CLASSIFICATION PERFORMANCE OF A HYPERSPECTRAL DATA PROCESSING ALGORITHM USING A BLOCK-COMPRESSIVE SENSING APPROACH

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Abstract
Compressive Sensing is an area of great recent interest for signal acquisition, manipulation and reconstruction tasks. Approaches based on this technology can improve the efficiency of acquisition, manipulation, analysis and storage processes already established for hyperspectral imagery, with little discernible loss in data performance. The current work presents the results of a comparative analysis on classification performance between a hyperspectral data cube acquired by traditional means, and one obtained through reconstruction from compressively sampled data points. To obtain a broad measure of the classification performance of both data cubes, we use a set of five classifiers commonly used in hyperspectral image classification. General accuracy statistics are presented and discussed, as well as class-specific statistical properties of the evaluated data set.

Method

Hyperspectral Cube

Band Division

Block Division

Compressive Sensing

Classification

Band-Cube Reassembly

Recovery Optimization

Results

Absolute Percent Accuracy Difference per Classifier

Mahalanobis Distance

Minimum Distance

Maximum Likelihood

Neural Network

Support Vector Machine

Classification Map Comparison
(Support Vector Machine / Neural Network and Minimum Distance Classifiers)

Conclusions

• CS-based technologies show great potential for improving Hyperspectral Image manipulation tasks with little loss in classification performance.

• Deployment of in-sensor CS technology promises to increase very limited sensor access times, allowing more data to be captured in a smaller amount of time.

• By saving only compressive samples from a hyperspectral image for long-term storage, storage requirements are reduced by a margin dependent only on the accuracy required by a specific application.

• Future work in this subject includes evaluating the effect of the selected block-size on the classification performance of the resulting data cube, as well as determining the specific nature of the difference in classification performance for individual classes in hyperspectral images for further correction and/or optimization.

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References