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Use of Chest X-Rays in Predicting Pneumonia

Dr. V Venkata Ramana[1], Dr. V Lokeswara Reddy[2] Dr K Sreenivasa Rao[3], M Ramanjeneya Reddy[4]

[1,2,3,4]Professor, Department of CSE, K.S.R.M College of Engineering(A), Kadapa

Abstract

Pneumonia is a fatal infection that affects one or both lungs in humans and is often caused by Streptococcus pneumonia. The aim of the current study was to examine risk factors for death from pneumonia in young children. Therefore, implementing an autonomous pneumonia detection system would be beneficial, especially in remote areas, as it could save many lives and help prevent, treat and control the disease.

In this paper, different models like KNN, Random Forest, Decision Tree and CNN were trained from 5856 dataset images at 64 x 64 pixel resolutions. As KNN, Random Forest and Decision Tree are traditional models with around 70-80% accuracy, which are used widely, we intend to use CNN and hope to increase the efficiency to detect the pneumonia from the pictures. Statistical results show that the trained model was able to detect pneumonia by examining chest X-ray images.

Keywords: CNN (convolutional neural network), Random Forest, Decision Tree, KNN (K nearest neighbour).

LITERATURE SURVEY

[1].Rohit Kundu, Pnuemonia detection in chest x-rays using ensemble deep learning models, deep learning models.
[2].Dejun Zhang, Pneumonia Detection from Chest X-ray Images Based on Convolutional Neural Network,specialized on CNN classification.
[3].Dimpy Varshini, Pneumonia detection using CNN based feature extraction.
[4].Keval Shah, Pneumonia Detection using x-ray,based on CNN model.

I. INTRODUCTION

Pneumonia accounts for her one in three deaths in Asia, according to the World Health Organization. An experienced radiation oncologist should evaluate chest x-rays used to diagnose pneumonia.

Convolutional Neural Networks (CNNs) have gained a lot of attention in disease classification due to the success of deep learning algorithms in interpreting medical images. Moreover, features discovered by CNN models pre-trained on large datasets are of great value

for image classification applications. In this article, we evaluate the performance of a pre-trained CNN model used as a feature extractor, followed by severclassifiers for classifying abnormal and normal chest radiographs to do. Use analytics to identify the best CNN model for the job. Statistical results show that using pre-trained CNN models in combination with supervised classification algorithms can be very advantageous in evaluating chest radiographs, especial Pneumonia is a contagious, fatal respiratory disease caused by bacteria, fungi, or viruses infecting fluid- or pus-filled human lungs. A chest x-ray is the usual method of diagnosing pneumonia, and a medical professional is required to evaluate the results of the x-ray cause and diagnosing these diseases can take time, and hospitals need good radiologists, which our country can't afford need to do it.

The advent of computer technology has enabled the development of automated systems to detect pneumonia and treat the disease, especially when patients are remote and medical care is limited. This study intends to include deep learning techniques to mitigate the problem. Convolutional neural networks are optimized to perform the complex task of detecting diseases such as pneumonia, helping medical professionals diagnose and potentially treat the disease. The authors developed several models to determine the best model for detecting pneumonia with the most accurate results.

Medical staff will examine the patient's chest x-ray to determine if he or she has pneumonia. In addition, the usual way to detect pneumonia is through the patient's medical history and laboratory results. Chest x-rays are penetrated by x-rays, producing darker colours in soft tissues and lighter colours in hard tissues such as bone. In patients diagnosed with pneumonia, X-rays appear brighter, indicating signs of fluid filling the air sacs of the lungs in the chest cavity. You may see multiple abnormalities in the lung spaces, as bright colours can represent cancer cells, swollen blood vessels, and heart abnormalities. A chest X-ray is the best way to verify the area and location of infected areas in the lungs. These methods can lead to inaccurate occurrence of disease, which can be mistaken for another disease. The company is therefore pleased with the improved processing in remote medical settings for pneumonia detection. Researchers were able to train and evaluate the performance of a CNN model and use different classifiers to classify chest x-rays as normal or diseased. Recent developments have made it one of the most important research areas in artificial intelligence .The important features of the image are valuable when using machine learning techniques in this system compared to traditional hand-crafted features that have limitations in extracting important features. Progress towards a smarter future is now productive across generations. Today, this technological advance has brought another step forward in human intelligence. Deep learning has acquired the ability to simulate the functioning of the human brain. Recommend a solution to solve the real problem. Deep learning using convolutional neural networks has the ability to preserve important properties in image classification tasks, yielding medically promising results in image analysis. An advantage of CNNs is that they help identify some features from an image and use these features to generate probabilities in classifying a given input. The contribution of this research is the development of an optimized CNN deep learning model that can efficiently detect and classify pneumonia diseases. This work consists of optimized CNN models and experimental analysis of each model for the detection and classification of pneumonia diseases.

