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A System for Covid 19 Recognition from Chest X-ray Using CNN And Vgg19 Algorithm

Sambhaji Pawar[1], Sarika Kamble[2], Amruta Dhaygude[3], Shruti Washilkar[4]

Department of E&TC, SKNCOE, SPPU, Pune

Abstract--**Because of the COVID-19 epidemic, the whole globe is now experiencing a health catastrophe that is unprecedented in its sort. Researchers are worried about finding ways to halt the pandemic and preserve lives as the coronavirus spreads. The issues brought on by pandemics have been addressed partly through adopting artificial intelligence. In this paper, we construct a deep learning system to recognize COVID-19 from chest X-ray pictures and extract characteristics from the photos. An expanded dataset, created by combining COVID-19 and standard chest X-ray pictures from public sources, has been fine-tuned on two potent networks, namely CNN and VGG19. The findings provide excellent performance and simple COVID-19 identification techniques, demonstrating the effectiveness of transfer learning. This makes it possible to accurately automate the process of interpreting X-ray pictures, and it may also be used when the materials and RT-PCR tests are few.**

***Keywords*--COVID-19, X-ray, RTPCR, AI, CNN, VGG19.**

I. INTRODUCTION

Wuhan, China, had the first COVID-19 case in December 2019. Two months have seen over 5000 suspected cases, and 1000 confirmed cases. New coronavirus pneumonia became a global epidemic by September 2020 as cases increased daily. Early in the pandemic, the new coronavirus was unknown. Dr. Nanshan Zhong's COVID-19 explanation states that the new coronavirus and the SARS bat-like coronavirus (Bat-SL-CoVZC45) share approximately 85% homology. China's novel coronavirus pneumonia clinical characteristics were studied by the Zhong Nanshan academic team. Particular attention was paid to the radiological characteristics of the patients as well as their essential symptoms. Isolation should persist for 1–14 days, according to the "Novel Coronavirus Infection Pneumonia Diagnosis and Treatment Plan" by the National Health Commission. Epidemiological studies also advise monitoring based on clinical pneumonia symptoms, illness features, laboratory nasopharyngeal swabs, and the findings of negative or positive tests. The frequency of COVID-19 incidence reported in the most affected nations globally is shown in Fig.1. Out of a total of 185,039,249 documented illnesses, and the United States leads the world with 63,390,876 cases.

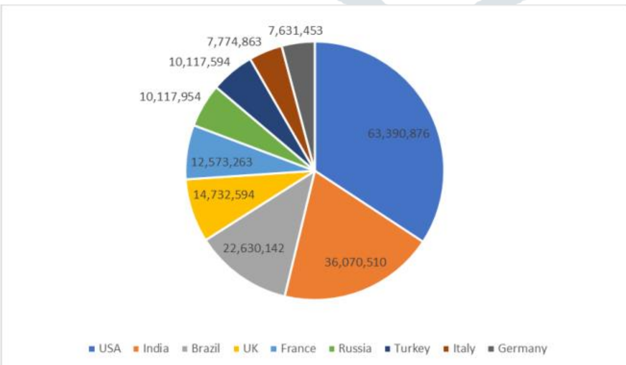


Fig.1. Confirmed COVID-19 cases globally (January 15, 2022)

Real-time polymerase chain reaction is the most used method of COVID-19 detection (RT-PCR). It may take up to two days to get results, generate a significant number of false-negative results, and have a sensitivity range of 70 to 90 [9]. Additionally, it has a significant percentage of false-negative results. Due to the enormous volume of tests that need to be evaluated, it might take up to five days or more in certain nations.

II. LITERATURE SURVEY

Deep learning-based image classification techniques were used for the photos in [1] after they had been adjusted to extract more valuable attributes. Five cutting-edge CNN systems, VGG19, MobileNetV2, Inception, Xception, and InceptionResNetV2, were evaluated to separate COVID-19 from control and pneumonia photos in a transfer-learning scenario. One study utilized 504 control photographs, 700 COVID-19 photos, and 224 COVID-19 photos. With 96.78% and 94.72 % accuracy in two- and three-class classifications, respectively, MobileNetV2 net fared best.

