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REVIEW ARTICLE **OPEN ACCESS**

CT Image Processing for Early diagnosis of COVID-19

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ABSTRACT
The growth in technology has resulted in its deployment in various industries. One such industry that uses technological development to a great extent is healthcare. For any disease, an early diagnosis is essential. Therefore, early diagnosis is critical to the healthcare industry to detect patients with symptoms. The proposed system uses CT Image Processing for early diagnosis of contagious disease Covid-19 which is caused by a virus called Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). Humans are affected by this, which causes respiratory sickness. Affected patients may recover without medical treatment, but medical therapy is required in some instances. People who are elderly and have other medical disorders, such as diabetes, heart disease, or respiratory disease, are more likely to be affected. If COVID -19 is not treated promptly, it can lead to severe illness and death. In this research, a study of early diagnosis of COVID-19 in CT images is performed.
Keywords: *CT Image Processing, COVID-19, Early diagnosis, Deep Learning, Artificial Intelligence*

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INTRODUCTION
In 2019, a deadly virus known as COVID-19 began to spread over the planet. Wuhan, China, located the foremost case of this virus. Within months, it had spread all across the world named SARS-CoV-2. So far, 477 million cases have been verified worldwide, with over 6 million people dying as a result of COVID-19. Reverse Transcription-Polymerase Chain(RT-PCR) is the most widely used approach for diagnosing the condition. Collecting nasal swabs is the first step in the RT-PCR will determine the occurrence of SARS-CoV-2 RNA. In Computed Tomography (CT), image processing is essential in diagnosis. Using chest CT scans, the authors of [1] developed and evaluated an automated approach for COVID-19 Lung Infection feature extraction and quantification [2] introduced.
The Artificial Intelligence (AI) aids in the prediction of COVID-19 on each 3D CT image to identify COVID-19 and other CT data by employing the ResNet-50 which is a Deep Learning (DL) model. They showed that the DL model could identify COVID-19 on CT scans with an AUC of 0.9. In [3], the authors have reviewed chest computed tomography (CT) scan data to screen patients for COVID-19-related pneumonia. Several CT dose reduction options will also be described, as these procedures can minimize the radiation burden. Compared to the standard-dose technique, the low-dose chest CT procedure decreases radiation dosage by up to 89 percent while preserving COVID-19 diagnostic accuracy in CT images. As a result, it is strongly recommended that it be utilized during the COVID-19 pandemic.

LITERATURE REVIEW
The following review looked at the literature on employing CT images for processing to diagnose the COVID-19 at earlier stage. The authors of [4] evaluated the efficacy of DL models are trained using chest CT scans for diagnosing the infected people rapidly and efficiently. The system learns the characteristics of COVID and non-COVID data that are represented in CT scans as well-separated clusters. Furthermore, as well-trained radiologists have demonstrated, our algorithms are capable of not only detecting COVID-19 instances but also properly localizing COVID-19-associated areas. Convolutional Neural Network (CNN) [5] is used to train and evaluate both the type of images and they achieved 96.28% as accuracy. Furthermore, major existing DNNs generated consistent findings when merging CT scans and CXRs to

detect COVID-19 positive patients. [6] Compared the sensitivity, specificity, and feasibility of chest CT in identifying COVID-19 to that of a RT-PCR. When the RT-low PCR's sensitivity was considered, the "reverse calculation technique" demonstrated that CT might have a higher specificity (83–100%). In [7], the authors have developed an automatic COVID-19 recognition method that categorizes CT-scan images of the lungs as COVID or Non-COVID. The authors proposed a technique to employ an ensemble strategy that uses the Gompertz function to generate fuzzy rankings for the base classification models and adaptively fuses the base models' decision scores to make final predictions. The decision scores are fused with the proposed ensemble model are generated using transfer learning-based CNN models such as VGG11, Wide ResNet50-2, and Inception v3. GraphCovidNet is a type of Graph Isomorphic Network (GIN)-based model for identifying COVID-19 in CT scans and CXRs of patients with COVID-19, is presented [8]. The recommended model can only receive input data based on a graph because we employ a GIN-based architecture. The model has a phenomenal accuracy of 99 percent. Convolutional Neural Network (CNN) [9] seeks to collect features from CT scans before optimizing the network's hyperparameters using a Parzen estimator tree. Compared to pre-trained CNNs and other state-of-the-art works, the suggested technique yielded superior results. According to the findings, the suggested approach can assist clinicians in screening for COVID-19 and diagnosing individuals infected with the virus and concluded that the outcomes were better [10].

