Lab1
Part1: Introduction to Image Processing in Python

Objective:

- Understanding the basics of Python, Jupyter, Skimage.
- Reading an image and then plot it.
- Indexing Numpy matrices
- HSV colormap.
- Function with positional or keyword arguments

Basics about Python + Skimage + Numpy:

- Images are treated as Matrices where every pixel is a matrix element.
- All operation defined on matrices works with images (e.g. *, /, +, -, sin, cos ...etc.)
- Can read different image formats (BMP, GIF, HDF, JPEG, PCS, PNG, TIFF, XWD).
- Image matrices are
  - 2D matrix: {0, 1} in Binary Images.
  - 2D matrix: double[0, 1] or uint8[0, 255] in Intensity Images (Gray Scale).
  - 3D matrix (MxNx3).

Requirements:

- Read an image and save it in a variable and copy half of the image to another variable (Hint: Use io.imread).
- Print the shape of an image (Hint: Use: shape property of image object)
- Display image (Hint: Use io.imshow).
- Convert RGB image to Gray Scale image (Hint: Use rgb2gray).
- Write a function that takes a path of the file where it gets the gray scale of the image and display original image and the gray scale one side by side (use show_images function).
- For the given images, show the RGB image and the 3 channels of HSV image separated:
  - Use rgb2hsv (to get the hsv representation of the image).
  - To separately get the Hue, Saturation and Value channels, use hsvImg[:,:,X], where hsvImg is the hsv representation of the image. Hue is the first channel, Saturation is the second and value is the last channel. X value can be 0 or 1 or 2
  - Test for the three images. And comment on the results.

Part2: Noise

Objective(s):

- Understand the effect of noise on images and how to produce it.

Requirement(s):

1. For an image of your choice (the effect of noise must be obvious):

   ☐ Read the image.
   ☐ Convert it to grayscale.
   ☐ Apply salt & pepper noise with amount=0.05, 0.5 and 0.9
      Hint
      *Use **random_noise(image, mode='s&p',amount)***

** 2. From the other images. Recommend one image that won't be greatly affected by the noise and state why.

Part3: Histogram

Objective(s):

- Understand Histogram.

- Get histogram for different images and understand the difference.

Requirement(s):

1. For the given images:

    ☐ Read the image.
    ☐ Apply histogram and show it.
       Hint
       Use histogram(***image***)

** 2- Draw a grey-scale image that has uniform histogram (same number of pixels for all intensity levels) using code only. Let the size of the image be 256x256.

Useful Functions and Attributes

Name	Attribute or Function	Usage
shape	Attribute for Numpy array	Gets the shape of the matrix (Array).
io.imread	Function	Reads an image into a Numpy matrix
io.imshow	Function	Shows an image to a plot
plt.figure	Function	Generates a new figure
rgb2gray	Function	Converts RGB image to Gray
rgb2hsv	Function	Converts RGB image to HSV
random_noise	Function	Adds noise to image
histogram	Function	Gets histogram of an image

Custom Functions:

Name	Attributes or functions	Usage
show_images	Function	Takes two arrays one for images' matrices and the second for images' titles and draws images accordingly for example show_images([img1,img2],['Title1','Title2']
Show_hist	Function	Show histogram of an image.