ARTIFICIAL INTELLIGENCE

Text by Dr Lee Yik Voon

I recall reading a science fiction series when I was younger. It was the *Foundation* series on the story of a psychohistorian, where past history is used to predict how humans should react to future events and exceptions to apply when unexpected events occur.

That was probably the first time I came across anything close to artificial intelligence (AI). Nowadays, we think of AI as a machine with the ability to correctly interpret available data, to learn from such data and to use those learning to achieve specific goals and tasks.

What is AI really to us? We have seen movies that depict robots with AI taking command of our lives, taking over the world or even being a danger to humanity. We have heard in various media that AI can take over our jobs and create mass unemployment, but which type of jobs are most likely to be taken over by AI? We are not sure. Despite feeling confident that our job as medical healers will be least likely to be replaced, our minds still play tricks on us from time to time.

Between the late 1990s and early 2000s, AI began to be employed in areas such as logistics, data mining and medical diagnosis, to name a few. As the computational power of computers increases exponentially, AI's prowess also increases by leaps and bounds.

High-profile examples of how AI is used include autonomous vehicles (eg, drones and self-driving cars), medical diagnoses, art (eg, poetry), mathematical theorems, games (eg, Chess and Go), search engines (eg, Google), online assistants (eg, Siri), facial recognition in photographs, spam filtering, flight delay predictions, judicial decision predictions, online advertisement targeting, energy storage, and even helping news agencies post stories more effectively to generate higher traffic.

AI in healthcare

The faster computers, algorithmic improvements and access to large amounts of data enabled advances in various types of AI, of which machine learning with neural networks and deep learning, natural language processing, rule-based expert systems, physical robots and robotic process automation are just a few that are relevant to medical science and healthcare.

These technologies have the potential to transform many aspects of healthcare, as well as administrative processes between providers, payers and pharmaceutical organisations. Some examples are listed below.

Advancing surgery methods

A medical team at the Children's National Medical Center, Washington, successfully demonstrated a supervised surgery where an autonomous robot stitched together a pig's bowel during open surgery.

Many such robots exist today, one of which is the da Vinci Surgical System, a robotic surgical system controlled by a surgeon from a console that facilitates minimally invasive surgery.

Classification

AI can be used to determine whether to automate initial evaluation of a CT scan or ECG, or to identify high-risk patients for population health.

Precision medicine

AI is used to correctly determine the accurate dose of immunosuppressant drugs to give to organ transplant patients.

Microsoft's AI "Hanover" helps doctors to find the right treatments for cancer. With more than 800 medicines and vaccines, the machine memorises all the papers relevant to cancer and helps predict which combinations of drugs will be most effective for each patient.

AI can also be used to monitor multiple high-risk patients based on data acquired from live doctor-patient interactions.

Transfer learning

In ophthalmology, a machine can perform a diagnosis similar to a well-trained ophthalmologist and generate a decision within 30 seconds on whether or not the patient should be referred for treatment, with more than 95% accuracy.

Concerns with AI adoption

Many AI projects have shown that they can accurately diagnose and treat disease with methods, but they are not yet adopted for clinical practice as they are not substantially better than human diagnosticians, and have poor integration with clinician workflows and medical record systems.

Many AI projects are standalone in nature or address only a single aspect of care. They are often not able to handle the explosion of data and knowledge based on genomic, proteomic, metabolic and other approaches to care.

An example would be IBM's Watson, well known for its focus on precision medicine, in particular cancer diagnosis and treatment. However, enthusiasm faded quickly when potential customers realised the difficulty in teaching Watson how to address particular types of cancer and integrating Watson into care processes and systems.

Patient engagement and adherence has long been seen as the "last mile" problem of healthcare. The more patients proactively participate in their own well-being and care, the better the outcomes in utilisation, financial outcomes and member experience. When a patient does not follow his/her treatment plan or take the medicine prescribed as recommended, it becomes a major problem. The reasons for poor compliance and non-compliance are increasingly being looked into and studied by AI and big data.

Experimentation with chatbots for patient interaction, mental health, wellness and telehealth has been applied for simple transactions like refilling prescriptions or making appointments. User surveys revealed several concerns, some of which include revealing confidential information, discussing complex health conditions and poor usability.

Opinions have been voiced concerning AI leading to automation of jobs and replacement of the workforce. However, a number of external factors that limit job loss include the cost of automation technologies, cost of connectivity and power, and the labour market growth and its cost. The benefits of automation beyond simple labour substitution, as well as regulatory and social acceptance, are only a suspicion.

The healthcare jobs most likely to be automated would be those that involve dealing with digital information (eg, radiology and pathology), rather than those with direct patient contact.

Even so, our radiologist colleagues are not likely to be put out of jobs as they do more than just reading and interpreting images. Radiologists also consult with other physicians on diagnosis and treatment, provide treatment options (eg, local ablative therapies), perform image-guided medical interventions (eg, cancer biopsies and vascular stents), define the technical parameters of imaging examinations to the patient's condition, relate findings from images to other medical records and test results, discuss procedures and results with patients, and others.

Also, for automated image analysis to take off, there need to be substantial changes in medical regulation and health insurance. Similarly for pathology and other digitally oriented aspects of medicine; hence, we are unlikely to see substantial change in healthcare employment due to AI over the next two decades or so. Rather, it is more likely that new jobs will be created to work with and develop AI technologies.

Ethical implications

Finally, there are various ethical issues about the use of AI in healthcare. Current healthcare decisions are made by humans. If AI were to be used, it will raise issues of accountability, transparency, informed consent, regulation and confidentiality.

I see transparency as the most difficult issue. Many AI algorithms, for example the deep learning algorithms used for image analysis, are practically impossible to interpret or explain. Physicians, familiar with their operations, may find it very hard to explain to these patients how an image has led to a diagnosis of cancer.

Mistakes will undoubtedly be made by AI systems in patient diagnosis and treatment, and it may be difficult to establish accountability, let alone responsibility.

We know that patients prefer to receive medical information and advice from an empathetic clinician instead of a cold AI system.

AI in healthcare may also be subjected to algorithmic bias. Sometimes, the prediction of a greater likelihood of disease is based on gender or race, when these may not actually be the causal factors.

Looking ahead

In the roads ahead, we will encounter many ethical, medical, occupational and technological changes with AI in healthcare. It is important that the various healthcare stakeholders form a framework to monitor key issues and establish governance mechanisms to limit negative implications over a longer term period with frequent and regular reviews and revisions.

I think that AI systems will not replace human clinicians on a large scale, but instead it will augment their efforts to care for patients. Over time, human clinicians may move toward tasks and job designs that draw on uniquely human skills like empathy, persuasion and big-picture integration. Perhaps those who lose their jobs may only be those who refuse to work alongside AI.

We are in the exciting times of rapid adoption of AI in our world and one needs to be mindful and discerning what AI can do to make our lives better instead of fanatically chasing it like paparazzi going after celebrities.

Like all things, they have their own strengths and weaknesses, and looking at them with clear glasses will make it safe to be used in humans for healthcare. This will allow for AI to be a valuable partner in healthcare application. ◆

Further readings

1. Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthc J. 2019; 6(2):94-8.

2. Artificial intelligence. Wikipedia. Available at: http://bit.ly/2ZJUvKr.

Dr Lee is a GP practising in Macpherson. He is also a member of the current National General Practitioner Advisory Panel. He is a pet lover at heart who is the proud owner of a dog, and regularly feeds neighbourhood community cats. He also enjoys playing online war games and thinks that playing Pokemon Go is a good form of exercise.