measures predictive model performance, with an AUC closer to one being better. Improving a model by even 0.01 can be challenging. The model is one of the most accurate in the children's population health literature and uses data from 48 hospitals and 1.4 million encounters.

"When considering when to discharge a patient, or what additional support will be required post-discharge, the clinician can look at a readmission risk score directly in the patient's medical record," says William Feaster, MD, chief health information officer at CHOC Children's. "This tool also shows the six most significant reasons for the risk determination. The clinician can focus on variables likely to make a difference in readmission rates, such as medication education."

"Initially, we executed data science using on-premises resources, which limited the speed and scale of our investigations," notes Feaster. "When Cerner approached us to collaborate on the creation of HealthDataLab, we quickly grasped the opportunity."

These kinds of collaborations are central to Cerner's mission. "As a global health platform and technology company, we are focused on enabling healthcare organizations with intelligence that can help detect and mitigate clinical, financial, and operational risk," says Cole Erdmann, director of clinical intelligence at Cerner. "With HealthDataLab, we aim to empower innovative organizations, such as CHOC Children's, to use more data and to discover insights efficiently."



About CHOC Children's

Affiliated with the University of California, Irvine, the CHOC Children's regional pediatric healthcare network includes a state-of-the-art, 334-bed, main hospital facility in the city of Orange, California, and a hospital-within-a-hospital in Mission Viejo, California. CHOC Children's also offers many primary and specialty care clinics, more than 100 additional programs and services, a pediatric residency program, and four centers of excellence.

¹ HealthDataLab is a registered trademark of Cerner Corporation and/or its subsidiaries.

² Leveraging Cerner HealthDataLab for readmission data from 2004 to 2018.

A playground for insights

HealthDataLab ingests and normalizes information from the CHOC Children's electronic health records (EHR) system, enabling its data science team to build models that help predict clinical outcomes based on medical, demographic, and other data. These models help providers make more-informed decisions for the health of their patients in near-real time.

The ability to apply cloud-scale computing power to complex healthcare challenges has improved the productivity of the CHOC Children's team and enabled it to achieve results faster. "We can now complete studies start to finish in record time using HealthDataLab," says Louis Ehwerhemuepha, PhD, data scientist at CHOC Children's. "We will be able to publish a new study once a month this year, and we see that rate increasing in the future. That means empowering healthcare organizations around the country to improve patient care using the results of our research."

Building a smart solution in the cloud

CHOC Children's knew there was significant value hidden in the large amounts of data it gathered. Its instance of HealthIntent³, the Cerner source-agnostic data and insights platform, includes more than five years of inpatient and outpatient records, as well as additional sources including claims from independent practitioners, pharmacy fulfillment and laboratory data. HealthDataLab provides an elastic environment for ingesting, cataloging, and analyzing this data using a full range of open source, machine learning (ML) tools.

The solution ingests patient data from an [Amazon Simple Storage Service](#) (Amazon S3) bucket into HealthDataLab. From there, [Amazon EMR](#) enables rapid analytics at lower cost than on-premises solutions. Popular open source tools enable data scientists to build ML and deep learning models, and an Apache Spark ML pipeline enables deployment back into clinical systems.

Ehwerhemuepha says, "Using on-premises systems, this type of analysis could take days or weeks, and if there was an error, you would have to start all over again. Using HealthDataLab on AWS means we are able to get outcomes in minutes or seconds, quickly adjust, and continually improve accuracy."

Working together for a healthier future

CHOC Children's expects the solution to continue delivering value over the long term. "The sky's the limit in terms of the ways we can apply this technology," says Feaster. "We are implementing an algorithm in our Emergency Department that can predict which patients will likely develop sepsis during hospitalization. Additionally, we would like to identify efficiencies in our administrative processes that could increase our financial stability in the face of risk. We also see applications related to the genomic data that will soon become a major part of all types of healthcare."

Erdmann agrees, saying, "AWS enables us to apply sophisticated algorithms, such as deep learning neural nets, giving us the ability to analyze unstructured data including text or images." Using the analytical power of the cloud, organizations like CHOC Children's can continually innovate to improve population health.



About Cerner

Cerner's health technologies connect people and information systems at thousands of contracted provider facilities worldwide. Cerner assists clinicians in making care decisions and assists organizations in managing the health of their populations. The company also offers an integrated clinical and financial system to help manage day-to-day revenue functions, as well as a wide range of services to support clinical, financial, and operational needs focused on people.

³ HealthIntent is a registered trademark of Cerner Corporation and/or its subsidiaries.

The promise of AI/ML for healthcare and life sciences with AWS

At its essence, healthcare and life sciences are about improving lives. The next wave of innovations will rely on unprecedented volumes of data in multiple formats, coming from multiple sources, aggregated in the cloud. AWS is excited to support the minds that will bring these innovations to market using the next generation of AI/ML tools.

To get started with Machine Learning on AWS, connect with an APN Partner

<https://aws.amazon.com/machine-learning/partner-solutions/>

Explore machine learning solutions on AWS

<https://aws.amazon.com/machine-learning/>

Learn about healthcare and life sciences with AWS

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