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EDITORIAL

Artificial Intelligence and Machine Learning in Cardiology - A Change of Paradigm

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A robot may not injure a human being or, through inaction, allow a human being to come to harm.

First Law of Robotics - Isaac Asimov

We are experiencing a change paradigm in modern life. With the presence of computers and intelligent machines everywhere, the predictions of science-fiction books from years ago gradually become reality; these are the times of pervasive computing. Among the computational most frequently mentioned tools in clinical studies and seen with enthusiasm by the scientific community is the Artificial Intelligence and consequently the machines that learn, which is best quoted in its original English form, Machine Learning. In general Artificial Intelligence is defined as the constellation of items (algorithms, robotics, neural networks) that allow a software to have intelligence properties that are comparable to those of a human being, among them learning from databases with minimal human interference.[1]

Obermeyer and Emanuel recently wrote an editorial stating that Machine Learning has become widespread and imperative for solving complex problems in the various fields of science, and in the medical field its use will transform the practice.[2] The use of artificial intelligence is evolving increasingly in cardiology and there are already excellent examples in several areas. Using a sophisticated learning system to electrocardiographic interpretation, Li et al. achieved that electrocardiographic patterns were automatically recognized with an accuracy of 88% for the classification of abnormal rhythms[3]. One of the most important limitations of the system studied was the quality of the electrocardiographic signal for interpretation and learning, which highlights one of the essential characteristics of Machine Learning, that is the need for accurate and reproducible information for the formation of databases.[2,3] As databases are usually produced from patients selected for their basic condition, one of the most important points for development is the creation of broader and generalizable databases that do not induce biases in the interpretation of findings, point in which industry is heavily investing at the moment.[2]

In echocardiography, many studies are evaluating the use of Machine Learning in image interpretation, such as the Narula et al.[4] who, through a database of patients with hypertrophic cardiomyopathy and individuals with physiological hypertrophy who were submitted to Speckle Tracking, were able to create a computer system based on Machine Learnig that reached to assist inexperienced echocardiographers in distinguishing between the two conditions with excellent accuracy. Tajik,[5] in an enthusiastic editorial, pointed out that Machine Learning should reduce or even eliminate the intra- and interobserver variability of echocardiographic exams and greatly reduce cognitive errors. At this point the use of artificial intelligence comes across medical ethics, because the doubts that can occur in cases of errors may be linked to the attribution of responsibilities: did the doctor fail or did the software fail? Experiences with the use of autopilots in aviation may serve as a basis for the ethical discussion that will occur, given that there is always at least one human being responsible for the flight even when using the modern devices of commercial aviation. Obermeyer and Emanuel[2] point out that there will be a massive reduction in the need for doctors in situations where computers can be fed directly by digital information such as radiology and pathology because the large amount of digital information available will allow the formation of reliable databases that will lead to a performance of the machines superior to the human.

Keywords

Artificial Intelligence / trends; Computer Systems / trends; Machine Learning / trends; Cardiovascular Diseases; Echocardiography / trends; NucleAR Medicine / trends.

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When artificial intelligence is employed in more complex clinical contexts, there is a still longer way to go. Austin et al.[6] used a Machine Learning and data mining system to evaluate and classify patients with heart failure and found that although the system was superior to conventional methods for predicting heart failure with preserved ejection fraction, there were no advantages over the traditional logistic regression. Liu et al.[7] developed a system based on Machine Learning for prediction of adverse coronary events in patients with chest pain in the emergency room and compared it with the TIMI score. Although the performance of the new system is reliable for predicting mortality and cardiac events in 30 days, the authors themselves acknowledge that clinical decisions are dependent on factors that still can not be fully incorporated into the machines, one of which is the physicians experience.[7]

In nuclear cardiology Arsanjani et al.[8] evaluated the use of the Machine Learning tool to predict myocardial revascularization from myocardial perfusion scintigraphy data, finding an accuracy comparable or even superior to that of experienced examiners in the interpretation of the scintigraphic examination. Garcia et al.,[9] in an excellent review on the subject, point out that clinical decision support and artificial intelligence systems serve as warnings for the cognitive bias of clinicians and reduce intra and interobserver variability, allowing to interpret the exams faster and with greater accuracy, as observed in studies in which the diagnostic interpretation of the examination by the computer is similar to that of the experts.[10] We generally agree with this view and consider that the support to make the clinical decision and the improvement of diagnostic and prognostic performances should be encouraged and supported by physicians of the various specialties. The frequent concern about the eventual replacement of the physician by the machines is not substantiated by the facts. The medical profession is of a complexity and subjectivity that makes the task impossible in its entirety by the machines, at least at the present stage of knowledge. The proper use of computing allows for not only the improved of medical performance but also the quest for solidarity among patients with successful experiences in creating social networks for patients.[11]

Only the study of the profound impact for the development and use of these tools can bring the answers to the questions that are now in the minds of doctors and their patients. The *International Journal of Cardiovascular Sciences* encourages its readers and contributors to send scientific papers on the subject for publication.

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