

Leveraging AI in the Cloud to Tackle Sepsis

“Sepsis is a condition that can be best understood as the body’s immune system going into overdrive. It doesn’t know what is going on, so it starts attacking everything in front of it, including all the organs. And, it’s life threatening,” said Ashish Sharma, PhD, Assistant Professor, Department of Biomedical Informatics at Emory University.

“Studies have sepsis mortality rates can be improved if you catch sepsis early,” Sharma said. In fact, the earlier the better as every hour equals a 4 to 8 percent improvement in survival.

1.7 million

adults in America develop sepsis

270,000

people die as a result of sepsis each year

1/3

patients who die in a hospital have sepsis¹

With early detection being so important, Sharma, along with Shamim Nemati, PhD, and a team at Emory University, developed an algorithm for the early prediction of sepsis. Referred to as the Deep AI Sepsis Expert (Deep-AISE), the algorithm relies on high-resolution vital-signs time series and electronic medical record data to develop a set of 65 variables on an hourly basis to predict the onset of sepsis. As a result, it can predict the onset of sepsis in intensive care unit patients **4 to 12 hours** sooner than typical clinical recognition. The algorithm also identifies the top sepsis causes for each prediction.

“Artificial intelligence systems really should be a second set of eyes. I like to think of Deep-AISE as this really sharp set of eyes that teases out patterns and then presents those to the clinicians,” Sharma said.

The process starts at the patient bedside. Data from patient monitors are fed into Deep-AISE’s predictive engine, which then produces an at-a-glance sepsis risk score that represents a composite of numerous types of data.

Care providers are then presented with a summary of their patients and their sepsis risk scores on a dashboard. In addition, clinicians can also assess historical data via the dashboard, empowering them to make more informed patient-care decisions.



¹ <https://www.cdc.gov/sepsis/data/reports/index.html>

A comprehensive view of *how, if* and *when* a patient will develop sepsis



Challenges

The challenge, according to Sharma, is to “tease out these clinical wavelengths. As the algorithm predicts and states the incidence of sepsis developing in the next eight hours, it also presents those key clinical indicators that draw the algorithm to that prediction. So, when clinicians log in to the system, they can quickly glean out who are the patients at high risk at this time. They can quickly see the patient name, the base score, and how much has that score changed. So, it’s quickly actionable.” The predictive engine is ultimately designed to empower clinicians. It doesn’t just emit results after analysis, it gives a detailed explanation of how a prediction was realized, ensuring healthcare workers that intervention is warranted.

manage infrastructure. By relying on the cloud’s processing power and managed services, Emory will be able to further develop the sepsis program.



“We want to try and validate more algorithms and see how they behave in bigger populations from other institutions. We also want to see how this algorithm will interface and tie into existing IT healthcare systems,” Sharma said.



Why Cloud

The sepsis program is just one of many initiatives that are being supported by cloud computing at Emory.

“Our big push for being on the cloud stems from the need to process at scale. We work in precision medicine and precision oncology. So, we need to leverage cloud pipelines to do other IT activities. We are working with real-time data from radiology departments and the fusion of radiology to genomics and pathology to do early outcome predictions. These are very computationally intensive activities. And cloud computing systems give you that added edge that local IT just cannot provide,” Sharma concluded.



Solution

Emory chose to deploy Deep-AISE through Google Cloud Platform for scalability and flexibility using the Google Healthcare API, Pub/Sub, Dataflow, ML Engine, TensorFlow, Kubernetes and the Google Container Engine.



“We wanted the on-demand nature of the cloud system, and we wanted to be able to rely on elastic computing,” Sharma said

The development team also wanted to leverage the cloud’s managed services such as BigQuery, a highly scalable, enterprise data warehouse designed to make analysis more productive by eliminating the need to

For more information visit the healthcare website:

<https://cloud.google.com/solutions/healthcare/>