IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 7, July 2021

DOI 10.17148/IJARCCE.2021.10747

# "Pneumonia Detection Using Deep Learning"

**Divyashree P[1], Priya Srinivasa[2], Nishanth Verma[3]**

Assistant Professor, Computer Science & Engineering, Bangalore Institute of Technology, Bengaluru, India[1]

Assistant Professor, Computer Science & Engineering, Bangalore Institute of Technology, Bengaluru, India[2]

Graduate Tranent, IT, NTT India GDC Private Limited, Bengaluru, India[3]

**Abstract**: This project prioritizes a convolutional neural network model that has been trained to differentiate and detect pneumonia from X-ray image samples. Unlike other procedures that relay on learning methods of transmission or traditional hand-crafted procedures for obtaining different isolation functions, the convolutional neural network model from scratch to extract features from a given X-ray chest image and isolate to determine whether a person has pneumonia or not. This model can help reduce the reliability and accountability challenges they face when dealing with medical imaging.

**Keywords**: Convolutional Neural Network (CNN), World Health Organization (WHO), artificial neural network (ANN), Artificial neural network, CheXNet algorithm.

## I. INTRODUCTION

Pneumonia is the leading cause of death in children in many countries. WHO estimated that 1/3 of the deaths of newborns were due to pneumonia? Part of this death can be avoided as it is caused by germs that can be cured by vaccination. Chest X-ray (CXR), is one of the most important tools for diagnosing pneumonia and many clinical decisions will depend on radiation exposure. Learning-based programs are used to increase the accuracy of image integration. This has encouraged researchers to use these networks in medical imaging to create disease collections, which is why the results show that deep networks can be powerful in extracting useful substances that divide different categories of images. The Convolutional Neural Network (CNN) is a deep structure commonly used in the convolutional neural network (CNN). This method has been used in various images of medical photography to extract various aspects of images from photographs. The deep convolutional neural network (CNN) is used to improve the function of the diagnosis of asthma with precision and minimal square error. For this purpose, conventional and deep learning-based networks are isolated to differentiate the most common thoracic diseases and present comparative results. This proposal suggests an automatic diagnosis of Pneumonia and its isolation with the help of a neural implant network. Here the Chest x-ray image is processed in advance to remove its features and make it suitable for c1assification image as normal and abnormal. Mathematical features such as definitions, standard deviations and geometric features. For the purpose of arranging geometric elements and contrast they are considered. Tools such as the artificial neural network are used for chest segregation.

## II. LITERATURE SURVEY

[1] "CheXNet: Radiologists-Level Pneumonia on Chest X-Rays on Deep Learning" Pranav Rajpurkar, Jeremy Irvin, Kaylie Zhu, Brandon Yang, Hershel Mehta, Tony Duan, Daisy Ding, Aarti Bagul , Robyn L. Year: 2017 | Volume: 2 | Conference Paper | Publisher: IEEE, proposed how to create a 121-layer CheXNet algorithm layer of neural network trained in the ChexX-ray14 database.
[2] "Active Pneumothorax Acquisition of Chest X-Ray Imaging Using Local Binary Pattern and Support Vector Machine", suggested by Yuan-Hao Chan, Yong-Zhi Zeng, Hsien-Chu Wu, Ming-Chi Wu by Hung-Min Sun In this paper, Image multiscale with strong texture analysis and classification is used.
[3] "Diagnosis of Pneumonia Clouds by Chest X-ray using image processing method" Abhishekh Sharma, Daniel Raju Publisher: IEEE | Conference Paper | Year: 2015 | proposed This document introduces the novel's method of detecting the presence of pneumonia clouds in the chest X-rays (CXR) using image processing methods only. Traditional techniques are designed to cut and remove the lung region from the images.
[4] "In-depth Neural Convolutional Neural Networks for Diagnosis of Tuberculosis" Rahib H. Abiyev and Mohammad Khaleel Sallam Maaitah Year: 2018 | Document Paper | Hindawi, Journal of Health Engineering in Paper, introduced convolutional neural networks (CNNs) to diagnose asthma. The construction of CNN and its construction process was introduced.
[5] "Recognition and Interpretation of Convolutional Neural Network Predictions in Detecting Pneumonia in Pediatric Chest Radiographs" Sivaramakrishnan Rajaraman, Sema Candemir, Incheol Kim, George Thoma and Sameer Antani