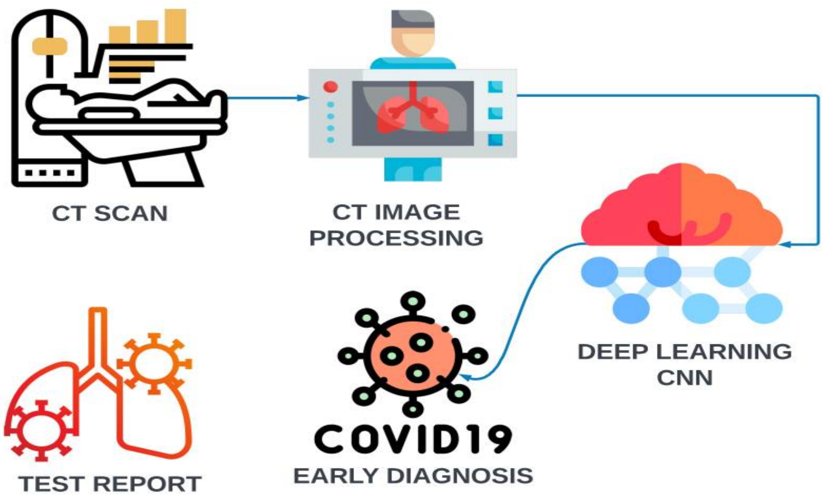

Figure-1: CT Image Processing in Early Diagnosis of COVID-19

CT IMAGE PROCESSING IN EARLY DIAGNOSIS OF COVID-19

For the early diagnosis of COVID-19, the suggested technique uses CT image processing is represented in Figure 1. A Computed Tomography scan (CT scan) is a radiology diagnostic imaging technology that produces interior human body pictures. A CT scan is a method that combines sequences of X-ray pictures obtained from various angles around the human body with computer capacity. It generates cross-section pictures of the blood vessels, body's bones, and soft tissues. CT scan pictures provides more information than the traditional X-rays. Machine learning functions based on the premise that computers can learn new data sets and perform tasks without human intervention. Deep learning is a subcategory of machine learning technology. A Convolutional Neural Network (CNN) uses deep learning technology to perform classification operations on a series of visual pictures. Convolution is the method through which CNN operates. Convolution is a mathematical function that combines two functions to produce a third. To anticipate, Deep Learning CNN needs pictures. CT scans were used to create these pictures. As a result, CT scan pictures are critical in the early detection of COVID-19.Three dimensions constitute an Effective Net: I depth, (ii) width, with (iii) resolution. Every dimension being scaled more by parameter φ given in Equation (1), where $\alpha = 1.2\, \beta = 1.1\, with\, \gamma = 1.1$experimental measurements constants are acquired using a linear search. Other derivative networks can be found by varying. For example, $\varphi = 1$ yields the Effective Net B1, $\varphi = 2$ yields the Effective Net B2, and etc. Equation (1) offers adequate exchange between computational expense and efficiency.

$$depth = \alpha^{\emptyset}$$
$$width = \beta^{\emptyset}$$
$$resoluation = \gamma^{\emptyset} \quad (1)$$
$$\alpha.\beta^2.\gamma^2 \approx 2$$
$$\alpha \geq 1, \beta \geq 1, \gamma \geq 0$$

To recover COVID-19 acknowledgment on x-ray pictures, four extra blocks are introduced to the base method. We presented improvements directed at CT images in this paper, while six different block were added to with an Effective Net.

Regardless of the fact that has been the more commonly using activation method; we will look at the whirling input signal in this article. The splashing function is described by the equation, although could be specifically defined as f(x)=max(0,x):

$$f(x) = \max(0, x)(1 + exp^{-x})^{-1} \quad (2)$$

Classic sweep activating produces a curve through in the loss minimization procedure, while Back Propagation provides a sharp change. In addition, the swish procedure does not remove minor negative numbers. Those criteria, we believe, are critical for spotting patterns in the data.

Acc- Accuracy
Sec- Sensitivity
Pc- Prediction

$$\left.\begin{aligned} Acc &= \frac{TP + TN}{TP + FP + TN + FN} \\ Sec &= \frac{TP}{TP + FN} + P_C = \frac{TP}{TP + FP} \\ F1 &= 2 * \frac{+P_C * Sec}{+P_C + Sec} \end{aligned}\right\} \quad (3)$$

With True, False, Positive and Negative the COVID-19 items that were classified correctly, the non-COVID-19 materials that were correctly classified, all COVID-19 tests that were known as non, and the non-COVID-19 data that were classified as COVID-19 are all represented.

They provide the results is terms of area Under Operational Characteristic Curve, which may be compared to literature (AUC). This Operating Characteristic Curve is a graph that compares the genuine positive rate (AKA sensitivity = Sec) to the false positive rate (FPR). Equation defines the FPR (4)

