Pneumonia Detection Using X-Ray Image Processing Using CNN

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***Abstract*—Pneumonia is a life-threatening infectious disease affecting one or both lungs in humans commonly caused by bacteria called Streptococcus pneumonia. The present study aimed to examine the risk factors for death due to pneumonia in young children. One or more in three deaths in Asia is caused due to pneumonia as reported by World Health Organization (WHO). Chest X-Rays which are used to diagnose pneumonia need expert radiotherapists for evaluation. Thus, developing an automatic system for detecting pneumonia would be beneficial and it can save lots of peoples life and help stopping and curing and controll for treating the disease without any delay particularly in remote areas. Due to the success of deep learning algorithms in analyzing medical images, Convolutional Neural Networks (CNNs) have gained much attention for disease classification. In addition, features learned by pre-trained CNN models on large-scale datasets are much useful in image classification tasks. In this work, we appraise the functionality of pre-trained CNN models utilized as feature-extractors followed by different classifiers for the classification of abnormal and normal chest X-Rays. We analytically determine the optimal CNN model for the purpose. Statistical results obtained demonstrates that pretrained CNN models employed along with supervised classifier algorithms can be very beneficial in analyzing chest X-ray images, specifically to detect Pneumonia**

Keywords— Pneumonia, x-ray, rural area, CNN

I. INTRODUCTION

— Pneumonia is an infectious and deadly illness in respiratory that is caused by bacteria, fungi, or a virus that infects the human lung with the load full of fluid or pus. Chest X-rays are the common method used to diagnose pneumonia and it needs a medical expert to evaluate the result of X-ray. The troublesome method of detecting the pneumonia cause a life loss due to improper diagnosis and treatment.And the diagnosis of this diseases can take time to do that and hospital must have good radiologist but in our country we cant afford it. So we must go to the automated system. With the emerging computer technology, development on an automatic system to detect pneumonia and treating the disease is now possible especially if the patient is in a distant area and medical services is limited. This study intends to incorporate deep learning methods to alleviate the problem. Convolutional Neural Network is optimized to perform the complicated task of detecting diseases like pneumonia to assist medical experts in diagnosis and possible treatment of the disease. The authors developed several models to determine the best possible model in detecting pneumonia with the most accurate results. This study has trained different models of CNN, namely ResNet and VGGNet using 1024 by 1024 resolution of 26,684 dataset images. The result achieved a 97 percent accuracy rate for VGGNet and the lowest rate is 74 percent achieved by the ResNet model. The result of statistics shows that the trained model was able to detect Pneumonia through examined images of chest X-ray.

Medical personnel check the patient's radiograph of their chest to determine if they are infected with pneumonia or not. In addition, the usual method for finding pneumonia is through medical history and laboratory results of the patient. Radiograph of chest is penetrated through X-rays where the soft tissues produces a dark color and hard tissues like bones produces a bright color. Patients diagnosed with pneumonia shows the chest cavity signs of fluids filling the air sacs of lungs as for the radiograph picture appears brighter. Several abnormalities may be seen on lung cavities as brighter color may represent such as cancer cells, blood vessels swelling, and abnormality of heart . To validate the range and spot of an infected area of the lungs, chest x-rays is the utmost method. In these method, emergence of the disease can be imprecise and misinterpreted with another illness.Therefore, the undertaking is pleasing in the improvement of the processing in medical situations in isolated areas for pneumonia detection. The researchers were able to train and assessed CNN model's performance and classify chest x-rays with normal and infected with disease using different classifiers. With the recent development of Computer Aided Design (CAD) tools becomes the most important field of research in artificial intelligence and machine learning. CAD systems has proven in facilitating the medical field such as breast cancer detection, classification of disease using mammograms, lung cancer detection, etc. CAD system is an applicable instrument in use today for diagnosis and classification of diseases in medical imaging. In achieving the precise diagnosis, the medical personnel integrate the CAD to assist and verify to support their decision making. Significant features of the images are valuable in employing machine learning techniques in this system compared to the traditional handcrafted features which has limitations in extracting significant features.The progress in a more intelligent future is now productive through generations. This technological improvement today reached new step closer in human intelligence. The deep learning has gained the ability in simulating the function of the human brain. It recommends the solution to solve real-life problems. The deep learning by means of the convolutional neural networks has ability in obtaining significant characteristics in image classification tasks and provides medical promising results in image analysis. CNN advantages is capable in assisting the identification of some features from an image and use this feature to generate probabilities in classifying specific input .The contribution of this study is developed an optimized deep learning models of CNN that can detect and classify pneumonia diseases efficiently . The work consists of an optimized CNN models and experimental analysis of each model towards the detection and classification of pneumonia diseases

II. METHODOLOGY

The proposed methodology presents the architectural design that is divided into three stages: pre processing, handover learning and refinement, and classification

A. Data Collection

Data is collected from Kaggle.com whuch is the biggest data source now a days for analysis and machine learning data you need to do your data science work. Use over 50,000 public datasets .If anyone working with data for machine learning then kaggle.com will be the primary choices.