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 10, Issue 7, July 2021
DOI 10.17148/IJARCCE.2021.10747

Year: 2018 | Document Paper | Publisher: Lister Hill National Biomedical Communication Center CXRs contain non-pulmonary regions that do not contribute to the diagnosis of pneumonia. When presented with a targeted radiograph of the target chest, the algorithm uses the Bhattacharyya range measurement to select the most similar model of CXRs. Links between CXRs and CXR target models are calculated by modeling the CXR target with local feature presentations and identifying similar locations using the SIFT-fl ow algorithm.
[6] "In-Depth Equally Learning Machines and Their Use in the Diagnosis of Pneumonia" Sriram Vijendran, Rahul Dubey Year: 2018 | Conference Paper | Publisher: IEEE Multilayer advanced learning machine (MLELM) is a learning algorithm of the artificial neural network that captures the benefits of deep learning with an advanced learning machine. The combination of MLELM and OSELM prioritized Multilayer OSELM and is used in the Pneumonia Chest X-Ray image database in this paper.
[7] "Automatic Diagnosis of Major Lung Diseases Sings Radiographs of the Chest and is divided into feed-forward Artificial Neural Network" Aditya Tiwari, C.Y Patil, Vikram Narke Year: 2018 | Conference Paper | Publisher: IEEE This paper proposes an automatic detection of lung diseases such as TB, pneumonia and lung cancer and its c1assification with the help of an artificial neural network.

## III.SYSTEM ARCHITECTURE

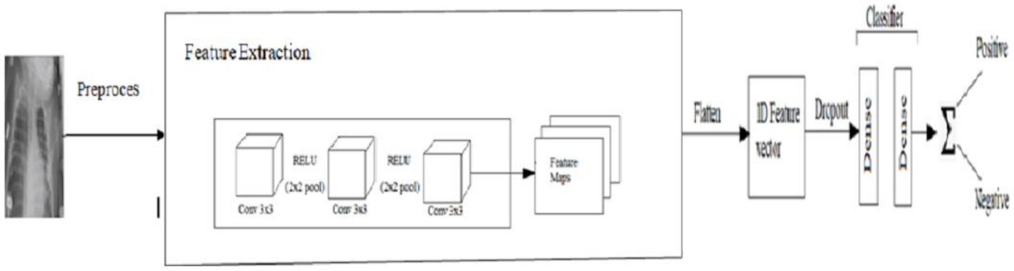



Fig 1: CNN Architecture

The structure has two main output components and separators. Every removal layer takes the output of its previous layer as input, and the output is transferred as input to subsequent layers. The above diagram consists of convolution, max-pooling, and layers of partition that are grouped together. Feature extractors contain 3 layers of conv2D, a max-pooling layer of size 2 × 2, and a RELU activator between them. The output of convolution and max-pooling functions are integrated into 2D planes called feature maps. It is noteworthy that each layer plane in the network is obtained by combining one or more previous aircraft. The separator is placed at the end of the convolutional neural network (CNN) model. It is simply an artificial neural network (ANN) commonly referred to as a dense layer. This division class requires different features (portable professionals) to perform calculations like any other divider. Therefore, the feature output (part of CNN) is converted to the 1D feature detector for classifiers. This process is known as the process by which the dissolution function is silenced to produce a vector of the long-term aspect of a dense layer that will be used in its final separation process. The split layer consists of a flat layer, a size of 0.5, two dense layers, the RELU between the two thick layers and the sigmoid start function that performs the separating functions.

