Correspondence

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Advances in artificial intelligence based diagnosis and treatment of liver diseases – Correspondence

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Dear Editor,

A large volume of patient data (multimodal) is generated by medical care in modern times. Processing and synthesis of such data to actionable knowledge is troublesome for several clinicians. In this regard, there is an emergence of artificial intelligence (AI) as an efficacious tool having useful applicability in medical science and the field of hepatology is not an exception. There are an ever increasing number of studies from which the use of AI in the diagnosis and therapy of hepatic disorders become evident. These techniques include algorithms (machine learning) viz., regression models, support vector machines, and Bayesian network for predicting the progression of disease or complications as well as mortality associated with the disease. For interpretation of pathologic as well as radiologic images in an automated fashion quickly, deep-learning algorithms are available. Moreover, natural language processing helps in the extraction of concepts that are meaningful clinically from huge quantities of data that are unstructured and available in electronic health records[1]. The images of ultrasonography of the abdominal cavity, computed tomography along with MRI can be helpful for prediction of fatty liver disease (nonalcoholic) and for the purpose of distinguishing benign tumors from hepatocellular malignancy or carcinoma. There is a continuous rise in the prevalence of nonalcoholic fatty liver disease. Even though non-invasive modalities viz., ultrasonography along with scoring systems clinically have been recommended as alternative to biopsy of liver; however, the performance is limited.

Integration of AI with conventional diagnostic methods improves the diagnostic performance. By the use of electronic health records, the AI algorithms can help in predicting the diagnosis as well as the consequences of liver cirrhosis, hepatocellular carcinoma (HCC) and fatty liver disease (nonalcoholic). The use of pathological data with AI can help predicting the seriousness/ severity and patterns of steatosis, fibrosis, nonalcoholic fatty liver disease, and the survival rate from HCC[2,3]. The models assisted by AI have shown good performance in assessing fibrosis of the liver and steatosis. Importantly, for detecting cirrhosis, imaging-based models (AI-assisted) have been found to have greater sensitivities than AI-assisted clinical based models. In contrast, for diagnosing fibrosis, significantly a greater sensitivity of clinical based models has been found. The negative predictive value of AI-assisted models for the detection of fibrosis of the liver at an advanced stage has been found to be 90% approximately. This implies that the AI-assisted models are capable of guiding clinical decisions without the necessity of invasive methods like liver biopsy. There is utilization of several features from ultrasonographic images as inputs by AI for analyzing the images systematically. This approach causes reduction of bias in the interpretation of images. Further, diagnosis systems assisted by AI have found potential applications both in the general population and the population at risk as well[4].

The most common liver cancer (primary type) is HCC. It has spatial as well as temporal heterogeneity significantly. Quantitative analysis of tumor imaging has become possible due to the advent of imaging-based on AI viz., imaging omics, which can help revealing the imaging manifestations of these heterogenous features[5]. Lambin *et al.* (2012) first proposed the concept of imaging omics that involve extraction of a large number of influential characteristics from radiological images (high-throughput) and then the use of statistics and AI algorithms for constructing predictive models for tumor. Imaging omics has got its own significance, it helps in digging deeper into the data of medical images traditionally available for compensating the deficiency of eye of human[6]. There is transition of machine learning health care applications from a contrasting possibility of the future to a reality in current time. It is almost certain that there will be a substantial impact of machine learning health care applications on processes, cost, standard and access to hepatology related health care ultimately modifying the relationship between physician and patient[7,8].

With the advent of direct acting antivirals along with new technologies for detection and service models, progress has been made globally in detecting and treating hepatitis C virus (HCV) infection. However, resistance to direct acting antivirals has been noticed in some patients with HCV, hence, they do not show a

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positive response to antiviral therapy. Moreover, the lacunae in screening such patients may cause an unwanted delay in the treatment process. In such a case, going beyond human reasoning, the AI algorithms can work and help in building predictive models from several combinations that are complex. Identification of all the variants by whole genome sequencing of HCV has been done in a current study and further a support vector machine on the basis of a machine algorithm has been found to be the best prediction model. The use of similar models can be done for determining the best possible therapy for other viral infections as well as cancers of the liver[9]. At present, in certain populations, it is common to have co-infection with HIV 1 and HCV, the treatment of which is a challenge. For the prediction of multiple target inhibitors with anti-HIV and anti-HCV activity, a multiple quantitative structure-activity relationship model revealed high performance[10]. The identification of variables in association with reduction in HCV treatment intake is enabled by applying machine learning methods[6].

AI has become a crucial part of research concerning liver diseases and is becoming inevitable in improving the accuracy of diagnosis improvement of decision making by augmenting predictive power, enhancing automation induced efficiency, and even helping in the prognosis of liver diseases. Key biomarkers of the liver can be analyzed by the use of machine learning thereby providing deeper insights into the pathophysiology of hepatic diseases. Despite of the challenges, the utility of AI in the field of hepatic diseases is showing good promise and certainly worthy for futuristic studies and exploring its potential applications. Obviously, the researchers need to develop newer AI-based models in the diagnosis and precise therapy of liver diseases along with conduction of verification clinically for improving the precision of results and for promotion of applications in the clinics.

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