Indian Journal of Artificial Intelligence and Neural Networking (IJAINN)
ISSN: 2582-7626 (Online), Volume-2 Issue-3, April 2022

Deep Learning Approaches for Detection of COVID 19 from CT Image: A Review

Suyash Kulkarni, Sushila Sonare

***Abstract:** WHO (World Health Organization) classified COVID-19 (Corona virus Disease 2019) as a pandemic after a substantial number of individuals died from an illness. This virus has infected millions and continues to infect new victims every day. Traditional RT-PCR tests to identify COVID-19 are prohibitively expensive and time-consuming, thus researchers are turning to deep learning (DL)-based algorithms that utilize medical imagery such as computed tomography (CT) scans. This helps automate the scanning process. All areas of COVID-19 research targeted at halting the current epidemic are currently being conducted using deep learning. We looked at some of the newest DL-based models for detecting COVID-19 in CT lung images in this work. During our investigation, we gathered information on the many research resources that were accessible. This survey may serve as a starting point for a novice/beginner level researcher working on COVID-19 categorization. The COVID-19 and its rapid detection technique are described in full in this study. This is followed by a discussion of computed tomography (CT) and a review of deep learning and its different covid detection methods, such as RNN, CNNLSTM as well as DNN. Deep learning approaches have been used in several recent research on the identification of COVID-19 patients. To identify COVID-19, we reviewed the most recent DL approaches used in conjunction with CT scans. A DL system for disease detection during the COVID-19 epidemic is discussed in this study, as are many authors' methodologies and the relevance of their research efforts, as well as possible difficulties and future developments.*

***Keywords:** Coronavirus disease (COVID-19), Computed Tomography (CT) Screening, Deep Learning (DL).*

I. INTRODUCTION

This week's Corona Virus Disease (COVID-19) is a worldwide epidemic. The WHO on February 11, 2020, identified the viral disease the condition COVID-19. As of May 10, 2021, there have been over 150 million cases of COVID-19, spanning 223 nations or regions, with a total of 3,288,455 fatalities. RT-PCR is often used to screen patients infected by COVID-191 to limit the epidemic's progress. For this reason, the accuracy of RT-PCR is currently lacking when used to assess whether or not a user is infected with the virus.

Manuscript received on 31 March 2022 | Revised Manuscript received on 04 April 2022 | Manuscript Accepted on 15 April 2022 | Manuscript published on 30 April 2022.
* Correspondence Author
Suyash Kulkarni*, M.Tech Scholar, Department of Computer Science and Engineering, Lakshmi Narain College of Technology & Science, Bhopal (M.P), India. E-mail: suyashkulkarni50@gmail.com
Prof. Sushila Sonare, Department of Computer Science and Engineering, Lakshmi Narain College of Technology & Science, Bhopal (M.P), India. E-mail: sushilas@lnct.ac.in

There was even a recent epidemic of RT-PCR negative in India, but lung imaging indicated evidence of infection. As a result, other data must be considered in addition to RT-PCR to conclude.

Lung CT scan is a popular and successful way of diagnosis and therapy in practice. AGGO (Ground-Glass Opacity) of lung2 may be seen on a CT scan, providing additional pathological information with greater precision. As a result, it's easier for physicians to determine if a patient is afflicted with COVID-19 and devise a therapeutic approach depending on the patient's infection status. Nevertheless, physicians are ultimately responsible for diagnosing as well as treating patients. In areas where epidemics are serious as well as medical resources are limited, no. of physicians is low, & workload in the affected area is high when examined with the human eye, which might lead to the impact of imaging evaluation and management [1]. Doctors use XRs or CT scans to look for signs of COVID-19 deformity before making a diagnosis.

A huge number of patients have been admitted to hospitals as a consequence of the fast spread of COVID-19, putting a heavy demand on imaging specialists and sometimes leading to a scarcity of physicians to help battle the illness. It is possible to solve this issue by using deep learning techniques, that have been making remarkable progress, primarily owing to steadily rising computing power and indeed the continually expanding quantity of obtainable data, and also the quality enhancement of deep learning techniques as well as their computational methods, as has shown in hurdles championships to accomplish record-breaking achievement. The goal of DL (Deep Learning) is to develop ML (Machine Learning) model with several hidden layers that are trained on a huge quantity of data to enhance the classification or accuracy of the proposed.

II. NEED OF FAST COVID-19 DETECTION

The epidemic of COVID-19 began in Wuhan, Hubei Province, China, as well as has since spread around the globe at an alarming rate [2].

