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Identification of Intrathoracic Pathological Conditions in Chest X-rays Using Deep Learning and Digital Image Processing

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The interpretation of chest X-rays plays a pivotal role in diagnosing various intrathoracic pathological conditions. Traditionally, this task has heavily depended on the expertise of radiologists and clinicians, often leading to delays and subjective variability in displaying the results. With recent advancements in Deep Learning and Digital Image Processing, there is a promising opportunity to enhance the accuracy, efficiency, and speed of diagnosing these conditions. This study focused on the development and evaluation of an automated system for detecting intrathoracic pathologies in chest X-ray images, particularly for pneumonia, pleural effusion, and cardiomegaly. Deep learning models including VGG-16 and a custom Convolutional Neural Network (based on AlexNet), designed with the Sequential API in Keras, were utilized for the analysis. The dataset comprised of both primary and secondary chest X-ray images, which were meticulously pre-processed through techniques such as resizing and normalization. Model training involved fine-tuning hyperparameters, selecting optimizers, and optimizing loss functions to maximize predictive performance while minimizing overfitting. Both the VGG-16 and custom CNN models achieved an accuracy of 0.79. Considering the balance between precision and recall, the VGG-16 model appears to be slightly more suitable for chest X-ray identification, particularly for its better performance in detecting Pleural Effusion and Cardiomegaly. The customized model also performed well, especially in identifying normal cases and has almost equivalent performance in detecting Pneumonia. These findings underscore the potential of deep learning models in revolutionizing chest X-ray analysis, offering the possibility of improved patient outcomes and more efficient diagnostic processes.

Keywords: *chest X-rays, convolutional neural network, VGG-16*