II. RELATED WORK

VGGA chest x-ray is not sufficient to make an accurate diagnosis. Pneumonia attempted to develop one in this study Algorithms That Can Detect Chest Disease research; they used many existing CNN models. Different classifiers for classifying abnormal and normal chest x-ray, these models extract the information from Using image datasets and feature selection Algorithms to Reduce Deep Features Using ML classifier and ML classifier, DT, LDA, linear regression, they are getting the good results that using ML algorithms provides better results. Here, the classic developed by this deep learning network VGG16. This method of CNN models for diagnosing pneumonia.

A ConvNet is another name for a convolutional neural network, which is a type of artificial neural network. An input layer, an output layer, and many hidden layers make up a convolutional neural network. One of the top computer vision models to date is the CNN (Convolutional Neural Network) variant known as VGG16. This model's developers analyzed the networks and enhanced the depth using an architecture with exceptionally small (3X3) convolution filters, which showed a significant improvement on the prior-art configurations.

The data pretreatment and data augmentation module of the Keras deep learning package is called Keras Preprocessing. It offers tools for interacting with picture, text, and sequence data.

We consider the pre-trained network as an arbitrary feature extractor when executing deep learning feature extraction, allowing the input picture to propagate forward, terminating at a pre-specified layer, and using the outputs of that layer as our features.

By doing this, we may continue to use the powerful, discriminative properties that the CNN has learnt. They can also be used to identify subjects that CNN was not instructed on!

III. METHODOLOGY

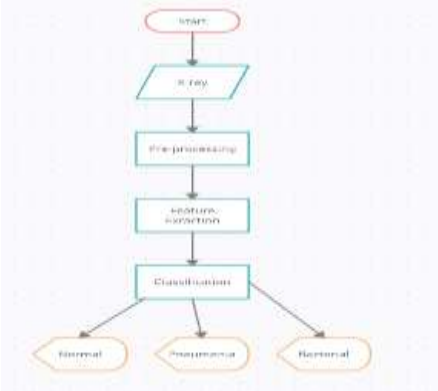

Fig 3.1 Architectural flow

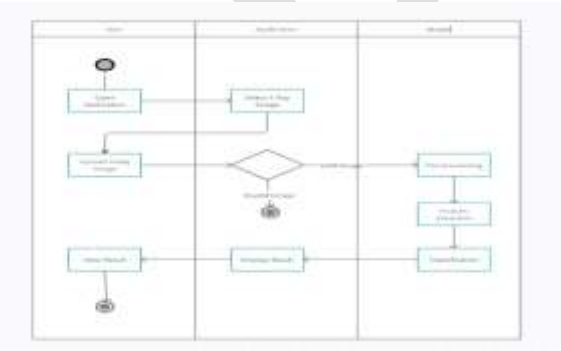

Fig 3.2 Block Diagram of model

IV. IMPLEMENTATION

This section contains a thorough account of the experiment and procedures used to test the effectiveness of the suggested approach. On the frontal view chest X-ray images, experiments are carried out. MATLAB software is used to conduct each experiment on a regular PC.

Sample images of normal and pneumonia case are shown in Fig. 1 and Fig. 2, respectively. The Fig. 3 represents the workflow of the proposed framework.

