PRIMITIVE DIAGNOSIS OF RESPIRATORY DISEASES

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1.ABSTRACT

Nowadays for identifying or predicting any diseases on human beings, we should have a proper diagnosis for predicting the disease which is present in that human body. In general, for prediction of diseases we try to use either X-ray, CT or MRI scan techniques for taking decisions on that appropriate disease. In general medical people need complete knowledge on that appropriate domain to find out the abnormality which is present in human beings. As we all know that India tops the world for having more deaths due to lung diseases. After the second highest cause of deaths in India due to heart disease, this lung disease is one which is increasing its rank more and more. In order to reduce that problem early diagnosis and treatment of lung diseases is critical to prevent complications including death. Normally for finding the abnormality present in lungs, lung X-ray is playing a very important role to detect the complete information about the lungs. In this project we try to present an effective way for expert diagnosis of lung diseases using deep learning models.This will especially benefit rural areas where continuous medication is not easily available.We conclude by discussing research obstacles, emerging trends, and possible future directions for improving some more advancement.

2.INTRODUCTION

2.1 GENERAL BACKGROUND

The chest is the most important part of the body as it contains the respiration organs, which are responsible for sustaining the important life functions of the body. The count of people being diagnosed with a chest disease globally is in millions. Chest X-rays are considered to be one of the most cost-effective medical image examinations available. The one who specializes in diagnosing diseases using X-rays is Radiologists. To discover possible diseases in the lungs the radiologists spend a lot of time diagnosing chest X-ray images. The knowledge of anatomical principles, physiology and pathology, and also keen analysis are needed for diagnosing X-rays. Developing a system for analyzing chest X-ray could make a huge impact on the radiologists. A chest X-ray produces a black-and-white image of the organs in the chest. Tissues like lungs which consist of air appear as black and bones like dense tissues absorb X-rays that appear white in images. The gray appears as tissues. Some of the diseases that are diagnosed using chest x-ray images are heart diseases, pneumothorax, bronchitis, fractures, etc.

However, reading X ray images can be tricky and requires domain expertise and experience.An approach of deep learning is used to train an AI algorithm that analyzes chest X ray images and detects the lung disease whether it is pneumonia or Tuberculosis or Normal. Deep Learning techniques like Convolutional Neural Networks(CNNs), have been successfully employed for image classification in a broad range of medical applications (e.g. for pathology detection in X-ray images). CNNs are very similar to normal Neural Networks (NNs). They are made up of neurons with their weights and biases. Each neuron receives inputs, which outperforms a dot product followed by non-linearity. The loss function (Sigmoid) is included in the last layer. These are done at image analysis which is designed to process 2D inputs. It is also used to learn, to detect spatial patterns in the training data and uses it to make predictions on testing data. A model which can predict diseases based on X-rays will provide a reasonable check to help achieve higher accurate diagnoses.The network is trained on a large-scale dataset of 3600 X-ray images in order to predict lung diseases.

2.2 OBJECTIVE OF THE PROJECT

Objective is to predict respiratory diseases from chest X-ray images using Deep Learning Algorithms like Convolution Neural Network.

2.3 SCOPE OF THE PROJECT

Respiratory diseases are one of the leading causes of death. The scope of this project is to assist the radiologists by minimizing the time for diagnosing the X rays.The inherent modeling and efficient predictive capabilities of Respiratory disease prediction system is explored to assist medical researchers in their effort to evaluate and predict risk of lung diseases.The model is implemented using deep learning which uses CNN for classification.

a b c

Figure 1.1: (a) shows Normal (b) shows Pneumonia and (c) shows Tuberculosis

3.LITERATURE SURVEY

3.1 Transfer Learning with Deep Convolutional Neural Network (CNN) for Pneumonia Detection using Chest X-ray. AUTHOR: Rahman, T.; Chowdhury, M.E.; Khandakar, A.; Islam, K.R.; Islam, K.F.; Mahbub, Z.B.; Kadir, M.A.; Kashem, S. YEAR OF PUBLICATION: 2018 This study presents a deep-CNN-based transfer learning approach for the automatic detection of pneumonia and its classes. Four different popular CNN-based deep learning algorithms were trained and tested for classifying normal and pneumonia patients using chest x-ray images.