On January 30, 2020, the WHO designated it public health emergency of international concern, also even on march 11, 2020 [3]. This latter classification made it possible to conduct a thorough investigation as well as transnational large-scale research, which resulted in an enormous increase in the amount of evidence gathered. This illness, which was once described as "pneumonia of undetermined origin," has now been extensively studied and characterized to a significant degree.

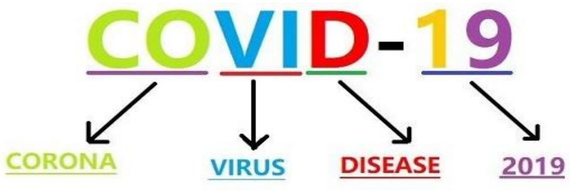

Figure 1: Definition of Covid-19

During the pandemic, chest imaging, particularly CT, has grown in importance as more and more information has accumulated. Since the beginning of the pandemic, there has been much discussion about how well chest imaging for COVID-19 compares to real-time RT-PCR. Following a historical assessment of chest imaging findings, this article will focus on diagnosis, treatment, & follow-up of COVID-19. The death toll from the COVID-19 illness has risen to 244K, making it the leading cause of death in the globe. As soon as it enters the human respiratory system, the new coronavirus causes significant lung damage, resulting in symptoms similar to but more severe than well-known "Pneumonia." This causes lungs to fill up with fluid, become irritated, & form patches known as "GGO". Because it is difficult to recognize the disease's symptoms because there are only a limited number of testing kits available, we must surely find other ways to diagnose it. COVID-19 medicine has been sought for some time, but social isolation and city lockdowns have proven to be the only effective means of protection thus far. Nevertheless, the lockdown harms the country's GDP as well as the mental health and well-being of its citizens. Globally, the number of people who have been affected by COVID-19 is growing at an exponential rate. We've already exceeded China in terms of the influence on the global economy from nations like the US of America, Italy as well as Spain. As a result, a health clinic system centered on AI must be established to prevent this natural pandemic from occurring [4].

III. COMPUTED TOMOGRAPHY (CT)

CT scanning is a kind of imaging method that makes use of specializedX-ray equipment to generate thorough images, or scans, of inside organs. It is referred to as computerized tomography or computerized axial tomography in certain circles (CAT).

In contrast to the initial CT machines, modern CT machines capture continuous photos in helical (or spiral) patterns, instead of taking a sequence of photographs of discrete slices of the body, as they did with the first machines. Helicopter CT (also known as spiral CT) provides various benefits over earlier CT systems, including the following: It is quicker, creates higher-quality 3-D images of inside organs, and maybe more sensitive in detecting minor abnormalities than traditional CT scans.

Along with its use in cancer diagnosis, CT scans are widely used to aid in the diagnosis of circulatory (blood) system chronic diseases, including coronary heart disease (arteriosclerosis), vascular aortic dissection, but instead blood clots, specialty care, kidney but instead bladder boulders, inflammations, autoimmune disorders including such ulcerative colitis as well as sinusitis, as well as injuries to the head, skeleton, as well as internal organs. It is often used to diagnose Alzheimer's disease as well as other forms of cognitive decline in individuals with mild to moderate cognitive decline who are being examined for Alzheimer's disease or other causes of cognitive impairment.

CT has modified diagnostic decision-making since its inception in the 1970s. The results were better procedures, detection, and treatment of cancer, post-injury care, serious therapy for trauma, stroke, and heart treatment. CT offers several benefits over other methods of imaging because it can be done within minutes and is readily accessible, which enables doctors to confirm or exclude diagnosis more confidently. It has had a major effect on the surgical sector, decreasing the need for surgery from 13 percent to 5 percent& virtually eliminating several explorations of surgical procedures. Extensive use of CT has been discovered in clinical practice that decreases patients who have to be hospitalized. The continuous technical developments in CT have made the imaging method even more attractive, improving spatial resolution and shorter scanning time, resulting in a wide range of clinical applications [5].

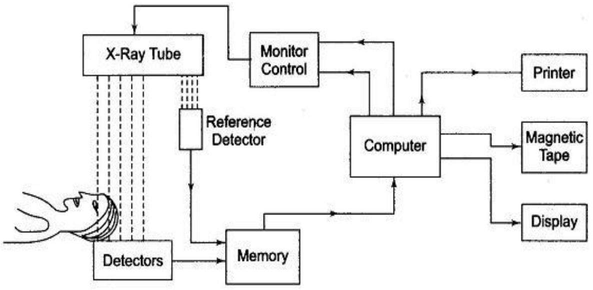

Figure 2: Basic principle of CT scanning

CT scanning is a recent advancement in diagnostic analysis that is symbolized by the term. Although traditional radiography (X-rays) depicts a 3-dimensional item (part of the body) on a plane (film), CT allows the 3-D architecture of the object to be reconstructed. The fundamental concept of CT scanning is shown in Fig. 1.4 (Eeeguide, 2014).

