Automatic Lung Disease Diagnosis System Development using Deep Learning Techniques

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Abstract

Early detection of lung diseases such as COVID-19, pneumonia, and lung opacity is crucial for improving treatment effectiveness and reducing the spread of illness. However, conventional methods of analyzing medical images such as X-rays and CT scans are often time-consuming and prone to human error. Therefore, an artificial intelligence-based approach is needed to enhance the speed and accuracy of detection. This study develops a modified YOLOv11 model to detect four categories of lung conditions: COVID-19, pneumonia, lung opacity, and normal. The modifications include the integration of Depthwise Separable Convolution and ELAN blocks to improve computational efficiency without compromising accuracy. Additionally, layer freezing techniques are explored to optimize the model for devices with limited computational resources. The results show that the Modified YOLOv11 model achieved a precision of 0.96638, recall of 0.95154, mAP50 of 0.98591, and mAP50-95 of 0.96061. Freezing 10 layers yielded the best performance, while freezing all layers significantly reduced accuracy. This research contributes to the development of accurate and efficient deep learning models for lung disease detection, particularly for deployment on resource-constrained devices. The findings indicate that the Modified YOLOv11 has strong potential to assist medical professionals in detecting lung diseases quickly and reliably.

Keyword: lung disease detection, yolo, deep learning, covid-19, x-ray, layer freezing