Artificial Intelligence in Healthcare: Past, Present and Future

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The need for artificial intelligence

In modern day health care system, physicians have little time to embrace the latest developments in digitized patient care thus health expenditures still remain high and unfortunately there are major inequalities for the access to care among a large segment of society. Considering the hypercorrect approach to patients in all departments, 'data' and 'experience' offer the described care if syncretized properly (1). This notion combining the power of data and experience has to be absorbed in order to comprehend artificial intelligence (AI) and its implementation in medical sciences. In the past, the practical medical information can only be reached by using textbooks, journals formatting the guidelines and expert opinion including master-apprentice relationship. In addition, physicians gain experience by directing patient treatments and observing the outcomes. It appears as a great limitation to digest this large amount of knowledge and experience to provide the targeted patient care. AI has already come forward to assist by blending the large amount of patient data to promote and elaborate the effectiveness of the physicians (2). If we ask the accurate questions, AI has the potential to reveal the remarkable information hidden in the big data, which may have a role in clinical decisions (3).

Artificial intelligence, What do we have now?

AI is simply defined as the imitation of human cognitive functions by several forms of computer software.

Artificial neural network (ANN) is a multilayered connection between the input and the output that is very similar to the work of the human brain (4). There have been several attempts to use ANN in decision making in cardiology in which ANN has been obviously superior to logistic regression models. Baxt et al have proved the predictive superiority of ANN in patients with suspected myocardial ischemia admitted to the emergency department with chest pain (5).

Another popular type of AI is machine learning (ML) which is defined as the learning capability of the computers by building algorithms to gain features from data. The algorithms in ML offer performance improvement by automatizing model forming for constituting patterns or decision support using the examined data (6). There are four types of ML methods; the most popular ones are supervised and unsupervised learning methods, the others are semi-supervised and reinforcement learning methods. In supervised ML, the algorithm used in the data evaluations deduces risk stratification and prediction with the aid of logistic regression, Bayesian networks, ANNs, ridge regression and etc. (7) Samad et al have compared nonlinear ML models with linear logistic models in terms of predicting survival using some clinical and echocardiographic variables. Supervised type of ML has a great success in predicting survival with a superior prognostic value compared to traditional clinical risk score (8). In unsupervised type of ML, the data is not usually divided into as training and testing categories. Moreover, this type of ML includes hierarchical clustering and principal component analysis (9). We can examine the study conducted by Bentancur et al. as an example to unsupervised type of ML, and ML has been proved to increase the accuracy of disease prediction for obstructive coronary artery disease in nuclear cardiology era (10).

Deep learning is the recently developed field of ML. The rapid changes in the volume and complexity of big data necessitate the use of deep learning method. Deep learning methods consist of fundamentally neural networks with several layers of hidden neurons (6). Deep learning has been usually tested in cardiac imaging procedures, especially in echocardiography. A new statistical deep learning-based pattern recognition method for left ventricle endocardium tracking has demonstrated the superiority when compared current state-of-the-art to endocardium

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tracking methods in ultrasound data (11). Considering cardiac MRI, we need datasets for the segmentation of the left ventricle for the accurate measurement of ejection fraction and ventricle volume. AI based deep learning processes have a potential to be utilized for both ventricles (12, 13).

Convolutional neural network (CNN), which is a featured subtype of ANN, is also derived from deep learning with hidden multilayers to evaluate the data. CNN has been tested and shown to help calculating coronary artery calcium in cardiac CT angiography using supervised type of ML (14). The aforementioned algorithm has a more accurate results compared to existing algorithms.

Future perceptions of artificial intelligence

Artificial intelligence has already started to change the shape of healthcare. However, there are many details and challenges that need to be addressed before its implementation to the clinical practice. Current regulations lack of standards to evaluate the safety and efficacy of AI algorithms. Before incorporating AI and ML into clinical practice, legislative issues should be solved. Accordingly FDA attempted to guide how to assess and implement AI in general wellness products (15). In near future cognitive computers will be assisting clinicians in their decision-making and determining predicting patients outcomes. The massive amount of data generated by routine daily work-up necessitates application of AI into practice. We already witnessed the rapid adaptation of compute vision in pathology and radiology.

It is important not to fear AI but to embrace it as the health becomes more and more digitalized every day. AI will provide clinicians the skill to interpret patient level data in greater depth than ever before. Physicians should prepare themselves for the era of AI and acquire needed skills on when to apply ML models and how to interpret results properly.

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