CT scanning is a technique that creates cross-section scans of the body using computers & rotating X-ray equipment. CT scans were used to see soft tissues, bones, &blood arteries in differentparts of the body using X-rays. CT has a high sensitivity for detecting tiny lesions and gives a more thorough evaluation than other imaging modalities. For diagnosis of pulmonary nodules, CT scans are routinely employed. Malignant pulmonary nodules must be identified to make an accurate diagnosis of lung cancer. Z[6]

1) How is CT Used in Cancer Screening?

Research has shown that computed tomography (CT) may be beneficial in both colorectal cancer screening (which includes screening for large polyps) and lung cancer screening.

A. Colorectal cancer

Both big colorectal polyps, as well as colorectal cancers, may be detected with CT colonography (also referred to as virtual colonoscopy).

Published By:
Lattice Science Publication

Approximately 10 millisieverts (mSv) of radiation is utilized in CT colonography, the same as in normal CT abdomen and pelvis (1). Natural sources of radiation are thought to provide an annual exposure of roughly 3 mSv on average.) Until this procedure, the colon is thoroughly cleansed as with a regular colonoscopy. To have a clearer image of the colon, a gas such as carbon dioxide or air is injected into it.

According to an NCI-sponsored clinical investigation, the reliability of CT colonography was shown to be comparable to that of conventional colonoscopy. CT designed to uncover is a less intrusive procedure with a reduced risk for infection than a normal colonoscopy. Nevertheless, a regular colonoscopy is often done to remove polyps or another abnormal growth identified on CT colonography.

No one knows yet if CT colonography may assist lower the mortality rate from colorectal cancer and also most insurance companies (including Medicare) don't pay expenses of this operation at the present moment. Noncolorectal anomalies may also be detected by CT colonography, which may yield pictures of tissues and cells beyond the colon. New tests and operations may be unnecessary for some of these "extracolonic" results.

B. Lung Cancer (LC)

Adults aged 55 to 74 who have a history of smoking are 20 percent less likely to die from a heart attack if they are evaluated using low-dose helical CT instead of standard CXR (Chest X-Rays), according to the NLST (NCI-sponsored National Lung Screening Trial). Lung cancer mortality rates have not been demonstrated to be reduced by screening with routine chest x-rays in previous research; In a low-dose helical CT operation, the expected radiation exposure is 1.5 mSv (1). Nonsmokers are not regarded to have a high enough risk of developing lung cancer to advantage from screening.

While low-dose helical CT is useful in the screening of lung cancer in heavy smokers, NLST found hazards andadvantages. True positives (i.e., ++

aberrant findings that were not cancerous) were more common in those checked with low-dose CT helical than in those examined with regular radiographs. Information on the advantages and disadvantages of the National Lung Screening Trial is available in the NCI's Patient and Physician Guide. When it comes to lung cancer screening, the value of helical CT varies depending on how close a person's genetic profile is to that of the NLST participants. Someone with a higher chance of developing lung cancer may also recover more from the procedure, while those with more medical issues (such as heart or other lung disorders) may be more vulnerable to complications. It is conceivable, nevertheless, that non-pulmonary abnormalities likethyroid or renal tumors can be discovered with low-dose lung CT. Certain extracolonic discoveries from CT colonography will be significant, while many others will not.

IV. COMPUTER ANALYSIS OF COMPUTED TOMOGRAPHY SCANS

With today's CT technology, the whole chest may be imaged in a single breath-hold with submillimeter resolution and near isotropic CT. This new generation of thin-slice thoracic CT scans has revolutionized thoracic radiology, but it has also significantly increased the amount of data radiologists have to deal with. Since its invention in 1975, medical computed tomography (CT) has been accessible to the public. Thoracic CT was not originally thought of as a method that was especially well-suited for. The huge disparity in attenuation values among tissue as well as air (the now major basis for CT's success in thoracic imaging) makes it hard to appropriately interpret tiny lesions because of the high partial volume effects (PVEs) caused by low resolution. According to Kollins (1977), CT had a significant influence on the research of thoracic disorders in 1977, but the "final significance of CT in the study of diagnosis of diseases is not as definite. Emergency medical aid may also be provided via the scanner in distant areas. Figure 3displays CT scans & diagnostic results.

