

GEOG 361

Remote Sensing in Geosciences

Lab Exercise 1 The Basics of ENVI and the Nature of Digital Images

This lab was originally designed by Dr. Hongxing Liu and modified by Dr. Klein

I. Introduction

This lab aims to introduce you to the basics of the ENVI image processing software and to help you begin to understand the nature and statistical properties of digital remote sensing images.

By the end of the lab you should have a working knowledge of basic image operations in ENVI and have a basic understanding of digital images. The teaching assistant will guide you through this lab. The learning objectives of this lab assignment are to:

- 1) Understand the user interface of ENVI and ENVI help well enough to complete the following basic image processing tasks.
 - Load and open image data;
 - Label and comment the image data;
 - Display images in gray-scale, pseudo color or RGB mode;
 - Zoom and pan images;
 - View and record the digital number (DN) values of image pixels;
 - View the geolocation information about the image and individual pixels;
 - Enhance image brightness and contrast.
- 2) Use the histogram and scatter plots to explore the statistical properties of Landsat 7 ETM+ panchromatic and multi-spectral data for Houston in ENVI; and calculate the statistical measures to quantify the satellite image data;
- 3) Make an annotated image map using ENVI composition tools.

II. Overview of ENVI Software Features

ENVI (*The Environment for Visualizing Images*) is one of several commonly used image commercial processing packages. Others you may have heard about include ERDAS Imagine, ERMapper and PCI. Each of these packages has its own strengths and weaknesses. ENVI's strengths lie in well-developed algorithms for hyperspectral and SAR data. In addition, it is built upon the IDL (Interactive Data Language) platform which enables ENVI functionality to be available in IDL and IDL functionality in ENVI. It also makes development, customization and extension of ENVI easier than other software packages. While this class uses ENVI, proficiency in using one image processing package should make it easy to translate this skills to another image processing package.

ENVI can directly read image data in ENVI Standard image file or External files including:

Landsat	Radar (SAR)	ArcView Raster
SPOT	AVHRR	Mr. SID
IKONOS	MODIS	TIFF/GeoTIFF
Quickbird	USGS DOQ	JPEG
ASTER	Thermal	ASCII

However, only ENVI raster datasets accommodate the full functionalities of ENVI. An ENVI raster data set consists of two component files:

- A binary data file containing the raster data in one of three formats: Band Sequential (BSQ), Band Interleaved by Pixel (BIP), or Band Interleaved by Line (BIL) format.
- A corresponding ASCII header file with an ".hdr" file extension

Vector information containing lines, points, and polygons can be also loaded and displayed in ENVI. For example, overlay a network of known roads (vector data) on a satellite image backdrop. An ENVI Vector data set consists of one data file with an ".evf" file extension. ENVI can also open numerous vector formats including: Shapefiles, ARC/INFO Interchange files, DXF files, USGS Digital Line Graphs (DLG), and USGS DLGs in Spatial Data Transfer Standard (SDTS) format, *etc.*

Statistical information about the images, indicating image quality and characteristics, can be calculated and viewed in a tabular or graphical format using histograms and scatter plots.

You can directly save raster images in ENVI in a number of formats including:

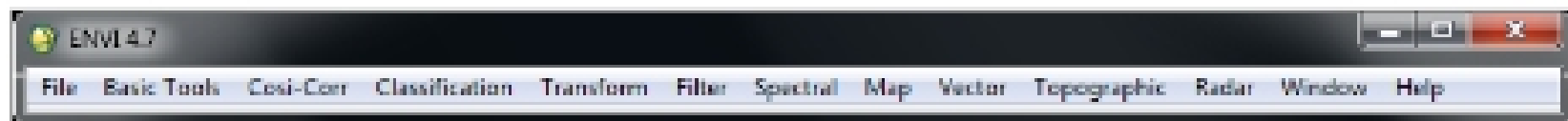
- ENVI Standard Raster Dataset
- ArcView Raster (.bil)
- ERDAS File (.lan)
- NITF (.ntf)
- TIFF/GeoTIFF (.tif)
- ASCII (.txt)
- ER Mapper File (.ers)
- JPEG (.jpg)
- PCI File (.pix)
- ESRI GRID

The following is a brief tutorial and exercises that are aimed at helping you learn the basics of the ENVI image processing system. As the menus change somewhat between versions the exact menu options you may see on your computer may differ slightly from those shown in the screenshots here, but you should be able to easily identify the basic functionality discussed in this lab.

My advice here is to spend some time this week simply playing with ENVI and trying out its features, there is no substitute for learning how to use an image processing system other than exploring its features – remember you cannot break anything – so do not be fearful from playing. Also, it is a good skill to learn how to find information in help if you have a problem.

A) Starting ENVI

To Start ENVI, you need to locate the ENVI Software just like you would any other software. You can also simply double click ENVI icon on the desktop (if present) to start ENVI. After starting ENVI, the main menu (which should be similar to what is shown below) should appear. Most of the main image processing functionality can be found under the options on this menu and are grouped by task.



ENVI Main Menu Bar

B) ENVI Tutorials

However, before we begin using ENVI it is necessary to introduce the ENVI help system that if used properly during this course can help answer many of your questions and problems. ENVI provides an extensive on-line help system with both simple overviews and detailed descriptions of its features and functions as well as PDF tutorials which can walk you through the specifics of certain tasks. The tutorial included in ENVI software provides simple step-by-step lessons that give you hands-on practice using the basic features of the software. It is imperative that you learn to use the available help system.

To start the **online help system**, simply select **Help** from the main ENVI Menu Bar simply select Help from the Main ENVI Menu (*it is typically the rightmost option as shown above*). An example of the ENVI help system is shown in the screen capture below.

ENVI PDF tutorials are available online from ITT Visual Information Solutions – the company that produces ENVI and IDL. These online tutorials can be reached from the main ENVI online help page. You will need to register with ITT to have access to these online materials.