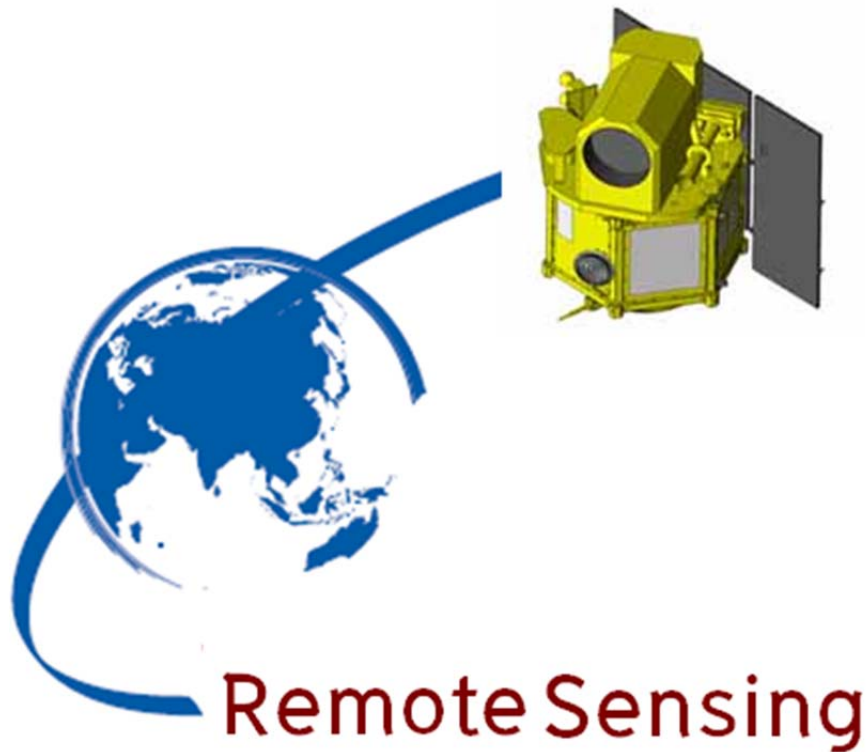


Remote Sensing Instruction Laboratory



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**Remote Sensing Laboratory
Lab Assignment # 1**

Introduction of Basic Tool and Color Composite Images

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Instructors

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February 2014

1. OBJECTIVE

To familiarize ourselves with image processing software (ENVI) and multi-spectral data by;

- Creating True Color Composite, False Color Composite and Pseudo color images
- Saving part of the file as another image in Tiff format
- Viewing the X, Y & Z profiles
- To differentiate between water, bare land, paddy field and buildup area through “X profile“, “Y profile“ & “Z profile“

2. METHODOLOGY

2.1 Color Composite: True color, False color and Pseudo color.

2.1.1 True color:

- Open the image file named *pathum_edm*.
- Select RGB Color and then assign spectral

Region of Red, Green and Blue by select band 3, 2 and 1 following.

2.1.2 False color:

- Select RGB Color and then assign spectral

Region of Red, Green and Blue by select Band 4, 3, and 2 following.

2.1.3 Pseudo color:

- Select Gray scale and then click the Band for showing such as Band 5
- Click “Load Band” for display.
- From menu “Tool” select “Color Mapping”
- select “ENVI color Tables” and then select “Rainbow” in color Tables list.

For appropriate image, should to design range of Blue region by sliding “stretch Bottom” bar and slide “Stretch Top” bar for assign range of Red region.

2.2 Subsection a dataset

- Load True color image.
- From main window in menu “File” select menu bar on “image window”, select “Save Image as”
- click on “Spatial subset” and enter X0, X1 in samples and Y0, Y1 in lines to subsection a dataset. Click “OK” button.
- select output file type to “TIFF/GeoTiff”
- Specific output filename and location of output file. And then click “OK”

2.3 Checking Pixel value/Location and Profiles.

2.3.1 Load true color image of subsection image.

2.3.2 Go to “Tools” in the menu bar on “image window” and select “Cursor location/value...” or double click some point in “main window”

2.3.4 Try to move mouse to another point and check the value of location, data color value and screen color value.

2.3.5 Go to menu “Tools”, select “Profiles” and then Select “X profile”

2.3.6 Pick some objects and try to move mouse along horizontal direction (X) and then check the red line value (the line of the profile for which the DN number are plotted”, or check the value from “cursor location/value..” in R color.

