Physics > Geophysics

Exploiting Structural Complexity for Robust and Rapid Hyperspectral Imaging

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This paper presents several strategies for spectral de-noising of hyperspectral images and hypercube reconstruction from a limited number of tomographic measurements. In particular we show that the non-noisy spectral data, when stacked across the spectral dimension, exhibits low-rank. On the other hand, under the same representation, the spectral noise exhibits a banded structure. Motivated by this we show that the de-noised

spectral data and the unknown spectral noise and the respective bands can be simultaneously estimated through the use of a low-rank and simultaneous sparse minimization operation without prior knowledge of the noisy bands. This result is novel for for hyperspectral imaging applications. In addition, we show that imaging for the Computed Tomography Imaging Systems (CTIS) can be improved under limited angle tomography by using low-rank penalization. For both of these cases we exploit the recent results in the theory of low-rank matrix completion using nuclear norm minimization.

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