IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

# Detection of Chest Diseases from X-Ray Images Using Deep Learning

**Hruthuik AK, Nived Krishna MS, Lokaiah Pullagura**

Department of CSE DS, Faculty of Engineering and Technology, Jain University, Karnataka, India

**ABSTRACT:** Medical imaging technique using chest X-rays enables the identification of numerous lung disorders. It is well known that hospitals regularly employ this technology because it is the most reliable method of identifying the majority of lung disorders. The procedure of identifying lung disorders by radiologists from these images can take some time. On the other hand, an automated artificial intelligence system could assist radiologists in more quickly and reliably detecting lung disorders. Our project aims to create a deep learning model which can detect chest diseases from X-ray images. In our daily lives, artificial intelligence is becoming more significant. In the field of medical science, convolutional neural networks (CNN) are a very emerging and promising technology. The choice of an appropriate and successful course of therapy is greatly influenced by an accurate diagnosis of the disease. The categorization of lung Xray images using a self-built convolutional neural network trained on a small amount of data is reported in this research. With the use of this CNN, people may be classified into one of two categories: chest disease infected or normal.

**KEYWORDS**: Chest disease, Deep learning, X-ray images, Convolutional Neural Network

## I.INTRODUCTION

Chest disease detection at an earlier stage has become a very important and needy one for human beings. Early detection helps several patients with the best chance of recovery from various diseases. Timely diagnosis has important clinical significance in recovery and reduce mortality rate. Therefore, chest disease detection at an early stage is very important. Many methods have been developed for the detection of chest diseases. In this project we are detecting the chest diseases from X-ray images us-ing Convolutional Neural Networks. The features which are used for the detection of Chest disease are extracted from the X-ray images. Input as X-ray images will be given and output will tell whether that person have disease or not. Machine Learning is an emerging technique that allows us to increase the accuracy of the result.

In the area of Chest disease categorization and detection, CNN has under-gone substantial research, far outperforming earlier methods for image recognition. In conclusion, CNN has demonstrated the vast healthcare potential to identify people who are more likely to contract a disease. CNN can be used for binary classification as well as multi-class classification. With multi-layer function representations, CNNs have already demonstrated good performance in identifying the com-plex structures in high-dimensional datasets.

## II.RELATED WORK

[1] In this study, it was suggested to use chest X-ray images to diagnose chest diseases using deep convolutional neural networks. The suggested Deep Convolutional Neural Network models were trained using a dataset of 12,000 chest x-ray images from patients with pneumonia. Chest X-rays of infected and uninfected patients. The Chest X-ray8 dataset served as the foundation for this preprocessed dataset. The photos in the collection were annotated using metadata and additional contents using the Content-based image retrieval approach. The number of images in each of the classes was increased using data augmentation techniques. The enhanced images were produced by combining fundamental image editing methods like Deep Convolutional Generative Adversarial Network. The suggested Deep Convolutional Neural Network model was developed using the VGG19 network. In the unseen chest X-ray pictures, the suggested Deep Convolutional Neural Network model's accuracy for classification was around 99%. The suggested eep Convolutional Neural Network 's performance was compared to that of latest transfer learning techniques like AlexNet, VGG16Net, and InceptionNet. The comparative findings demonstrate that the suggested Deep Convolutional Neural Network model performed better at classifying than the other methods.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

[2] The strain on radiologists and physicians is significantly reduced by the speedy diagnosis of coronavirus illness 2019 (COVID-19) made feasible by a three-dimensional (3D) deep learning system. Motivated by the fact that the current chest computed tomography (CT) datasets are different in equipment types, we propose a COVID-19 graph in a graph convolutional network to contain multiple datasets that distinguish COVID-19 infected patients from normal controls. We initially use a 3D convolutional neural network to extract picture properties from the original 3D-CT pictures. In order to enhance performance, a transfer learning technique is suggested in this section. This method establishes the parameters for the 3D- Convolutional Neural Network structure using the prediction of the equipment job. The COVID-19 graph was subsequently built in Graph convolutional neural network using the gathered characteristics. Each cluster in the graph is made up of samples from the same type of equipment. All samples are sorted into these clusters. Then, we use edges to create connections between samples belonging to the same cluster. We suggest merging the correlation distance of the recovered features with the subject -specific score differences from the 3D- Convolutional Neural Network structure in order to compute correct edge weights. We can get the definitive diagnostic results by importing the COVID-19 graph into Graph convolutional neural network.

