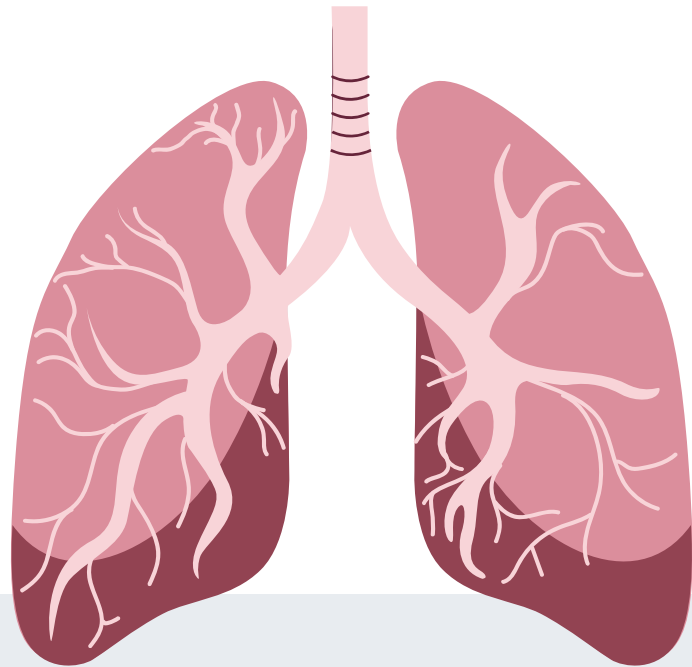


# PneumonoDetect

An AI-Powered Pneumonia Detection Tool

Developed by Team Alpha  
Praful John  
Mohibkhan Pathan  
Tingfei Gu  
Ranyi Zhang

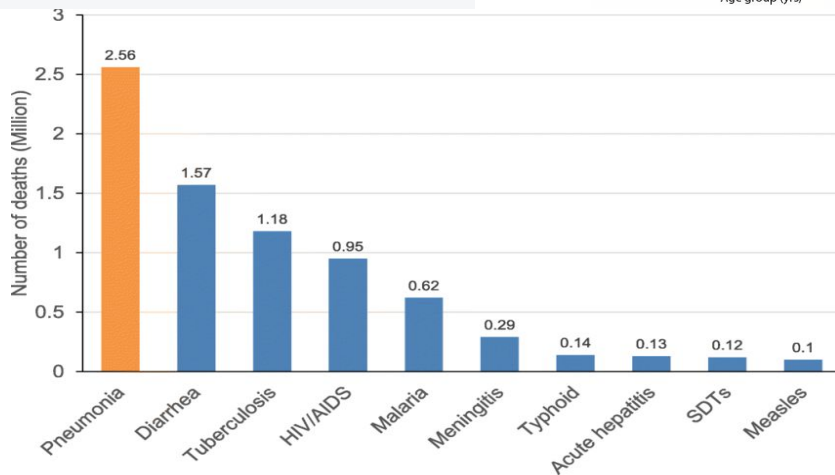
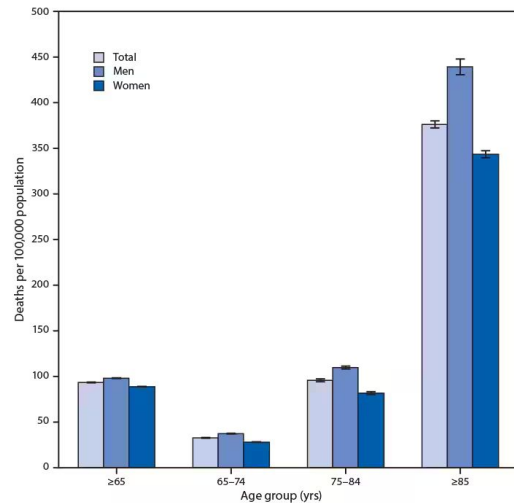
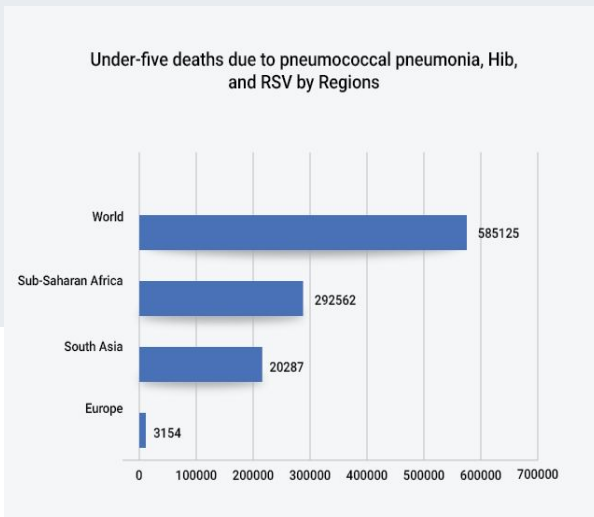


