

Pneumonia Detection with AI- and GRAD-CAM

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Abstract

Pneumonia is a serious respiratory disease that affects millions of people worldwide. Traditional diagnosis through manual interpretation of chest X-ray images is time-consuming and may lead to errors. This project proposes an automated deep learning-based system for detecting and classifying pneumonia using chest X-ray images. A Convolutional Neural Network (CNN) model is trained on publicly available Kaggle datasets containing normal and pneumonia X-ray images. The proposed system performs preprocessing, feature extraction, and classification to identify pneumonia cases with high accuracy. The model is integrated with a Flask web application to provide a user-friendly interface for uploading X-ray images and obtaining predictions. The experimental results demonstrate an accuracy of 96.07%, showing the effectiveness of deep learning in assisting medical diagnosis.

Keywords: Pneumonia, Deep Learning, CNN, Chest X-ray, Flask, Medical Image Processing.

1. INTRODUCTION

Pneumonia is a life-threatening lung infection caused by bacteria, viruses, or fungi. Early detection is important to reduce mortality rates. Artificial Intelligence and Deep Learning have become powerful technologies in medical image analysis. In this work, a CNN-based model is used to analyze chest X-ray images and classify them as normal or pneumonia infected.

2. LITERATURE SURVEY

Several researchers have applied deep learning techniques for pneumonia detection. Studies using VGG16, ResNet-50, AlexNet, and transfer learning approaches achieved high accuracy in detecting pneumonia and COVID-19 from chest X-ray images. Existing works highlight the importance of data preprocessing, feature extraction, and model optimization in improving classification performance.

3. METHODOLOGY

The dataset used in this project contains 5863 chest X-ray images collected from Kaggle. Images are preprocessed using resizing, normalization, and augmentation techniques such as zooming, shearing, and horizontal flipping. The CNN model consists of convolutional layers, pooling layers, and dense layers. ReLU activation is used in hidden layers, while Sigmoid activation is used for binary classification. The model is trained using the Adam optimizer and binary cross-entropy loss function.

4. SYSTEM IMPLEMENTATION

The trained deep learning model is integrated into a Flask-based web application. Users can upload chest X-ray images through the interface, and the system predicts whether the patient is affected by pneumonia. The application provides fast and accurate results, making it useful for supporting healthcare professionals.

5. RESULTS AND DISCUSSION

The proposed CNN model achieved an accuracy of 96.07% with high precision and recall. Experimental results show that the model effectively distinguishes between normal and pneumonia cases. The confusion matrix and prediction visualizations confirm the reliability of the proposed system.

6. CONCLUSION

This project presents an efficient deep learning-based pneumonia detection system using chest X-ray images. The proposed model automates the diagnostic process and provides accurate predictions in less time. Future work can focus on improving dataset diversity, reducing overfitting, and integrating the system with real-time hospital environments.

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