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Detection of Covid-19 Using AI Application

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Abstract

INTRODUCTION: In December of 2019, the infection which caused the pandemic started in the Hubei territory of Wuhan, China. They were identified as SARS-CoV-2, a highly infectious, easily transmissible virus that has caused an increasing number of deaths worldwide. Covid can be perceived with a testing strategy known as RT-PCR. As of now, this technique is broadly utilized for identifying the infection.
OBJECTIVES: The imaging modalities are utilized for various degrees of seriousness from asymptomatic to basic cases. Side effects of an individual contaminated with COVID-19 incorporate gentle hack, fever, chest torment, weakness, and so forth An individual with an extreme fundamentalailment requires basic consideration. Imaging has assumed a larger part during the flare-up, with CT being a betteroption than invert transcriptase-polymerase chain response testing.
METHODS: With artificial intelligence and robotics, a variety of devices and solutions have been introduced to improve contactless service for humans. The presentationof AI technology may be a distinct advantage for the contactless treatment of patients. Information technology and AI could solve the testing and tracking system without any human interaction.
RESULTS: CT imaging methods permit radiologists and doctors to distinguish inner structures and see their shape, size, thickness, and surface, which could help in the early discovery of asymptomatic cases.
CONCLUSION: This detailed information data can be utilized to decide whether there's a clinical issue, provide the extent and accurate area of the matter, and uncover other significant details which will assist the doctor with deciding the best treatment.

Keywords: Corona virus, Contagious, Artificial Intelligence, CT imaging, RT-PCR.

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1. Introduction

Covid is identified as a respiratory illness. Older people and people with underlying medical conditions are most likely to be seriously ill and in need of critical care. The primary instance of Covid-19 in China was accounted for on December 1, 2019. It has been identified as COVID-19. Researchers have initially concluded that the cause of the illness could have been originated from animals and later mutated to transmit to humans [1]. It is believed that the COVID-19 outbreak was caused by a zoonotic origin. It can be easily spread by people. It began from the fish market in Huanan, Wuhan. As of March 12, 2020, over 81,000 human infections with SARS-CoV-2 and a minimum of 3100 deaths related to COVID-19 are confirmed in China alone [2]. The COVID-19 might prompt some genuine respiratory intricacies like intense respiratory pain condition (ARDS). ARDS requires ICU confirmation and oxygen treatment [3]. A few side effects of COVID-19 are fever, cough, chest pain, shortness of breath, diarrhoea, fatigue, etc. The asymptomatic cases are highly contagious and they progress rapidly, leading to a high fatality rate. For the rapid development of a diagnostic test of COVID-19 gene sequencing of the disease has been employed [4].The high amount of false-negative results of

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the RT-PCR test will potentially increase the problem in managing the outbreak; the misdiagnosed patients might miss the most effective timing for correct treatment and cause the spread of disease [5]. So, to avoid the misdiagnosed issues faced by the clinicians due to the low viral content in the test sample or uneven distribution of the samples, some imaging techniques have been employed to rectify or improvise such issues. Chest computed axial tomography is recommended for early identification and detection of asymptomatic individuals [6].

Due to its similarity with pneumonia cases artificial intelligence has been used to assist the CT images of a COVID-19 patient to differentiate it from other clinical features. The AI-based deep learning technique can localize different entities and classify them from COVID-19 images, this method has achieved an accuracy of 90% [7].

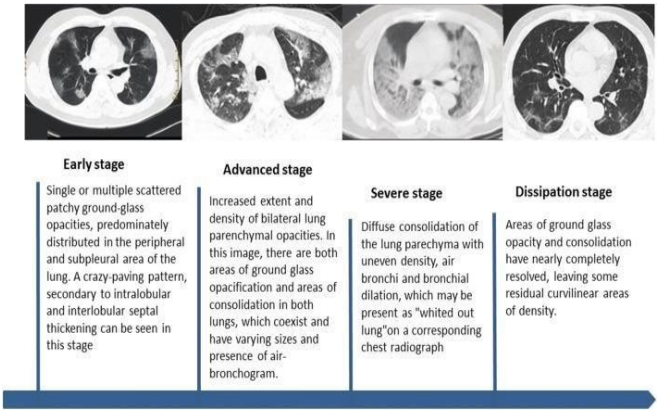

Figure 1. CT image of different stages of infection

2. Methodology

Computed Tomography (CT) is an imaging strategy used to examine the internal organs of the body. It is otherwise called modernized tomography or electronic axial tomography (CAT).CT machines take constant pictures in a helical way as opposed to taking a progression of pictures of individual cuts of the body [8].

