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COVID-19 Prediction System Using VGG-19 Deep Learning Method

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ABSTRACT:According to the World Health Organization, the coronavirus epidemic threatens the global health system on a daily basis. In the majority of countries, health care resources are either insufficient or not distributed fairly. There are further concerns, including the amount of medical personnel, hospital beds, and intensive care units. Detecting illnesses is essential for averting epidemics. In academic research, deep learning techniques have gained popularity by analysing multi-layered images in a single run and by manually adding machine learning parameters. This technique predicts COVID-19 independently using pre-trained transference models and chest X-ray images with deep CNN. This model utilises a VGG16 model that has been pretrained for more accurate prediction in the various regular (healthy) and COVID-19 rays. Later, the learned model is utilised to characterise a collection of X-ray images by providing contextual explanations. The technique was evaluated using 116 COVID and 317 standard x-ray pictures, with an overall accuracy of 92%, which outperforms both the typical CNN system and the baseline transmission method comparison. High classification accuracy allowed us to perform a qualitative, comprehensive analysis that uncovered several COVID-19 case identification factors of greater significance.

KEYWORDS:VGG-19, Deep Learning, COVID-19, Non-COVID19.

I. INTRODUCTION

COVID-19 and non-COVID-19 patients will be classified in this research according to their phase. A machine learning strategy known as "deep learning," deep learning utilises a number of different techniques. Using a specific data set, artificial intelligence may be trained to anticipate future events. Artificial intelligence may be taught using both supervised and unsupervised methods of learning. Voice and facial recognition, ailment diagnosis, defence, and security all benefit from deep learning. Artificial neural networks (ANNs) are used in deep learning. Neuronal networks in the human brain serve as inspiration for artificial neural networks. It is made up of neurons, much like the human brain. In terms of speed and quantity of education, the two are very different. This means that in order to train artificial neural networks, you'll need to gather data and make use of computing power.

The quality of machine learning algorithms is influenced by the selection of features. Hierarchical selection rather than human feature selection is more accurate in Deep Learning.

Scientists are actively seeking for any evidence of a SARS-CoV-2 pandemic at this early stage of the COVID-19 pandemic's spread. One way is to examine the X-rays of COVID-19 patients in great detail. When it comes to identifying COVID19 patients based on a chest X-ray, we first devised an improved classification system that is model-independent and can be interpreted. For the transfer learning modification's hyperparameter needs, a number of studies have shown that the application of deep learning algorithms and systems, especially those applying CNN, to challenges in the medical sector has shown promising results in recent years. The usage of machine learning methods for COVID-19 detection has increased in recent months. One of the most prominent solutions to the aforementioned

problem is transfer learning, as shown. We were able to meet our goal of identifying COVID-19 chest X-ray pictures based on a very small dataset based on our past experience with recognising brain haemorrhage using head CT scans and the favourable outcomes of analogous studies.

Chest X-rays are subjected to intense deep learning (DL) in order to be catalogued under COVID-19. To identify COVID-19 cases, the open source deep CNN framework COVIDNet has been adapted to use chest radiography images as input. Deep learning and transfer learning using CNNs to detect uneven X-ray pictures in tiny COVID19 datasets yielded good results, demonstrating the effectiveness of both methods.

II. RELATED WORK

A review of deep learning in medical imaging included A.S. Lundervold and A.Lundervold [1] Rnri. Current breakthroughs in machine learning as well as a few tasks relevant to medical image processing and analysis were briefly summarised in this work. MRI is a fast-growing field, thus we won't take any requests to concentrate on a deep understanding of the technology.

