BMS COLLEGE OF ENGINEERING

(Autonomous Institute, Affiliated to VTU, Belagavi)

DEPARTMENT OF MACHINE LEARNING

(UG Program: B.E. in Artificial Intelligence and Machine Learning)

Course :Deep Learning

Course Code: 24AM5PCDEL

Alternative Assessment Tool

Date: 13-01-2025

AI Based System for Lung Disease Diagnosis

Presented By,

Student Name & USN :

MS Anagha : 1BM22AI067

Shriya Sai : 1BM22AI067

Semester & Section: **5B**

Faculty In-Charge:

Dr. Gowrishankar

Associate Professor

Department of Machine Learning

BMS College of Engineering

Agenda

- Introduction
- Background
- Problem Statement
- Dataset
- Network design
- Network architecture diagram
- Conclusion

Introduction

Overview:

- Artificial intelligence (AI) is revolutionizing healthcare by offering tools for faster and more accurate diagnostics.
- In radiology, interpreting chest X-rays is critical for diagnosing lung diseases. However, manual interpretation is time-consuming and prone to variability.
- AI-based systems can enhance radiologists' efficiency by automating abnormality detection and providing insights into disease severity.

Introduction

Objective:

Develop an AI system to assist radiologists by:

- Detecting abnormalities such as pneumonia, tuberculosis, and lung cancer.
- Classifying the severity of detected diseases into mild, moderate, or severe.
- Generating interpretable heatmaps to highlight regions of interest in the X-ray, fostering trust and aiding diagnosis.

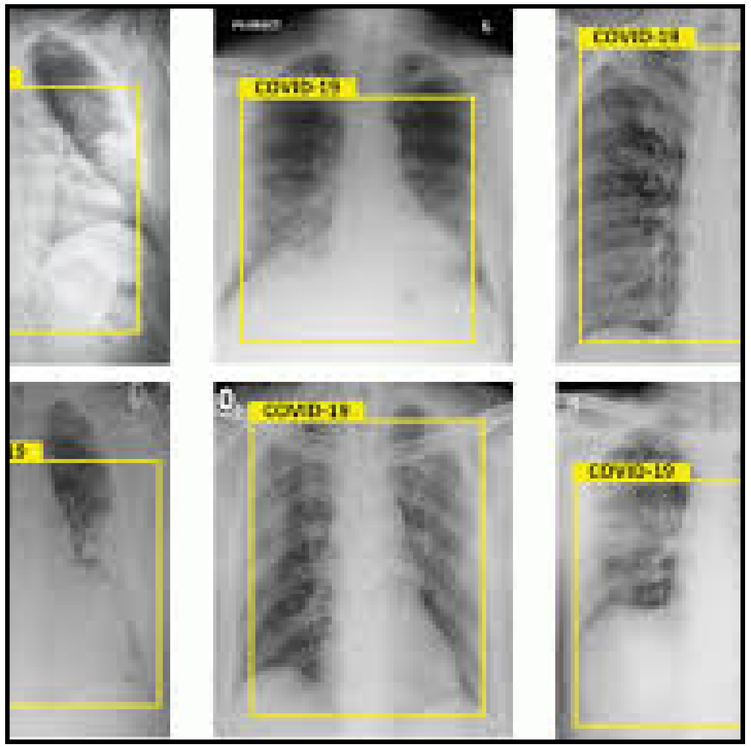
Background

- Lung diseases like pneumonia, tuberculosis, and lung cancer are major health concerns requiring accurate and timely diagnosis.
- Chest X-rays are commonly used but are challenging to interpret due to overlapping features and subtle abnormalities.
- Radiologists often face fatigue and variability, which can impact diagnostic accuracy.
- Deep learning models, especially convolutional neural networks (CNNs), have shown great success in medical imaging tasks.
- Pre-trained models like ResNet-50 and detection frameworks like YOLOv5 provide robust feature extraction and localization capabilities.
- Interpretability methods such as Grad-CAM enhance trust in AI systems by highlighting relevant regions in images.

Problem Statement

Develop an AI-based system to assist radiologists by detecting lung disease abnormalities from chest X-rays, classifying disease severity, and generating interpretable heatmaps, while addressing challenges like data imbalance, real-world scalability, and ethical considerations.

Dataset



Dataset Overview:

A comprehensive collection of 50,000 labeled chest X-ray images.

Annotations include:

- Disease type (e.g., pneumonia, tuberculosis, lung cancer).
- Severity levels categorized into mild, moderate, and severe.
- Bounding boxes marking regions of abnormalities.
- Diversity and Challenges:
- Includes common diseases (e.g., pneumonia) and rare ones (e.g., tuberculosis).
- Imbalanced distribution with fewer samples for rare diseases, posing challenges for model training.
- This dataset provides a solid foundation for training the deep learning model while presenting realistic challenges like imbalance and variability.

Dataset

Preprocessing Steps:

- Resizing all images to 256x256 pixels to ensure uniformity.
- Image normalization for consistent pixel intensity distribution.
- Augmentation techniques used to enhance variability and reduce overfitting:
- Rotation to simulate different viewing angles.
- Zooming to focus on specific regions.
- Contrast adjustment to mimic varying imaging conditions.
- Quality and Source:
- High-quality medical images sourced from trusted healthcare organizations and research datasets.
- Labels and annotations verified by expert radiologists.

