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A Tuberculosis (TB) Detection Using Convolution Neural Network

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Abstract- Tuberculosis, a highly contagious lung disease, is the leading cause of worldwide death followed by malaria and HIV/AIDS. The World Health Organization alludes that more than 95% of TB patients live in developing countries that lack adequate healthcare funding and supporting medical infrastructure. In descending order, two-thirds or 67% of newly TB-infected cases occur in eight developing nations beginning with India, followed by China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh (formerly, East Bengal of British India), and South Africa. Timeliness in TB diagnosis is critical when mitigating its spread, improving TB preventive efforts and/or minimizing the TB death rate. With advances in deep learning, the convolutional neural networks (CNNs) have consistently surpassed other traditional recognition algorithms in achieving superordinate performance for image-based classification and recognition problems.This project is to detect Pulmonary Tuberculosis based on the patient chest X-ray images using Densenet and Resnet models.

Keywords- TB Detection, ResNet, DensNet, X-Ray, TB Classification, Tuberculosis Detection.

I. INTRODUCTION

Pulmonary tuberculosis is a disease caused by pathogenic bacteria called Mycobacterium tuberculosis. Ii the disease is not treated effectively will be chronic and it will lead to death. Tuberculosis is one of the main causes of death and as a single infectious agent, higher than deaths due to HIV or AIDS. On every year millions of people get infected and suffer pulmonary tuberculosis. Diagnosis of tuberculosis is based on the patient's history, physical examination, and supporting examinations namely laboratory and radiological examinations.

A laboratory test in the form of Acid-Resistant Bacteria Test.Radiological examination for tuberculosis cases is the posterior-Anterior chest x-rays position. Increasing the number cases and variety of radiological examinations increases the workload of the radiologist. These conditions lead the radiologist to experience fatigue due to workload so that it can trigger inaccuracies in diagnosis, missed, and delayed diagnosis of tuberculosis.

Some time radiologist also produce false positive cases to the patient .To over come this issue and gain proper diagnosis of tuberculosis we use different layer of CNN architecture like convolutional, ReLU, pooling layers as well as fully connected layers.

In this Study 3D convolution neural network is proposed for detecting Tuberculosis (TB) in X-Ray scan images. The main aim of our project is to demonstrate the accuracy level of DenseNet and Resnet model of CNN in predicting Tuberculosis (TB) so that it can be used for accurate prediction in medical imaging field.

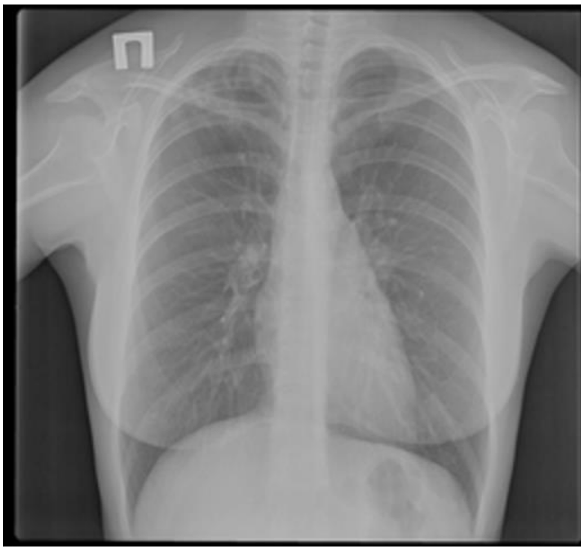

Fig 1. Human Chest X-Ray.

II. METHODOLOGY

1. Residual Networks (Resnet):

Residual Network common know as ResNet. It is Convolutional Neural Network architecture. Residual neural networks utilize and skip connections,.Typical ResNet models are implemented with double layer or triple layer skips that contain nonlinearities (ReLU) and batch normalization in between.

