Image Processing with MATLAB

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Introduction

MATLAB (MATrix LABoratory)

- Integrates Computation, Visualization and Programming in an easy-to-use Environment

Toolboxes

- MATLAB functions (M-files)
- Signal Processing, Control Systems, Neural Networks, Fuzzy Logic, Wavelets, Simulation, Image Processing ...

Image Processing Tool Box

Extensive Functions

Image Restoration
Enhancement
Information Extraction

Demo of Basic Features

IRS (Indian Remote Sensing) Satellite 1C
LISS III data

- B2 (Green) 0.52-0.59 µm 23.5 m
- B3 (Red) 0.62-0.68 µm 23.5 m
- B4 (NIR) 0.77-0.86 µm 23.5 m
- B5 (SWIR) 1.55-1.70 µm 70.5 m

Uttara Kannada district, Karnataka

- IMAGE?.JPG

Read and Display an Image

Read an image (image4. JPG) and store it in an array named I

- I = *imread* ('image4. JPG');

Call *imshow* to display Image

- *imshow* (I)

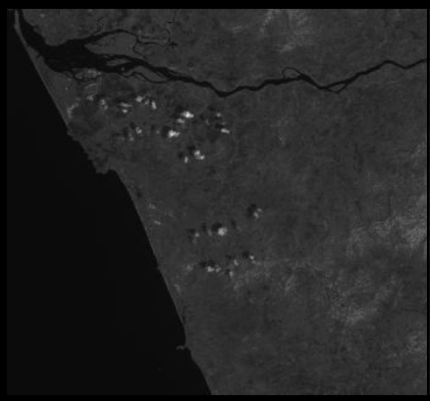
Features in the image

- Arabian Sea on the left
- Kalinadi in top half
- Dense vegetation.
- Small white patches in the image are clouds

Raw Image (Band 4)

Features

- Arabian Sea on the left
- Kalinadi in top half
- Dense vegetation.
- Small white patches in the image are clouds



Check the Image in Memory

- Use *whos* command to see how I is stored in memory

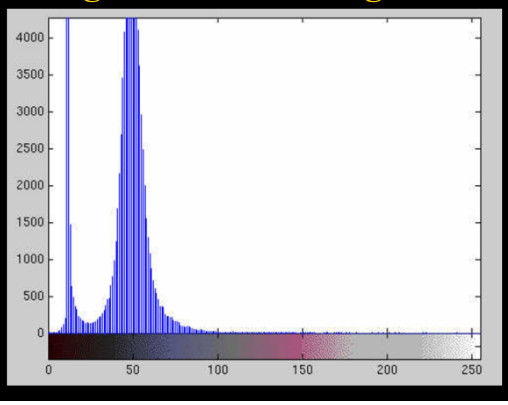
Name	Size	Bytes	Class
I	342x342	116964	uint8

Histogram of an Image

- Typical Low contrast in Image (0-255)
- Display Histogram of Image

figure, *imhist* (I)

Histogram of Raw Image



Histogram Equalization

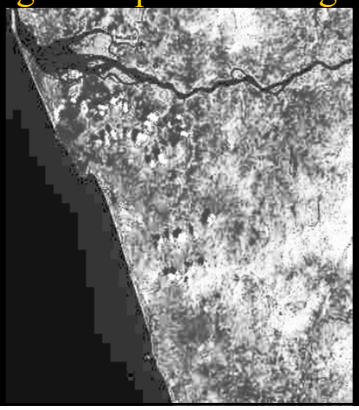
Use *histeq* to spread the intensity values over the full range to improve the contrast of I

I2 = *histeq* (I);

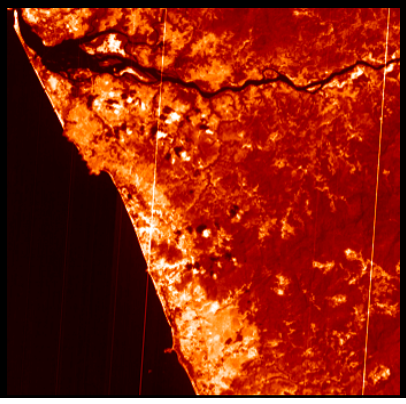
Display the new equalized image, I2

figure, imshow(I2)

Histogram Equalized Image



Enhanced Image (Band 5)



Standard FCC

Images in MATLAB

Data Structure in MATLAB

- Matrix representation
- I(2,15) gives the Pixel value at Row 2, Column 15
- Multidimensional Array for RGB…

Supports Different Image Formats

- BMP, HDF, JPEG, PCX, PNG, TIFF, XWD

Converting Image Storage Classes

Converting Graphics File Formats

Information Extraction

Image Arithmetic

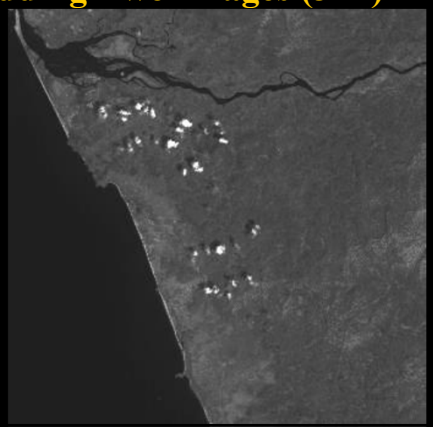
- Addition, Subtraction, Multiplication and Division on Images
- Adding Images
  - Add 2 images

```
I = imread('image3.JPG'); J = imread('image4.JPG');
K = imadd(I,J); imshow(K)
```

