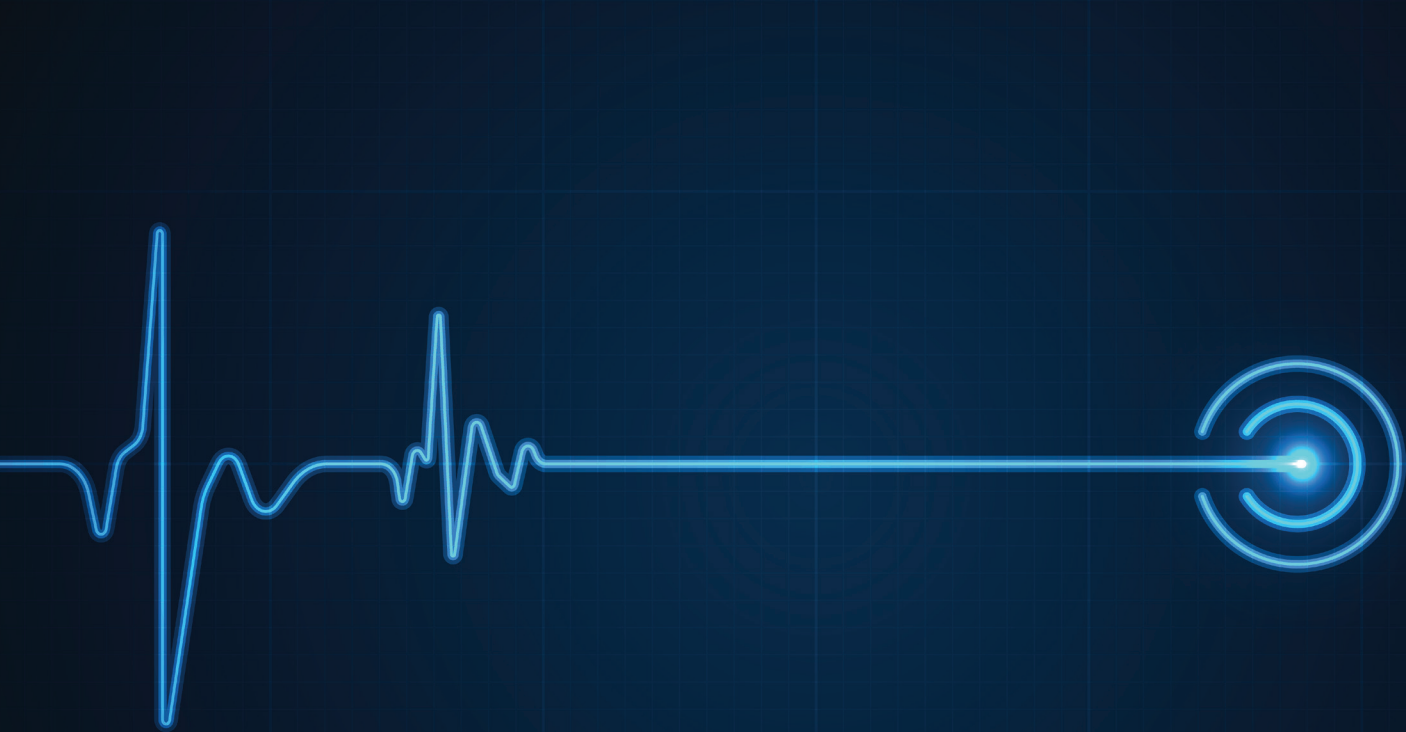
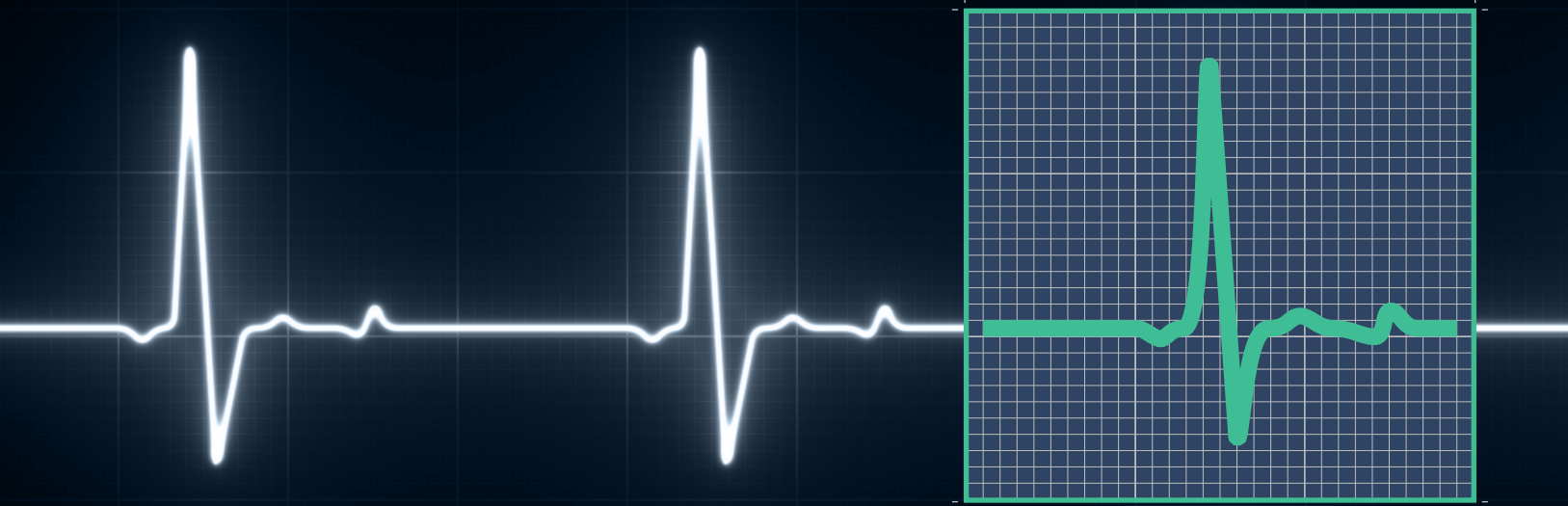