[3] These days, the COVID-19 epidemic and respiratory problems claim the lives of a great number of individuals all over the world. A large number of people will die from the pandemic COVID-19, which first began to spread in the first quarter of 2020. Due to the aforementioned rationale, the majority of nations have attempted to discover solutions and reduce this pandemic, including respiratory ailments. Inadequate medical supplies and staff are another issue we deal with while treating illnesses. It might be difficult to diagnose diseases without the use of technology. In this study, we take into account the identification and classification of a variety of lung disorders from chest X-ray images using a deep learning method with VGG16 models.

[4] Medical image analysis, which provides tools for detecting and making decisions regarding a range of diseases including MERS and Corona virus, is one of the most promising topics of study. This study compares the most recent Deep Convolutional Neural Network for automatically binary identifying images of pneumonia infection using modified versions of VGG16, VGG19, DenseNet201, Inception ResNet V2, Inception ResNet V3, Resnet50, MobileNet V2, and Xception. The recommended work was tested using the 5856-image chest X-ray and CT images dataset (4273 pneumonia and 1583 normal). As a result, we can conclude that the upgraded versions of Resnet50, MobileNet V2, and Inception Resnet V2 operate flawlessly, showing steady gains in both training and validation preciseness.

[5] In this study, three Convolutional Neural Network architectures—InceptionV3, ResNet50, and VGG19—were used to interpret COVID-19 chest X-ray images utilizing a Deep Transfer Learning (DTL) approach using the Apache Spark system as a large-scale data platform. The three models are correctly evaluated in the COVID-19 and conventional X-ray image classes. However, in covid or Normal or pneumonia, the InceptionV3 model, ResNet50 model, and VGG19 model all had detection accuracy of 97.55%, 98.55%, and 98.55%, respectively.

[6] The classification of current diseases in the population that can be detected from X-ray radiographs is proposed in this work; the diseases include COVID-19, which poses a threat to life and health, as well as tuberculosis, which is still a major public health concern, and viral and bacterial pneumonia cases, which exhibit initial symptoms that are similar to those of COVID-19 and tuberculosis. A convolutional neural network of its own and the ResNet-50, which has shown promise in prior studies, were offered for the classification task. ResNet-50's Accuracy metric is 0.72%, whereas the suggested model's is 0.87%, according to the results.

[7] In this study, pneumonia brought on by COVID-19 respiratory problems was identified using specialized and previously trained deep learning models based on Convolutional Neural Network. 368 verified COVID-19 patients' chest X-ray photos were gathered locally. Moreover, information from three publicly accessible datasets was utilized. Both training and testing were conducted using the public dataset. The models were trained and tested using a combination of data from local and public sources. The model was trained using a public dataset, while local data were solely utilized for testing. The local dataset was used for testing, while the combined data were used for training. The combined dataset's findings reveal a high detection accuracy of around 98, and most models handled additional data with a little decrease in preciseness.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

[8] In this study, they provide a generalizable graph-convolutional framework for multi-modal population-based illness prediction. The proposed approach can automatically learn to generate a population graph with variational edges, in contrast to other methods that manually crafted static affinity population graphs. We demonstrate how this population graph may be optimized along with spectral graph convolutional networks. We also suggest Monte-Carlo edge dropout uncertainty estimates to calculate the prediction uncertainty associated with the built-in graph. The suggested strategy can significantly increase the prediction accuracy for eye disorders, Alzheimer's disease, and Autism Spectrum Disorder, according to experimental results on four multi-modal datasets.

