ENVI® 5.6.2 Functional Summary

ENVI System Requirements

ENVI has the following system requirements:

- **Operating systems**:

    - Windows 10 and 11 (Intel/AMD 64-bit)

    - macOS 10.14, 10.15 (Intel 64-bit), 11, and 12 (M1 and Intel 64-bit)

    - Linux (Intel/AMD 64-bit, kernel 3.10.0 or higher, glibc 2.17 or higher)

- **Disk space**: Approximately 4 GB for installation

- **Memory (RAM)**: Minimum of 8 GB

- **Number of processing cores**: Minimum of 2, recommended 4 or more

- **Graphics card**: Minimum of 1 GB RAM and support for OpenGL 2.0 or later

Details

ENVI 5.6.2 has been tested with ArcGIS Pro version 2.9 and ArcMap version 10.8.

An X-Windows manager is required for macOS. ENVI was tested using XQuartz 2.8.1.

A Rosetta 2 emulator is required for Mac M1.

The 64-bit Windows installer contains 32-bit binaries so that you can launch ENVI in 32-bit mode on 64-bit Windows systems. This ensures interoperability with ArcGIS. To access the 32-bit version of ENVI, go to the Windows Start menu and select **ENVI *x.x* > ENVI *x.x* (32-bit)**, where *x.x* is the software version.

Recommending the best hardware configuration for ENVI is difficult, as hardware needs vary depending on the type of processing that is anticipated. The following are items to consider when selecting a system configuration for use with ENVI.

Disk space

The amount of hard-drive space that is needed for ENVI depends on the specific workflows and data that will be used. Our technical support group uses systems with 1 TB of disk space, which is more than adequate for day-to-day use. However, this would not address the needs of a production facility that processes large amounts of data on a daily basis.

A solid-state drive (SSD) is highly recommended for optimal performance.

Memory (RAM)

Most image display and processing capabilities in ENVI and IDL have been designed to work with minimal amounts of system RAM. Having a lot of RAM can help to avoid occasional memory allocation problems, especially with large datasets. Tests have shown that 8 GB of RAM is adequate for most tasks run using the latest versions of ENVI and IDL. However, if you anticipate working with very large datasets, or if you are building custom applications with ENVI+IDL code, then you may consider adding more RAM to your system.

Graphics card

For optimal performance, your graphics card should have a minimum of 1 GB RAM and should support OpenGL 2.0 or later. Also be sure to install the latest drivers for your graphics card. If you anticipate implementing sophisticated graphical displays while building custom applications in ENVI+IDL—or if you expect to work with large datasets—then the more RAM the better.

Processors and Cores

ENVI only supports CPUs with the Advanced Vector Extensions (AVX) instruction set. In general, any CPU after 2011 will contain this instruction set.

Supported Data Types

The following table lists the data types that ENVI supports.

- A separate NITF/NSIF license is required to view NITF files.

- See the ENVI System Requirements topic for supported versions of ArcGIS Pro and ArcMap.

Raster Formats

Data Type	Read	Write
ADS40 (TIFF)	•	
ADS80 (TIFF)	•	
AIRSAR (JPL Stokes matrix format)	•	
AlSat-2A (TIFF)	•	
ALOS Level-1B2 AVNIR-2	•	
ALOS Level-1A and 1B1 AVNIR-2	•	
ALOS Level-1A and 1B1 PRISM	•	
ALOS Level-1B2 PRISM	•	
ALOS-1 and -2 PALSAR (CEOS)	•	
ArcGIS Enterprise Geodatabase (Raster dataset)	•	•
ArcGIS File Geodatabase (Raster dataset)	•	•
ArcGIS Personal Geodatabase (Raster dataset)	•	•
ArcGIS Image Services (JPEG, TIFF, PNG)	•	
ArcGIS Mosaic datasets (JPEG, TIFF, PNG)	•	
ArcView Raster (BIL)	•	•
ASCII (x,y,z and gridded)	•	•
ASTER Level-1A and 1B (HDF-EOS)	•	
ASTER Level-2 (HDF-EOS)	•	
ASTER Level-3 DEM (HDF-EOS)	•	
ATSR GBT, GBROWSE, GSST	•	
AVHRR KLMN Level-1B	•	
AVHRR SHARP (ESA)	•	
AVHRR Quorum (HRPT)	•	
AVIRIS	•	

Data Type	Read	Write
BigTIFF	•	•
Binary	•	
Bitmap (BMP)	•	
CADRG	•	•
Cartosat-1 (TIFF)	•	
CIB	•	•
Cloud Optimized GeoTIFF	•	•
COSMO-SkyMed Level-1A SCS, 1B DGM, 1C GEC, 1D GTC (HDF5)	•	
Deimos-1	•	
Deimos-2	•	
DigitalGlobe / Maxar Analysis Ready Data (ARD)	•	
DMC UK-DMC Level-1R, 1T, 2R (TIFF)	•	
DMC UK-DMC2 Level-1R, 1T, 2R (TIFF)	•	
DMC ALSAT-1 Level-1R, 1T (TIFF)	•	
DMC Beijing-1 Level-1R, 1T (TIFF)	•	
DMC NigeriaSat-1 Level-1R, 1T (TIFF)	•	
DMC NigeriaSat-2 Level-1R, 1T (TIFF)	•	
DMSP	•	
DPPDB (NITF)	•	
DTED Level-0, 1, 2	•	•
DubaiSat-1 (TIFF)	•	
DubaiSat-1 (RAW)	•	
DubaiSat-2 (TIFF)	•	
ECRG	•	
ECW (Windows 32-bit only)	•	
ENVI classification file	•	•
ENVI feature counting file	•	•
ENVI meta file	•	•
ENVI raster	•	•
Envisat AATSR Level-1B and 2	•	
Envisat ASAR Level-1B	•	
Envisat MERIS Level-1B and 2	•	
EO-1 ALI (HDF4)	•	
EO-1 ALI Level-1T (GeoTIFF)		
EO-1 Hyperion Level-1R (HDF)	•	

