## 三级训练BP神经网络遥感图像超分辨重建

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## Super-resolution reconstruction of remote images based on three level training BP neural network

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**摘要** 为了进一步提高遥感图像超分辨效果,降低超分辨重建时间,建立了一种三级训练BP神经网络(BP Neural Network, BPNN)超分辨重建方法,重点研究了网络训练样本的图像获取、输入输出样本的图像筛选、网络结构及训练算法的设计等。建立遥感图像退化模型,采用亚像素位移欠采样的方法获取网络训练样本;然后以方差比较法筛选出各级网络训练的输入/输出样本图像;最后,采用3组超分辨映射模式的遥感图像分别作为同一结构BPNN的输入/输出训练样本图像,连续进行3个周期的训练和学习,从而使图像尺寸映射模式和空间分辨率依次提高3次。仿真和泛化实验表明,三级训练BPNN较其他常见超分辨算法的峰值信噪比最高提高了6 dB左右,超分辨重建图像细节更丰富,重建时间大大降低,更适合遥感图像的实际应用。

**关键词** : 三级训练BP神经网络, 遥感图像, 图像重建, 超分辨率

**Abstract** : To further improve the effect of the super-resolution reconstruction(SRR) of remote sensing images and reduce its time-consuming, a three level training BP Neural Network(BPNN) was established. The research was focused on the acquisition of training samples, selections of input-output training samples, and the design of BPNN structure and training algorithm. A remote sensing image degradation model was set up. Then, training sample images were got by undersampled and subpixel-shifted method. The input-output training sample images were selected by variance comparison. Finally, three groups remote sensing images with different super-resolution mapping modes were used as the input-output training samples for the same BPNN. The net was continuously trained and learned three cycles, and image size and spatial resolution were improved three times. Experimental results indicate that the three level training BPNN for the SRR of remote sensing image can obtain better SRR effect and higher spatial resolution in the process of fitting remote sensing image SRR mapping, and the Peak Signal to Noise Ratio(PSNR) is improved about 6 dB than that of other ordinary super-resolution algorithm. For preserving more image details and reducing reconstructing time, it is more suitable for practical applications of remote sensing images.

**Key words** : three level training BP neural network　remote sensing image　image reconstruction　super-resolution

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