$$FPR_c = \frac{FP_c}{TN_C + FP_C} \quad (4)$$

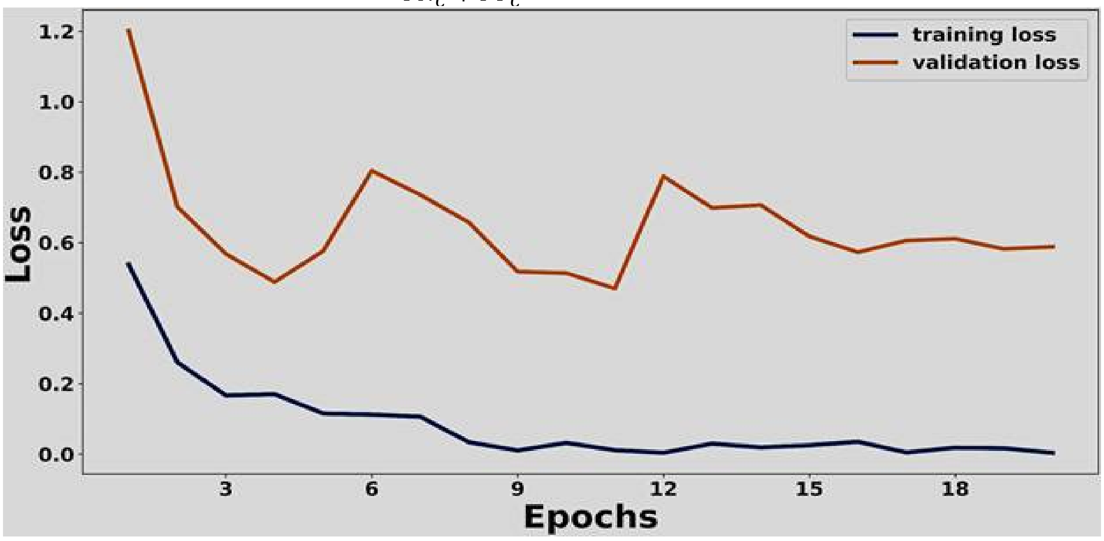

Figure 2: The training loss curve with 500 x 500 inputs.

We give a comparison of a best suggested technique to those found in the literature is given in Figure 2. Despite the outcome reported by both, researchers only assessed their approach using 105 photos (48 COVID as well as 59 Non Covid) therefore can be compared straight to the current work. As a result, the best results obtained before in this setting were given. Regardless of the fact that its work reported here beats that in terms of strength overall F1 measure just on COVID-CT data by employing a suggestively. The proposed dishonorable perfect has 15,159,490 parameters, whereas the base model has just 5,789,048 parameters. The training failure curves of the best model.

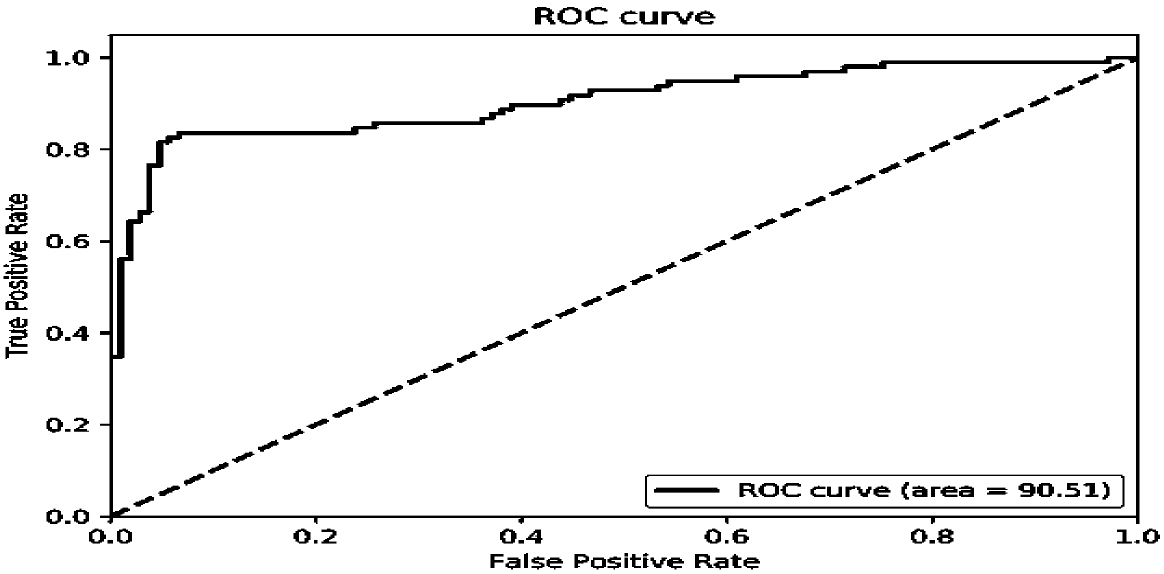

Figure3: The proposed approach's ROC curve

We only apply the specified methodology to the COVID-CT dataset, which advises partitioning the dataset into 3 groups: training, verification, then testing. They also employed data mining techniques to rotate (max 0.16° on every side), randomly expand (82% of a time) with a 20% probability, and then horizontal rotate with such a 50% chance. We want to underline that image enhancement is only utilized for training purposes. Its total training time images was 2968 at the end. (1442 COVID as well as 1408 Non COVID). The methodology is used to construct a variety of 203 images for testing purposes (97 of COVID with 106 of Non COVID). The model using an input size of 500x500 is the best. The model's receiver operating characteristic (ROC) curve is displayed in Figure 3.

CONCLUSION

Early Recognition of COVID has played a significant role in recent days. This disease directly affects the lungs leading to death among the infected persons. In this research, the analysis is performed with the backpropagation algorithm to achieve early diagnosis and timely treatment. The results show that the proposed model leads higher accuracy of 0.95%, and it can be trained further to get an improved accuracy rate in the early diagnosis.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest for this study

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