Chest X-Ray Classification Using Deep Learning

Project Overview

This project focuses on applying deep learning techniques to classify chest X-ray images into multiple pulmonary disease categories. The goal is to develop a decision support system that assists medical professionals by providing fast and accurate predictions based on radiographic images.

Problem Statement

Diagnosing chest diseases from X-ray images requires high medical expertise and can be time-consuming. Additionally, some diseases show very similar visual patterns, making accurate diagnosis challenging even for experienced clinicians. This project aims to address these challenges using artificial intelligence techniques.

Disease Classes

The model classifies chest X-ray images into six categories: Normal, COVID-19, Pneumonia (Bacterial), Pneumonia (Viral), Tuberculosis, and Emphysema.

Dataset Description

The dataset used in this project is the Chest X-Ray 6-Class Dataset obtained from Kaggle. It contains 18,036 grayscale chest X-ray images resized to 224×224 pixels. The dataset is divided into training, validation, and testing sets to ensure fair evaluation.

Methodology

A transfer learning approach was adopted using the DenseNet121 convolutional neural network pre-trained on ImageNet. The base model was used as a feature extractor, while custom classification layers were added on top. Data preprocessing included normalization and data augmentation to improve model generalization.

Training and Hyperparameter Tuning

The model was trained using the Adam optimizer and categorical cross-entropy loss function. Several learning rates and epoch values were tested to identify the best configuration. The optimal setup achieved stable training performance with minimal overfitting.

Results and Evaluation

The trained model achieved a test accuracy of approximately 80.5%. Evaluation using precision, recall, F1-score, and confusion matrix showed strong performance for Normal and Tuberculosis classes. The main challenge remained distinguishing between Pneumonia Viral and Pneumonia Bacterial cases.

Project Impact

The results demonstrate the potential of deep learning models as supportive tools in medical diagnosis, especially in healthcare environments with limited resources. Early and accurate

detection of pulmonary diseases can significantly improve patient outcomes.

Disclaimer

This project is intended for educational and research purposes only and should not be used as a replacement for professional medical diagnosis.