

## *Can AI Achieve Its Potential in Healthcare? Only if Medical Schools Teach Students About Its Shortcomings*

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The words big data and artificial intelligence (AI) are heard in all fields of medicine. From retrospective research to drug development, one might presume that the frequent use of these terms demonstrates their evolution into fundamental methods of medicine. In reality, this is far from being true.

The simple definition of big data are sets of information that are too large or complicated to be dealt with using traditional software. Such data sets offer greater statistical power. One of the main methods to extract value from big data, especially in the medical world, is to use predictive analytics on an immense amount of data. Predictive analytics is a term that encompasses various statistical techniques, among them machine learning (ML). This is a type of AI that analyzes current and previous patterns to predict future outcomes. Surprisingly, although AI seems like a relatively new technology, the basic methods of AI were developed in the 1950s. Still, it was not until the first decade of our century, when vast data fields and sufficient computing power became available, that AI could be successfully applied to various areas and became a well-known technological concept.

AI is already widely integrated into high-tech environments and encounters, such as in Google services, and even in more conservative contexts, such as banking or industrial supply chains. In medicine however, despite frequent discussion of big data and the technologies driven by its availability, the implementation of big data-based technology, such as AI, has barely begun to achieve its full potential.

The discrepancy between the potential and the actual use of big data technolo-

gies in medicine can be explained by various factors. One is the risk of bias when the data sets in the database to which a ML algorithm is to be applied to develop a model to detect a particular disease, are mainly from a specific demographic group. Some properties may be dominant in the database as a result of the sample, and therefore the data set will not represent the general population, for which the model is supposed to predict the disease. Unintentional bias in large data sets is not a theoretical problem. For example, dermatological algorithms developed to diagnose skin lesions using image recognition technology, were found to be less accurate on darker skin because the data sets that were used to develop and train the algorithm were derived from fair skinned populations.

Another reason for this discrepancy is a lack of understanding of how some AI algorithms work. Clinical decision support systems (CDSS) models were developed using black box AI technologies, which is a general name for AI models with indeterminate processes. We know that when software makes a recommendation, not only to a physician but also to the average person, the software will likely be a trusted source; this is part of modern society's psychological disposition. Even according to those who created the models, CDSS might encourage clinicians to diagnose a particular disease or prescribe treatments wrongly due to blind trust in the software [2].

Furthermore, healthcare data privacy is one of the most challenging issues when dealing with data sets. Privacy of a patient's medical records is fundamental in every aspect of medicine, from research

to bedside therapies. Anonymizing electronic medical records (EMR) is a serious concern in exploiting databases to develop and test algorithms. Nevertheless, the option of sharing databases, for instance, between hospitals or Health Maintenance Organizations (HMOs) is limited, mainly because of the risk of patient data leakage. The legal and ethical complexities emerge and remain in other aspects, for example, in the domain of legal liability. Who is to blame if the model contributes to a mistake? Is it the physician, or the company that developed the product?

These are only a few of the many challenges that prevent modern medicine from benefiting from big data-driven technologies and that keep AI as a buzzword rather than a valuable tool for clinicians [3].

Recently, evolving technologies are increasing expectations that some of these challenges will be overcome. For example, explainable AI (XAI) or explainable ML (XML) refers to models that provide results derived by an algorithm in a way that is understood by computer scientists. Once the computational process is understood, it opens the possibility of examining the model's function and output.

Another emerging technology that might cope with the challenge of sharing databases is federated learning (FL). Also called collaborative learning, FL is a ML technique that trains algorithms across multiple databases without centralizing or exchanging data. This, for example, allows the option of training a model on numerous databases of various healthcare organizations without centralizing the data. This practice overcomes crucial issues such as data privacy and data security.

The relative conservativeness of medicine is one of the ways to keep immature technologies from reaching the clinic for the wrong reasons, such as for financial gain. Rapid technological improvement and the vast amount of funds invested in healthcare technologies, such as AI, should erase the discrepancy between their potential and their actual use sooner rather than later. As medical students, we are mainly taught well-established methods and technologies already implemented in western medicine. We are less exposed to emerging technology, which we will meet in the future as young physicians. As the future of medicine lies with technology, there is an increasing consensus that the medical school curriculum should include more extensive teaching of emerging technologies, providing future physicians with knowledge about tools they will be required to use [4]. The basic methodology of how an AI-based tool works should

be introduced alongside the function of existing technology, such as MRI. In practice, however, not only is the curriculum struggling to catch up with current technology, it is also becoming harder to provide the basic concepts of how a tool you are required to implement actually works [5].

Therefore, it is essential to invest not only in introducing the general idea behind new technologies in medical schools in the same manner the curriculum includes teaching about existing bedside technology, but also to introduce medical students to the shortcomings, drawbacks, and nuances of new emerging technologies. Not only because when dealing with treating human life, the slightest mistake can have grave implications, but also since a thorough understanding of the pitfalls can contribute to proper integration - present simple instead of progressive big data-driven technologies into healthcare.

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