

COVID Detection using Deep Learning

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Abstract— COVID-19 is a rapidly spreading pandemic, with the first cases being discovered in December 2019 Wuhan, China. CT scan images of the patient's lung are used where CNN algorithm is implemented. A comparative study of two more CNN models are used to evaluate this model (Resnet). The proposed model (Resnet) is capable of accurately predicting illness with an accuracy of 95.74%. This model can distinguish between covid, pneumonia, and normal CT scan pictures. Alexnet, Resnet, and Xception methods are utilised to compare the trained model to the input photos. Its then used to forecast the outcome. COVID/PNEUMONIA will be informed to the user through SMS based on CT scan findings. Result, availability of beds in the users' immediate vicinity, and hospital recommendations will be sent as an sms to the user.

Keywords— COVID-19, pneumonia, Alexnet, Resnet, Xception

I. INTRODUCTION

Coronavirus disease is a communicable disease. The severity of the disease can vary from a normal cold like sickness to the possibility of death. Signs of the respiration system being infected due to coronavirus may additionally have minor, self-proscribing ailments with unfavourable outcomes like influenza on uncommon activities. Fever, coughing, anosmia, ageusia, headaches, diarrhea, issues with respiration, weariness, and sore throat are other common symptoms. Some of the methods used for determining covid includes X-ray & CT scan images.

The emergence of COVID in December 2019 has brought on big harm to physical and social well-being of people all over the world and it was declared as pandemic by the WHO. Presently, there are approximately six million proven cases death due to Covid-19. The virus is still spreading everywhere as a different variant. Major hospitals across the world are not equipped with the right quantity and quality of kits which is used for testing especially the manual RT-PCR test. Additionally, RT-PCR test consumes a lot of time, and it is costly. Therefore, its crucial to navigate towards an automated prognosis machine that could possibly provide a faster choice as well as substantially lessens the errors in diagnosis. This research presents a DL – assisted automated method for diagnosis of COVID by screening X-ray photographs and emerging artificial intelligence (AI) methodologies.

Several scientific health regulations recommended that the chest imaging process is the best and most efficient method, and several papers as proposed them as one of the initial tools in the field of epidemic screening. Computer imaging techniques consisting of segmentation and classification are used in this. While there is a need for a short and simple method that can be run on restricted computing equipment, an automated method is used that provides fragmentation and other calculation for every 3 to 5 days of the infected patients and shows the development of infected patients using images taken from the computed tomography-experiments and medical screening. One of the most difficult diseases to diagnose is the COVID19, for medical professionals. Many studies have been conducted and steps have been undertaken to address the limitations of COVID19 scientific methods based on radiological images.

II. BACKGROUND

[1] A DL model for Covid detection which employs 100 CT images and 1431 CT images of patients and pneumonia patients respectively, where two classes are involved which are Covid and non-Covid patients. ImageNet algorithm was implemented and pre-trained. A large dataset for image classification is offered by imangenet. An accuracy of 96 percent is achieved in diagnosing COVID patients and 70.65 percent in non-COVID patients. Limited batch of x-rays are used to detect Covid. An overall accuracy of 89.2% is accomplished using Resnet50.

[2] Deep characteristics were used to detect Coronavirus illness. The model is built with ResNet50 and SVM, which obtained 95.38 percent accuracy and 91.41 percent F1-score,

respectively. For training their model, this research included chest X-ray of 224 affected by covid, 714 affected by Pneumonia, and 504 people who were healthy. The accuracy of this model was 96.78 percent.

[3] The researchers employed the established COVNet CNN algorithm can be used to find covid diseased patients. The dataset collected is categorized as normal, COVID-19, and pneumonia, with each category including 1525 X-ray pictures. The total accuracy of CNN-LSTM-based model was 99.4 percent, with an F1-score of 98.9.

[4] This study uses the suggested DCN model, which is based on the Darknet concept, to classify binary and multi-class data. The model was trained and validated using 127 COVID-19 X-ray images and 500 normal X-ray images. This model has accuracy as 98.0 percent and for multi-class 87.0 percent.

[5] For the classification of covid positive pictures, DeTraC is used which is capable of training 80 normal and 105 covid CT images . The exact value is 95.12 percent. Afshar et al., Haghifar et al., Khan et al., Minaee et al., and Wang et al. detected COVID-19 from chest X-ray images using DL techniques. CT scans have also been used in other studies for detection of COVID in patients.

