

# Interpretable Deep Learning (AI) for

## Pneumonia Detection in Chest X-Rays



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 GitHub Repository:

# Data Set Source



The dataset used in this project was downloaded from a publicly available GitHub repository. It originates from the NIH Chest X-ray dataset and has been curated for binary classification: Pneumonia vs Normal. It's widely used in academic and clinical machine learning research.

The dataset is organized into three folders: train, val, and test, each containing chest X-ray images labeled as either 'Pneumonia' or 'Normal'. There are 5,216 training images, 16 validation images, and 624 test images.

# Problem Statement



- Detecting pneumonia from chest X-ray images is critical for timely treatment, especially in low-resource settings where radiologist availability is limited. Manual examination is time-consuming and prone to human error. This project automates pneumonia detection using deep learning to improve diagnostic efficiency, accuracy, and interpretability.



# Dataset



- NIH Chest X-ray Dataset
- 100,000+ labeled images across 14 disease categories
- Publicly available and widely used in medical imaging research
- Includes pneumonia cases

# Proposed Techniques



- Convolutional Neural Networks (CNNs) with Transfer Learning
- Pre-trained ResNet50 model fine-tuned for pneumonia detection
- Implemented using TensorFlow and Keras
- Grad-CAM visualizations for model interpretability

# Project Steps



1. Data Preprocessing (resize, normalize, augment)
2. Data Splitting (train, validation, test)
3. Model Development (ResNet50 fine-tuning)
4. Model Training (hyperparameter optimization)
5. Evaluation (accuracy, precision, recall, AUC)
6. Visualization (Grad-CAM heatmaps)
7. Reporting (methodology & results)

