Cross-scale attention mechanism of FastMAD-UNet enhances the segmentation of pneumonia CT

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Abstract. In order to improve the accuracy and efficiency of pneumonia CT image segmentation, and solve the problems of insufficient recognition ability of traditional UNet model in complex lesion areas and slow segmentation speed of complex models. We propose the FastMAD-UNet model based on MAD-UNet with a lightweight design. ResNet18 was used as the backbone network instead of ResNet50, and the pooling and feature modules were lightweight. Using the public pneumonia CT dataset (1000 cases, including expert labeled lesions), the preprocessing included image scaling to 256×256, normalization, and comparison of UNet, UNET ++ and MAD-UNet models. The evaluation indicators included Dice coefficient, G-mean, F2 score, etc. Finally, FastMAD-UNet model was superior to MAD-UNet model in Dice coefficient (0.83), sensitivity (0.93), and G-mean (0.96), with about 30% fewer parameters and 3 times faster training speed. The segmentation results were highly consistent with the real labeling. FastMAD-UNet can significantly improve efficiency while ensuring accuracy through lightweight module design, which is suitable for real-time medical image analysis and resource-limited scenarios, providing reliable technical support for precise diagnosis and treatment of pneumonia.

Keywords: Deep learning, FastMAD-UNet, CT image, Medical image segmentation