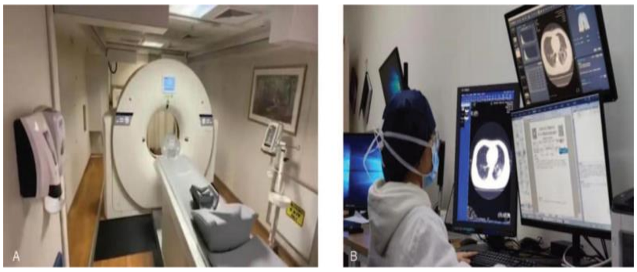

Figure3: Vehicle-Mounted CT Machine &Doctor Remote Operation Scan[7]

CT and thoracic imaging have been dramatically revolutionized as a result of technological advances. As earlier as in the development of the Mayo Clinic's dynamic spatial reconstruction, the importance of image processing was acknowledged [8]. At least two developments have had a significant impact on CT thorax scans. HRCT scans were made feasible around twenty years ago when axial resolution became better. Slices with a thickness of 1 mm might give lung anatomical information comparable to that seen in gross pathological specimens of the organs concerned [9]. A 1 cm gap among slices was essential because of the scanner speed limits at the time to cover the complete thorax without breathing artifacts. In the past decade, multi-detector-row scanners that can capture up to 64 1-mm slices concurrently each rotation, as well as complete every rotation in under a second, have essentially eliminated this constraint. Within such a single breath-hold, modern scanners can acquire the whole chest with submillimeter resolution in an isotropic manner. The scanning of the lungs with CT is superior than that with other modalities. Images created and need to be commented on have grown exponentially as a result of these technological advances. The term "data explosion" has been used to describe this problem [10]. Computer vision methods are needed to make CT interpretation easier. As a result of the significant advancements in chest CT collection methods, research into computer analysis of thoracic CT images has increased dramatically. [11].

Retrieval Number: 100.1/ijainn.C1050042322
DOI:10.54105/ijainn.C1050.042322
Journal Website: www.ijainn.latticescipub.com

Published By:
Lattice Science Publication

V. DEEP LEARNING USING COMPUTED TOMOGRAPHY (CT) IMAGING

Deep learning (DL) using a convolutional neural network (CNN) is a technique that may be utilized in the area of computer vision to achieve exact generic picture categorization. Deep learning has been more popular in the field of computed tomography in recent years. Deep learning can perform a variety of tasks, like object identification and picture segmentation, according to some. A common distinction between medical and general pictures is that medical images often include solely representations of human anatomy, with no backdrop structure other than that of the human body. Historically, several types of research have documented classification of scan position with CT scanning utilizingDL; nevertheless, these studies only examined the performance of the classifier when detecting scan slice positions, not when identifying scan position.

The investigation has acknowledged the importance of enhancement intelligence gathered via the use of contrast material in tumor diagnosis since radiologists often refer to slice location, organ structure condition, as the existence of an organ or tumor enhancement when making a diagnosis of tumors.Data on the position as well as the existence of contrast media is also one of the most important aspects for the fundamental need for automated diagnostic utilizing deep learning, which is the most crucial factor for a fundamental requirement for automatic detection utilizing DL. Essentially, DL necessitates the use of multiple pictures to develop classification models, even though human structures are composed of diverse organ structures of varying sizes in each person. Aside from that, recent publications on deep learning in CT scans have dealt with the recognition of anatomical structures and malignancies, among other things.

Whole-body CT scans could not be utilized for DL in these approaches meanwhile pictures had to be categorized as of specific area in advance of being used. Though no research has yet determined how many pictures are necessary for the categorization of CT scans, incorporating visibility restoration data, no such study has been conducted. If the accurate categorization of CT images has been completed as preprocessing step, automated diagnostic for the whole-body scans utilizing deep learning will be a more feasible method. As a result, the purpose of this research was to determine the link between both the frequency of CT images taken as well as the reliability of models, as well as the use of background subtraction to develop classification techniques. [12].

VI. OVERVIEW OF DEEP LEARNING AND ITS APPROACHES

Since its introduction in the machine learning (ML) community some few years ago, deep learning (DL) computer architecture has come to be regarded as the reference standard. In AI, machine learning is a subset of technology that allows a system will automatically learn from ideas and information without having to be explicitly designed. Observing such firsthand experiences serve as a starting point for preparing for the characteristics and patterns in data, which in turn leads to improved outcomes and judgments in the future. DL is dependingupon the combination of ML techniques that model top-level conceptions in data using many nonlinear transformations. DL is a kind of ML that is applied to model high-level abstractions in data. The deep learning system is extremely reliant on two stages, which are referred to as the training phase as well as the inferring phase, in order to function properly. The training step entails labelling vast volumes of data & finding their matching properties, whereas the inferring phase entails drawing inferences and classifying fresh unexposed data based on the existing information gained during the training phase. DL is one such strategy that assists system in comprehending complicated perceptual tasks with the greatest amount of accuracy possible.

