BACKGROUND

The echocardiogram is one of the most prescribed diagnostic tests in cardiology. It provides an incredibly complex and multidimensional data set, impossible to process entirely at the brain level. When physicians record the echocardiogram of a patient, the information is tracked in a spreadsheet file consisting of approximately 30 columns and more than 50 rows - all of which the physician needs to go through manually line by line. Therefore, when physicians use echocardiograms to diagnose a patient, they commonly use only seven attributes among the thousands of attributes available in the data to make a diagnosis. Cognitive computing platforms offer a new approach for not only unifying all this disparate data and processing it entirely, but also identifying potentially unrealized patterns of cardiovascular function and disease.

CHALLENGE

Dr. Partho Sengupta, Director of Cardiac Ultrasound Research and Associate Professor of Medicine in Cardiology at The Mount Sinai Hospital, needed a way to accurately identify disease patterns resulting from echocardiograms in order to improve diagnostics and save more lives. Specifically, he wanted to distinguish between two disparate diseases: cardiomyopathy, which directly impacts the heart muscle and often leads to heart failure, and pericarditis, which acts as if the heart is involved but doesn’t actually affect the heart. While both diseases present with similar heart conditions, the treatments are vastly different. For pericarditis, the treatment may include medication and, rarely, surgery. However, if the diagnosis is cardiomyopathy the patient undergoes medical management (i.e. a pacemaker) or in extreme cases, a heart transplant. Misdiagnosis of these disease conditions can put the patient’s life at risk and be very expensive for the hospital. Dr. Sengupta, therefore, looked to Saffron’s Natural Intelligence Platform to help his team increase the diagnosis accuracy of these medical conditions.

SOLUTION

Working with Saffron’s Natural Intelligence Platform, Dr. Sengupta initiated a blind study comprising 15 patients with constrictive pericarditis and 15 patients with restrictive cardiomyopathy. When the multi-dimensional echocardiography diagnostic data was ingested into Saffron’s associative memory base, the data consisted of 10,000 attributes per heartbeat per patient. The attributes were collected from 90 metrics in six locations of the heart and 20 times within a single heartbeat.

RESULTS

Saffron’s Natural Intelligence Platform was not only superior in computational speed than the traditional tools physicians normally use, but also significantly better in diagnostic accuracy. Participating physicians overall had a 65% accuracy rate of diagnostic accuracy, including Dr. Sengupta who discerned the conditions with 76% accuracy compared with Saffron’s 90% accuracy rate. In order to compare these results to a traditional reference method commonly used in this clinical setting, Dr. Sengupta also used a widely accepted statistical approach like R’s program C-trees, which resulted in only 54% accuracy. Based upon its incremental and adaptive learning using its associative memory capabilities, Saffron
has demonstrated the ability to identify patterns and classify distinct disease states more quickly and accurately than even the most highly trained cardiologists.

**HOW IT WORKS**

Saffron ingested complex echocardiography data, resulting in 10,000 attributes. Nearly two million associations were examined in 15 patients with constrictive pericarditis and 15 patients with restrictive cardiomyopathy.

Saffron’s associative memory base constructed a coincidence matrix of associations by calculating the co-occurrence of each attribute with all other attributes, for each of the 3 classes: the control group (c1), the constrictive pericarditis group (c2), and the restrictive cardiomyopathy group (c3). Saffron generated three memories during the ingest process. These three memories and the directory memory are all that’s required for non-parametric classification.

While all the coincident information was used for classification, visualization by heat maps was limited to the most informative interactions for each class due to the extremely large resulting matrices.

In the figure below, the green and red rectangular cells represent the presence of significant interactions seen with constrictive pericarditis (green) and restrictive cardiomyopathy (red). The two heat maps shown on the left are overlapped to form the third heat map on the right. The matrix of associations seen in constrictive pericarditis (green) and restrictive cardiomyopathy (red) are primarily non-overlapping with only minimal overlap (yellow).

Comparing these heat maps allowed the differentiation of the two disease states to be obvious. Dominant associations between variables seen in restrictive cardiomyopathy were distinct from dominant associations seen in constrictive pericarditis.

**Figure 1: Comparison of 2 conditions: Constrictive Pericarditis and Restrictive Cardiomyopathy**

---

**ABOUT SAFFRON**

Saffron combines the power of computing with brain-like intelligence to make sense of data and help anticipate future trends, events and outcomes. The platform adapts in real-time, ingesting data from disparate sources and automatically finding new patterns, similarities, anomalies or sequences, revealing previously undetected knowledge. Saffron enhances the speed and volumes at which data can be processed but also critically improves the accuracy of results. Businesses using Saffron can anticipate market trends, optimize processes, mitigate risk, personalize customer experiences and find new revenue streams. Founded in 1999, Saffron Technology is headquartered in Los Altos, California. For more information, please visit www.saffrontech.com.