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

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Bytes</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>342x342</td>
<td>116964</td>
<td>uint8</td>
</tr>
</tbody>
</table>

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

```matlab
figure, imhist(I)
```

**Histogram Equalization**

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

```matlab
I2 = histeq(I);
```

Display the new equalized image, I2

```matlab
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
    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);

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(I)

Image Cropping
• imcrop function
Image with Color Bar

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