Article

Importance of artificial intelligence in the treatment of COVID-19 disease

Faizan Jamal, Musangi Sumanth and Madhavarani Alwarsamy[1]

ABSTRACT

Covid-19 is a disease which is caused by SARS-CoV-2 virus of coronaviridae family. World health organization (WHO) declared it as pandemic during March 2020 since it affected many countries globally. The rise of artificial intelligence is posing a significant role in this crisis and they are act as a savior of humanity. Here in this review paper, the ideology artificial intelligence that strengths the medical imaging tools in detection and diagnosis of infected individual was focused. The usage of machine learning algorithms for the possible case identification of COVID-19 individual using mobile phone-web survey was also discussed. By the study, it was highlighted that the strategies of artificial intelligence are also inevitable to limit the spread of COVID-19 in susceptible population to enhance the diagnosis therapy using nuclear imaging techniques.

Keyword- SARS-CoV-2, Machine learning algorithm, X-ray, Computer tomography, Mobile phone-based web survey

Introduction

COVID-19 A-Pandemic disease

The COVID-19 disease is caused by a SARS-CoV-2 (severe acute respiratory syndrome corona virus 2) virus which is an ongoing pandemic. The number of people infected by this virus is increasing progressively. In a period of one month from March-April 2020, the number of COVID-19 cases reported all over the world has reached 1,436,198 individuals and deaths were approximately 85,521 individuals (WHO, 2020).

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[1] Department of Biochemistry, JAIN (Deemed to be university), School of science, Block-1, Bangalore- 560011, Karnataka, India.

World Health Organization (WHO) declared it a public health emergency of an international concern (PHEIC) and recognized it as a pandemic disease. This SARC-CoV-2 virus, directly attack the type II alveolar cell inside the alveoli of lungs which is responsible for reducing surface tension during exchange of gases (Yel *et al.,*2019). This virus releases its positive sense single stranded RNA [(+) ssRNA] inside the cell through ACE-2 receptor (Angiotensin converting enzyme 2 receptor) and then it seize the ribosome of host cell to synthesize protein via translation process (Leila and Ghasemi, 2020). The SARS-CoV-2 virus also utilizes the RNA dependent RNA polymerase enzyme to create more viral RNA genetic material. The viral proteins produced through translation are utilized for synthesis of glycoprotein spikes and other viral components. Once the viral components assembled, it trigger viral multiplication more rapidly and eventually destroy both type 1 and type 2 alveolar cells of lungs. Immediately after the disruption of type 2 alveolar cells, the victim start to suffer from acute symptoms like shortness of breathing, cough, fever to multi organ failure based on the severity of infection which even cause death of the host (Leila Mousavizadeh and Sorayya Ghasemi, 2020)

Conventional imaging technologies

Chest X-ray is a kind of nuclear imaging technique which uses a limited dose of ionizing radiation that helps to identify the physiological changes in a human lung. It has also been used to monitor any structural abnormality in heart and chest wall as well. The X-ray images aid in the diagnosis of a majority of COVID-19 symptoms like shortness of breath, cough, fever, chest pain and injury. For this X-ray imaging, medical technicians would have specially trained to correct the posture of a patient in X-ray machine following the standard procedures. However, all these steps involve a physical contact between patient and medical technician which increases the high chance of viral infection exposure.

Computer tomography (CT) also called as computerized axial tomography is also being used for the diagnosis of COVID-19. It uses X-ray beam to build a cross section images of body for diagnosis purposes. Radiologists inject a contrasting material inside the arm of patient or in rectum via an enema which block the X-ray beam and appear white background on images. This imposes the patient blood vessel, intestine and other body parts more visible on image. Unfortunately, all these conventional imaging tools for the diagnosis of COVD-19 involve unavoidable contact between patient and doctors which indirectly increases the high risk of COVID-19. Due to these factors, we desperately need AI (Artificial Intelligence) aided medical imaging technologies which reduces the contact between health care workers and infected individual in a smart way (Zhang and Song, 2020).

Image segmentation by artificial intelligence

The most important step in image processing for evaluation and calculation is segmentation. It helps us to identify the infected region of lungs or region of interest. It may be the infected region of lung lobes, or broncho pulmonary segments in chest CT-scan or X-ray. This segmented region is used for diagnosis and for various other applications. CT-scan gives us a high quality image of infected region of lungs in COVID-19 patient. The segmentation can be

done by using deep learning method like basic U-Net or U-Net++ (Ronneberger and Philipp Fischer; 2015)

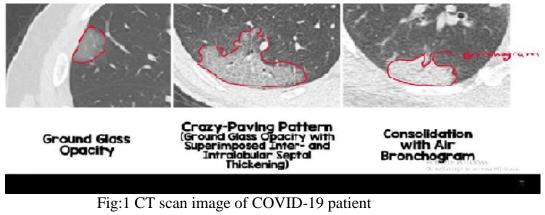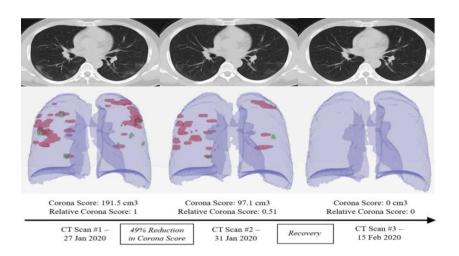Fig:1 CT scan image of COVID-19 patient
Image source- //doi.org/10.1148/radiol.2020200432

