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Detecting Pneumonia from X-Ray Images Application-Nemo

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ABSTRACT: Pneumonia is a contagious disease that causes ulcers of the lungs, and is one of the main reasons for death among children and the elderly in the world. Several deep learning models for detecting pneumonia from chest X-ray images have been proposed. One of the extreme challenges has been to find an appropriate and efficient model that meets all performance metrics. Proposing efficient and powerful deep learning models for detecting and classifying pneumonia is the main purpose of this work. The project aims at building a machine learning model that will be able to detect pneumonia from chest X-rays. In this user independent model, classification machine learning algorithms are trained using a set of chest X-ray image data and testing is done on a completely different set of data. Various machine learning algorithms are applied on the datasets, including Convolutional Neural Network (CNN). An attempt is made to increase the accuracy of the CNN model by pre-training it on the Chest X-ray Images (Pneumonia) dataset from kaggle.

KEYWORDS: Pneumonia, Convolutional Neural Network, kaggle

I. INTRODUCTION

Pneumonia is considered the greatest cause of children in all over the world. Approximately 1.4 million children die of pneumonia every year, which is 18% of the total children who died at less than five years old. Globally overall two billion people are suffering from pneumonia every year. Pneumonia is a lung infection, which can be caused by either bacteria or viruses. Luckily, this bacterial or viral infectious disease can be well treated by antibiotics and antiviral drugs. Nevertheless, faster diagnosis of viral or bacterial pneumonia and consequent application of correct medication can help significantly to prevent deterioration of the patient's condition which eventually leads to death. Chest X-rays are currently the best method for diagnosing pneumonia. X-ray images of pneumonia are not very clear and often misclassified to other diseases or other benign abnormalities. Moreover, the bacterial or viral pneumonia images are sometimes mis-classified by the experts, which leads to wrong medication to the patients and thereby worsening the condition of the patients. There are considerable subjective inconsistencies in the decisions of radiologists in diagnosing pneumonia. There is also a lack of trained radiologists in low resource countries (LRC) especially in rural areas. Therefore, there is a pressing need for computer aided diagnosis (CAD) systems, which can help the radiologists in detecting different types of pneumonia from the chest X-ray images immediately after the acquisition.

Currently many biomedical complications (e.g., brain tumor detection, breast cancer detection, etc.) are using Artificial Intelligence (AI) based solutions. Among the deep learning techniques, convolutional neural networks (CNNs) have shown great promise in image classification and therefore widely adopted by the research community Deep Learning Machine learning techniques on chest X-Rays are getting popularity as they can be easily used with low-cost imaging techniques and there is an abundance of data available for training different machine-learning models. Several research groups have reported the use of deep machine learning algorithms in the detection of pneumonia, however only an article has reported the classification of bacterial and viral pneumonia.

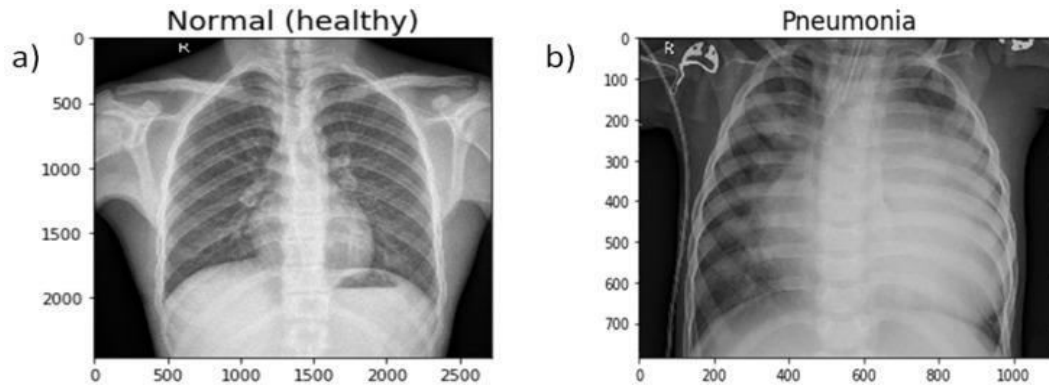


Figure 1: Chest X Ray of (a) a healthy person and (b) a person suffering from pneumonia.

II. RELATED WORK

In recent time, exploration of Machine learning (ML) algorithms in detecting thoracic diseases has gained attention in research area of medical image classification. Lakhani and Sundaram (2017) proposed a method of detecting pulmonary tuberculosis following the architecture of two different DCNNs AlexNet and GoogleNet. Lung nodule classification mainly for diagnosing lung cancer proposed by Huang et al. also adopted deep learning techniques. Performance of different variants of Convolutional Neural Networks (CNNs) for abnormality detection in chest X-Rays was proposed by Islam et al. using the publicly available OpenI dataset. For the better exploration of machine learning in chest screening, Wang et al. (2017) released a larger dataset of frontal chest X-Rays.

