Editorial

# Artificial intelligence in the practice of pulmonology: The future is now

Modern medicine is undergoing a major transformation in terms of predicting occurrence of pathologic processes and interpreting any test based on images, patterns or numeric data. The legion of electronic data being generated daily is not easy to be handled by human brain alone. This is where the role of artificial intelligence (AI) comes into picture. AI originated in the year 1956 in the USA, but it was only in 1980s that it found its application in the field of pulmonary medicine.[1]

Imaging is an arena of medicine where the majority of innovations in machine learning have taken place, which is a subfield of AI. Most of the studies mention computed tomography (CT) scan as the tested imaging modality. A multicentre study showed that high-resolution computed tomography evaluation by AI software provides a classification of fibrotic lung disease with accuracy matching human-level.[2] In the United States, low-dose CT (LDCT) is recommended for adults who are at high risk of developing lung cancer. A study on lung cancer screening with three-dimensional deep learning on LDCT showed that the AI algorithm not only performed at par with radiologists at some occasions but also outperformed them at others.[3] The recent SARS-CoV-2 pandemic also saw the use of AI in codifying CT scans of lungs of COVID-19 patients.[4] Chest CT scans are highly sensitive in detecting lung abnormalities due to SARS-CoV-2 infection but lack specificity, leading to false-positive COVID-19 diagnosis especially in patients with pre-existing lung diseases. By assisting radiologists, AI has shown to differentiate COVID pneumonia from pneumonia due to other causes.[5] It has been suggested that changes seen on CT scans of severe COVID-19 pneumonia or ARDS may improve, persist or even worsen with the passage of time.[6] Pulmonologists and general physicians are already coming across such post-COVID and long COVID patients in their clinical practice. AI can play an important role in predicting which patients with a particular cluster of CT images are likely to worsen, so that prognosis may be known and treatment initiated early in this select group of patients. AI also played an important role in rapid recognition of COVID-19 outbreak using an algorithm called BlueDot.[7] It predicted early spread by analyzing the travel data generated from International Air Transport Association. It translated foreign-language news reports and official announcements that provided advance warning to avoid danger zones like Wuhan during the initial stage of COVID-19 outbreak.

A recent domain for use of AI in pulmonology has been in cytopathology. An AI model, consisting of an open-sourced convolutional neural network was able to classify on-site cytology smears during endobronchial ultrasound transbronchial needle aspiration procedure.[8] Practical application of this concept would help bronchoscopists in not only knowing that they have sampled the target lesion but also in predicting the final histologic diagnosis. In a small group of lung cancer patients, the original red–green–blue pattern of bronchoscopic images was transformed to hue–saturation–value texture. A computer-aided diagnosis system was able to distinguish lung cancer subtypes using these bronchoscopic images.[9] The use of AI during bronchoscopy would benefit those subset of patients who are classified by machine learning and deep learning algorithms to be malignant so that the process of histologic diagnosis by a pathologist and thereafter curative therapy may be expedited.

The assessment of lung physiology and evidence of abnormal respiratory function is another domain where AI is benefiting physicians. Pulmonary function test (PFT) interpretation is subject to multiple criteria regarding acceptability and repeatability. PFTs are essentially numerical values of different variables related to respiratory function and consequently amenable for machine learning analysis. Multiple studies have demonstrated variability in inter-rater agreement among pulmonologists. An AI-based algorithm was able to out-perform pulmonologists in the accuracy of reporting PFTs.[10]

Polysomnography (PSG) consists of measurements of a wide range of physiologic signals and exhaustive evaluation of parameters related to sleep quality. It requires dedicated personnel to analyze the large portions of data associated with each study. There has been a steady interest in the application of AI in this area. The American Academy of Sleep Medicine has also released a position paper on this aspect of sleep medicine.[11] Being electrical signals that can be represented as an array of numbers, these are well-suited for the application of machine learning algorithms for reporting purposes. A deep-learning model categorized respiratory events in PSG with reasonable sensitivity and specificity.[12]

AI has the ability to interpret diverse and complicated interrelationships between different variables and outcomes that is beyond the scope of mathematics and conventional statistics. Its use in healthcare sector is still at a stage of infancy. A large amount of individual patient data is needed to form a database over which an algorithm can be trained. This opens the issue of data privacy which has led to the origin of the field of ethics

in AI. Apart from scientists, it involves other stakeholders like law and policymakers to govern the use of all the raw data. A faulty result by an algorithm is a matter of serious concern especially if it is being used in a large group of patients. We need to look at AI not as a more intelligent competitor that is aimed at replacing human input, but as a buddy to reduce our workload and guide us in challenging clinical scenarios. Humane touch of a doctor, an integral part of medicine, goes a long way in treating a patient that cannot be replaced by machines.

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