# Artificial Intelligence for Improving Health

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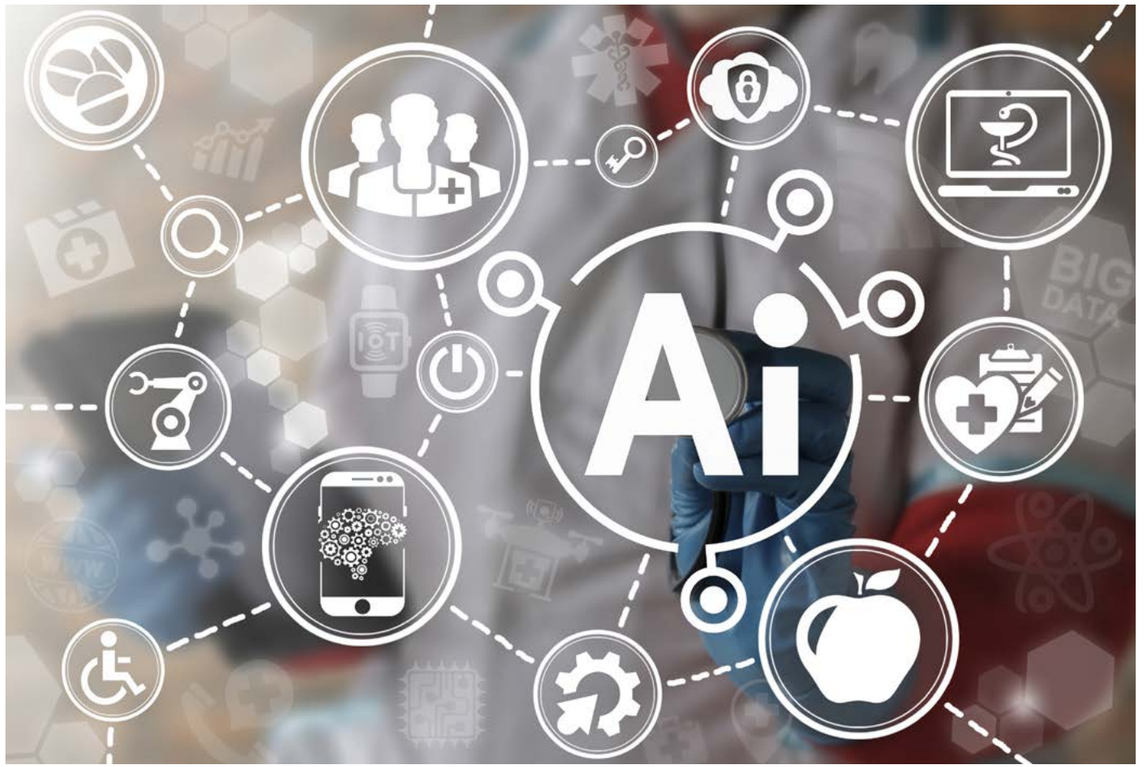
First, what is Artificial Intelligence (AI) that we hear about so much recently? Simply put, it is algorithms or mathematical techniques capable of demonstrating cognitive abilities. Why is this field, which has its roots in techniques developed several decades ago, receiving so much attention now? This is a manifestation of the convergence of advances in several technologies including computing, software, algorithms, instrumentation, among others. These advances not only resulted in significant progress in the field of AI in the past few years but also in reducing the barrier to entry for researchers and users. Among the several areas of application of AI, medicine and health are arguably the most impactful. AI techniques have an ability to process, assimilate and "learn" from data. This has led to AI being developed and used in numerous applications to enable better diagnosis, prognosis, and improved outcomes. For example, IBM's Watson has been used for diagnosis in oncology with notable success. AI can also be used to improve prescription dosage such as blood thinners by using complex information including genetics, and predict if patients with heart disease will 'well behave' and restrict their salt intake as recommended. Other applications include assessment and diagnosis based on medical imaging analysis (ultrasound, MRI, CT). Probably among the most famous uses of AI today are the applications increasing the ability to identify blood clots in the brain by computed tomography images. This was used part of a pathway that reduced the delay time before patients receive the proper therapy and led to better recovery of critical neurologic functions.

One of the main advantages of AI stems from the computation power that comes along. This computation power, which doesn't tire, can process every medical research article and every medical reference known about a topic accomplishing great breadth and depth of "learning". It can learn from a large number of cases drawing correlations which might not be obvious. This extensive learning and processing ability is an enabler for precision medicine. More importantly, compared to traditional clinical statistical models, AI models identified hidden relationships thus widened scientific understanding of how multiple factors interplay leading to an outcome.

Of all the advantages of AI, the fact that AI can contribute to reducing healthcare cost and provide within reach solutions to poorer countries and individuals from lower socioeconomic backgrounds is the most intriguing. AI is simply enhancing healthcare equity – a goal that all societies aspire to. Data from the USA and Lebanon, in addition to many others, show that around 50% of individuals who undergo coronary angiography turn out not to have obstructive coronary disease. This means that these individuals were exposed to an invasive procedure with risks because of false positive assessment of their conditions. In recent work we demonstrated how using AI based clinical decision making can cut down the use of not needed coronary angiographies or stress tests among patients with chest pain by more than 70% while maintaining superior accuracy compared to traditionally used clinical models. The important aspect of AI that warrants underlining here is that societies can choose the level of accuracy they opt based on their economic situation. This gives societies choices that were not present before i.e. more affordable healthcare with




superior accuracy, and in addition the ability to adopt a model to local situations instead of copying standards of care from other societies. The issue of international applicability of standards has been subject of debate recently, and AI certainly has a positive role to play here. On the other hand, doctors should not worry about their job stability (yet). AI still suffers from several limitations and challenges. Despite the advances, AI techniques are computationally intensive. In addition, AI techniques are data hungry requiring a considerable amount of data to "learn" from. Not any data but accurate and unbiased data. Availability of accurate and representative data in several domains can be very difficult to collect requiring a strictly applied protocol, considerable resources, and a long time. Another challenge regarding data is bias. For example, if an AI learns from the data gathered for patients of a specific ethnic background it should not be applied to patients from a different ethnicity because of the inherent bias.

Furthermore, even in the most successful AI applications, AI plays a complimentary role that assists physicians in decision making and does not actually take decisions. In fact in modern medicine decisions are taken in a shared process between care providers and patients. AI's role is to enhance the decision making process. And even in that, because of regulatory issues related to accountability, physicians are needed as the bridging link between AI applications and patients.

Finally, when plastic surgery was first developed, it was to help heal wounds and limitations that were congenital or from wars or accidents. With time, humans started requesting to 'beautify' what was within the normal range- humans wanted an upgrade. AI can be simply viewed as a tool that provides a statistical upgrade. This is not to undermine AI, but to the contrary this is to emphasize that as we request more of AI, we will have to deal with the ethical and moral questions that applying AI will pose to us at the level of the individuals and societies at large.