Predicting sepsis seven hours ahead of symptoms

Machine learning in the cloud derives life-saving predictions from real-time data, saving lives in the ICU.

KPMG LLP

Is a professional-services firm that continuously strives to keep abreast of industry trends, drivers, and issues through knowledge-sharing and industry-insights programs. The firm harnesses innovative technology to help clients overcome their biggest challenges.

If you're an intensive care physician monitoring and treating varied health crises, you're always on the lookout for sepsis, one of the leading causes of death in hospitals worldwide. A life-threatening condition where the body's response to fight infection causes underlying damage, sepsis can elude early diagnosis, since its outward symptoms are common to many conditions. Even though you channel considerable medical knowledge and experience into your very best effort, sepsis still manages to steal lives.

But what if you had an alert system that could predict the onset of sepsis—based on each patient's up-to-the-minute labs, vitals, and other indicators—up to seven hours in advance? You could tune into the earliest indications that it's time to adjust a patient's care and begin treatment before they show any outward symptoms, quite possibly saving their life.

From Hollywood to healthcare

An early warning system that accurately predicts a patient's condition might sound futuristic, but it's not science fiction. It's actually here. The sepsis-alert system, a collaborative effort among KPMG, Google Cloud, and a major Academic Medical Center, offers a glimpse into myriad game-changing possibilities for applying machine learning and artificial intelligence (AI) to healthcare.

"We rely today on evidence-based medicine and the experience of a single doctor who makes life-changing decisions. Yet we use machine learning to do things like telling us what product to buy next, what movie to go see," says Bharat Rao, KPMG's national leader for healthcare and life sciences and a leader in their innovation and enterprise solutions practice. "There's an opportunity to completely transform healthcare to a tech-driven system, to take large amounts of data and crunch it to find insights that would otherwise not be used."
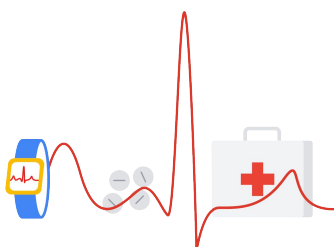
True to their moniker, machine learning systems continually "learn" by identifying patterns and making increasingly precise predictions as more data comes in and researchers fine-tune the algorithms. The ever-expanding machine learning capabilities of Google Cloud Platform (GCP) can derive meaning from massive amounts of data, like those generated in healthcare environments today.

Security, privacy, and compliance, every step of the way

In developing the sepsis prediction system, Rao's team took on the challenge of creating a platform for hosting multiple prediction engines that rely on streamed data while ensuring security, privacy and compliance from start to finish.

"We developed a solution—Data Transformation Hub—that interfaces with existing healthcare IT systems and employs various data, quality, integrity, and security checks before loading the data into GCP for real-time computation," Rao says. "Our unique IP enables us to transform this data into an analytics-ready set in an environment that is specifically designed for industries like healthcare that request strong controls, security, and governance."

Google Cloud Platform is designed to accommodate compliance measures unique to healthcare. "When the data is sent to the cloud," Rao explains, "it is encrypted both in transit and at rest, meeting or exceeding the requirements for HIPAA." To protect patient privacy, the hub obscures the source and PHI (Protected Health Information) of ingested data, making it essentially anonymous once it's in Google Cloud. KPMG also ensures that every project from every client that runs on its platform stays separate. There's no co-mingling of data. Researchers and physicians who want access must get permission.

To prepare data for analysis, the hub converts data ingested from disparate systems into an apples-to-apples format, something no physician or researcher could do quickly enough by hand to save an at-risk patient.

Bharat Rao, partner and national leader for healthcare and life sciences analytics, KPMG

"There's an opportunity to completely transform healthcare to a tech-driven system, to take large amounts of data and crunch it to find insights that would otherwise not be used."

"The possibilities are endless," says Rao. "Imagine if you could actually analyze patient results or share data across hospital networks in seconds, or at least hours."

To prepare data for analysis, the hub converts data ingested from disparate systems into an apples-to-apples format, something no physician or researcher could do quickly enough by hand to save an at-risk patient. "The possibilities are endless," says Rao. "Imagine if you could actually analyze patient results or share data across hospital networks in seconds, or at least hours."

The speed of the sepsis-prediction application gives doctors an advantage over infections that appear asymptomatic until hours later. "This is tremendous," Rao emphasizes. "It could be the difference between ensuring a really good outcome versus a bad one."

Putting data to work saving lives

Today many healthcare organizations do not have a cohesive strategy to integrate data analytics into their hospitals operations. Rao says the Data Transformation Hub establishes a key mechanism for transmitting information to secure, compliant environments in Google Cloud Platform for analysis, something that will "be relevant for every healthcare customer of Google."

The implications and potential applications are broad. "There are many ways all of this data can be put to use," Rao continues. "With Google Cloud's enormous capabilities in scaled data processing, healthcare providers can securely collect data, store it, and extract insights and highly accurate predictions, which doctors can use to treat cancer patients or hospital administrators can use to improve financial returns."

"We can definitely expand the scope to do other things," he adds, "like genomics data, or anything that needs to be sent up in real time or in batches in a secure way." Although he anticipates the platform will also be useful for research, Rao says that its real value is in clinical settings like the intensive care unit, where deploying algorithms like the sepsis-prediction system can support doctors already doing everything they can to save lives.

Bharat Rao, partner and national leader for healthcare and life sciences analytics, KPMG

"We can definitely expand the scope to do other things, like genomics data, or anything that needs to be sent up in real time or in batches in a secure way."

To learn more about
Google Cloud Healthcare and Life Sciences visit:
https://cloud.google.com/solutions/healthcare-life-sciences

To learn more about KPMG visit:
https://read.kpmg.us/googlecloudalliance