Transfer learning was implemented in [2] using the VGG16 CNN and the Resnet50, both trained on color camera photos from ImageNet. Both of these networks were used to train the transfer learning model. To determine whether or not using chest X-rays to diagnose COVID-19 is effective, a 10-fold cross-validation study was conducted, and the findings indicated that the test had an overall accuracy of 89.2%.

In [3], researchers evaluated the effectiveness of three different CNN architectures (ResNet50, InceptionV3, and InceptionRes-netV2) for detecting COVID-19 using a database containing just 50 controls 50 COVID-19 cases. The accuracy rate of ResNet50 was measured at 98 %.

Deep Convolutional Neural Networks were able to effectively and efficiently identify between 21,152 normal and abnormal chest radiographs, as the findings of this study on the accuracy of diagnosis demonstrated (as shown in [4]), as can be seen in [4]. The CNN model showed a distinction between normal and pneumonia with an accuracy of 94.64%, a sensitivity of 96.5%, and a specificity of 92.86% after it was pre-trained on datasets of adult patients and refined on datasets of pediatric patients. Additionally, the CNN model had a sensitivity of 96.5%.

Transfer learning was performed in [5] with the assistance of four CNN networks. These networks were ResNet18, ResNet50, SqueezeNet, and DenseNet-121. During the study, a database was used that had a total of 184 COVID-19 photographs, 5000 images that did not provide any findings, and images of pneumonia. The presented numbers indicated that the sensitivity was close to 98%; however, the specificity was just 92.9%.

III. PROPOSED SYSTEM

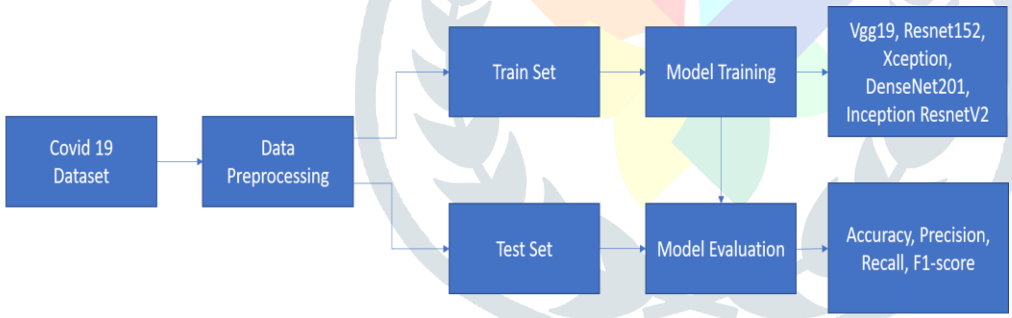
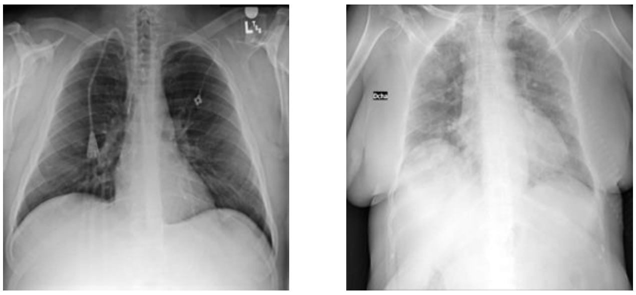


Fig.2. Block Diagram of the proposed system.3

A. Dataset

Chest imaging is routinely used in medicine and is essential for identifying COVID-19. When establishing a diagnosis based on chest imaging, medical practitioners can more fully comprehend the imaging modal features of COVID-19 patients, such as the early-stage interstitial changes and many small patchy shadows. Then it grows into many grounds glass and penetrates the shadows in both lungs. Pleural effusion and lung consolidation are uncommon in severe instances.



(b)

Fig3. Dataset image sample (a) Covid 19 (b) Normal image

B. Pre-processing

The crucial step in removing noise from the input frame is preprocessing. The segmentation procedure is smoother and more precise thanks to the preprocessing stage. Much of the input from the camera is salt and pepper noise, which the median filter will eliminate.