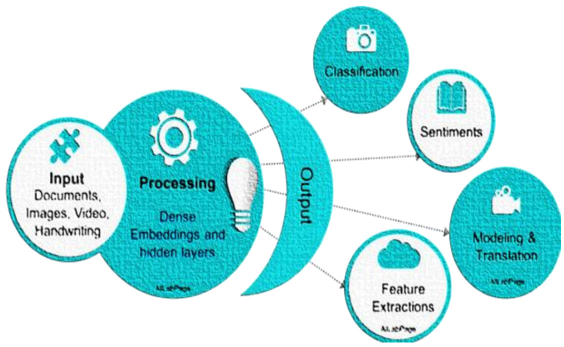

Figure 4: Overview of DL

1) Basic Architectures of DNN (Deep Neural Network)

DNNs, RNNs (Recurrent Neural Networks), including DBNs (Deep Belief Networks)are all examples of deep learning approaches. Due to the angle of Artificial Neural Networks may be used to build DNNs by adding numerous layers of hidden layers between input & output layers. In models where an object is considered as a layered combination of primitives, the DNN can describe complex & noninteractions. This is a kind of feed-forward network that does not have any looping and instead just sends data from the input layer to the output layer. Employing deep learning is made possible by a broad range of architectural and algorithmic variants. [13].

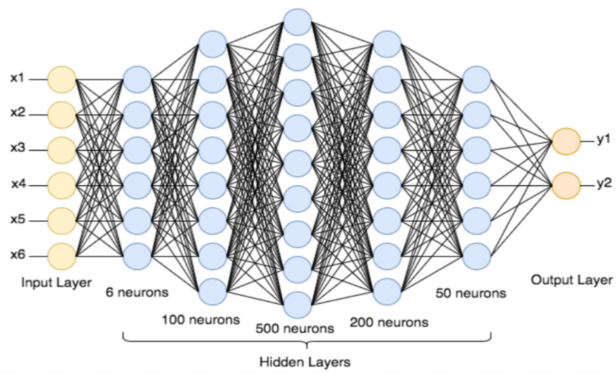

Figure 5: Deep neural networks Architectures

A. Auto-encoders

AE is a sort of NN (Neural Network) that is founded on an unsupervised learning approach and employs the back-propagation method to learn new information. At first, the network first sets the goal outcome values such that they are equivalent to the values in the input. The network attempts to comprehend an estimate to the identity function that is equal to the integrity function. Its design is comprised of 3 layers: the input layer, hidden layer (called encoding layer), as well as decoding layer (also known as the decoding layer). The network attempts to recreate its input, this drives the hidden layer to learn whose interpretations of the input are best reconstructions of it. The hidden layer is used to define code that aids in the representation of the input information.

B. Convolutional Neural Network (CNN)

Multi-layered neural networks, such as CNN, take their inspiration from the visual brain of animals. The inventor of the first CNN was [14]. Image processing as well as handwritten character recognition, such as postal code translation, are the primary uses of CNN. When evaluating the structure, the early layers are being used to find edge detection, while the later layers are used to recombine features to generate high-level input characteristics, followed by classification. The extracted features' number of dimensions is reduced through a process known as pooling. Following convolution operation, a properly connected multilayer perceptron is supplied into the system. Use backpropagation methods to identify images' characteristics in the last layer, known as an output layer. Speech recognition, medical applications, video identification, and then a wide range of natural language processing tasks may all benefit from CNN's deep processing elements, which include convolutional as well as pooling layers as well as a fully connected classification layer.

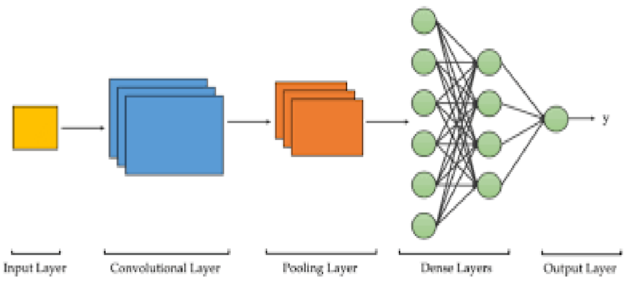

Figure 6: Structure of Convolutional Neural Network

C. Deep Belief Network &Restricted Boltzmann Machines

This kind of representation is undirected and visual and depicts both the hidden and the visible layers of an onion, as well as the symmetric connection between both layers. The hidden layer is not connected to the input in RBM since there is no link between them. DBN is a multilayer network design, which contains a revolutionary training approach that has many hidden layers, as represented by the name. In this case, each pair of connected layers is RBM, which is also known as a stack of restricted Boltzmann machines in certain areas. While the basic sensory input is contained within the input layer, its characteristic is represented by the abstract description of this information contained inside the hidden layer. For the output layer to function properly, it must only do network classification. A total of two steps are included in the training process: unsupervised pre-training as well as supervised fine-tuning. The RBM is excellent in reconstructing its input in unsupervised pre-training, starting with the first hidden layer. Similarly, to the first RBM, the second RBM is qualified, & first hidden layer is utilized as input & visible layer, with RBM being operated by using outputs from the first hidden layer as input.

