

Teaming Up with MIT to Accurately Predict Sepsis and Save More Lives in the ICU Using Sentient's Distributed Artificial Intelligence

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- Agency for Healthcare Research and Quality 2011

The Problem

Sepsis affects a million patients a year in the US. Between 28 and 50 percent of these patients die - far more from prostate cancer, breast cancer and AIDs combined. Sepsis is also the most expensive condition treated in U.S. hospitals, costing \$20 billion a year in treatment and preventative care.

Physiologic data, which could be used to predict the onset of sepsis, is collected in all ICUs but is too expensive to continuously

Over a one-year period, Sentient Labs worked with MIT's Computer Science and Artificial Intelligence Laboratory team (CSAIL) to apply evolutionary algorithms on a massive scale to evolve classification rule-sets with high accuracy and acceptable false-positives over unseen data and accurately predict the onset of sepsis. If this could be done, it would provide medical staff with a window of opportunity to prevent the disease from becoming fatal.



monitor and analyze from skilled technicians due to the sheer size of data. Two such data streams, which are indicators for sepsis, include arterial blood pressure and heart rate data -- both of these signals are available minute-by-minute or every 15 minutes but are largely ignored because the immediate focus of attention and fast-paced nature of the ICU.

The Solution

In the first phase of the project, MIT uncovered what features of the arterial blood pressure waveform are highly influential in predicting future arterial blood pressure. Then, using this information and applying evolutionary algorithms at scale, Sentient Labs was able to evolve

classification rule-sets with high accuracy and acceptable false-positive rates over unseen data. Applying these rule-sets to more than 6,000 patient records (4TB of data) resulted in the ability to predict 30 minutes ahead of time, with over 90 percent

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Dr. Muhammad Mamdani, Director, Applied Health Research Center, St. Michael’s Hospital, University of Toronto

accuracy, whether a patient was likely to suffer a fatal event. This gave doctors time and the opportunity to act quickly in an effort to prevent the disease, and ultimately save more lives.

“The results are impressive enough to start commercialization,” said Dr. Muhammad Mamdani, Director, Applied Health Research Center, St. Michael’s Hospital, University of Toronto.

“The MIT Computer Science and Artificial Intelligence Laboratory team worked with Sentient to deploy problems from our ICU blood pressure prediction analytics research,” said Una-May O’Reilly, Principal Research Scientist, MIT CSAIL. “Sentient’s unique evolutionary algorithm, mapped across tens of thousands of nodes, gave us access to a method that scales to vast resources and addresses highly complex problems. Sentient enabled us to solve problems previously thought too formidable to tackle due to scale.”

At a Glance

What St Michael’s Wanted To Do

- Provide doctors and nurses in the ICU with an intelligent warning system that would provide sufficient time to treat and effectively prevent sepsis fatalities
- Create an intelligent system that could be easily scaled across multiple ICUs
- Allow the system to be operated and maintained by non-AI experts

What Sentient Labs Did

- Worked with MIT to identify complex relationships within physiologic data sets (heart rate/arterial blood pressure)
- Used its massively scaled, distributed AI to interpret and accelerate analysis of per second heart rate data and arterial blood pressure data to predict onset of sepsis with over 90 percent accuracy and only 12 percent false positives
- Used insights gained to guide research and productization

What Sentient Labs and MIT Accomplished

- Derived massive value from physiologic data that was not being used by leveraging Sentient’s distributed AI
- Established a roadmap for the productization of invaluable early warning system for sepsis

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