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A Survey on Pneumonia Detection Using Machine Learning

Ms. V.M. Dilpak [1], Prof. Anjali S. khandagale[2], Mr. Yogesh Jadhav[3], Ms. Sakshi Kashid [4], Mr. Amit Ankalgikar[5], Ms. Dhanshri Kakade[6]

Lecturer, Department of Information Technology, AISSMS's Polytechnic, Pune, Maharashtra, India1

HOD, Department of Information Technology, AISSMS's Polytechnic, Pune, Maharashtra, India[2]

Student, Department of Information Technology, AISSMS's Polytechnic, Pune, Maharashtra, India[3,4,5,6]

ABSTRACT: Chest X-ray images are extremely difficult to interpret because they are produced using a projection imaging modality. This is large because anatomical structure and disease are closely intertwined. A large number of chest X-rays help radiologists develop their knowledge and diagnostic abilities after they have mastered the principles of chest X-ray analysis. Droplets fill the lungs and make breathing difficult as a result of pericardial effusion caused by pneumonia. Pneumonia can be treated more effectively and with a higher chance of survival if caught early. Chest X-ray imaging is the most routinely used diagnostic technique for pneumonia. Examining chest X-rays, on the other hand, is a tough task with a high degree of subjectivity. In this study, we employed chest X-ray pictures to develop a computer-aided specialized diagnostic system capable of identifying pneumonia. We constructed a Convolutional neural network model from scratch to extract features from a given chest X-ray image and classify it to determine if a person is infected with pneumonia. This model could help mitigate the reliability and interpretability challenges often faced when dealing with medical imagery.

KEYWORDS: Pneumonia, Machine learning, medical imaging, Chest X-rays Deep learning, Convolutional neural networks (CNNs)Classification algorithms, Real-time detection.

I. INTRODUCTION

Pneumonia is an infection in one or each lung. Bacteria, viruses, and fungi cause it. The infection causes inflammation within the air sacs in your lungs, creating it troublesome to breathe. To diagnose pneumonia, a chest X-ray is used by medical practitioners as the best imaging modality and it can be managed effectively with medicines and proper treatment. the current system to detect pneumonia is not very précised, *so we propose a system that will give more accuracy and the type of pneumonia.*

the medical field is predicted to be the most benefitted field, after finance from the new age concepts of artificial intelligence. we aim at applying these concepts to the field of medical science and make use of these concepts to unleash new horizons in medical diagnosis. we aim to process x-ray images of the chest to predict if the patient is diagnosed with pneumonia. we have a set of 5,863 x-ray images which will be used to predict if the x-ray of the chest is suffering from pneumonia or not. in the summary of the system, the system consists of modules, where each module has smaller submodules that build up to the whole system. the image processing component is for obtaining the data set and converting each image into a matrix of data using various algorithms. this is because machine learning algorithms can only accept numerical values. a component of this tabulated data will be used to train the machine learning algorithm. once the algorithm has been trained, a component of the dataset will be used to test the algorithm and obtain the system's level of efficiency and accuracy. however, each component has more in-depth steps which will be explained further.

II. LITERATURE SURVEY

1. **PAPER NAME:** PNEUMONIA DETECTION USING IMAGE PROCESSING AND DEEP LEARNING

Abstract: Pneumonia is the leading cause of death all around the world. On average, it kills 700,000 children per year and affects 7% of the world's population. This condition is diagnosed mainly using X-rays. We have devised a novel Image processing-based Deep Learning approach to detect Pneumonia using the concept of Transfer Learning and Image Augmentation. We were able to achieve a recall score of 97.44% and an accuracy of 96.00%.

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2. **Paper Name:** A Combined Approach Using Image Processing and Deep Learning to Detect Pneumonia from Chest X-Ray Image.

