Paper ID: 31582
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EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data Management Systems (4)

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A SIMPLE INDICATOR FOR ESTIMATING THE NOISE LEVEL OF A HYPERSPECTRAL DATA CUBE FOR EARTH OBSERVATION MISSIONS

Abstract

A method for estimating the level of noise of a hyperspectral data cube is proposed. The method includes noise reduction using the Minimum Noise Fraction (MNF) transform and mapping the spectral dissimilarity between the pixels in the resulting noise-reduced radiance image, as well as in the original noisy radiance image, using the Spectral Angle Mapper (SAM) algorithm. Comparing the two maps, on a pixel by pixel basis, gives a value indicating the addition of noise to the spectrum of each pixel. An average value for the entire image is calculated, defined as the Image Noise Indicator (INI). In practice, this value indicates the quality of the data. Combining the INI value with the level of radiance enables estimating the Image Noise Level (INL). The method was applied and examined on a noisy synthetic image and then implemented for over 20 acquired images from different hyperspectral sensors and their noise level was estimated. Further examination showed that the INI value is independent of the heterogeneity of the hyperspectral data cube. The INI value, indicating the noise level, might increase as a geo-reference procedure which causes a spatial abridgment is applied to the hyperspectral data cube. The INIcan also be used as a quality indicator (QI) in the ongoing effort to objectively certify hyperspectral remote sensing images for practical usages.