

Convolutional neural network in the classification of COVID-19

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ABSTRACT

Covid-19 spread out rapidly around the world, forcing many countries to full shutdown, and economical and social consequences. Resulting in rapid need for new and effective methods to deal with this crisis and control it. X-ray lung images is considered one of the most effective and safe method for diagnosing Covid-19, since it could provide solid proof of the existing of the disease, and it has limited effect on the health of the human comparing with other radiography methods. In this proposed work, CNN model is designed and trained to classify Covid-19 X-ray images, by using the COVID-19 Radiography Database, which is published and available online. This database is collected by researchers and experts from various universities around the world. The database contains total of 15153 lung x-ray images, divided into three classes. The classification classes are: *Normal*, *Covid-19*, and *Viral Pneumonia*. The model is trained and tested on publicly available dataset. The dataset is divided into three parts: training, validation, and testing datasets. The model is evaluated based on the three of these datasets. Totally, the evaluation metrics include Accuracy, F1-score, Area Under Curve (AUC), Precision, and Recall, with values of greater than 98% for all of the evaluation metrics. Comparing the results with state of arts publications, which used the same dataset, the proposed method outperformed the state of arts publications depending on the evaluation metrics. The number of the trainable parameters in the proposed CNN model is about 25.4 millions.

Keywords: CNN, Deep learning, Covid-19, X-ray, classification.

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1. Introduction

Coronavirus disease (Covid-19) is type of infection disease. Caused by SARS-CoV-2 virus. Infected people can spread the virus by coughing, sneezing, or just even breathing. The virus are transported in small liquid particles in the air, infecting other people, or laying down on surfaces. And could be spread further by touching the contaminated surface by healthy people [1]. Since the pandemic of Coronavirus and up to 20 October 2021, more than 242 million people are infected, and 4.93 million are dead [2]. Early diagnosis of Coronavirus is considered a critical and important factor in the treatment. There are different methods to diagnose Coronavirus. One of the most common and effective methods is the radiological imaging. Since they reveal the presence of the disease severity. The most common chest radiography imaging are chest X-ray and computed tomography (CT) [3, 4].

Deep Learning (DL) techniques showed high-level performance in many different tasks. Especially in medical images analysis and classification [5-7]. One prominent Deep Learning algorithm in the field of Computer Vision in general, and especially in medical images analysis is Convolutional Neural Network (CNN). Since CNN could extract features from the training images, without the need to the manually extract the features. This will lead to the potential of extracting hundreds of thousands or millions of features from training images. Moreover, it have what is called the "Dense layer", which is responsible of classifying the images based on their extracted features [8, 9].