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Medical Image Fusion Based on Modified Parameter-Adaptive Simplified Pulse-Coupled Neural Network

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Positron Emission Tomography (PET) images of the brain can reflect the level of brain molecular metabolism with low spatial resolution, while magnetic resonance imaging (MRI) brain images can provide anatomical structure information with high spatial resolution. In order to achieve the complementary of molecular metabolism information and spatial texture structure, it is meaningful to fuse the two types of images. Traditional fusion methods are prone to color distortion of PET image or unclear texture of MR image. A novel medical image fusion algorithm is proposed here. Firstly, the source image is processed with nonsubsampled shearlet transform (NSST) to obtain low-frequency sub-band and a series of high-frequency sub-bands, which can effectively extract the contour and texture details of the image; Secondly, a regional adaptive weighted fusion is adopted for the low- frequency sub-band, which is conducive to the high fidelity of the fused PET image color. while the improved Laplacian gradient sum is used as the input excitation of the parameter-adaptive simplified pulse-coupled neural network (PA-SPCNN) to fuse the high-frequency sub-bands, which improves the clarity of the fused MRI image texture. Finally, inverse NSST is performed on the fused low-frequency and high-frequency sub-bands to obtain the fused image. The experimental results show that the proposed algorithm can retain the basic information of the source image, and show the metabolic status of the functional image without losing the texture features of the structural image. The fusion algorithm achieves good results in both subjective and objective evaluation.

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