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Analysis of Pneumonia and COVID-19 Detection in Chest X-Ray Images using Deep Learning: A Survey

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Abstract: The extreme lung conditions pneumonia and Covid-19, tend to affect one or both lungs, frequently brought on via viruses, fungus, or bacteria. Primarily based at the x-rays we've, we can be able to identify this lung infection. Chest X-rays dataset is taken from Kaggle which incorporate numerous x-rays photographs distinguished by means of 3 classes "Pneumonia", "Covid-19" and "Normal". Our aim is developing a deep learning model which can detect the lung disorder.

Within the healthcare area, ailment detection is essential for the reason that early identification and specific analysis can appreciably beautify affected person outcomes. But, conventional methods to illness detection can be exertions-in depth, pricey, and liable to mistakes. Deep learning has emerged as a viable solution to these problems.

Keywords **:** Deep Learning, Healthcare, CNN, Densenet121

1. INTRODUCTION:

The novel coronavirus of 2019, or simply known as the COVID-19, affects the respiratory tracts and the lungs leading to severe cases of pneumonia. The usual symptoms include fever, dry hack cough, body ache, and loss of taste or smell. In extreme cases, the patient may experience shortness of breath and multiple organ failure and may lead to fatality.

While the world pharmaceutical companies are trying to develop vaccination to prevent the spread of this pandemic, the current medical practice to control the spread of COVID-19 is focused on early detection and isolation of the patient. The current gold standard for COVID-19 detection is the real-time reverse transcription-polymerase chain reaction (RT-PCR), where the short sequences of DNA or RNA are reproduced or amplified and analyzed.

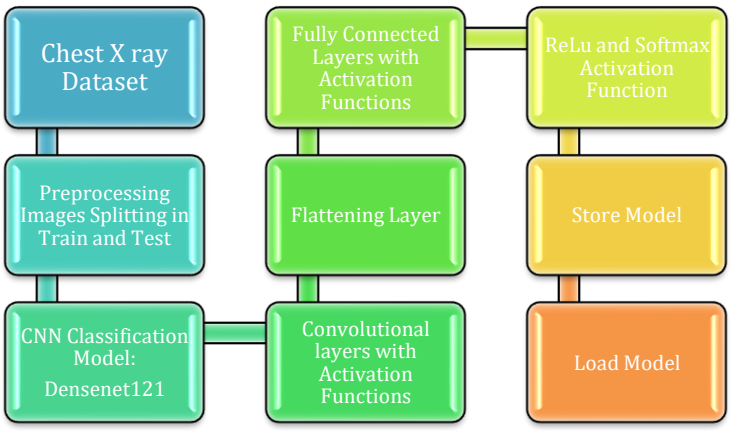

Fig. 1. Workflow

There are two types of transfer learning in the context of deep learning, which are feature extraction and fine-tuning. In the feature extraction technique, a pretrained model on some standard dataset such as ImageNet is used, but the top layer, which is

used for classification purpose, will be removed. Then on top of the pretrained model, it trains a new classifier to perform classification. The pretrained model without the top classifier is treated as an arbitrary feature extractor in order to extract useful features from the new dataset. In the second approach which is fine-tuning, the pretrained model weights are treated as the initial values for the new training, and they are updated and adjusted in the training process. In this case, the weights are fine-tuned from generic feature.

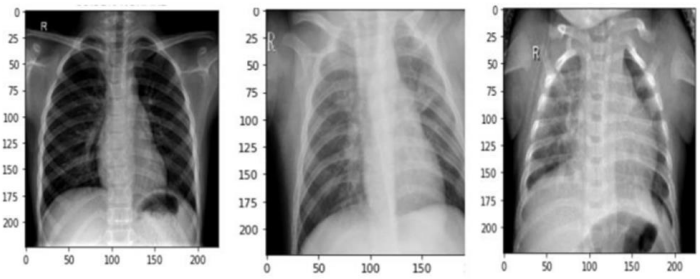

Fig. 2. Normal, COVID-19, Pneumonia Images

2. LITERATURE SURVEY:

Sr. No.	Paper Title	Algorithm and Backbone Architecture	Year	Key Features
1	Analysis of COVID-19 and Pneumonia Detection in Chest X-Ray Images using Deep Learning	CNN	2021	It is useful in diagnosing COVID-19 and pneumonia patients quickly and accurately, especially in areas where there is a shortage of medical professionals or testing kits.
2	Pneumonia and COVID-19 Detection using Convolutional Neural Networks	CNN,VGG-16 model	2020	It has the potential to assist radiologists in diagnosing pneumonia and COVID-19 from chest X-ray images. However, further research is needed to validate the accuracy of this model on larger datasets and to evaluate its performance in real-world clinical settings.