B. 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 1-channel black and white images were resize from 1024×1024 into 224×224 pixels to reduce the heavy computation and for faster processing. All of the further techniques has been applied over these downsized images.in prepossessing we must reject incomplete data or lebel all any type of problem that is not working with the model success.and we also need to take only valid and updated value

C. 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 benchmark model for the feature extraction stage. Therefore, this stage deals with the description of DenseNet-169 .When we make our own model we will compare it with the benchmark model and how efficient and accurate it is.Since CNN can do the feature extraction easily we can do that with multiple CNN with different feature combination

D. Architecture of our proposed model

We Use DNN (Deep Convolution Neural Network) which has become the most productive framework in this field

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1) Collect The Data:

Data will be collected from the kaggle.com and with valid form of data and data should have sized 1024x1024.
Data Size will be almost 1.5 gigabyte depending on the update of the data set.

2) Reshape the data

Since it is public data set there might be some form og glitch.so we need to handle it.and to increase the processing time we down sample the data.Since we have plenty of image we will directly discard the data. Then we reshape the data so our model will be done better.

3) Feed the Classification Model

In this model we do not apply Transfer learning, we split the data 80% for training and 20% for testing and we train the model with the 80% of image all the image are from chest x-ray.Then we test the image with the test data ad then we calculate the accuracy.and we also compare with other mode used for transfer learning.
In our model we add convlutional layer,droupout layer,Dense layer,outpuyt layer
We use rectified linear as a activation function but for classify the image as non pneumonia and non pneumonia so use the softmax activation function and our loss function is "rectified Linear" function .Figure 1 will display the CNN model

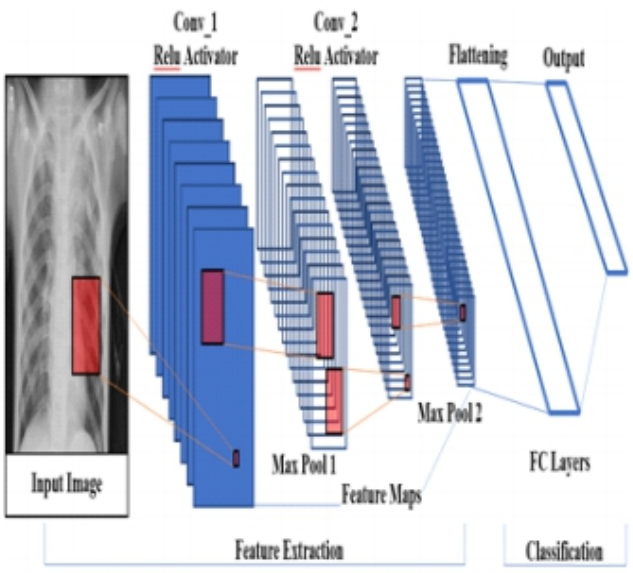

Fig. 1. CNN Process.

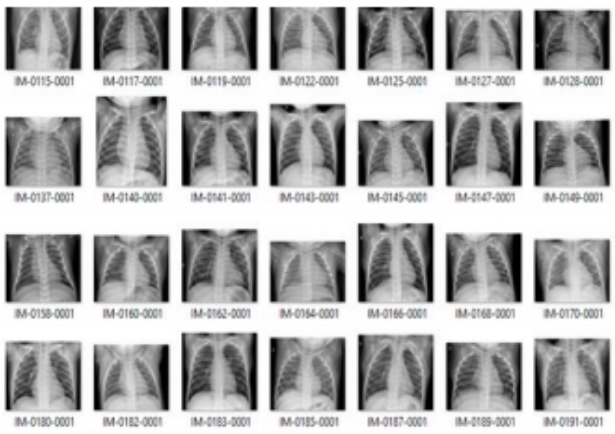

Fig. 1. Example fetched x-ray image

III. Experiment Setup

We use different technology to implement this concept
We use python as a programming language,Kaggle for data service,Tensorflow for machine learning model,Keras for High level API,sklearn for data management,.jupyter-notebook for writing application , Colab for google environment for fast GPU processing and matplotlib for visualizing data. All the tools are open source and free to use under GNU license.and can be found in public software repository

IV. Result and evaluation

We tok several test to check if out model is better than the benchmark model.and every time our result turns good based on the other

Fig 2 : Accuracy Score of different model

	Accuracy Result Based On (AUC)
Proposed Model	***99.98 %***
VGG19	*98.45 %*
VGG16	*97.85 %*

V. Acknowledgment

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VI. Conclusion

Comparing to other previous result that is generated from the transfer learning Our Model show significant Good result.This will help our early detection of pneumonia quickly.

