

Pneumonia Detection Using Machine Learning

1. Introduction

Pneumonia is a serious respiratory disease that affects millions of people worldwide, especially children and elderly patients. Traditional diagnosis through chest X-rays requires experienced radiologists and can be time-consuming.

This case study focuses on the development of a machine learning-based system that automatically detects pneumonia from chest X-ray images, helping doctors in faster and more accurate diagnosis.

2. Problem Statement

Manual analysis of chest X-ray images has the following challenges:

- Time-consuming diagnosis
- Human error due to fatigue
- Limited availability of expert radiologists

Objective:

To design an automated system that classifies chest X-ray images as Pneumonia or Normal using machine learning techniques.

3. Dataset Description

The dataset consists of chest X-ray images divided into two classes:

- Pneumonia
- Normal

Dataset Features:

- Medical X-ray images
- Labeled data for supervised learning
- Images resized and normalized before training

The dataset is split into:

- Training set
 - Validation set
 - Testing set
-

4. Methodology

The following steps were followed in the system development:

4.1 Data Preprocessing

- Image resizing to standard dimensions
- Normalization of pixel values
- Data augmentation to improve model generalization

4.2 Model Selection

A Convolutional Neural Network (CNN) was used because it performs well on image classification tasks by automatically extracting spatial features.

4.3 Model Training

- The CNN model was trained on the training dataset
- Validation data was used to avoid overfitting
- Accuracy and loss were monitored during training

4.4 Model Saving

After training, the model was saved and reused for predicting pneumonia on new chest X-ray images without retraining.

5. System Architecture

The system follows this flow:

1. Input chest X-ray image
 2. Image preprocessing
 3. CNN model prediction
 4. Output result (Pneumonia / Normal)
-

6. Results and Analysis

- The trained model achieved good accuracy on the validation dataset
 - The system successfully classified unseen chest X-ray images
 - Predictions are generated in real time
-

7. Advantages of the System

- Fast diagnosis
 - Reduced human error
 - Helpful for doctors as a decision-support tool
 - Can be deployed in hospitals with limited resources
-

8. Limitations

- Model accuracy depends on dataset quality
 - Cannot fully replace medical professionals
 - Requires further training on diverse datasets for real-world deployment
-

9. Future Scope

- Integration with hospital management systems
 - Training on larger and more diverse datasets
 - Deployment as a web or mobile application
 - Use of advanced deep learning architectures
-

10. Conclusion

This case study demonstrates how machine learning can be effectively used to detect pneumonia from chest X-ray images. The proposed system provides a fast and reliable solution that can assist healthcare professionals in early diagnosis and treatment planning.

Khushi Giri

B.Tech – Computer Science & Engineering
Galgotias University

23scse1011651