e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 7, July 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

6381 907 438 6381 907 438 ijmrset@gmail.com www.ijmrset.com

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707205 |

Deep Learning based Pneumonia Detection using VGG16 Architecture

M Nithish[1], A G Vishwanath[2]

Student, Department of MCA, Bangalore Institute of Technology, Bangalore, India [1]

Assistant Professor, Department of MCA, Bangalore Institute of Technology, Bangalore, India [2]

ABSTRACT: Pneumonia, a severe infectious disease, affects millions globally and results in over four million fatalities each year. Early detection is crucial for optimal treatment and enhanced patient care outcomes, but diagnosing pneumonia is challenging, especially in resource-limited settings. Deep learning has become a potent tool in the analysis of medical images., enhancing pneumonia detection's accuracy and efficiency.

I. INTRODUCTION

This paper proposes developing a model of deep learning using the VGG16 architecture for detection of pneumonia by using images of chest X-ray. programmed using an extensive dataset of X-rays, the model aims to distinguish between healthy and infected lungs with high accuracy. By improving both speed and precision in pneumonia detection, the model supports timely and effective diagnosis, enhancing treatment outcomes. Its deployment in hospitals and clinics offers a valuable tool to reduce pneumonia's burden and save lives.

Pneumonia, a significant global health issue, is associated with high morbidity and mortality due to various pathogens causing lung inflammation. Effective management hinges on rapid and accurate diagnosis, traditionally reliant on clinical symptoms, physical exams, and chest X-rays. These processes are important but they can be subjective and vary, especially in regions with limited radiological resources.

The demand for sophisticated diagnostic tools is pressing. Current development in Artificial Intelligence, especially deep learning, have revolutionized clinical imaging analysis. Leveraging large datasets and computational power, these models enhance diagnostic accuracy and clinical decision-making. This research adapts deep learning methodologies using fine-tuned ResNet models and a diverse dataset of annotated X-rays, aiming to create a high-accuracy tool for automated pneumonia detection, especially beneficial in resource-limited settings.

II. LITERATURE SURVEY

1. Ünver H.M and Aryan E discuss pneumonia, a lung disease caused by bacterial infection, where early diagnosis is critical for effective treatment. Typically diagnosed from X-ray images of chest by expert radiologists, this procedure could be subjective due to ambiguous disease presentation or similarities to other conditions. Therefore, computer-aided diagnostic systems are essential to support clinicians. In their study, they used two popular convolutional neural network models, Xception and VGG16, for pneumonia diagnosis, employing transfer learning and fine-tuning during training. Research findings indicated that the VGG16 model achieved higher accuracy at 87% compared to Xception's 82%. However, Xception was more effective in identifying pneumonia cases, highlighting that every framework possesses distinct advantages when utilized for the same dataset.

2. Stephen, Okeke, Sain, Mangal, Maduh, Uchenna, and Jeong, Doun present a convolutional neural network (model developed from scratch to classify and pneumonia in X-ray images of chest. Apart from different procedures that depend solely on transfer learning or traditional approaches for high classification performance, their approach involves building a CNN from the ground up to extract features and determine pneumonia infection. This model aims to address reliability and interpretability challenges frequently linked with imagery of medical. Because of the challenge of obtaining a large pneumonia dataset, different augmentation procedures of data were employed to enhance the model's validation and classification accuracy, resulting in significant validation accuracy.

3. Rajpurkar, Pranav, et al. developed CheXNet, an algorithm that identifies pneumonia from chest X-rays with performance surpassing that of practicing radiologists. CheXNet is a 121-layer convolutional neural network trained on ChestX-ray14, the largest publicly available chest X-ray dataset, containing over 100,000 frontal-view images with 14

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707205 |

different diseases. Four academic radiologists annotated a test set, and CheXNet's performance was compared to theirs, showing that CheXNet exceeded the average radiologist performance depending on the F1 metric. CheXNet was also extended to detect all 14 diseases in the ChestX-ray14 dataset, achieving state-of-the-art results for each disease.

4. Hashmi, Mohammad Farukh, et al. address pneumonia, that impacts 7% of the worldwide demographic and causes annual deaths of 700,000 children, primarily diagnosed through chest X-rays. This task is challenging even for trained radiologists, necessitating improved diagnostic accuracy. This study proposes efficient framework for pneumonia detection using digital chest X-rays to assist radiologists. A novel weighted classifier approach combines predictions from top models of deep learning (Xception, DenseNet121,ResNet18, InceptionV3, MobileNetV3) optimally. Transfer learning is employed to optimize these models, and selective data augmentation methods are applied to balance the training set of data. The classifier of weighted outperforms individual models, achieving a test precision of 98.43% and an AUC score of 99.76 on new data from the and Children's Medical Center and Guangzhou Women pneumonia dataset, providing a quick and accurate diagnostic tool for radiologists.

