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Detection of COVID-19 in Computed Tomography (CT) Scan Images using Deep Learning

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ABSTRACT

Coronavirus disease (COVID-19) is a fresh genus found in 2019 that was not previously known in humans. On the other hand, Deep learning is one of the most important fields of medical imaging science at present. In this article, a model of deep learning is being trained for the COVID-19 detection in CT Scan images. This study is implemented using Python programming language. To build and train the Convolution Neural Network (CNN) model, Python Deep Learning libraries such as Keras and TensorFlow 2.0 have been utilized. As for the dataset, the open source dataset of COVID-19 chest computed tomography (CT) images were used. These image where been confirmed by the senior radiologist who performed Diagnosis of and treatment of patients with COVID-19. There were total of 745 images belonging to two classes were sampled. 348 positive (+) COVID-19 images and 397 negative (-) COVID-19 images. Based on the training process, the model was able to detect 79 per cent accuracy on the test set. The performance of the model, Convolution Neural Network were evaluated by comparing with Logistic Regression model. Findings from the research proves that Convolution Neural Network are reliable by producing higher accuracy rate of 79% while Logistic Regression produce a rate of 54%. However, in the future more reliable and quality image datasets should be used along with the metadata of the patients to train the model.

Key words: Convolution Neural Network (CNN), COVID-19, CT Scan Images, Deep learning.

1. INTRODUCTION

Coronavirus (CoV) is a vast group of viruses which provoke cold-related diseases including Severe Acute Respiratory Syndrome (SARS-CoV) and Respiratory Syndrome in the Middle East (MERS-CoV). Coronavirus disease (COVID-19) is the latest genus found in 2019 that was not previously known in humans. These viruses are zoonotic transmission by wildlife to humans [1]. International Committee on Taxonomy of Viruses (ICTV) identified the virus as SARS-CoV-2 [2]; and the infectious diseases contaminated with this coronavirus is referred to as Coronavirus Virus 2019 (COVID-19) by the World Health Organization (WHO). The recent coronavirus is being identified as human-to-human transmission. The further airborne transmission of the disease from one human to another has triggered widespread infection [3]. Symptoms of the disease comprise cough, fever and respiratory symptoms. The infection can lead to septic shock, pneumonia, serious acute respiratory syndrome, multi-organ failure, and death in much more extreme cases. [4]. It had since been reported that women are less affected than men and there is no infant mortality between 0-9 years old [5]. COVID-19, viral pneumonia caused by a unique coronavirus, has spread worldwide exponentially within a few months, threatening the health of billions of human beings [6]. Although COVID-19 triggers milder symptoms in about 82 percent of cases, the others are serious or severe [5]. These viruses invade the lungs, forcing them to enlarge and obstruct the supply of oxygen that may be life-threatening. With the threat of SARS-CoV-2 further transmission, the WHO has therefore proclaimed a Public Health Emergency of International Concern (PHEIC) by 30 January 2020 [2]. Moreover, disease outbreak is growing all over the world at a pace that has never been seen before with any infectious disease. One of the powerful strategies suggested by WHO to monitor the transmission of viral infection is social isolation and contact mapping. Farooq & Hafeez in [7] mentiond that a crucial step in this path is efficient and reliable monitoring of COVID-19 patients not just for rapid diagnosis but also for isolation from the public to mitigate the transmission of infectious disease. The restricted supply of test kits makes it difficult to diagnose a large population of infected individuals by the epidemic. In the current public health crisis, poor RT-PCR sensitivity