C. Training and testing

Several deep-learning techniques are available to train the network. Still, our method uses a network already trained to train the covid19 image classification algorithm. The CNN and Vgg19 networks are trained in this method.

a) CNN

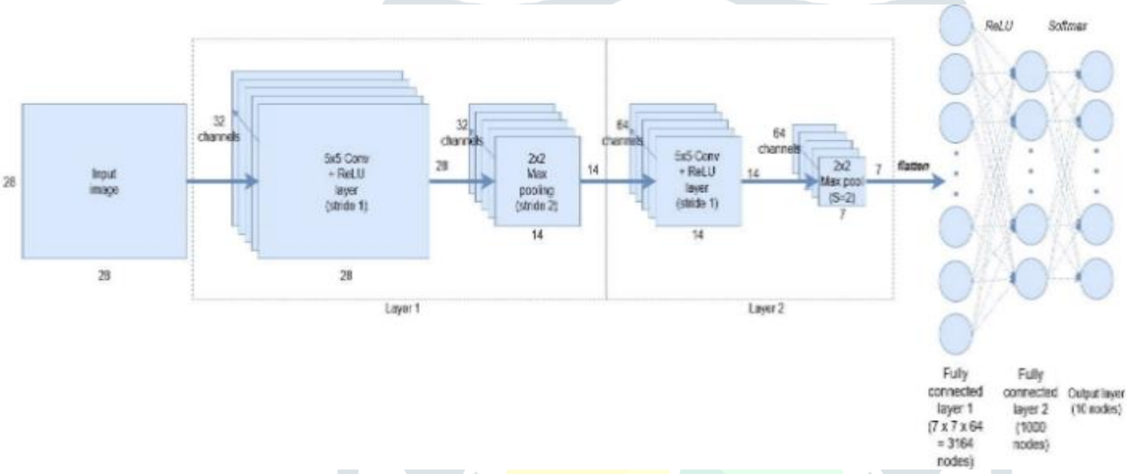
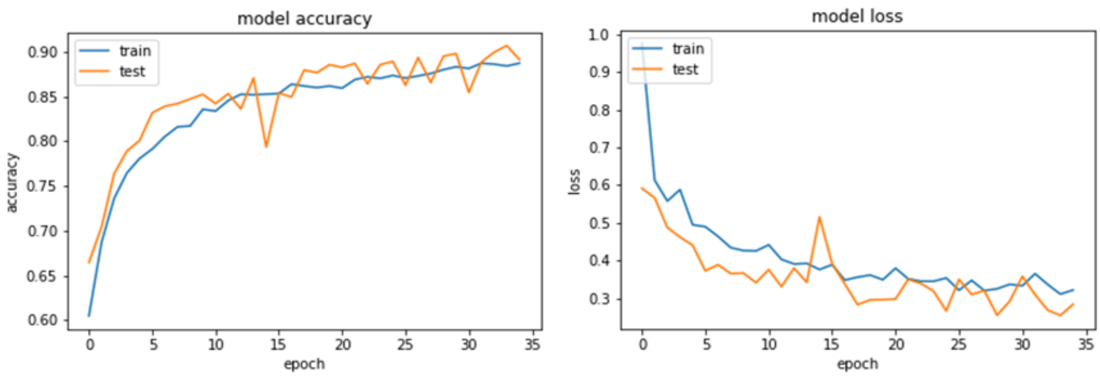


Fig.4. Block Diagram of CNN algorithm

CNNs are a specific kind of neural network that excels at classifying and recognizing pictures because of their unique architecture. Multi-layered feed-forward neural networks include CNNs as a subclass. With biases, parameters, and learnable weights, CNNs comprise filters, kernels, or neurons. Each filter accepts inputs, carries out convolution, and offers a non-linearity option as an additional feature. The Convolutional Neural Network (CNN) is comprised of many layers: convolutional, pooling, Rectified Linear Unit (ReLU), and FCL

