

Chapter 4

Detection of COVID-19 From Chest X-Ray Images Using Machine Learning

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ABSTRACT

COVID-19 is a pandemic caused by novel coronavirus. Molecular diagnostic tests and serologic tests are the two types of testing procedures currently available to detect virus of COVID-19 in the human body. Another way to detect COVID-19 is the use of chest x-ray. Radiology doctors use x-ray report to identify COVID-19-positive patients and the severity of that. In the proposed methodology, the authors develop an algorithm that can detect COVID-19 from chest x-ray images automatically. In the proposed work, image descriptor such as local binary pattern (LBP) is used to extract the features of the x-ray images. Using those textural pattern, LBP image of the original image is generated, and a meta-data has been curated. This modified dataset is given as input to the convolutional neural network (CNN) for classification of the images. The CNN identifies whether the x-ray image is of a COVID-19-affected person or a healthy person with accuracy measured as high as 92.24%.

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INTRODUCTION

A pandemic situation was created due to *COVID-19* (novel coronavirus disease) which leads to critical respiratory syndrome called Coronavirus 2 or known as Severe Acute Respiratory Syndrome (SARS-CoV-2) (Stoecklin, 2020). In December 2019, SARS-CoV-2 was first detected in China. After affecting China on a large scale, it spread very rapidly all over the world and has conserved a phylogenetic parallelism with SARS-CoV (Zhu et al., 2020). But this is not the first time, in 1960 Coronavirus was first discovered from the nasal pits of human. It is mainly encompassed RNA viruses which belongs to an immensely infected group and this RNA virus catalyzed respiratory, hepatic, and neurologic diseases, which mainly affects humans and other mammals (Guan, 2020; Zhu et al., 2020). Coronaviruses are a type of virus that causes diseases like MERS-CoV and SARS-CoV, which are generally build up from bats. The SARS-CoV-2 outbreak follows the SARS-CoV, which outbreaks in 2002 and MERS-CoV, which outburst in 2012.

Meantime COVID-19 became an infectious disease, which is rapidly spreading over the globe. On January 30th, 2020 COVID-19 outburst was declared as a public medical crisis of international concern by the *World Health Organization* (WHO). On March 11th, 2020, the situation was announced as pandemic by WHO. To control spreading of COVID-19, WHO announced to maintain different pre-cautions like keeping social distancing, washing hands with soap, sanitizing hands and objects used in our daily life with sanitizer, avoiding touching nose, mouth, eye, using face mask etc. to stop spreading of COVID-19. However, most of the affected countries tried to stop spreading of the disease by making lockdown in their regions. Fever, cough, weariness, loss of appetite, muscle discomfort, and other symptoms are the most frequent signs of a Corona virus infection. On May 19th, 2020, the overall number of infected patients is estimated to be 4,885,738; the percentages of total recovered, fatalities, mild and severe condition patients are 86%, 14%, 98%, and 2%, respectively (Coronavirus, 2020). To prevent spreading of the disease and stable the explosion curve we need to point out COVID-19 positive patients, isolate them from their family and ensure treatment policy at very preliminary stages.

Currently two types of testing procedures are available to detect COVID-19, one of them is Molecular disorder tests and other one is serological tests (Global & Alert, 2020). Molecular diagnostics is used to detect COVID-19, when people are already suffering with the infection. In this pandemic situation, most popular molecular diagnostics is *Reverse Transcription Polymerase Chain Reaction* (RT-PCR) test. Currently RT-PCR is considered as an important pathological test to detect COVID-19, which helps to identify the viral RNA from saliva or nasopharyngeal swab. This RT-PCR test is very fairly linked with a low true positive success rate and needs certain equipment. Another technology called viral antigen detection is

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