III. PROPOSED WORK

A. Algorithm used

- Resnet-50: ResNet also known as Residual Network was introduced in 2015 by Researchers at Microsoft Research.
- Alexet: AlexNet is the first convolutional community which uses GPU to reinforce performance. AlexNet structure consists of one softmax layer, two normalization layers, two completely connected layers, three max-pooling layers and five convolutional layers.
- Xception: Xception is also known as “extreme” version of an Inception module Xception is a 71 layers deep convolutional neural network .

B. Methodology

The proposed model (Resnet) can perform with a high accuracy to detect the covid-19/pneumonia. This model can categorize the CT images into 3 categories as covid, pneumonia and normal. To compare the trained model with the input images Alexnet , Resnet and Xception algorithms are used. Then it will be used for result prediction. Based on CT scan results, availability of the beds in the users nearby location, and hospital suggestions if COVID/PNEUMONIA will be intimated to the user via SMS. In fact, CNN could use a wide variety of feature extractions in order to automatically learn representations from the database. In this research, a comparison of three potential CNN models—

ALEXNET, RESNET, and XCEPTION—has been conducted. The datasets are gathered using freely accessible tool, Kaggle. The dataset link has been attached as a reference. A total of 7000 photos from a database were utilised for training. Data for three conditions, namely covid/normal/pneumonia, included roughly 2500 entries in each category. The CT scan data are used to forecast illnesses in accordance with how the model was trained. Flash2sms is an open source technology that enables message sending. Here, the user receives the result using Flash2sms via SMS. Flash2sms is a freely available tool that is used in the service industry.

C. Block-Diagram

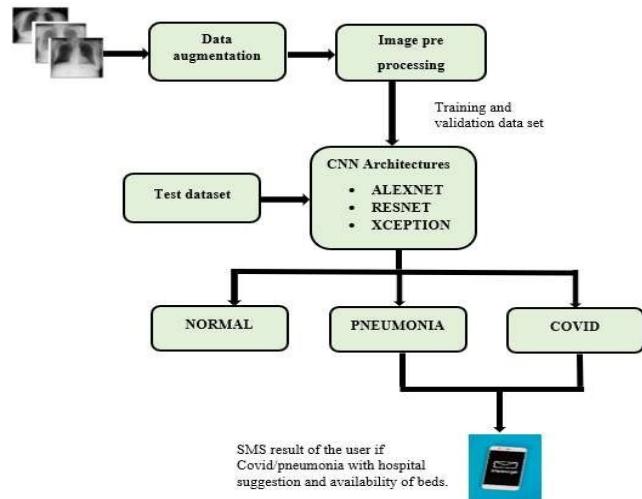


Figure 1 Block-Diagram

The BD of the convolutional neural networks (CNN) is shown in the Figure 1. Here the input CT scan images undergoes pre-processing, and the features are extracted with the help of convolutional layer and relu layer. Relu is an activation function layer that eliminates negative values and substitutes positive values in their place. Then the model gets trained. Finally, the model accuracy and model loss are obtained.

D. Results and Discussions

• ALEXNET

The Table 1 shows the CNN algorithm's output executed in the Google Collaboratory. It displays the input test image of CT scans and the output terminal parameters. This terminal shows the parameters like estimation time, training loss, validation loss.

TABLE 1 VALIDATION AND TRAINING LOSS

S.No	CT IMAGE	Training Accuracy	Validation Accuracy
1.	1	0.8182	0.8177
2.	2	0.8213	0.8537
3.	3	0.8230	0.8156
4.	4	0.8242	0.8170
5.	5	0.8257	0.8552

TABLE 2 TRAINING AND VALIDATION ACCURACY

S.No	CT Image	Estimation Time (Ms/Step)	Training Loss	Validation Loss
1		10s 57ms/step	0.5015	0.4459
2		10s 55ms/step	0.4918	0.4080
3		10s 57ms/step	0.4907	0.4620
4		11s 62ms/step	0.4795	0.4742
5		10s 55ms/step	0.4796	0.3851

The Table 2 shows the parameters like estimation time, training accuracy, test accuracy. The sensitivity and specificity of the prediction rise as the training accuracy improves.

