Experiment No. (1)

Image Types

Aim:

The four image kinds are demonstrated and a conversion from one image type to others is applied using a suitable conversion formula(s).

Theory:

Image could be classified into four categories,

1. True colour or Red Green Blue (RGB) image. This kind of image consists of three colored planes, each one represent a 2D matrix. The data class for this kind of image might be unsigned integer (0-255), double, or scaled double (0 – 1), e.g; the jpg or png image
2. Indexed image. It consists of one main matrix with a color map associated for each pixel value. The data class might be a scaled double value, e.g; tif image
3. Gray-scale or intensity image which consist of one matrix. The data class for this image type might be uint(0-255) or scaled double (0-1). These values represents the intensity of gray level values
4. Binary image, consists of one matrix with 0/1 data-class value

- The RGB to Gray-scale Conversion

There are four algorithms for converting color to gray-scale. If each color pixel is described by a triple (r,g,b) of intensities for red, green, and blue. These formulas could be applied separately to map the colored pixel to its equivalent gray level value::

1. The **lightness** method which averages the most prominent and least prominent colors: **(max(R, G, B) + min(R, G, B)) / 2**.
2. The **average** method, simply averages the values: **(R + G + B) / 3**.
3. The **luminosity** method is a more sophisticated version of the average method. It also averages the values, but it forms a weighted average to account for human perception. We're more sensitive to green than other colors, so green is weighted most heavily. The formula for luminosity is: **0.21 R + 0.71 G + 0.07 B.**
4. The weighted average method is given by the formula.

Gray = 0.299 R + 0.587 G + 0.114 B

Example: A shade of dark purple has an (r,g,b) value of (100, 0, 150). The weighted average is: gray = 0.299(100) + 0.587(0) + 0.114(150),

Converting Image Types

Matlab also contains many built-in functions for converting different image types. See table below;

Function	Use	Format
Ind2gray	Indexed to grayscale	y=ind2gray(x,map);
Gray2ind	Grayscale to indexed	[y,map]=gray2ind(x);
Rgb2gray	RGB to grayscale	y=rgb2gray(x);
Rgb2ind	RGB to indexed	[y,map]=rgb2ind;
Ind2rgb	Indexed to RGB	y=ind2rgb(x,map);
Mat2gray	Matrix to grayscale	Y=mat2gray(x);

Example : The green and red color plane of image rgbimage.jpg are swapped

```
f = imread('rgbimage.jpg');
red = f(:,:,1);
g(:,:,1) = f(:,:,2);
g(:,:,2) = red;
g(:,:,3) = f(:,:,3);
imshow(g);
```

Requirements:

1. Read and display your stored images " 1rgb.jpg " and " 1ind.tif "
2. Find the equivalent gray (intensity) image for " 1rgb.jpg" and "1ind.tif" using the built-in MATLAB functions
3. Repeat step 2 using for-Loop statement and four conversion formulas. Which formula is better (use subplot (m,n,p) function for displaying)
4. Can you re-convert a gray value back to its equivalent RGB color code?

5. Fill the following table:

image	Size (row × col.× dim)	Plane Size			Gray-level size (row × col.× dim)	Binary size (row × col.× dim)
		Red	Green	Blue		
1rgb.jpj						
1ind.tif						

6. Write a program to display the individual red, green, and blue channels of "1rgb.jpg" colour image. Use subplot( ) function for displaying