A Deep Learning Framework For Diagnosis Of Covid-19 Using Radiographs And Classification

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Abstract: In 2019 a worldwide assert problem of Corona virus is reported. Day by day it increases the number of contagious and deaths. The main objective of this research work is to develop a rapid method to identification of corona virus in chest radiograph. Here in this research work deep structure learning techniques are implemented on chest radiograph. The study determines that infected patients with severe acute respiratory disease show distinct radiance visual characteristics along with fever, dry cough, fatigue, dyspnea, etc...A common way of determining Covid-19 is from chest radiographs which is non-intrusive clinical examination methods that play a vital role in the detection. A Deep learning approach gives higher accuracy on future extraction as the algorithm is applied to a pixel in all-inclusive image size. Deep learning provides the flexibility to perform a huge collection of mathematical operations, which is the basic requirement for image processing and machine learning. For the categorization of radiograph and improves efficiency and comprehensive accuracy, in this research work artificial neural network's deepest learning based algorithm can be used.

Index terms: Covid-19, Pneumonia, Radiograph, Radiogram, Deep learning model (CNN,RNN etc.),Image categorization

I. INTRODUCTION

A corona virus first case was reported in the city of Wuhan, China in December, 2019. Presently, Covid-19 has led to a crucial impact on the economic and social systems of both developed and emerging countries [1]. The standard real-time corona virus test is called the RT-PCR (Polymerase Chain Reaction) test, which is intended to evaluate the presence of antibodies to the virus. In addition, molecular testing of respiratory samples is recommended for identification and laboratory confirmation of infection with Covid-19. However, it takes a long time and is likely to generate false-negative results as well.

Artificial intelligence (AI) accelerates the processing of the data needed to obtain higher than expected details, responses, and recommendations to deal with the Covid-19 epidemic. Also, AI techniques can sometimes be useful in eliminating inaccuracies such as a sufficient number of RT-PCR test kits, test costs, and waiting times for medical reports. One of the methods used to track or diagnose a patient's symptoms is a radiograph or CT-Scan. Radiograph machines are used to scan the affected body, such as fractures, bone removal, lung infections, pneumonia, and tissue. Radiograph(X-ray) scanner that examines the most delicate structure of the active body and vivid images of soft tissue and internal organs. X-ray is a faster, easier, cheaper, and less risky procedure than CAT(computed axial tomography). Assessment and testing are of utmost importance. Failure in doing so can be fatal.

In this research, we will develop a deep learning model because it has revolutionized automated disease detection and management by precisely observing, recognizing, and classifying patterns in medical images. The explanation for such success is that deep learning techniques do not rely on handcrafted features, but these algorithms automatically learn features from the data themselves to help the radiologists to detect covid-19 using a chest radiograph of person and thus delay the rapid spread of corona virus. A model that requires less time , the most accurate results for detection of covid-19 from the larger data set and also, categorize the disease.

II. LITERATURE REVIEW

Numerous researchers have recommended different deep structured learning algorithms and approaches to detect corona virus from chest radiograph. Rahul K. et al. [2] Proposed the Resnet152 CNN model, using a 5840 chest radiograph in which 5216 chest radiographs for training and the remaining 624 for the testing, which was from different classes like Normal, pneumonia, COVID-19. Synthetic minority over-sampling technique is utilized for balancing the unbalanced data points of Covid-19 and Normal patients to use the Random forest, a XGBoost algorithm for image classification. SMOTE algorithm creates an equal number of samples for each class. The SMOTE is included to assure the smooth working of many ML(machine learning) algorithms like Naive Bayes, Decision Tree, Random Forest and XGB classifier achieved the different accuracy respectively 0.89,0.93 and other two gives the same accuracy of 0.97. Ali N. et al. [3] Proposed the three inconsistent ConvNet models like ResNet50, Inception-V3, and Inception-ResNet-V2 were pretrained with random weights using the Adam optimizer. The dataset was randomly split using 5 fold cross-validation for the training and testing respectively. Among a three model, the ResNet50 model achieved the highest accuracy for the detection of Covid-19 from the chest radiogram. Mohammad Rahimzade et al. [4] The study contains the Concatenation of the Xception and ResNet50V2 networks for detection of COVID-19and achieving a good classification accuracy of 91.4%.They proposed training model for imbalanced data. Fátima A. Saiz et al. [5] Used the VGG-16 model to classify the patient status either negative or positive Covid-19 case using chest x-ray images and achieved 94.92% of sensibility and 92.00% specificity.