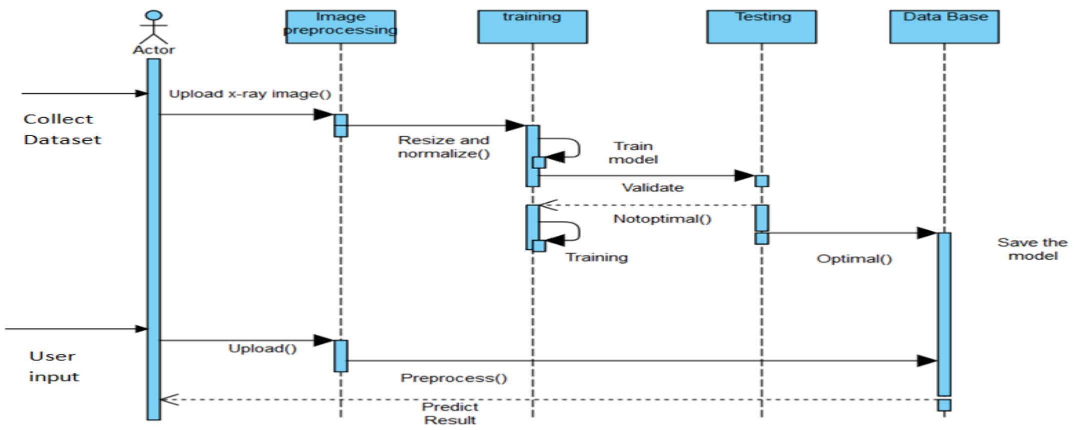



Fig 2: Sequence Diagram

For our developed system, the user inputs the image from the file system. The selected image is uploaded to the flask server using web user interface. The image is further pre-processed and then the output is predicted as pneumonia or

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 7, July 2021

DOI 10.17148/IJARCCE.2021.10747

normal from the saved CNN model. The Model API returns the output to the flask server as Pneumonia or Normal with the Confidence Score. Then the result will be displayed to the user through Web UI.

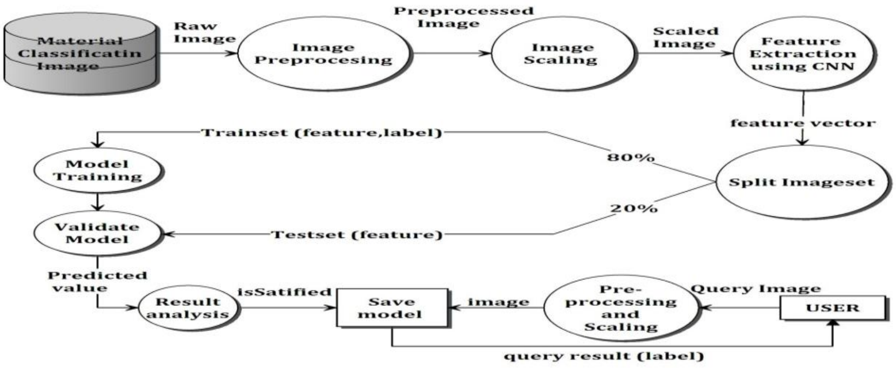



Fig 3: Activity Diagram

First, a set of Chest x-ray data is processed first to make it suitable for training the CNN model. We then split the data set to an 8:2 ratios where 80% of chest x-ray labels (such as pneumonia or normal) were used to train the CNN model and rest was used for testing purposes. When the used model is verified, it is saved to predict user input. Once the model has been created a visual interface where the user can insert a chest x-ray image and predict whether you have pneumonia or not.

## IV. METHODOLOGY & IMPLEMENTATION

### A. *Convolution Neural Network:*

CNN's is a process of obtaining and separating images from readable features. It is effective in multi-line construction where the required features of graphic images are detected and analysed.

### B. *Convolution Layer:*

This layer considers the installation features of each image. Maintains three-dimensional connections between pixels by detecting important image features with small squares for image insertion. Described in Figure 4 below is the complete process and kernel functions, where image inputs are converted to 5x5 matrix pixel values and the resulting filter is a 3x3 matrix or a feature map that appears in this layer. The feature map contains specific details of the actual image needed to specify the input. Feature map and downgrade the sample in a ReLU way to reduce any negative values to zero and remain the same for all others.

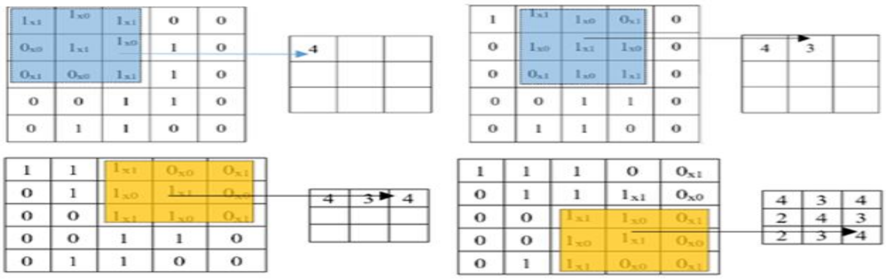


Fig 4: Demonstration of convolution layer

Max-Pooling Layer This layer cut down the values further to half of its original value by choosing only max values from the kernel matrix. The sample illustration is the 4x4 matrix pixel values of an input image degraded into 2x2 filters. Its process is described in Fig. 4

C. *Pseudo code:*

1. *Input:*

   The Input to our model are the x-ray images.

