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AI and computational thinking in Medicine

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As computational technology has developed, so has the structure of our society around it. This has led to many shifts in our culture met with varying levels of resistance, but the integration of machine learning into many spheres of life has been a major cause of concern for many. There are fears of human ability becoming obsolete, but also of the dangers that a reliance on artificial intelligence (AI) might cause. This is particularly so in the field of medicine. The advances in AI in the last few years have been highlighted by the recent launch of a variety of AI interactive online platforms which interact in a conversational manner such as Chat GPT. This allows patients to ask questions related to their illness or symptoms with often reasonable replies in relation to their diagnosis. Some models of AI can even suggest what tests are necessary and what medication may be useful. Other AI platforms can perform tasks such as radiological interpretation of certain scans with interpretation in some cases to an acceptable standard but at a significantly higher speed. The big question for doctors is whether AI is perceived as a threat or something that can be embraced to enhance their work and result in better and more efficient outcomes for patients.

In medicine, the merit of AI is a much more concrete question than in many other fields. The effectiveness of AI in medicine can be scientifically measured and standards set. Its accuracy in many situations can be monitored, gauged and refined. However, there is a resistance to AI in medicine, partly due to distrust, fear or threat but also due to a lack of understanding of the inner workings of deep learning.

This lack of understanding is not due to ignorance, rather, it is due to the very nature of AI. Aaron I. F. Poon and Joseph J. Y. Sung discuss the idea of this “black box” in AI medicine and how this prevents trust of its output, especially when it comes to the subject of a person’s health [1]. When patients are dealing with their health, it is understandable that they wish to know the rationale behind their diagnosis and how they are advised to deal with it. Poon and Sung cite liver disease as an example that requires confidence in the accuracy of the diagnosis as “many of the liver diseases are asymptomatic until advanced stage”[1]. Diagnosis and treatment of disease is expensive and when combined with the stress that comes with being diagnosed with any sickness, it is very understandable why people would want to feel confident in their diagnosis. There is always the danger of unnecessary treatment that comes with false positives. From the clinician’s perspective, Poon and Sung point to three aspects that are necessary for confidence in a machine learning model: trust, consistency, and explanation. Trust that a model is accurate and what’s right for a patient, consistency with what the clinician knows to be true, and explanation for how the model comes to its decisions.[1]

Unfortunately, understanding complex models is not easy, but there are steps that can be taken: "First, one needs to make existing data structural so that it is analysable by the machine. Second, from the structural data, the machine has to identify key vectors related to outcome. Then, the machine has to develop mechanism to explain why the outcomes happen. Next, based on the vectors and the mechanisms developed, the machine will need to project and predict what will happen. Finally, with all the preceding steps being successful, the machine has to recommend strategies to fix the clinical problem and to make the favourable outcome happen" [1]. The outcome of an interoperable algorithm is it allows the user to better understand and, as a result, to debug and improve the algorithm. Despite this, there is still a mistrust of AI, particularly in comparison to humans. Maciej A. Mazurowski interrogates how this perception of AI can lead people to expect an unreasonably high standard before they will accept it[2]. There is a certain innate trust that people have in other humans, an expectation that behind every decision a human doctor makes is a rational thought process, unlike the unknowable nature of AI. But in truth, humans are not so logical. Although humans like to believe their thought processes and instincts to be explainable and rational, Mazurowski suggests that this is not the case. Much like artificial neural networks, human brains make decisions by processing signals by a complicated network of interconnected neurons. As humans cannot perceive precisely which neurons are firing in their own brains, there is no way for them to wholly understand the way their own decisions are made.[2] There is concern that AI models will make mistakes when it comes to outlier cases, yet the same can be said for human doctors. Despite this, there is still a greater expectation of explanation for AI than for humans.

Mazurowski notes that while may AI receive an undue burden of expectation, there must still be a healthy amount of mistrust towards AI. While both humans and AI, make mistakes, human mistakes are still more predictable as a result of how long humans have been making mistakes in medicine for. AI is still relatively new and must be rigorously tested against diverse real-world scenarios. [2]

While doctors have reason to be concerned that AI will take over their job, what matters the most in medicine is the lives saved, however, for AI to be at its most effective it must be implemented carefully and over time. Mazurowski points out the importance of managing expectations when it comes to the future of AI in medicine. If the extent to which AI is expected to take over medicine is exaggerated, then medical students may be dissuaded from studying the specialty leading to a shortage, but if AI's future involvement in medicine is underestimated, then medical students will be forced to retrain in order to use their skills to help improve lives.[2]

In summary, careful consideration must be taken to properly implement artificial intelligence. AI may be a key step in human progress, but that progress is still human and influenced by our own flaws and societal issues. Like deep learning in computers, our own sense of understanding evolved almost randomly, based on what helped us to survive and reproduce. Fittingly, this thing we call a "neural network" is not too different to how our own brains work, and it must be treated as such rather than an infallible creator or a random unpredictable set of processes. It should be adopted

as an adjunct, partner and helper, and be rigorously tested and improved upon. It will unlikely replace doctors, but rather help to enhance medicine and ultimately improve patient outcomes.

Declarations of Conflicts of Interest:
None declared.

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References

1. A. I. F. Poon and J. . J. Y. Sung, "Opening the black box of AI-Medicine," *Gastroenterology and Hepatology,* vol. 36, no. 3, pp. 581-584, 2021.
2. M. A. Mazurowski, "Do We Expect More from Radiology AI than from Radiologists?," *Radiology: Artificial Intelligence,* vol. 3, no. 4, 2021.