

Accurate Mass Segmentation Using U-Net Deep Learning Architecture for Improved Cancer Detection

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Abstract : Accurate segmentation of breast ultrasound images is of paramount importance in enhancing the diagnostic capabilities of breast cancer detection. This study presents an approach utilizing the U-Net architecture for segmenting breast ultrasound images aimed at improving the accuracy and reliability of mass identification within the breast tissue. The proposed method encompasses a multi-stage process. Initially, preprocessing techniques are employed to refine image quality and diminish noise interference. Subsequently, the U-Net architecture, a deep learning convolutional neural network (CNN), is employed for pixel-wise segmentation of regions of interest corresponding to potential breast masses. The U-Net's distinctive architecture, characterized by a contracting and expansive pathway, enables accurate boundary delineation and detailed feature extraction. To evaluate the effectiveness of the proposed approach, an extensive dataset of breast ultrasound images is employed, encompassing diverse cases. Quantitative performance metrics such as the Dice coefficient, Jaccard index, sensitivity, specificity, and Hausdorff distance are employed to comprehensively assess the segmentation accuracy. Comparative analyses against traditional segmentation methods showcase the superiority of the U-Net architecture in capturing intricate details and accurately segmenting breast masses. The outcomes of this study emphasize the potential of the U-Net-based segmentation approach in bolstering breast ultrasound image analysis. The method's ability to reliably pinpoint mass boundaries holds promise for aiding radiologists in precise diagnosis and treatment planning. However, further validation and integration within clinical workflows are necessary to ascertain their practical clinical utility and facilitate seamless adoption by healthcare professionals. In conclusion, leveraging the U-Net architecture for breast ultrasound image segmentation showcases a robust framework that can significantly enhance diagnostic accuracy and advance the field of breast cancer detection. This approach represents a pivotal step towards empowering medical professionals with a more potent tool for early and accurate breast cancer diagnosis.

Keywords : mage segmentation, U-Net, deep learning, breast cancer detection, diagnostic accuracy, mass identification, convolutional neural network

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