INNOVATION AND TECHNOLOGY

Artificial intelligence helping to make medicine and care more personalized and proactive

IMAGINE YOUR NEWBORN DAUGHTER IS DIAGNOSED with a serious congenital heart defect. You can't quite fathom a tiny infant having open-heart surgery, but the surgeon assures you the survival rate is well above 90 per cent. After the five-hour procedure, your baby looks to be recovering well. Then, quite suddenly, her heart starts to fail. The clinical team springs into action, and you watch helplessly as they resuscitate her. Her heart starts beating again and she's back on the road to recovery. You're grateful to the team that saved her, and overwhelmed by the thought that you could have lost her. But what if doctors had seen this coming? What if they'd had time to prepare or even prevent the crisis? This is the promise of artificial intelligence (AI) in medicine. And because of donor support, SickKids is poised to drive the field forward.

In January, SickKids launched AIM (AI in Medicine for Kids), a donor-funded initiative that brings together computer scientists and clinicians to implement AI projects across the hospital, signalling a palpable momentum in computational medicine. Dr. Ronald Cohn, SickKids president and CEO, says, "We are at an unprecedented time in scientific discovery and computational technology. And we have a unique opportunity to improve human health by focusing on our most vulnerable time – childhood."

AIM found early support from the Canadian tech industry. Formed in 2017, Tech4SickKids is a fundraising initiative with a goal of $25-million toward big data projects and building a modern new hospital able to support the limitless possibilities of AI. Fittingly, the first major contribution came from Toronto entrepreneur Amar Varma to fund a Chair in Bioinformatics and Artificial Intelligence – the first of its kind in Canada. It was awarded to Dr. Anna Goldenberg, a noted computer scientist with a keen interest in applying AI "for good."

"To be able to help children is so important because they have their whole life ahead of them," she says. "We can actually make a huge difference here."

As the newest member of the AIM team, Melissa McCradden, inaugural fellow of Ethics of AI in Healthcare and staff bioethicist, makes sure the tools being refined in the lab work in the real world. "Medicine is so complex, so how we move AI from the research space into clinical care must be carefully considered," she says.

Looking to infuse cold hard algorithms with transparency, fairness and the messiness of humanity, Dr. McCradden also flags ethical implications, including biases. For example, do the data inputs equitably represent the patient population? How can AI-aided decisions be explained to patients and families?

Every diagnosis and treatment decision can benefit from the insights of big data, and data-driven medicine will be personalized and proactive. It will predict and prevent so that one day, when a baby is recovering from open-heart surgery, doctors will be able to see a crisis coming and do everything to stop it.

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> **Dr. Ronald Cohn**
> president and CEO, SickKids

When she was four years old, Peyton was diagnosed with myocarditis, severe inflammation of the heart. She suffered a cardiac arrest and stroke so severe that her heart was permanently damaged, leaving her dependent on machines until a donor heart came through. Dr. Anna Goldenberg and Dr. Peter Laussen, chief of Critical Care Medicine at SickKids, are working to create an early-warning system to predict these sudden cardiac events – before they get so critical. SUPPLIED

SHOW AND TELL: VISUAL AND VERBAL ANALYSIS ADVANCING FALL DETECTION IN SENIORS

We all know them: the elderly relatives and friends who insist on living independently as they grow older. Yet advanced age can bring a number of challenges, frailty and susceptibility to falls among them.

How can we leverage technology innovation to detect falls in seniors and then initiate a timely response? For Edward Sykes, director of the Centre for Mobile Innovation at Sheridan College, the answer lies in combining computer vision, machine learning and natural language processing.

In partnership with PointClickCare, a Mississauga-based multinational technology company specializing in senior care, the Centre for Mobile Innovation is developing an approach to fall detection that addresses gaps in existing solutions, explains Dr. Sykes.

For triggering an alarm with an alert bracelet, for example, the person who has fallen needs to be conscious and able to move. Other wearable devices require seniors to frequently recharge them as well as being diligent about wearing them during the day and even for bathroom visits at night.

"There are a number of issues with current approaches," he says. "So rather than depending on wearable devices, we are interested in using feeds from unobtrusive cameras to analyze the pose of a person with a computer vision algorithm."

Multiple camera feeds can help to triangulate a person's pose and position – even behind an obstruction – and a sophisticated algorithm can determine whether a fall has taken place with a high degree of accuracy. Dr. Sykes adds that with recent research, his team is taking the approach "one step further. We are interested in using natural language processing to ask the person if he or she is okay."

When both the visual analysis and the verbal response indicate a fall, family members, caregivers or personal support workers can be notified by text message or email. And 911 calls can be initiated where required, he explains.

The aim of the Centre for Mobile Innovation is to develop prototypes that can then be commercialized by industry partners, and Dr. Sykes says it is exciting to see solutions achieve measurable impact.

"We conduct applied research with our partners to collaboratively improve the health outcomes for Canadians," he says. "For the fall detection project, we combine our capabilities in machine learning, computer vision and IoT with PointClickCare's expertise in senior care for meeting a pressing societal need."

Mike Wessinger, CEO, PointClickCare, agrees, "PointClickCare is committed to transforming health care and making a meaningful impact on the lives of millions. As a technology leader, we believe it is our responsibility to foster innovation and enable a higher quality of care and wellness for seniors, and our work with Sheridan is one of the many ways we continue to achieve this."

Technology solutions that enable seniors to live independently can improve personal health and safety as well as help to alleviate the pressure of an aging population on the health-care system, adds Dr. Sykes.

At the Centre for Mobile Innovation at Sheridan College, research student Brigham Moll works on an applied research project on fall detection for seniors with Dr. Aeiman Gadafi, the project's principal investigator. SUPPLIED