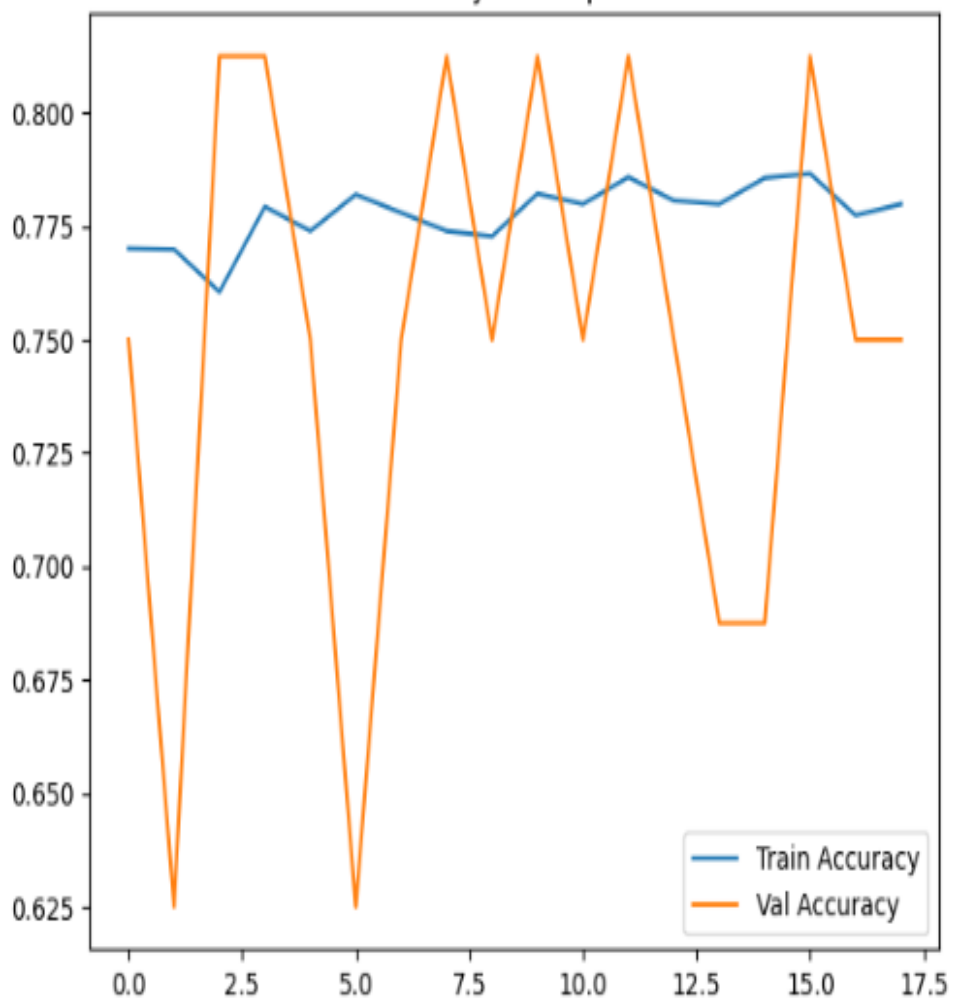


# Expected Results

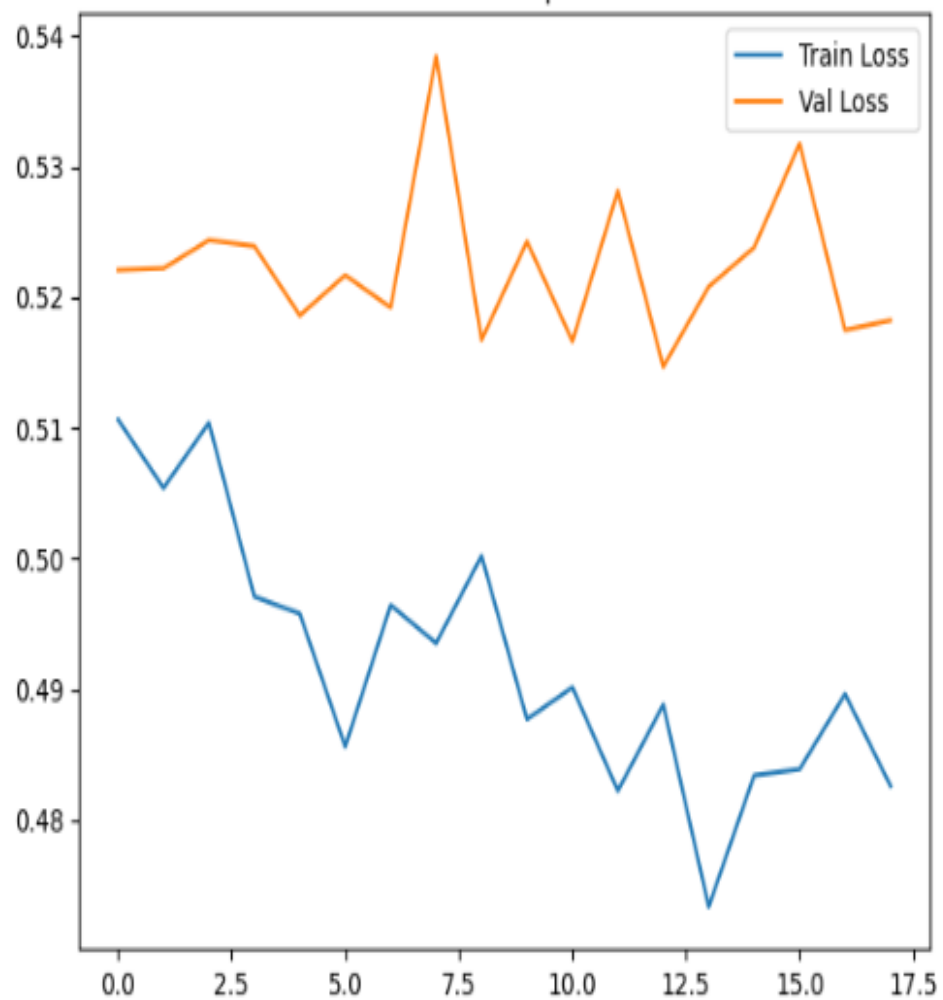


- Achieve  $>90\%$  classification accuracy on test data
- Provide an automated pneumonia screening tool
- Reduce radiologist workload and human error
- Improve early detection rates in clinical settings

