**INTRODUCTION:**

The COVID-19 is a deadly disease caused by the newly recognized coronavirus. In December 2019, coronavirus (SARS-COV-2) infected the human body for the first time, and it can spread principally among humans through the droplets formed by the infected persons when they speak, cough or sneeze [1–6]. As the droplets are too heavy to travel far, they cannot spread person-to-person without coming in close contact [7]. Although the exact time is not yet known, a new study has estimated that the COVID-19 can be viable in the air for up to 3 hours, on copper for 4 hours and up to 72 hours on plastic and stainless steel. However, the exact answers to these questions are still not agreed upon by the general health research community and currently under investigation. COVID-19 attacks the lung and damages the tissues of an infected person. At the early-stage, some people may not find any symptoms where most of the people had fever and cough as the core symptoms. Other secondary symptoms could be body aches, sore throat, and a headache could be all possible.

At present, COVID-19 disease is increasing daily due to the lack of quick detection methods. All over the world, a huge number of people died of this disease in 2020. The respiratory tract and lungs are the media where the virus can spread easily. As a result, inflammation occurs, and air sacs can be filled with fluid and discharge. The process is responsible for creating an obstacle in oxygen intake. Quick and accurate detection of the virus is a major challenge for doctors and health professionals around the world in order to reduce the death rate caused by this virus.

Due to the global climate changes, people have already been suffering from many other diseases, and the impact created by the COVID-19 is immeasurable. Currently, the virus has spread to almost every country in the world [8]. Recently, all over the world, America, South-East Asia, and Europe have the uppermost number of confirmed COVID19 cases (Figure 1). On 7 January 2021, more than 85,929,428 confirmed cases of the virus and 1,876,100 deaths were reported by World Health Organization (WHO) due to the disease [8]. At present, further research on an effective screening process is required for diagnosing the virus cases and segregating the affected people. Health professionals and scientists of many countries in the world are attempting to improve their treatment plan and capacity of test through implementing multifunctional testing to stop spreading the virus and for protecting themselves from the deadly virus.

Currently, a number of countries have developed vaccines for the COVID-19. Among them, the vaccines developed by Pfizer (USA), AstraZeneca (UK) and Moderna (USA) have been accepted and used in the USA, UK, and many countries in Europe. Based on the clinical-trial data, it has been claimed that the three popular vaccines have achieved the target of 50% efficacy and safe to use without any serious side effects [9,10]. The Pfizer vaccine is required to store at −70 ◦C temperature. This low-temperature storage makes it challenging to transport and store all over the world, particularly in underdeveloped countries. However, the AstraZeneca vaccine requires regular fridge temperature, which will be easier for both carrying and storing worldwide. More recently, the vaccine developed by Sinovac Life Sciences in China has been approved in many countries globally, including Brazil, Indonesia, Colombia, Turkey, Chile, Uruguay and Laos [11]. Furthermore, Sputnik V was developed by Gamaleya Institute, Russia and is currently being used in Belarus, United Arab Emirates, Saudi Arabia, India and Iran [12]. Furthermore, mass vaccination worldwide still remains a huge logistical challenge [13]. Still, large-scale manufacturing is required to produce the vaccine for covering people all over the world. Further research is required on how long the protection lasts and to find out the effectiveness of the vaccines, particularly against new variants of viruses, which are currently detected in the UK, South Africa, Brazil, and Portugal.

Recently, the reverse transcriptase-polymerase chain reaction (RT–PCR) diagnostic method is found to be effective in detecting the virus. However, the method has some drawbacks, including longer detection time and lower detection rate of the virus. Strict requirements in the laboratory and diverse characteristics of the testing could be attributed to the drawbacks [18,19]. Researchers are working on overcoming the limitations of RT– PCR testing to enhance diagnosing and detection of the COVID-19. According to the recommendations by WHO provided in October 2020, chest imaging examination is an effective method for the detection of clinical symptoms of people who have been affected and recovered from the virus [20]. Furthermore, other diagnostics tests are also suggested, including ultrasound, X-rays and MRI of the chest and computed tomography (CT) and needle biopsy of the lung. At present, chest X-ray is extensively used for the detection of the COVID-19 cases compared to the CT image as it takes longer for imaging, and CT scanners are not available in many underdeveloped countries. In addition, CT imaging is highly costly, and pregnant women and children may face health risks due to its high radiation [21]. On the contrary, X-ray imaging has played a great role in many medical and epidemiological cases due to its wider availability [22,23]. Chest X-ray is promising for emergency cases and treatment due to its operational speed, cost and simplicity for the radiologists. However, in prior research, some inconsistencies were observed for the chest X-ray images taken from people affected by the COVID-19 [24].

In the past, artificial intelligence (AI) techniques were employed to successfully diagnose Pneumonia either from chest X-ray images or CT [25–27]. The classification methods employed vary from Bayesian function to convolutional neural network (CNN). More recently, CNN has been found to be useful and effective in identifying COVID-19 via image classification. CNN consists of multilayer neural networks, which are highly capable of recognizing the image patterns without conducting diverse preprocessing of the images. Although several CNN models, including AlexNet, Resnet50, VGG16, VGG19, are available, VGG19 demonstrates better performance for the COVID-19 classification.