Recently, Pranav Rajpurkar, Jeremy Irvin, et al. (2017) explored this dataset for detecting pneumonia at a level better than radiologists, they referred their model as CheXNet which uses DenseNet-121 layer architecture for detecting all the 14 diseases from a lot of 112,200 images available in the dataset. After the CheXNet model, Benjamin Antin et al.(2017) worked on the same dataset and proposed a logistic regression model for detecting pneumonia. Pulkit Kumar, Monika Grewal (2017) using the cascading convolutional networks contributed their research for multilabel classification of thoracic diseases. Zhe Li (2018) recently proposed a convolutional network model for disease identification and localization.

III. METHODOLOGY

Dataset

The dataset comprised a total of 5836 images segmented into two main parts, a training set and a test set. Both bacterial and viral pneumonia were considered as a single category, pneumonia infected. The dataset used in this study did not include any case of viral and bacterial co-infection.. Two expert physicians then graded the diagnoses for the images before being cleared for training the AI system. The evaluation set was also checked by a third expert to account for any grading errors. The proportion of data assigned to training and testing was highly imbalanced. Therefore, the dataset was shuffled and arranged into training and test sets only. Finally, there were 5136 images in the training set and 700 images in the test set. Eleven-point-nine-five percent of the complete dataset was used as the testing dataset.

Proposed Model

This section deals with the detailed description of the applied methodology. The proposed pneumonia detection system using the 'Densely Connected Convolutional Neural Network' (DenseNet-201) The architecture of the proposed model has been divided into two different stages - the preprocessing stage, the feature-extraction stage

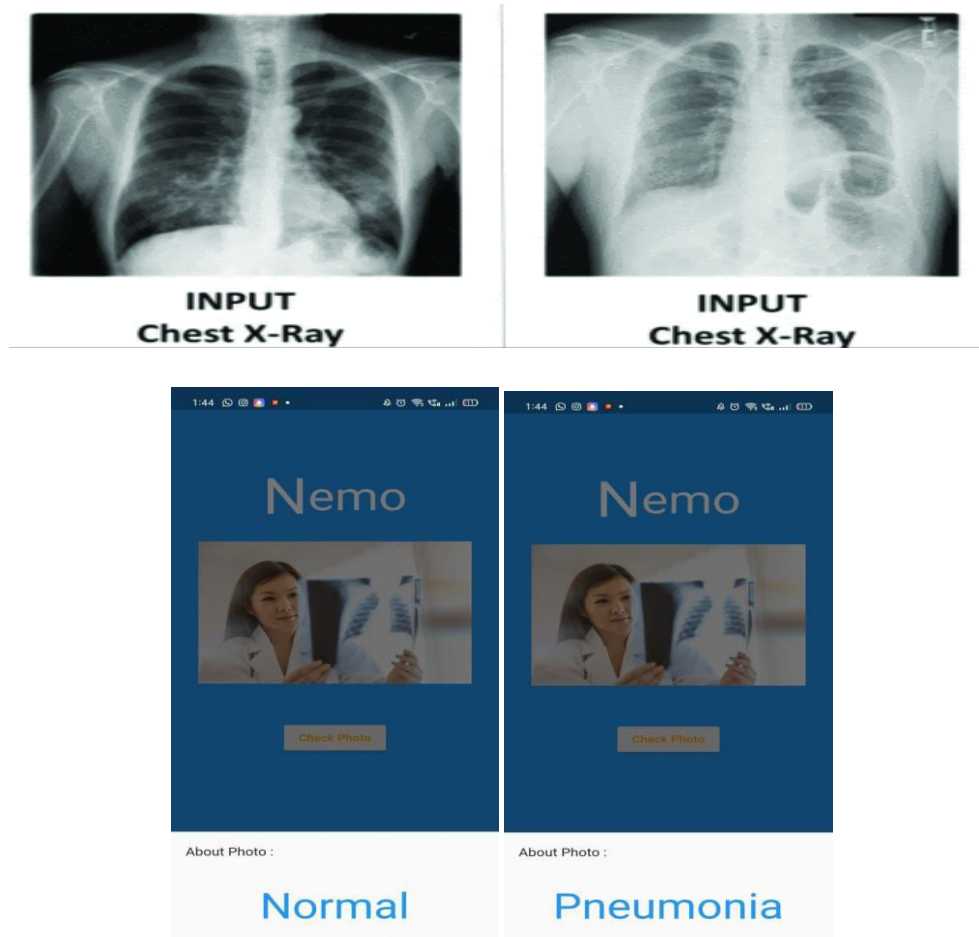


Figure 2: An example of Normal CXR (right) and an example of a Pneumonia CXR (left) from ChestX-ray14 dataset.