2.3.7 Selecting “Y profile” that same methods in step 2.3.5 to 2.3.6 but change select “Y profile” instead of “X profile”. Move mouse cursor along vertical direction (Y) and then check the value from “cursor location/value..” in R color.

2.3.8 Selecting “Z profile” that same methods in step 2.3.5 to 2.3.6 but change select “Z profile” instead of “X profile”. Move mouse cursor along vertical or horizontal direction and then check the value from “cursor location/value..” in R color.

3. DATA

Sample datasets of Landsat7

4. RESULT

5. DISCUSSION AND CONCLUSION:

Remote Sensing Laboratory
Lab Assignment # 2
High Resolution Remote Sensing

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February 2014

1. OBJECTIVE

The main objective of this exercise is to be acquainted with the high-resolution remote sensing data and compare characteristics types of each data set

2. DATA PROVIDED

The data sources used are from following satellites/sensors;

2.1. Landsat 7:

Data provide is that of Pathumthani province of Thailand with its upper left corner Long./Lat. of 100° 26' 13.88" E, 14° 03' 14.38" N. Although ETM+ sensor provides data in 8 bands but the data provided is of 6 bands. The Panchromatic (Band 8) and Thermal (Band 6) is not provided.

2.2. ASTER:

The location of image is not specified in header file. The Spatial resolution is 15m. Out of 14 Bands of ASTER, only 3 are provided i.e. NIR, Red & G while 6 bands of SWIR & 5 bands of TIR are not provided. Long./Lat. are also not mentioned.

2.3. IRS 1D LISS III and IRS 1D Panchromatic:

LISS-III sensor data for band 2, 3 & 4 are provided and Band 5 (SWIR) is not provided. Also Band 1 (Panchromatic) data is provided. Long./Lat. of upper left corner are 98° 45' 19.54" E, 7° 41' 40.35" N. The location of image is not known.

2.4. IKONOS:

The data provided is that of Edward Airbase, USA with its Long./Lat. of upper left corner 98° 06' 38.15" E, 34° 57' 17.47" N, The 1m spatial resolution data is provided in Red, Green & Blue, while NIR band is missing.

2.5. Quickbird:

The image provided is recorded on 07/11/2002. It contains a band of Panchromatic and four bands of MSS i.e. NIR(4) Red (3) Green (2) & Blue(1). The Long./Lat. of upper left corner is 100° 33' 32.72" E, 13° 43' 36.27" N.

3. METHODOLOGY

The Envi-4.5 of Research Systems, Inc. USA is utilized to view and differentiate various types of high resolution remote sensing images. Also Topographical features like 3D surface and topographical modeling have been utilized in this exercise.

4. RESULT**5. DISCUSSION AND CONCLUSION:**

Remote Sensing Laboratory
Lab Assignment # 3
Moderate Resolution Remote Sensing

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February 2014

1. OBJECTIVE

The main objective of this exercise is to be acquainted with the moderate-resolution remote sensing data and compare characteristics of each data set.

2. DATA PROVIDED

The data sources used are from following satellites/sensors;

1. NOAA NDVI 30 days composite
2. SPOT VI dataset
3. RADARSAT dataset

3. METHODOLOGY

1. Start image processing software ENVI 4.5
2. Open moderate resolution remote sensing data set image file
3. Compare characteristic type of each dataset.
 - Examine the change of vegetation value from dataset by Z- profiles tools.
(For NOAA NDVI 30 days composite dataset and SPOT VI dataset)
 - Examine the quality of the image and explain how dose it look like.
(For RADARSAT dataset)

4. RESULT**5. DISCUSSION AND CONCLUSION:**

Remote Sensing Laboratory
Lab Assignment # 4
Map Development

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February 2014

Objective: To create a map using ENVI.