Helical CT is used because it is faster, produces better quality 3D images of the internal organs, and may also detect small abnormalities better. Computed tomography imaging is highly sensitive in detecting early disease, assessing the abnormalities, progression of the disease, etc [9].

CT image of COVID-19 is described by glass opacity, patchy lesions, crazy paving patterns, and some areas of consolidation [10]. They have disseminated alongside the lung bronchovesicular groups and subpleural space. COVID-19 is detected using chest CT in four different stages.

1. Early-stage: Single and numerous dispersed fixed ground-glass opacity are conveyed in the peripheral and subpleural spaces of the lung. The interlobular and intralobular septal thickening prompts a crazy-paving pattern at this stage.

2.Advanced stage: Expanded degree and thickness of two-sided lung parenchymal haziness can be seen. There are areas of ground-glass opacification and area of consolidation in both lungs, which co-exist with variation in size and presence of air bronchogram.

3. Severe stage: The CT scans of diffuse consolidation of the lungs at this stage reveal variations in density due to fibrous exudate into the alveolar cavity, air bronchograms, and bronchial dilation. A portion of the lung that appears as patchy ground-glass opacity is required to prove. When all its components are integrated, the lungs seem to be "whited out."

4.Dissipation stage: Ground glass opacities and solidification show resolution, leaving some remaining curvilinear spaces of thickness.

3. ARTIFICIAL INTELLIGENCE IN COVID-19

Artificial intelligence (AI) has been suggested highly in clinical practice for the identification of diseases, the diagnosis of COVID-19, monitoring of cases, tracking and maintaining records, the prediction of a sudden future outbreak, mortality risk, disease management, and pattern recognition for studying the future outbreak of diseases.

During this pandemic, the AI algorithm has immensely developed in diagnosing diseases. Researchers and scientists have developed and employed numerous techniques using the advancement of AI technology and its use has been constantly increasing since the COVID-19 outbreak in 2020. AI has contributed as a medium for contactless delivery of clinical services during the outbreak of COVID-19 in hospitals and clinics. This system has been adopted to avoid the asymptomatic and misdiagnosis of the patient.

Clinically, AI technology is used for rapid diagnosis and medical analysis of a variety of diseases, including COVID-19. AI technology has adopted two methods for the identification of disease: machine learning (ML) and deep learning (DL). Therefore, the application of machine learning and deep learning has provided a correct and accurate diagnosis of COVID-19 using CT images and X-rays.

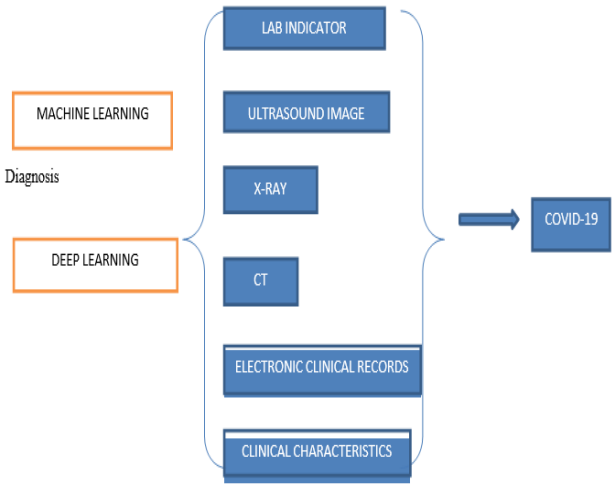

Figure 2. CT imaging Methodology

4. MACHINE LEARNING BASED DIAGNOSIS

Machine learning was the recommended technology used to support front liners for the early detection and diagnosis of diseases and infections.