Dataset

Fig 4.1 Dataset

The dataset is divided into the following 3 folders: train, test, and val. Each image category (Pneumonia/Normal) has its own subfolder within the dataset. There are 2 categories (Pneumonia/Normal) and 5,863 X-Ray images in JPEG format

From retrospective cohorts of children patients aged one to five at the Guangzhou Women and Children's Medical Centre in Guangzhou, chest X-ray images (anterior-posterior) were chosen. All chests X-ray imaging was done as part of the regular clinical treatment provided to patients.

For the analysis of chest x-ray images, all chest radio-graphs were initially screened for quality control by removing all low quality or unreadable scans. Before the diagnosis for the photos could be used to train the AI system, they were graded by two experienced doctors. The evaluation set was also examined to adjust for any grading issues.

Labels	Training	Testing	Validation
Normal	1341	234	8
Pneumonia	3875	390	8
Total	5216	624	16

Table 1 Dataset distribution.

Pre-processing and feature Extraction

Pre-processing is essential for enhancing image clarity and removing noise and other defects in order to enable meaningful analysis. There is a need for data cleaning methods to remove noisy and missing data for the original.

The standardisation of a dataset is a typical condition for many machine learning estimators since they could behave poorly if the individual features do not more or less resemble standard normally distributed data (e.g. Gaussian with 0 mean and unit variance).

Being able to visualise your data is useful for many machine learning applications. It is not difficult to visualise data in two or three dimensions. The Iris dataset, which was used in this part of the lesson, is, however, only four dimensional. By using PCA, you may reduce the four-dimensional data into two or three dimensions.

You must scale the features in your data before performing PCA because scale has an effect on PCA. For the best performance of many machine learning algorithms, normalize the dataset's characteristics onto unit scale (mean = 0 and variance = 1) using Standard Scaler.

Algorithms Used.

In addition to using Python as a programming language, Kaggle for data services, Tensorflow for machine learning models, Keras for high level APIs, and Sklearn for data administration, we also use these tools. Colab for Google is used for quick GPU processing, and Matplotlib is used for data visualisation. Under the GNU licence, all the tools are open source and are free to use. This is available in a public software repository.

Decision Tree, Random Forest, KNN and CNN models are selected for classification.

Random Forest

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The Random Forest is a supervised machine learning algorithm composed of individual decision trees. It is based on the principle of the wisdom of crowds, which states that a joint decision of many uncorrelated components is better than the decision of a single component.

KNN

It is an classification and Regression algorithm which is also called as lazy algorithm. This simple class prediction gives rise to machines that differentiate between cats and dogs, and more sophisticated ones that identify diseases from X Rays and MRI scans!

Decision Tree

The supervised learning method includes the well-known machine learning algorithm Random Forest. It can be applied to ML Classification and Regression issues. Its foundation is the idea of ensemble learning, which is the process of mixing various classifiers to solve a challenging problem and enhance the performance of the model.

CNN

A Convolutional Neural Network (ConvNet/CNN)is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a Conv Net is much lower as compared to other classification algorithms.

V. RESULTS AND ACCURACY.

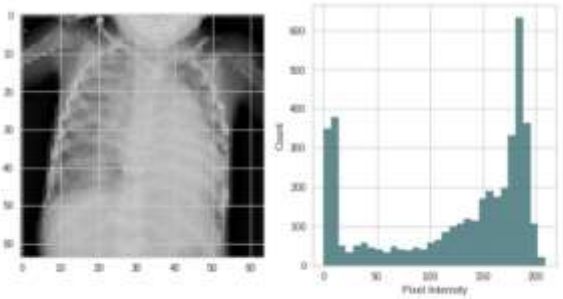

Fig 5.1 Pixel Intensity

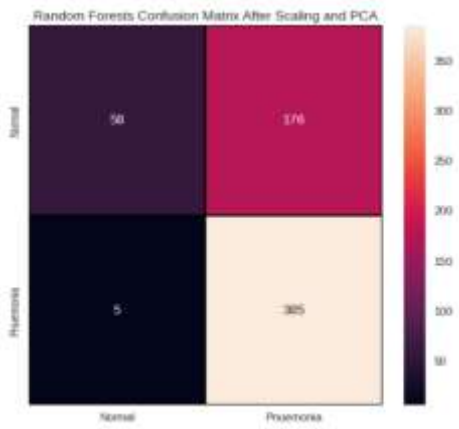

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Fig 5.2 Confusion matrix of Random Forest