Accuracy Over Epochs

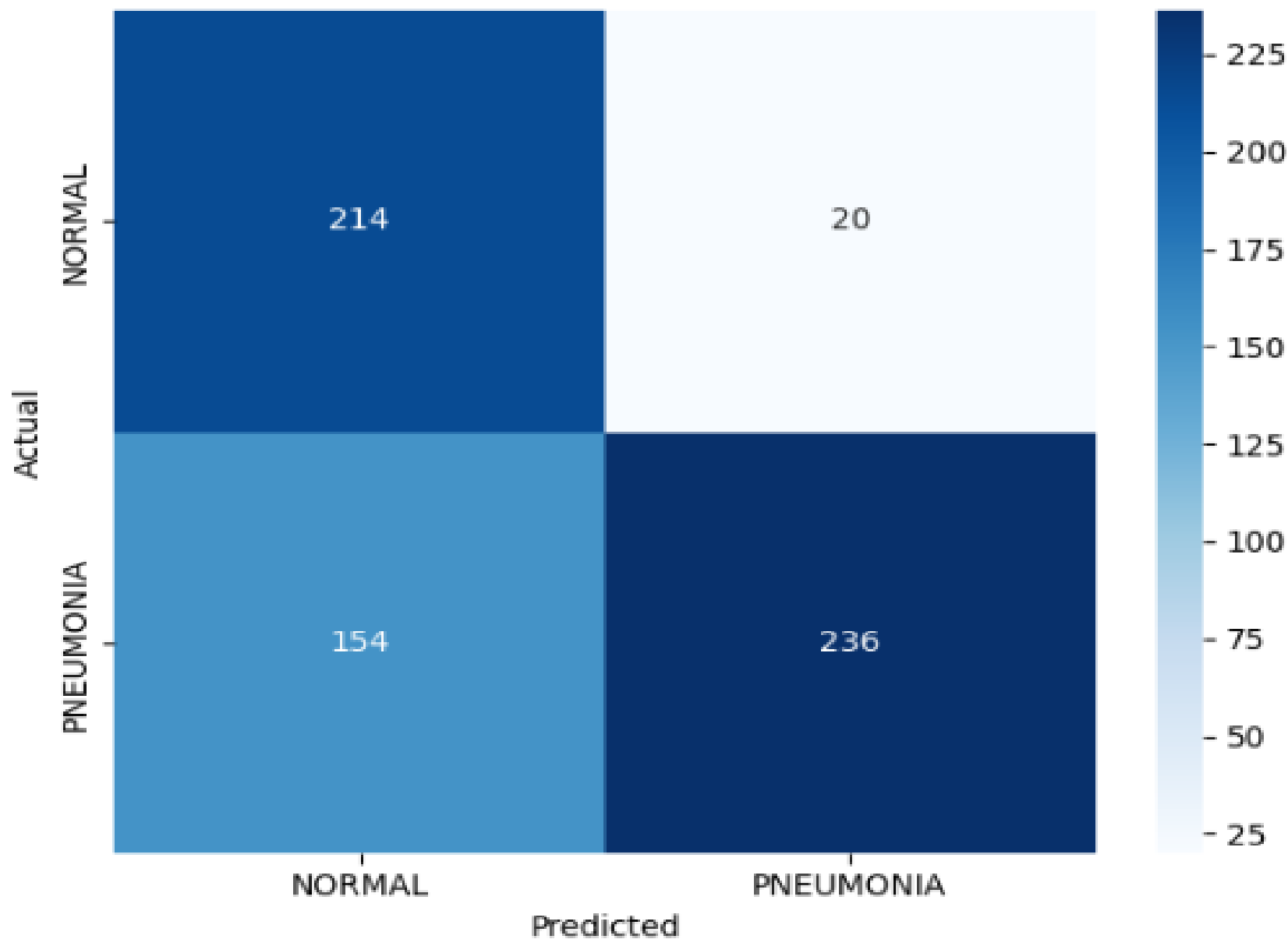


Loss Over Epochs





Confusion Matrix

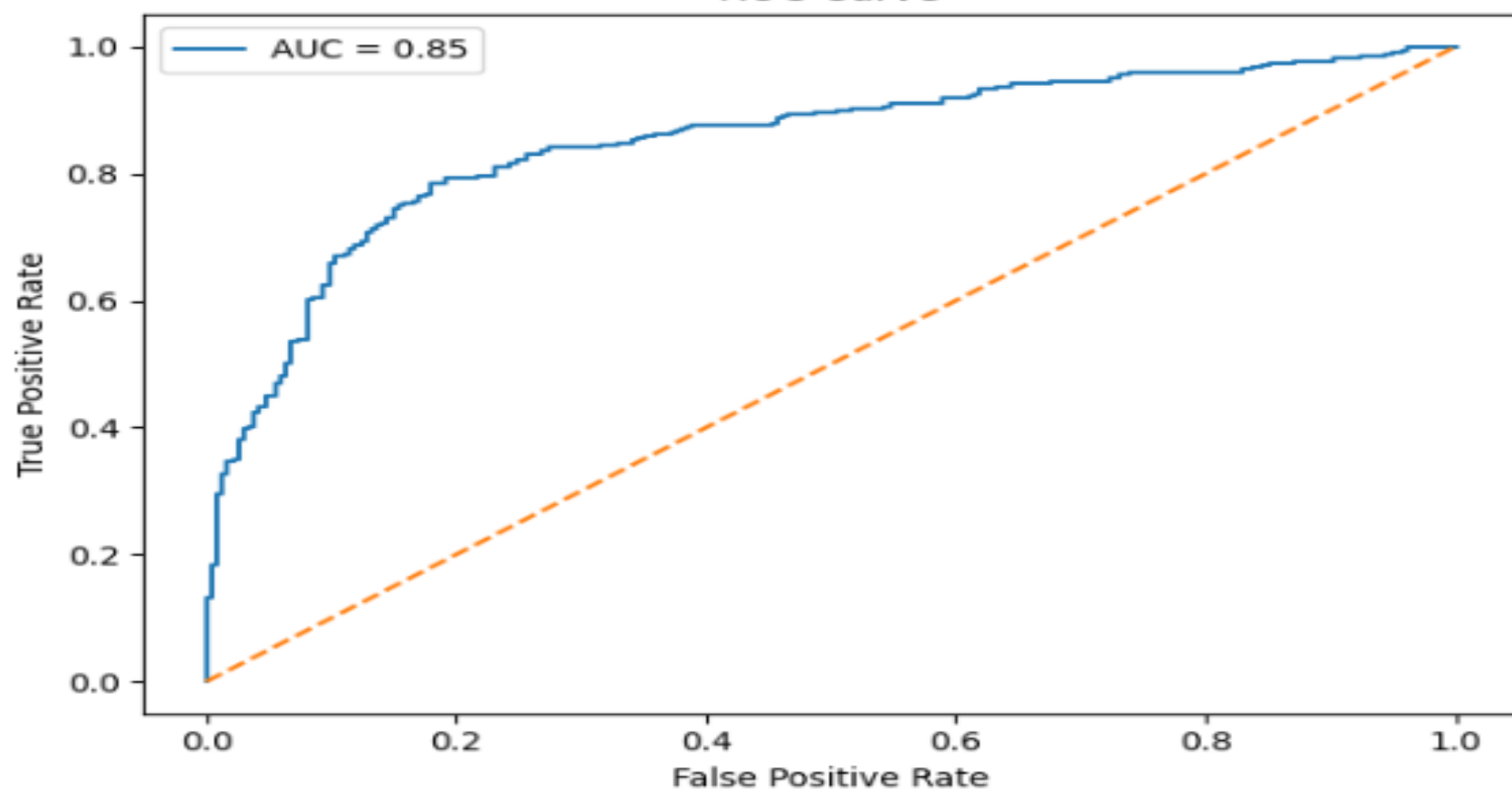