Data Type	Read	Write
EO-1 Hyperion Level-1T (GeoTIFF)	•	
ER Mapper (unsigned integer data)	•	•
ERDAS IMAGINE	•	•
EROS A Level-1A	•	
EROS A Level-1B (GeoTIFF)	•	
ERS-1 Level-0, SLC (CEOS generic)	•	
ERS-2 Level-0, SLC (CEOS generic)	•	
Esri GRID (single band)	•	
Esri GRID Stack 7.x (multispectral)	•	
FormoSat-2	•	
FormoSat-5	•	
Gaofen-1	•	
Gaofen-2	•	
GeoEye-1 (NITF)	•	
GeoEye-1 (GeoTIFF)	•	
GeoEye-1 (DigitalGlobe format)	•	
GIF	•	
GeoTIFF	•	•
GOES-16 (NetCDF-4)	•	
GOES-17 (NetCDF-4)	•	
Göktürk-1 and Göktürk-2 (GeoTIFF)	•	
GRIB-1	•	
GRIB-2	•	
HDF-EOS	•	
HDF4	•	
HDF5	•	
Himawari-8 (NetCDF-3)	•	
IKONOS (NITF)	•	
IKONOS (GeoTIFF)	•	
JERS-1	•	
JPEG	•	
JPEG2000	•	•
JPIP (JPEG2000)	•	
KOMPSAT-2 (GeoTIFF)	•	
KOMPSAT-3 (GeoTIFF)	•	

Data Type	Read	Write
KOMPSAT-3A (GeoTIFF)	•	
Landsat 4, 5 TM files with Metadata (GeoTIFF)	•	
Landsat 7 ETM+ files with Metadata (GeoTIFF)	•	
Landsat 8 OLI/TIRS files with Metadata (GeoTIFF)	•	
Landsat 9 OLI/TIRS files with Metadata (GeoTIFF)	•	
Landsat Analysis Ready Data	•	
Landsat Level-3 Products	•	
Landsat 8 Surface Reflectance	•	
Landsat ACRES CCRS	•	
Landsat ESA CEOS	•	
Landsat TM Fast	•	
Landsat 7 Fast Pan data, Band 8	•	
Landsat 7 Fast VNIR/SWIR data, Bands 1-5 and 7	•	
Landsat 7 Fast thermal data, Bands 61-62	•	
Landsat HDF4	•	
Landsat MRLC	•	
Landsat NLAPS	•	
LAS LiDAR versions 1.0 through 1.4	•	
MASTER (HDF4)	•	
Meteosat 2nd generation (Level 1.5)	•	
MIE4NITF	•	
MODIS Level-1B through 4 (HDF-EOS)	•	
MrSID (Windows and Linux only)	•	
Multi-page TIFF	•	
NetCDF-3	•	
NetCDF-4	•	
NigeriaSat-1 (TIFF)	•	
NigeriaSat-2 (TIFF)	•	
NITF 1.1 (license required)	•	
NITF 2.0 (license required)	•	•
NITF 2.1 (license required)	•	•
NSIF 1.0 (license required)	•	•

Data Type	Read	Write
NPP VIIRS (HDF5)	•	
OGC WCS (GIF, JPEG, PNG, TIFF/GeoTIFF)	•	
OGC WMS (GIF, JPEG, PNG, TIFF/GeoTIFF)	•	
OrbView-3 (NITF, TIFF)	•	
PCI	•	•
PDS	•	
PeruSat-1	•	
PICT	•	
PlanetScope	•	
Pleiades-HR DIMAP V1	•	
Pleiades-HR 1A, 1B Primary and Ortho	•	
Pleiades-HR DIMAP V2 (JPEG2000, TIFF)	•	
Pleiades-HR mosaic tiles	•	
Pleiades-NEO	•	
PNG	•	
PRISMA	•	
Proba-V (HDF5)	•	
QuickBird (DigitalGlobe format)	•	
QuickBird (NITF)	•	
QuickBird (GeoTIFF)	•	
RADARSAT-1 (CEOS)	•	
RADARSAT-2 (GeoTIFF)	•	
RapidEye Level-1B Basic (NITF, GeoTIFF)	•	
RapidEye Level-3A Ortho (NITF, GeoTIFF)	•	
RapidEye Level-3B Area-based Ortho (GeoTIFF)	•	
RASAT	•	
ResourceSat-1 Fast	•	
ResourceSat-1 Super Structured	•	
ResourceSat-2 (HDF5)	•	
SeaWiFS LAC 1B, 2A, 2B (CEOS)	•	
SeaWiFS Level-1A, 1B (HDF4)	•	
Sentinel-2	•	
Sentinel-3	•	
SICD (NITF)	•	
SIR-C / X-SAR	•	

Data Type	Read	Write
SkySat	•	
SPOT ACRES	•	
SPOT CAP	•	
SPOT GeoSPOT	•	
SPOT Level-1A, 2A, 1B	•	
SPOT mosaic tiles	•	
SPOT 2-5 DIMAP V1 (BIL, TIFF)	•	
SPOT 6 DIMAP V2 (JPEG2000, TIFF)	•	
SPOT 7 DIMAP V2 (JPEG2000, TIFF)	•	
SPOT SISA	•	
SPOT Vegetation (HDF4)	•	
SRF	•	
SRTM DEM	•	
SSOT DIMAP V2	•	
STANAG 4676 Track Points, Edition B	•	
SuperView-1 (Level-1B and Level-2A multispectral and panchromatic data)	•	
TFRD (license required)	•	
TIFF	•	•
Multi-page TIFF	•	
TIMS	•	
TOPSAR Correlation Image, Incidence Angle, DEM	•	
TripleSat (DIMAP)	•	
TripleSat (XML)	•	
UrtheCast Theia	•	
USGS DOQ	•	
USGS DRG	•	
USGS Native DEM	•	
USGS SDTS DEM	•	
VNREDSat-1	•	
WorldView-1 (DigitalGlobe format)	•	
WorldView-1 (NITF)	•	
WorldView-1 (GeoTIFF)	•	
WorldView-2 (DigitalGlobe format)	•	
WorldView-2 (NITF)	•	
WorldView-2 (GeoTIFF)	•	

