Image Processing

Java and OpenCV

TechnoWings

Rajesh Agrawal

Agenda

- Image Basics - BufferedImage
- Image Reading & Show Information
- Image Mouse Listener
- Steganography
- Color Filtering
- OpenCv Camera Capture
- Color Conversions
- Face Detection

Image Basics

- Image is an array of pixels
- Image Dimesion = width x height
- 1 Pixel = 4 Attributes
- (Alpha Red Green Blue)
- 1 integer = 4 bytes
- BufferedImage

A	R	G	B
0-255	0-255	0-255	0-255

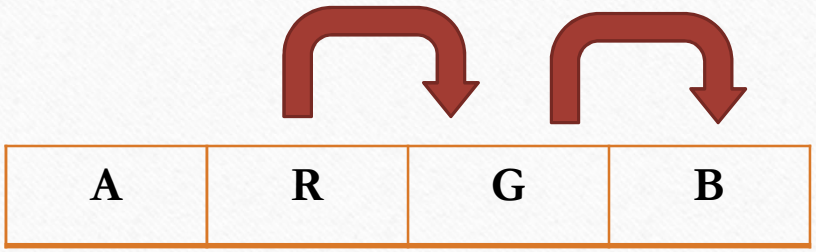
Image Reading

- ImageIO class is used for image reading/writing

```
BufferedImage img = null;
try {
File f=new File("strawberry.jpg");
img = ImageIO.read(f);
} catch (IOException e) {
}
```

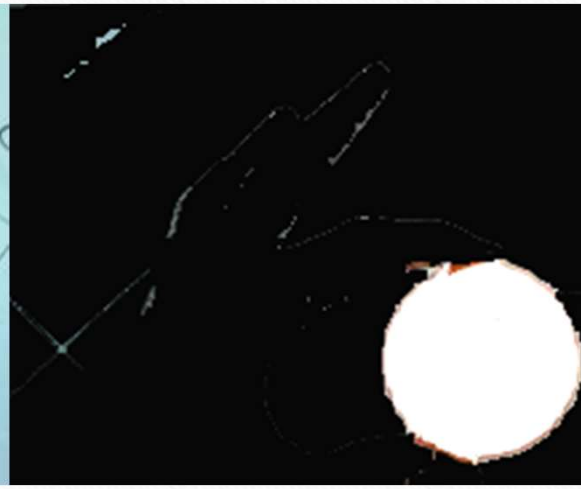
Reading Image Pixels

```
for (int x = 0; x < width; x++){
                for ( int y = 0; y < height; y++){
                    int pixel = im.getRGB(x,y);
                    int  red = (pixel >> 16) & 0xFF;
                    int green = (pixel >> 8) &0xFF;
                    int blue = (pixel) & 0xFF;
                }
}
```



Show Information

- Width
- Height
- Add Event Listeners for Mouse record RGB of each pixel
- Detect a color in an image



Steganography

- Hide Data in an image without changing the aesthetics of the image
- Hiding data in LSB bits of the pixel
- Image pixels does not change considerably

Steganography Capacity - LSB

- 1 Pixel = 4 bytes (A R G B)
- User lower 3 color values (R G B)
- 3 bits per pixel
- If the image size is 800x800 , what will be the storage capacity???

- 800x800x3 bits = 100x800x3 bytes = 80x3 KB

OpenCV

- Image Processing Library that provides
  - Camera Interfacing Support
  - Multiple Resolutions Support
  - Image Processing Functions
    - Grayscale,binary
    - Color Models
  - Face Detection
  - Canny Edge Detector, Background Subtraction

OpenCV Installation

- OpenCV3.3
- JDK
- Javacv jars
  - Javacv is paired with Opencv version

OpenCV	JavaCV
3.0	Javacv 1.1
4.0	Javacv 1.4

Mat

- The class Mat represents an n-dimensional dense numerical single-channel or multi-channel array.
- RGB Image – 3 channel row x col matrix – (R G B)
- Gray Image – 1 channel row x col matrix – channel has (0-255)
- Threshold Image – 1 channel row x col matrix – channel has (0 & 1)

Mat

- public Mat()
- public Mat(int rows, int cols, int type)
  - Type CV_8UC1,..., CV_64FC4
- public Mat(Size size, int type)
- public Mat(Size size, int type, Scalar s)

Width
Height
Channels
Depth

Writing on Image

- circle(mat, new Point(x, y), 10, Scalar.RED);
- putText(mat, TEXT, new Point(x, y), 0, 0.6, Scalar.GREEN);
- rectangle(mat_color, new Point(x,y), new Point(x+w,y+h), Scalar.GREEN, 1, 8, 0);

JavaCV Packages

- import static org.bytedeco.javacpp.opencv_core.*;
  - Core Data Structures of core package
- import static org.bytedeco.javacpp.opencv_highgui.*;
  - Camera,video capture video interfacing
- import static org.bytedeco.javacpp.opencv_imgproc.*;
  - Image processing that includes transformations (resize, rotate)
- Import static import org.bytedeco.javacpp.opencv_objdetect.CascadeClassifier;
  - Face Detection

OpenCV Image / Functions

- VideoCapture cap = new VideoCapture(1);
- captured = new Mat();
- cap.read(captured);
- Frame f = OpenCVHelper.mat2frame(captured);
- BufferedImage bi = OpenCVHelper.frame2buffered(f);
- cap.release();