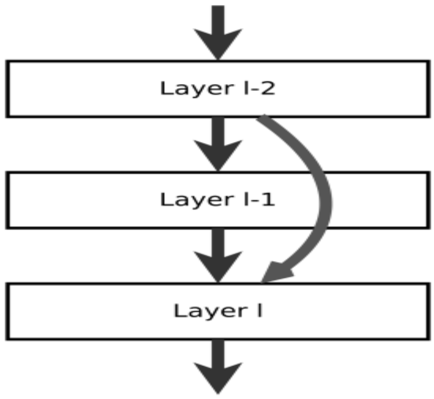

Fig 2. Double or triple layer skips that contain nonlinearities.

2. Dense Convolutional Network (DenseNet):
Dense net is densely connected-convolutional networks. It is very similar to a ResNet with some-fundamental differences and utilises dense connections between layers, through Dense Blocks, where we connect all layers (with matching feature-map sizes) directly with each other.It focuses on making the deep learning networks go even deeper, but at the same time making them more efficient to train, by using shorter connections between the layers.

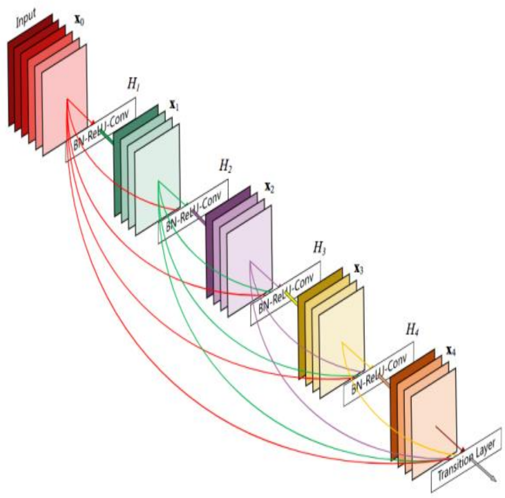

Fig 3. Densely connected Convolutional Networks.

III. PROCESS IN CNN

1. Data Collection:
Appropriate Real-life datasets of Chest X-Ray are required at all stages of object recognition research, starting from training phase to evaluating the performance of recognition algorithms. Chest X-Ray image dataset downloaded from kaggle website

2. Image Processing and labelling:
Images downloaded from the kaggle were in various formats along with different resolutions and quality. In order to get better feature extraction, final images intended to be used as dataset for deep neural network classifier were preprocessed in order to gain consistency. Furthermore, procedure of image preprocessing involved cropping of all the images manually, in order to highlight the region of interest and renaming it by order.

3. Augmentation Process:
Image data augmentation is a technique that can be used to artificially expand the size of a training dataset and rotating the dataset at 30’ by creating modified versions of images in the dataset. In Training deep learning neural network models on more data can result in more skillful models, and the augmentation techniques can create variations of the images that can improve accuracy of the test result

4. Neural Network Training:
The main goal of training the network is for neural network to learn the features that distinguish one class from the others. When using more augmented images in training phase the chance for the network to learn the appropriate features has been increased.

5. Testing Trained Model With Valuation Data:
The trained network is used to detect the disease by processing the input images in valuation dataset and results are processed by using front end

IV. RESULT

In this study, Tuberculosis is predicted from human Chest X-ray images. Large collection Human chest X-Ray is used in prediction of Tuberculosis disease by using the Convolution Neural Network. ResNet and DenseNet algorithms were used for classification.

1. DensNet Accuracy and Model Loss Model:
In this study by using Subplots the accuracy and loss of the model is shown in Figure 4.

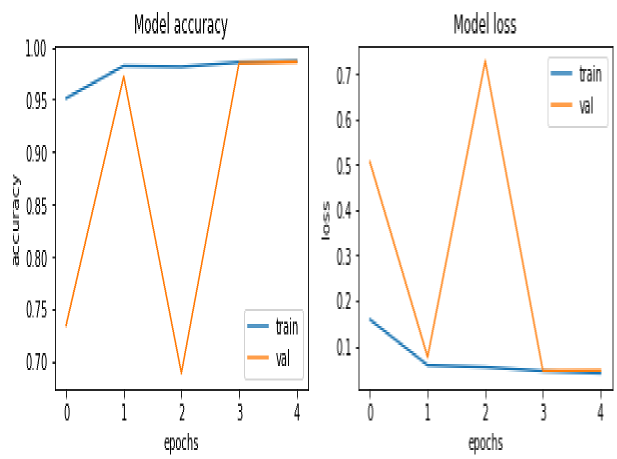

Fig 4. DenseNet Model Accuracy and Model loss.

