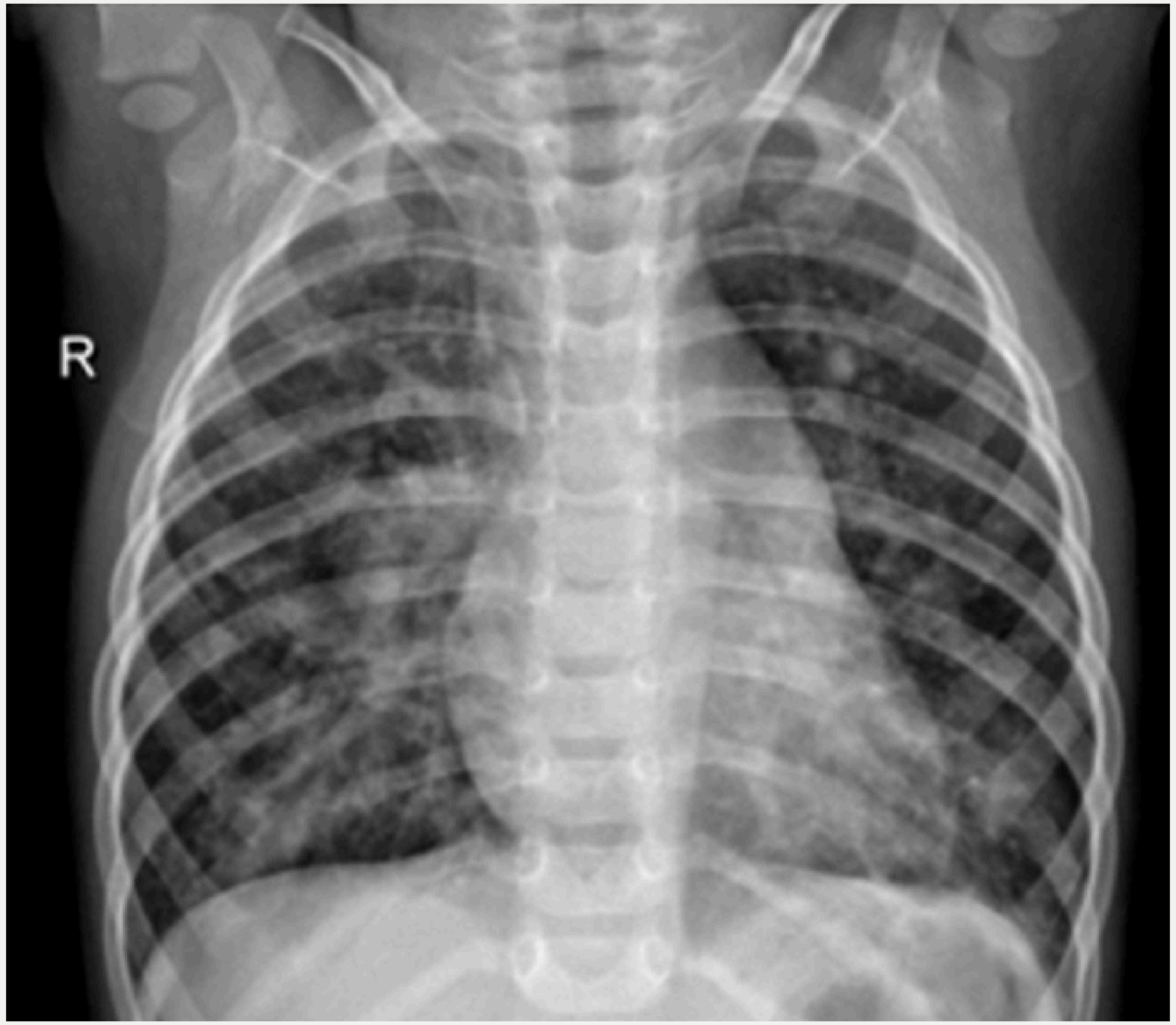
Pneumonia Detection from Chest X-Ray



Under The Guidance Of

Dr. Beebi Naseeba
VIT-AP University
beebi.naseeba@vitap.ac.in

Team:

Benedict Paul
21BEC8836
benedict.21bce8836@vitapstudent.ac.in

Hritwik Ghosh
21BEC8973
hritwik.21bce8973@vitapstudent.ac.in

Agenda

- Abstract
- Existing Approach
- Proposed Approach
- Dataset used
- Software and Libraries used
- Architecture
- Expected Output/outcome
- Reference

NEXT

ABSTRACT :

Pneumonia, a serious lung infection characterized by inflammation in the alveoli, poses a significant health risk, especially when diagnosis is delayed or inaccurate. Traditionally, pneumonia diagnosis relies on chest X-rays, ultrasounds, or biopsies, requiring professional expertise and often subject to human error, leading to potential misdiagnoses. This research aims to address this challenge by developing a deep learning-based model that can efficiently and accurately detect pneumonia from chest X-ray images. By automating the diagnostic process, the system offers a faster, more reliable tool that could greatly reduce diagnostic errors and improve patient outcomes. Given the severe complications that can arise from delayed or incorrect diagnoses, the implementation of such a system has the potential to significantly impact healthcare, providing an accessible solution to assist medical professionals in diagnosing pneumonia with greater precision.

EXISTING APPROACH :

Transfer Learning in Research:

- In previous research, transfer learning was used with pre-trained models like Xception and VGG16 for pneumonia detection from chest X-rays.
- These models were fine-tuned for the specific task by leveraging their learned features from large datasets like ImageNet.

Challenges Observed:

- VGG16 achieved higher accuracy (87%) but was less effective at detecting pneumonia-specific cases.
- Xception showed lower overall accuracy (82%) but excelled at identifying pneumonia cases.
- The models performed well but were not fully optimized for this particular task.

NEXT

PROPOSED APPROACH

Shift to Fine-tuning and Machine Learning:

- Instead of solely relying on transfer learning, we propose fine-tuning the CNNs to extract relevant features from the X-ray images.
- These features will then be passed into machine learning algorithms (such as SVM or Random Forest) to enhance the accuracy of the final prediction model.

Abstract:

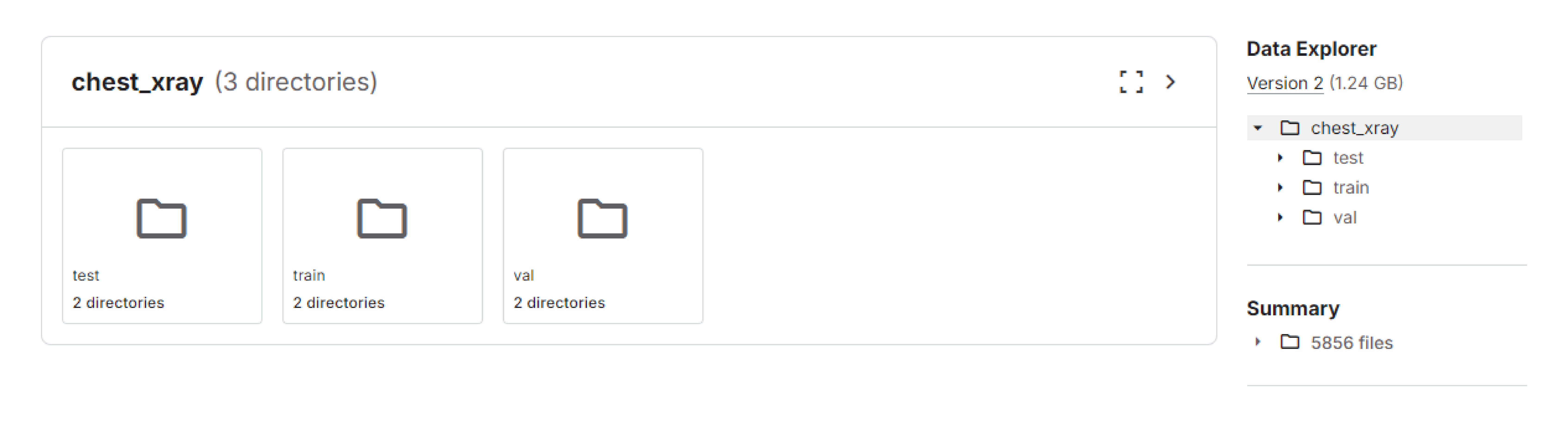
Pneumonia is a disease which occurs in the lungs caused by a bacterial infection. Early diagnosis is an important factor in terms of the successful treatment process. Generally, the disease can be diagnosed from chest X-ray images by an expert radiologist. The diagnoses can be subjective for some reasons such as the appearance of disease which can be unclear in chest X-ray images or can be confused with other diseases. Therefore, computer-aided diagnosis systems are needed to guide the clinicians. In this study, we used two well-known convolutional neural network models Xception and Vgg16 for diagnosing of pneumonia. We used transfer learning and fine-tuning in our training stage. The test results showed that Vgg16 network exceed Xception network at the accuracy with 0.87%, 0.82% respectively. However, the Xception network achieved a more successful result in detecting pneumonia cases. As a result, we realized that every network has own special capabilities on the same dataset.