Data Type	Read	Write
WorldView-3 (DigitalGlobe format)	•	
WorldView-3 (NITF)	•	
WorldView-3 (GeoTIFF)	•	
WorldView-4 (DigitalGlobe format)	•	
WorldView-4 (NITF)	•	
WorldView-4 (GeoTIFF)	•	
XWD	•	
Zhuhai-1	•	
Ziyuan-1-02C	•	
Ziyuan-3A	•	

Vector Formats

Data Type	Read	Write	Remote
ENVI vector format (EVF)	•	•	
ArcGIS Enterprise Geodatabase (Feature class)	•		•
ArcGIS File Geodatabase (Feature class)	•		•
ArcGIS Personal Geodatabase (Feature class)	•		•
Esri Layers, including files that reference Esri Image Services	•		
Esri Shapefile (excluding Z and M polygons)	•	•	
OGC GeoPackage vector file (.gpkg)	•		

Video Formats

The combination of video file format and codec used for video streaming determines whether ENVI can read a particular video file.

Data Type	Read	Write	File to Select
Adobe Flash (FLV)	•	•	`.f4v, .flv`
Adobe Shockwave Flash (SWF)	•	•	`.swf`
Animated GIF	•	•	`.gif`
Apple QuickTime	•	•	`.mov`
Audio Video Interleaved (AVI)	•	•	`.avi`

Data Type	Read	Write	File to Select
DV (Linux only)	●	●	`.dv`
Google WebM Matroska	●	●	`.webm`
Matroska Video	●	●	`.mkv`
Motion JPEG	●	●	`.mjpeg, .mjpg`
Motion JPEG2000	●		`.mj2`
MPEG-1 Part 2	●		`.mpeg, .mpg, .mp1, .m2v`
MPEG-2 Transport Stream	●		`.ts`
MPEG-2 Part 2	●		`.mpeg, .mpg, .mp2, .mpg2, .mpeg2, .mpv, .m2v`
MPEG-4 Part 12 / 3GPP / 3GPP2			`.3gp, .3g2`
MPEG-4 Part 14	●	●	`.h264, .mp4, .mpeg4, .mpg4, .mp4`
RAW	●	●	`.raw`

Video Codec Formats

Codecs are used to encode data streams for transmission, storage, or encryption; and to decode the data streams for video playback.

Name	Description	Read	Write
BMP	Bitmap (Windows only)	●	

FLV	Adobe Flash Video:
	  FLV
	  Sorenson Spark
	  Sorenson H.263
		●	●

GIF		●	●
H.263	H.263-1996 H.263+ H.263-1998 H.263 Version 2	●	●

H.264	MPEG-4 Part 10:
	  H.264
	  AVC
		●	

HEVC	High Efficiency Video Coding	●	
MJPEG	Motion JPEG	●	●
MPEG1 Video	MPEG-1: H.261	●	

Name	Description	Read	Write
MPEG2 Video	MPEG-2: 　H.222 　H.262	•	•
MPEG4	MPEG-4 Part 2	•	•
MSMPEG4V1	MPEG-4 Part 2 Microsoft Variant Version 1	•	•
MSMPEG4V2	MPEG-4 Part 2 Microsoft Variant Version 2	•	•
MSMPEG4	MPEG-4 Part 2 Microsoft Variant Version 3	•	•
RAW	Raw video (uncompressed)	•	•
VC-1	Microsoft codec, also known as SMPTE 421M	•	
VP8	Google codec	•	

ENVI Functional Summary

This document lists all of the capabilities that the current version of ENVI provides.

Supported Data Types

See the Supported Data Types topic for an extensive list of raster, vector, and video data types that ENVI reads and writes.

The following are specialized tools for working with specific data types:

Dataset Browser

Read HDF4 and HDF5 files

Read HDF-EOS files

Read NetCDF-3 and NetCDF-4 files

Add custom metadata

Build new rasters using a combination of bands and metadata fields

Build ENVI Meta files

Change interleave

Create templates

Export dataset structures to XML, JSON, or text

Flip images vertically

View metadata

Full Motion Video

Display Motion Imagery Standards Board (MISB) metadata

Export entire videos to an ENVI raster series

Export individual frames to ENVI raster format

Export frames to Google Earth

Load frames to the ENVI view

Play and pause video frames

Plot metadata values over time

Rotate video frames to North up

Set display options and frame rates for viewing videos

Use bookmarks to manage points of interest in a video

View frames in separate ENVI views

NITF Dataset Browser

An ENVI NITF license is required to use these features.

Read NITF 1.0, 1.1, 2.1 files

Read MIE4NITF files

Copy metadata to system clipboard

Edit select metadata fields

Load image segments to the ENVI view

Load camera frames to the ENVI view

Save metadata

Subset camera frames (MIE4NITF)

View global metadata

View segment-specific metadata

View tagged record extension (TRE) fields

Xtreme Viewer for fast animation of MIE4NITF frames

Remote Connection Manager

Connect to Open Geospatial Consortium (OGC) datasets

- Web Coverage Service (WCS) versions 1.0.0, 1.1.0, 1.1.1, 1.1.2, 2.0.1
- Web Feature Service (WFS) versions 1.1 and 2.0
- Web Mapping Service (WMS) 1.3.0
- Web Map Tile Service (WMTS) 1.0.0

Connect to ArcGIS geodatabases

Connect to ArcGIS Image Services

Connect to Jagwire servers

Also use the Open Remote Dataset dialog to connect to all of these, plus JPEG2000 Interactive Protocol (JPIP) servers.