Author: Md. Mehedi Hasan, Mir Md. Jahangir Kabir, Md. Rakibul Haque, Mohiuddin Ahmed

Abstract: Pneumonia is an epidemic disease that is needed to be detected in the early stage to prevent unfortunate deaths. Traditional methods take a lot of time to detect the disease. With the introduction of Medical Imaging, the detection of disease has been accelerated by using chest x-ray images. Butit also requires the availability of an expert and experienced radiologist to interpret the x-ray image accurately. Sometimes, manual interpretation is affected by various kinds of artifacts in X-ray or Optical Coherence Tomography(OCT) images. For this reason, in our paper, we have proposed a combined approach using Image Processing and either VGG-16 or VGG-19, variants of Deep Convolutional Neural Networks for the automatic detection of pneumonia from Chest X-ray images. We have used Mendeley OCT and Chest X-Ray dataset to evaluate our model. We have achieved an accuracy of 96.2% using VGG-16 and 95.9% using VGG-19, both of which outperform the transfer learned InceptionV3 benchmark model used on this dataset which hasan accuracy of 92.8%.

3. **Paper Name:** Detection of pneumonia infection
in lungs from chest X-ray images using deep convolutional neural network and content-based image retrieval techniques

Author: T. Rajasenbagam1, S. Jeyanthi, J. Arun Pandian

Abstract: In this research, A Deep Convolutional Neural Network was proposed to detect Pneumonia infection in the lung using Chest X-ray images. The proposed Deep CNN models were trained with a Pneumonia Chest X-ray Dataset containing 12,000 images of infected and not infected chest X-ray images. The dataset was preprocessed and developed from the Chest X-ray8 dataset. The Content-based image retrieval technique was used to annotate the images in the dataset using Metadata and further contents. The data augmentation techniques were used to increase the number ofimages in each class. The basic manipulation techniques and Deep Convolutional Generative Adversarial Network (DCGAN) were used to create the augmented images. The VGG19 network was used to develop the proposed Deep CNN model. The classification accuracy of the proposed Deep CNN model was 99.34 percent in the unseen chest X- ray images. The performance of the proposed deep CNN wascompared with state-of-the-art transfer learning techniques Such as Alex Net, VGG16Net, and Inception Net. The comparison results show that the classification performance of the proposed Deep CNN model was greater than the othertechniques.

4. **Paper Name:** Pneumonia Detection on Chest X-ray Images Using Ensemble of Deep Convolutional Neural Networks.

Author: Alhassan Mabrouk, Rebeca P. Díaz Redondo, Abdelghani Dahou, Mohamed Abd Elaziz and Mohammed Kayed

Abstract: Pneumonia is a life-threatening lung infectionresulting from several different viral infections. Identifying and treating pneumonia on chest X-ray images can be difficult due to its similarity to other pulmonary diseases. Thus, the existing methods for predicting pneumonia cannot attain substantial levels of accuracy. This paper presents a computer-aided classification of pneumonia, coined Ensemble Learning (EL), to simplify the diagnosis process on chest X-ray images. Our proposal is based on Convolutional Neural Network (CNN) models, which are trained CNN models that have been recently employed to enhance the performance of many medical tasks instead of training CNN models from scratch. We propose to use three well-known CNNs (DenseNet169, MobileNetV2, and Vision Transformer) pre-trained using the Image Net database. These models are trained on the chest X-ray data set using fine-tuning. Finally, the results are obtained by combining the extracted features from these three models during the experimental phase. The proposed EL approach outperforms other existing state-of-the-art methods and obtains an accuracy of 93.91% and an F1-score of 93.88% in the testingphase.

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5. **Paper Name:** Detection of Pneumonia clouds inChest X-ray using Image processing approach.

Author: Abhishek Sharma, Daniel Raju, Sutapa Ranjan

Abstract: Finding ways to automate diagnostics from medical images, has continuously been one of the most interesting areas of software development. This article presents a novel approach for detecting the presence of pneumonia clouds in chest X-rays (CXR) by using only Image processing techniques. For this, we have worked on 40 analog chest CXRs about Normal and Pneumonia infected patients. Indigenous algorithms have been developed for cropping and extraction of the lung region from the images. To detect pneumonia clouds, we have used Otsu thresholding which will segregate the healthy part of the lung from pneumonia-infected cloudy regions. We are proposing to compute the ratio of the area of the healthy lung region to thetotal lung region to establish a result. The task has been performed using Python and OpenCV as they are free, open-source tools and can be used by all, without any legal issues or cost implications.

III.PROBLEM STATEMENT

Diagnosing pneumonia using chest X-Rays needs expert radiotherapists for evaluation However, it is not an easy task for a radiotherapist to examine a chest radiograph. Thus, developing an automatic system for detecting pneumonia would be beneficial for treating the disease without any delay.To detect the exact type of pneumonia we are developing an automatic system for detecting the exact type of pneumonia.

