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Artificial Intelligence in Precision Medicine

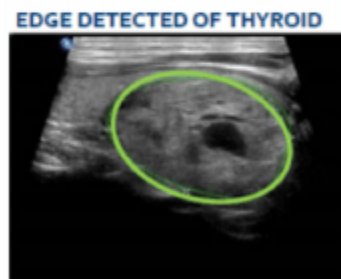
Precision Medicine is one of the next generation concepts in healthcare. The overarching idea being an emerging approach for treatment and prevention that takes into account individual variability such as genes, environment, and lifestyle for each patient [1]. Though this idea is not new in respect to medical history, blood transfusions for example [1]. The term is emerging due to the expanded capability for fast diagnoses leveraging the collective global knowledge instead of just the practicing physician the patient is in the care of.

Currently, there are already established machine learning and artificial intelligence platforms such as IBM Watson whose first commercial application was for lung cancer treatment [2]. While IBM is expanding Watson to other applications, it is still in the early phases of being applied to the whole spectrum of care. Which in itself is rapidly growing globally as technology is expanding and is predicted to be a total of 2.3 zettabytes of data by the end 2020 most of which is not structured [3].

As a result, this is the current difficulty in the application of precision medicine that machine learning and AI solve. The strengths being able to work with the dataset and process the vast amount of health information being generated. However, this is also what is slowing down progress as the data that would be used as a training set still needs to be aggregated and evaluated in order to be useful [4]. Additionally, this also brings up an ethical question of these algorithms in containing a bias or utilized for gain, suppression, or overall legal liability.



While overall it can be used as a great tool to augment a physician both in education and practice, the key issue where almost all solutions are a “black-box” in providing an answer provides an ethical dilemma. Not to mention current health and privacy policies are lagging behind technology innovation [5]. Thus, should be a high priority item to address in order to prevent malicious or unintentional results causing a rift in society.



Moving on to a current application, is in analysis of Thyroid ultrasounds where AI is being applied to lessen the workload of China's radiologists [3]. With the large population it was found that most of the radiologists' time was spent on normal results delaying abnormal cases which may be valuable time for the patient. The actual implementation of AI is in analyzing an ultrasound and detecting the edges of a Thyroid allowing for less experienced

radiologists to take on more of the initial screening workload. Resulting in faster response times to abnormal cases, 10% increase in accuracy, and higher job satisfaction [3]. Overall, this example illustrates the increase in productivity within health that AI can provide even if the result it provides seems fairly trivial to the average person.

Closing out with one interesting developmental trend are the type of models being applied to Precision Medicine. In addition to the increase of compute power over the past decade, additional algorithms that optimize this power and tailored to identify and predict patterns in multidimensional datasets have been incrementally improved. Yet neural network and evolutionally algorithms have been favored more heavily in recent years from their potential over polynomial algorithms [6]. One reason this could be is due to the architecture allowing for more flexible variable tuning by the algorithm as polynomial algorithms are limited by the number of roots. One possible limitation could be that the data has to have a linear relationship to be modeled accurately compared to the theoretically infinite combinations of non-polynomial algorithms. Overall, this trend does make sense given the properties of the applications and datasets precision medicine has.

In conclusion, while precision medicine has been around for quite a while, it is still in its infancy. One that is inspiring with the vast improvement of the global standard of living. But also concerning based on the policy decisions made in the development and regulation of these algorithms of which most are outdated or not addressed.

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