5. Chouhan, Vikash, Singh, Sanjay, Khamparia, Aditya, Gupta, Deepak, Tiwari, Prayag, Moreira, Catarina, Damasevicius, Robertas, and Albuquerque, Victor discuss pneumonia, a primary cause of global mortality, which can be caused by viruses, bacteria, or fungi and is difficult to diagnose from chest X-rays alone. This study aims to streamline pneumonia detection for both experts and novices using an innovative deep learning method utilizing transfer learning. Attributes are derived from images using different pretrained neural network models on ImageNet, which are then used in a classifier for prediction. Five different models were analyzed, and an integrated model that merges the outputs of all pretrained models was proposed. This ensemble model outperformed the individual models, achieving state-of-the-art efficacy with a precision of 96.4% and a recall of 99.62% on new data from the Guangzhou Women and Children's Medical Center collection.

EXISTING SYSTEM

The existing framework for detection of pneumonia typically involves the manual interpretation of chest X-rays by trained medical professionals. This process can be time-consuming and labor-intensive, requiring significant expertise to accurately interpret the images. The accuracy of diagnosis can also be affected by subjective interpretations and variability in the expertise of medical professionals.

The current model is programmed on the architecture ResNet and fine-tuned to achieve exceptional precision and prediction capabilities. This fine-tuned model can accurately classify pneumonia with 91% accuracy.

ResNet uses connection of skip to pass information across several layers. It addresses two major issues in deep neural networks: the degradation problem and the gradient vanishing problem.

In summary, although there are constraints to the existing systems for pneumonia detection, the advancement of computer-aided diagnostic systems using deep learning procedures has the capability to greatly improve the efficacy and precision of pneumonia detection, ultimately leading to better patient outcomes.

PROPOSED SYSTEM

we aim to create a model of deep learning for detecting pneumonia in lung X-ray images using the VGG16 architecture, a commonly employed framework in computer vision. We will begin by preparing the dataset, which includes a large collection of labeled chest X-ray images as well as Optical Coherence Tomography images sourced from Mendeley Data, totaling 5686 images. After importing the necessary libraries and retrieving the images, we will build a model of deep learning based on the VGG16 architecture, with modifications to the final layers for binary classification images of x-ray having pneumonia or not. This model will be trained on a training set, and the performance will be evaluated on a validation set. We will fine-tune the hyperparameters to enhance the model's performance, and once trained, the model will be saved and deployed using the Flask web framework.

The proposed system aims to provide an accurate and efficient tool for pneumonia detection, enabling more effective care and enhancing patient results. This system can potentially be widely adopted by hospitals and clinics, offering a crucial resource for healthcare practitioners in the diagnosis of pneumonia.

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707205 |

III. IMPLEMENTATION

Dataset

The dataset comprises 5,856 chest X-ray images, including those with and without pneumonia, sourced from Kaggle. This initial data collection is critical, as the quality and quantity related to data directly impact the effectiveness and performance of the machine learning model.

Importing Libraries

Python is used for the implementation, with libraries such as Keras for model construction, sklearn for data splitting, and PIL for converting images to numerical arrays. Additional tools like matplotlib, pandas, numpy, and tensorflow are utilized to support various stages of model development.

Retrieving Images

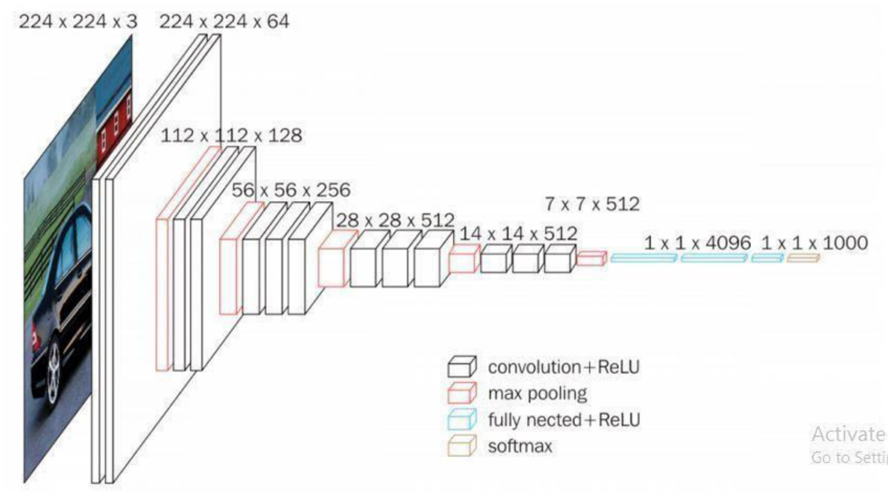
Chest X-ray images are extracted from the dataset, resized to 224x224 pixels, and normalized for consistent input into the model. Each image is converted into a numpy array to prepare for training and testing phases, ensuring uniformity in the dataset.