D. Recurrent Neural Network

Deep learning as well as the creation of models simulating the activity of neurons in the human brain both make use of RNNs. The RNN is a diverse range of architectures, and it's the underlying network structure. The recurrent network has a link that may be used as a feed-forward relationship into the preceding layer, unlike the full feed-forward connections. It makes use of previously stored input data to create time-dependent models of the issues.

E. LSTM (Long-Short Term Memory)

The issue of gradient vanishing of exploding in the training of RNNs was addressed by Hochreiter & Schmidhuber by developing an LSTM kind of RNN. Testing and inspection of the LSTM cell state involve using three gates: an input gate, that also prevents modifications in cellular done in a manner by an input signal, an output gate, that also controls or allows the cell state to impact other neurons, and a forget gate, which specifies the self-recurrent correlation of the cell to either accumulation in the body or forgets its original state.

VII. LITERATURE REVIEW

For several months after it first surfaced in December, researchers have been investigating the COVID-19 virus. Any use of computer-aided approaches for COVID-19 detection has occurred in various recent studies. In the majority of the studies, researchers have made use of a multitude of separate learning methodologies that have been more prominent in recent years. COVID-19 is now the subject of several successful studies. Numerous scalable telehealth systems used to help patients afflicted with COVID19 as well as other illnesses are reviewed in[15]. (Islam, Mahmud, et al., 2020) There are a variety of wearable monitoring gadgets including respiratory support systems that may be used to help persons with coronavirus infection [16]. (Islam, Ullah, et al., 2020) They provide a convergent parallel of the many devices that have been built, outlining the obstacles they face as well as the potential paths they may go in the future. Put out a plan to stop the spread of COVID-19 in smart cities by recognizing persons who aren't wearing masks network[17]. Research on how to use CT scans to identify COVID-19 has been substantial because of the possibility of employing CT pictures in addition to COVID-19 screening and the difficulties of interpreting CT for COVID-19 screening.

According to Muhammad and colleagues(Muhammad et al., 2020), (. Islam, M. M., Karray, F., Alhajj, R. & Zeng, 2021) COVID-19 researchers are using DL throughout all aspects of their efforts to control continuing emergence and spread [18], [19]present overview of newly developed system applications predicated on DL methods utilizing various medical validated tools including such CT but instead X-ray. (Wang, Lin, and Wong, 2020) built database of thousands of CT scans of COVID-19 positive patients & devised a DL strategy based on self-supervision30 as well as transfer learning that had a high sample efficiency. COVID-19 may also be diagnosed using an artificial intelligence system that can distinguish the illness from the other common pneumonia and normal cases32 [20]. As a result,(Zhao, Jiang, and Qiu, 2021) generated a library of Computed tomography of 1,521 pneumonia patients, and also a series of symptoms, which include multiple biological assessments of urine and blood. They then predicted whether either patient had mild, moderate, or severe situations of the SARS-CoV-2 infection. According to [34] computer architecture explorations, a DCNN structure based on CT scans has been presented. CNCB (China National Center for Bioinformation) (China) provided 104,009 CT scans from 1,489 patients that were used to create a COVIDx-CT dataset, which was then validated as well as analyzed using the GSInquire technology35 employing explainability-driven effectiveness validation as well as analysis. Continuing from the progress made before. A larger and more diverse sample of patients was offered by investigators with the inclusion of the COVIDx CT-2 databases. [21].

(Hammoudi et al., 2021) developed customized models for early detection of COVID-19 pulmonary symptoms in early stages. The researcher indicated that they didn't involve COVID-19 case CXR photographs in their prototype training phase so even though they did believe that now a percentage of COVID-19 CXR images that are presently accessible at t is insufficient. Their classifiers are trained with just a dataset that contains viruses and bacteria pneumonia as well as normal chest X-Ray images. Those who genuinely think that if their model assumes CXR photograph as viral pneumonia then it is likely that it is COVID-19. It is thus assumed by them that if their prediction accuracy indicates a high chance of viral pneumonia, and so the case is more than likely to be COVID-19 infection. Their model achieved the greatest efficiency utilizing a modified DenseNet169 framework, resulting in an accuracy of 95.72 percent and the highest accuracy[22].

