



ARTIFICIAL INTELLIGENCE LENDS A HAND TO CARDIOLOGISTS

Research shows how machine learning can help doctors discern between two very serious heart conditions with very similar symptoms.

TAKEAWAYS

- 1 Researchers have found that artificial intelligence can discern between two similar heart conditions with greater accuracy than most doctors
- 2 Rather than a replacement for doctors, machine learning is a powerful diagnostic tool to help providers deliver better, more cost-effective care
- 3 Artificial intelligence and machine learning have the potential to bring expert diagnoses to clinics anywhere in the world

Dr. Partho Sengupta had a hunch. A leading cardiologist now practicing at the West Virginia University Heart and Vascular Institute, Sengupta wanted to know whether the emerging field of machine learning could help solve a problem that had long vexed heart doctors.

Driven by his conviction and curiosity, Sengupta cold-called data scientists at Saffron, a pioneering artificial intelligence company in North Carolina's Research Triangle acquired by Intel in 2015¹, with an idea for a novel experiment. Several phone calls and one proof of concept later, Sengupta and Saffron were able to show that a particular type of machine learning can be a powerful—even lifesaving—aid to cardiologists.

The groundbreaking work also holds promise for delivering on the triple aims of healthcare reform: lowering costs, elevating quality of care, and improving access.

The idea for the experiment had its genesis in Sengupta's office, where, like every other cardiologist, Sengupta struggled to diagnose between two very different diseases with dangerously similar symptoms.

Constrictive pericarditis is a tricky disease for heart doctors to diagnose. People suffering from the condition have symptoms that look a lot like cardiomyopathy, a constellation of diseases affecting the heart muscle. Patients with either condition have difficulty breathing, are constantly fatigued, suffer from legs and ankles that swell with liquid, and feel weak.

But pericarditis is not heart failure. It's an inflammation of the double-walled sac that covers the heart. If it's misdiagnosed as failure of the heart muscle, and treated as such, the condition can be fatal, said Sengupta: "It's like treating a fever, but not treating the infection. You have to treat the cause."

To make the right diagnosis, heart doctors rely on their experience and the wealth of data from echocardiograms. But even with the combined power of training and technology, results are mixed. A skilled and experienced cardiologist like Sengupta can distinguish between the two diseases three out of four times. For other physicians the accuracy rate is closer to one in two.

The big question Sengupta wanted answered was this: Could artificial intelligence discern between these two diseases with greater accuracy than the most skilled doctors, thereby giving physicians a valuable diagnostic tool?

¹ <http://blogs.intel.com/technology/2015/10/intel-acquires-saffron-for-cognitive-computing/>

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After an internet search led Sengupta to Saffron, it didn't take long for the company's data scientists to realize that the cardiologist's idea for a proof of concept was well worth pursuing.

The team loaded data from 15 patients with constrictive pericarditis and 15 patients with cardiomyopathy into Saffron's Natural Intelligence Platform. That's a staggering quantity of data: 90 measurements taken from six locations in the heart and 20 times in a single heartbeat for a total of 10,000 attributes per patient per heartbeat².

Saffron and Sengupta also used a variety of machine learning known as associative memory classification, which, compared to other types of machine learning, requires less data to learn, can learn and adapt in real time without predetermined rules and parameters, and can yield insights faster. Sengupta said that associative memory classification more closely resembles the way doctors develop expertise: “A doctor learns to see certain features, to identify and recognize certain patterns. That's why this was such a good use case for associative memory classification.”

The results from the proof of concept were impressive. Not only did Saffron's Natural Intelligence Platform ultimately achieve an accuracy rate of more than 90 percent³, the tool learned quickly. It reached its accuracy rate after ingesting data from only one third of the patients, Sengupta said.

The implications for cardiology are profound, said Sengupta:

“This shows that artificial intelligence can give doctors an expert helping hand. It's a new tool to help drive decision-making and shorten the time to diagnosis.”

Sengupta cautions doctors to resist any anxiety that artificial intelligence is a replacement for the work of humans. Rather, he said, doctors and caregivers should see artificial intelligence as a tool that augments their work, an assistant that frees time and brainpower to apply to other problems, a force multiplier in the hospital.

He is also excited about what artificial intelligence can mean for heart patients who may not have access to experienced cardiologists. In the future, a clinic in any part of the world with an ultrasound machine and internet access can deliver expert heart care.

Jennifer Esposito, Intel's worldwide general manager for health and life sciences, said that this research study points the way toward a new model of healthcare: “This shows the transformative power of machine learning and artificial intelligence in healthcare.”

That research study was completed a couple of years ago, when Sengupta practiced at Mount Sinai Hospital in New York City. In that time, Intel bought Saffron and Sengupta moved from Mount Sinai to West Virginia University, where he is the chair of cardiac innovation. He continues to work on applying machine

² <http://safrontech.com/case-studies/>

³ See full case study here: <http://safrontech.com/case-studies/>

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learning to cardiology. Sengupta said the need for AI and augmented algorithms is more essential in a place like West Virginia, where cardiovascular disorders are prevalent.

“My move brings the opportunity to test the use of automation and advanced analytics using AI in real-time clinical programs in areas of highest need,” Sengupta said.

His advice for other doctors looking to experiment with artificial intelligence?

“Look for a big cause. Whenever I use technology on a problem that is bigger than my own interests,” Sengupta said, “the results have been amazing.”