NEXT

DATASET USED :

Chest X-Ray Images (Pneumonia) :

https://www.kaggle.com/datasets/paultimothymooney/chest-xray-pneumonia/data



NEXT

SOFTWARE AND LIBRARIES USED

- **Software:**
  - Python: Python is used as the primary programming language for building and training the deep learning model.
  - Anaconda: A distribution for managing packages and environments efficiently.
  - Jupyter Notebook (via Anaconda): Used as the development environment for writing and testing code, visualizing results, and organizing the workflow.
- **Libraries:**
  - NumPy (import numpy as np): For numerical computations and handling multidimensional arrays.
  - Pandas (import pandas as pd): For data manipulation and analysis, especially useful for handling tabular data.
  - TensorFlow (import tensorflow as tf): The core deep learning framework used for building and training the convolutional neural networks (VGG16 and Xception).
  - PIL (from PIL import Image): For loading and processing images before feeding them into the model.
  - Matplotlib (import matplotlib.pyplot as plt): For data visualization, including plotting graphs to visualize training progress and results.

ARCHITECTURE :

Data Preprocessing:

- Preprocessed images by resizing them to 256x256 and normalizing the pixel values to prepare for model input.

Model Training:

- Trained the CNN model for 15 epochs with a batch size of 32, monitoring validation performance to avoid overfitting.

Save Trained Model:

- Saved the trained model as pneumonia_model.h5 for future use in real-time predictions.

NEXT

ARCHITECTURE:

- Designed a CNN architecture with multiple layers to capture features from the X-ray images.

```
f.keras.layers.Conv2D(32,(3,3), input_shape=(120,120,3), activation="rel
f.keras.layers.MaxPooling2D(2,2),
f.keras.layers.Conv2D(64, (3,3), activation="relu"),
f.keras.layers.MaxPooling2D(2,2),
f.keras.layers.Conv2D(128, (3,3), activation="relu"),
f.keras.layers.MaxPooling2D(2,2),
f.keras.layers.Conv2D(256, (3,3), activation="relu"),
f.keras.layers.MaxPooling2D(2,2),
f.keras.layers.Conv2D(512, (3,3), activation="relu"),
f.keras.layers.MaxPooling2D(2,2),
f.keras.layers.Flatten(),
f.keras.layers.Dense(256, activation="relu"),
f.keras.layers.Dense(1,activation="sigmoid")])
```

```
[34]: model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 118, 118, 32)	896
max_pooling2d (MaxPooling2D)	(None, 59, 59, 32)	0
conv2d_2 (Conv2D)	(None, 57, 57, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 28, 28, 64)	0
conv2d_3 (Conv2D)	(None, 26, 26, 128)	73,856
max_pooling2d_2 (MaxPooling2D)	(None, 13, 13, 128)	0
conv2d_4 (Conv2D)	(None, 11, 11, 256)	295,168
max_pooling2d_3 (MaxPooling2D)	(None, 5, 5, 256)	0
conv2d_5 (Conv2D)	(None, 3, 3, 512)	1,180,160
max_pooling2d_4 (MaxPooling2D)	(None, 1, 1, 512)	0
flatten (Flatten)	(None, 512)	0
dense (Dense)	(None, 256)	131,328
dense_1 (Dense)	(None, 1)	257

Total params: 1,700,161 (6.49 MB)
Trainable params: 1,700,161 (6.49 MB)
Non-trainable params: 0 (0.00 B)

NEXT

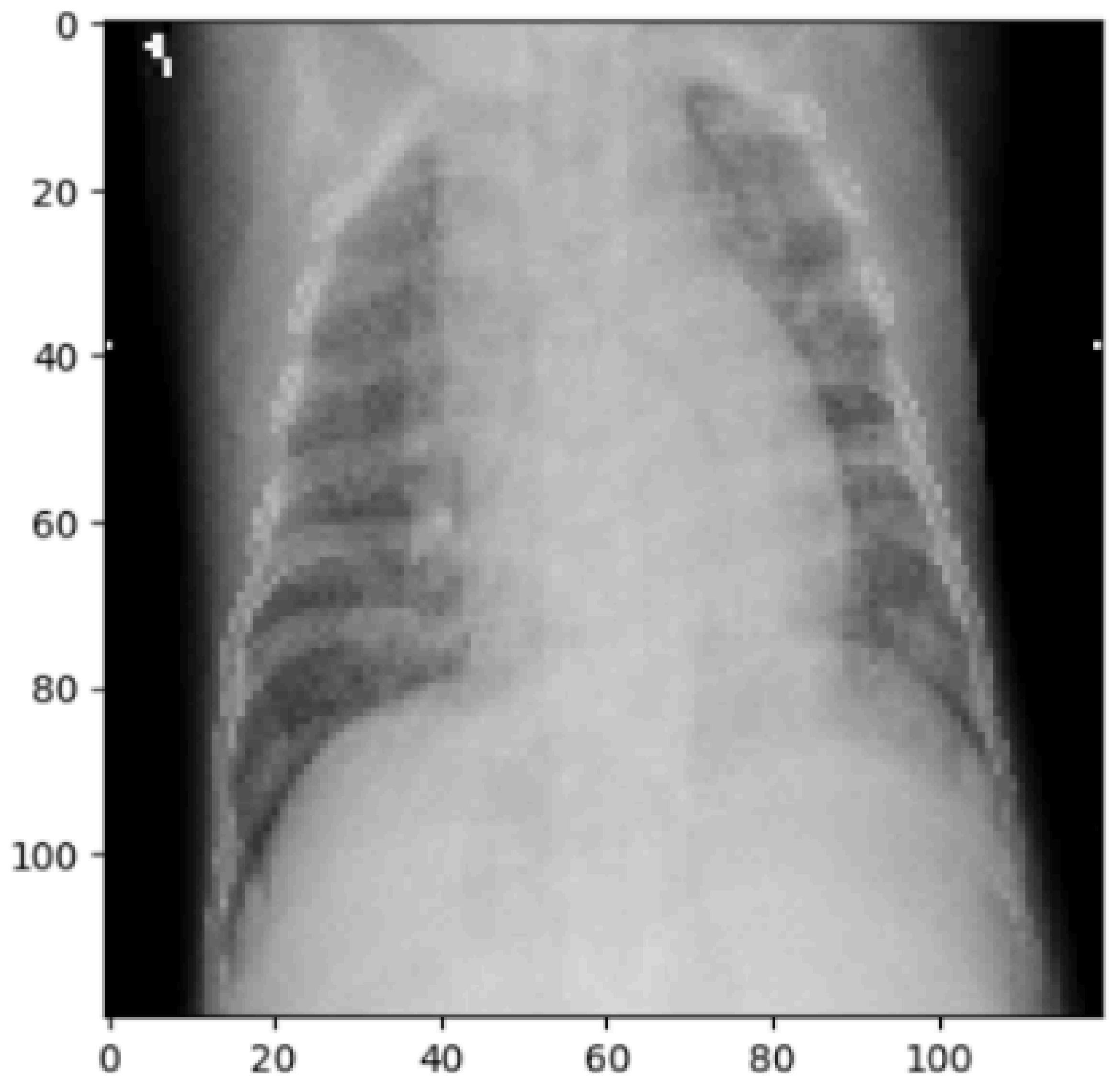
EXPECTED OUTPUT

The model's performance demonstrates its effectiveness in pneumonia detection.

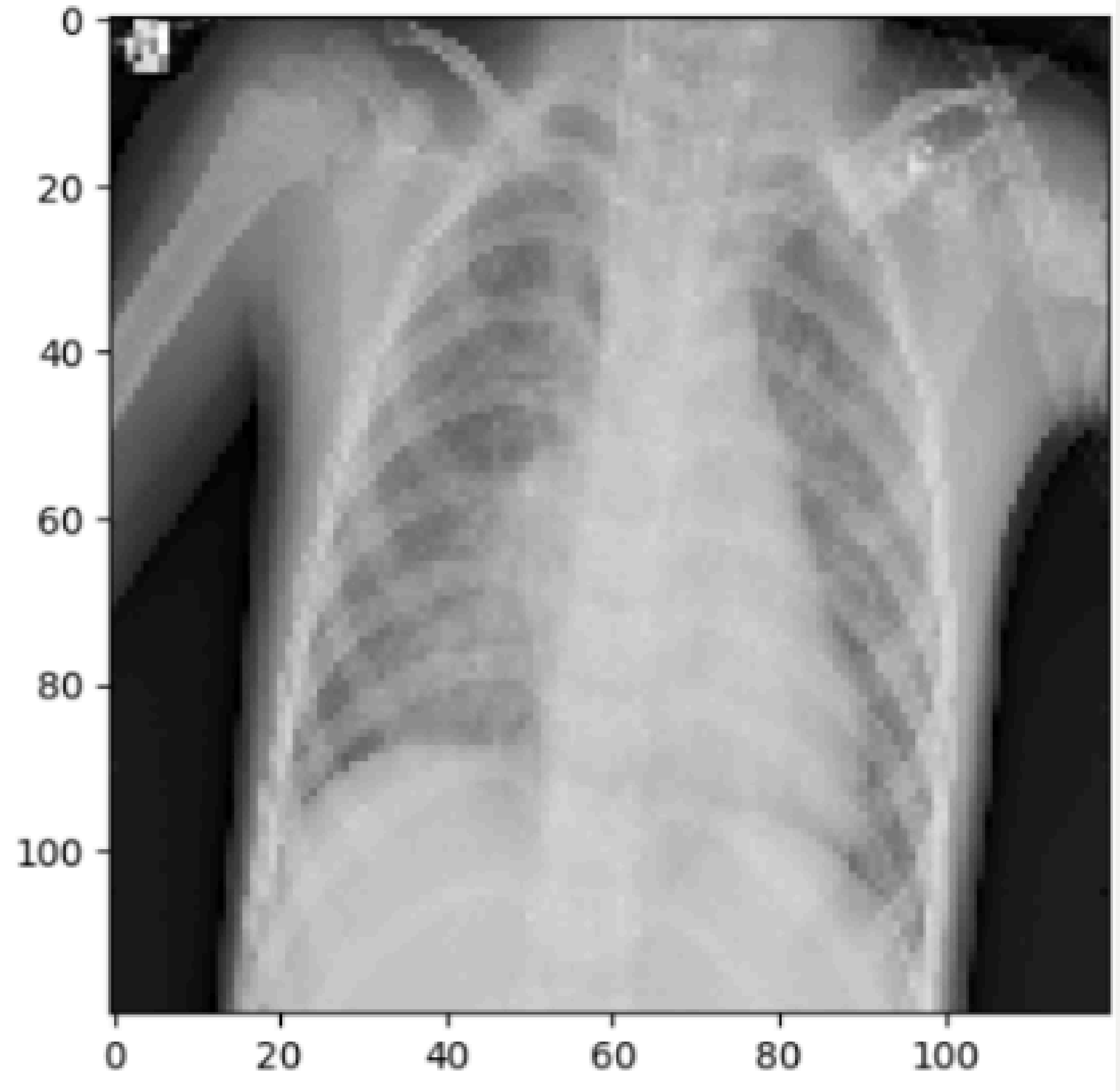
- **Pneumonia Detection:**
  - The model will be able to determine if a person has pneumonia or not based on chest X-ray images.
- **Threshold-based Classification:**
