

## Synopsis

## Introduction

Artificial intelligence (AI) generally refers to computerised systems that can make 'good' decisions. Proof-of-concept successes with diagnostic AI<sup>1-3</sup> have fuelled dermatologists' fears of redundancy and what economists term "technological unemployment"<sup>4,5</sup>. This essay will discuss diagnostic AI in the wider context of the dermatologist's role, whether dermatology is uniquely vulnerable, and external factors that may stall the adoption of AI.

## What diagnostic AI is currently available?

The predominant diagnostic AIs are convolutional neural networks (CNNs). CNNs train on large datasets of known input-output pairs, then alter internal values to minimise error. They 'evolve' the ability to recognise minute non-linear relationships that are infeasible to program. CNNs mimic data flow through the visual ventral stream<sup>6,7</sup>. Accordingly, CNNs excel at image recognition. By 2014, the GoogLeNet CNN was already within 2% of the estimated 5.1% human error rate<sup>8,9</sup>.

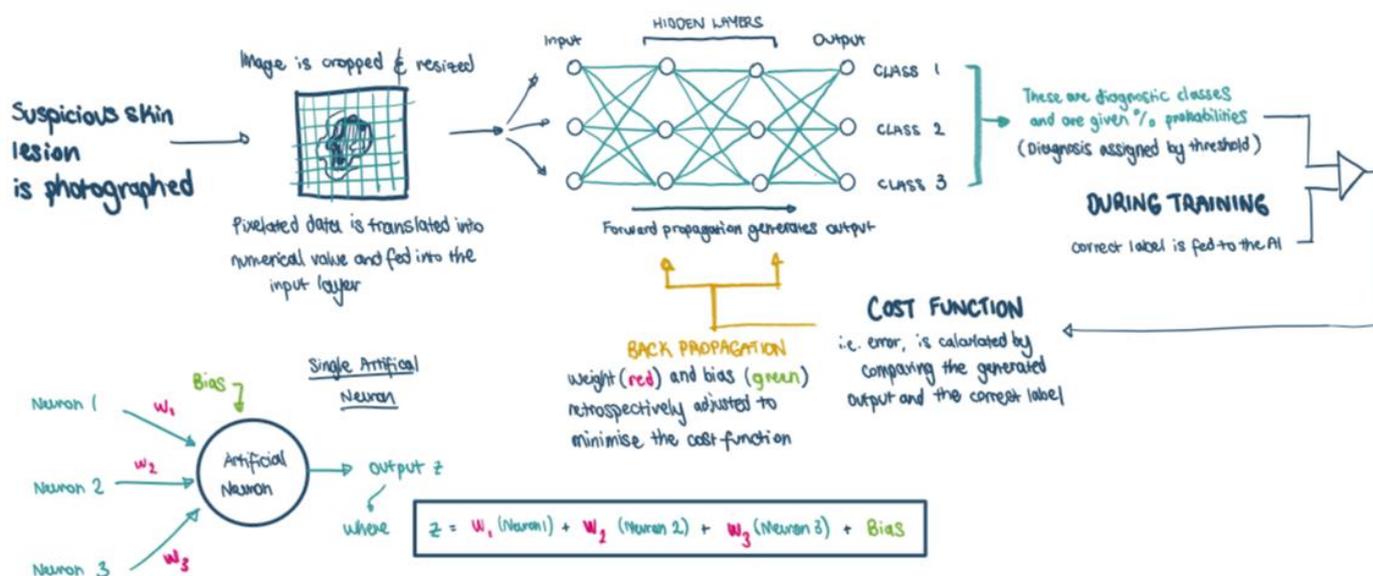


Fig.1 – Simplified overview of Neural Networks

## What can diagnostic AI currently do?

Diagnostic AI can accurately distinguish at least 9 skin disease categories from images of skin lesions<sup>1</sup>. Regardless of clinical context, most dermatologists were outcompeted by AI predictions made on dermoscopy alone<sup>2</sup>. Whereas a 2017 AI needed hundreds-of-thousands of images<sup>1</sup>, a 2018 CNN using fewer than 5,000 images accurately classified even more tumour types<sup>3</sup>.

## What do dermatologists do?

Dermatologists see 800,000 patients a year in England and Wales<sup>10,11</sup>. Their role includes hosting specialist clinics, participating in multidisciplinary team meetings, overseeing specialist treatments, advising on hospitalised dermatological comorbidity, teaching junior staff, carrying out clinical audits, regular appraisals, and academic research<sup>12</sup>. The diagnosis and management of skin cancers make up 50% of the dermatological workload; surgery accounts for a third<sup>11-14</sup>.

## **Will AI replace dermatologists?**

To replace dermatologists, AI would need to excel at more than spot diagnosis. This feat is still a while away. A 2013 report deemed that, of 700 occupations listed, the physician/surgeon was ranked 15<sup>th</sup> least likely to be automated imminently.

A primary care AI screening tool could save resources while improving detection rates, and thus increase demand for specialists by picking more cases for referral. However, why have dermatologists reconfirm cases an AI has triaged? AI will detect more cases and inappropriately treat fewer patients than the dermatologist<sup>2</sup>. The slim advantage human dermatologists have is their broad understanding of skin that, metaphorically, AI has traded for diagnostic depth.

### *Is Dermatology uniquely vulnerable?*

So far, AI successes have clustered around image-recognition CNNs. Visual diagnosis is a significant proportion of dermatologists' workload. With the lack of dermatological expertise in primary and secondary care<sup>12,14</sup> then diagnostic automation may be welcome. Dermatological surgery remains safe for now; there are few developments with surgical automation<sup>14</sup>.

## **Acceptance**

Alongside demonstrations of efficacy, AI will have to be accepted by the regulator, the public, and the profession. The predictive reasoning of neural networks is notoriously difficult to analyse and regulators will need to assess systems which are designed to constantly be rewritten. Elsewhere, public opinion is often poor when automation is explicit. In aviation, Boeing's chief technology officer referenced public perception as the main obstacle to fully automated airplanes<sup>34</sup>. SEDASYS, an automatous sedation system, was ultimately withdrawn after long-standing opposition by professional groups<sup>17</sup>. Unforeseen legal, cultural, and political barriers could stall the current momentum behind development and cast diagnostic CNNs into a new "AI winter"<sup>31</sup>.

## **Conclusion**

AI has shown proficiency with specific diagnoses, but dermatologists are needed translate these diagnoses into holistic care. There are still hurdles to overcome but indefinitely withholding the benefits of AI from patients is difficult to justify. By conceding ground to AI diagnosis, dermatologists can continue to further their role and improve patient care by dedicating more time to counsel, treatment, or research.

Word Count: 600

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