Estimation of Global Image Fusion Parameters for KOMPSAT-3A

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Abstract: Image fusion is a technique for producing high resolution multi-spectral images by fusing spatial details of high resolution panchromatic image and spectral information of low resolution multi-spectral images. The purpose of this study is to estimate the global image fusion parameters applicable to KOMPSAT-3A. The spatial boundary for estimating the optimal fusion parameters was set by the Korean Peninsula, and a total of 117 KOMPSAT-3A images were used as test data.

1. Introduction

Image fusion is a technique for producing high resolution multi-spectral images by fusing spatial details of high resolution panchromatic image and spectral information of low resolution multi-spectral images (Zhang, 2004; Choi, 2011; Choi et al., 2010). Since the spatial detail information and the spectral information are in a trade-off relationship, determining the ratio of fusion of the two information is known as the main point of the image fusion process. Most studies for estimating optimal fusion parameters have been proposed from statistical-based methods in local or full-scene regions (Oh et al., 2014). In this case, since the fusion parameters based on statistical method are estimated from the characteristics of the region, there is a problem that the optimal fusion parameters can be different between images placed in the same path. The purpose of this study is to estimate the global image fusion parameters applicable to KOMPSAT-3A.

2. Study area and dataset

The 117 KOMPSAT-3A images were used in this study. The KOMPSAT-3A satellite provides four channel images including Blue, Green, Red, and NIR wavelength bands with a spatial resolution of 2.2 m. The spatial boundary for estimating the optimal fusion parameters was set by the Korean Peninsula.

3. Methodology

Optimal image fusion parameters were estimated from each full-scene region, and the estimated 177 optimal fusion parameters were analyzed. Figure 1 shows an image processing flow chart for applying image fusion technique. According to Figure 1, the weights between the multispectral image and the panchromatic image are determined, and the high frequency components are extracted by relationship between simulated panchromatic image and actual panchromatic image (Lee et al., 2012; Oh et al., 2014). All image fusion parameters are extracted by statistically analyzing the extracted high frequency components. Finally, global fusion parameters were proposed and the image fusion results using global and optimal parameters were compared.

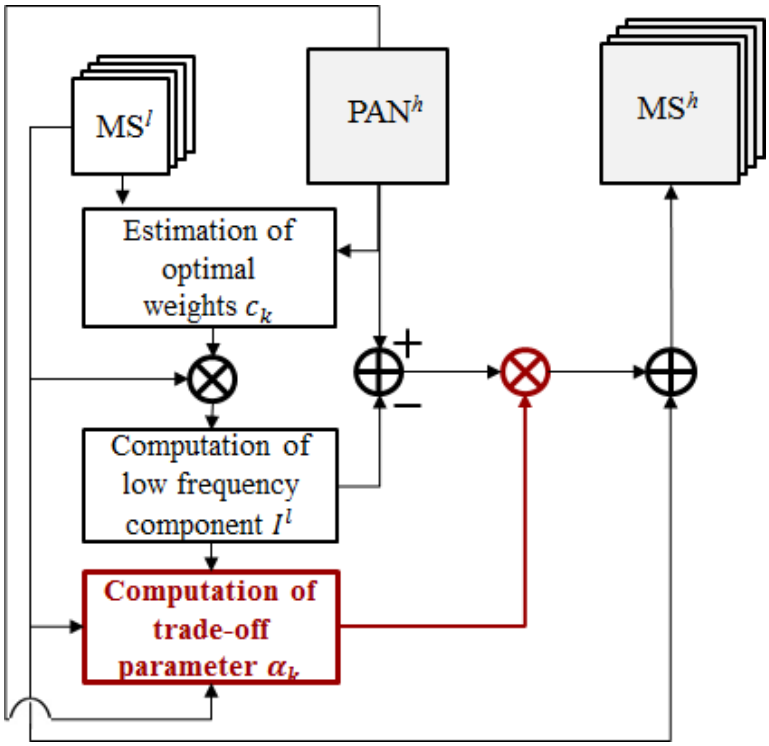

Fig. 1. Flow chart for applying image fusion technique.