Jocelyn Z. et al. [6] Used the deep transfer learning neural network to predict lung diseases like COVID-19, Pneumonia. The chest radiologist scored the left and right lung separately based on the geographic extent and degree of opacity. This approach is useful to stage lung infection, predict cure response and survival. The proposed model achieved the R^2 value of 0.85.This study also shows that the transfer learning technique scores were highly correlated with traditional learning scores. Shervin M. et al. [7] Used the Deep-COVID model for predicting COVID-19 from chest images using deep transfer learning on a subset of 2000 radiograph was used to train four popular ConvNet, including ResNet18, ResNet50, SqueezeNet, and DenseNet-121. Most of these networks achieved a sensitivity rate of 98%, while a precision rate of 90%. Ozturk T. et al. [8] They proposed deep CNN-based DarkNet model, for automatic identification of Covid-19 using a radiogram of the chest. The DarkCovid-Net prototype gives an accurate diagnosis for tri-class classification like Covid-19, Normal, Pneumonia, and binary categorization such as covid-19 and normal. They used the dark19 classifier for object detection from the radiographs.The accuracy of the model 87.02% for 3-classes.

Ioannis D. et al. [9] They have proposed the VGG19, Mobilenet, Inception, Xception, Inception ResNetV2 for recognition of Covid-19 from chest radiograph using transfer learning CNN models with 1427 radiogram images, including 504 images of normal cases, 700 images with confirmed bacterial, pneumonia and 224 images with confirmed Covid-19 cases. Using transfer learning, the identification of various anomaly in medical image datasets is an attainable target and gives the accuracy of 93.48% for 3-classes.Among all models VGG-19 and MobileNet was given higher accuracy. Khan AI. et al. [10] They proposed Coronet deep neural network model that is placed on Xception a pre-trained model for detection and diagnosis of Covid-19 from chest radiograph and also classify in Normal, Bacterial Pneumonia, and viral classes for achieving a good accuracy score of 89.6% and 95% for 4 classes and 3 classes respectively. Ghosal Biraja et al. [11] Used the Drop weights based Bayesian Convolutional Neural Networks (CNN) for estimating unreliability and understandability in deep structured learning for coronavirus (Covid-19) detection. Use the dataset having 5941 chest radiographs over four classes like Bacterial pneumonia, Normal, Covid-19,Viral pneumonia. They used the Adam optimizer with the learning rate of le-5 with the decade factor 0.2. Drop weights with the rates of 0.1,0.3,0.5 were appended to the fully connected neural network. The model achieved an accuracy of 92.90%.

Table 1:Comparison of model with dataset, accuracy and different classes

Model	Dataset	Classes	Performance
Inception ResNetV2	50 radiographs of normal and 50 radiographs of Covid-19	2-class(Normal and Covid-19)	Accuracy of 87%
ResNet50	50 radiographs of normal and 50 radiographs of Covid-19	2-class(Normal and Covid-19)	Accuracy of 98%
ResNet152	Total of 5840 chest radiographs in which 5216 training and 624 test	3-class(Covid-19,Normal,Pneumonia)	Accuracy of 97%
CoroNet	1203 normal, 660 bacterial Pneumonia and 931 viral Pneumonia cases,290 Covid-19	4-class(Normal,Covid-19,Pneumonia bacterial and Pneumonia viral)	Accuracy of 89.6%
CoroNet	1203 normal, 660 bacterial Pneumonia and 931 viral Pneumonia cases,290 of Covid-19 radiographs	3-class(Normal,Covid-19,Pneumonia)	Accuracy of 95%
ResNet18	Total 5000 dataset contains 2084 training and 3100 test radiographs	2-class(Normal and Pneumonia)	Accuracy of 89%
SqueezeNet	Total 5000 radiographs contains 2084 training and 3100 test radiographs	2-class(Normal and Pneumonia)	Accuracy of 92.29%
VGG-19	1427 radiographs including 504 images of normal cases, 700 images of bacterial pneumonia and 224 images of Covid-19 cases.	3-class(Normal,Covid-19,Pneumonia)	Accuracy of 93.48%