Map Layout:

1. Open Image with true color composite (i.e. RGB =321).
2. From Display menu bar (Image window menu bar), select **File** → **QuickMap** → **New QuickMap**.
3. When the QuickMap Default Layout dialog appears, enter the page size, select **Portrait** or **Landscape** page orientation, and enter your desired output map scale.
4. Click **OK**, The QuickMap Image selection window appears.
5. Select from the following options to select the image subset to be used in the QuickMap”
 - Resize and move the red box outline (drag from corners to resize, click and drag the middle of the box to move).
 - Enter x and y sizes, in inches, in the **Image Size** text boxes, or use the arrow increment buttons to select dimensions.
 - Click the **Spatial Subset** button and use standard ENVI spatial subset methods.
6. Click **OK**.

Setting QuickMap Parameters

1. When QuickMap Parameters dialog appears, select from the following options:
 - To add a title to the map, type the text in the **Main Title** text box.
 - To add text to the lower left or lower right corners of the map, type the text into the corresponding text boxes.
 - To automatically load the map projection from the ENVI header into either the **Lower Left** or **Lower Right** text boxes, right-click in the text box and select **Load Projection Info**.
 - To change the grid line parameters (thickness, style, color, etc.) , click **Additional Properties** button.
 - To add scale bar and grid lines, leave the corresponding check boxes selected and edit the parameters as needed.
 - To add a North arrow, leave the corresponding check box selected and select an arrow type from the **North Arrow Type** button menu.
 - To return to the QuickMap Image Selection window and edit the image subset or map scale, click **Change Mapping Parameters** button.
2. Click **Apply** to view the changes.
3. Save image in .jpeg format.

Follow these steps for IKONOS, IRS and QUICKBIRD images given below.
Also try to plot the Map with different scale and different paper sizes.

Table: International Standard Paper Sizes

Size	millimeters	inches
Letter (US)	215.9 x 279.4	8.5 x 11
Legal (US)	215.9 x 355.6	8.5 x 14
Ledger (US)	279.4 x 431.8	11 X 17
A0	841 x 1189	33.125 x 46.75
A1	594 x 841	23.375 x 33.125
A2	420 x 594	16.5 x 23.375
A3	297 x 420	11.75 x 16.5
A4	210 x 297	8.25 x11.75

Submit the report with discussion and conclusion with your result obtained.

Remote Sensing Laboratory
Lab Assignment # 5
Image enhancement

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February 2014

1. OBJECTIVE

The main objective of this exercise is to familiarize with image enhancement, histogram stretching and LUT (Look Up Table)

2. DATA PROVIDED

The data used in this session is an image from Landsat 7 ETM+ sensor. Spatially it covers the area around Pathumthani province of Thailand (Upper Left Coordinates are 100° 26' 13.88"E+14° 3' 14.38" N). The image contains six bands of Landsat having spatial resolution of 30 m (excluding the panchromatic and thermal bands having different resolution).

3. METHODOLOGY

1. Start image processing software ENVI 4.5
2. Open image file and select RGB color as True color
3. Compare characteristics of image enhancement, histogram stretching and LUT by goto menu **Enhance**=> **interactive stretching** .. Then you can see histogram
4. Following methods of image enhancement through histogram stretching;
 - Linear
 - Piecewise linear
 - Gaussian
 - Equalization
 - Square Root
 - Arbitrary &
 - User Defined Lookup Table

4. Result**5. Discussions and Conclusion:****6. Reference:**

Remote Sensing Laboratory
Lab Assignment # 6
Math Operation

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Instructors

Dr. Weerakaset Suanpaga and Dr. Wathinee Krisanapant

February 2014

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1. Objective

The main objective of this exercise is to familiarize with Math operation of image processing such a Logical Operation, NDVI and PCA (Principal Component Analysis) calculation

2. Data provided

The data used in this session is an image from Landsat 7 ETM+ sensor. Spatially it covers the area around Pathumthani province of Thailand (Upper Left Coordinates are 100° 26' 13.88"E, 14° 3' 14.38" N). The image contains six bands of Landsat having spatial resolution of 30 m (excluding the panchromatic and thermal bands having different resolution).

3. Methodology

3.1 Subset of the Image

1. Start image processing software ENVI 4.2

2. Open image file and consider to subset image to size 1000x1000 pixels but this image size 500x500 pixels then should to use this image size.

Note: All the Math operations are carried out on this subset, to reduce the computation time and storage required for the resultant images.