[9] In this work, Convolutional Neural Network s were used to detect crop ailments automatically. We also provided advice and guidelines on how to make the best use of Convolutional Neural Network is used in real-world applications. Many previously published Convolutional Neural Network-based solutions are no longer applicable in the real world, mostly because they don't follow many important machine learning concepts. This lack of conformity may result in inadequate generalization capabilities for unknown data samples and/or imaging conditions, which reduces the utility of the trained models.

[10] In this study is to identify a simple method for detecting 38 distinct kinds of plant illnesses while utilizing the least amount of computer power possible to outperform existing models. For the purpose of identifying and categorizing plant diseases, the VGG16 training model is used. Automatic feature extraction is used by neural network models to help categorize the input picture into the appropriate illness classifications. The average accuracy of our suggested system is 94.8%, demonstrating the viability of the neural network technique even under challenging circumstances.

[11] The proposed model is evaluated using the public UCI heart-disease dataset, which consists of 1050 patients and 14 characteristics. By assembling a set of directly reachable qualities from the heart -disease dataset, we considered this feature vector as input for a Deep Convolutional Neural Network to determine whether an instance belonged to the healthy or cardiac disease class. The effectiveness of the recommended technique was assessed using a variety of performance metrics, including accuracy, precision, recall, and the F1 measure. Our model achieved validation accuracy of around 92%. The results of the trials demonstrate that the recommended method is effective in a real-world situation.

[12] One-dimensional convolutional neural network architecture for heart disease prediction is used in this study. To help in categorization, it also features an embedding layer that transforms the feature vector into a new vector embedding. The recommended concept is implemented as computer software that can help with the accurate and costeffective early diagnosis of heart disease. For the purpose of enhancing the performance of unobserved data, the design takes advantage of overfitting avoidance methods. The performance of 1D Convolutional Neural Network architecture is better when compared to other classification algorithms as Logistic Regression, Naive Bays, Support Vector Machine, Decision Tree, Random Forest, LightGBM, XGBoost, and Artificial Neural Network. The process might be broadened to incorporate additional and more criteria, which will aid in the classification of heart disease more precisely.

[13] In this study, Convolutional Neural Network-UDRP was used to predict illness risk using structured data. To predict cardiac illness, we applied the naive Bayes method, the Support Vector Machine and KNN. Our research reveals that KNN offers a classifier with a 100% Classification Accuracy. The Convolutional Neural Network -UDRP is a superior ML approach for predicting the risk of developing heart disease. Thanks to our input, which included patient reports that allowed us to understand the degree of illness risk prediction, we were able to provide a proper disease risk prediction as an output. There are three levels of heart disease risk predicted: low, medium, and high.

[14] In this study, machine learning techniques are used to the medical industry to address actual health-related problems through the early diagnosis and management of various diseases. This study uses a Convolutional Neural Network-based Instance Segmentation using Machine Method to explain the detection of heart disease. In this study, datasets are analyzed to identify the existence of heart illness using convolutional neural networks and machine learning classification models like Random Forest and Gaussian Nave Bayes. Accuracy, precision, recall, and F1-score were used to evaluate each model's performance.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

[15] In this study, the development of a predictive design for CAD diagnosis is the main topic. Using computational machine learning techniques like Random Forest (RF) and NB, the theory was developed. To assist in the diagnosis process, the study will employ the opensource database Z-Alizadeh Sani. In this case, NB surpassed the other tests in the literature review with 100% sensitivity and 100% negative predictive rate. NB outscored RF with 13 characteristics and 83 percent accuracy. The results obtained advocate the usage of the developed designs as auxiliary software in the therapeutic strategy.