The Fig.1, shows the symptoms of SARC-CoV-2 virus which include the formation of ground glass opacity, crazy-paving pattern (ground glass opacity with superimposed inter-and intralobular septal thickening) and consolidation with air bronchogram. These are the common symptoms of COVID-19 infected individual. Crazy paving pattern and consolidation with Air bronchogram are the most dominantly found in COVID-19 individual, which takes peak during the incubation period between 9-13 days followed by slow clearing is been used for AI (Tao *et al.,* 2019)
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Fig 2 : AI- aided segmentation methods
Image source – RADlogics

Using three CT-scans from a single corona virus patient, Radlogics algorithm (AI) help to quantify the amount of recovery with a "corona score". According to US San Diego health physicians AI has a capability to detect SARS-CoV-2 virus in patient even before its diagnosis get confirmed. In literature, there are various architecture given which can be used for lung

segmentation but the most famous architecture used is U-Net (Fully convolutional network). Its application includes segmentation of both lungs region and lung lesion for COVID-19 application using AI.

Identification of COVID-19 cases through AI framework with mobile-based phone survey when any city or town is in quarantine

This is a conceptual framework of AI aided data collection and possible COVID-19 case identification. It has 3 images (a), (b), (c)

(a) Any geographical region (city/ town/ village) **-:** It shows a number of household present in a given city or town which is under quarantine.

(b) Respondent and Non respondent of phone based web survey **-:** The number of people who responded through phone-based web survey about their symptoms, travelling history etc are represent in form of blue circle, whereas non-respondent are represented in form of yellow circle.

(c) Possible identified cases of COVID-19 in a survey which includes respondent and non respondent **-:** Identified possible COVID-19 case among the respondent are denoted by red dot whereas the number of people who don't respond in Phone-based web survey but they are possible COVID-19 case individual are denoted by red circle having yellow colour in center
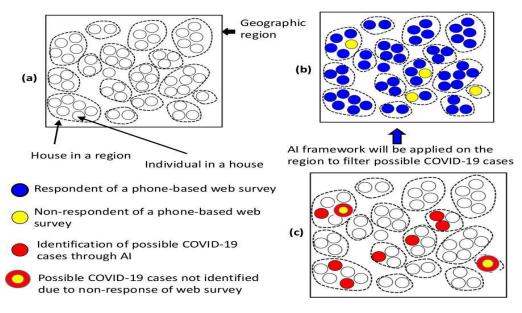

Fig: 3 Identification of COVID-19 through AI (Srinivasa Rao, 2020)

Participatory diseases surveillance of COVID-19 pandemic in India

COVID-19 diseases pandemic requires an urgent close observation of infected individual to control the spread of diseases. Participatory disease surveillance technology already adopted in many other countries like China to track the movement, geographical location of infected individual to stop the exposure of viral infection to any other healthy individual. India is a country

which has a high dense population and has a strong telecom industry facility. Therefore it is very important for a country like India to introduce a PDS (Participatory disease surveillance) technology into its population to track the viral infection.

Recently India has launched its own app called Aarogya setu app developed by government of India to connect the common people to promote health care facility without any time delay. This app track the COVID-19 infected individual based on their mobile location. The core function of this app is to provide information of health status of individual to the government. This app predict the high risk of chances of viral infection of a given individual on the basis of databases which is created by Lab confirmed report of COVID-19 cases. This app use Bluetooth and users mobile location to track the individual. It asks for certain questions about gender, age, symptoms detail, travel history etc. Then, it scores the risk status of the given individual with COVID-19 as low, moderate or high.

Users of this app are informed on the basis of risk assessment like isolation, log temperature after every 2 hours. Finally it informed the suspect of viral infection to go for detail testing in health care clinics present nearby its location. This technique is cost effective and gives very quick result. It helps us to stop the spread of viral infection in pandemic or in crisis (Suneela Garg and Nidhi bhatnagar, 2020)

Conclusion

The SARS-CoV-2 virus spread all over the world and it is an ongoing pandemic. Application of AI acts as a very useful tool for diagnosis and for treatment measures. Artificial intelligence or intelligent medical imaging plays a very important support system to fight against COVID-19. This article provides the application of artificial intelligence in support with regular conventional methods. AI assists to track the infected individual effectively to stop the spread of diseases by using mobile-based phone survey. It is very important to note that AI provides only partial information about patient infected with COVID-19. Therefore it is very important to combine clinical data and laboratory experiment results which will help in better screening, diagnosis and treatment of patient infected with COVID-19. We believe that AI will show excellent capability in fusing information from multiple sources to give us accurate, efficient result in diagnosis and in treatment of diseases.

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