3.2 Band Math Operations

1. Click Basic Tools Menu and select the Band Math

Calculation of NDVI:

Normalized Difference Vegetation Index is the most widely used vegetation index to relate the remotely sensed signals with the ground features like vegetation, health of vegetation, bare soil, snow, irrigated land and droughts. It can be calculated using following equation.

Note that the MIN and Max keywords are required in the function call to BYTSCL to ensure that the same minimum and maximum values are used for scaling all ties as tiled image.

$$NDVI = \tan \alpha = \frac{NIR - RED}{NIR + RED} \quad (1)$$

when $-1 \leq NDVI \leq 1$

Providing the result of NDVI in term of floating value then Band Math should be rewriting equation 1 by the following expression in Band Math window; (see equation 2) and in ENVI math window used b1 for NIR and b2 for Visible RED the result as equation 3.(see figure 1).

$$NDVI_{float} = \frac{float(NIR) - RED}{float(NIR) + RED} \quad (2)$$

$$NDVI_{float} = \frac{float(b1) - b2}{float(b1) + b2} \quad (3)$$

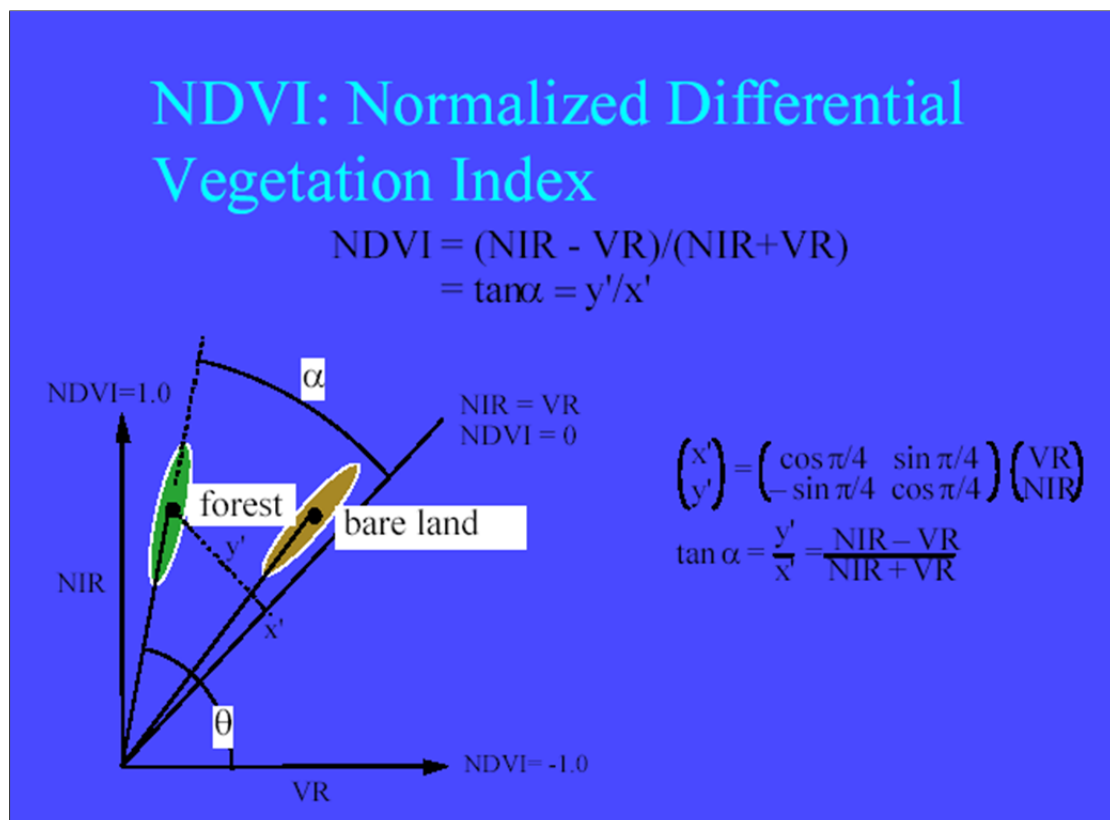


Figure1. Graphic Transformation of NDVI. [Ref 1.]