[16] Accurate clinical data analysis is now helpful for both earlier illness identification and patient treatment due to the vast volume of information increase in the biomedical or healthcare domains. Even so, accuracy diminishes when medical data is lacking. Data cleaning and imputation can be used to replace missing values with accurate data to solve the problem of a shortage of medical data. The Naive Bayes and K-Nearest Neighbors algorithms are still being used by the authors to forecast cardiac disease based on the dataset. And suggest expanding this study by using structured data to estimate the probability of contracting a disease. The author uses a convolutional neural network-focused unimodal illness risk prediction model. Forecasting accuracy for the Convolutional Neural Network-UDRP method is greater than 65%.

[17] In this article, they found that while various techniques, from Machine learning algorithms to deep neural networks, had differing degrees of accuracy, they were unable to get satisfactory results for silent heart attack predicting. advocates using RNN from Deep Learning techniques, in particular, to determine the severity of the patient's heart-related disorders in a heart attack forecasting design. Our investigation led the author to make the decision to employ RNN and GRU in order to increase the system's precision and effectiveness in foretelling silent heart attacks and alerting the user as soon as feasible. This plan has increased heart attack forecasting accuracy of around 92 percent and shown to be a reliable source for predicting silent heart attacks.

## III. OBJECTIVE

To build a chest disease detection deep learning model.

## IV. SYSTEM DESIGN

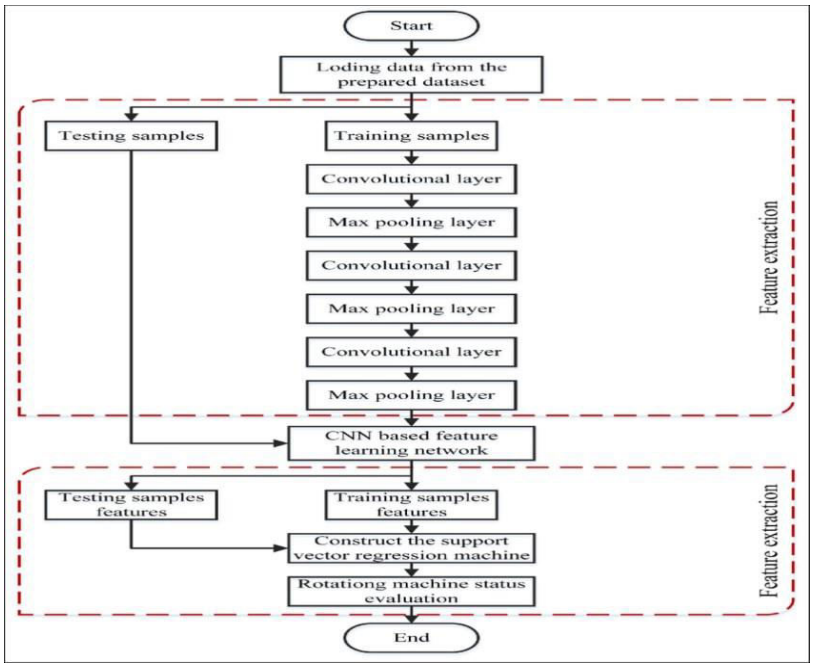


**Fig. 1.** Flowchart of the model

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

## V.METHODOLOGY

### DATA CLEANING AND PREPARATION

This is the first step in any machine learning model. It is the process of preparing the raw data to be appropriate for further processing and analysis . The main steps in data preparation includes collecting, cleaning and validating the data into a suitable form for applying machine learning algorithms

### DATA SPLITTING

The data is split into training, testing and evaluation datasets at this step. In this model 70% of data is used for training the model and 15% of data is used for each testing and validation of the model respectively. DATA VISUALIZATION

