Using Machine Learning Algorithms for the Prediction of Future Reachability of the COVID-2019

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Abstract

The catastrophic outbreak of COVID-19, acute respiratory syndrome, has created a threat to the entire world. People all over the world became vulnerable to the consequences of this deadly virus, with the increase in cases and the development of the mutation of the virus, a second and third wave appeared, with different symptoms at each stage. Since many patients with COVID-19 show nonspecific symptoms when they come to hospitals, doctors cannot easily identify patients whose condition will rapidly deteriorate. The AI and machine learning algorithm can quickly predict the outcome of patients with COVID-19, and it can also calculate the likelihood of patients needing before their condition worsens, which helps caregivers make more accurate care decisions, and disease diagnosis with the help of various artificial intelligence tools. Whereas, an artificial intelligence (AI) algorithm can use routine clinical laboratory test data to determine if a patient has COVID-19. Textual clinical reports can also be classified using machine learning algorithms that detect viral RNA on nasopharyngeal swab samples. Also, diagnosing COVID-19 as a screening tool in hospital settings, whereas, the PCR test is not available.

This paper presents the possibility of using artificial intelligence and machine learning algorithms to analyze epidemiological development using shared data at the international (national) level to counter the spread of this deadly virus, identifying epidemic patterns. There is no specific treatment for COVID-19; however there are alternatives that may reduce the enormous burden on limited healthcare systems.

Keywords:*COVID-19, SARS-CoV-2, Pandemics, artificial intelligence algorithms, machine learning algorithms.*

1. Introduction

COVID-19, known as Corona virus, appeared in Wuhan State in China in late December 2019, Corona viruses are a large family of viruses that belong to the SARS-CoV-2 family that causes serious human diseases that are transmitted from animals to humans, and it has been proven that the SARS virus has transmitted From civet cats to humans in China in 2002, or in bats in the case of the current coronavirus infection [1]. This new virus is extremely contagious and dangerous and has spread very quickly to all parts of the world. And it has become a health emergency of great international importance (PHEIC) as it spread to most countries of the world. This virus, COVID-19, which belongs to the SARS-CoV-2 family, is a large family of viruses known to start from the initial level of symptoms ranging from the common cold to the severe level of more serious diseases such as severe acute respiratory syndrome (SARS). That causes fever, dry cough, shortness of breath, extreme fatigue, diarrhea, loss of sense of smell and taste, muscle pain and inflammation in the lungs,

which leads to respiratory failure, and its symptoms are bluish skin color, difficulty breathing, feeling tired and exhausted [2,3].

Acute respiratory distress syndrome is diagnosed (ARDS) is diagnosed by measuring a PaO2 / FiO2 ratio below 300 mm Hg. Which is often more severe in the elderly, and people with other chronic diseases such as asthma, diabetes, heart disease, pressure, kidney disease, and allergic patients are more susceptible to the virus. The patient is diagnosed based on symptoms and their travel history. No specific treatment has been discovered yet, but patients are treated using commercially available drugs such as hydroxychloroquine, antipyretic, and antivirals to treat symptoms [4]. To prevent this deadly virus, you must take some precautionary measures by washing your hands regularly with soap and water for 20 seconds, or cleaning them with an alcohol-based disinfectant, covering the mouth and nose, avoiding touch the nose, ear, and mouth, and avoiding contact with others by keeping a distance of at least 1 meter until it reduces Chances of transmission of infection with this virus [5].Coronavirus can be identified by imaging with immunoelectron microscopy. Figure 1 shows the typical structure of the COVID-19 virus, from a throat swab. But until now, the detailed structure of this virus is still not fully or clearly understood [6, 7].

