

A Multi-temporal Wide Swath Hyperspectral Image Simulation

Approach

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Abstract: Compared to conventional multispectral optical sensors, hyperspectral sensors can obtain images with hundreds of spectral bands and containing much more spectral information than do multispectral data, greatly extending the range of remote sensing applications. However, it becomes difficult to obtain high spatial resolution and wide data coverage hyperspectral data because of the trade-off between the spectral and spatial performance of optical sensors. In this paper, a hyperspectral image simulation approach (HISA) was proposed to simulate multi-temporal wide swath hyperspectral images using auxiliary multi/hyper-spectral data. The approach makes use of the linear relationships between multi- and hyper-spectra of specific materials to generate a set of transformation matrices. A spectral angle weighted minimum distance (SAWMD) matching method was then used to select a suitable matrix to simulate hyperspectral data from the reference multispectral image, pixel by pixel. Especially, the reference multispectral image can be obtained in different times to generate multi-temporal hyperspectral data. The simulation approach was tested with two image data sets, and the simulated and real hyperspectral data were compared by visual interpretation, statistical analysis, and classification to evaluate the performance. The experimental results demonstrated that the HSIA algorithm produces good image data, with a spectral resolution the same as the original hyperspectral data. The spatial resolution and swath were also the same as for the original multispectral data, which will not only greatly improve the range of applications for hyperspectral data but will also encourage more utilization of multispectral data.

Keywords: Data simulation; Hyperspectral data; Multispectral data; Hyperion; ALI