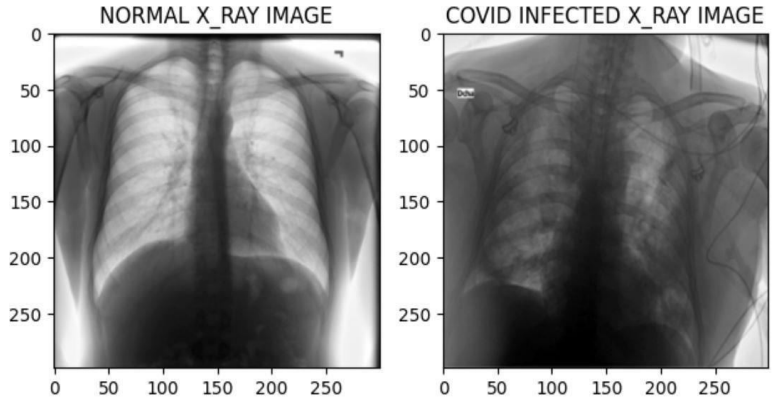


**Fig. 2.** Data visualization.

### BUILDING DEEP LEARNING MODEL

It is the process of creating a deep learning model for extracting useful features from the given training dataset. In this model, tenserflow was used to create the deep learning model. Parameters like Keras Conv2d is used to sum up the results into a single output pixel and MaxPool2D is used for downsample the input along its spatial dimensions.

### IMAGE PREPROCESSING AND AUGMENTATION

In this step all the images are converted into usable format and duplicate images are created using data augmentation technique in order to expand the dataset.

### TRAINING THE MODEL

The model is trained with the preprocessed dataset at this step. Accuracy and Loss Function of both Training and validation datasets are compared at this step and visualized to check the performance of the model.

### MODEL EVALUATION

In this step, the trained model's performance is tested on the Test dataset.

### PREDICTIONS

In this step, the created model is tested on random data and it predicts if the X-ray image is of a healthy or infected person. Precision, Recall, F1 Score, Support and Accuracy are also calculated at this part.

### TRANSFER LEARNING

In this step Transfer Learning is used to improve performance by leveraging the knowledge gained from the above steps

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

## VI. RESULTS

| | loss | accuracy | val_loss | val_accuracy |
|---|---|---|---|---|
| 0 | 2.226697 | 0.738955 | 0.428557 | 0.771015 |
| 1 | 0.454782 | 0.781273 | 0.420760 | 0.799034 |
| 2 | 0.414731 | 0.804863 | 0.363177 | 0.840097 |
| 3 | 0.376084 | 0.826384 | 0.425549 | 0.819324 |
| 4 | 0.360897 | 0.839628 | 0.297383 | 0.871498 |
| 5 | 0.334385 | 0.854009 | 0.300950 | 0.872947 |
| 6 | 0.323355 | 0.858251 | 0.282867 | 0.882126 |
| 7 | 0.292777 | 0.872633 | 0.233655 | 0.901449 |
| 8 | 0.304527 | 0.866529 | 0.216328 | 0.912560 |
| 9 | 0.280348 | 0.876875 | 0.241916 | 0.905797 |
| 10 | 0.274929 | 0.878220 | 0.209703 | 0.919324 |

