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Deep Learning in Chest Computed Tomography to Differentiate COVID-19 from Influenza

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Abstract : Intro: The COVID-19 (Corona Virus Disease 2019) has greatly changed the global economic, political and financial ecology. The mutation of the coronavirus in the UK in December 2020 has brought new panic to the world. Deep learning was performed on Chest Computed tomography (CT) of COVID-19 and Influenza and describes their characteristics. The predominant features of COVID-19 pneumonia was ground-glass opacification, followed by consolidation. Lesion density: most lesions appear as ground-glass shadows, and some lesions coexist with solid lesions. Lesion distribution: the focus is mainly on the dorsal side of the periphery of the lung, with the lower lobe of the lungs as the focus, and it is often close to the pleura. Other features it has are grid-like shadows in ground glass lesions, thickening signs of diseased vessels, air bronchi signs and halo signs. The severe disease involves whole bilateral lungs, showing white lung signs, air bronchograms can be seen, and there can be a small amount of pleural effusion in the bilateral chest cavity. At the same time, this year's flu season could be near its peak after surging throughout the United States for months. Chest CT for Influenza infection is characterized by focal ground glass shadows in the lungs, with or without patchy consolidation, and bronchiole air bronchograms are visible in the concentration. There are patchy ground-glass shadows, consolidation, air bronchus signs, mosaic lung perfusion, etc. The lesions are mostly fused, which is prominent near the hilar and two lungs. Grid-like shadows and small patchy ground-glass shadows are visible. Deep neural networks have great potential in image analysis and diagnosis that traditional machine learning algorithms do not. Method: Aiming at the two major infectious diseases COVID-19 and influenza, which are currently circulating in the world, the chest CT of patients with two infectious diseases is classified and diagnosed using deep learning algorithms. The residual network is proposed to solve the problem of network degradation when there are too many hidden layers in a deep neural network (DNN). The proposed deep residual system (ResNet) is a milestone in the history of the Convolutional neural network (CNN) images, which solves the problem of difficult training of deep CNN models. Many visual tasks can get excellent results through fine-tuning ResNet. The pre-trained convolutional neural network ResNet is introduced as a feature extractor, eliminating the need to design complex models and time-consuming training. Fastai is based on Pytorch, packaging best practices for in-depth learning strategies, and finding the best way to handle diagnoses issues. Based on the one-cycle approach of the Fastai algorithm, the classification diagnosis of lung CT for two infectious diseases is realized, and a higher recognition rate is obtained. Results: A deep learning model was developed to efficiently identify the differences between COVID-19 and influenza using chest CT.

Keywords : COVID-19, Fastai, influenza, transfer network
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