HPC Empowers the Study of the Heart & Cardiovascular Functions for Immense Healthcare Potential



Contents

Intro	3
Challenge	4
Solution	4
Research	5
Future of AI in Healthcare	6



Intro

Montreal Heart Institute is the leading medical and research facility for specialized Cardiology in Canada and is one of the largest cardiovascular institutes in the world. As a leader in clinical research, ultra-specialized care, and training programs for professionals MHI recognizes the capabilities of modern-day technologies. Robert Avram, an interventional cardiologist and researcher in Artificial Intelligence at MHI, shares his study on cardiovascular health utilizing AI & machine learning and its ability to deliver compelling benefits.





Challenge

Artificial intelligence and machine learning need both large amounts of data and large amounts of computing resources for the effective training and deployment of these models. With the explosion of digital medical data and electronic health records, large-scale medical research requires a high-performance cluster (HPC) to work with large amounts of highly sensitive medical data; passing such data over a network involves many hurdles to comply with local data privacy governance laws.

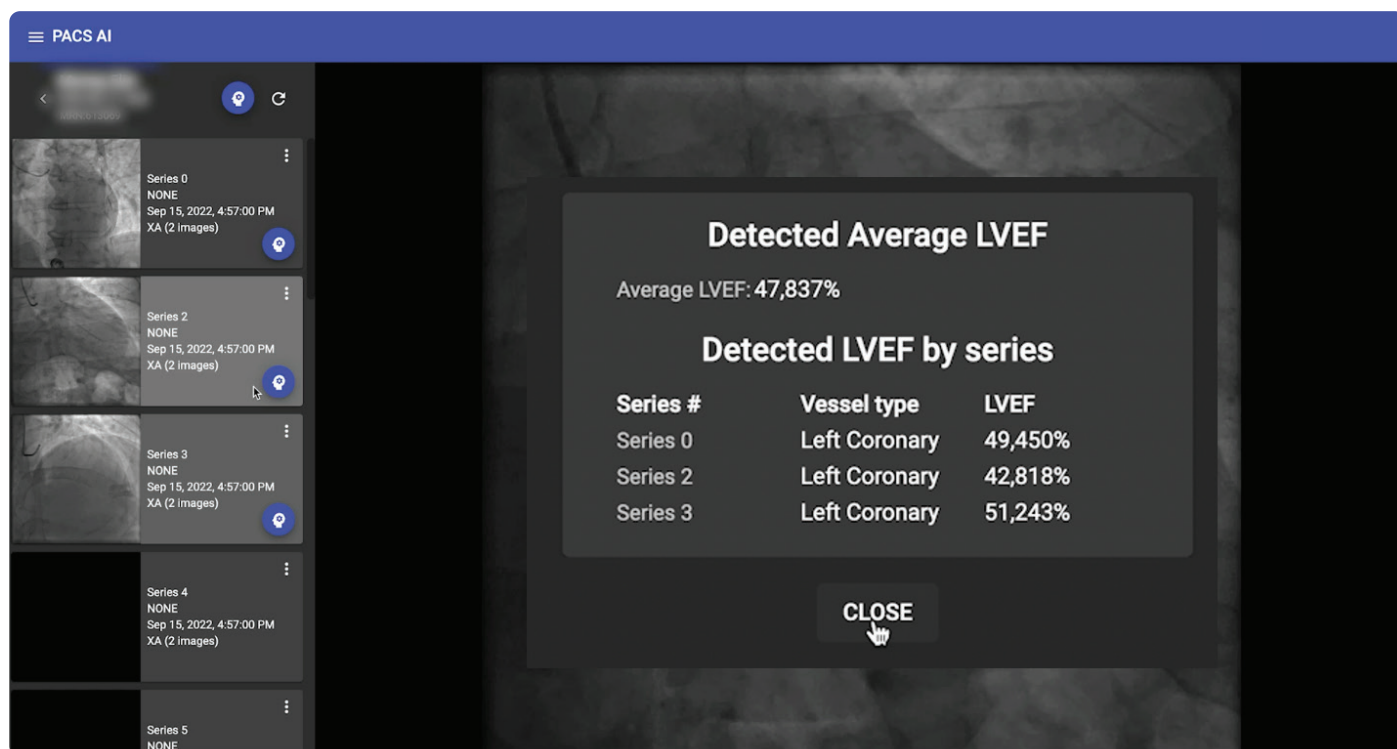
With cloud computing and remote access to supercomputers off of the table, Dr. Avram's research necessitated the need for an on-premise solution to continue & further his research at MHI. No normal desktop PC would suffice with the large amount of data needed to be ingested to train compelling AI models at an acceptable rate.