Fig 3. Loss and Accuracy values

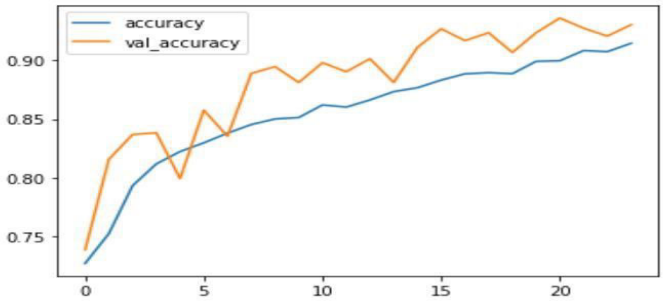


**Fig. 4.** Subplot for the comparison of accuracy and validation accuracy.

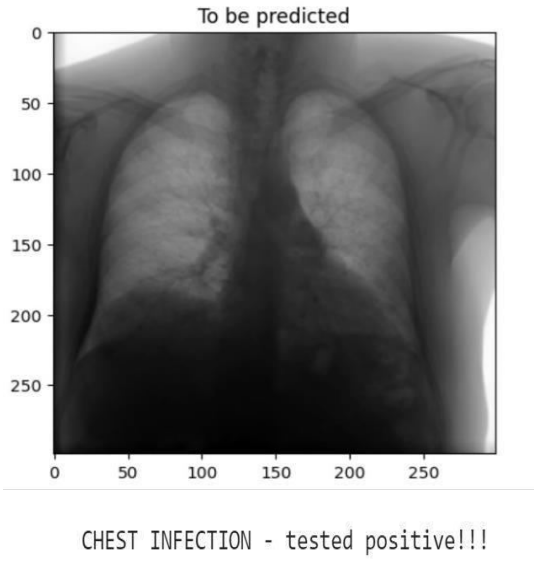


**Fig. 5.** Model prediction result of chest disease infected person.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

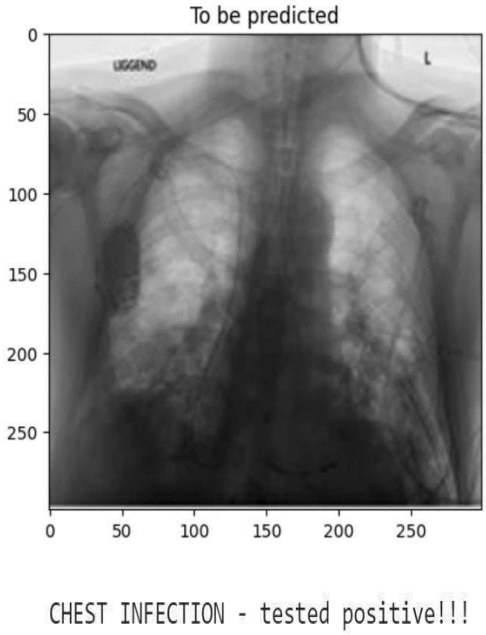


**Fig. 6.** Model prediction result of chest disease infected person.

(chest x-ray abnormalities, such as multifocal and bilateral ground glass opacities and consolidations with a preponderance of the basal and peripheral tissues are observed for the patients with chest infections)

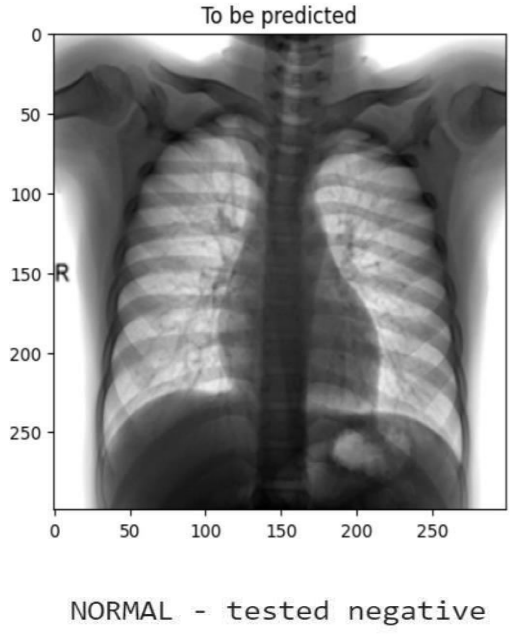


**Fig. 7.** Model prediction result of chest disease infected person.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

```
[[ 487   55]
 [  76 1452]]
              precision    recall  f1-score   support

           0       0.87      0.90      0.88       542
           1       0.96      0.95      0.96      1528

    accuracy                           0.94      2070
   macro avg       0.91      0.92      0.92      2070
weighted avg       0.94      0.94      0.94      2070
```

***We achieved 93% accuracy using the custom CNN model***

**Fig. 8.** Values of machine learning evaluation metrics

## VII. CONCLUSION AND FUTURE WORK

The project described involves the detection of chest diseases from X-ray images using deep learning methods specifically convolutional neural network. Timely diagnosis of chest diseases has important clinical signifi-cance in recovery and reduce mortality rate. The features which are used for the detection of Chest disease are collected from the X-ray images. Back propagation neural network is used for the classification of chest diseases from the X-ray images. The model was trained and tested using the X-ray images of different chest diseases and a lot of experiments were carried out. Manual labelling of training data was not required as it was carried out for the backpropagation networks. The proposed CNN demon-strated high chest disease recognition rates and resulted in an accuracy of 93%.