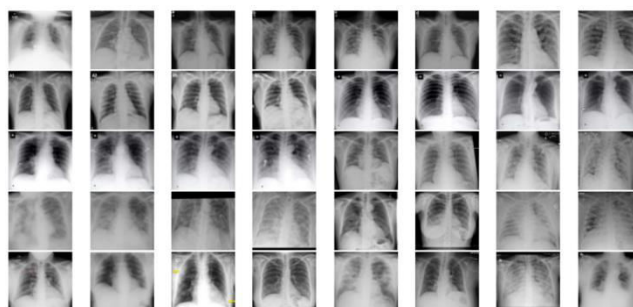
Automatic x-ray image identification using transfer learning and a convolutional neural network is shown in Covid-19 [2] by I.D Apostolopoulos and T.A Mpesiana. For the intuitive diagnosis of Coronavirus illness, this article used X-ray pictures from people who had identical bacterial pneumonia, as well as Covid-19 that had been validated. With the use of X-ray imaging, Deep Learning can detect biomarkers such as Covid-19 with an accuracy rate of 96.78% (96.66%), 96.66% (96.66%, and 96.46%). At this point in time, each diagnostic test shows a failure rate that causes worries, and although the medical community may analyse the probability of using X-rays in illness detection based on their results, the X-ray technique itself can be evaluated based on its many qualities.

Auto-diagnosis of coronavirus illness using X-ray pictures and deep convolutional neural networks has been suggested by researchers A. Narin, C. Kaye, and Z. Pamuk (COVID-19). Fully Convolutional Neural Networks (FCNs) were used to train FCNs to analyse MRI volumes (FCNN). Instead of using slice-wise preprocessing, they used volumetric convolutions.

III. METHODOLOGY

Patients' chest X-rays may help detect whether they have COVID-19 or not. The phases of the virus are also detailed if COVID-19 is found in a patient. A total of 116 COVID-19 patients and 317 healthy persons have had their chest X-rays included in this database. There are a total of 433 pictures in this collection. Chest X-rays from the data set are shown in Figure 1.

Chest_COVID X-ray



Chest_NonCOVID X-ray

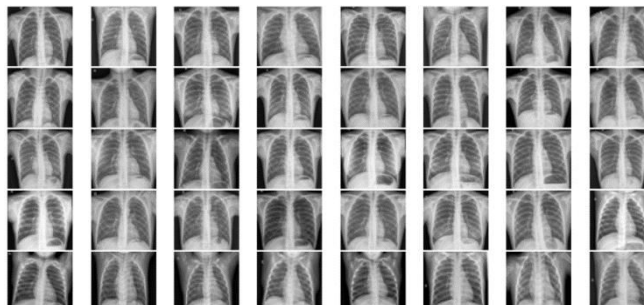


Figure1: Dataset Samples

Deep learning models are evaluated using a confusion matrix. In order to assess the classification performance of deep learning systems, the confusion matrix compares predicted target values to the actual target values.

Confusion matrix was not included in these evaluations of categorization outcomes.

- The study's accuracy must be judged against a number of standards. Calculated by taking the total number of right predictions and dividing it by the total number of predictions that were examined.

- Precision: The ratio of positive real values categorised as positive values to the total positive values categorised as positive values.

A positive real value (PV) is defined as a real value with a value of at least one.

F-Score: This is the harmonic mean of the recall and accuracy numbers.

Data augmentation is one way to increase the accuracy of the research. Because of the deep learning model's tendency to overfit tiny datasets, the overfitting issue becomes particularly obvious. Consequently, this shows a low level of accuracy. A 15-degree clockwise or counter-clockwise rotation of the photos in the dataset improves the accuracy of the data. As a consequence, more information has been included into the analysis.

The use of deep learning algorithms has risen since the 2012 ImageNet competition. Academic research is growing more and more interested in it. Deep learning for computer vision is being used by CNN and other networks. Because of its similarities to animal visual cortex, the algorithm for creating CNNs was inspired by it. In computer vision, CNNs are useful structures that can receive pictures as input. For comparison, CNNs have one or more fully linked layers as well as one or more convolutional layers. These layers include convolution, relu, pooling, flattening, and fully connected. CNN is built on a convolution layer. Detecting picture quality is done by this layer. High- and low-level attributes of a picture may be extracted using a variety of filters applied to the image in question. Multidimensional matrices and pixels are often used in the construction of filters. The applied filters provide the basis for creating the feature map, which is the final matrix produced as a consequence of the filtering process. The order-containing nonlinear layer follows the Convolution layer. The Relu layer might be referred to as such since activation occurs here. Negative feature map values are wiped clean by the relu activation algorithm. This layer's primary goal is to minimise the network's size and the amount of parameters and computations it contains. Network compatibility can be determined using this approach. For the most part, the primary goal is to decrease the number of characteristics and maintain just the most necessary ones. This saves time and eliminates the need for memorization in later levels. The primary function of the flattening layer is to prepare data for the fully connected layer, which comes after it. The Convolutional and Pooling layers' matrices are reduced to a one-dimensional array via this algorithm. The last layer, the Fully Connected Layer, performs the neural network's learning process utilising data from the Flattening layer. Convolutional neural network model VGG19 is seen in Figure 2.