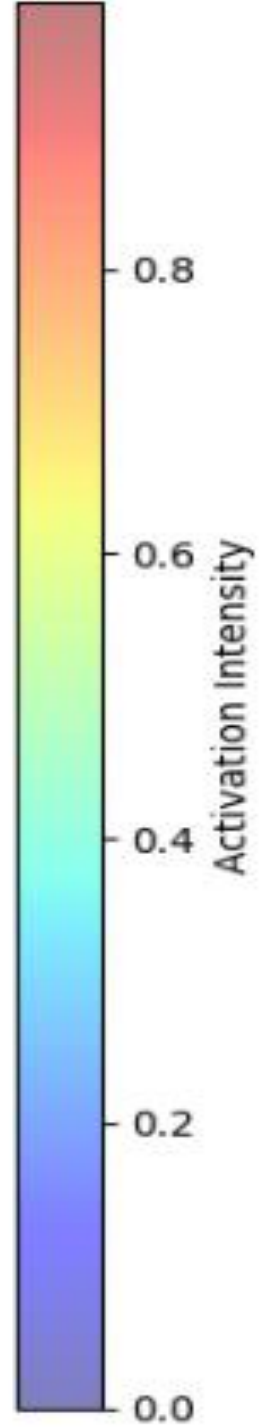
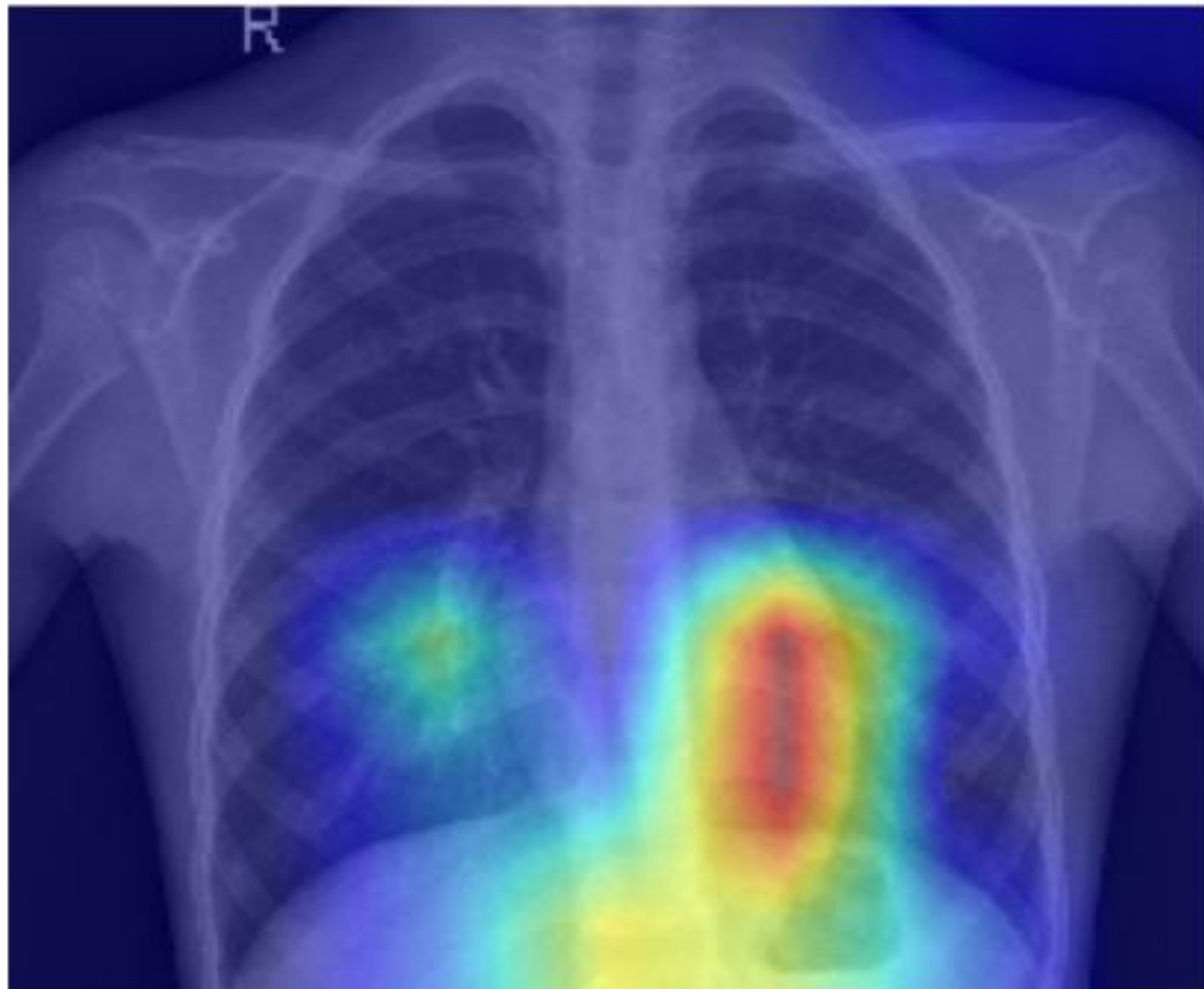
### Classification Report:

	precision	recall	f1-score	support
NORMAL	0.58	0.91	0.71	234
PNEUMONIA	0.92	0.61	0.73	390
accuracy			0.72	624
macro avg	0.75	0.76	0.72	624
weighted avg	0.79	0.72	0.72	624