Solution

To be able to quickly train compelling AI models on large amounts of data, Dr. Avram advocated for an HPC that far surpasses the capabilities of a workstation. **Exxact Corporation** had made an impression on Dr. Avram during his post-doctorate at UCSF and his research team at MHI chose Exxact to be their solutions provider.

Over the course of their relationship, MHI has sourced two 2U GPU Compute Servers, each equipped with Dual AMD EPYC Processors and four NVIDIA RTX A6000 GPUs built to accelerate scientific computing and artificial intelligence. One server is used for AI model development (training), while the other GPU server is used for inferencing (deployment). By splitting the tasks up into different systems, MHI is able to deploy AI solutions in clinical practice while simultaneously train new models to advance the field.

Having multiple systems requires the need for a Network Attached Storage to consolidate hospital data for both GPU compute servers to be trained and deployed. With a NAS, keeping both servers fed with a consolidated data storage infrastructure is crucial for deploying and training on separate systems. Let's explore the capabilities of artificial intelligence in cardiovascular health with the use of two powerful GPU servers built for AI acceleration.



Using Computer Vision to calculate the Left Ventricular Ejection Fraction

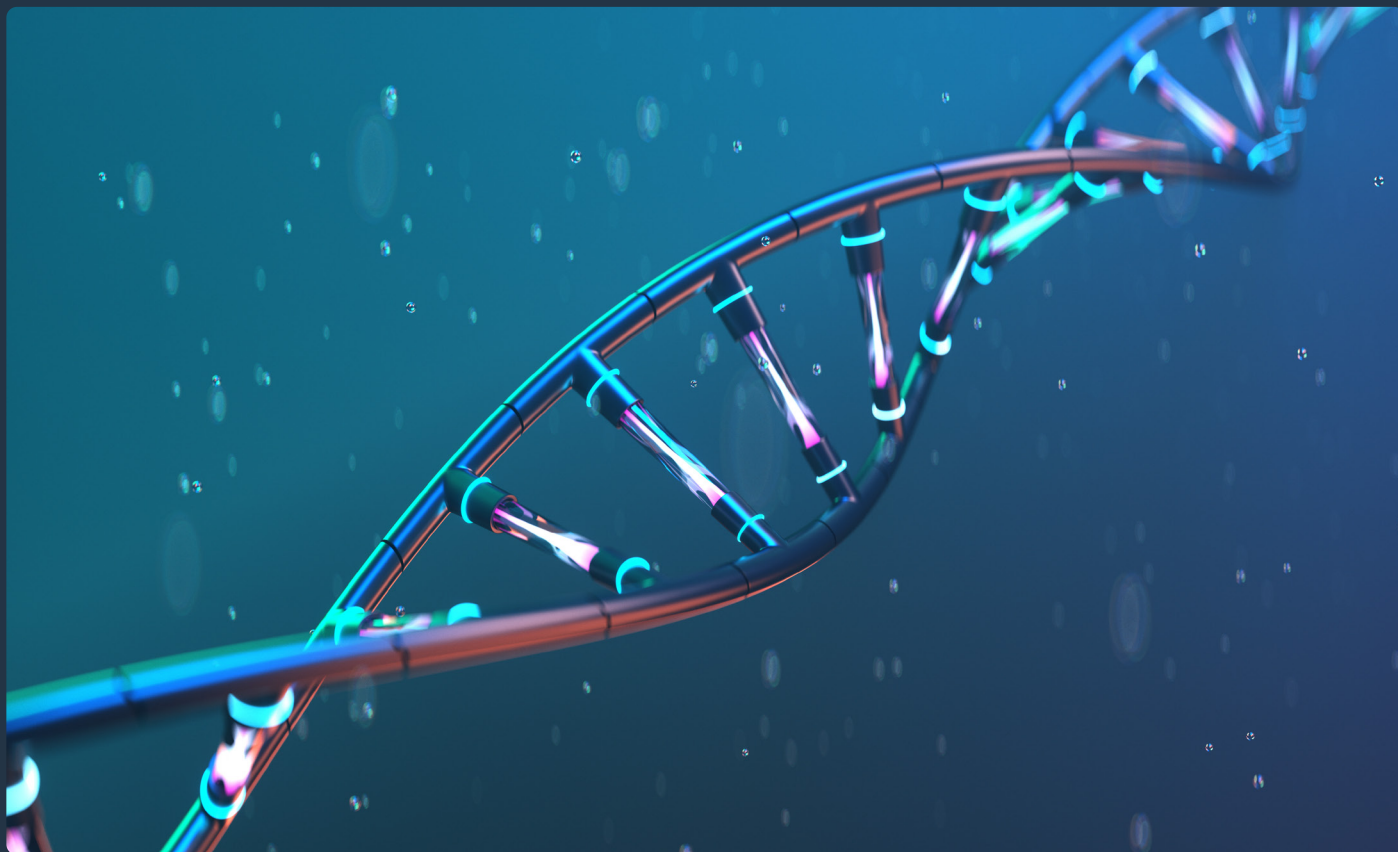
Research

Through the utilization of the HPC and NAS provided by Exxact, Dr. Avram and his team at MHI are able to develop and explore the capabilities of AI in providing automated analysis and interpretation of data from coronary angiographies, computer tomography, ECGs, and health records. These predictive models can support doctors with rapid diagnoses and provide deep insight by utilizing a combination of data science, deep learning, & computer vision to improve the screening or diagnosis of cardiovascular disease

An example of MHI's innovation is the development of an AI and machine learning model used to assist in ECG monitoring for potential heart attacks. Conventional monitoring algorithms have a small yet measurable rate of false activations. The implementation of a machine learning and AI model can be used to detect patterns in the ECG to differentiate between the edge cases of true and false activations. With extensive training & validation, internal research at MHI found that their trained AI model delivers a highly accurate diagnosis of heart attacks with significantly fewer false activations compared to traditional algorithms. Deploying these AI models around the clock could save both hospital personnel time and resources.