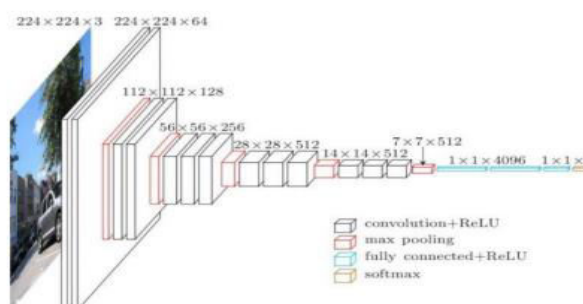


Figure 2. VGG Architecture

As the input for the layer, a 224 224 RGB picture is utilised. The image is passed through a series of convolutional (conv.) layers with a limited receptive field: 3x3 (the smallest size that captures the concepts of left/right, up/down, and centre), and spatial padding of convolution layer input is set to 1 pixel for the 3x3 convolution layers to preserve the spatial resolution after convolution. After a section of the convolution layers, five max-pooling layers are added to accomplish spatial pooling. With Stride 2, a 2x2 pixel window may be max-pooled to its maximum. After a series of convolutional layers, the next three Fully-Connected (FC) layers are applied. Third one employs 1000-way ILSVRC classification, therefore it has 1000 channels instead of 4096. (one for each class). The soft-max layer is the last one to be applied. All linked network tiers are configured in the same way. During the rectification process, the buried layers became nonlinear (ReLU).

IV. EXPERIMENTAL RESULTS

The dataset of chest x-rays is processed using the CNN and VGG16 deep learning techniques. This paper made use of the Tensorflow and Keras Python libraries. Adam was utilised as the optimizer in the four used deep learning models, whereas Relu and softmax were used as activation functions.

Table 1 shows the CNN model assessment criteria, including the confusion matrix. With an accuracy rate of 85%, the CNN model is a good bet. The closer the accuracy and recall values are to 1 the better the model's ability to discriminate between classes.

TABLE I. CONFUSION MATRIX OF CNN

	precision	recall	f1-score	support
0	1.00	1.00	1.00	28
1	1.00	1.00	1.00	20
accuracy			1.00	48
macro avg	1.00	1.00	1.00	48
weighted avg	1.00	1.00	1.00	48

As the validation loss (val loss) increases, the validation accuracy (val acc) decreases (see Figure 3). This shows that the model is cramming values instead of learning. Overall, the accuracy is acceptable.

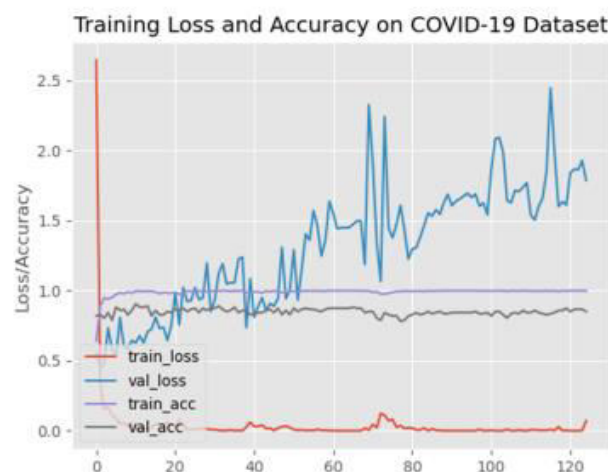


Figure 3 Training-validation loss and accuracy of CNN.