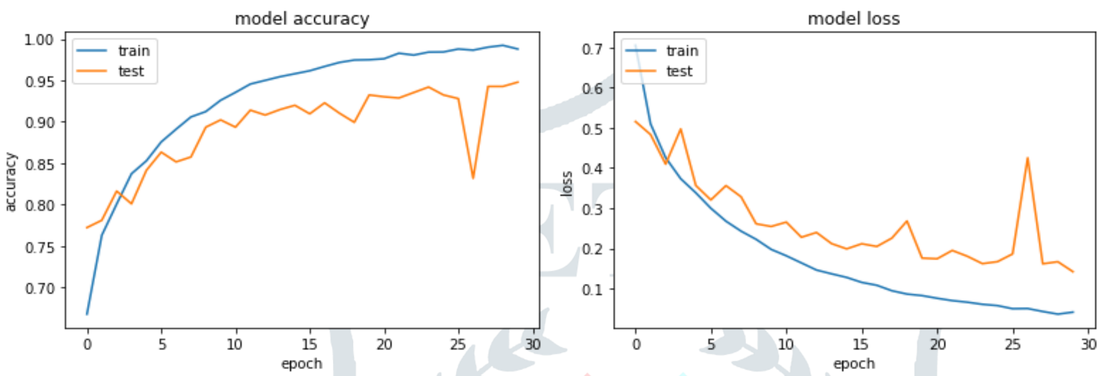
IV. RESULTS

The proposed system uses CNN, and the Vgg19 algorithm is implemented, and the results are explained below. The training accuracy and loss plot of the CNN and Vgg19 algorithm is shown in Fig. 10.



(a) (b)

Fig.10. Training progress graph of CNN algorithm (a) model accuracy (b) model loss



(a) (b)

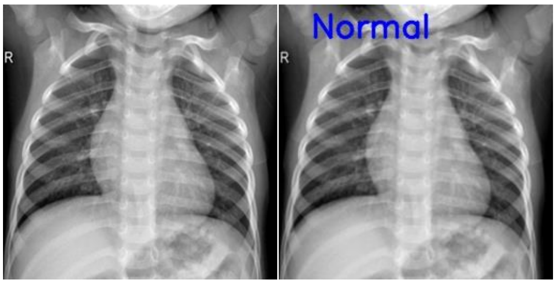
Fig.11. Training progress graph of Vgg19 algorithm (a) model accuracy (b) model loss

The chest X-ray pictures in this system are divided into Normal and Covid-19 algorithms. The CNN algorithm's training accuracy, training loss, and validation accuracy were 0.8870, 0.3217, and 0.2837, respectively. The performance of another method, vgg19, was 0.9879 for training accuracy, 0.0414 for training loss, and 0.9478 for validation accuracy, with a training loss of 0.1421. The comparative analysis of the CNN and Vgg19 algorithms is presented in Table 5.1.

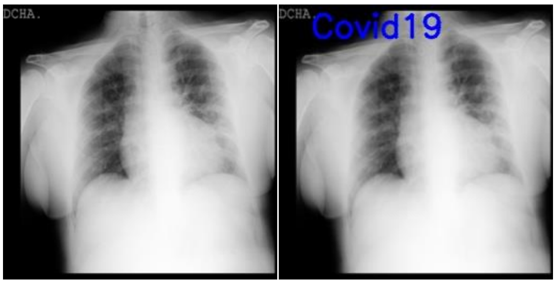
Table I: Comparative analysis of CNN and Vgg19

gorithm	aining		llidation		ecution me (Sec)
	curacy	ss	curacy	ss	
NN	3870	3217	3912	2837	13
g16	)879	)414	)973	.421	6

From Table 5.1. it is observed that the vgg16 algorithm outperforms the CNN algorithm in terms of accuracy, loss, and Execution time. The proposed system's qualitative analysis is shown in Fig.5.6.



(a)



(b)

Fig.12. Training progress graph of CNN algorithm (a) model accuracy (b) model loss

V. CONCLUSION

In this approach, a chest X-ray is classified as normal, and covid19 is presented. This system uses CNN and Vgg19 algorithms for classification. The proposed system has dataset collection, training, and testing phase. The training accuracy, training loss, and validation accuracy for the CNN algorithm were 0.8870, 0.3217, and 0.2837, respectively. The performance of another method, vgg19, was 0.9879 for training accuracy, 0.0414 for training loss, 0.9478 for validation accuracy, and 0.1421 for training loss. The qualitative analysis of the proposed system shows promising results for classification. The chest X-ray pictures in this system are divided into Normal and Covid19 algorithms. The CNN algorithm achieved a validation accuracy of 0.8912, a training accuracy of 0.8870, a training loss of 0.2837, and a validation loss of 0.3217. A different approach, vgg19, produced training accuracy, training loss, and validation accuracy, all of which were 0.9879, 0.0414, and 0.1421, resp.

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