4. Results and Discussions

Figure 2 shows the fused image by the image fusion method. As shown in Fig. 2, image fusion was performed well because the fusion coefficient was estimated appropriately. However, in the case of adjacent images up and down, it was confirmed that the fused image was produced using different fusion coefficients. Figure 3 shows the result of image fusion of overlapping regions of adjacent images up and down. The fusion results are similar, but as shown in Table 1, the fusion coefficients used for fusion are different.

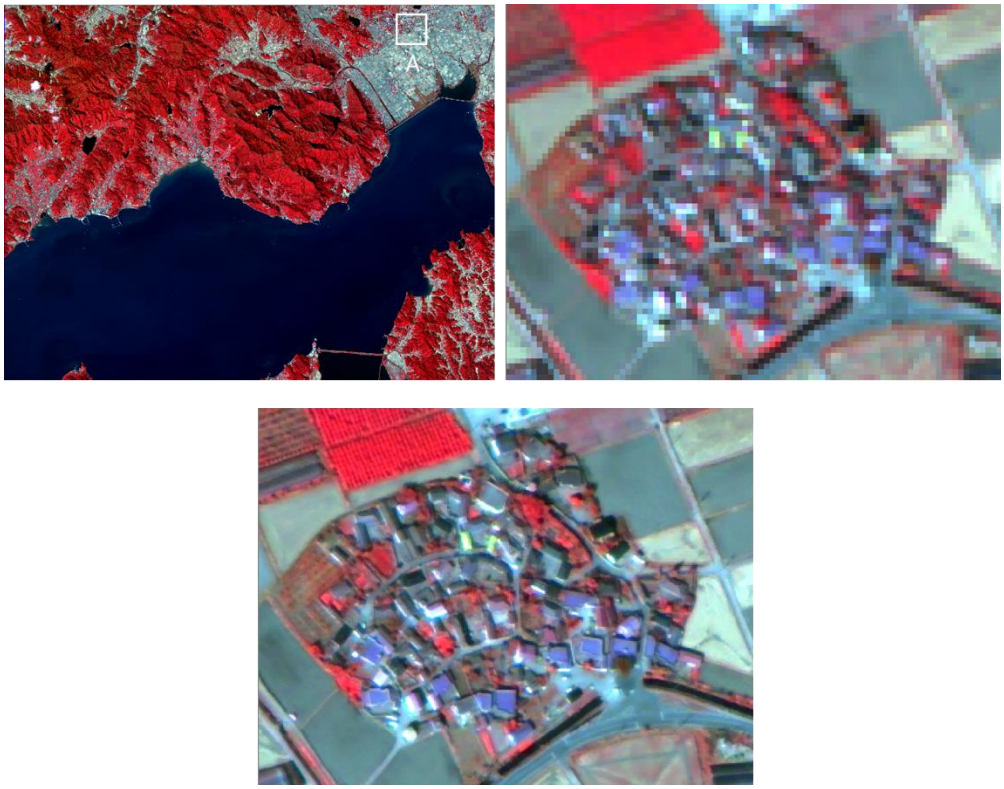

Fig. 2. Image Fusion Results.

Fig. 3. Fused results of overlapping regions.

Table 1. Estimated fusion parameters.

	Fusion Parameters	
Channels	09221259	09221260
Blue	0.37	0.81
Green	0.31	0.65
Red	0.65	1.07
Nir	1.85	1.40

Figure 4 shows the distribution of the fusion coefficients used in the production of all fusion images. It can be seen that the fusion coefficients in all channels has a variation of about 0.5.