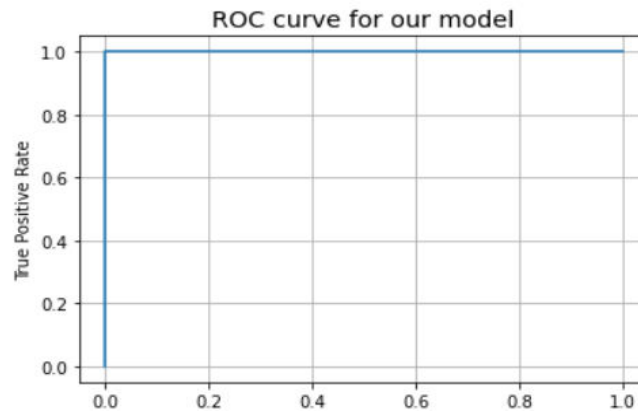


Figure4:ROC curve of CNN model

The CNN model's receiver operating characteristic (ROC) curve is shown in Figure 4. The graph shows the CNN model's classification performance. False positive rate (FPR) and true positive rate (TPR) are shown on the X- and Y-axes, respectively (True positive rate). For better accuracy, the AUC (area under the curve) should be as large as possible; conversely, for worse accuracy, the AUC should be as little as possible.

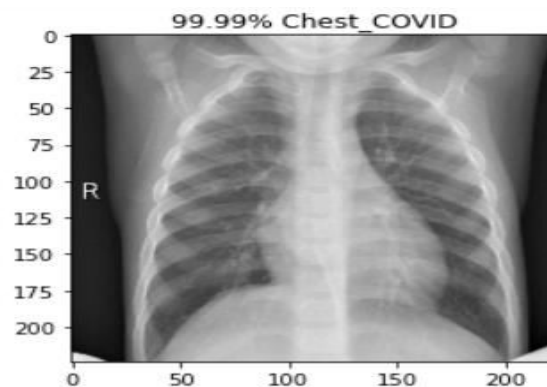


Figure5:Result ofthe COVID-19 detected image

Using the CNN-VGG19 Model, COVID-19 image detection is shown in Figure 5. COVID-19 has been found in the image and is predicted to be 99.99 percent accurate.

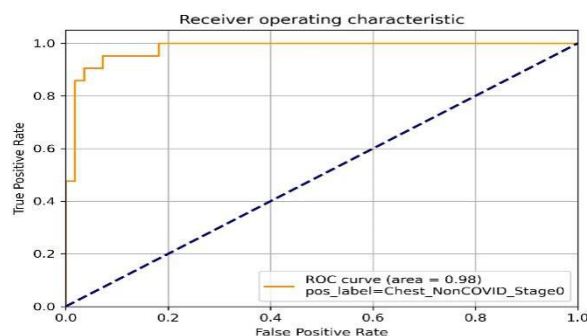


Figure6:ROC curve of Stage 0 Non-Covid-19 model

Figure 6 shows ROC Curve of Stage 0 Non-COVID19 image.The curve depicts the model performs well in describing that ROC curve for the given image is Non COVID-19.

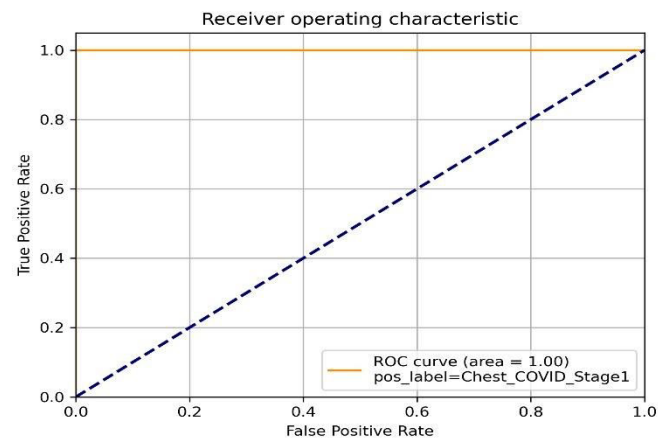


Figure7:ROC curve of Stage 1 COVID-19 detected image

Figure 7 shows ROC Curve of Stage 1 COVID19 image. The curve depicts the model performs well in describing that ROC curve for the given image is infected with some amount of infection.

