

Pneumonia Disease Detection using Machine Intelligence Techniques to Diagnose Acute Respiratory Failure

Abstract

Pneumonia isn't just one disease. It is a family of more than 200 different lung diseases. Statistics for Pneumonia disease detection in Egypt detected that Pneumonia deaths is about 13,393 with 2.50 % and Rate of 20.69 with a World Rank #100. According to the latest World Health Organization (WHO) data published in 2020 Lung Disease Deaths in Egypt reached 13,393 or 2.50% of total deaths. Our main goal is earlier detection of Pneumonia by predicting a patient's severity of decline in lung function and based on Chest X-ray of their lungs. Using image processing and machine intelligence techniques to help Pneumonia impacted patients.

Methodology

We did our methodology on 6 phases, as following:

Phase (1) Dataset Preparations: In our methodology, a data set from Mendeley Data has been used, which is comprised of 5,856 chest X-ray images, 2 categories (Normal - Pneumonia). Out of these 5,856 X-ray images, 4273 are from different subjects affected by pneumonia and 1583 are normal subjects. **Phase (2)** Data Loading: In this phase we needed to: Decide validation percentage, provide path for training data, and decide image size. **Phase (3)** Data Exploration: In data exploration phase, our image dataset is stored as .jpg files in 2 different folders, with each folder holding the name of model of the images contained in the folder. **Phase (4)** Data Preprocessing: We used data preprocessing here to prepare the raw data and making it suitable for a machine learning model. **Phase (5)** Create and build Model: Here, we used a pre-trained Convolutional Neural Net model and use transfer learning to learn weights of only the last layer of the network. **Phase (6)** Interpret the results and prediction: Interpret the results and use the test data to predict whether the X-ray image of the patient indicates pneumonia or just a normal X-ray.

Discussion & Conclusion

To sum up, the model's presentation could be an extraordinary aid for exact assurance of the decay rate in the help of Pneumonia impacted patients. The proposed method further states that high resolution X-rays, evaluated by the proposed deep learning algorithm, provides a low-cost, fast, and accurate way to find the decline in the lung function of a patient suffering from Pneumonia disease.

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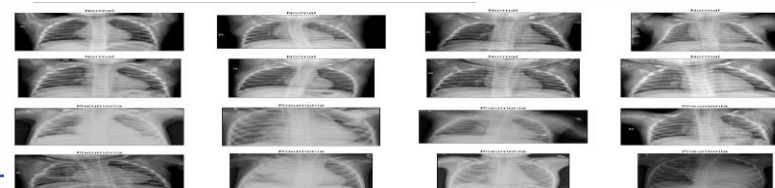
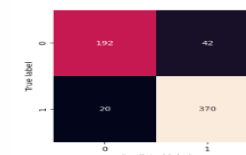


Introduction

Pneumonia is an inflammatory condition of the lung is affected primarily the small air sacs known as alveoli. Symptoms typically include some combination of productive or dry cough, chest pain, fever and difficulty breathing. The severity of the condition is variable. Pneumonia is usually caused by infection with viruses or bacteria. As, Pneumonia worsens, making you more and more breathless. Numerous variables may contribute to the Pneumonia disease. However, doctors are frequently unable to determine the exact cause of the issue. Also, Pneumonia isn't just one disease. It is a family of more than 200 different lung diseases. Our main goal is earlier detection of Pneumonia by predicting a patient's severity of decline in lung function and based on Chest X-ray of their lungs.

Results

	precision	recall	f1-score	support
0	0.91	0.82	0.86	234
1	0.90	0.95	0.92	390
accuracy			0.90	624
macro avg	0.90	0.88	0.89	624
weighted avg	0.90	0.90	0.90	624



Figs. Shows: Predicting Pneumonia Disease with chest X-ray images

CNN Model	Accuracy	Loss
VGG-16	86%	0.29
MobileNetV2	92%	0.19
DenseNet169	96%	0.12
InceptionV3	94%	0.17

References

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- ❖ Singhal, A.; Phogat, M.; Kumar, D.; Kumar, A.; Dahiya, M.; Shrivastava, V.K. Study of deep learning techniques for medical image analysis: A review. *Mater. Today Proc.* 2022, 56, 209–214.

Future work & suggestions

In our future work, a convolutional Neural Network (CNN) algorithm will be more developed, and we can apply our code on real world environment so it can be used on a larger scale as it's very effective compared to other deep learning algorithms. Also, the model's presentation could be an extraordinary aid for exact assurance of the decay rate in for COVID-19 impacted patients.