


Utilization of Transfer Learning Model in Detecting COVID-19 Cases From Chest X-Ray Images


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ABSTRACT

Diagnosis of COVID-19 pneumonia using patients' chest x-ray images is new but yet important task in the field of medicine. Researchers from different parts of the globe have developed many deep learning models to classify COVID-19. The performance of feature extraction and classifier plays a vital role in the recognizing the different patterns in the image. The pivotal process is the extraction of optimum features from the chest x-ray images. The main goal of this study is to design an efficient hybrid algorithm that integrates the robustness of MobileNet (using transfer learning approach) to extract features and support vector machine (SVM) to classify COVID-19. Experiments were conducted to test the proposed algorithm, and it was found to have a high classification accuracy of 95%.

KEYWORDS

Accuracy, COVID-19, Deep Learning Network, MobileNet, SVM

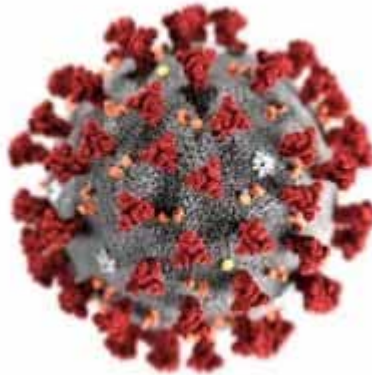
1. INTRODUCTION

Corona Virus Disease 2019 (COVID-19) is a new virus that was first discovered to be affecting humans in 2019 and it was found to be related to the same family of viruses as Severe Acute Respiratory Syndrome (SARS) (Lancet, 2020). It is a contagious virus that have made its first appearance in Wuhan, China. Currently (as of 28 November 2020) 14,524,141 have died worldwide due to this virus. The rapid spread of this virus worldwide has resulted in a pandemic. India registered the first COVID-19 case on January 30 in Kerala and by February 03 two more cases were reported from the same city. In all three cases the infected individuals were students who have just returned back to India from Wuhan, China. The virus makes the immune system weaker which can eventually lead to death (Lancet, 2020; Razai et al., 2020). The virus is illustrated in Figure 1 and as it can be seen, the virus contain spikes on the crown of its outer surface which helps it in establishing a secured connection with human's airway cells (Texas, n.d.). As of November 28, 2020; 62,165,882 people were infected worldwide and 42,951,570 have recovered (Jaiswal et al., 2019; Peng et al., 2020) in the world.

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Figure 1. Illustration of COVID-19 (Sharon et al., 2018)



COVID-19 can spread often by physical touch between two individuals. In general, it is possible for an infected individual to infect other healthy individuals through breath, hand contact, touch, or mucosal contact (Peng et al., 2020). As the virus makes its way to the lungs, infected individuals can suffer from pneumonia. Due to the extreme shortage of the expensive test kit, Real-time polymerase chain reaction (RT-PCR) (Xie et al., 2020) has further aggravated the situation. Hence, people with possible signs of pneumonia were prescribed a chest scan such as Computer Tomography (CT) scans and X-Rays to quickly diagnose and detect whether they are infected with COVID-19 or not. The presence of COVID-19 can be automatically detected with CT scans combined with deep learning techniques (Gozes et al., 2020; Li et al., 2020). In the recent years deep learning has demonstrated a promising result in various fields of research. For the medical field in particular, deep learning methodologies were found to deliver an improved accuracy on detecting different diseases using a data set of images such as images of chest X-Ray, retina image, and brain MRI (Mahmud et al., 2020; Mahmud et al., 2018). X-Ray machines are very useful as they offer a feasible and faster means of detecting disease through the process of scanning different human organs.

A professional radiologist usually performs the interpretation of different X-Ray images manually. These acquired images can be trained using deep learning models to assist medical experts in detecting patients with COVID-19. The detection of individuals with COVID-19 using deep learning is especially important when the X-Ray facility is available but there is a shortage in professional radiologist in the hospital. With that being said, developing a deep learning model to detect COVID-19 cases is a challenging task due to the scarcity of COVID-19 X-Ray images (Chakraborty et al., 2015; Garg et al., 2020; Muhammad et al., 2021). Thus, it is extremely difficult to efficiently train a very deep network. On the other, transfer-learning models are found to provide a feasible solution and they are widely implemented in several recently proposed solutions (Sethy & Behera, 2020). The conventional transfer-learning method, which uses deep networks pre-trained on ImageNet database to transfer its preliminary learning, cannot be the best option because the characteristics of COVID-19 patient's chest X-Ray images may vary from other applications. Consequently, feature engineering and classification plays a vital role in image processing applications, especially in this case. Conventional hand-crafted feature extraction and selection is a time-consuming process. Deep learning architectures have been proven to be efficient in feature extraction for many applications (Sethy & Behera, 2020). The major contribution of this research work is to investigate the implementation of feature engineering method through knowledge transfer approach of combining the deep learning MobileNet model trained in different domain to a domain specific such as COVID-19 data set. SVM classifier was trained and tuned

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