3.2 Diagnosis of pneumonia from chest x-ray images using deep learning.AUTHOR: Ayan, E.; Ünver, H.M. YEAR OF PUBLICATION :2019 computer-aided diagnosis systems are needed to guide the clinicians. In this study, we used two well-known convolutional neural network models Xception and Vgg16 for diagnosing pneumonia.

3.3 Applying multi-cnns model for detecting abnormal problems on chest x-ray images. Proceedings of the 10th International Conference on Knowledge and Systems Engineering (KSE) AUTHOR: Nguyen, K.P.; Son, T.H.; Le, T.H.; Tuan, L.; Nguyen, T.T. 10 YEAR OF PUBLICATION: 2018 Each component of the Multi-CNN is a convolutional neural network that is developed base on the ConvnetJS library. The output of the proposed model is Normal/Abnormal density.

3.4 Automatic detection of lung nodules in computed tomography images: training and validation of algorithms using public research databases. AUTHOR: Camarlinghi N., YEAR OF PUBLICATION :2018 Lung Cancer is the most fast growing cancer around the world and is mostly diagnosed at an advanced stage. Due to enhancement in medical imaging modalities like Computed Tomography (CT) scans there is a need for computer aided detection system to classify the lung nodule into benign and malignant type with maximum accuracy

3.5 “Lung nodule classification on computed tomography images using deep learning,” Wireless Personal Communications AUTHOR: Naik and D. R. Edla, YEAR OF PUBLICATION: 2016 this survey also presents challenges and opportunities in classifying lung nodules by using advanced deep learning strategies. The paper concludes with the need to address new issues in nodule classification with an aim to detect the malignant lesion at an early stage.