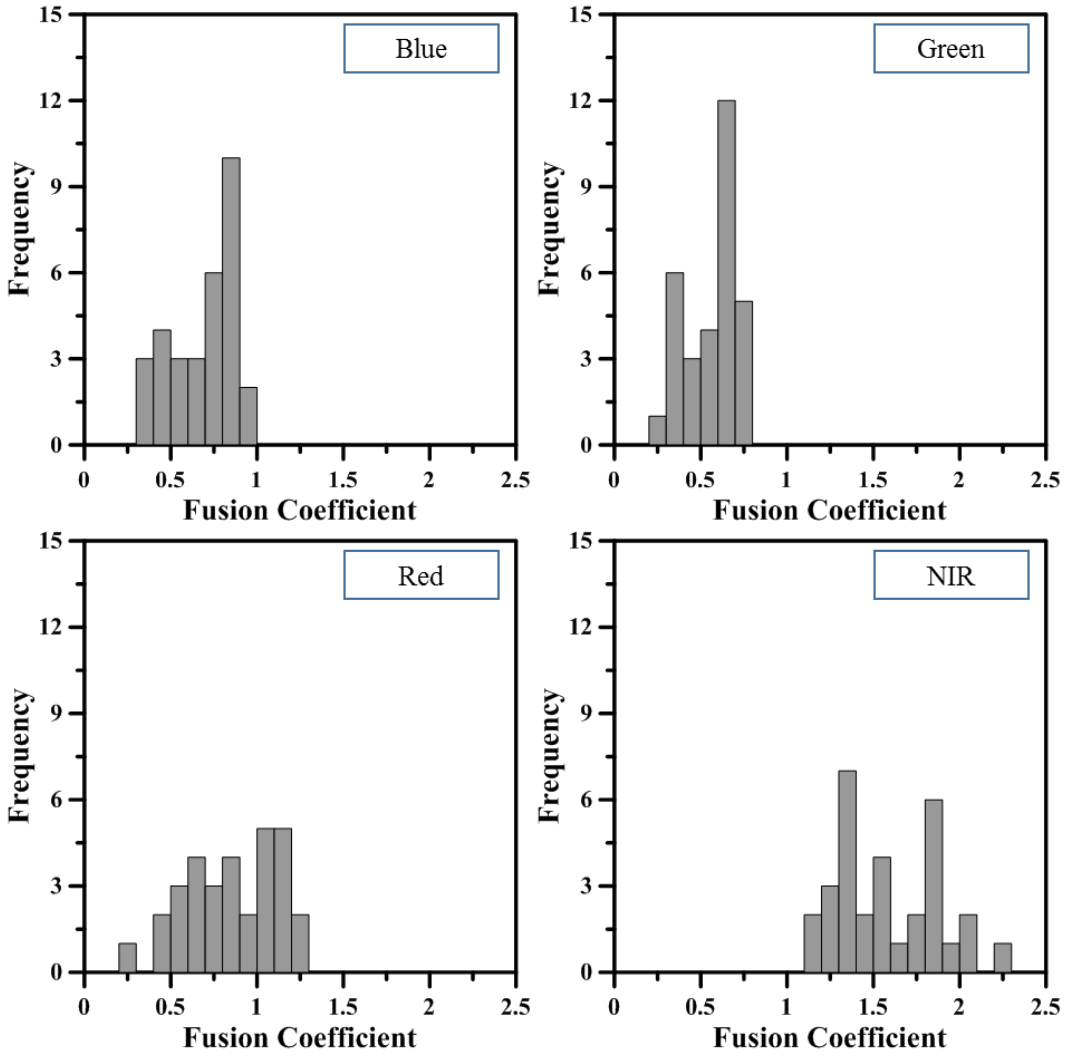

Fig. 4. Distribution of estimated fusion coefficients.

5. Conclusions

In this study, a study was conducted to estimate the global fusion coefficients essential for the image fusion process. At present, it can be seen that the fusion coefficient is estimated by reflecting the overall characteristics of the image. For example, an image with a large urban area has a high fusion coefficient, and an image with a large amount of baresoil appears in reverse. The difference was confirmed to be up to 0.5 in this study. In the future, it is necessary to analyze the results of image fusion according to the difference of fusion coefficients and to present global fusion coefficients.

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References

1. Choi JW. A WorldView-2 satellite imagery pansharpening algorithm for minimizing the effects of local displacement, Journal of the Korean Society of Surveying, Geodesy, Photogrammetry and Cartography. 2011; 29: 577-582.
2. Choi JW, Kim YI. Pan-sharpening algorithm of high-spatial resolution satellite image by using spectral and spatial characteristics, Journal of the Korean Society for Geospatial Information System. 2010; 18: 79-86.
3. Lee HS, Oh KY, Jung HS. Comparative analysis of image fusion methods according to spectral responses of high-resolution optical sensors, Korean Journal of Remote Sensing. 2014; 28: 39-54.
4. Oh KY, Jung HS, Lee KJ. Comparison of image fusion methods to merge KOMPSAT-2 panchromatic and multispectral images, Korean Journal of Remote Sensing. 2012; 28: 39-54.
5. Zhang Y. Understanding image fusion, Photogrammetric Engineering and Remote Sensing. 2004; 70: 657-661.