IV. PROPOSED METHODOLOGY

1. Dataset: The original dataset consists of three main folders(i.e., training, testing, and validation folders) and two subfolders containing pneumonia (P) and normal (N) chest X-ray images, respectively. A total number of 5,863 X-ray images of anterior-posterior chests were carefully chosen from retrospective pediatric patients.
2. Image Processing: Image processing is a method to convertan image into digital form and perform some operations on itto get an enhanced image or extract some useful informationfrom it. It is a type of signal dispensation in which the input is an image, like a video frame or photograph and the outputmay be an image or characteristics associated with that image. Usually, an Image Processing system includes treating images as two-dimensional signals while applying already set signal processing methods to them. The following steps are performed for implementing the image processing module:
3.
a. Take the dataset of 5,863 images.
b. Repeat the steps for all the images in a particular folder.
C. Load the image in python. Perform image processing on itto get only the required part of the image.
d. This can include getting rid of the background, finding theoutline, etc.
e. Perform Feature Extraction on the image. Migrate the extracted features to an external storage location. These extracted features will be used for further steps in the algorithm.

3 Classification Algorithms For detecting pneumonia from chest x-ray images we aim at using three classifiers. By usingdifferent classification algorithms, we can get different results in which we have used the CNN algorithm.

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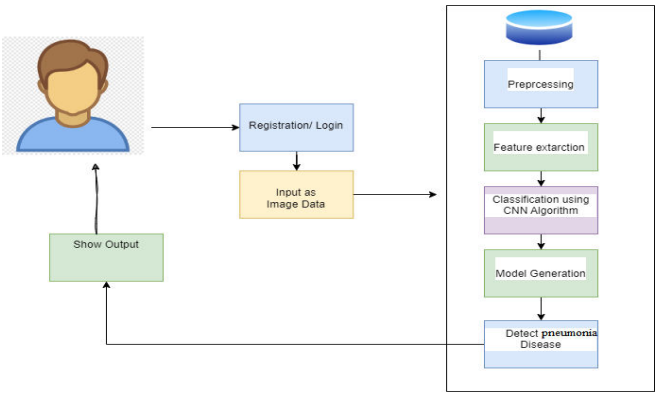

IV. PROJECT PURPOSE

The purpose of a survey on Pneumonia Detection Using Machine Learning is to explore and evaluate the current state-of-the-art in using machine learning techniques for detecting pneumonia from medical images, such as chest X-rays. The survey aims to identify the strengths and weaknesses of existing approaches, highlight the challenges and limitations of the current methods, and suggest potential avenues for future research to improve the accuracy, speed, and reliability of pneumonia detection using machine learning. Ultimately, the survey aims to contribute to the development of more effective and efficient tools for diagnosing and treating pneumonia, a potentially life-threatening respiratory illness.

V. CONCLUSION

increasing the accuracy and trustworthiness of machine learning models by including more data sources, like patient histories or clinical notes.
enhancing the model's capability to identify pneumonia and other respiratory disorders and better capture complex patterns in medical images by using deep learning algorithms,such as convolutional neural networks (CNNs).
building algorithms that can quickly identify pneumonia, allowing for a more accurate and timely diagnosis and courseof treatment.
To boost the tool's versatility and value to healthcare professionals, models that can handle a variety of medical images, including CT scans and ultrasounds, are being developed.
Healthcare practitioners would feel more confident in the results if machine learning models were made easier to understand and interpret.

VI. FUTURE ENHANCEMENT

incorporating more data sources, including patient histories or clinical notes, to increase the precision and dependability of machine learning models.
investigating the use of deep learning algorithms, such as convolutional neural networks (CNNs), to enhance the model's ability to distinguish between pneumonia and other respiratory illnesses and better capture complicated patterns in medical images.
creating algorithms that can instantly detect pneumonia, enabling more rapid and precise diagnosis and treatment.
Developing models that can deal with many kinds of medical pictures, such as CT scans or ultrasounds, to increase the tool's adaptability and usefulness for healthcare practitioners. Making machine learning models more understandable and interpretable would help healthcare practitioners have more confidence in the outcomes they receive.

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