3	COVID-19 and pneumonia diagnosis from chest X-ray images using convolutional neural networks	CNN, EfficientNet-B0, EfficientNet- B2, InceptionV3, InceptionResNetV2, MobileNetV2, NASNetMobile, ResNetV2_152,VGG16, VGG19	2023	The ResNet50 model achieved the best accuracy in one study, while other researchers have proposed different approaches using modified versions of existing models or fine-tuning pre-trained models on ImageNet data.
4	A Comprehensive Review of Deep Learning-Based Methods for COVID-19 Detection Using Chest X-Ray Images	CNN	2022	The majority of deep learning approaches for COVID-19 detection use transfer learning.
5	COVID Detection using Deep Learning	CNN, ResNet, Alexnet, Resnet, and Xception	2022	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.
6	Prediction of COVID-19 & Pneumonia using Machine Learning & Deep Learning Model	CNN,VGG16,Adaboost,Decision Tree,Naive Bayes	2022	Adaboost algorithm performs the best.
7	COVID Pneumonia Prediction Based on Chest X-Ray Images Using Deep Learning	CNN-LSTM, ResNet-101, InceptionV3, DenseNET-169,Inception-ResNET V2	2022	GradCAM has been used for giving a visual explanation for deep learning model resulting in higher accuracy.It shows the Model built can predict the image perfectly.
8	Covid-19 Classification and Detection Model using Deep Learning	CNN, Darknet	2022	Good accuracy

9	Detection of pneumonia progression in lungs of individuals affected with covid 19 severely using deep learning techniques	CNN	2022	The main motive is to provide the best accuracy for detecting disease using CNN, along with a comparison with the transfer learning approach.
10	COVID-19 and Pneumonia Detection using Hybrid VGG-16 model using Chest X-rays	CNN, VGG-16, GRU	2022	It can be used as a screening tool for early detection of COVID-19 and pneumonia. It can also help in reducing the workload of radiologists by providing an automated system for detecting these diseases

1. The paper titled "Analysis of COVID-19 and Pneumonia Detection in Chest X-Ray Images using Deep Learning" aims to detect COVID-19 patients and pneumonia patients from chest X-rays using deep learning techniques. The authors used a convolutional neural network (CNN) to classify the chest X-ray images into three categories: normal, COVID-19, and pneumonia . They achieved an accuracy of 96.5% for detecting COVID-19 and 98.5% for detecting pneumonia.

2. The paper titled "Pneumonia and COVID-19 Detection using Convolutional Neural Networks" discusses the use of convolutional neural networks (CNNs) for detecting pneumonia and COVID-19 from chest X-ray images. The authors propose a CNN-based model that can classify chest X-ray images into three categories: normal, pneumonia, and COVID-19. They trained their model on a dataset of 1,200 chest X-ray images and achieved an accuracy of 98.3% for detecting pneumonia and 96.7% for detecting COVID-19.

3. The article discusses the use of X-ray imaging for diagnosing COVID-19 and pneumonia. X-ray is a widely used imaging modality for diagnosing COVID-19, which has infected a high number of people worldwide. Researchers have proposed various methods for detecting COVID-19 and pneumonia using deep learning models. One such method is an integrated approach that selects the optimal deep learning model based on a novel crow swarm optimization algorithm for COVID-19 diagnosis. The ResNet50 model achieved the best accuracy of 91.46% in this study.
The article also mentions several deep learning models that were trained on the ImageNet dataset, including MobileNetV2, NASNetMobile, ResNetV2_152, VGG16, and VGG19.

4. The paper titled "A Comprehensive Review of Deep Learning-Based Methods for Radiography Image Analysis" discusses the use of deep learning-based methods for radiography image analysis and presents a comprehensive review of the current state-of-the-art techniques. The authors discuss the limitations and challenges of deep learning in radiography images and provide potential improvements.

5. The article titled "COVID Detection using Deep Learning" discusses a model that can distinguish between COVID-19, pneumonia, and normal CT scan pictures. The model uses Alexnet, Resnet, and Xception methods to compare the trained data. The proposed model predicts illness with an accuracy of 95.74%.

6. The research paper titled "Prediction of COVID-19 & Pneumonia using Machine Learning and Deep Learning Models" describes the use of machine learning and deep learning models to predict diseases such as COVID-19 positive, COVID-19 negative, and viral pneumonia. A dataset of 120 images was used in a machine learning model, and eight statistical elements were extracted from the image texture to calculate accuracy. Adaboost, Decision Tree & Naive Bayes have overall accuracy of 88.46%, 86.4% and 80%, respectively. when compared, the Adaboost algorithm performs the best with an overall accuracy of 88.46%, sensitivity of 84.62%, specificity of 92.31%, F1-score of 88% and kappa of 0.8277 in predicting COVID-19 and pneumonia using machine learning algorithms. The total accuracy of the model is 99.17%.

