Capstone Three Presentation

Classifying Respiratory Diseases from Chest X-Ray Images

Problem Statement

- This project aims to build a machine learning model that can classify chest X-ray images into five categories:
- 1. COVID-19
- 2. Pneumonia
- 3. Tuberculosis
- 4. Lung Opacity
- 5. Normal

- The goal is to assist radiologists in diagnosing respiratory diseases more accurately and efficiently.

Data Overview

- The dataset contains chest X-ray images representing five categories, including respiratory diseases.
- The images were collected from multiple sources and underwent preprocessing, including:
- 1. Resizing and Normalization
- 2. Image Augmentation (rotation, flipping, scaling)
- 3. Splitting into training, validation, and test sets.

Approach

- The project approach involved the following steps:
- 1. Preprocessing chest X-ray images
- 2. Fine-tuning pre-trained convolutional neural networks (CNNs) such as ResNet and EfficientNet
- 3. Evaluating the model using metrics such as accuracy, precision, recall, and F1-scores.

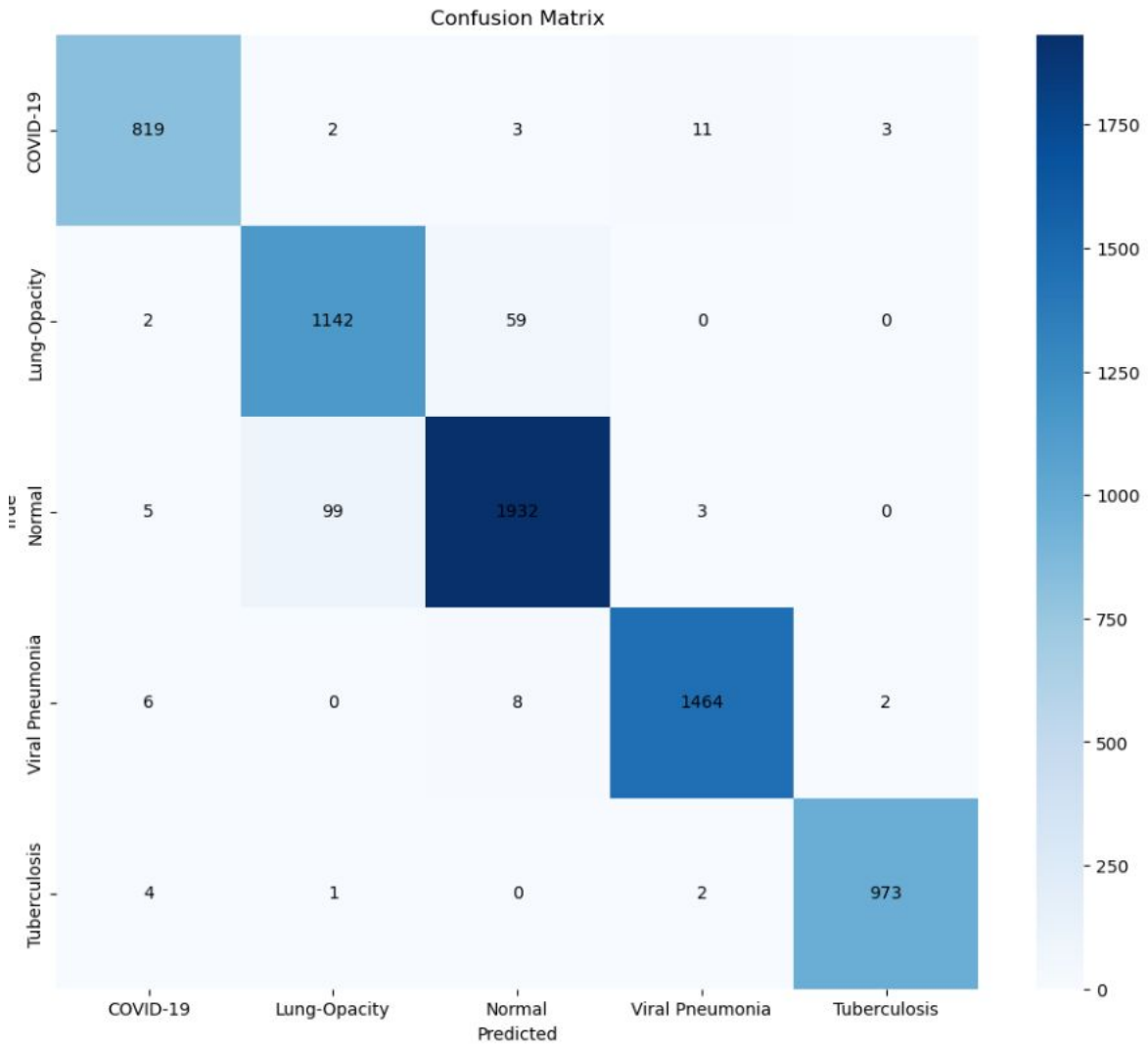
Model Architecture

- A convolutional neural network (CNN) was used for this classification task. The architecture was based on fine-tuning pre-trained models such as ResNet, leveraging transfer learning to improve accuracy given the moderate dataset size.

Findings

- The model achieved high accuracy in distinguishing between the five categories. COVID-19 was successfully detected, but some confusion occurred between Pneumonia and Lung Opacity due to their overlapping radiographic features.

Confusion Matrix



Further Research

- Further research opportunities include:
- 1. Data augmentation and collection to expand the dataset, particularly for rare diseases like Tuberculosis.
- 2. Multi-modal analysis, combining chest X-ray images with clinical data such as patient history and symptoms.
- 3. Deployment of the model in real-world clinical settings for real-time diagnostics.

Recommendations

- Based on the findings, we recommend the following:
- 1. Incorporate the model into radiologists' workflows to enhance diagnostic accuracy for respiratory diseases.
- 2. Use the model in public health monitoring to track the prevalence of diseases like COVID-19.
- 3. Deploy the model in resource-limited settings for remote diagnostics and telemedicine.

Conclusion

- This project demonstrated the potential of using machine learning models to assist in diagnosing respiratory diseases from chest X-ray images. The model performed well in distinguishing between multiple diseases, particularly COVID-19, and offers valuable assistance to healthcare providers.