# Necessity for early detection

Pneumonia is the leading cause of death, particularly in children and elderly

**Children Under Five:** In 2019, pneumonia was responsible for 740,180 deaths in children under five, accounting for 14% of all deaths in this age group. (WHO)

**Adults Over 70:** In 2019, the highest pneumonia death rates were among people aged 70 and older (WHO)



# Necessity for Early Detection

**Pneumonia patients needs a reliable diagnosis for their health and survival.**

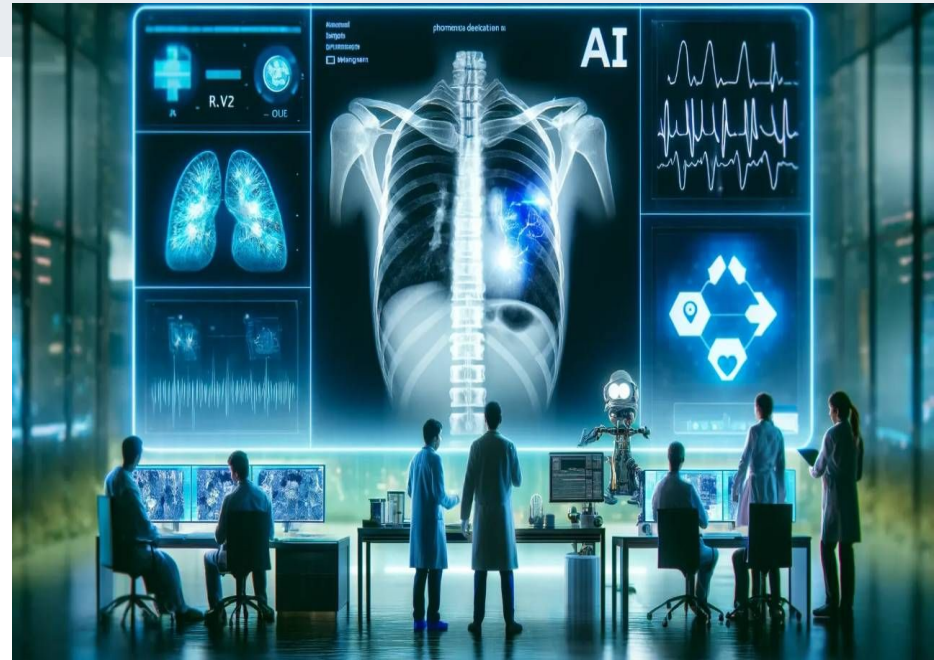
- Early and accurate detection can significantly improve the chance of survival.
- Challenges: Reliance on manual diagnosis, prone to errors (41% error rate); time-consuming for radiologists



# Automated and Accurate Detection

To develop a robust deep learning model that can:

- Be deployed for real-world usage via an accessible web interface.
- Accurately classify chest X-rays into pneumonia and non-pneumonia categories.
- Provide a user-friendly application for healthcare professionals to expedite diagnosis.