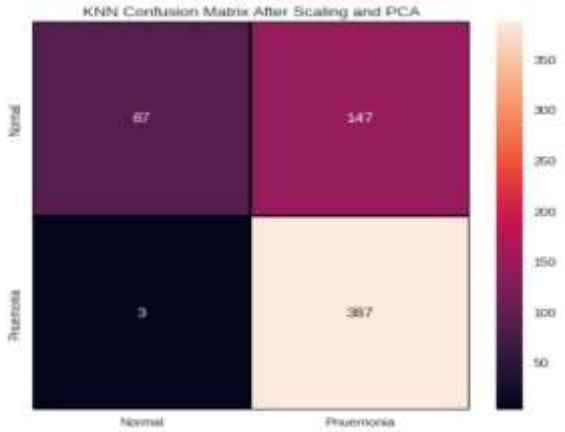

Fig 5.3 Confusion matrix of KNN

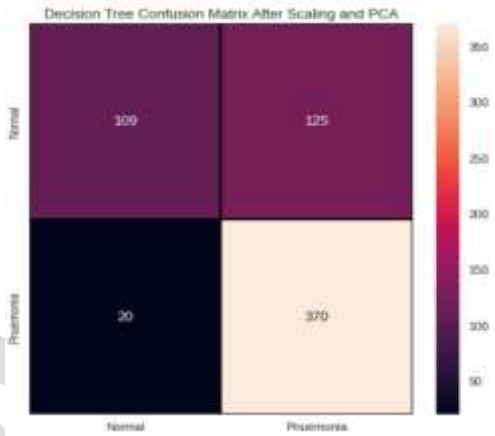

Fig 5.4 Confusion matrix of Decision Tree

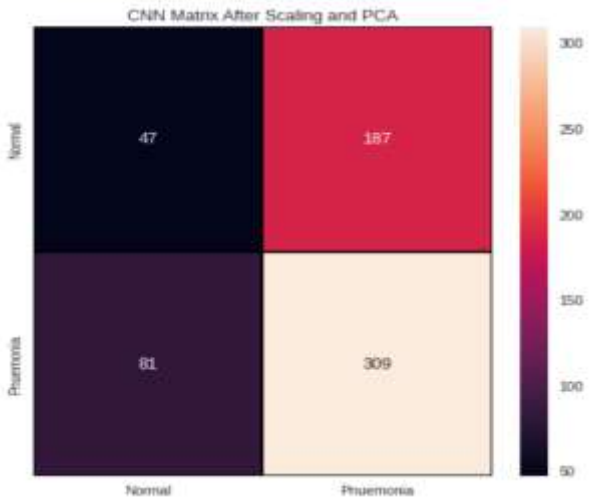

Fig 5.5 Confusion matrix of CNN

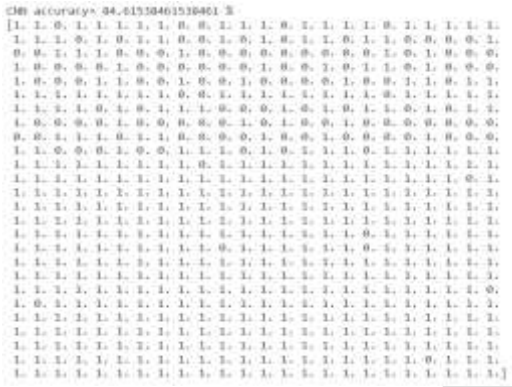

Fig 5.6 Predicted values of CNN

S.NO	Algorithm	Accuracy
1	Random Forest	71.6%
2	KNN	75.9%
3	Decision Tree	76.4%
4	CNN	84.6%

Table 2 Accuracy Table

VI. CONCLUSION

This system is being used in order to decrease the time complexity and extend the working of CNN model. This system demonstrates improved algorithmic usage and demonstrates strength in accurately identifying pneumonia. The outcome demonstrates the system's ability to handle variations in the lungs colour and positions of darker tissues. We can say that we made a difference from other models. The whole project is implemented using the python programming language.

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