SPEAR Google Earth Bridge

Export images and vectors from ENVI to Google Earth

Add-on Modules

Atmospheric Correction: QUAC® and FLAASH®

DEM Extraction

Deep Learning

Feature Extraction

NITF

Photogrammetry

Annotation and Map Composition

Add annotations to the display:

- Arrows
- Classification legends
- Color Bars
- Ellipses
- Grid lines
- Image magnifiers
- Pictures
- Plots
- Points, polylines, polygons
- Rectangles
- Scale bars

- Symbols
- Text

Affix annotations to the display so they remain stationary when rotating or zooming

Create and save annotation layers

Create map layouts using ArcGIS templates (**File > Print**)

Edit annotation properties

Interactively resize and reposition annotation items

Overlay contour lines

Scale annotations while zooming in or out of the display

Band Math and Spectral Indices

Combine ENVI Band Math with IDL to create powerful mathematical operations on pixel data

Choose from 74 pre-built spectral and vegetation indices to indicate the relative abundance of features

Create color composites from image bands

Use band ratios to enhance the spectral differences between bands

Change Detection

Perform quick thematic change detection

Perform SPEAR image change detection

Perform THOR image change detection

Image Change Workflow

Show changes between two images:

- Automatically coregister images
- Specify image differencing methods:
  - Input band
  - Feature index: NDVI, NDWI, NDBI, Burn index
  - Spectral angle

- Specify image transform methods:
    - Principal Components Analysis (PCA)
    - Minimum Noise Fraction (MNF)
    - Independent Component Analysis (ICA)
- Specify the type of change to show:
    - Increase only
    - Decrease only
    - Increase and decrease

Apply thresholding: Automatic or manual

Smooth and/or aggregate image change results

Specify reprojection, resampling, and warping methods

Export classes to ENVI classification image

Export class vectors to shapefile or ArcGIS geodatabase

Export class statistics to text file

Export grayscale change image to ENVI, ArcGIS geodatabase, or TIFF

Thematic Change Workflow

Show changes between thematic classes:

- Show class transitions
- Smooth and/or aggregate thematic change results
- Specify reprojection methods
- Export classes to ENVI classification image
- Export class vectors to shapefile or ArcGIS geodatabase
- Export class statistics to text file

Classification

Perform decision tree classification

Perform supervised classification:

- Adaptive Coherence Estimator (ACE)

- Binary Encoding

- Constrained Energy Minimization (CEM)

- Mahalanobis Distance

- Maximum Likelihood

- Minimum Distance

- Orthogonal Subspace Projection (OSP)

- Parallelepiped

- Spectral Angle Mapper (SAM)

- Spectral Information Divergence (SID)

- Support Vector Machine (SVM)

Perform unsupervised classification:

- ISODATA

- K-Means

Perform post-classification tasks:

- Aggregate classes

- Calculate confusion matrices

- Clump classes

- Combine classes

- Convert classes to pixel ROIs

- Convert classes to polygon ROIs

- Convert rule images to classes

- Create buffer zone images

- Display ROI curves

- Edit classification images

- Export classes to vector layers

- Generate random samples

- Run majority and minority analyses
- Sieve classes
- Calculate statistics for classes
- Classify lines of communication for roads and water (SPEAR Tools)
- Edit class layer names and colors

Deep Learning

An ENVI Deep Learning license is required to use these features.

- Find one or multiple features in imagery
- Use the Deep Learning Labeling tool to collect training samples in imagery
- Train TensorFlow models to identify features of interest
- View real-time training metrics in TensorBoard
- Create classification images of features using trained models
- Create class activation (heat map) images of features using trained models
- Convert class activation images to shapefiles and ROIs
- Use the Deep Learning Guide Map to walk through the entire process
- View model metadata and accuracy metrics

Display Tools

Animate bands

Apply color tables

- Adjust gradients
- Choose from predefined options
- Define color spaces: RGB, HLS, HSV

Apply custom histogram stretches

Apply quick stretches:

- Bipolar
- Equalization

- Gaussian

- Linear

- Linear 1%, 2%, 5%

- Logarithmic

- Optimized Linear

- Square Root

Blend data layers

Chip views to:

- ArcMap

- File: ArcGIS Geodatabase, ENVI, JPEG, JPEG2000, NITF, TIFF

- Geospatial PDF

- Google Earth

- Print Layout

- PowerPoint: Configure and use PowerPoint templates

Count image features:

- Count up to 5000 individual features in raster and vector data

- Define separate feature types

- Edit properties

- Export features to ArcGIS geodatabase, CSV, ROI, shapefile, text

- Manage feature records

- Overlay grids

- Save and restore feature counting files

Create color slices:

- Calculate class statistics

- Define custom slices

- Export slices to classification image or shapefile

- Interactively edit slices

Create shapefiles of contour lines from full-resolution images

Create data profiles:

- Arbitrary (transect)

- Spatial

- Spectral

- Time Series

Display dataset properties

Display different band combinations:

- Color-infrared

- Custom

- True-color

Display reference maps showing the extent of data layers

Dock and undock panels

Drag and drop files from/to:

- ArcMap and ArcCatalog (Windows only)

- Data Manager

- File system

- Windows explorer

Enhance views:

- Brightness

- Contrast

- Quick stretches

- Sharpen

- Transparency

Expand and collapse Layer Manager and Toolbox

Export views to:

- Geospatial PDF

- Images: ENVI, TIFF

Export layers to TIFF

Flicker between data layers

Geographically link data with ArcMap

Go to specific locations:

- Map coordinates
- Pixel coordinates

Manage views:

- Change background color
- Establish zoom links between views
- Link views by geographic location or pixel
- Save and restore views
- Set up multiple views: Preset or custom number
- Specify base projection

Measure distances (mensuration)

Navigate data layers:

- Fly
- Pan
- Scroll through views

Plot data values

Query cursor locations:

- Report sub-pixel file and/or map coordinates
- Report data values
- Report vector information

Reorder data layers

Rotate the display

Send files to ArcMap

Show an overview window:

- Locator rectangle
- Snail trail
- Save snail trail to TIFF file

Show and hide individual data layers

Stretch views by:

- Full extent

- View extent

- View extent with automatic update

Swipe data layers

Use portals to see through underlying data layers

Watch the progress of multiple processes that are running

Zoom in and out of views

ENVI Modeler

Create task-based workflows

Batch-process multiple datasets

Build models using a simple user interface

Add breakpoints to pause models at certain points during execution

Add comments to models

Add conditional statements

Create metatasks

Drag and drop model files from Windows to ENVI

Generate ENVI toolbox extensions from models

Generate IDL programs from models

Generate metatask files from models

Generate Python programs from models

Run models in a desktop or enterprise environment

Run models on ENVI Servers

Validate models before execution

ENVI Server

Run multiple, concurrent ENVI processes in the background

Scale processing power by setting up and using other ENVI Servers in a distributed environment

Monitor the status of running jobs

Use the ENVI Modeler to batch-process multiple datasets on different ENVI Servers

Feature Extraction

An ENVI Feature Extraction license is required to use these features.

Use individual tools or end-to-end, guided workflows

Segment images into objects with similar pixel characteristics

Merge adjacent segments with similar spectral attributes

Import ancillary data such as DEMs to improve classification

Define and edit output classes

Perform example-based classification:

- Choose supervised methods: KNN, PCA, SVM

- Import ground truth shapefiles

- Interactively define training data

- Save training data to shapefiles

Perform rule-based classification:

- Build rules based on spatial, spectral, and texture attributes

- Export attribute image to ENVI raster file

- Preview attribute image

Perform image segmentation without classification

Preview classification results

Export classes to ArcGIS geodatabase

Export classes to ENVI raster file

Export classes to shapefile

Export confidence image to ENVI raster file

Export segmentation image to ENVI raster file

Export segmentation vectors to shapefile

Save processing summary to text file

Filters

Apply adaptive filters:

- Bit Error
- Enhanced Frost
- Enhanced Lee
- Frost
- Gamma
- Kuan
- Lee: Additive, multiplicative, additive-multiplicative
- Local sigma

Apply convolution filters:

- Directional
- Gaussian high pass
- Gaussian low pass
- High pass
- Laplacian
- Low pass
- Median
- Roberts
- Sobel

Apply frequency (FFT) filters

Apply morphology filters:

- Binary
- Grayscale

Apply texture filters:

- First order (occurrence): Data range, entropy, mean, skewness, variance
- Second order (co-occurrence): Contrast, correlation, dissimilarity, entropy, homogeneity, mean, second moment, variance
- Label entropy
- Rank strength

Geographic Positioning Tools

Automatically generate tie points by:

- Cross correlation
- Cross correlation with orthorectification
- Mutual information
- Mutual information with orthorectification

Build geometry files:

- ASTER
- AVHRR
- SeaWiFS
- SPOT

Build grid definitions from:

- Image intersection
- Image union
- The spatial information of an existing image

Build rational polynomial coefficients (RPCs) for aerial and satellite sensors

Convert ASCII coordinates from one projection to another

Convert between pixel and map coordinates

Convert map coordinates from one coordinate system to another

Correct bowtie artifacts in MODIS images

Filter tie points by:

- Fundamental matrix
- Global transform

- Global transform with orthorectification
- Pushbroom model

Generate coordinate system strings for use with the ENVI API or header files

Georeference images using input geometry files:

- Build geographic lookup tables (GLTs)
- Build super GLT files from input geometry (IGM) files
- Georeference images from GLTs
- Georeference images from super GLTs
- Georeference files from IGMs
- Reproject datasets that contain GLTs: GOES-16, GOES-17, MODIS, NPP VIIRS, PRISMA, Sentinel-3

Georeference specific sensors using dedicated tools:

- ASTER
- AVHRR
- COSMO-SkyMed
- Envisat
- MODIS
- RADARSAT
- SeaWiFS
- SPOT

Orthorectify images using RPCs:

- Use standalone tools or an end-to-end, guided workflow
- Improve overall accuracy using input GCPs
- Use a reference image to automatically create GCPs
- Overlay relative error color gradients
- Preview orthorectification results
- Export result to ENVI or TIFF
- View error metrics

Overlay grid lines on georeferenced images

Perform image-to-map registration

Perform rigorous orthorectification (requires the ENVI Photogrammetry Module)

Register images and vectors with GeoServer

Register two images to the same coordinate system using our patented registration engine

- Automatically create tie points by choosing one of four geometric models

- Export result to ENVI or TIFF

- Export tie points to text file

- Import seed tie points

- Overlay relative error color gradients

- Preview tie points in both the base and warp image

- Set warping parameters

- Use standalone tools or an end-to-end, guided workflow

Reproject images to different coordinate systems

Resample images:

- By pixel scale

- Using column and row mapping

Select from hundreds of coordinate systems using a dedicated dialog

Warp and resample images

SPEAR Tools

Coregistration

Image to Map Registration

Orthorectification

Image Transforms

Apply decorrelation stretches

Apply tasseled cap transforms to Landsat images

Create pan-sharpened images:

- Gram-Schmidt
- NNDiffuse

Create spectrally sharpened images:

- Brovey color normalized
- Color normalized
- Hue/saturation/value (HSV)
- Principal components

Create synthetic color images

Enhance the color of red/green/blue (RGB) images:

- Photographic stretch
- Saturation stretch

Expand the dimensionality of images

Reduce the dimensionality of images:

- Independent Components Analysis (ICA)
- Minimum Noise Fraction (MNF)
- Principal Components Analysis (MNF)

Transform color spaces:

- HLS to RGB
- HSV to RGB
- RGB to HSV
- RGB to HLS
- USGS Munsell to HSV
- USGS Munsell to RGB

LiDAR Analysis

Extract point clouds from overlapping stereo images (requires the ENVI Photogrammetry Module)

Read and convert LAS files into ENVI raster format or ENVI Vector Files (EVFs)

Use the Classic LiDAR Viewer to interactively explore point values in LAS files

View LAS header files

ENVI LiDAR Application

Color point clouds by:

- Height
- Classification
- Intensity
- RGB

Create and manage projects

Extract landscape features from point clouds:

- Buildings
- Power lines
- Power poles
- Trees

Create image products from point clouds:

- Digital elevation models (DEMs)
- Digital surface models (DSMs)
- Orthophotos

Correct processed data:

- Buildings
- DEMs
- Power lines and poles
- Trees

Create other products from point clouds:

- Classified point clouds
- DEM contours
- Terrain TIN

Establish cross-sectional views

Add and edit vectors after processing:

- Buildings
- Power lines

Change the point classification of contours

Perform quality assurance on processing results

Export products to their native formats after quality assurance (QA)

Save and restore view locations

Transform point clouds into GIS layers

View point density maps

Metadata

Edit ENVI header file metadata

Edit NITF metadata

View dataset properties and basic metadata alongside displayed data

View detailed metadata for various types of data:

- Raster
- Vector
- Raster Color Slices
- Raster Series
- Classification
- Esri layers
- NITF
- Annotations

Preprocessing and Calibration

Also see Image Transforms and Geographic Positioning Tools.

Apply gains and offsets to image bands

Apply masks to images:

- From pixel values
- From ROIs
- From vectors

Build band- and layer-stacked images

Calibrate AVHRR data from NOAA-12 through NOAA-19:

- Reflectance
- Brightness temperature
- Sea surface temperature

Calibrate NASA Thermal Infrared Multispectral Scanner (TIMS) data to radiance

Convert complex data:

- Real
- Imaginary
- Power
- Magnitude
- Phase

Convert data interleave (BSQ, BIL, BIP)

Convert between data types (floating point, integer, byte, etc.)

Correct images for atmospheric effects:

- Dark subtraction
- Emissivity and temperature correction
- Empirical line correction
- FLAASH® (requires the ENVI Atmospheric Correction Module)
- Flat field correction
- Internal Average Relative Reflectance (IAR)
- Log residuals correction
- QUAC® (requires the ENVI Atmospheric Correction Module)
- Thermal atmospheric correction for TIMS data

Correct Landsat MSS aspect and skewing issues

Create binary rasters using thresholds:

- Automatic

- Greater than

- Less than

Create cloud masks with Fmask algorithm:

- Landsat

- Sentinel-2

- NPP VIIRS Moderate Resolution (750 m)

Create ENVI Meta files

Create test images for ENVI:

- Constant value images

- Gaussian Point Spread function

- Horizontal and vertical ramps

- Random number images using both uniform and normal distributions

Create mirrored and transposed images

Create stretched images:

- Bipolar

- Equalization

- Gaussian

- Linear percent

- Linear range

- Logarithmic

- Optimized Linear

- Square Root

Define spatial subsets:

- By bounding box

- By another image's extent

- By ROI

- By shapefile

Define spectral subsets

Dice images into individual tiles:

- By distance

- By pixel count

- By tile count

- By vectors

Examine data files at the byte level

Export and/or subset image bands to IDL variables

Generate a thumbnail image

Import IDL variables into ENVI

Perform radiometric calibration:

- Brightness temperature

- Top-of-atmosphere (TOA) reflectance

- Radiance

Regrid raster to a custom grid

Remove striping artifacts from Landsat MSS data

Replace bad lines of image data

Resize and resample images

Rotate and flip images

Set data values to ignore

Suppress vegetation spectral signatures from imagery

Mosaics

Create pixel-based mosaics for non-georeferenced images

Create quick mosaics from displayed images

Create seamless mosaics:

- View and recalculate input image footprints

- Set input data values to ignore

- Perform color correction:
    - Use only the overlap area or the entire extent
    - Choose which image to use for calculating statistics
- Automatically add seamlines
- Edit seamlines
- Set the feathering distance to blend images
- Set the input scene display order
- Interactively select the output spatial extent
- Export mosaics to ENVI or TIFF

SPEAR Tools

Atmospheric Correction

Independent Components Analysis (ICA)

Pan Sharpening

Vertical Stripe Removal

Programming API

Batch-process data

Create custom plot functions

Create ENVI Toolbox extensions

Create custom ENVITasks:

- Incorporate existing user interface (UI) elements instead of writing UI code from scratch
- Use style sheets to control appearance

Create custom workflows

Create metatasks (tasks within tasks)

Deploy programs to cloud environments such as Geospatial Services Framework (GSF)

Manage raster metadata

Manage views and layers

Process data using ENVITasks

Run ENVI analytics at the command line:

- Bash shell scripts

- Custom tasks

- stdin, stdout, stderr

- Windows batch scripts

Use tile iterators to process large datasets

Write end-to-end classification programs:

- Randomize input data

- Scale input data

- Split data into training and validation sets

- Specify classifier methods: Softmax Regression and SVM

- Train classifiers: Iterative and gradient-descent methods

- Evaluate classifiers and produce accuracy metrics

Write error-handling code

Write event-handling code:

- Keyboard events

- Mouse events

- Selection change events

Write program notification (messaging) code

Write programs that combine IDL and ENVI functionality

Radar Analysis

The ENVI SARscape module offers a comprehensive set of tools and workflows for analyzing modern radar datasets. The following tools are available in ENVI and are separate from ENVI SARscape.