Recent studies have shown that computationally trained models on a large clinical database can provide more precise diagnostics. The COVID-19 patient could be differentiated based on serum levels of immune cells, gender and symptoms documented.

Computational models were used to differentiate between COVID-19 patients and influenza, which gave a sensitivity rate of 92.5% and a specificity rate of 97.90%.

Integrated advanced AI models are highly sensitive and have been compared to clinical professionals because of their sensitivity. AI-assisted screening for chest images is in high demand for radiologists with less expertise. An artificial intelligence algorithm combined with chest CT has been successful in detecting COVID-19 in some tests set up by the expert.

5. DEEP LEARNING BASED DIAGNOSIS

A DL-based screening framework for COVID-19 has been developed through multi-view chest CT imaging.

Multitask deep learning technology can be used to identify and observe lesions on CT scans caused by the infection of COVID-19. A multitask deep learning model is used, characterized by segmentation, classification, and reconstruction techniques.

This shows an accuracy of 87%. For early detection of coronavirus based on X-ray imaging, a transfer learning method has been applied. Some techniques are being employed in the identification and regulation of acute respiratory disorders such as Lung Ultrasonography.

Recent findings suggest that the deep learning technology could assist the clinician in analyzing the images of the COVID-19 patient with Lung Ultrasonography (LUS). Lund Ultrasonography has been shown to have a correct prediction and detection of image biomarkers in a COVID-19 patient.

6. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

1. AI may be used in forecasting to construct early warning systems by gathering information from news sources,social media, and telephone systems to anticipate morbidity and death. Using existing data, machine learning may identify a cluster to anticipate an outbreak's geographical location.

2. AI-powered mobile apps are used to trace COVID-19 contacts. Smartphones and wearables with mobile healthapps can diagnose and monitor diseases.

3. AI can screen COVID-19 patients and predict therapy success. The AI-based approach might give clinical resource allocation and decision-making information from clinical parameter data. They can predict recovery andmortality rates.

4. AI detects, analyses, quantifies, and segments COVID-19 instances from chest CT and X-ray pictures. Machinelearning and deep learning can diagnose the illness. AI-based approaches employing chest CT and X-rays have led to accurate diagnosis and prediction.AI to minimize the workload for medical practitioners & healthcare staff:The AI-based system can reduce the workload for medical practitioners and health workers using the pattern recognition technique to analyze the clinical applications. This would lead to the automatization of several clinical procedures such as training the health practitioners and determining the mode of treatment to minimize contact with the patients.

5. AI could also minimize the frequent visit to the hospital by incorporating telemedicine for distant monitoring of the patient. AI-based robotic models could also be used for delivering essentials and other services.

6. AI in protein structure prediction: AI has also been used in protein studies. It is important to know the useful insight of protein structure crucial for virus

entry and replication for the development of drug within a short period. To determine the protein complex structure of Coronavirus, a deep convolutional neural network was trained using amino acid sequences and high-resolution cryoelectronic microscopy density.

7. AI in the development of vaccines: Artificial intelligence innovation has changed medical revelation lately. By combining the AI-based model for drug discovery with machine learning's characteristic feature pattern recognition, machine learning makes this possible. Deep learning has given a program included in extricating the information. This deep learning feature has shown to be promising and superior in performance than the computer-aided models.

8. AI in curbing the spread of misinformation: The pandemic has showered us with lots of information, awareness, and practices. Artificial Intelligence-based machine learning techniques have been used to separate misleading information from rumours and interpret the information to determine the source of information. Additionally, these methods can be used to provide accurate information about recovery rates, accessibility, and the availability of healthcare.

7. Result

As a result of machine learning and deep learning methods, it is possible to detect COVID-19 disease at an earlystage and manage outbreak-related issues. Researchers have used different analytical methods to assess the clinical image of a COVID-19 patient and a non-COVID patient. Numerous methods have been developed to observe the best performing computer-aided system to distinguish between a COVID-19 positive patient and other viral infections.

