Correspondence

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Advances in artificial intelligence (AI)-based diagnosis in clinical practice—correspondence

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Dear Editor,

Before the advent of the era of mobiles, medical technologies were primarily known as classic devices for medical purpose viz., stents, prosthetics, implants etc. The evolution of wearables, sensors along with smart phones and systems of communication has brought revolution in clinical practice with the ability to contain tools of artificial intelligence (AI) powered in tiny sizes. Certainly, AI has brought revolution in the medical sciences and can be understood commonly as the component of computer science capable of dealing with complex problems with several applications in areas with vast data[1]. Intelligent AI-powered technologies in the medical field have made people enthusiastic partly due to its ability to enable a 4P's model that indicate predictive, preventive, participatory and personalized[2,3]. Successful application of AI in the field of radiology, dermatology and pathology is reflected with the speed of diagnosis exceeding that of experts in the medical field. Moreover, the accuracy of diagnosis through implementation of AI technologies is very high paralleling medical experts[4].

Analysis of medical images viz., X-rays, ultrasounds, MRI, computerized tomography scans and dual-energy X-ray absorptiometry can be done through AI algorithms. This provides assistance to healthcare professionals for identification and diagnosis of diseases rapidly with more accuracy. Analysis of large amount of patient data can be done by AI. These data may be related to 2D/3D imaging in the medical field, bio signals (viz., electrocardiography, electroencephalography, electromyography etc), vital signs like temperature of the body, pulse rate, rate of respiration and blood pressure, information related to demography, medical history and results of laboratory test. By this way, the decision making process may be supported and provision of prediction results with accuracy is possible. The diversity of the data of patients in terms of multimodal data is a smart solution (optimal) that can facilitate diagnostic decisions in a better way on the basis of more than one finding in images, signals, representation in text form etc. By integration of more than one data sources, the diagnosticians can gain a better understanding of the health of the patient in a comprehensive manner and the underlying root causes in relation to the symptoms of the diseases can also be understood. The chances of misdiagnosis also get minimized in that way. Healthcare providers can be helped by multimodal data which help them in better diagnosis and monitoring of the progress of a clinical condition over time. This allows therapeutic management of chronic illnesses in a more effective way. By the use of medical data (multimodal), the explainable AI (XAI)-based diagnosticians can determine potential problems of health at an early stage before the condition becomes grave and threatens life of the patient. Further, Clinical Decision Support Systems (CDSSs) (AI-powered) provides assistance in real-time and ensures support to make informed decisions about care of the patient in a better way. Automation of routine tasks is possible through application of XAI tools. This frees the healthcare professionals for focusing on more complex care of patients[5,6].

One of the earliest applications of AI in clinical practice is the detection of atrial fibrillation at an early stage. Food and Drug Administration (FDA) has approved AliveCor in the year 2014 for their mobile application Kardia. This allows monitoring of electrocardiogram (smart phone based) and helps in detecting atrial fibrillation[3]. Approval of a software program had been done by the FDA in the year 2020 allowing medical professionals to perform ultrasound imaging of heart without any special training. It utilizes AI for providing real-time guidance and also has the capability of saving images of diagnostic quality. It acts as a co-pilot for the people who perform an ultrasound scan and can give instructions on the mechanisms involved in manipulating the transducer. Moreover, automated feedback on the image quality of diagnostic importance is also provided[7]. Several AI-based techniques viz. machine as well as deep learning models are being used by researchers for detecting the diseases of heart, skin, liver, Alzheimer's disease, which requires early diagnosis[8]. Machine learning has an added value for processing of image where identification of early signs of disease through classical tools is not possible. This is especially true for cancer, the diagnosis of which frequently requires assistance of AI approaches. It is applicable for developing nations too where the resources, cost of

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healthcare and other shortcomings resist the provision of care optimally. FDA has given a breakthrough status to AI for an algorithm (AI-based) which has the ability of diagnosing cancer in computational histopathology with tremendous precision. This facilitates pathologist to obtain time for focusing on important slides. It is possible to develop a cost-effective point of care diagnostic for lymphoma on the basis of basic imaging along with deep learning[9,10].

By the application of fuzzy clustering method and neural network, successful classification and detection of people at greater risk of influenza has been done by using rate of respiration, heart rate and facial temperature. It is to be noted here that there is difference between fuzzy clustering methods and *k*-means clustering because of the addition of fuzzifier and membership values. Thus in contrast to the non-fuzzy clustering methods, each point can belong to more than one cluster. This in turn reflects the capability of developing efficacious methods for identification of population at risk. In more sophisticated contexts, the application of methods of machine learning can be done. For example, when support vector machine (SVM) learning algorithm, Matlab, leave one out cross-validation method, and nested one-versus-one SVM are used combinedly, the sequences of the genes of the bacteria can be separated in a better way thereby aiding in diagnosis more efficiently. Interestingly, there exists artificial immune recognition system for diagnosis of various diseases by using the properties of immune system such as immunological memory which is in line with the development of AI tools on the basis of cognitive function of human. The artificial immune recognition system that utilize supervised methods of machine learning is found to be more accurate. Another pandemic infection that puts the life of the patient at risk is malaria. Diagnosis of malaria takes much time and intervention of various health services may become essential. Development of machine learning algorithms has been done for detection of red blood cells infected with the parasite from in-line holographic microscopy (digital) data which is a relatively cost-effective technology. Various machine learning algorithms have been tried for improvement of the diagnostic capacity for malaria. Best accuracy is shown by the model trained by SVM[11].

In clinical practice, the application of AI for the purpose of diagnosis holds promise of further developments and has evolved rapidly in combination with other modern fields of teleconsultation and genomics. It is mandatory for the progress in science to remain extremely thorough and careful along with transparency for development of new solutions for improvement of healthcare in modern times. But it must not be forgotten that the focus of the health policies should be to tackle the financial issues in association with development of various AI tools for the progress of clinical medicine. Last but not the least, the experts in the medical field should understand in a better way to decide how exactly AI should be used for diagnosis of different diseases and illnesses. This will lead to fruitful proposals and formulating action pans in a more appropriate manner in the future for developing and exploring highly beneficial AI-based techniques in the medical field.

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