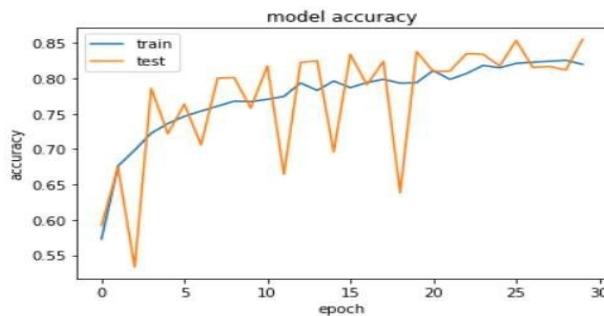


Figure 2 Accuracy of the model

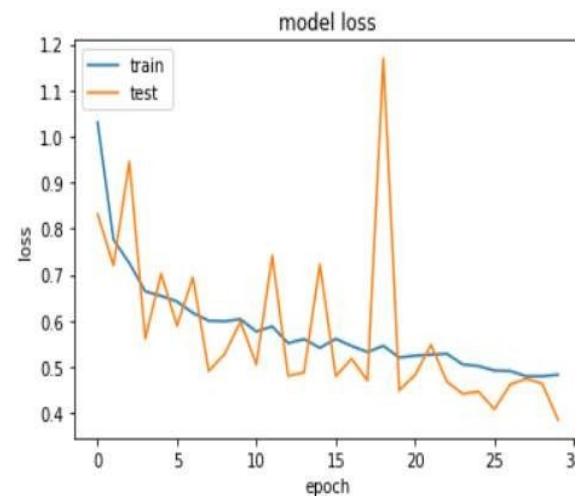


Figure 3 Loss obtained in the model

Figure 2 and 3 represents the accuracy and loss plot for the same. The graph is plotted against test and train datasets. There is a drop in accuracy and loss percentage is also high in this model.

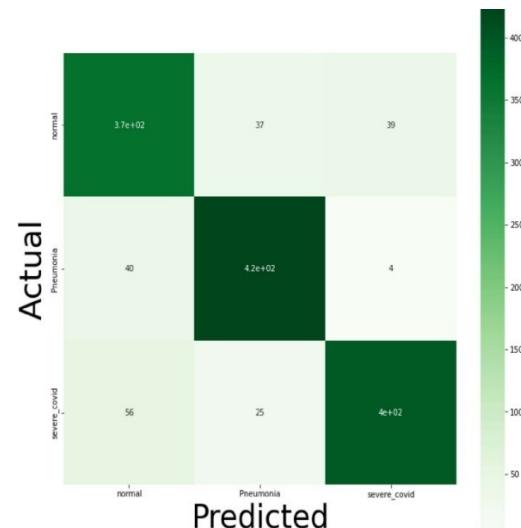


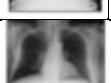
Figure 4 Confusion matrix

Figure 4 represents the confusion matrix of Alexnet algorithm.

- || Dark green shades represent the perfectly predicted results.
- || As the shade decreases the accuracy of result also decreases.

- RESNET:

TABLE 3 TRAINING AND VALIDATION LOSS

S. No	CT Image	Estimation Time (Ms/Step)	Training Loss	Validation Loss
1		54s 112ms/step	0.9543	24.3923
2		56s 116ms/step	0.9339	36.3669
3		55s 113ms/step	0.8626	24.0873
4		54s 111ms/step	0.8945	16.6040
5		56s 116ms/step	0.8674	4.1468

The Table 3 exhibits the output of the CNN algorithm executed in the Google Collaboratory. It reveals the CT scan images along with the output terminal parameters. This terminal shows the parameters like Estimation time, Training loss and Validation loss

TABLE 4 TRAINING AND VALIDATION ACCURACY

S.No	CT Image	Training Accuracy	Validation Accuracy
1.	1	0.8801	0.9486
2.	2	0.8897	0.9545
3.	3	0.8866	0.9539
4.	4	0.8935	0.9468
5.	5	0.8876	0.9575

The Table 4 shows the parameters like estimation time, training accuracy, test accuracy. The sensitivity and specificity of the prediction rise as the training accuracy improves.