These two patients can be differentiated by the location of the lung, the number of lesions on the image, ground-glass opacity, and some crazy paving patterns. The deep learning convolutional neural network has also been used to evaluate chest CT and X-rays to detect COVID-19 patients.

8. Discussion

COVID-19 can be diagnosed using high-dimensional features of medical images to discriminate from one another AI-based deep learning and machine learning have been employed.

Apart from the assessment of the chest CT image, an application of X-ray has shown promising results and it's easily accessible and low cost. X- ray is cheaper than CT scans. Most of the studies have incorporated both methods.

The CNN-based method has achieved an accuracy rate of 99% in the identification of COVID-19 patients from other viral diseases. Deep learning required large data sets to give the final result, whereas machine learning needs a very less amount of data provided by the user.

Deep learning requires good performance hardware, whereas machine learning needs precise user input. One of the most promising methods applied to the study is transfer learning, it requires knowledge on a huge database to transfer it to another new set of problems.

Transfer learning is highly useful in medical imaging. The data obtained after analysing the CT image show a high accuracy rate which will be helpful in future studies and research.

9. Conclusion

Corona virus which started in the seafood market of China has spread throughout the country and beyond. Detecting the virus is essential for isolation of the patient, treatment, development of drugs and vaccines, etc. Some nucleic acid test has shown false-negative errors, such issues could alarm the health professionals. A chest CT imaging of COVID-19 is highly crucial due to its recognition feature, which enables clinicians to make a primary diagnosis within the first few minutes of contact with a suspected patient. AI (artificial intelligence) has been employed to improve healthcare systems, its algorithm is used for diagnostic purposes, decision making, pattern recognition, protein sequencing, and other health-related issues. These techniques could be used to develop contactless services for frontline workers and to improve public health.

References

[1] Rezazadeh B, Asghari P, Rahmani AM. Computer-aided methods for combating Covid-19 in prevention, detection, and service provision approaches. Neural Computing and Applications. 2023 May 5:1-40.

[2] Kanna, R. Kishore, et al. "Human Computer Interface Application for Emotion Detection Using Facial Recognition." 2022 IEEE International Conference on Current Development in Engineering and Technology (CCET). IEEE, 2022.

[3] Kanna, R. Kishore, and R. Vasuki. "Advanced Study of ICA in EEG and Signal Acquisition using Mydaq and Lab view Application." International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN (2019): 2278-3075.

[4] Kripa, N., R. Vasuki, and R. Kishore Kanna. "Realtime neural interface controlled au-pair BIMA bot." International Journal of Recent Technology and Engineering 8.1 (2019): 992-4.

[5] Kanna, R. Kishore, et al. "Nursing Assist Module Compact Patient Monitoring System Using Iot Application." Journal of Pharmaceutical Negative Results (2022): 236-239.

[6] Mohapatra, Srikanta Kumar, et al. "Systematic Stress Detection in CNN Application." 2022 10th International

Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)(ICRITO). IEEE, 2022.

[7] Forecasting COVID-19 Pandemic Using Prophet, ARIMA, and Hybrid Stacked LSTM-GRU Models in India, Sweeti Sah, Surendiran, R.dhanalakshmi, Sachi Nandan Mohanty, Fayadh Alenezi, Kemal Polat, Computational and Mathematical Methods in Medicine, 2022, Vol 2022, Article ID 1556025, doi.org/10.1155/2022/1556025, ISSN: 17486718, 1748670X

[8] Ağralı, Mahmut, et al. "DeepChestNet: Artificial intelligence approach for COVID-19 detection on computed tomography images." International Journal of Imaging Systems and Technology (2023).

[9] Saffari A, Khishe M, Mohammadi M, Hussein Mohammed A, Rashidi S. DCNN-FuzzyWOA: Artificial Intelligence Solution for Automatic Detection of COVID-19 Using X-Ray Images. Computational Intelligence & Neuroscience. 2022 Aug 9.

[10] Özbilge, Emre, et al. "Artificial Intelligence-Assisted RT-PCR Detection Model for Rapid and Reliable Diagnosis of COVID-19." Applied Sciences 12.19 (2022): 9908.