A. The Pre-Processing Stage

The primary goal of using Convolutional Neural Network in most of the image classification tasks is to reduce the computational complexity of the model which is likely to increase if the input are images . The original 3-channel images were resized from 1024×1024 into 224×224 pixels to reduce the heavy computation and for faster processing. All of the further techniques have been applied over these downsized images.

B. The Feature-Extraction Stage

Although the features were extracted with different variants of pre-trained CNN models, the statistical results obtained proposed DenseNet-169 as the optimal model for the feature extraction stage. Therefore, this stage deals with the description of DenseNet-169 model architecture and its contribution in feature extraction.

1) Architecture of DenseNet-201

DenseNet, which is a short form of Dense Convolutional Network, needs fewer parameters than a conventional CNN as it does not learn redundant feature maps. The layers in DenseNet are very narrow, i.e., 12 filters, which add a lesser set of new feature-maps. DenseNet has four different variants: DenseNet121, DenseNet169, DenseNet201 and DenseNet264. In this paper, we have used DenseNet201 for pneumonia detection. Each layer in DenseNet has direct access to the original input image and gradients from the loss function.

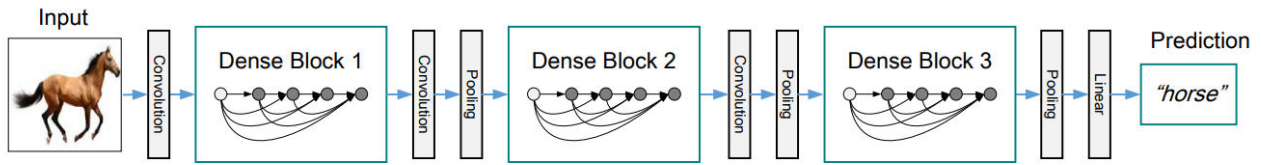


Figure 3: Represents a flow diagram of our methodology applied.

2) VGG-16

VGG16 is a convolutional neural network model proposed by K. Simonyan and A. Zisserman from the University of Oxford in the paper “Very Deep Convolutional Networks for Large-Scale Image Recognition”. The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It was one of the famous models submitted to [ILSVRC-2014](#). It makes the improvement over AlexNet by replacing large kernel-sized filters (11 and 5 in the first and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one after another. VGG16 was trained for weeks and was using the NVIDIA Titan Black GPU.

3) Extraction of Features

The process of feature extraction from the model explained in this [seapplies](#) all the layers of the network except the final classification layer. The final feature representation obtained were interpreted as a 50176×1 dimension vector which was then supplied as input to different classifiers.

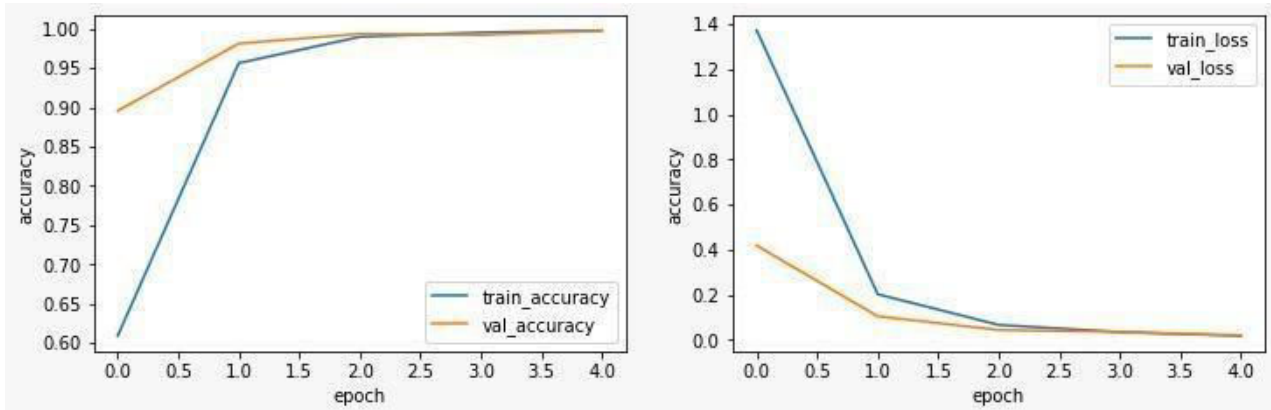


Figure 3: Model Accuracy

Mobile Application

A mobile application is developed in flutter which consumes our api which is developed using flask. The input to the application is an uploaded X-ray image which gives the confidence level of pneumonia prevalent in the patients. The patient can upload a pre-taken picture or can take a new picture also. Then after uploading the image the result is provided with the help of API whether the person has pneumonia or not.

