

# How your next doctor could be a machine

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Columnist

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Dr Allison Young, an audiologist and researcher at Sydney's Royal Prince Alfred hospital, is working on modified swim goggles that she hopes one day will be able to feed data into an artificial intelligence algorithm and help diagnose the dizziness disorders suffered by 40 per cent of Australians at some point in their life.

Across town, at Sydney's Westmead Hospital, Dr Narinder Singh is working on a digital otoscope – the combination of flashlight and magnifying glass that healthcare workers stick in your ears – that uses AI to quickly and accurately diagnose ear diseases among Aboriginal and Torres Strait Islander children, before the diseases lead to hearing loss.



Dr Allison Young has won \$300k to develop AI tech that helps hearing and balance impairment. Nick Moir

Helping Siri tell you what the weather's like outside isn't the only thing machine learning and artificial intelligence are good at, it's emerging.

AI machines are good at medicine, too. In fact, it could be the thing they're best at.

"Medicine is *the* use case for AI," says Nicholas Therkelsen, co-founder and CEO of Max Kelsen, a Brisbane-based AI company that builds machine-learning models for industries as [wide-ranging as fast-food, car share](#) and healthcare.

"When we look back and ask, 'What was the biggest disruption that AI and ML caused?', it will be to how we deliver healthcare," he says.

## Better than humans

The reason is a straightforward one: when you boil it down, diagnosing medical conditions is all about recognising patterns in data, be the source of that data an x-ray, a CT scan, a blood test or simply a conversation with a patient; and machine learning is really, really good at recognising patterns.

In many cases, it's already better than humans at recognising patterns in data taken from a single source, and it's quickly developing the ability to find patterns in "multimodal" data taken from multiple sources at once, says Therkelsen.

"Healthcare is extremely pattern-recognition focused. And not just simple patterns, but multimodal signals," he says. "Healthcare professionals infer things visually, they infer things from language, from test results, from scans, and the sum of all those, the pattern that exists across all those modes, is what will drive them to make a diagnosis.

"That is something that, traditionally, machines have been very bad at – looking at different modalities of data at once – but it's something that AI has started to get very good at."

Dr Young's modified swim goggles look for patterns in eye movements.

## "A machine can look at a patient's entire medical record at once ... and make an inference."

— Nicholas Therkelsen, co-founder and CEO of Max Kelsen

One of the symptoms of some inner-ear disorders, she explains, is that they can cause the sufferer's eyes to flick side-to-side, leading to crippling dizziness attacks that can be likened to the "bed spins" you might suffer after a heavy night's drinking.

(Indeed, bed spins are actually caused by the eyes involuntarily moving side-to-side, too, she points out. When you're drunk "a misbehaving inner-ear system" causes them to flick in one direction, and the next morning when you're sobering up they flick the other direction, oddly enough. Her professional cure for the bed spins: put one foot on the floor.)

The goggles, for which Dr Young recently received a grant from the Passe and Williams Foundation, contain small infrared lights, and cameras that record a 15-second video of patients' eyes when they're in the middle of a dizziness attack.

The video is fed into a machine-learning system to help create a model that could one day be used to diagnose the disorder.

The computer, Dr Young says, is looking for "eye movements that are too subtle to view just by looking at someone while they're dizzy".

She's hoping it will identify patterns in the movements, that it can then correlate to particular conditions, turning it into a powerful diagnostic tool.

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"We're hoping to find patterns we hadn't noticed before. That's the whole point of machine learning: to find things we hadn't thought of before, that might help to connect the dots," Dr Young says.

Over at Westmead Hospital, Dr Singh is heading up a team, backed by Microsoft's AI platform and also funded by a grant from the Passe and Williams Foundation, that's using machine learning to detect those elusive "multimodal" patterns, taken from a combination of otoscopic videos of the eardrum, clinical notes and other tests conducted on children suffering ear infections, eardrum perforations and other illnesses in remote and regional Australia.

Healthcare workers in the Northern Territory had already collated and annotated 10 year's worth of data, matching otoscopic videos with the diagnosis that specialists ultimately came to in each case, and Dr Singh's team has been using that data "gold" to train a machine learning model to make diagnoses for itself.

"When you have hearing loss in an older person, it's not a big deal," he says. "They can wear a hearing aid. But if it happens in young childhood, then they never properly learn how to speak, and that can lead to a whole cascade of problems."

The solution is timely intervention, such as antibiotics that might prevent a simple ear infection from turning into permanent hearing loss. But with a lack of specialists in rural and remote communities, Dr Singh is hoping an AI processor built into an otoscope, or possibly just an otoscope that connects to an AI processor running on a mobile phone, will provide the instant examination results that are needed.

The ML model is already 95 per cent accurate at diagnosing a single disease, but it's not yet as accurate when it's asked to identify one of a number of possible diseases.

Like Dr Young, Dr Singh is hoping that ML's pattern-recognition ability will find correlations in the data that even specialists like him have missed.

"As specialists we are trained to look for certain features which we use to then define a diagnosis," he explains.

"But with AI, if we give them the training data, give them the test data, we don't know what they're looking for. We assume it's the same thing that we're looking for, but sometimes it can be other things that we hadn't anticipated."

And, like Dr Young, Dr Singh isn't worried by the possibility that machine learning may one day soon be better at diagnosing ear disorders than he is.

"What we don't want to do is replace the doctors. There's much more to diagnosis than simple image classification. The idea is to augment and help what the doctors are doing," he says.

Indeed, back at Max Kelsen, Nicholas Therkelsen says health care professionals are not only *not* worried about being replaced by AI, they're enthusiastically embracing the idea.

"A machine can look at a patient's entire medical record at once," he says. "All of their test results, all of their clinical notes, all of their scans, pay attention to the timeline over which the events all occurred, and make an inference.

"A human struggles to hold all that information in their head at once. With clinicians, there's always the fear of getting something wrong, and so having a second opinion from a machine that looks at all the information is generally very welcome.

"We work across a range of industries, and of all our customers, clinicians stick out as the most engaged and excited by the technology. They annotate and curate data to help us build algorithms that can perform tasks they don't want to do, so they can focus on the tasks they do want to do."

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