  - Add a constant 50

```
I = imread('image4.JPG');
J = imadd(I,50);
```

Adding Two Images (3+4)



Subtracting Images

- Subtract One Image from Another (DVI)

```
X= imread('image5.JPG');  J= imread('image4.JPG');
K= imsubtract(X,J);
```

- Subtract a Constant Value From an Image

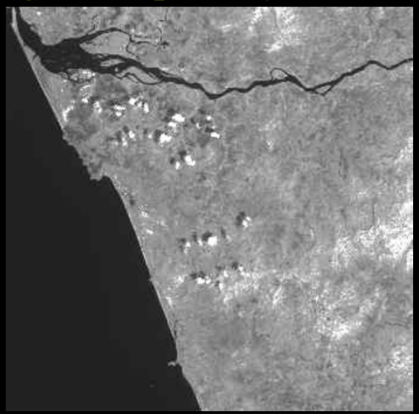
Multiplying Images

- Multiply two images
- Multiply a Constant

```
I = imread('image4.JPG');J = immultiply(I,3.0);
figure, imshow(J);
```

Dividing Images (RVI)

Image Multiplied by 3 (Band 4)



Special Display Techniques

Adding a *Colorbar*

```
F= imread('image5.JPG');
imshow(F), colorbar
```

Image Resizing

```
F = imread('image5.JPG'); J = imresize(F,0.5);
```

Image Rotation

```
F = imread('image5.JPG');
J = imrotate(I,35,'bilinear'); figure, imshow(J)
```

Image Cropping

- ***imcrop*** function

Image with Color Bar

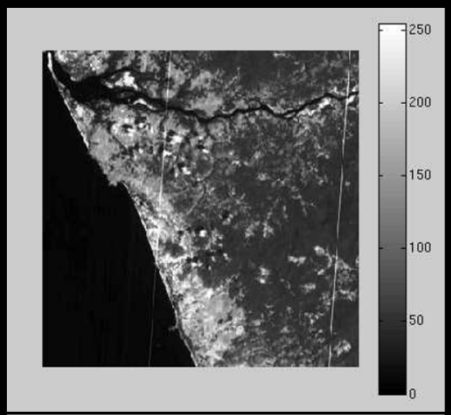


Image Rotated by 35 Degrees

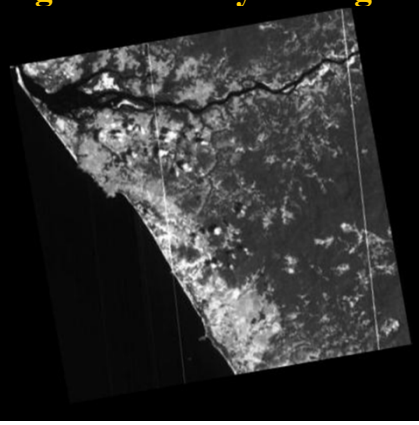
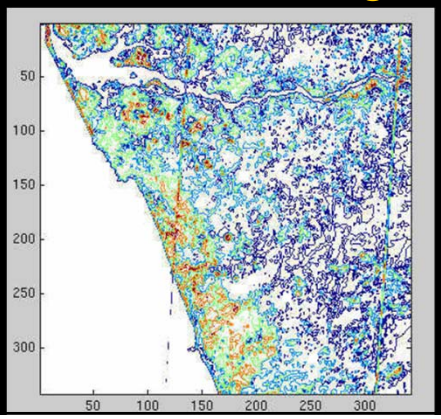


Image Contours

I = *imread*('image5.JPG');
figure, ***imcontour***(I)

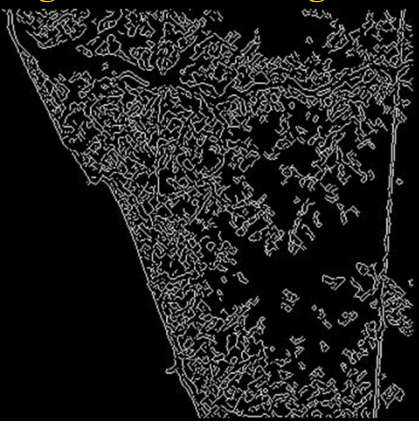
Contour Plot of an Image



Edge Detection

F = *imread*('image5.JPG');
BW1 = ***edge***(F,'sobel');
BW2 = ***edge***(F,'canny');
imshow(BW1);
`figure, imshow(BW2)`

Edge Detection Image



Summary

MATLAB Image Processing Tool Box has Excellent Features for the Analysis of Satellite Images

Assignment – 3

Digital Image Processing using MATLAB

Landsat TM Images (Bands 1-7) showing coastal region are enclosed in a ZIP file.
Using the image Processing Toolbox of MATLAB, answer the following.

1. Show the histograms of all the images.
2. Show the scatter plot of Bands 3 versus 4 and comment.
3. Contrast stretch Bands 3 & 4 and comment.
4. For standard FCC, get the pixel value at row=15 and column=45, for all the three bands and comment on the likely feature at that pixel.
5. Produce NDVI image and also show the color bar.
6. Produce Band 5 – Band 4 image.
7. From Band 4 image, approximately estimate the area occupied by water bodies (use spatial resolution of Landsat TM data).

Challenge Questions:

1. Produce standard FCC (already enclosed in the ZIP file.
2. Produce principal component images using six bands data (excluding band 6) and comment about image compression.
3. Produce FCC of first three principal component images.
4. Derive ISH Images
5. Density slice NDVI image and show vegetation in different tones of green color.

Last date:
October 25, 2018