HIGH-RESOLUTION RECONSTRUCTION OF MULTISPECTRAL IMAGERY BASED ON PANCHROMATIC IMAGERY

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During the past two decades, technologies acquiring a wide range of remotely-sensed image over the ground surface are maturing to enable routine monitoring for a wide-variety of scientific research and applications related to earth environments. In remote sensing sufficiently high spatial-resolution imagery is required for detailed structure on ground surface and it is also necessary for detection of complex features to integrate abundant spectral information. Up to now the satellite imagery with very-high resolution of less than or equal to 1m resolution can be obtained from panchromatic sensors and multispectral/hyperspectral data are available only with mid-high or moderate spatial-resolution of 4 ~ 30m resolution. An image processing technique that can effectively integrate the spatial detail of the panchromatic image and the spectral characteristics of the multispectral image into one image is important for human's visual interpretation or computer's autonomous recognition to improve the accuracy in analyzing land-cover types.

The techniques to integrate the panchromatic and multispectral data have mainly been applied for the applications to generate RGB imagery of high-resolution. Their algorithms for remote sensing data are generally based on IHS Transform [1], Principal Component Analysis (PCA) [1], Brovey Transform [2], High Pass Filtering [3]. Among the these categories, the IHS technique has been most widely used in the practical applications, and the wavelet fusion technique has been discussed most frequently in the recent publications due to its advantages over other fusion techniques [4]. However the conventional approaches including the schemes mentioned reconstruct the multispectral image of low-resolution as one of high-resolution by synthesizing the data of different spectral characteristics. It may result in spectral distortion for the reconstructed data of high resolution.

This study presents an approach to reconstruct high-resolution imagery for multispectral imagery of low-resolution using panchromatic imagery of high-resolution. The proposed scheme reconstructs a high-resolution image which agrees with original spectral values. It uses a linear model of high-and low- resolution images and consists of two stages. The first one is to perform a global estimation of the least square error on the basis of a linear model of low-resolution image associated with high-resolution feature, and next local correction makes the reconstructed image locally fit to the original spectral values. In this study, the new method was applied to generate an 1m RGB image rom 4m IKONOS multispectral data. Fig 1 contains two RGB images of i1m resolution, one is the image provided by the agency with original raw data and the other the image reconstructed by the proposed method. They show very similar structure in spatial detail, while having a difference in color contrast. Fig. 2 displays the graphs of data distribution of three multispectral image data (since the original raw IKONOS multispectral data have 4m resolution, the frequency numbers of each bit for the original raw data are multiplied by $4 \times 4=16$). As shown in Fig. 2, the RGB data provided by the agency (IKONOSRGB) are not fit along the original distribution (Multispectral Low). It means the IKONOSRGB data are distorted in spectral characteristics. However, the results of the proposed method (Reconstructed High) show its capability to fit well to the original distribution.

REFERENCES

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Fig. 1. Comparison of RGB image generated by the proposed method (right) to one provided by agency (left)

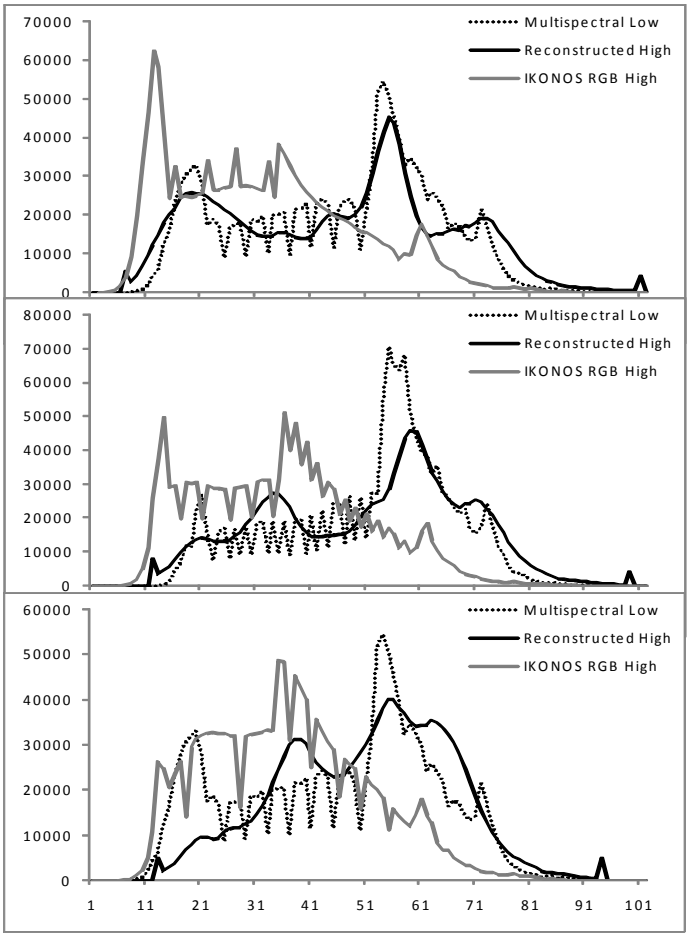

Fig. 2. Comparison of data distribution between RGB images reconstructed by the proposed method and provided by agency (from top, Red, Green, Blue bands)