In (Han et al., 2020), The researchers used a dataset of CT scans that contained 230 scans of COVID-19 from 79 patients, 100 scans of pneumonia from 100 patients, and 130 CT scans from 130 people who did not have pneumonia to screen for COVID-19 pneumonia to distinguish it from other types of viral pneumonia in the population. An overall accuracy rate of 97.9 percent was investigated and reported of the technology [23].

VIII. CONCLUSION& FUTURE WORK

Worldwide, COVID-19 has had a huge influence on people including healthcare systems. Because ofthe COVID-19 pandemic, the world's health insurance system, particularly in less developed nations, has been become vulnerable. In areas where bulk conventional testing is not practical, new computer-assisted diagnostic methods are needed to offer speedy and cost-effective screening. In recent years, computer-assisted analysis of lung CT images has shown significant promise for detecting as well as diagnosing pulmonary diseases, such as COVID-19. To compare how well different deep-learning approaches work in recognizing COVID-19 infections in CT images of the lungs. COVID-19 screening and diagnosis may be improved with the use of DLtechniques for computer-assisted image processing of CT images of the lungs. As a non-invasive and low-cost technology, lung CT imaging may be utilized to diagnose lung disorders.

COVID-19's severity will be a focus for us in the future, but we want to learn more about the pandemic through CT imaging. With the help of the models, we'll perform further research into how COVID-19 is detected so that we can better understand the CT pictures and make the screening process for physicians easier. Even though the system performs well on publicly available datasets, the work is still in the theoretical phase of research as well as the models have not been tested in clinical practice. Consequently, we'll put our systems to the test in real-world settings, talking to doctors about their experiences and thoughts on the models as they're put to use. That means that in the future, we will be able to further develop the model.

REFERENCES

1. Q. Zhang, X. Ren, and B. Wei, "Segmentation of infected region in CT images of COVID-19 patients based on QC-HC U-net," *Sci. Rep.*, 2021, doi: 10.1038/s41598-021-01502-0. [CrossRef]
2. X. Xie, Z. Zhong, W. Zhao, C. Zheng, F. Wang, and J. Liu, "Chest CT for Typical Coronavirus Disease 2019 (COVID-19) Pneumonia: Relationship to Negative RT-PCR Testing," *Radiology*, 2020, doi: 10.1148/radiol.2020200343. [CrossRef]
3. D. Wang *et al.*, "Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China," *JAMA - J. Am. Med. Assoc.*, 2020, doi: 10.1001/jama.2020.1585. [CrossRef]
4. H. Panwar, P. K. Gupta, M. K. Siddiqui, R. Morales-Menendez, and V. Singh, "Application of deep learning for fast detection of COVID-19 in X-Rays using nCOVnet," *Chaos, Solitons and Fractals*, 2020, doi: 10.1016/j.chaos.2020.109944. [CrossRef]
5. S. P. Power, F. Moloney, M. Twomey, K. James, O. J. O'Connor, and M. M. Maher, "Computed tomography and patient risk: Facts, perceptions and uncertainties," *World J. Radiol.*, 2016, doi: 10.4329/wjr.v8.i12.902. [CrossRef]
6. M. Puttagunta and S. Ravi, "Medical image analysis based on deep learning approach," *Multimed. Tools Appl.*, 2021, doi: 10.1007/s11042-021-10707-4. [CrossRef]
7. F. Zhang, "Application of machine learning in CT images and X-rays of COVID-19 pneumonia," *Medicine*. 2021, doi: 10.1097/MD.0000000000026855. [CrossRef]
8. E. L. Ritman, J. H. Kinsey, R. A. Robb, B. K. Gilbert, L. D. Harris, and E. H. Wood, "Three-dimensional imaging of heart, lungs, and circulation," *Science (80-.).*, 1980, doi: 10.1126/science.7423187. [CrossRef]
9. M. A. Meziane *et al.*, "High resolution CT of the lung parenchyma with pathologic correlation.," *Radiographics*, 1988, doi: 10.1148/radiographics.8.1.3353534. [CrossRef]
10. G. D. Rubin, "Data explosion: The challenge of multidetector-row CT," *Eur. J. Radiol.*, 2000, doi: 10.1016/S0720-048X(00)00270-9. [CrossRef]

Retrieval Number: 100.1/ijainn.C1050042322
DOI:10.54105/ijainn.C1050.042322
Journal Website: www.ijainn.latticescipub.com