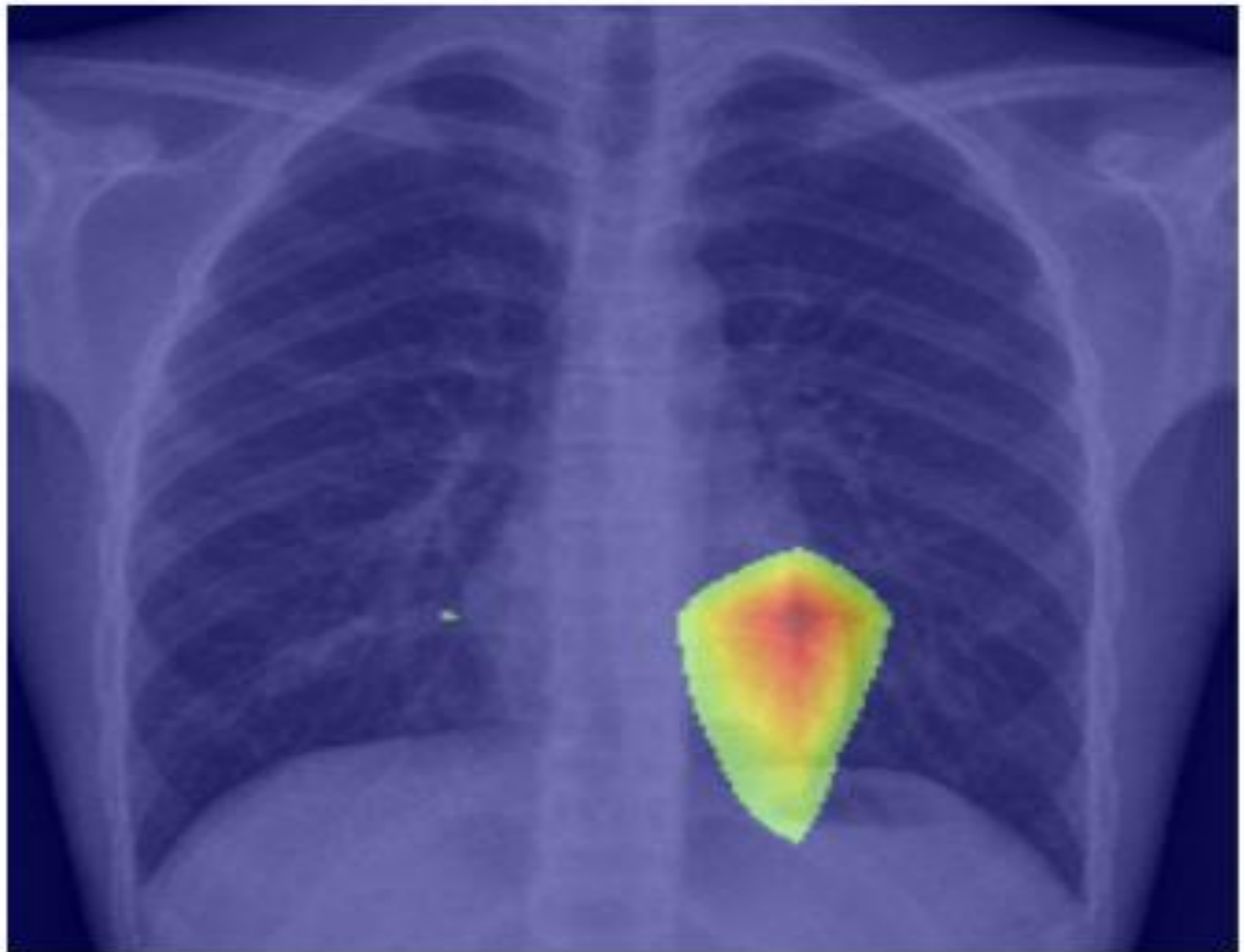
ROC Curve



## Grad-CAM: Pneumonia Detection



## High-Activation Regions





Found 5216 images belonging to 2 classes.  
Found 16 images belonging to 2 classes.  
Found 624 images belonging to 2 classes.

