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)

- 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 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)
```

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
    \[ L = \text{imread('image3.JPG')} \]; \[ J = \text{imread('image4.JPG')} \];
    \[ K = \text{imadd}(L,J); \text{imshow}(K) \]
  - Add a constant 50
    \[ L = \text{imread('image4.JPG')} \];
    \[ J = \text{imadd}(L,50) \]

Subtracting Images
- Subtract One Image from Another (DVI)
  \[ X = \text{imread('image5.JPG')}; \] \[ J = \text{imread('image4.JPG')} \];
  \[ K = \text{imsubtract}(X,J) \]
- Subtract a Constant Value From an Image

Multiplying Images
- Multiply two images
- Multiply a Constant
  \[ L = \text{imread('image4.JPG')} \];
  \[ J = \text{immultiply}(L,3.0) \]
  \[ \text{figure, imshow}(J) \]

Dividing Images (RVI)

Special Display Techniques

Adding a Colorbar
\[ F = \text{imread('image5.JPG')}; \]
\[ \text{imshow}(F), \text{colorbar} \]

Image Resizing
\[ F = \text{imread('image5.JPG')}; \]
\[ J = \text{imresize}(F,0.5) \]

Image Rotation
\[ F = \text{imread('image5.JPG')} \];
\[ J = \text{imrotate}(F,35,'bilinear'); \text{figure, imshow}(J) \]

Image Cropping
- \text{imcrop} function
Image Contours

\[ I = \text{imread}('image5.JPG'); \]
\[ \text{figure, imcontour}(I) \]

Edge Detection

\[ F = \text{imread}('image5.JPG'); \]
\[ \text{BW1 = edge}(F,'sobel'); \]
\[ \text{BW2 = edge}(F,'canny'); \]
\[ \text{imshow}(\text{BW1}); \]
\[ \text{figure, imshow}(\text{BW2}) \]
Summary

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