Pneumonia Detection Using CNN - Technical Documentation

# 1. Project Overview

This project aims to detect pneumonia from chest X-ray images using a Convolutional Neural Network (CNN). The system leverages deep learning techniques to classify whether a patient has Pneumonia or is Normal. The model is trained on labeled X-ray datasets and saved as pneumonia\_cnn\_model.h5 for later use.

# 2. Workflow

1. Data Preprocessing: Images are resized, normalized, and augmented to improve generalization.  
2. Model Architecture: A CNN with multiple convolutional and pooling layers is used.  
3. Training: The model is trained on training data and validated on unseen data.  
4. Evaluation: Accuracy, loss, and confusion matrix are analyzed.  
5. Prediction: The saved model (pneumonia\_cnn\_model.h5) is loaded to predict on new X-ray images.

# 3. Technologies Used

- Python  
- TensorFlow / Keras  
- NumPy  
- Matplotlib  
- Streamlit (for UI)

# 4. Model Details

The CNN model consists of several convolutional and pooling layers followed by fully connected dense layers. The final activation function is Sigmoid for binary classification (Normal vs Pneumonia).

# 5. Results

The model achieved high accuracy in distinguishing pneumonia from normal cases. Evaluation metrics and graphs (accuracy vs epochs, loss vs epochs) are included in the notebook.

# 6. Deployment

The system is integrated with Streamlit to allow users to upload X-ray images and receive instant predictions. The output is displayed with labels (Normal / Pneumonia) along with confidence scores.

# 7. Limitations & Future Work

- Dataset bias may affect accuracy.  
- Further training on larger datasets can improve results.  
- Adding explainability techniques like Grad-CAM would enhance trust in predictions.