Network design

Input Layer:

- Chest X-ray image input (256x256 pixels).

Feature Extraction:

- ResNet-50 Backbone: Pre-trained CNN for extracting high-level features from input images.

Abnormality Detection:

- YOLOv5 Detection Head:
  Receives features from ResNet-50.
  Localizes abnormalities using bounding boxes.

Network design

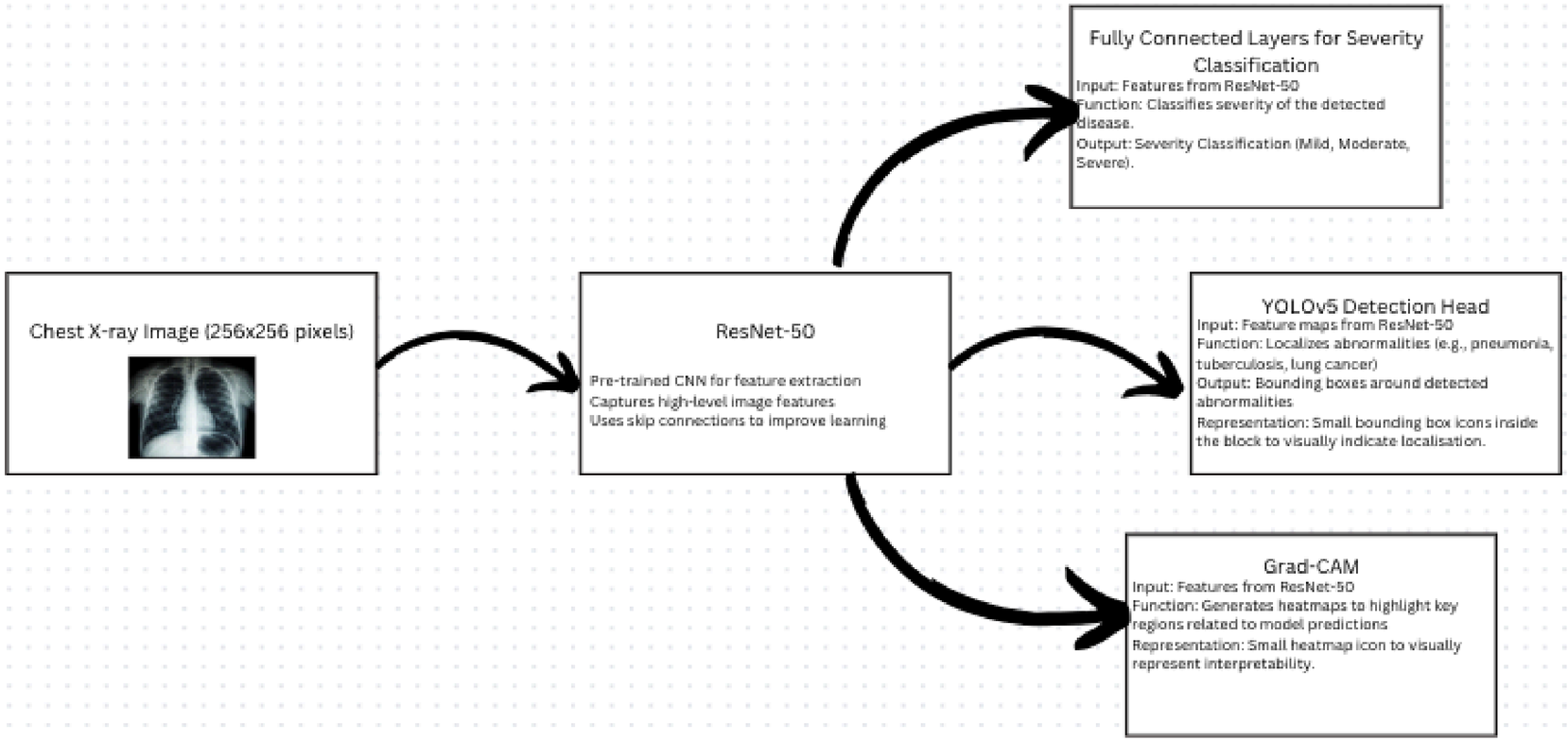
Severity Classification:

- Dense layers (two fully connected layers):
  Input: Features from ResNet-50.
  Output: Severity classification (mild, moderate, severe).

Interpretability:

- Grad-CAM: Generates heatmaps to highlight key regions in the image related to model predictions.

Network architecture diagram



Conclusion

- The proposed system leverages state-of-the-art deep learning techniques for accurate detection and classification of lung diseases in chest X-rays.
- Strengths: Combines powerful feature extraction (ResNet-50), effective abnormality localization (YOLOv5), and severity classification with interpretability (Grad-CAM), ensuring that the system is both accurate and trustworthy.
- Challenges: Addressing data imbalance, optimizing for real-time inference, and balancing interpretability with model performance.
- Future Work: Exploring additional data augmentation, model fine-tuning, and integrating other imaging modalities like CT scans or MRIs for broader applicability.

Thank you!