



AUTOMATION OF MEDICINE:

**THE INTERSECTION OF HEALTH CARE
AND ARTIFICIAL INTELLIGENCE**



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For years we have been bombarded with the daunting notion that the rise of artificial intelligence (AI) spells the doom of humankind. Through the insidious uprising of AI in movies like “The Matrix” and “Ex Machina”, mainstream media has presented the question of, “What will happen to humankind when man and machine are indistinguishable?”

This question dates back to 1950 with Alan Turing’s article, “Computing Machinery and Intelligence.” Turing proposed the idea of the “imitation game” in which a machine is substituted in for a human with the sole purpose of convincing the “interrogator” of its humanity through the imitation of human behavior.¹ If human’s innate behavior can be reproduced, what will make humans, human? Approaching a supposed epoch, “have we already passed that point?”

We exist in a world where this entire article could have been written by AI. In fact, who’s to say it hasn’t been? However, I can assure you with my humanity, by no means imitable—or so I would like to believe—that the ideas discussed are of human mind and thought.

It would be foolish to suggest that AI should be curtailed. Society has already seen breakthroughs in the fields of communications, health care, disease control, education, and agriculture, all attributable to AI.² To ensure a more mutualistic relationship, methods of integration should be explored in the field of medicine that allows the combined efforts of man and machine to continue revolutionizing patient care and safety.

AI in health care

The portrayal of AI in popular media has created a negative stigma that leads one to wonder, “What do patients think of AI?” In a study of focus groups of 87 participants lacking experience with AI impacting their healthcare, run between 2019 and 2020, Richardson et al., noted undertones of distrust and uncertainty. Participants stated, “I don’t know that I’d want a machine doing the treatment, especially depending on what it is,” and “I want a human there making sure that it’s doing what it’s supposed to.”³ While medical professionals may share an interest in pushing the boundaries of health care, patients, the lives of which this integration will truly affect, share a sentiment of wary optimism.

These concerns are not without substantiation. Deep neural networks (DNNs), which have been promising in image-based medicine, have demonstrated that they are not mistake-proof. A skin cancer classifier that was approved in Europe began to associate surgical skin markings with malignant melanoma, increasing its false positive rate by 40 percent.⁴ A diagnosis that, when given to patients and later retracted, has the potential to cause a systematic distrust of medicine. Nevertheless, DNNs possess the ability to diagnose and work without fatigue. This is an important attribute that is valuable in a society that is expected to have a primary care physician shortage of between 17,800 and 48,000 by 2034.⁵

The current integrated AI models/examples have been able to harness the strengths of both man and machine. Northwestern’s Machine Learning model with an AI workflow has been integrated into their electronic health record to identify patients with advanced heart failure (HF), and allowed for the coordination of life-saving medical interventions.⁶ Their model, while predicting the prevalence for advanced HF, coordinated 15 patients to be seen more urgently in clinic, of which five received time-sensitive advanced interventions.⁶

The current paradigm of AI in health care is uncertain, especially with regard to its future integration. It seems as if there needs to be a momentary pause in the interest of increasing patient comfortability and physician expertise.

Thus, the man/machine relationship is best when progress can occur step-by-step, in unison. An unchecked increase in pace by either side only hinders the potential of the union.

Conversations with ChatGPT

What better way to explore the utility of AI in health care than to directly communicate with the online AI-based chatbot, ChatGPT. In the interest of eliciting its medical utility, the author posed as an individual who has been experiencing an acute infection. The following conversation includes the entry and response of the conversation with ChatGPT, including excerpts from the chatbot's responses.

Nitin: "I have a stuffy nose and my head feels heavy."

ChatGPT: "It sounds like you may be experiencing symptoms of a common cold or allergies. Stuffy nose and a heavy head can be caused by a variety of factors, including viral infections, sinusitis, allergic rhinitis, or even changes in weather....If your symptoms persist or worsen, it is advisable to consult a health care professional to rule out any underlying conditions and get the appropriate treatment."

Nitin: "My mucus has also been green the past couple of days."