# Tools & Technologies



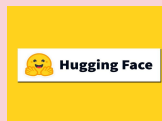
## Google Colab

Leveraged its GPU (T4) environment for efficient training



## Python

TensorFlow, Keras, Matplotlib, NumPy



## Huggingface

Used radio for UI and further deployed it using Huggingface

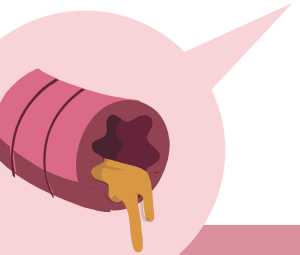
# Data Collection

Dataset source:

- [Kaggle](#)
- Detecting Pneumonia in X-ray Images

Details:

- Over 5000 chest X-Ray Images.
- Split across training, validation and test splits.



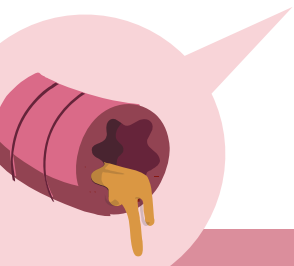
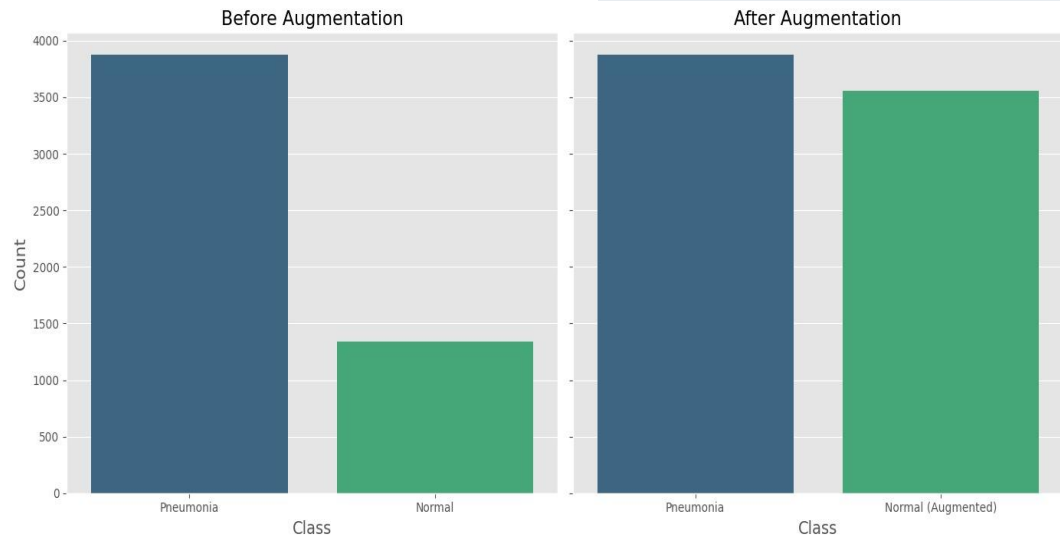
# Data Cleaning/Preparation