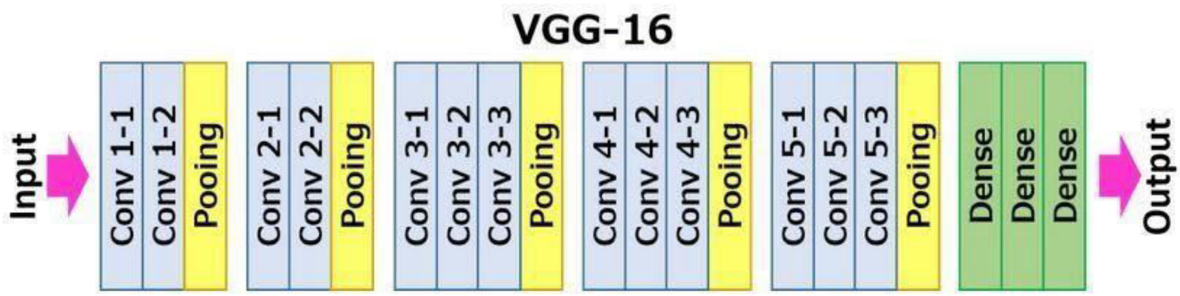
Splitting the Dataset

The set of data is segmented into training (80%) and testing (20%) subsets. This split enables effective model training and validation, allowing for accurate assessment of the model's efficacy and perfomance in distinguishing between X-ray images with and without pneumonia.

Building the Model

The VGG16 model, renowned for its image recognition capabilities, is employed. It uses convolutional layers to identify features, with a consistent 3x3 filter size and max-pooling layers. The model's architecture includes multiple convolutional and fully connected layers to enhance feature extraction and classification.





The "16" in VGG16 refers to the 16 layers with learnable weights, comprising 13 convolutional layers and 5 max-pooling layers, totaling 21 layers. It accepts input images of size 224x224 with 3 RGB channels. VGG16 simplifies

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707205 |

hyperparameters by using 3x3 convolutional filters with stride 1 and same padding, and 2x2 max-pooling with stride 2. The convolutional layers include: 64 filters (Conv-1), 128 filters (Conv-2), 256 filters (Conv-3), and 512 filters each for Conv-4 and Conv-5. It features three fully connected layers: the first two with 4096 channels each, and the third with 1000 channels for classification. The final layer is a softmax for classification.

Apply the Model

Once trained, the model is evaluated using the validation set to determine its accuracy and loss. Graphs are plotted to visualize performance trends over epochs. The model achieved an average validation accuracy of 95.00%, reflecting its effectiveness.

Accuracy on Test Set

The model's performance is further tested on a separate test set, achieving an accuracy rate of 92.00%. This metric is crucial for evaluating the model's real-world applicability and reliability in detecting pneumonia from chest X-ray images.

Archiving the Model

The final step involves saving the trained model as a `.h5` file using pickle for deployment. This process ensures the model is preserved and ready for production use, making it accessible for practical application in clinical settings.

IV. CONCLUSIONS

In this project, we developed a pneumonia detection system using the VGG16 architecture, chosen for its simplicity and high accuracy. By training the model on a large dataset of chest X-ray images, both with and without pneumonia, we enhanced its performance in detecting the disease. This approach aims to improve both the accuracy and efficiency of pneumonia detection, ensuring consistent diagnosis and treatment. The model, once deployed in hospitals and clinics, will provide a valuable tool for medical practitioners, facilitating early and accurate detection of pneumonia and potentially improving patient outcomes.

REFERENCES

[1] E Ayan and H. M. Ünver, "Diagnosis of Pneumonia from Chest Xray Images Using Deep Learning," 2019 Scientific Meeting on Electrical-Electronics & Biomedical Engineering and Computer Science (EBBT), 2019, pp. 1-5, doi: 10.1109/EBBT.2019.8741582.

[2] Stephen, Okeke & Sain, Mangal & Maduh, Uchenna & Jeong, Doun. (2019). An Efficient Deep Learning Approach to Pneumonia Classification in Healthcare. Journal of Healthcare Engineering. 2019. 1-7. 10.1155/2019/4180949.

[3] Rajpurkar, Pranav, et al. "Chexnet: Radiologist-level pneumonia detection on chest x-rays with deep learning." arXiv preprint arXiv:1711.05225 (2017).

[4] Hashmi, Mohammad Farukh et al. "Efficient Pneumonia Detection in Chest Xray Images Using Deep Transfer Learning." Diagnostics (Basel, Switzerland) vol. 10,6 417. 19 Jun. 2020, doi:10.3390/diagnostics10060417

[5] Labhane, G., Pansare, R., Maharashwari, S., Tiwari, R., & Shukla, A. (2020). CNN and transfer learning for the detection of pediatric pneumonia from chest X-ray images. Proceedings of the 2020 International Conference on Emerging Trends in Computing and Engineering (ICETCE), 85-92. https://doi.org/10.1109/ICETCE48199.2020.9091755

INNO SPACE
SJIF Scientific Journal Impact Factor

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com