Published By:
Lattice Science Publication

11. I. Sluimer, A. Schilham, M. Prokop, and B. Van Ginneken, “Computer analysis of computed tomography scans of the lung: A survey,” *IEEE Trans. Med. Imaging*, 2006, doi: 10.1109/TMI.2005.862753. [CrossRef]
12. H. Sugimori, “Classification of Computed Tomography Images in Different Slice Positions Using Deep Learning,” *J. Healthc. Eng.*, 2018, doi: 10.1155/2018/1753480. [CrossRef]
13. S. Dargan, M. Kumar, M. R. Ayyagari, and G. Kumar, “A Survey of Deep Learning and Its Applications: A New Paradigm to Machine Learning,” *Arch. Comput. Methods Eng.*, 2020, doi: 10.1007/s11831-019-09344-w. [CrossRef]
14. H. G. . LeCun Y, Bengio Y, “Deep learning,” pp. 1–10, 2015.
15. S. M. A. Ullah, M. M. Islam, S. Mahmud, S. Nooruddin, S. M. T. U. Raju, and M. R. Haque, “Scalable Telehealth Services to Combat Novel Coronavirus (COVID-19) Pandemic,” *SN Comput. Sci.*, 2021, doi: 10.1007/s42979-020-00401-x. [CrossRef]
16. M. M. Islam, S. Mahmud, L. J. Muhammad, M. R. Islam, S. Nooruddin, and S. I. Ayon, “Wearable Technology to Assist the Patients Infected with Novel Coronavirus (COVID-19),” *SN Comput. Sci.*, 2020, doi: 10.1007/s42979-020-00335-4. [CrossRef]
17. M. M. Islam, S. M. A. Ullah, S. Mahmud, and S. M. T. U. Raju, “Breathing Aid Devices to Support Novel Coronavirus (COVID-19)Infected Patients,” *SN Comput. Sci.*, 2020, doi: 10.1007/s42979-020-00300-1. [CrossRef]
18. L. J. Muhammad, M. M. Islam, S. S. Usman, and S. I. Ayon, “Predictive Data Mining Models for Novel Coronavirus (COVID-19) Infected Patients’ Recovery,” *SN Comput. Sci.*, 2020, doi: 10.1007/s42979-020-00216-w. [CrossRef]
19. J. . Islam, M. M., Karray, F., Alhajj, R. & Zeng, “A review on deep learning techniques for the diagnosis of novel coronavirus (COVID19),” *IEEE Access 9*, pp. 30551–30572, 2021. [CrossRef]
20. L. Wang, Z. Q. Lin, and A. Wong, “COVID-Net: a tailored deep convolutional neural network design for detection of COVID-19 cases from chest X-ray images,” *Sci. Rep.*, 2020, doi: 10.1038/s41598-020-76550-z. [CrossRef]
21. W. Zhao, W. Jiang, and X. Qiu, “Deep learning for COVID-19 detection based on CT images,” *Sci. Rep.*, 2021, doi: 10.1038/s41598-021-93832-2. [CrossRef]
22. K. Hammoudi *et al.*, “Deep Learning on Chest X-ray Images to Detect and Evaluate Pneumonia Cases at the Era of COVID-19,” *J. Med. Syst.*, 2021, doi: 10.1007/s10916-021-01745-4. [CrossRef]
23. Z. Han *et al.*, “Accurate Screening of COVID-19 Using Attention-Based Deep 3D Multiple Instance Learning,” *IEEE Trans. Med. Imaging*, 2020, doi: 10.1109/TMI.2020.2996256. [CrossRef]

AUTHORE PROFILE

Suyash Kulkarni and was born on 21 May 1998. I am student of LNCTS college, Bhopal (Affiliated by AICTE/ Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal) MTech - 2022. In 2020 I completed my B.E in computer sciene branch from LNCTE, Bhopal. I had done multiple researches on the Artificial Intelligence and machine learning. During my bachelors course I also worked on my major project which was " Student performance Analysis " which was based on java, Swing and MySQL. My latest research is on Machine Learning Algorithm. Now i am working on Deep Learning Approaches for Detection of COVID 19 from CT Image.

Prof. Sushila Sonare, was born in India on August 22, 1982. She is research scholar in LNCTU, Bhopal. She completed her M.Tech. in Computer Science and Engineering from NIT Calicut, Karala, in 209, and B.E in Computer Science and Engineering from Jabalpur Engineering College, in 2006. She has working experience as 10+ years including industrial and teaching. Her research interest fields are machine learning, deep learning, data mining, NLP, Data Analysis and computer network.

Retrieval Number: 100.1/ijainn.C1050042322
DOI:10.54105/ijainn.C1050.042322
Journal Website: www.ijainn.latticescipub.com

Published By:
Lattice Science Publication