Hyperspectral Image Destripping with a Spectral-Spatial Adaptive Regularization Model

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Abstract: The amount of stripping noise included in a hyperspectral image limits its application and has a negative impact on hyperspectral image classification, unmixing, and so on. In hyperspectral images, because the stripping noise intensity in different bands is different, to better suppress the noise in the high noise intensity bands and preserve the detailed information in the low noise intensity bands, the denoising strength should be adaptively adjusted with the noise intensity in the different bands. Meanwhile, in the same band, there exist different spatial property regions, such as homogeneous regions and edge or texture regions; to better reduce the noise in the homogeneous regions and preserve the edge and texture information, the denoising strength applied to pixels in different spatial property regions should also be different. In this paper, the destripping process is defined as an inverse and ill-posed problem, and a spectral-spatial adaptive regularization model is proposed to constrain the stripping noise reduction process, in which the spectral noise differences and spatial information differences are both considered in the process of stripping noise reduction, and the complement information in different bands is used to control the destripping strength in different pixels. Experiments illustrate that the proposed approach can satisfactorily reduce the striping noise in the hyperspectral image, while without smoothing the edge and detail information.

Key Words—hyperspectral image destripping; spatial adaptive; spectral adaptive; regularization model; ill-posed problem.