2. *Convolutional Phase:*

Initialize all weights of the CNN to a small value.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 10, Issue 7, July 2021
DOI 10.17148/IJARCCE.2021.10747

Select the learning rate(lr) such that 0<lr<1.
n=1
repeat
For m=1 to M do:
Propagate through the network.
For k=1 to the number of neurons:
Find error
End For
For layer L-1 to 1 do
Find error factor to be back propagated.
End For
For i=1 to L do
For j=1 to to J do
Find delta w
Update weights: w(new) =w(old)+delta w
End For
End For
n=n+1
Find Mean Square Error (MSE)
Until MSE< or n>maximum bounds

3. *Output:*
Our final output will be in the binary format pneumonia (1) or normal (0) and confidence score.

## V. Testing and Results

A. *Unit Testing*

| Scenario | Actual Result | Expected Result | Confidence Score | Result |
|---|---|---|---|---|
| Clear chest x-ray image | Normal | Normal | 1 | Pass |
| | Pneumonia | Pneumonia | 1 | Pass |
| Blurred image | Normal | Normal | Less than 1 | Pass |
| | Pneumonia | Pneumonia | Less than 1 | Pass |
| | Normal | Pneumonia | Less than 1 | Pass |
| | Pneumonia | Pneumonia | Less than 1 | Pass |

Table 1: Unit Testing

B. *Results:*
We trained our model using Convolution Neural Network to 5 epochs which gave us an accuracy of 96% on the test set with a minimum loss of 0.118499. When evaluated our model with confusion matrix it was found that only 4 images out of 738 pneumonia images were wrongly predicted as normal.
Our Model predicts the outputs pneumonia for pneumonia positive images and normal for non-pneumonic images. The accuracy of the prediction is indicated by Confidence Score which has a value between 0 and 1. The accuracy of the prediction is high when we have a clear chest x-rays and it degrades as the image blurs. Best case occurs when we have clear chest x-ray image and the confidence score may be 1 or near to 1. The worst case occurs when the image is fully blurred and confidence score may be near to zero

C. *Output*
1. *Pneumonia chest x-ray image:*
Input the chest x-ray image of pneumonic person the output is predicted for Pneumonia with accuracy equal to 1.

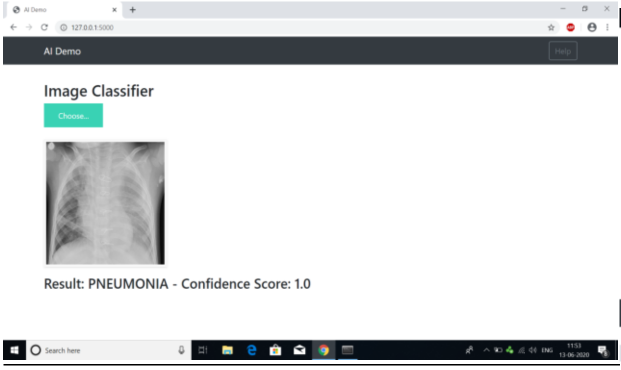
IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 7, July 2021