VII. Reference

[1] Dev Kumar Das, Madhumala Ghosh, Mallika Pal, Asok K Maiti, and Chandan Chakraborty. 2013. Machine learning approach for automated screening of malaria parasite using light microscopic images. Micron 45 (2013), 97106

[2] MahdiehPoostchi,KamolratSilamut,RichardMaude,StefanJaeger,and George Thoma. 2018. Image analysis and machine learning for detecting malaria. Translational Research (2018).

[3] Nicholas E Ross, Charles J Pritchard, David M Rubin, and Adriano G Duse. 2006. Automated image processing method for the diagnosis and classification of malaria on thin blood smears. Medical and Biological Engineering and Computing 44, 5 (2006), 427436.

[4] Ali Sharif Razavian, Hossein Azizpour, Josephine Sullivan, and Stefan Carlsson. 2014. CNN features off-the-shelf: an astounding baseline for recognition. In Proceedings of the IEEE conference on computer vision and pattern recognition workshops. 806813.

[5] Alex Krizhevsky, Ilya Sutskever, and Geoffrey E Hinton. 2012. Imagenet classification with deep convolutional neural networks. In Advances in neural information processing systems. 10971105.

[6] Karen Simonyan and Andrew Zisserman. 2014. Very deep convolutional networks for large-scale image recognition. arXiv preprint arXiv:1409.1556 (2014).

[7] F Chollet. 2016. Xception: deep learning with separable convolutions. arXiv Prepr. arXiv1610 2357 (2016).

[8]] Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. 2016. Deep residual learning for image recognition. In Proceedings of the IEEE conference on computer vision and pattern recognition. 770778

[9] Gao Huang, Zhuang Liu, Laurens Van Der Maaten, and Kilian Q Weinberger. 2017. Densely Connected Convolutional Networks.. In CVPR, Vol. 1. 3.

[10] Heba Mohsen, El-Sayed A El-Dahshan, El-Sayed M El-Horbaty, and AbdelBadeeh M Salem. 2017. Classification using deep learning neural networks for brain tumors. Future Computing and Informatics Journal (2017).

[11]] Kai-Lung Hua, Che-Hao Hsu, Shintami Chusnul Hidayati, WenHuang Cheng, and Yu-Jen Chen. 2015. Computer-aided classification of lung nodules on computed tomography images via deep learning technique. OncoTargets and therapy 8 (2015).

[12]] Mohammad Tariqul Islam, Md Abdul Aowal, Ahmed Tahseen Minhaz, and Khalid Ashraf. 2017. Abnormality detection and localization in chest x-rays using deep convolutional neural networks. arXiv preprint arXiv:1705.09850 (2017).

[13]] Xiaosong Wang, Yifan Peng, Le Lu, Zhiyong Lu, Mohammadhadi Bagheri, and Ronald M Summers. 2017. Chestx-ray8: Hospital-scale chest x-ray database and benchmarks on weakly-supervised classification and localization of common thorax diseases. In Computer Vision and Pattern Recognition (CVPR), 2017 IEEE Conference on. IEEE, 34623471.

[14]] Pranav Rajpurkar, Jeremy Irvin, Kaylie Zhu, Brandon Yang, Hershel Mehta, Tony Duan, Daisy Ding, Aarti Bagul, Curtis Langlotz, Katie Shpanskaya, and others. 2017. Chexnet: Radiologist-level pneumonia detection on chest x-rays with deep learning. arXiv preprint arXiv:1711.05225 (2017).

[15]] Zhe Li, Chong Wang, Mei Han, Yuan Xue, Wei Wei, Li-Jia Li, and F Li. 2017. Thoracic disease identification and localization with limited supervision. arXiv preprint arXiv:1711.06373 (2017).

[16] Suhail Raoof, David Feigin, Arthur Sung, Sabiha Raoof, Lavanya Irugulpati, and Edward C Rosenow III. 2012. Interpretation of plain chest roentgenogram. Chest 141, 2 (2012), 545558.

[17] Nijhawan R, Das J, Balasubramanian R. A Hybrid CNN+ Random Forest Approach to Delineate Debris Covered Glaciers Using Deep Features. Journal of the Indian Society of Remote Sensing. 2018:1-9.

[18] Nijhawan, Rahul, Rose Verma, Shashank Bhushan, Rajat Dua, and Ankush Mittal. ”An Integrated Deep Learning Framework Approach for Nail Disease Identification.” In Signal-Image Technology and InternetBased Systems (SITIS), 2017 13th International Conference on, pp. 197202. IEEE, 2017.

[19] Nijhawan R, Rishi M, Tiwari A, Dua R. A Novel Deep Learning Framework Approach for Natural Calamities Detection. InInformation and Communication Technology for Competitive Strategies 2019 (pp. 561-569). Springer, Singapore