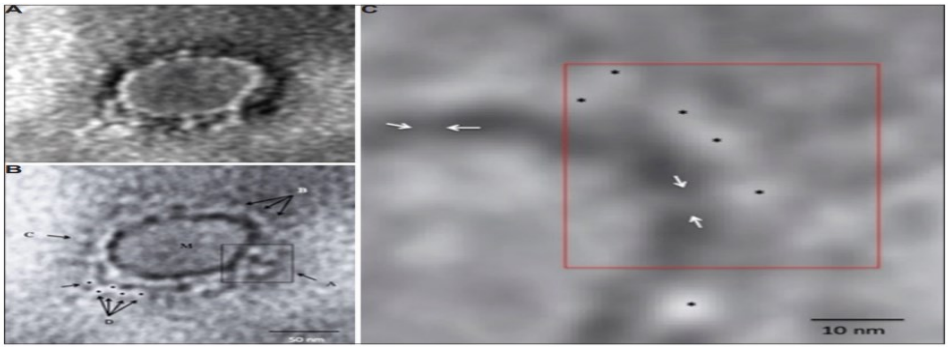

Figure 1. Electron microscopy imaging of COVID-19 representing morphological features at varying levels

The new mutation of this virus has now emerged, as most countries of the world have now swept the second stage of transmission and are facing a greater number of infections and deaths. Coronavirus test results may take several days. Also, some diagnostic RT-PCR tests for COVID-19, which detect viral RNA on nasopharyngeal swab samples, may take up to several days to return depending on the test and laboratory location [8]. But routine medical lab tests go back to minutes or hours, making this a potential shift for triage of infected patients.As the COVID-19 outbreak has become a global pandemic, now analyzes of epidemiological data are absolutely necessary to prepare for better and faster action plans against the disease. The capacity of the PCR test remains limited. Many hospitals lack PCR capabilities and are mandated to send samples to central laboratories, which delays results up to 48 hours to 96 hours, thus slowing down the clinical decision-making process and wasting personal protective equipment [9].

Artificial intelligence and machine learning algorithms play an important role in analyzing and predicting epidemics to fill this gap, and in light of the presence of a huge amount of past and current epidemiological data, with the help of disaggregated data, to predict future events [10].

The aim of this paper is to use artificial intelligence and machine learning algorithms to diagnose COVID-19 as a screening tool in hospital settings, to identify patterns of the epidemic so that early action can be planned to stop the spread of this virus, and to help

doctors anticipate a severe deterioration of patients, and test drugs to provide appropriate treatment. This paper discusses the role of artificial intelligence and machine learning algorithms in analyzing and predicting epidemics to prevent the spread of epidemic and provide appropriate treatment.

The rest of the paper is organized as follows: Section 2 COVID19 World Health Organization reports, Section 3 the Potential role of AI and ML algorithms in fighting the against COVID-19, Section 4 provides results and discussion of a brief overview of virus Corona and known AI and ML technologies, and discusses the implications of using AI and ML algorithms in analyzing and predicting epidemics. The final section concludes the paper and explains future work.

2. COVID-19 World Health Organization Reports of a Second Wave of Coiv-19

As countries ease travel restrictions, a second wave of Covid-19 led to an increase in cases and deaths due to lockdown easementsin June and July 2020. At the global level, cases increased until mid-April 2020, stabilizing until mid-May 2020 and then rising again, Figure 2 shows Daily new COVID-19 cases [11].At continent level for new cases, Asia has risen steadily, while Europe is increasing again, the Africa and Americas are declining, Figure 3 shows 14 moving average for new cases by continent. Deaths cases followed the same pattern; Table 1 shows Pearson correlation of trends in new cases and deaths. The monthly ratio of detected cases to deaths rose to 0.08, and then decreased to 0.02 [12-14].

Table1. Pearson correlation of trends in new cases and deaths

	New cases			New deaths		
	31/12–11/4	**12/04–12/05**	**13/05–20/09**	**11/01–16/4**	**17/04–28/05**	**29/05–20/09**
Days	103	31	130	97	42	130
r2	0.77	0.33	0.92	0.77	−0.65	0.42
P	<0.0001	0.07	<0.0001	<0.0001	<0.0001	<0.0001