MobileNet	1427 radiographs including 504 radiographs of normal cases, 700 radiographs of bacterial pneumonia and 224 radiographs of Covid-19 cases.	3-class(Normal and Covid-19,Pneumonia)	Accuracy of 92.85%
Covid-Net	125 with Covid-19, 500 normal and 500 pneumonia radiographs	3-class(Normal,Covid-19,Pneumonia)	Accuracy of 87.02%
VGG-16	104 Covid-19 , 205 Normal and 204 pneumonia radiographs for training, and 100 Covid-19 , 444 Normal and 443 pneumonia radiographs for testing.	2-class(Normal,Covid-19)	Specificity of 92% and Sensitivity of 94.92%

III. DATASETS

There are a number of datasets available, but we use a chest radiograph of corona virus patients were getting from the open-source GitHub depository shared by Joseph Cohen et al.[12]. The depository contains 5218 chests radiogram bifurcated as non-infected, infected with Covid-19, and having pneumonia. Additional data for pneumonia is taken from the Kaggle repository named "Chest X-Ray Images (Pneumonia)" [13]. In below fig.1 shows the chest radiogram of the normal people, fig 2. Shows the chest radiogram of the Covid-19 infected people, fig 3. shows the chest radiogram of the pneumonia patients from the prepared dataset.