Calibrate radar data to brightness values (β^0) or backscatter coefficients (σ^0):

- ERS Pulse Repetition Interval (PRI)

- RADARSAT Georeferenced Data (Level-1)

Calibrate radar amplitude images to sigma nought backscatter:

- ALOS-1
- ALOS-2 PALSAR Level 1.1, 1.5, 2.1, and 3.1 data

Convert complex data:

- Real
- Imaginary
- Power
- Magnitude
- Phase

Convert raw TOPSAR data files to physical units

Create AIRSAR scattering classification images

Create incidence angle images:

- AIRSAR
- RADARSAT
- SIR-C
- Generic

Create pedestal height images:

- AIRSAR
- SIR-C

Create phase images:

- AIRSAR
- SIR-C

Perform multilooking on compressed SIR-C data

Remove antenna gain variations

Resample data from slant to ground range:

- AIRSAR
- RADARSAT

- SIR-C
- Generic

Synthesize data:

- AIRSAR
- SIR-C

View headers:

- AIRSAR
- COSMO-SkyMed
- Generic CEOS
- RADARSAT

Regions of Interest

Create ROIs interactively:

- From band thresholds
- From geometry
- From pixels

Grow ROIs:

- From neighboring pixels
- With the Magic Wand tool

Compute ROI separability

Compute statistics from ROIs

Convert data types to ROIs:

- ASCII
- Buffer zones
- Classes
- Feature counts
- GeoJSON features
- Vector records and attributes

Create confusion matrices from ground truth ROIs

Create receiving operating characteristic (ROC) curves from ground truth ROIs

Define spatial subsets from ROIs

Interactively draw ROIs:

- Ellipses
- Multiple objects within one ROI
- Pixels
- Polygons
- Polygons with interior spaces
- Polylines
- Rectangles

Merge ROIs

Pixelate ROIs

Report the area of ROIs

Save and export ROIs:

- Comma-separated value (CSV)
- ENVI Classic format (.roi)
- GeoJSON
- Shapefile
- XML

Send ROIs to the n-D Visualizer

Spatially subset images from ROIs

Spectral Analysis

Apply EFFORT spectral polishing to apparent reflectance data

Apply mathematical expressions or IDL procedures to spectra

Classify imagery based on vegetation and ecologic health:

- Agricultural stress
- Fire fuel distribution

■ Overall forest health

Create 3D image cubes from hyperspectral and multispectral bands

Find pixels that are spectrally anomalous throughout an image (Anomaly Detection)

Perform THOR spectral analysis using multiple standalone tools

Resample spectra to match:

■ ASCII wavelength file

■ Response of a known instrument

■ User-defined filter functions

■ Wavelengths of a specific image input file

Use spectral mapping methods with hyperspectral imagery:

■ Continuum Removal

■ LS-Fit (Linear Band Prediction)

■ Matched Filtering

■ Mixture Tuned Matched Filtering (MTMF)

■ Multi Range Spectral Feature Fitting

■ Spectral Feature Fitting

Use Linear Spectral Unmixing to determine the relative abundance of materials

Use the n-D Visualizer to assign the purest spectral endmembers to classes

Use the Pixel Purity Index tool to locate the purest spectral endmembers in imagery

Use the Sequential Maximum Angle Convex Cone (SMACC) tool to find spectral endmembers and their abundances

Use the Spectral Analyst to help identify materials based on their spectral characteristics

Use the Spectral Hourglass Wizard to find and map image spectral endmembers:

■ Specify input and output files

■ Apply MNF transform to reduce data dimensionality

■ Use PPT and n-D Visualizer to locate the purest spectral endmembers

■ Use spectral mapping methods to map endmembers back to image pixels

■ View rule images and classification results

Spectral Libraries

Build spectral libraries

Collect endmember spectra from various sources

Drag and drop spectral curves between plot windows

Export spectral library data to:

- ASCII
- ENVI spectral library file (SLI)

Import spectra from:

- Analytical Spectral Devices (ASD) spectrometer files
- ASCII files
- Other spectral libraries
- ROI means
- Spectral profiles and plots

Perform dimensionality expansion on spectral libraries

Resample spectral libraries to match:

- ASCII wavelength file
- Response of a known instrument
- User-defined filter functions
- Wavelengths of a specific image input file

Use pre-built laboratory spectra of vegetation and man-made materials:

- John Hopkins University
- NASA Jet Propulsion Laboratory
- U.S. Geological Survey

View spectral library files:

- ASD
- ENVI SLI
- THOR Metadata Rich Spectral Library (MRSL)

SPEAR Tools

Anomaly Detection

Relative Water Depth

Spectral Analogues

Vegetation Delineation

Watercraft Finder

Statistics

Calculate global spatial statistics:

- Moran's I
- Geary's C
- Semivariance

Calculate local spatial statistics:

- Anselin Local Moran's I
- Getis-Ord Local G_i
- Anselin Local Geary's C

Create 2D scatterplots

Create rasters of pixel statistics:

- Basic: Minimum, maximum, mean, standard deviation
- Kertosis
- Mean absolute deviation
- Skewness
- Sum
- Sum of squares
- Variance

Get band statistics:

- Basic: Minimum, maximum, mean, standard deviation
- Histograms

- Covariance

Get classification accuracy metrics:

- Confusion matrix

- Errors of commission

- Errors of omission

- Kappa coefficient

- Overall accuracy

- Producer accuracy

- User accuracy

Get classification image statistics:

- Basic: Minimum, maximum, mean, standard deviation

- Covariance

- Histograms

- Pixel count

- Percentage per class

Get quick statistics from images:

- Histograms

- Minimum

- Maximum

- Mean

- Standard Deviation

Get ROI statistics:

- Basic: Minimum, maximum, mean, standard deviation

- Histograms

- Pixel count per ROI

Save band statistics to text files

Save classification statistics to text files

Target Detection

Target Detection Wizard

Apply MNF dimensionality reduction

Choose target detection methods:

- Adaptive Coherence Estimator (ACE)

- Constrained Energy Minimization (CEM)

- Orthogonal Subspace Projection (OSP)

- Matched Filtering (MF)

- Mixture Tuned Matched Filter (MTMF)

- Mixture Tuned Target-Constrained Interference-Minimized Filter (MTTCIMF)

- Spectral Angle Mapper (SAM)

- Target-Constrained Interference-Minimized Filter (TCIMF)

Filter targets

Import target and background spectra from:

- Spectral libraries

- Individual spectral plots

- Text files

- ROIs

- Statistics files

Open and preview rule images

Select atmospheric correction methods

Export results to:

- ROIs

- Shapefiles

View output statistics and report

SAM Target Finder with BandMax

Import target and background spectra from:

- ASCII files
- ASD files
- Endmember Collection files
- ENVI Vector Files (EVF)
- ROIs
- Statistics

Select band subsets for suppressing background signatures

Use the SAM algorithm to find targets

Examine output rule and classification images

THOR Target Detection

Apply dimensionality reduction

Choose target detection methods:

- ACE
- CEM
- MF
- Normalized Euclidean Distance (NED)
- OSP
- SAM
- SID
- Spectral Similarity Mapper (SSM)
- TCIMF
- Unsupervised Water Detection (UWD)

Import target and background spectra from:

- Metadata Rich Spectral Library (MRSL) files
- ROIs

- Spectral libraries

Process single files or batch-process multiple files

Select atmospheric correction methods

Select signature matching methods

Clump and sieve results

Export results to:

- ENVI Vector Files (EVFs)
- KML files
- ROIs
- Shapefiles

Time Series Analysis

Animate raster series

Build raster series from:

- MIE4NITF camera frames
- Multi-page TIFF files
- Multiple images, with or without time metadata
- Proba-V video files
- SkySat-1 video files
- Video files

Create time series profiles

Regrid raster series by:

- Index number
- Intersection of images
- Union of images

Topographic Modeling

Apply topographic shading using color spaces:

- HLS
- HSV
- RGB

Blend color DEMs with topographic features using the Topographic Shading Tool

Conduct viewshed analysis using:

- End-to-end, guided workflow
- ENVI LiDAR

Convert vector topographic maps into DEMs

Create 3D surface views of elevation and image data

Create classification images of morphometric features:

- Channel
- Pass
- Peak
- Pit
- Plane
- Ridge

Create digital surface model (DSM) images from overlapping stereo images (requires the ENVI Photogrammetry Module)

Create shaded relief images from digital elevation data

Create shapefiles of contour lines from full-resolution digital elevation data

Display a global Natural Earth I shaded relief dataset, included with ENVI

Extract DEMs from aerial and satellite imagery (requires the ENVI DEM Extraction Module):

- Requires stereo imagery with RPCs
- Create epipolar images
- Use the 3D Epipolar Viewer to extract elevation values from stereo imagery
- Match image features
- Geocode DEMs to epipolar projections to standard map projections

Extract topographic modeling features from digital elevation data:

- Aspect
- Cross sectional convexity
- Longitudinal convexity
- Maximum and minimum curvature
- Plan convexity
- Profile convexity
- Root mean square (RMS) image
- Slope

Fill bad values in digital elevation data

Perform terrain categorization (TERCAT) using SPEAR Tools

Rasterize ASCII point data

Use the GMTED2010 dataset (included with ENVI) for topographic applications

Vectors and GIS Support

Also see Supported Vector Formats.

Convert ENVI Classic Vector Files (EVFs) to shapefiles

Create masks from vectors

Create new vector layers from ASCII and CSV files:

- Multi-point
- Point
- Polygon
- Polyline

Create shapefiles:

- From bounding boxes
- From centroids
- From classes
- From feature counts
- From filtered attribute records

- From smoothed polylines and polygons
- From ROIs

Display world vectors:

- Airports
- Coastlines
- Countries
- Geographic lines
- Minor islands
- Populated places
- Ports
- Rivers
- Roads
- States/provinces

Download and display OpenStreetMap® vectors

Edit vector layer properties

Group and ungroup vectors

Interactively draw vectors:

- Multi-point
- Point
- Polygon
- Polyline

Interactively edit vectors:

- Add and delete polyline and polygon vertices
- Delete records
- Group and ungroup records
- Join polylines
- Merge and split polylines and polygons
- Move polyline and polygon vertices

- Rectangulate polygons
- Remove polygon holes
- Smooth polylines and polygons

Merge vectors

Reproject vectors to different coordinate systems

Save vector symbology to file

Spatially subset images from vector files

Upload vectors to ArcGIS Portal

Work with attributes:

- Add columns
- Create new attribute records
- Convert attributes to ROIs
- Convert attribute records to feature counts, one ROI, separate ROIs
- Edit display properties (color, line width, etc.)
- Filter records by attributes
- Import from ASCII, CSV, EVF, Esri feature class layers, geodatabases, shapefiles
- Remove columns
- Replace multiple cells with one value
- Save records to shapefile
- Select and edit records
- View attribute tables