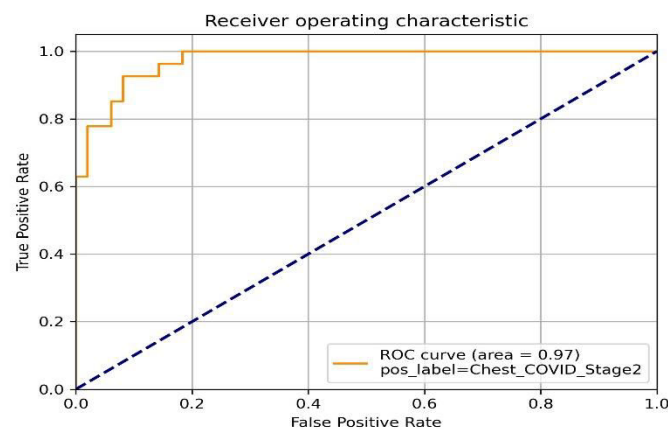


Figure8:ROC curve of Stage 2 COVID-19 detected image

Figure 8 shows ROC Curve of Stage 2 COVID19 image. The curve depicts the model performs well in describing that ROC curve for the given image depicts person is infected with severe amount of infection.

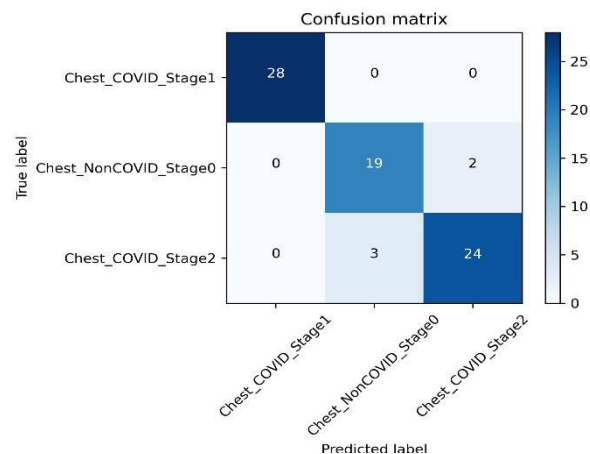


Figure9:Confusion Matrix of Stage 1,Stage 2 and Stage 3 Chest X-Ray images



Figure 9 shows Confusion matrix of input images. In this Stage 0 is predicted as NonCOVID, Stage 1 is predicted as COVID with moderate amount of infection and Stage 2 is predicted as COVID with severe amount of infection.

V. CONCLUSION

Deep learning was used to analyse 433 chest X-rays for COVID-19. This value has been increased. VGG19 has 99.9% accuracy. VGG19 properly classifies COVID-19 patients and healthy people. This essay emphasises COVID-19. As x-ray and ultrasound pictures rise everyday, healthcare will employ deep learning more. Research shows that deep learning can reduce the COVID-19 epidemic.

Data collecting may boost future success rates. Lung tomography supplements chest radiography. Deep learning models may boost success rate and productivity.

REFERENCES

- [1] A. S. Lundervold and A. Lundervold, "An overview of deep learning in medical imaging focusing on rnri," Zeitschrift fur MedizinischePhysik, vol. 29, no. 2, pp. 102- 127, 2019.
- [2] I. D. Apostolopoulos and T. A. Mpesiana, "Covid-19: automatic detection from xray images utilizing transfer learning with convolutional neural networks," Physical and Engineering Sciences in Medicine, p. 1, 2020.
- [3] AndriasMaier,Christopher,"A gentle introduction to deep leaning",2019
- [4] A. Narin, C. Kaya, and Z. Pamuk, "Automatic detection of coronavirus disease (COVID-19) using X-ray images and deep convolutional neural networks," arXiv preprint arXiv: 2003.10849, 2020.



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