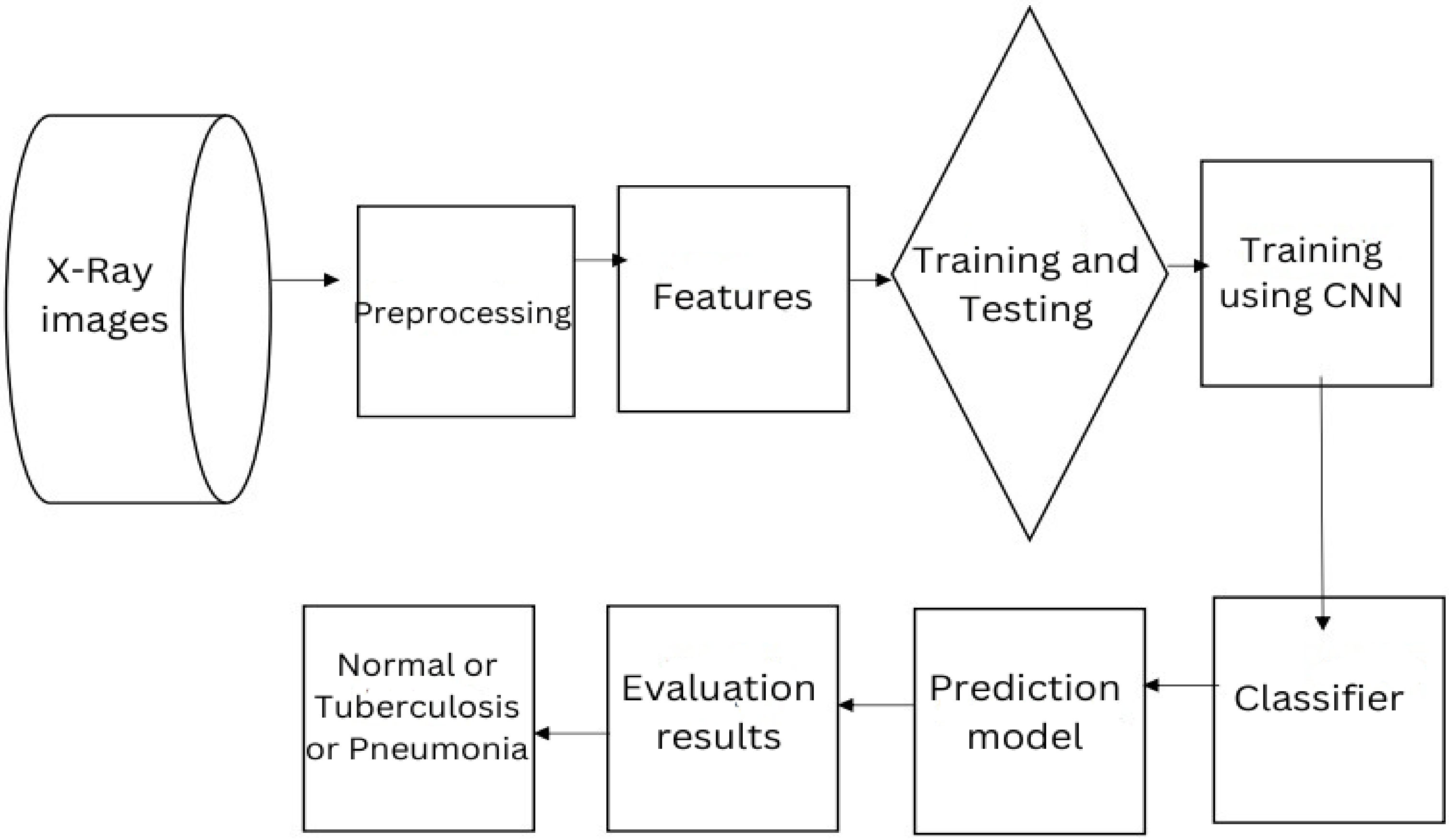
4.PROPOSED METHODOLOGY

4.1 DATASET DESCRIPTION

The dataset used is amassed by the NIH (National Institutes of Health - Clinical Center). It comprises chest X-ray images of 5860 from 1356 unique patients. The dataset is available from open source. 3600 of images are used here. Each image in the dataset is labeled with Pneumonia and Tuberculosis and Normal. The deep learning model uses 224x224 resolution and normalizes the data subsequently. Each pixel has zero mean and approximately unit variance and downsampled in the neural net to predict disease as either Pneumonia or Tuberculosis or Normal. The below fig shows the example of the input image.

Figure 3.1: Example of Lung X-ray image as input

4.2 WORKFLOW



In this proposed work we try to design a model which can be used for prediction of lung cancer from real world chest x-ray images. For training the system we try to collect the sample chest X-ray images from KAGGLE website and then train the system. Once the system is trained now we can check the model performance by giving dynamic images and check the performance of each and every individual Model. Using Deep Learning to predict lung diseases from Chest X-rays can be a lifesaving factor for an individual suffering from the disease. This is possible as the results can be predicted with a high percentage of accuracy instantly. This project presents an effective way for expert diagnosis of lung diseases using Deep Learning. It focuses on creating a system for assistance of Radiologists in detection of lung diseases. This will especially benefit rural areas where radiologists aren't easily available.

4.3 ADVANTAGES OF THE PROPOSED SYSTEM

1. The proposed scheme is very accurate in classification of check x–ray images
2. The proposed system gives accurate recommendations for the doctors.
3. The proposed system is capable of classification of chest x-ray and finding out the accuracy of images.