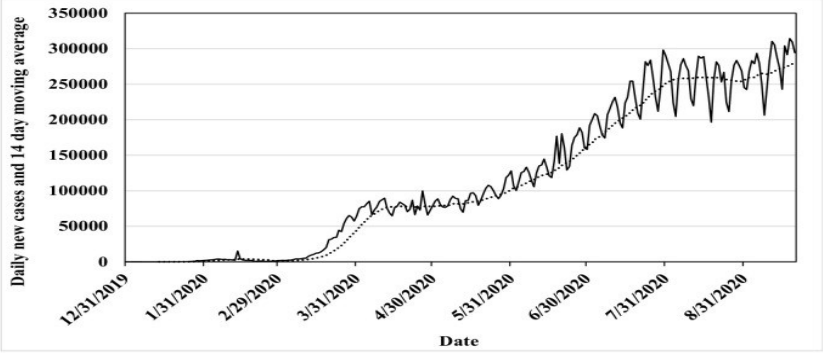

Figure 2. Daily new COVID-19 cases and 14 day moving average

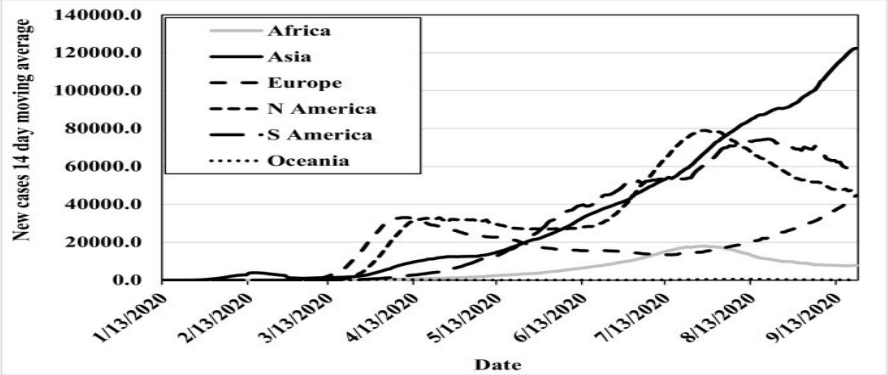

Figure 3. 14 moving average for new cases by continent.

3. The Potential Role of Artificial Intelligence and Machine Learning Algorithm in Fighting the COVED-19

The machine-learning algorithm demonstrated a difference in features between patients with and without COVID-19, and higher values for those with severe COVID-19 compared to mild COVID-19 [15]. These features are age, gender, hemoglobin, red blood cell count, leukocytes, lymphocytes, C-reactive protein, ferritin, and LDH. Advances in the use of artificial intelligence in healthcare have led to the development of machine learning algorithms that are used as diagnostic tools for anatomical and radiology pathology and for specific complex diseases, such as cancer. Epilepsy is detected using machine learning methods, and electroencephalogram (EEG) signals are used to detect normal states and epilepsy using artificial neural networks (ANN) [16-18].

Additional laboratory values in the blood samples of patients with COVID-19 show a pattern distinct from that of other diseases. These changes include increases in ferritin, lactate dehydrogenase [LDH], and C-reactive protein, decreases in certain blood cell counts, and increases in the ratio of neutrophils to lymphocytes. Machine learning algorithms have led to predictability that is applicable in their own context. One of the major limitations of these earlier methods was that the data sets that were used to train and test the methods were small. A machine learning algorithm based on a scarce set of blood markers that includes markers of inflammation can efficiently predict the presence or absence of COVID-19 and can be used as a screening tool in clinical practice, to be useful in hospitals where the specific PCR test for CoV-2 is not available [19-21].

Machine learning algorithm and artificial intelligence provide a lot of support in identifying the disease with the help of images and text data, and they can also be used to identify the new Corona virus, and to predict the nature of the virus around the world. However, the machine learning algorithm requires a tremendous amount of data and also includes clinical reports to classify or predict diseases. Machine learning (ML) algorithm may provide useful input in making diagnoses based on clinical reports and radiographs. Machine learning algorithms demonstrate diagnostic accuracy based on early available data. The development of machine learning and artificial intelligence algorithms based on data warehouses, data sharing and valid*ation is important to realize the full potential of machine learning and its applicability to clinical medicine. A Machine learning algorithms using a new concept such as fixing data-related problems and deleting invalid data to identify important data, analyze data and extract new and useful knowledge, or information from previous experiences, which is very useful to address the Corona pandemic [22-26].