ChatGPT: "Green mucus can be a sign of a bacterial infection, particularly if it is accompanied by other symptoms like a fever, facial pain, or coughing up phlegm. If your mucus has been consistently green for a few days and you're experiencing other symptoms, it's a good idea to see a health care professional for an evaluation."

Nitin: "What are some antibiotics I can try?"

ChatGPT: "I'm sorry, but as an AI language model, I cannot prescribe or recommend specific antibiotics as it is important for health care professionals to evaluate and diagnose the cause of your symptoms before recommending a specific medication. Additionally, taking antibiotics without a proper diagnosis and prescription can lead to antibiotic resistance and other potential health complications."

In a way that only a real example of AI communication can provide, ChatGPT's response manner helped to demonstrate some of its strengths and weaknesses. With the speed that mimics IBM's Watson Computer's rapid diagnosis and list of treatments,⁷ ChatGPT was able to produce a list of therapeutics for the described symptoms

that included staying hydrated, rest, steam inhalation, nasal saline spray, and over-the-counter medications within seconds. In comparison to the median wait-time in an emergency department being 150 minutes,⁸ ChatGPT provides for instant support. The biggest insight into ChatGPT's utility came when it was unable to provide utility. This limitation presents the irreplaceable need for human oversight, an idea that is known as physician-in-the-loop. Physician-in-the-loop suggests that when AI meets an impasse it may make a decision that will lead to more problems,⁷ and thus ChatGPT's algorithm ensures its beneficence by stopping at the impasse and allowing the physician to step up into the patient care pathway. A more appropriate flow of health care information may resemble Figure 1.

Future implications

The expansion of AI is upon the medical profession whether we like it or not. The Precision Public Health Initiative is a collaboration started by the Rockefeller Foundation, World Health Organization (WHO), and UNICEF. With an initial fund of \$100 million dollars the initiative has been tasked with expanding the use of AI within low- to middle-income countries across the globe.⁹ Furthermore, the existing paradigm of AI in health care has already transformed by expanding into public health policy. The COVID-19 pandemic helped to highlight the inability for the world to act decisively with varying public policies around the globe. WHO's EPI-BRAIN is a platform that strengthens internal public health by analyzing untouched large datasets such as YouTube in order to help mitigate the impact of future epidemics.⁹ AI is able to offer advanced simulation exercises as well as help to coordinate a global response to the increasing prevalence of infectious agents.

Preparing for the next epidemic, EPI-BRAIN serves as an additional public health safeguard. Instead of asking if AI should be integrated into health care, the more appropriate question is, "What is the best way to integrate AI into health care"? Greg Corrado, co-founder of The Google



Figure 1

Brain Team, said, “The future that I imagine is one where doctors see computers as welcome and trusted multipliers and magnifiers of their ability to provide healing care.”¹⁰

This happy union can be accomplished through the education of medical professionals with AI and technology. In a study conducted by the Academic Health Science Networks, the importance of education and engagement of healthcare professionals were amongst the top five most important enablers of AI within the National Health Service.¹¹

Stanford University Center for Artificial Intelligence in Medicine and Imaging involves graduate and post-graduate students in solving health care problems with the use of machine learning.¹² This isn't a localized effort. The American Medical Association's 2018 annual meeting presented the nation with an official policy on how AI should be addressed in medical education.¹²

While the future of AI in the medical school curriculum is not yet thoroughly fleshed out, the initial introduction of material is quintessential. It is important that as curriculums are developed, core AI competencies are identified and integrated through case studies and experiential learning.¹³

The indefatigable nature of AI

Even the most experienced, highest-ranking medical professionals are not exempt from making mistakes.¹⁴ AI with its indefatigable nature offers an opportunity for human physicians to address health care errors. This includes active errors that occur on an individual basis and latent errors, which occur systematically.¹⁴ Medical errors could potentially account for around 250,000 deaths annually in the United States.¹⁵ To avoid even a fraction of that number would be revolutionary in the field of medicine.

When it comes to one's health, who would want anything but the best. AI offers an opportunity for medical professionals to redefine what their best means. With faith and constant oversight and development, AI and health care can change society where hearing, “I'm sorry that's all we can do,” is a relic of the past.

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