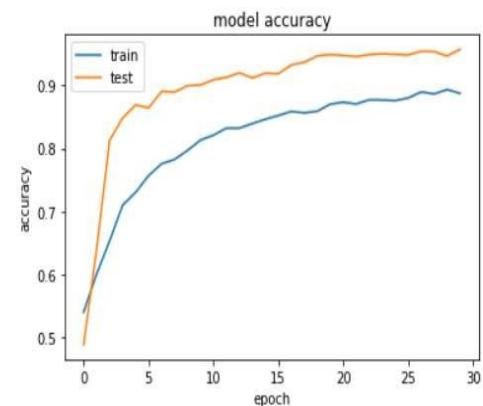


Figure 5 Accuracy

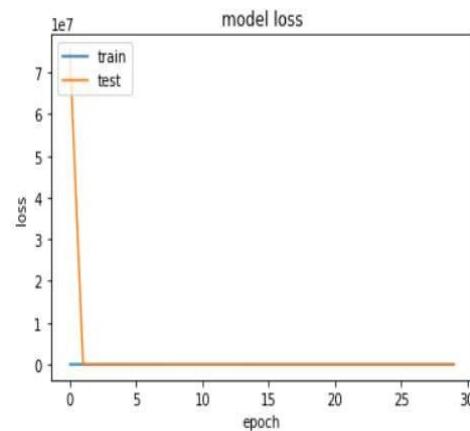


Figure 6 Loss

Figure 5 and 6 represents the accuracy and loss plot for the same respectively. The graph is plotted against training and test datas.

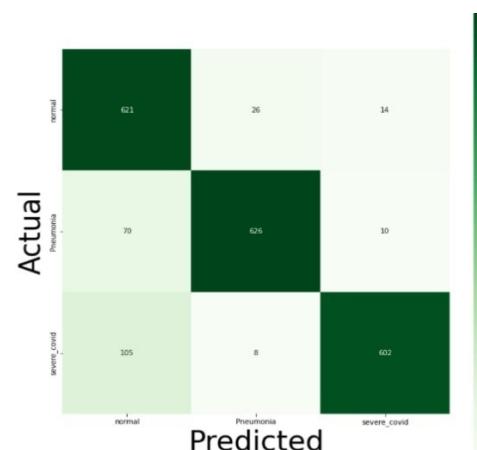


Figure 7 Confusion matrix

Figure 7 represents the confusion matrix of resnet algorithm.

- | Dark green represents the perfectly predicted results
- | As the shade decreases the accuracy of result also decreases.
- **XCEPTION:**

TABLE 5 TRAINING AND VALIDATION LOSS

S. No	CT Image	Estimation Time (Ms/Step)	Training Loss	Validation Loss
1		163s 945ms/step	0.4402	0.4438
2		162s 945ms/step	0.4448	0.4285
3		162s 935ms/step	0.4392	0.4415
4		162s 938ms/step	0.4382	0.4298
5		162s 938ms/step	0.4325	0.4649

The output of the CNN is shown in the Table 5. It displays the input CT scan images along with the output terminal parameters. This terminal shows the various parameters like estimation time, training loss, validation loss

TABLE 6 TRAINING AND VALIDATION ACCURACY

S.No	CT Image	Training Accuracy	Validation Accuracy
1.	1	0.9475	0.9475
2.	2	0.9466	0.9517
3.	3	0.9478	0.9481
4.	4	0.9481	0.9503
5.	5	0.9494	0.9437

The Table 6 shows the parameters like estimation time, training accuracy, test accuracy. The sensitivity and specificity of the prediction rise as the training accuracy

improves.

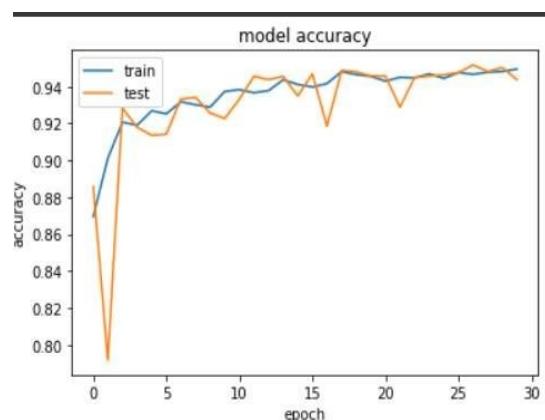


Figure 8 Model Accuracy

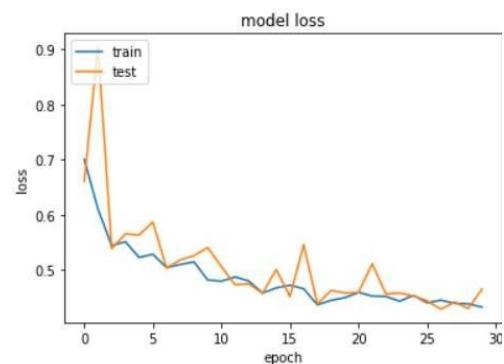


Figure 9 Model Loss

Figure 8 and 9 represents the accuracy and loss plot for the same respectively. The model graph is plotted against test and train dataset to plot loss and accuracy.

