



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.



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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 <code>show_images([img1,img2],['Title1','Title2'])</code>
Show_hist	Function	Show histogram of an image.