

Machine Learning Method: A Better Approach For Identifying COVID-19 Patients

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Abstract

Recently, the last year has been very difficult for the entire world and the cause is COVID-19, an infectious disease caused by a family of virus known as corona virus. This disease has been declared as a world-wide pandemic by the World Health Organization (WHO) in March 2020. These viruses cause severe respiratory problems, ranging from common cold to deaths of patients due to Severe Acute Respiratory Syndrome (SARS). Even after the vaccines have been discovered, successful detection of COVID-19 in a patient still needs improvement. Through this paper, we shall discuss various existing methods and approaches used in the identification of COVID-19 virus. Moreover, we shall discuss about the various datasets that are required for carrying out the detection and at last a comparing these methods on parameters to know which method has the best accuracy rates.

Keywords: COVID-19, Methods, Approaches, Datasets

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Introduction

COVID-19 or corona virus is a recently discovered virus which has affected the mankind in its worst way possible. GDP growth of various countries have declined due to complete lockdown or shut down of activities in these countries to prevent people from coming out of their homes. Internet and Newspapers are filled with news of people dying due lack of oxygen, treatment,

number of active cases rising per day, what measures need to be taken to eradicate the virus completely.

First of all, let us know what corona virus is. Corona virus, also known as SARS-CoV-2 is a virus which belongs to a family of Coronaviridae, the same family which causes pneumonia and other respiratory illness in humans. Common symptoms that are seen in a COVID-19 patient are fever, dry cough, tiredness, loss of taste and smell, shortness of breath, chest pain and sore throat. The virus is contagious and is spread by coming in contact with the person infected by the virus. The droplets coming from infected person's sneeze, cough and breath can travel in the air and reach the other normal person or a person can touch a surface which has been already touched by an infected person and then touch the nose or eyes. This is how a normal person gets infected by COVID-19. On reaching the throat, the virus travels down to the respiratory tracts. Since the virus has spikes of glycoproteins on its outer surface and genetic material (RNA) in the inner membrane, it mainly attacks the lungs, thus weakening the respiratory system. When a doctor suggests a CT scan or an X-Ray then in that particular image, shadows or patchy areas can be seen which have been infected by the virus.

As the virus is now mutated and been asymptomatic it is hard to find it by normal method and now-a-days there are several patients whose RT-PCR report is negative but the person is COVID-19 positive. Prediction by normal ways is quite a challenging task and is very risky as there is a chance of spread. Here various other methods including machine learning methods can help in predicting whether a person is COVID-19 positive or not as corona virus attacks the lungs and an inflamed chest image is noticeable hence, results in better and accurate results. Moreover, they can help in predicting the risk of spread and various other elements through which this disease is spreading.

The various methods and approaches include: COVID-19 detection using X-ray and CT images, identification using RT-PCR test and anti-body test, detection using machine learning methods with the help of blood samples.

Comparative Analysis

All over the world, various researches are going on for finding a true and a quick reference standard for SARS-CoV-2 diagnosis. Many machine learning methods have also been introduced in the field for helping in better diagnosis of the virus in patients.

Identification using RT-PCR test:

According to Food & Agriculture Organization of the United Nations, RT-PCR is one of the most accurate laboratory testing method for the current corona virus crisis.

RT-PCR test uses Real-Time Reverse Transcriptase (RT)-PCR Diagnostic Panels for detection. In this method, samples of swabs from nose and throat are taken and are dealt with reagents which identify the viral RNA. A process known as amplification is carried out in which multiple copies of genetic material RNA are generated to create a DNA. [5]

The accuracy rate achieved with this test for detecting COVID-19 patients is 67 percent.

Identification using anti-body test:

This test is only done when a rapid result is required for the identification. This test detects antibodies in blood to determine whether the human body has recently come in contact with a virus infection known as COVID-19, due to which the accuracy rate of such test is very low when compared to any other method. Many a time doctor recommend RT-PCR test even after the anti-body test results negative.

COVID-19 detection using X-ray and CT images [1]:

In this method, machine learning classification algorithms are used on X-ray and CT images of lungs. As we all already know that corona virus mainly attacks on human lungs and weaken the functioning of respiratory system and heart. Therefore, this virus has its own characteristics different from viral pneumonia which can be detected through X-ray and CT lung images of COVID-19 positive patients[1].

Let us understand how the overall approach works. In the very first stage, two datasets are taken, one of COVID-19 positive patients and the other which includes both viral pneumonia and COVID-19 patient's lung images. The system is fed with the features of already identified COVID-19 patients which have been extracted using deep learning model. Then, in this approach, feature extraction methods are used to extract relevant features from the images and then these features are further classified with the help of a precise classifier. [6]

Many studies show that the results produced by these approaches were more accurate than the standard RT-PCR test. The method works better in early stages of infection.

These approaches achieved 99.68% accuracy depending entirely on the types of machine learning algorithms used for feature extraction and classification.

Chest X-ray images of



(a) Normal Person

(b) Infected Person

COVID-19 detection using blood samples [4]:

This approach also uses machine learning methods for detecting COVID-19 patients by using datasets of blood samples of infected persons. The main concept behind this approach is that the blood composition changes whenever a virus invades the body. Comparing the changed composition to a normal human body composition can detect in the presence of corona virus. The famous Random Forest Algorithm is used in this approach.

The parameters on the basis of which this test is conducted are: total protein, glucose, calcium, magnesium, basophil, bilirubin, creatinine, lactate dehydrogenase, kalium, platelet distribution width. This test shows accurate results upto 91.67% for patients having severe infection. Persons with mild symptoms are usually not detected.

Conclusion and Results

From the above discussion, it can be seen that COVID-19 detection using X-ray and CT scans is a better approach when compared to others in terms of accuracy, early stage of infection, time consumption and precision.

RT-PCR test has been world-widely accepted but it still has many shortcomings such as,

- False-negative results,
- Results usually take 3-4 days,
- Costly medical kits and
- Mostly undetectable for mild symptoms.
- Moreover, the test is not suitable at early stages of infection. [5]

Same is the case for anti-gen and identification using blood samples composition. Although

the latter is a quicker test but still a blood report is required for knowing about the parameters values and then testing them for infections.

The accuracy rates for various approaches are given below:

Methods	Accuracy Rates
RT-PCR test	67%
Machine learning method using X-ray and CT images	99.68%
Anti-body test	85%
Machine learning method using blood samples	91.67%

Note: Accuracy rates is on the basis of whether a particular test is able to detect corona virus in human body or not.

In conclusion, there is a need for a quicker method which can only be achieved through a machine learning approach to control the outbreak and proper treatment can be given to the patient when their exact time of isolation can be identified with the help of detection in the very early stage of infection. [7]

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