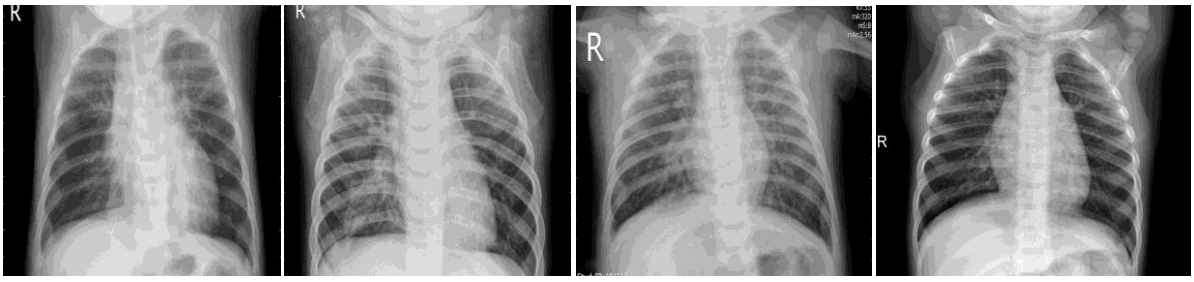

Fig. 1 Chest radiogram of the normal people

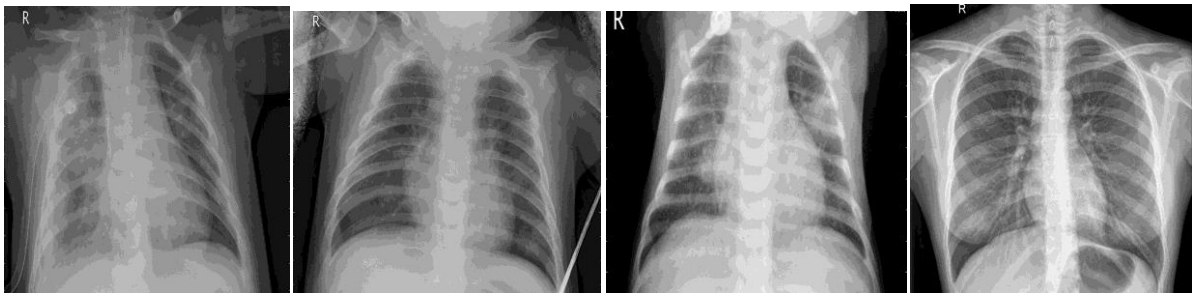

Fig. 2 Chest radiogram of Covid-19 afflicted people

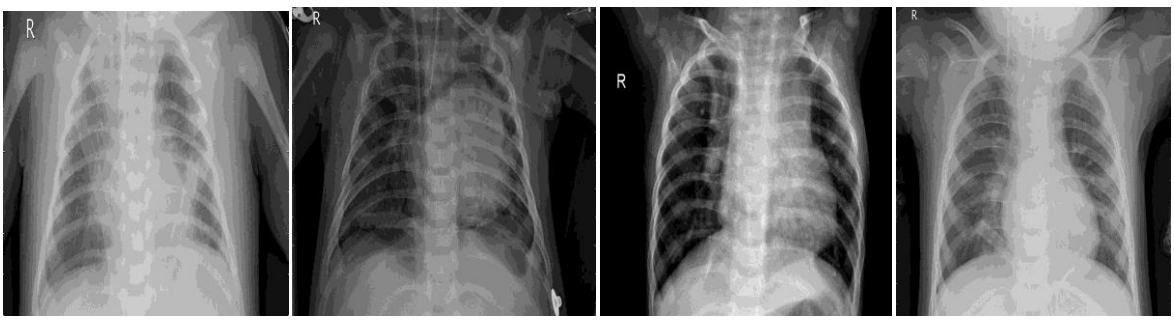

Fig. 3 Chest radiogram of the Pneumonia people

IV. PROPOSED WORK

The designed framework for our current study is given in Figure 4. This study, work demonstrates different extraction features and selection techniques from image objects and constructs the train's awareness accordingly. In the very first stage collect the data from the different open source repository like GitHub, Kaggle, etc., which involve Normal and Pneumonia, Covid-19 chest radiograph. For the data augmentation, we will use different techniques like horizontal and vertical shift range, zoom range, flip augmentation, random rotation, brightness and much more. After data augmentation , we will pass the train data, and test data to the ConvNet model as an input.

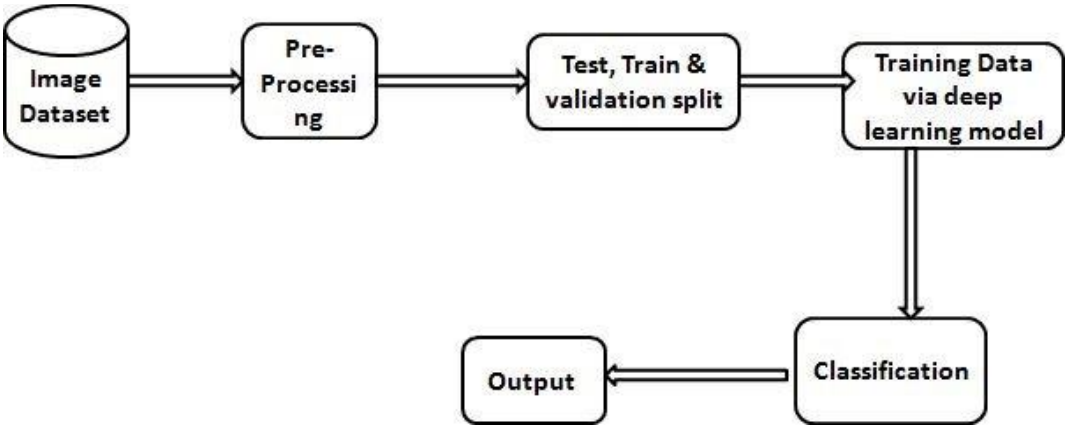

Fig.4 Proposed system

In the training phase, we also split the dataset to eliminate bias in the training data. Networks store the activation function and the last layer is the completely connected layer of ConvNet which gives the categorization of images. We will observe the changes in the model for reducing the overfitting problem. The network will classify the images into different categories like Covid-19, Normal, and Pneumonia.

V. CONCLUSION

Corona virus is worldwide and it is of utmost importance to give priority to detect the initial stages of the condition. Failure to detect might lead to serious medical conditions or even possible death. Chest radiography is the tomography technique that plays a significant concern in determining whether a patient is infected or not infected. It has a high sensitivity for the diagnosis of corona virus disease (Covid-19) as compared to RT-PCR or Rapid test. Chest X-rays can be deliberate as a key tool for the current Covid-19 detection in epidemic areas. The increasing the threat of Covid-19 leading up to inflation in mortality rate due to lack of pharmaceutical facilities, vaccine. Machine learning solutions for the identification of the Covid-19 can help doctors to take the imperative move to take care of patients good health. Deep learning study assures the solution that improves the comprehensive accuracy of the categorization and the framework will aid the Doctors diagnosis.

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