Automated X-Ray Image Classification for Covid-19 Diagnosis

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Abstract

The wide and continuous spread of COVID-19 with large numbers of deaths and infected persons in the world makes it a major concern for the health community around the globe. Although COVID-19 has available different vaccines, it needed a lot of time to cover numerous populations. The diagnosis process to isolate the infected cases still the main limitation. There are many ways to diagnose COVID-19 such as clinical findings and several laboratory tests. These tests may include virus isolation, nucleic acid-based molecular assays like real-time polymerase chain reactions, antigen, or antibody-based immunological assays such as rapid immunochromatographic tests, enzyme-linked immunosorbent assays, immunofluorescence techniques, and indirect fluorescent antibody techniques, electrochemical sensors, X-Ray, etc. There are many advantages of using X-Ray images such as availability, faster, and cheaper than other techniques. Moreover, portable chest radiography devices may be considered to minimize the risk of cross-infection. Although, X-Ray images are not recommended as a first-line tool in the diagnosis process because distinguishing between COVID-19 and other respiratory infections not accurate. In this research, a framework to diagnose chest X-Ray images that can be classified accurately between COVID-19, Pneumonia, and not infected person (Normal) is proposed. The proposed framework starts by segmenting the lung, which is considersed as Region of Interest (ROI) from CXR images using Fully Convolutional Networks (FCN). After that, features will be extracted from the segmented area of CXR images to make a numerical dataset. The features that adobted are statistical properties of image histogram, statistical properties of Histogram of Oriented (HOG) gradients, Gray-Level Co-occurrence Matrix properties, and first order statistical feature. The numerical dataset will be fed to several machine-learning algorithms in order to make a comparison and get the maximum accuracy. The test result shows that the Artificial Neural Network algorithm achieved the highest accuracy than other algorithms. After simple implementation in the number of neural in hidden layers and iterations, the accuracy improved from 97.78 % to 98.66 %.

Keywords: Covid-19, Corona virus, Machine Learning, Image processing, Computer Vision, Fully Convolution Neural Network.