## Challenges

- Class imbalance
- Large dataset

## Solution:

- Data Augmentation
- Resizing Images
- Balanced train-test split



# VGG19 Model Architecture

## Transfer Learning with VGG19:

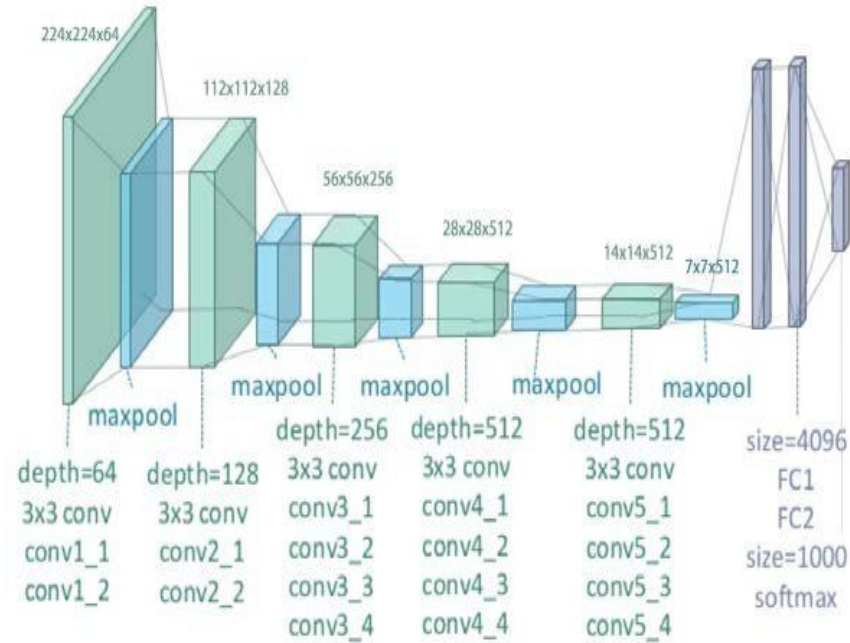
- Pretrained on ImageNet for feature extraction.
- Fine-tuned the Block 5 convolutional layers for enhanced generalization.

## Key Features:

- 19 layers deep:
  - 16 convolutional layers
  - 3 fully connected layers
- Small receptive fields (3x3) with max pooling for spatial reduction.

## Why VGG19?

- Achieves high accuracy for image classification tasks.
- Ideal for image datasets due to transfer learning capabilities.



[Image source](#)



# Model Training Process



## Transfer Learning with VGG19

- Used the pretrained VGG19 model, fine-tuned on the convolutional layers to achieve better feature extraction.



## Model Architecture

- Added custom fully connected layers on top of the VGG19 base model for pneumonia detection.
- Applied Dropout layers to reduce overfitting.



## Compilation

- Optimizer: Adam
- Loss Function: Categorical Crossentropy
- Metrics: higher accuracy and lower loss function



## Training Procedure

- Data split into training, validation, and test sets.
- Epochs: 5
- Batch Size: 32
- GPU Acceleration: Leveraged Google Colab's GPU for faster training.
- Real-time monitoring of validation accuracy and loss for early stopping.

# Optimization Techniques



## Regularization

Added Dropout layers in the fully connected layers to reduce overfitting.



## Early Stopping

Monitored validation loss during training to stop at the optimal point and avoid overfitting.



## Data Augmentation

Performed transformations like flipping, zooming, and rotation to improve model robustness and prevent overfitting.



## Fine-Tuning VGG19

adjusted **block5** layers of the pretrained model for better generalization



## GPU Utilization

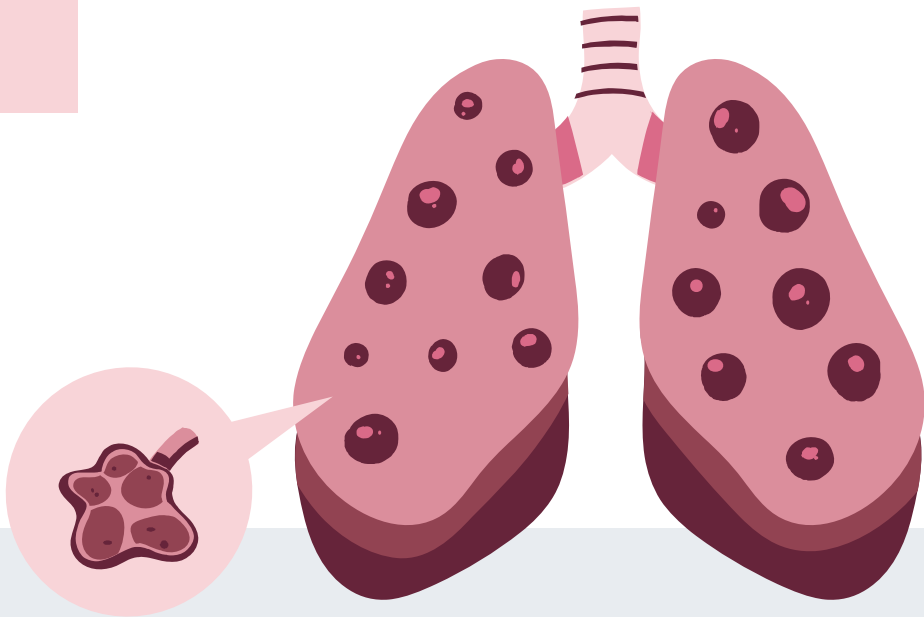
Used Google Colab's T4 GPU for faster model training and experimentation.