After entering this equation, ENVI will ask which band of the image should be used as b1 and which one to be used as b2. The band 3 (red) & band 4 (NIR) of the Landsat should be specified respectively as b2 and b1 (figure 2). The resulting image can be seen in figure 3. The inset of the image clearly shows that the data is in floating mode.

After the NDVI is calculated the resultant image can be viewed in gray shade. The values in this image vary from -1 to +1. Therefore it is customary to convert the floating point NDVI to Integer NDVI, with integer values of the range of 0-255. For this the Interactive Data Language (IDL) function BYTSCL is used as under (eq.4);

$$BYTSCL(b1, min = -1.0, max = 1.0) \quad (4)$$

After that, assign b1 should be linked with the floating NDVI band. The output file so generated will contain the integer values ranging from 0 to 255. The dialogue box for specifying the input and output files and the syntax of the formulae can be seen in figure 3 . The image result can be seen in figure 4. Band Math can also be used for hundred of other purposes like adding the bands, averaging the bands, removal of atmospheric errors, calculation of slope etc.

3.3 Principle Component Analysis (PCA) Calculation:

Use Principle component to procedure uncorrelated output bands, to segregate noise components, and to reduce the dimensionality of data sets. Because multi-spectral data bands are often highly correlated, the Principle Component (PC) Transformation is used to produce uncorrelated output bands. This is done by finding a new set of orthogonal axes that have their origin at the data mean and that are rotated so that the data variance is maximized.

Click Transform> Principle Component> Forward PC Rotation> Compute New Statistics & Rotate. It will open a menu to select the source file. Select the subset file. It will result into forward PC Rotation parameter dialogue .Specify 0.1 for Stats X Resize Factor & Stats Y Resize Factor in order to reduce the number of statistical calculations. Choose the statistics file name and output file name. Set the parameter '*Select the subset from Eigenvalue*' to '*Yes*' and then press OK. It will open a form showing eigenvalues of rotated bands (figure 5). Depending upon the user requirement select the number of bands with high values of eigenvalue (e.g. we have selected top 3 rotated bands). It will create a new image file with the no of bands as selected by the user in PCA. The new file can be used for image classification and for other purposes without losing amount of information too much extent. The six bands after PCA are shown as composite image in figure 6.

3.4 Logical Operation:

The NDVI product will use to mark PC1 image to show only vegetation are by the criteria that NDVI value is less than zero will as -999 values for non-vegetation area.

1. Select basic tools> band math form main menu bar.
2. enter equation (5) in expression text box.

$$(b1 \text{ lt } 0) * (-999) + (b1 \text{ ge } 0) * b2 \quad (5)$$

3. assign a b1 variable by NDVI band from last operation. And assign b2 variable for PC 1 band.

4. select result to file and enter the filename then click ok.

Note

lt = lesser than	le = lesser or equal than	eq =equal
gt=greater than	ge= greater or equal than	And ,or

4. Result

4.1 Band Math Operations NDVI

4.2 PCA Calculation:

4.3 The color table of Pseudo color by using NDVI mark on PC1

5. Conclusion.

6. Reference:

Remote Sensing Laboratory
Lab Assignment # 7
Geometric Correction

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February 2014

1. Objective

The main objective of this exercise is to familiarize yourselves with Map projection, map coordinate, geometric collection process and selection of ground control point (GCP).

2. Data provided

- Dataset of Landsat 7 ETM⁺ data
- Topographic map
THAILAND scale 1: 50,000 /CHANGWAT NONTHABURI
Edition 2-RTSD Series L7017 Sheet 5136 IV, Indian datum
(Grid 1,000m.UTM; Zone 47, Projection Transverse Mercator)

3. Methodology

1. Start image processing software ENVI 4.5
2. Open image file and save as file only interested area and close program.
3. Open interested area image file.
4. Geometric correction by Image-to-map registration.
5. Select Register Projection (UTM, Indian), Meters 47N, Pixel size 30.0)
6. Collecting Ground Control Points.
7. Select common reference features in both the map and the image.
8. Add additional GCPs using the same procedure.
9. Minimizing RMS Error
10. Wrapping and Resampling.

4. Result

- 4.1 Band Math Operations NDVI
- 4.2 PCA Calculation:
- 4.3 The color table of Pseudo color by using NDVI mark on PC1

5. Conclusion.**6. Reference:**