DOI 10.17148/IJARCCE.2021.10747



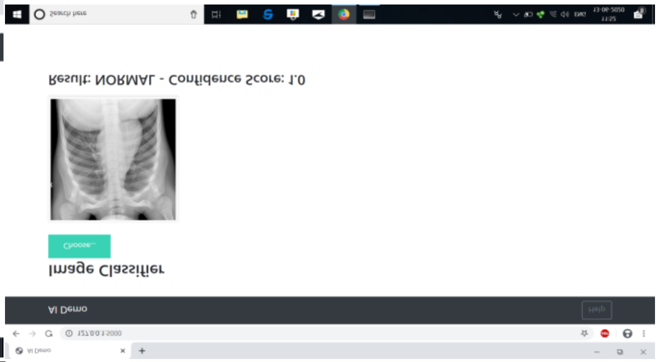
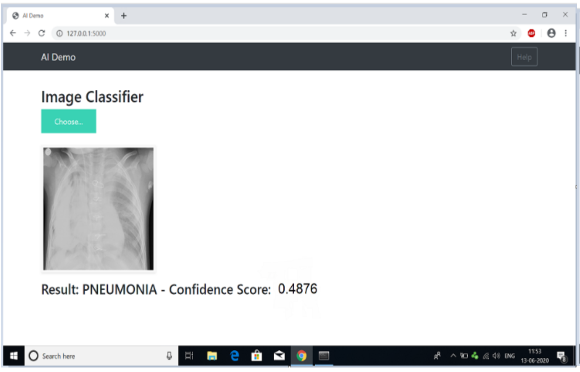




Fig 8: Output for pneumonic x-ray image

Fig 9: Output for Normal x-ray image



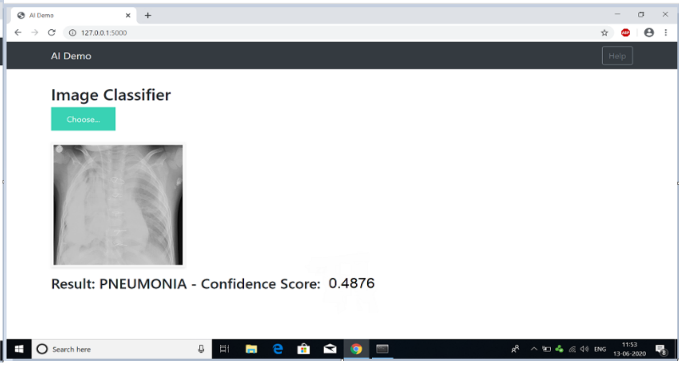




Fig 10: Output for Normal x-ray image

Fig 11: Output for Blurred image

## VI. CONCLUSIONS

In this project, we have used Convolution Neural Network to the binary classification problem of determining which of two classes normal or pneumonia a chest x-ray image falls under. We found that a CNN with one convolution layer and one hidden layer achieved accuracy of 95% on training set and 89% accuracy on test set. Later we have increased epochs to 6 which increased the accuracy to 96% on the train set. CNN model works amazingly well on image classification, hence we tried to train the same model on Chest x-ray Dataset and our results showed that the developed system has good accuracy in classifying the chest x-ray image into normal or abnormal.

## REFERENCES

[1] CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning Pranav Rajpurkar, Jeremy Irvin, Kaylie Zhu, Brandon Yang, Hershel Mehta, Tony Duan, Daisy Ding, Aarti Bagul, Robyn L. Year: 2017 | Volume: 2 | Conference Paper | Publisher: IEEE

[2] Effective Pneumothorax Detection for Chest X-Ray Images Using Local Binary Pattern and Support Vector Machine Yuan-Hao Chan, Yong-Zhi Zeng, Hsien-Chu Wu , Ming-Chi Wu and Hung-Min SunYear: 2018 | Hindawi, Journal of Healthcare Engineering | Volume 4

[3] Detection of Pneumonia clouds in Chest X-ray using Image processing approach Abhishekh Sharma, Daniel Raju Year: 2015| Volume:1|Conference Paper| Publisher: IEEE

[4] Deep Convolutional Neural Networks for Chest Diseases DetectionRahib H. Abiyev and Mohammad Khaleel Sallam Maaitah Year: 2018 | Journal Paper | Hindawi, Journal of Healthcare Engineering

[5] Visualization and Interpretation of Convolutional Neural Network Predictions in Detecting Pneumonia in Paediatric Chest Radiographs Sivaramakrishnan Rajaraman, Sema Candem Year: 2018 | Journal Paper | Publisher: Lister Hill National Centre for Biomedical Communications.

[6]"Deep Online Sequential Extreme Learning Machines and Its Application in Pneumonia Detection" Sriram Vijendran, Rahul Dubey Year: 2018 | Conference Paper | Publisher: IEEE

[7] Automatic Detection of Major Lung Diseases using Chest Radiographs and Classification by Feed-forward Artificial Neural Network Aditya Tiwari, C.Y Patil, Vikram Narke Year: 2018| Conference Paper| Publisher: IEEE.