4.4 MODEL DESCRIPTION

In this section we try to discuss the proposed CNN model which is used to detect chest disease using pre-trained CNN models.
The Application is mainly divided into 4 modules.They are as follows:

1. Convolution Layer
2. Rectified Linear Unit (RELU) Layer
3. Pooling Layer
4. Fully Connected layer

A) CONVOLUTION LAYER

A convolution is defined as an operation on two functions. In image analysis, one function consists of input values (e.g. pixel values) at a position in the image, and the second function is a filter (or kernel) each can be represented as an array of numbers. Computing the dot product between the two functions gives an output. The filter is then shifted to the next position in the image as defined by the stride length. The computation is repeated until the entire image is covered, producing a feature (or activation) map. This is a map of where the filter is strongly activated and ‘sees’ a feature such as a straight line, a dot, or a curved edge. If a photograph of a face was fed into a CNN, initially low-level features such as lines and edges are discovered by the filters. These build up to progressively higher features in subsequent layers, such as a nose, eye or ear, as the feature maps become inputs for the next layer in the CNN architecture.

B) RECTIFIED LINEAR UNIT (RELU) LAYER

The RELU layer is an activation function that sets negative input values to zero. This simplifies and accelerates calculations and training, and helps to avoid the vanishing gradient problem. Mathematically it is defined as: $f(x) = \max(0, x)$. Where x is the input to the neuron. Other activation functions include the sigmoid, tanh, leaky RELUs, Randomized RELUs and parametric RELUs.

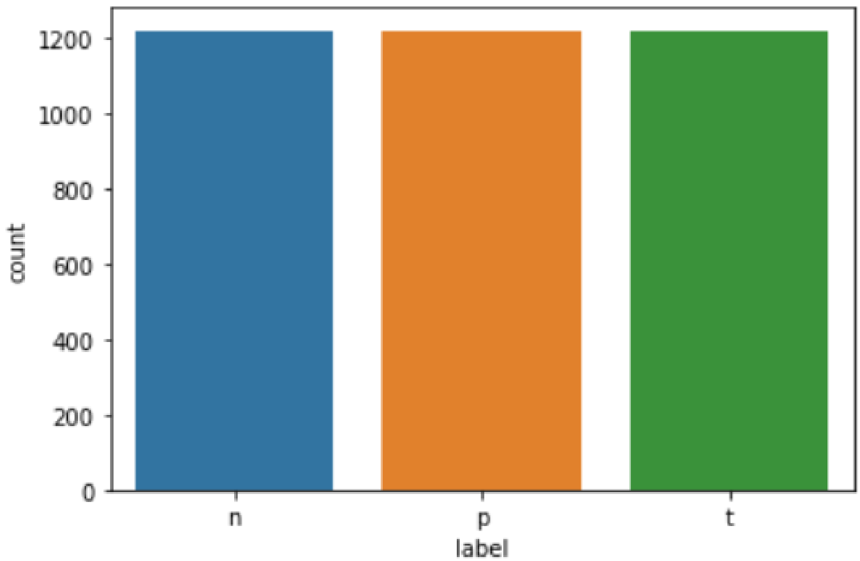
C) POOLING LAYER

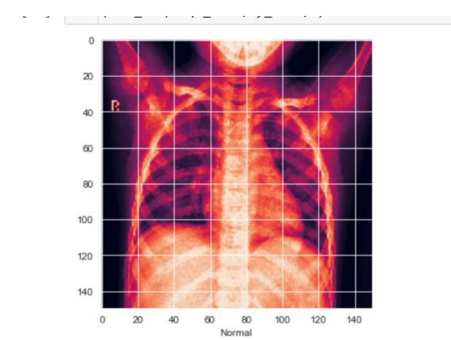
The Pooling layer is inserted between the Convolution and RELU layers to reduce the number of parameters to be calculated, as well as the size of the image (width and height, but not depth). Max-pooling is most commonly used; other pooling layers include Average pooling and L2-normalization pooling. Maxpooling simply takes the largest input value within a filter and discards the other values; effectively it summarizes the strongest activations over a neighborhood. The rationale is that the relative location of a strongly activated feature to another is more important than its exact location.

