A Distinct Method Based on Mamba-Unet for Brain Tumor Image Segmentation

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Abstract : Accurate brain tumor segmentation is crucial for diagnosis and treatment planning, yet it remains a challenging task due to the variability in tumor shapes and intensities. This paper introduces a distinct approach to brain tumor image segmentation by leveraging an advanced architecture known as Mamba-Unet. Building on the well-established U-Net framework, Mamba-Unet incorporates distinct design enhancements to improve segmentation performance. Our proposed method integrates a multi-scale attention mechanism and a hybrid loss function to effectively capture fine-grained details and contextual information in brain MRI scans. We demonstrate that Mamba-Unet significantly enhances segmentation accuracy compared to conventional U-Net models by utilizing a comprehensive dataset of annotated brain MRI scans. Quantitative evaluations reveal that Mamba-Unet surpasses traditional U-Net architectures and other contemporary segmentation models regarding Dice coefficient, sensitivity, and specificity. The improvements are attributed to the method's ability to manage class imbalance better and resolve complex tumor boundaries. This work advances the state-of-the-art in brain tumor segmentation and holds promise for improving clinical workflows and patient outcomes through more precise and reliable tumor detection.