2. DensNet Confusion Matrix:
By importing plot confusion matrix function DenseNet confusion matrix is generated and shown in figure 5 and F1 score is also calculated by using F1 score formula (2*precision*recall/(precision+recall)))

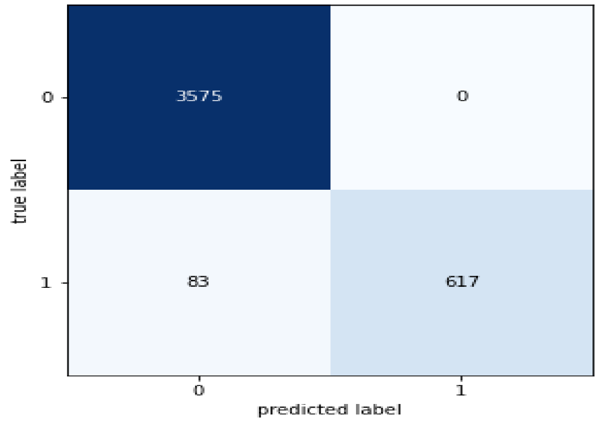

Fig 5. DenseNet Confusion Matrix.

3. ResNet Accuracy and Model Loss Model:
In this study we generate model accuracy and model loss for ResNet by using Subplots and shown in Figure 6.

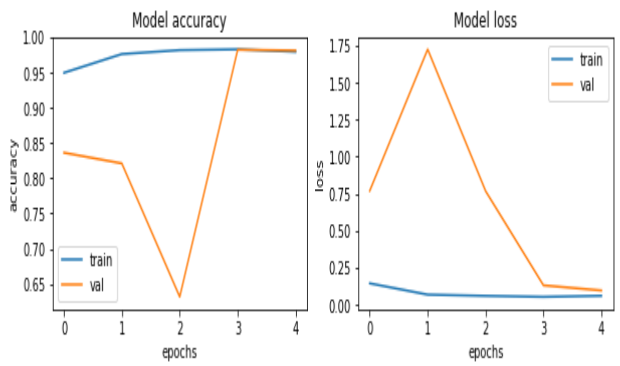

Fig 6. ResNet Model Accuracy and Model Loss.

4. ResNet Confusion Matrix:

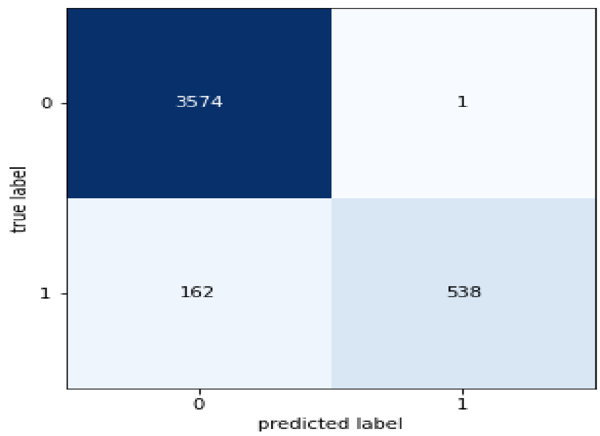

Fig 7. ResNet Confusion Matrix.

By importing plot confusion matrix function ResNet confusion matrix is generated and shown in figure 7 and F1 score is also calculated by using F1 score formula (2*precision*recall/(precision+recall)))

V. CONCLUSION

Tuberculosis is a deadly disease. This study discusses about number of methods used for the detection of tuberculosis using X-Ray based on ResNet and DenseNet has been developed. The CNN model detects different features according to the objective. The CNN model is used for classifying and identifying the images.

The CNN model combined with advanced tools is used for the detection of Microscopy images. Noise and contrast is improved for improving the accuracy. Greater accuracy is achieved using our CNN models.finally

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