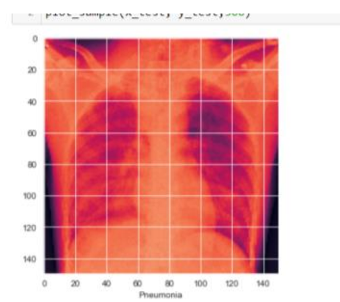
D) FULLY CONNECTED LAYER

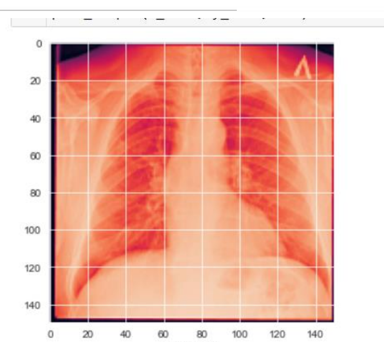
The final layer in a CNN is the Fully Connected Layer, meaning that every neuron in the preceding layer is connected to every neuron in the Fully Connected Layer. Like the convolution, RELU and pooling layers, there can be 1 or more fully connected layers depending on the level of feature abstraction desired. This layer takes the output from the preceding layer (Convolution, RELU or Pooling) as its input, and computes a probability score for classification into the different available classes. In essence, this layer looks at the combination of the most strongly activated features that would indicate the image belongs to a particular class. For example, on histology glass slides, cancer cells have a high DNA to cytoplasm ratio compared to normal cells.

5.RESULTS









6.CONCLUSION

In conclusion, our project successfully utilized deep learning techniques, specifically Convolutional Neural Networks (CNNs), to classify respiratory diseases from chest X-ray images. By training the CNN model on a dataset containing images of normal, pneumonia, and tuberculosis cases, we achieved significant accuracy in disease detection.The CNN architecture, implemented using Keras, proved effective in learning intricate patterns within the X-ray images, enabling precise classification of different respiratory conditions. Through multiple epochs of training and validation, we observed improvements in model accuracy and loss, indicating the robustness of our approach.While our project focused solely on deep learning methodologies for disease diagnosis, there exists potential for further advancements. Integration with additional data sources, such as patient metadata or clinical history, could enhance the model's predictive capabilities. Moreover, deploying the trained model in real-world healthcare settings would require rigorous validation and collaboration with medical professionals.Overall, our project demonstrates the utility of deep learning in medical image analysis and lays the groundwork for future research aimed at improving early detection and treatment of respiratory diseases through advanced machine learning techniques.

7.REFERENCES

[1] Rahman, T.; Chowdhury, M.E.; Khandakar, A.; Islam, K.R.; Islam, K.F.; Mahbub, Z.B.; Kadir, M.A.; Kashem, S. Transfer Learning with Deep Convolutional Neural Network (CNN) for Pneumonia Detection using Chest X-ray. Appl. Sci. 2020, 10, 3233. [Google Scholar] [CrossRef]

[2] Ayan, E.; Ünver, H.M. Diagnosis of pneumonia from chest x-ray images using deep learning. In Proceedings of the Scientific Meeting on Electrical-Electronics Biomedical Engineering and Computer Science (EBBT), Istanbul, Turkey, 24–26 April 2019; Volume 7, pp. 1–5. [Google Scholar]

[3] Nguyen, K.P.; Son, T.H.; Le, T.H.; Tuan, L.; Nguyen, T.T. Applying multi-cnns model for detecting abnormal problems on chest x-ray images. Proceedings of the 10th International Conference on Knowledge and Systems Engineering (KSE), Ho Chi Minh City, Vietnam, 1–3 November 2018; pp. 300–305. [Google Scholar]

[4] Camarlinghi N. Automatic detection of lung nodules in computed tomography images: training and validation of algorithms using public research databases. Eur Phys J Plus 2013; 128(9): 110

[5] . Naik and D. R. Edla, “Lung nodule classification on computed tomography images using deep learning,” Wireless Personal Communications, vol. 116, pp. 655–690, 2021. View at: Publisher Site | Google Scholar

[6] Lung Cancer Detection and classification Pratik Dubal, Sankirtan Bhatt, Chaitanya Joglekar, Dr. Sonali Patil, Department of Information Technology K. J. Somaiya College of Engineering Vidyavihar,Year-2017.