  - If the model predicts a probability greater than 0.5, it will classify the person as pneumonia-positive.
  - If the probability is less than 0.5, the person will be classified as pneumonia-negative.

NEXT

EXPECTED OUTPUT



The probability of pneumonia is: [0.98827624]



The probability of pneumonia is: [0.52389765]

NEXT

REFERENCE :

Diagnosis of Pneumonia from Chest X-Ray Images Using Deep Learning :

https://ieeexplore.ieee.org/document/8741582

Published in: 2019 Scientific Meeting on Electrical-Electronics & Biomedical Engineering and Computer Science (EBBT)

Date of Conference: 24-26 April 2019

Date Added to IEEE *Xplore*: 20 June 2019

▼ **ISBN Information:**

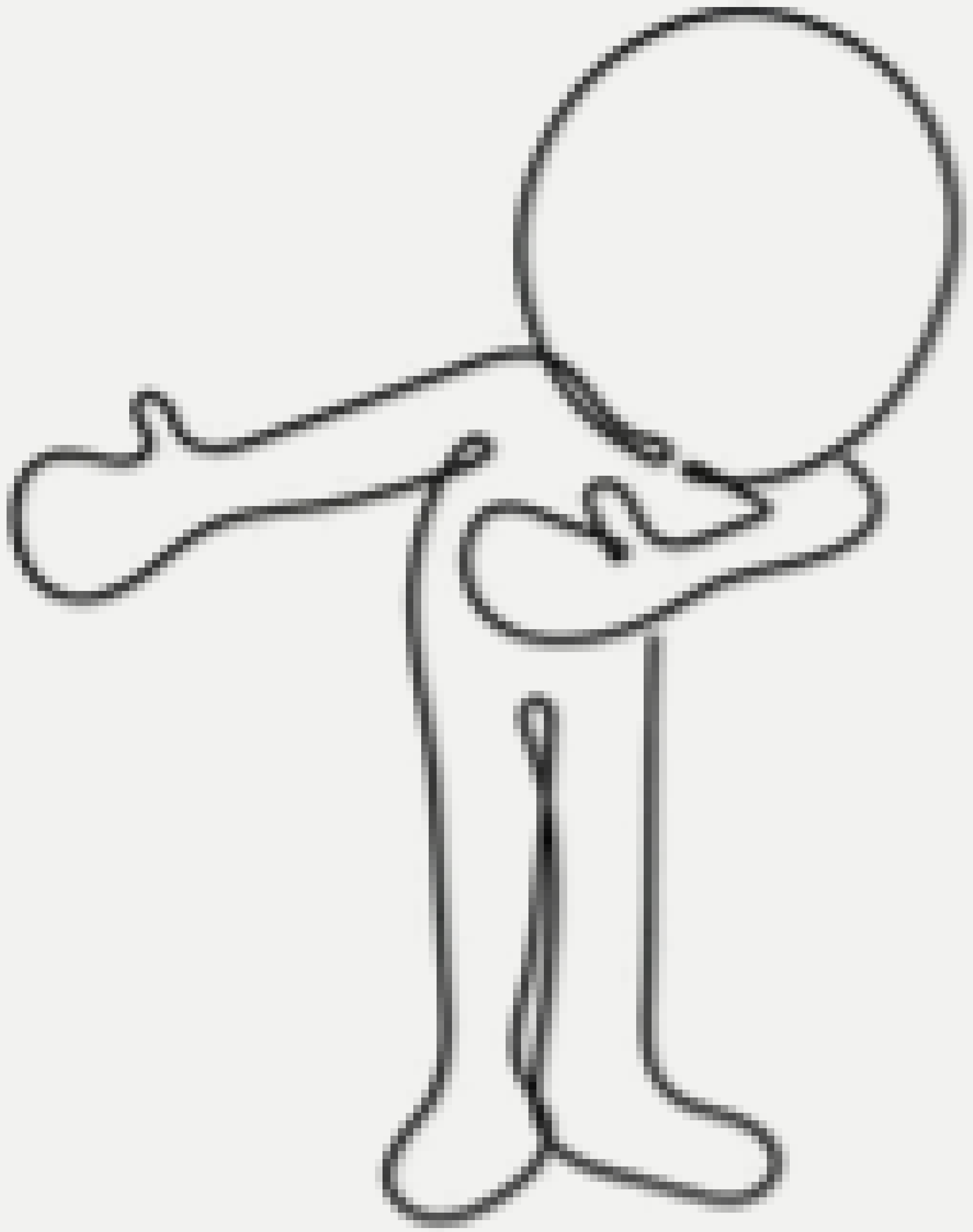
Electronic ISBN:978-1-7281-1013-4

Print on Demand(PoD) ISBN:978-1-7281-1014-1

DOI: 10.1109/EBBT.2019.8741582

Publisher: IEEE

Conference Location: Istanbul, Turkey



Thank You