MHI has also trained and deployed an AI-based system for the assessment and monitoring of the pumping function of the heart – a vital metric for the evaluation of a patient's cardiac function during a heart attack, while undergoing a life saving procedure called coronary angiography. Traditional methods of using ultrasound or MRI can possibly take hours or days for results & are not feasible for real-time analysis of the ejection fraction and pumping function. MHI's trained AI model utilizes coronary angiography videos & computer vision as a tool to accurately estimate, calculate, and monitor the heart in real-time. Doctors and physicians now have the ability to address potential impacts of blockages in vessels on the pumping function of the heart around the clock, by using artificial intelligence aided analysis of the images rather than waiting for more conventional methods the next day.

Inconsistencies in the diagnoses of cardiac and cardiovascular complications are an inherent feature of the hospital environment, resulting in the divergence of treatment protocols and patient management plans. Dr. Avram's research implicates the incorporation of artificial intelligence as a valuable tool to standardize and expedite diagnoses, guide patient care decisions, & tailor treatment plans according to individual patient characteristics. Artificial intelligence can also facilitate continuous patient monitoring of vital signs, voice-to-text data dictation, risk stratification identification, & other important clinical tasks.



The Future of AI in Healthcare

MHI, like many other healthcare organizations, faces the ongoing challenge of adhering to stringent data governance regulations while leveraging the benefits of advanced AI models. Smaller local institutions often lack the necessary resources and data to effectively train robust on-premise AI models.

With proper data security measures and enabling access to powerful AI models housed in a region-wide or nationwide API like a private databank or data lake, hospitals around the area will be able to leverage the amazing studies and trained models that MHI deploy at their institution. The ability to remotely monitor patients with a highly accurate AI model can optimize resource allocation and increase operational efficiency.

As AI models continue to be exposed to larger volumes of cross institution, heterogenous data, their performance and generality are expected to improve, enabling them to address complex healthcare challenges efficiently. Dr. Avram believes in the future of AI and its potential to revolutionize cardiovascular health and healthcare at large.



“At the Montreal Heart Institute, we’re on a mission to improve cardiovascular health with cutting-edge research and technology. And we couldn’t do it without Exxact. Their high-performance computing systems have given us the power to take our work to the next level, benefiting patients, doctors, & physicians alike. We’re thrilled with the progress we’ve made so far, and we’re excited to see how accessible AI will continue to revolutionize healthcare and cardiology in the years to come!”