What's next

Healthcare

How I learned my ABCs: The similarities between AI and toddlers

Artificial intelligence (AI) is quickly transforming decision-making in healthcare. From improving the accuracy and quality of clinical documentation to helping radiologists detect abnormal images to make them high priority, AI is freeing clinicians to focus more of their brain cycles on delivering effective patient care.

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Now, thanks to the impact of deep neural networks (DNN), the application of AI and machine learning to healthcare may finally be reaching a crucial tipping point. But what are neural

networks? One of the best ways to understand this is to think about how children learn.

I've been teaching my two-year old about animals, pointing to different ones in a book. It struck me that there are a lot of similarities in the basic elements of animals, yet small children are able to learn and tell them apart. Four legs and a tail— this could be almost any land-dwelling animal. But one has a very long neck while the other has a trunk. These distinguishing characteristics help our brain analyse the information and arrive at the correct conclusions: A giraffe versus an elephant.

Neural networks are designed to work in much the same way the human brain works. An array of simple algorithmic nodes—like the neurons in a brain—analyse snippets of information and make connections, assembling complex data puzzles to arrive at an answer. The "deep" part refers to the way deep neural networks are organised in many layers, with the intermediate (or "hidden") layers focused on identifying elemental pieces (or "features") of the puzzle and then passing what they have learned to deeper layers in the network to develop a more complete understanding of the input and produce a valid output.

Just like my two-year-old, and all other humans, the network is not born with specific knowledge; it must be trained, like understanding the difference between a giraffe and an elephant noticing one has a big neck and the other has a short one. By feeding the network large amounts of data with known answers, we are effectively "teaching" it how to interpret and understand various inputs— this is also known as "machine learning." For example, training a DNN to perform medical transcription might involve feeding it billions of lines of spoken narrative and resulting textual output to create a "truth set"—spoken words connected with accurate text. The truth set expands over time as the DNN is subjected to more inputs and the network's ability to deliver the correct answer becomes more robust. If it gets something wrong, the DNN then must be corrected to reinforce it's understanding. Like a toddler just learning to identify colours, shapes and animals, the DNN will soon be able to deliver the right answer.

So how are DNNs changing the way healthcare is practiced? Two areas among many potential applications include clinical documentation improvement (CDI) and radiology image processing. Clinical documentation includes a wide range of inputs, from speech-generated or typed physician notes to labs and medications. Traditionally, CDI involves having domain experts review the documentation to ensure a physician put into documentation an accurate representation of a patient's condition and diagnosis. However, this approach requires time and resources, and can be disruptive to physician workflow. One approach to automating this process is an arduous, complex processing task that involves capturing and digitising the domain expertise to create a knowledge base, then applying natural language processing technology to then generate a query for the physician in real-time as she is entering her documentation.

Neural networks improve this process dramatically. Now we can use historical clinical documentation from physicians, including the queries generated by domain experts, to create a truth set for training the neural network. This allows us to skip all the complexity in the

middle. The DNN figures that out for itself, based on what it "learned" from the historical truth set. Ultimately, this helps improve documentation by having AI figure out the missing pieces or connections to advise physicians in real time while they're still charting. What AI is doing here is allowing physicians to focus on patients while the system manages the billing codes, regulatory requirements, quality measures and safety indicators in records.

DNNs are also changing the game for evaluating visual data, including radiological images. It takes the highly experienced set of eyes of an expert who has studied thousands of similar images to read the subtle clues found there. With neural networks, we can leverage this experience by training the network with thousands of radiological images with known diagnoses. The more images fed through it, the more "experienced" and accurate it becomes, enabling the network to detect the subtle differences between a positive finding and a negative finding. This technology is going to augment the busy workflow of the radiologist and truly amplify their knowledge and productivity by helping them to do things like prioritise the most critical studies. Today when some radiologists read 100 images a day, having AI sift through and spot atypical images to prioritise them first delivers value to physicians and patients who are both looking for the best outcomes.

The possibilities for neural networks are incredibly exciting—they are powerful tools for augmenting human expertise, not replacing it. Clinicians today have so many responsibilities, and AI is a promising way to help offset that work and allow them to focus more on patient care and activities that require a human touch.

Tags: Artificial Intelligence, clinical documentation, health IT, radiology

More Information

About Sarah Fisher

Sarah Fisher is regional marketing manager at Nuance healthcare division covering UK, Ireland and APAC. Sarah has 25 years in marketing and sales at companies including Xerox, Siemens and Cisco. A spell at Novartis leading a team to deliver 'more-than-medicines' solutions in UK healthcare combined her degree and a first job in Pharmacology research with a passion for the potential of healthcare IT to overcome the many challenges faced by all healthcare systems. In her spare time Sarah leaps fences and tackles tricky trails pursuing her hobbies of horse trials and mountain biking.

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