## REFERENCES

[1] T Rajasenbagam, S Jeyanthi, J Arun Pandian, "Detection of pneumonia infection in lungs from chest X-ray images using deep convolutional neural network and content-based image retrieval techniques", Journal of Ambient Intelligence and Humanized Computing (2021).

[2] Xiaoling Liang, YuexinZhang,Jiahong Wang, Qing Ye,Yanhong Liu and Jinwu Tong "Diagnosis Of Covid-19 Pneumonia Based on Graph Convolutional Network", Front Med Lausanne (2021).

[3] Araya Chatchaiwatkul, PasukPhonsuphee, YurananatulMangalmurti, "Lung Disease Detection and Classification with Deep Learning Approach" https://ieeexplore.ieee.org/document/9501445,published on IEEE (2021).

[4] El Asnaoui, Khalid, Chawki, YounessIdriAli, "Automated Methods for Detection and Classification Pneumonia based on X-Ray Images Using Deep Learning" published on springerlink(2021).

[5] Mazhar Javed Awan,Muhammad Haseeb Bilal, Awais Yasin, Haitham Nobanee,Nabeel Sabir Khan and AzlanMohd Zain. "Detection of COVID-19 in Chest X-ray Images: A Big DataEnabled Deep Learning Approach" PMC - PUBMED (2021).

[6] Issac Neha Margret, Chalumuru Suresh, B.V. Kiranmaye, "Classification of X-ray Images for Pulmonary Diseases Using Deep Learning Techniques" IJISAE (2022).

[7] NatheerKhasawneh, Mohammad Fraiwan, LuayFraiwan, Basheer Khassawneh and Ali Ibnian "Detection of COVID-19 from Chest X-ray Images Using Deep Convolutional Neural Networks" SAGE Journals(2020).

[8] YongxiangHuang,Albert C.S. Chung. "Disease prediction with edge-variational graph convolutional networks", Sciencedirect (2020).

[9] Justine Boulent, Samuel Foucher, Jérôme Théau and Pierre-Luc St-Charles, "Convolutional Neural Networks for the Automatic Identification of Plant Diseases", Front. Plant Sci (2019).

[10] Rinu R, Manjula S H, "Plant Disease Detection and Classification using CNN", IJRTE (2021).

[11] Sadia Arooj, Saifur Rehman, Azhar Imran, Abdullah Almuhaimeed, A. KhuzaimAlzahrani and AbdulkareemAlzah, "A Deep Convolutional Neural Network for the Early Detection of Heart Disease", MDPI (2022).

[12] Shadab Hussain, SusmithBarigidad, Shadab Akhtar, Md Suaib, "Novel Deep Learning Architecture for Heart Disease Prediction using Convolutional Neural Network", OCIT (2022).

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105190 |

[13] V.Archana Reddy, K Venkatesh Sharma, "Heart Disease Classification and Risk Prediction by Using Convolutional Neural Network", IJAS (2021).

[14] N. Venkata Rao, "Detection of Heart Disease Using Convolutional Neural Network Based Instance Segmentation", TURCUMAT (2020).

[15] Sharma V, Rasool A, and Hajela G, "Prediction of Heart disease using DNN", ICIRCA (2020).

[16] SayaliAmbekar, Rashmi Phalnikar, "Disease Risk Prediction by Using Convolutional Neural Network.", IEEE (2018).

Abhay K, Ajay K, Karan S, Maninder P, Y.Hambir, "Heart Attack Prediction Using Deep Learning", IRJET (2018).

INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.379

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details