4. Results and Discussion

In the second wave of the Coronavirus, cases of COVID-19 have risen rapidly around the world. However, case death rates have decreased, which is a confusing finding. The reason may be due to some medicinal treatments currently available in the market that may work to relieve some disease conditions such as remdesivir, dexamethasone and convalescent plasma. But the country is always in dire need of restarting economies, and has been open to travel, but public health measures must be maintained so that cases do not spread. Countries without strict measures have high infection rates. And that the vaccine is only partially effective, there may still be a need for an effective treatment for this virus. Early prediction of COVID-19 can be helpful in reducing the overwhelming burden on hospitals by helping diagnose COVID-19 patients.

The machine learning algorithm indicated that the most important feature among all the features of the dataset, including clinical features, indicates that people over the age of 45 are at risk of contracting the Coronavirus compared to people of lower ages. Also, people with pneumonia, kidney disease, heart disease, diabetes, allergies, asthma, obesity and high blood pressure are more likely to (infection) develop COVID-19.As for gender, males are more likely to have COVID-19 infection than females, and those who smoke cigarettes are more likely than non-smokers. The machine learning and artificial intelligence algorithm will help doctors predict, diagnose and contain the COVID-19 pandemic and this will complete the RT-PCR COVID-19 test and thus reduce the massive burden on healthcare systems.

Machine learning and artificial intelligence algorithms can predict the likelihood that a COVID-19 patient will need a ventilator or ICU cares. Using a patient's medical history, and also, the algorithm can determine if the patient's condition will worsen within 72 hours. The expansion of PCR-based testing has many bottlenecks such as purchasing new test stands, obtaining samples, swabs and transports, and human experience with PCR testing. Through the use of available laboratory tests with machine learning algorithms, this has achieved a high sensitivity similar to that found in PCR, which is very useful as a screening test in small medical centers or located in resource-poor areas that have limited capacity for COVID-19 PCR-based diagnostics. , Or in cases where testing capacity is compromised due to reduced supplies. Routine test results return within two hours. It is useful to use routine laboratories to predict whether RT-PCR results will be positive or negative to improve the screening process.

Using a machine learning algorithm, it identified CoV-2 infection with a sensitivity of 80% and a specificity of 83%. The algorithm also correctly identified patients who had tested positive for COVID-19, but tested positive for the coronavirus upon retesting within two days. The machine learning algorithm helps predict the total number of deaths detected worldwide. The forecast will allow taking the necessary decisions to limit the spread of the epidemic, such as increasing the lockdown period, implementing health measures, providing daily resources, and other preventive measures. Patient results from multiple other types of laboratory tests can be analyzed using artificial intelligence and similar analytical algorithms to diagnose a health condition unrelated to the original reasons for performing those tests. In addition, asymptomatic cases and lack of diagnostic tools may lead to delayed or even loss of diagnosis, exposing patients, visitors and healthcare workers to 2019-CoV infection, which poses a major threat to the healthcare sector. Therefore, machine learning, clinical, and AI algorithms must play a critical role in diagnosing and containing the COVID-19 pandemic.

5. Conclusion and future work

Artificial intelligence algorithms run on cell phone records of coughs in order to accurately diagnose conditions like asthma or pneumonia. By developing artificial intelligence algorithms, it is possible to analyze cough recordings and identify individuals infected with the virus, as speech and cough sounds are affected by the vocal cords and surrounding organs. This means that when speaking, part of the speech resembles coughing, and vice versa. It also, means that things come out from speech; and an artificial intelligence can be easily pick up them from coughing, such as a person's language or gender, the strength of the vocal cords, the functioning of the lung and respiratory system, and muscular decline

Artificial intelligence algorithms will be essential to support clinical and academic trials of the emerging coronavirus and future crises. The machine learning algorithm can also target a specific SARS-CoV-2 protein that helps promote the discovery of a new and effective drug to treat COVID-19 cases, such as the main protease protein, as the main protease is a fundamental pillar in the virus protein mechanism, which is very important for how it is made Copies of it. Medicines that suppress the activity of the main protease protein can prevent (stopped) the virus from replicating. Antibody treatments are likely to be the first treatments during the pandemic. But these antibodies target the virus' prickly protein instead of the main protease protein, but it is possible that machine learning and artificial intelligence algorithms could help drug developers create treatments for COVID-19.

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