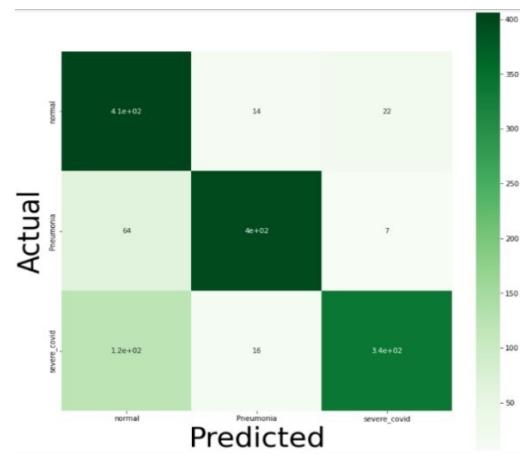


Figure 10 Confusion matrix

The above figure (Figure 10) depicts the confusion matrix of xception algorithm. In xception, the training loss is less when compared to other algorithms.

E. COMPARISON TABLE

The table 7 shows the comparison between Alexnet, Xception and Resnet. From the table it is inferred that Resnet algorithm shows higher accuracy of 95.74% with a monotonical decrease in loss percentage. It is also inferred that the testing dataset accuracy shows higher accuracy than the trained dataset.

TABLE 7 COMPARISON TABLE

PARAMETERS	CT IMAGES	ALEXNET	XCEPTION	RESNET
Training Accuracy		0.8257	0.9494	0.8876
Training Loss		0.4796	0.4325	0.8674
Validation Accuracy		0.8552	0.9437	0.9575
Validation Loss		0.3851	0.4649	0.1468
Model Accuracy				
Model Loss				

F. SUMMARY OF THE RESULT

The Table 8 shows the prediction of disease using CT scan by implementing the algorithm. From the obtained result, the location of the hospital, disease detected and available beds in the hospital will be sent as an sms using Flash2sms API.

TABLE 8 PREDICTION RESULT

S.No	CT IMAGE	RESULT
1.		the CT image is of condition: normal
2.		Result:severe_covid nearest hospital:GANGA HOSPITAL the CT image is of condition: severe_covid

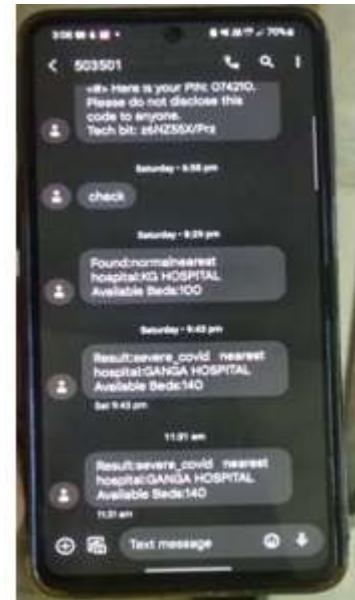


Fig.11 SMS RESULT

The above figure 11 shows the output obtained in mobile via sms through Flash2sms API. If the result is normal, text message will not be sent. If the disease predicted is pneumonia or covid message will be sent to the user.

IV. FUTURE SCOPE

Collective testing and diagnosis of COVID is pivotal in the reducing the impact of pandemic. The key factors in the detection of any disease are time, cost and accuracy. In order to overcome these problems, a corona virus detecting CNN model is proposed in this paper. Additionally, the CNN has better prospects in the detection of Corona Virus with highly restrictive time, resources, and costs. Despite not being tested clinically, the

proposed work shows promising results. Currently, the proposed system considers the CT scan alone to detect the disease. The project can be improved by including other parameters in the future to improve the efficiency and accuracy of the prediction. Further, real time values can be used to obtain valid diagnosis.

V. CONCLUSION

The COVID-19 pandemic initially started and discovered in Wuhan province, China, in the month of December 2019. In time, the disease was titled Coronavirus Disease-2019 by the World Health Organization (WHO) (COVID-19). To find the presence of COVID-19 virus in the patients' lung from the chest X-ray images, a CNN model is proposed. The proposed model (Resnet) has the ability to perform with a high accuracy to detect the disease. This system can segregate the CT images into normal, covid and pneumonia. Alexnet, Resnet and Xception algorithms are utilized to compare the trained model with the input images. Then, the result prediction process will take place. The availability of the beds near the user's location, and hospital suggestions if the patient is diagnosed with COVID/PNEUMONIA will be informed to the user via SMS.

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