MATLAB for Image Processing

BE 244 Medical Image Processing and Analysis

Outline

- Image Array Indexing
- Intensity Coding Schemes
- Data Formats
- Data Conversions
- Importing & Exporting Images
- Image Display

Image Array Indexing

- Image: 1 or more 2D arrays I(m,n)
- Each element of I(m,n) is a pixel
- Pixel coordinates (m,n):
  - Most common for images
  - m rows increase top to bottom
  - n columns increase left to right
- Spatial coordinates (x,y):
  - Allows non-integer indexing
  - Center of ULC pixel is (1,1)
  - ULC origin is (0.5,0.5)
  - x columns & y rows !!!

Opposite pixel coordinate indexing

Intensity Coding Schemes

- Binary images: [0,1]
- Intensity images: [0:1] or uint8
- Index images: M x 3 color map matrix
- RGB images: M x N x 3

All image data is of type uint or double

Binary Images

- Data Matrix (B)
  - M x N
  - B & W image
  - Only two values
    - [0,1]
    - [true,false]
  - etc.
  - Often used as masks for selecting regions of interest (ROIs) from other images

0 0 0
0 0 0
0 0 0

Binary Image
**Intensity Images**

- **Data Matrix (I)**
  - M x N
  - Greyscale image
  - Each value designates an intensity
  - [0:1] or [0:255]
    - (uint8)

**Intensity Image**

**RGB Images**

- **Data Matrix**
  - M x N x 3 RGB(m,n,i)
  - Each color page (aka bitplane) has values [0:1]
  - An individual pixel color is defined by the corresponding values in the three color pages

**RGB Image**

**Multiframe Images (IMF)**

- Also called “volume images”
- Each image in the set is a frame
- IMF = cat(I1, I2, I3, …) where 4 indicates the concatenation dimension
- IMF = (m, n, i, j)
  - i = RGB variable
  - j = frame index
Importing & Exporting Images

- `iminfo` - returns file information
- `imread` - reads image
  - Indexed Images: `[X,map]=imread('file.fmt')`
  - Intensity, RGB, & Binary Images: `X=imread('file.fmt')`
- `imwrite` - writes image

Displaying Images

- `figure` - opens new window for displaying image
- `imshow` - displays image using IPT preferences
- `movie = imovie(MFW); movie(mov)`
- `image` - create and display image object
- `imagesc` - scale data and display as an image
- `montage` - displays multiframe image as a montage
- `colorbar` - display colorbar of the indexed image
- `colormap` - sets colormap

Image Processing Toolbox

Preferences

- `iptgetpref` - Get IPT preference
- `iptsetpref` - Set IPT preference

Settable preferences:
- `imshowBorder: ['loose', 'tight']`
- `imshowAxesVisible: [on, off]`
- `imshowTruesize: [auto, manual]`
- `TruesizeWarning: [on, off]`
  
  default values shown in {}