The MATLAB Hyperspectral Image Analysis Toolbox

Samuel Rosario-Torres, samuel.rosario@ece.uprm.edu, Miguel Vélez-Reyes, mvelez@ece.uprm.edu, Shawn D. Hunt, shunt@ece.uprm.edu, and Luis O. Jiménez-Rodríguez, jimenez@ece.uprm.edu

Laboratory for Applied Remote Sensing and Image Processing
University of Puerto Rico at Mayagüez, P. O. Box 9048, Mayagüez, Puerto Rico 00681-9048

Introduction

The Hyperspectral Image Analysis Toolbox is currently being developed as an element of the CenSSIS Solutionware framework. The objective of the CenSSIS Solutionware team is to develop a set of catalogued tools and toolsets that will provide for the rapid construction of a range of subsurface algorithms and applications. Solutionware tools span toolboxes, visualization toolsets, database systems and application-specific software systems that have been developed in the Center. HIAT provides a computational environment where hyperspectral image processing algorithms developed from research done at UPRM Laboratory for Applied Remote Sensing and Image Processing (LARSIP) at UPRM are readily available to users in the environmental and biomedical communities. A HIAT deployment has been created in order to create an standard alone application.

State of The Art

Hyperspectral Image analysis is supported by a variety of available software packages. The best known commercial product is the Environment for Visualizing Images (ENVI) [1] of Research Systems Inc., a ITT subsidiary. ENVI provides code extensibility through the Interactive Data Language (IDL), allowing the possibility for routine and features expandability. Among the educational non-commercial products, the best known is MultiSpec [2] developed at Purdue University by Dr. David Landgrebe and the Remote Sensing research group in Purdue’s LARS. MultiSpec provides similar features to ENVI but does not provide extensibility.

HIAT Functionality

Input Image Formats

- Matlab (*.mat)
- JPEG
- ASTER file format
- TIFF

Image Enhancement

- Oversampling Filter
- Reduce Rank Filter

Feature Extraction/Selection Algorithms

- Principal Components Analysis
- Singular Value Decomposition Band Subset Selection
- Information Divergence Band Subset Selection

Classification

- Euclidean Distance
- Fisher’s Linear Discriminant
- Angle Detection
- Mahalanobis Distance
- Maximum Likelihood

Abundance Estimation

- Non Negative Sum To One
- Non Negative Sum Less than or Equal to One
- Non Negative Least Square

Unmixing Algorithms

- Mahalanobis Distance
- Euclidean Distance
- Fisher’s Linear Discriminant
- Positive Constrained

Covariance Estimation using Regularization

Online Documentation & Help

HIAT Value Added

The Hyperspectral Image Analysis Toolbox provides support for CenSSIS Researchers and Students from R2C, S1, S3, and S4 using spectral imaging. The toolbox will be part of the tools that will be disseminated with the proposed Introduction to Subsurface Sensing and Imaging textbook and is a key component of the CenSSIS Solutionware.

References


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