# MODEL RESULTS

**92%** accuracy  
on test data

Test Loss: 0.28

ROC-AUC: 0.96



# Deployment of the Model



## Frameworks

- Gradio
- Hugging Face Spaces



## Steps

- Save model weights
- Integrate with Gradio
- Deploy on Hugging Face Space

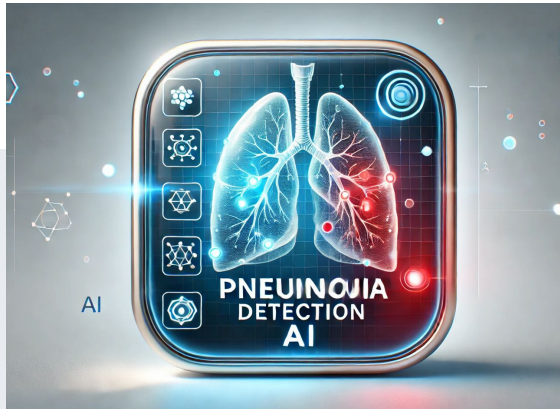


## Enhancements

- Icons
- Confidence
- Images

# Live Demo

Pneumonia Detection Application



## Pneumonia Detection CNN

ad an image to classify it as NORMAL or PNEUMONIA.

image

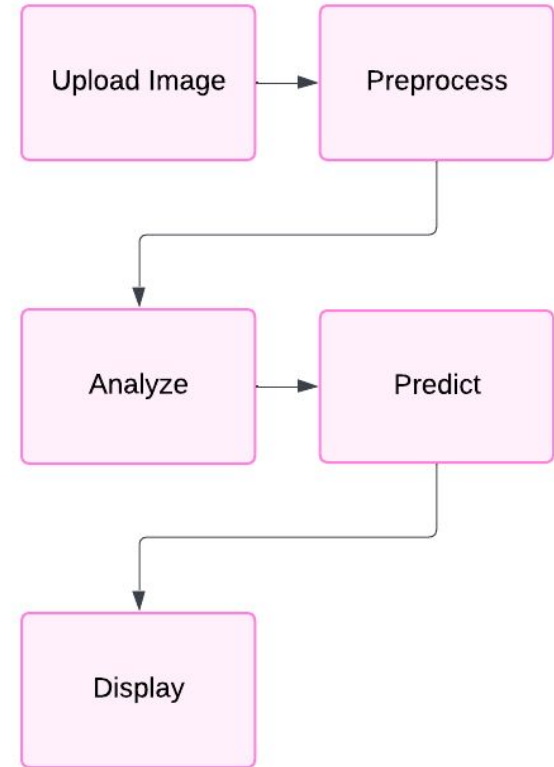
Drop Image Here  
- Or -  
Click to Upload

Clear

Submit

Predicted Class

Confidence



Please change this.

# References

VGG19

**Images**

Image Source

**Presentation Template**

Chronic Obstructive Pulmonary Disease (COPD) Case

Study Presentation

