A Hybrid Learning-Driven Approach for Lung Enhancement, Tumor Detection and Fibrosis System

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This study introduces a system that works seamlessly and automatically for lung pathology analysis, including fibrosis pattern categorization and lung cancer nodule detection in CT scans. In the fibrosis detection system, contrast limited adaptive histogram equalization (CLAHE) is employed to enhance grayscale lung images, followed by data augmentation and downsampling in an offline mode to prepare six state-of-the-art convolutional neural network (CNN) models for input (VGG16, VGG19, ResNet50, ResNet50V2, MobileNetV2, and EfficientNetB0). Strati- fied 5-fold cross-validation is employed to rigorously evaluate performance, and statistical metrics (accuracy, F1-score, and recall) depict the better capability of VGG16 and ResNet50V2 to handle various contrast conditions. Likewise, there is a specialized architecture for detecting nodules that have something to do with cancer. employed to classify CT scans in benign, malignant, and normal classes, and an approximate 98.6% accuracy is achieved by extensive augmentation and hyperparameter tuning. An automated nodule localization approach is also developed, using threshold-based segmentation, morphological operators, and filter-by-shape to identify suspect regions in the lung. These strategies demonstrate the effectiveness preprocessing steps, deep learning, and precise segmentation in the enhancing lung disease diagnosis.

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