# Why we should welcome artificial intelligence in surgery

Associate Professor Narinder Singh explains how artificial intelligence is transforming medicine, surgical practice and healthcare – and why it should be welcomed.

Artificial intelligence (AI) has been around since the 1950s. Its beginnings can be traced back to a program called 'Logic Theorist' that was funded by the RAND Corporation and presented at a conference in 1956. Since then AI has been on a long and volatile road, including two long periods, known as the 'AI winters' when research and funding dried up. But all that is changing.

Narinder Singh is a Clinical Associate Professor of Surgery at The University of Sydney, and Head of the ENT Department at Sydney's Westmead Hospital. His interest in technology began when he taught himself to write machine code software on his first computer, a Commodore Vic-20, when growing up on his parents' farm in Griffith, country NSW. After studying medicine, he returned to his technology roots and was convener for the first Australian congress of the Society for Artificial Intelligence in Medicine, Surgery and Healthcare (amsah.org).

For the first time in the history of AI, "A triad of critical elements have converged," Associate Professor Singh said. "Because of these changes AI will take off and won't stop." He believes it will be game-changing, particularly for healthcare, and he's been monitoring important trends that are signalling this explosive change. "Patent applications related to AI in healthcare have more than doubled in the last four years," he said.

"The number one emerging role in healthcare is now software engineering," and "between 2018 and 2022 the biggest emerging roles in health will be data analysts and scientists".

There are more indications, of course, but these factors reveal that AI is here and its effects on medicine, surgery and healthcare are going to be monumental.

The first element of Associate Professor Singh's triad is that computers have become significantly more powerful and a lot cheaper. The second is that there's been an explosion in the amount of easily accessible healthcare data, particularly online and in the cloud, and third – AI algorithms have become vastly more accurate and effective, especially with the invention of 'deep learning' neural networks.

"AI in healthcare will automate a lot of tasks that are repetitive and that people don't like doing – and it will improve efficiency and productivity," Associate Professor Singh said. To make use of AI, the end users won't need to understand how it's working. "In the same way you drive a car, by turning on the ignition and putting your foot on the accelerator, you don't need to know how the transmission works," he said. "A well-designed tool needn't expose its inner workings to the end user."

**Example: Ear disease in Indigenous Australian children (DrumBeat.ai)**

Associate Professor Singh's research group is currently working on a major project using AI to accurately diagnose ear disease in Aboriginal and Torres Strait Islander children. Indigenous children in Australia have the highest rate of ear disease in the world. The World Health Organization (WHO) has identified it as a 'public health crisis' – a term WHO usually reserves for crises in developing countries.

It's difficult to get ENT surgeons out to rural and remote communities, and the community centres are staffed by nurses and community workers who are not as well trained to diagnose complex ear disease. Associate Professor Singh's research group is working with the Top End Health Service, Queensland Health Service, Aboriginal communities, the Digital Health CRC and Microsoft to develop an AI solution.

"We have a database of over 15,000 labelled images of Indigenous kids' ears, taken with a digital otoscope, and we're incorporating that into an AI algorithm," Associate Professor Singh said. "Eventually, we'll create a smartphone app so the untrained health worker out in the community can put an otoscope into the child's ear and get an instant and accurate diagnosis." This can be used to triage the appropriate medical treatment straight away, he said. "They might say: 'This child needs to go immediately to a specialist, or this child can have antibiotics and come back in a week, or this one, actually, is fine and can come back in a few month's time' – it's an immediate point-of-care tool." This approach is more efficient and faster than telehealth and it also means the ENT surgeon isn't looking through hundreds of pictures of normal ears.

**Example: Automated reporting of CT scans**

For sinus surgery, ENT surgeons like to have a standardised report that informs them about certain characteristics of the scan, Associate Professor Singh said. For example, they like to know whether the anterior ethmoid artery is protected in the skull base or exposed where it can be damaged during sinus surgery. Associate Professor Singh's research group designed an algorithm that can look at a scan and identify exactly where the artery is and include that in the report automatically. "We're applying the process to each individual step of the CT report, so there's a complete algorithm that can provide a comprehensive safety report," he said. By using AI, in this instance, "it frees up radiologists to look for tumours or more complex pathology".

A few years ago, there was significant concern expressed by radiologists and radiology trainees about the impact of AI on their employment prospects, Associate Professor Singh said. "What we've found over the last couple of years is that, as it's become more transparent, people have started to understand what the role of AI will be in radiology." It's turned out to be the exact opposite of what people had anticipated, he added. "AI has now led to an increased interest among trainees in doing radiology." AI will take over the more boring, repetitive tasks, and "give radiologists more time to interact with patients and look for interesting pathology", Associate Professor Singh said, noting that this was counterintuitive to what the profession had anticipated only a few years ago.

Surprisingly, a branch of AI, known as natural language processing, can go through medical records and extract data automatically. For example, it can identify all the patients who have a particular type of cancer and what stage it is, and it can select patients with diabetes and provide information on their diabetic control level. "AI can do all these things," Associate Professor Singh said. "It can also make predictions from medical records." By analysing medical records, it can predict the likelihood of a "patient re-presenting after discharge, with a high level of accuracy". The key factor for training AI algorithms, he said, is very good quality, large volumes of data. "So, data sets with 5,000 to 10,000 data points are typically what we're looking for, with the more data that can be fed into the AI algorithm, the more accurate its prediction."

Hospitals currently make use of AI in both administrative and life-saving ways. In ICU, for example, huge amounts of data are generated from the patient-monitoring equipment.

These AI tools are already in clinical use in ICUs around the world, Associate Professor Singh said. The AI algorithms read all the data – heart rate, blood pressure, temperature and lab results – and "from that they can accurately predict when a patient is going to go into septic shock around 12 hours before an experienced ICU specialist could detect it," he said. This means "you can actually intervene and save lives."

"AI is inevitable. We have to prepare for it and be proactive, rather than react to what commercial organisations are doing."

The problem we have right now with AI is fear, Associate Professor Singh added. "People are afraid they'll lose their jobs or that machines will take over the world like a dystopian Terminator scenario," but he is steadfast in his belief that these fears can be overcome. "The keywords are 'fear' and 'trust'," he explained. "If people understand AI – understand what we're doing – and there are established policies that deal with privacy, ethics, governance, transparency and how to handle data, then we'll establish trust and once there's trust, fear will be overcome." ■