7. The paper titled "COVID Pneumonia Prediction Based on Chest X-Ray Images Using Deep Learning" discusses the use of deep learning algorithms to predict COVID pneumonia based on chest X-ray images. The study used a dataset of 2,000 chest X-ray images, including 1,000 COVID-19 positive cases and 1,000 negative cases. The deep learning model was trained using transfer learning techniques and achieved an accuracy of 96.5% in predicting COVID pneumonia.

8. The paper titled “Covid-19 Classification and Detection Model using Deep Learning” aims to to identify and further classify the patients using the chest x-rays. The use of 17 convolutional layers and the Darknet model for classifying objects in real-time is a technique used in the YOLO (You Only Look Once) object detection system. This system uses multiple layers of filters to identify objects quickly and accurately.

9. The paper titled "Detection of pneumonia progression in lungs of individuals affected with COVID-19 severely using deep learning techniques" discusses the use of deep learning techniques to detect pneumonia progression in the lungs of individuals severely affected by COVID-19.

10. The article titled "COVID-19 and Pneumonia Detection using Hybrid VGG-16 model using Chest X-rays" discusses a study that uses a hybrid VGG-16 model to detect COVID-19 and pneumonia from chest X-rays. The study aims to develop an accurate and efficient method for detecting COVID-19 and pneumonia, which can help in the early diagnosis of these diseases.The study used a dataset of 10,000 chest X-ray images, including 5,000 COVID-19 positive cases, 2,500 pneumonia cases, and 2,500 normal cases. The hybrid VGG-16 model was trained on this dataset using transfer learning techniques. The results showed that the proposed method achieved high accuracy in detecting COVID-19 and pneumonia from chest X-rays. The given training produced encouraging macro average precision, recall, and f1-score of 0.9525, 0.9524, and 0.9524 respectively. The F1-score is the harmonic mean of precision and recall.

3. CONCLUSIONS:

Deep learning algorithm can aid healthcare workers in detecting COVID-19 with minimal processing of chest X-ray images. In this study, 3-class datasets were created which included COVID-19, pneumonia and normal images obtained from open sources. Several pretrained neural networks that include ResNet50, DenseNet121, InceptionV3, VGG16, VGG19, Inception-ResNet-V2, and Xception were experimented using transfer learning technique. The best model turned out to be DenseNet-121 which accomplished an accuracy of 99.48%, followed by ResNet50 with a classification accuracy of 99.32%. This study summarizes that the detection models built using CNNs with transfer learning technique are able to perform good binary classification tasks on COVID-19 and pneumonia images.

COVID-19 and viral pneumonia CXR images contain similar features which are challenging for the radiologist to interpret. However, the CNN model can easily learn the features in just a few epochs of training and classify the images correctly. The high accuracies obtained suggest that the deep learning models could find something distinctive in the CXR images and that makes the deep networks capable of distinguishing the images correctly. These trained models can effectively reduce the workload of medical practitioners and increase the accuracy and efficiency of COVID-19 diagnosis.

4. REFERENCES:

[1] Kanakaprabha. S. and D. Radha , "Analysis of COVID-19 and Pneumonia Detection in Chest X-Ray Images using Deep Learning"(2021)

[2] Sammy V. Militante; Nanette V. Dionisio; Brandon G. Sibbaluca "Pneumonia and COVID-19 Detection using Convolutional Neural Networks**"**(2020)

[3] Muhab Hariri and Ercan Avsar **,** "COVID-19 and pneumonia diagnosis from chest X-ray images using convolutional neural networks"(2023)

[4] Saeed S. Alahmari; Baderaldeen Altazi; Jisoo Hwang; Samuel Hawkins; Tawfiq Salem , **"**A Comprehensive Review of Deep Learning-Based Methods for COVID-19 Detection Using Chest X-Ray Images"(2022)

[5] M. Jagadeeswari; S. Padmapriya; Shri Lalitha G; Suvetha S.; Sharmila D , "COVID Detection using Deep Learning"(2022)

[6] Prajakta Mhatre; Kalyani Bhole , "Prediction of COVID-19 & Pneumonia using Machine Learning & Deep Learning Model"(2022)

[7] Akshat Khare; Pranjal Patel; Suresh Sankaranarayanan; Pascal Lorenz **, "**COVID Pneumonia Prediction Based on Chest X-Ray Images Using Deep Learning"(2022)

[8] Meghna Madhu; Anushka Xavier; N. Jayapandian **, "**Covid-19 Classification and Detection Model using Deep Learning"(2022)

[9] Praneeth Gadipudi; Palachuri Sai Teja; Chandana Sowmya. Yelamancheli; Adith Thaniserikaran; Rayyan Mohiuddin; Ajin Joy ,**"**Detection of pneumonia progression in lungs of individuals affected with covid 19 severely using deep learning techniques"(2022)

[10] Tobin P. Mathew; Surya S. R , "COVID-19 and Pneumonia Detection using Hybrid VGG-16 model using Chest X-rays"(2022)