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COVID-19 Detection from Computed Tomography Images Using UNet Segmentation, Region Extraction, and Classification Pipeline

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Abstract : This study aimed to develop a novel pipeline for COVID-19 detection using a large and rigorously annotated database of computed tomography (CT) images. The pipeline consists of UNet-based segmentation, lung extraction, and a classification part, with the addition of optional slice removal techniques following the segmentation part. In this work, a batch normalization was added to the original UNet model to produce lighter and better localization, which is then utilized to build a full pipeline for COVID-19 diagnosis. To evaluate the effectiveness of the proposed pipeline, various segmentation methods were compared in terms of their performance and complexity. The proposed segmentation method with batch normalization outperformed traditional methods and other alternatives, resulting in a higher dice score on a publicly available dataset. Moreover, at the slice level, the proposed pipeline demonstrated high validation accuracy, indicating the efficiency of predicting 2D slices. At the patient level, the full approach exhibited higher validation accuracy and macro F1 score compared to other alternatives, surpassing the baseline. The classification component of the proposed pipeline utilizes a convolutional neural network (CNN) to make final diagnosis decisions. The COV19-CT-DB dataset, which contains a large number of CT scans with various types of slices and rigorously annotated for COVID-19 detection, was utilized for classification. The proposed pipeline outperformed many other alternatives on the dataset.

Keywords : classification, computed tomography, lung extraction, macro F1 score, UNet segmentation
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