ENVI® 5 HYPERSPECTRAL IMAGING

Functional Summary

PREPROCESSING & CALIBRATION

Apply Gain & Offset
Bad Band Identification
Bad Line / Pixel Replacement
Cross-Track Illumination Correction
Dark Subtraction
Destripe Data
EFFORT Polishing
Empirical Line Calibration
Flat Field Calibration
Internal Average Relative Reflectance Calibration (IAR)
Log Residuals Correction
Radiometric Calibration
Thermal Atmospheric Correction

ATMOSPHERIC CORRECTION MODULE

Fast Line-of-sight Atmospheric Analysis of Hypercubes (FLAASH®)
Aerosol Models (MODTRAN®)
Aerosol Retrieval
Atmospheric Models (MODTRAN®)
Cloud Map
Initial Visibility
Input data from: • Hyperspectral and multispectral sensors • Radiance, BIL or BIP
Spectral Polishing
Water Retrieval
Water Vapour Map
Quick Atmospheric Correction (QUAC)
Cloud removal
Empirical correction
Input data from: • Hyperspectral and multispectral sensors • Raw, Radiance, Reflectance
Vegetation Suppression

TRANSFORMS

Band Ratios
Color Transform
Decorrelation Stretch
Dimensionality Expansion
Independent Components Analysis
Image Sharpening: • Color Normalized Spectral • Gram-Schmidt Pan • HSV and Brovey • NN Diffuse • PC Spectral • Preserving Spectral Integrity
Minimum Noise Fraction (MNF)
Normalized Difference Vegetation Index (NDVI)
Pan Sharpening (see Image Sharpening)
Principal Components Rotation
Saturation Stretch
Tasseled Cap

IMAGE CLASSIFICATION

Adaptive Coherence Estimator (ACE)
Accuracy Assessment
Automatic Legends for Classified Images
Change Detection - PCA
Change Detection - 2CMV (2 Color Multi-view)
Change Detection - Subtractive
Change Detection, Thematic and Grayscale Images
Classification Preview
Classification Image from ROIs
Constrained Energy Minimization (CEM)
Decision Trees
Density Slicing
Interactive User-Defined Rule Classifier
Independent Components Analysis
Orthogonal Subspace Projection (OSP)
Mixture Tuned Target-Constrained Interference-Minimized Filter (MTTCIMF)
Separate Classification Thresholds for Each Class
Target-Constrained Interference-Minimized Filter (TCIMF)

IMAGE CLASSIFICATION (continued)

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|---|
| Supervised Classifications:
• Binary Encoding
• Parallelepiped
• Mahalanobis Distance
• Minimum Distance
• Maximum Likelihood
• Neural Network
• Spectral Angle Mapper (SAM)
• Spectral Information Divergence (SID)
• Support Vector Machine (SVM)
• TERCAT (Terrain Categorization) |
| Training Data From:
• Regions of Interest
• Pixel Spectra
• Library Spectra |
| Unsupervised Classifications:
• K-Means
• ISODATA |

SPECTRAL ANALYSIS TOOLS

Adaptive Coherence Estimator (ACE)
Anomaly Detection
Automated Corner Clustering in N-D Scatter Plot
BandMax Band Optimization
Constrained Energy Minimization (CEM)
Continuum Removal of Images, Spectra
Decision Tree Classifier
Extraction of Endmember Spectra
Integrated Spectral Viewing & Analysis
Linear Spectral Unmixing
Least Squares (LS) Fit
Matched Filtering
Mixture Tuned Matched Filtering
Mixture Tuned Target-Constrained Interference-Minimized Filter (MTTCIMF)
N-Dimensional Visualizer (Scatter Plot)
Orthogonal Subspace Projection (OSP)
Pixel Editing
Pixel Purity Index (PPI)
SAM Target Finder with BandMax
SMACC Endmember Extraction & Sub-pixel Analysis

ENVI® 5 Hyperspectral Imaging Functional Summary

SPECTRAL ANALYSIS TOOLS (continued)

Spectral Resampling:
- Predefined Sensor Band Filters
- User Defined Filters
- Spectral Libraries and Images

Spectral Analyst for Material Identification

Spectral Angle Mapper (SAM)

Spectral Feature Fitting (SFF)

Spectral Hourglass Wizard

Spectral Information Divergence (SID)

Spectral Libraries Included:
- Minerals, Vegetation, Rocks, Water, Soils, Snow, Manmade
- VNIR, SWIR, MWIR, LWIR

Spectral Library Builder/Importer

Spectral Library Viewer

Spectral Math

Spectral Plots:
- Boxcar Average of Pixel Spectra
- Continuum Removal
- Cursor Query of X, Y Plot Values
- Drag and Drop Spectra Among Plot
- From 3D SurfaceView
- From Image Pixels (Z Profile)
- From Spectral Libraries
- From ROI Averages
- Link Spectral Plots from Multiple Images
- Plot Stacked Spectra
- User-Defined Plot Functions
- Wavenumber or Wavelength

Subspace Background Suppression

Spectral Slices

Target-Constrained Interference-Minimized Filter (TCIMF)

Target Detection Wizard

Vegetation Guided Workflows:
- Agricultural Stress
- Forest Health
- Fire Fuel

Vegetation Indices:
- Canopy Nitrogen
- Canopy Water Content
- Dry or Senescent Carbon
- Leaf Pigments
- Light-use Efficiency
- Greenness (Broadband / Narrowband)

Vegetation Suppression

POST CLASSIFICATION TOOLS

Accuracy Assessment:
- Kappa Coefficient
- Confusion Matrix

Classification Aggregation

Classification to ROI / Vector

Class Statistics

Interactive Class Overlay Tool

Reassign Class Colors, Names

Receiver Operating Characteristic (ROC) Curves

Spatial Functions:
- Buffer Zones Around Classes
- Clump, Sieve, Combine
- Majority / Minority Analysis
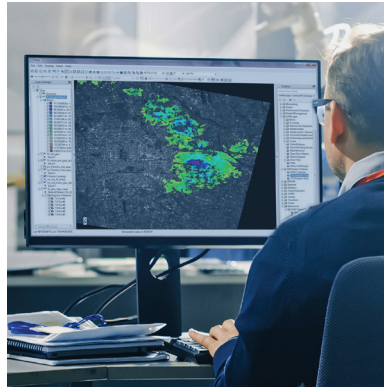
For more information:

ENVI was initially developed by imaging experts to process and analyze hyperspectral data and it continues to be the definitive leader in spectral analysis. ENVI includes hundreds of spectral image processing tools to analyze multi and hyperspectral data and extensibility options to automate your workflows. These tools are based on established, scientific methods for spectral analysis – using pixel responses at different wavelengths to obtain information about the materials within each pixel.

ENVI supports all of the latest data collection platforms (satellites, airborne, drone, terrestrial), more than 200 different types of data, and different modalities including panchromatic, multi and hyperspectral, LiDAR, SAR and FMV.

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