AI and CT Distinguish COVID-19 from Pneumonia

In a paper published in the journal Radiology, Chinese researchers propose that a 3D-deep learning model can be used for detecting coronavirus disease 2019 (COVID-19) from chest CT images.

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The model, known as COVID-19 detection neural network (COVNet), is able to detect COVID-19 and differentiate it from community acquired pneumonia and other lung diseases using chest CT scans, according to the researchers.

The highly contagious COVID-19 has quickly spread all over the world since the start of 2020, prompting the World Health Organization (WHO) to declare the disease a global pandemic. Early diagnosis of COVID-19 is important for treatment and the isolation of infected patients to prevent further spread of the virus.

The reverse-transcription polymerase chain reaction (RT-PCR) laboratory test is typically used to confirm if a person is infected. However, it has been found that computed tomography or CT – a noninvasive imaging approach – could be used as a reliable and rapid approach for screening of COVID-19. The abnormal chest CT findings in COVID-19 often include ground-glass opacification, consolidation, bilateral involvement, peripheral and diffuse distribution.

Despite its advantages, however, CT may share certain similar imaging features between COVID-19 and other types of pneumonia, thus making it difficult for clinicians to make a distinction, the researchers explained.

"Recently, artificial intelligence (AI) using deep learning technology has demonstrated great success in the medical imaging domain due to its high capability of feature extraction. Specifically, deep learning was applied to detect and differentiate bacterial and viral pneumonia in paediatric chest radiographs. Attempts have also been made to detect various imaging features of chest CT," wrote the researchers.

In the current study, COVNet, a supervised deep learning framework, was developed to detect COVID-19 and community acquired pneumonia (CAP). The researchers used a large dataset consisting of 4,356 chest CT exams from 3,322 patients.

The final dataset included 1,296 (30%) exams for COVID-19, 1,735 (40%) for CAP and 1,325 (30%) for non-pneumonia diseases. All the COVID-19 cases were confirmed as positive by RT-PCR and were acquired from 31 December 2019 to 17 February 2020.

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COVNet's predictive performance was evaluated by using an independent testing set. The deep learning model achieved high sensitivity of 90% [95% CI: 83%, 94%] and high specificity of 96% [95% CI: 93%, 98%] in detecting COVID-19. The area under the receiver operating characteristic curve (AUC) values for COVID-19 and community acquired pneumonia were 0.96 [95% CI: 0.94, 0.99] and 0.95 [95% CI: 0.93, 0.97],

respectively.

The study though has several limitations, including the fact that COVID-19 is caused by a coronavirus and may have similar imaging characteristics as pneumonia caused by other types of viruses. The researchers said they were not able to select other viral pneumonias for comparison in this study. Instead, they randomly selected CAP from August 2016 to February 2020.

Furthermore, this study focused on whether one exam is COVID-19 or not, but did not address categorising the disease into different degrees of severity.

"It would be desirable to test the performance of COVNet in distinguishing COVID-19 from other viral pneumonias that have real time polymerase chain reaction confirmation of the viral agent in a future study," wrote the researchers, noting the importance of not just predicting the presence of COVID-19, but also disease severity to better monitor and treat patients.

Source: Radiology

Image credit: Pixabay

Reference: Li L, Qin L, Xia J et al. (2020) Artificial Intelligence Distinguishes COVID-19 from Community Acquired Pneumonia on Chest CT. Radiology; Published online 19 March ahead of print. https://doi.org/10.1148/radiol.2020200905

Published on : Tue, 24 Mar 2020