This App is based on the flutter framework which helps us to provide a better and easy understandable design for our app. This app is efficient and effective for every user.

IV. EXPERIMENTAL RESULTS

Study Areas

The following libraries which are used in the project have been studied.

- OpenCV
- NumPy
- Keras with Tensorflow as backend

Implementation



The project has been successfully implemented.

Evaluated Results

The results have been evaluated and various tests have been performed to make the software robust and reliable. Some of those were Unit, Integration, System and User Acceptance Testing.

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Number of pictures in the training set: 5232
Number of pictures in the test set: 624
Number of pictures in the validation set: 16

Number of different labels: 2

Labels: ['PNEUMONIA' 'NORMAL']

```

	Filepath	Label
0	../input/chest-xray-pneumonia/chest_xray/train...	PNEUMONIA
1	../input/chest-xray-pneumonia/chest_xray/train...	PNEUMONIA
2	../input/chest-xray-pneumonia/chest_xray/train...	NORMAL
3	../input/chest-xray-pneumonia/chest_xray/train...	PNEUMONIA
4	../input/chest-xray-pneumonia/chest_xray/train...	PNEUMONIA

Figure 4: Dataset description

V. CONCLUSION

Pneumonia constitutes a significant cause of morbidity and mortality. It accounts for a considerable number of adult hospital admissions, and a significant number of those patients ultimately die (with a mortality rate of 24.8% for patients over 75 years). According to the WHO, pneumonia can be prevented with a simple intervention and early diagnosis and treatment. Nevertheless, the majority of the global population lacks access to radiology diagnostics. Even when there is the availability of imaging equipment, there is a shortage of experts who can examine X-rays. Through this paper, the automatic detection of pneumonia in chest X-ray images using deep transfer learning techniques was proposed. The deep networks, which were used in our methodology, had more complex structures, but fewer parameters and, hence, required less computation power, but achieved higher accuracy. Transfer learning and data augmentation were used to solve the problem of overfitting, which is seen when there is insufficient training data, as in the case of medical image processing. Further, to combine different architectures efficiently, a weighted classifier was proposed. The experiments were performed, and the different scores obtained, such as the accuracy, recall, precision, and AUC score, proved the robustness of the model. The proposed model was able to achieve an accuracy of 98.857%, and further, a high F1 score of 99.002 and AUC score of 99.809 affirmed the efficacy of the proposed model. Though many methods have been developed to work on this dataset, the proposed methodology achieved better results. In the future, it would be interesting to see approaches in which the weights corresponding to different models can be estimated more efficiently and a model that takes into account the patient’s history while making predictions.

REFERENCES

1. Fizman M, Chapman WW, Aronsky D, Evans RS, Haug PJ. Automatic detection of acute bacterial pneumonia from chest X-ray reports. Journal of the American Medical Informatics Association. 2000; 7(6):593-604.
2. Förster A, Brandstetter S, Schulze-Briese C. Transforming X-ray detection with hybrid photon counting detectors. Philosophical Transactions of the Royal Society A. 2019.



3. Sousa RT, Marques O, Soares FA, Sene Jr II, de Oliveira LL, Spoto ES. Comparative performance analysis of machine learning classifiers in detection of childhood pneumonia using chest radiographs. *Procedia Computer Science*. 2013; 18:2579-82.
4. Rajpurkar P, Irvin J, Zhu K, Yang B, Mehta H, Duan T, et al. Chexnet: radiologist-level pneumonia detection on chest x-rays with deep learning. *arXiv preprint arXiv:1711.05225*. 2017.
5. Stephen O, Sain M, Maduh UJ, Jeong DU. An efficient deep learning approach to pneumonia classification in healthcare. *Journal of Healthcare Engineering*. 2019.
6. Ayan E, Ünver HM. Diagnosis of pneumonia from chest X-ray images using deep learning. In scientific meeting on electrical-electronics & biomedical engineering and computer science (EBBT) 2019 (pp. 1-5). IEEE.
7. Huang G, Liu Z, Van Der Maaten L, Weinberger KQ. Densely connected convolutional networks. In *proceedings of the conference on computer vision and pattern recognition 2017* (pp. 4700-8).
[8] Deng J, Dong W, Socher R, Li LJ, Li K, Fei-Fei L. Imagenet: a large-scale hierarchical image database. In *conference on computer vision and pattern recognition 2009* (pp. 248-55). IEEE.



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