

AI, are dermatologists' days numbered? (Synopsis)

Technology is always moving forward and it is not surprising that investing in healthcare related artificial intelligence (AI) projects was more popular than any other sector of the global economy in 2016. (1) Many, however, believe AI will be the end of humanity and that medical AI would render doctors unemployed.

The media reinforced this when the diagnostic capabilities of convolutional neural networks (CNNs) against board-certified dermatologists were tested. "The CNN missed fewer melanomas, meaning it had a higher sensitivity than the dermatologists, and it misdiagnosed fewer benign moles as malignant melanoma, which means it had a higher specificity; this would result in less unnecessary surgery,"(2) This was reported as ‘machine beats man’, ‘the rise of AI’ or titles to that effect.

The art of diagnosis

Diagnosis comes from the Greek for ‘to discern/distinguish’ and follows:

- 1) Patient history
- 2) Differential diagnosis
- 3) Narrow differentials and order investigations
- 4) Confirm hypothesis and seal diagnosis

In 1945, Gilbert Ryle differentiated between 2 types of knowledge; “knowing that” (the propositional and factual kind) and “knowing how” (skill based, experiential). Do diagnosticians rely on one more than the other?

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A study investigated the brain activity of radiologists when they were making diagnoses.(3). They required, on average, 1.33 seconds to reach a diagnosis and certain areas of the brain lit up constantly throughout the experiment. “Our results support the hypothesis that a process similar to naming things in everyday life occurs when a physician promptly recognizes a characteristic and previously known lesion,” (3).

With extrapolation, it can be said that to a dermatologist, identifying a mole could be similar to identifying an animal. Making a diagnosis in 1.33 seconds requires training and experience; humans make mistakes, learn and grow. Can machines do the same?

CNNs

Current machines used in medicine don't learn. An ECG machine used 5000 times is no wiser than one used just once. CNNs, however, are capable of teaching themselves and improving their own performance. They learn from images that are fed into its system; much like how the neurones in the brain respond to what the eyes see (much like the brain of a child).

A CNN study carried out by Stanford university used a pre-trained version of the Google Inception-v3 deep neural network was trained by inputting 129,450 skin lesion photographs from public databases and data obtained from hospitals (2032 diseases).

The aim was to differentiate between:

- 1) Keratinocyte carcinomas and benign seborrheic keratoses (most common scenario)
- 2) Malignant melanomas and benign nevi (deadliest scenario)

The CNN performance was on par with, and in some cases better than dermatologists in both scenarios; demonstrating competence. A deep learning system beat doctors at a task they are

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specifically trained to perform. Does this mean dermatologists will be out of a job very soon in the future? Not quite.

- 1) Many conditions in dermatology and indeed medicine are rare. Rates of 1 in a million are not uncommon and since the system needs image input, hundreds of millions of cases will be required to teach the system all the diagnoses.
- 2) AI systems don't have explanatory powers. They can solve a case but cannot build one. To patients, clinical visits are more than just finding an answer. They seek comfort and reassurance; doctors are trained to do that.

Conclusion

The industrial revolution did not replace farming; it improved efficiency. The telephone did not replace human voice; it made it louder. Therefore, I believe AI systems are going to augment dermatology, not take over it. In conclusion, dermatology is heading into evolution thanks to artificial intelligence, not extinction.

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