Image processing concepts

Part 1

Objective

In this session we will

- ➔ Learn how to convert color (RGB) image to grayscale image ..
- ➔ Know difference between image Contrast & Brightness ..
- ➔ Write code to adjust image Contrast & Brightness
- ➔ Learn how to adjust image quality

convert a color image to grayscale image

All we have to do is repeat 3 simple steps for each pixels of the image.

1. Get the RGB value of the pixel.
2. Find the average of RGB i.e., Avg = (R+G+B)/3
3. Replace the R, G and B value of the pixel with average (Avg) calculated in step 2.

Example : consider a color image pixel with the following values

A = 255, R = 100 ,G = 150, B = 200

Avg = (100+150+200)/3 = 150

So, the new pixel value will be: A = 255, R = 150, G = 150, B = 150

Note! We don't have to change the alpha value because it only controls the **transparency** of the pixel.

Homework : complete this code to implements above algorithm

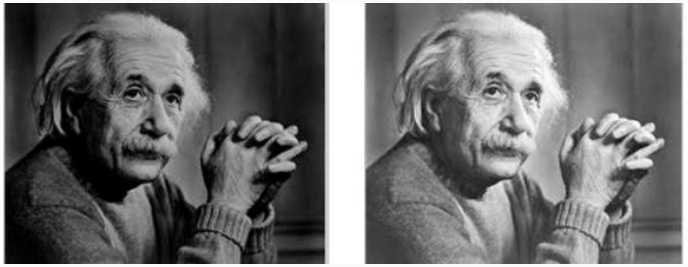
```
if image is not None and len(image.shape) == 3 and image.shape[2]==3:
    gray_image = np.mean(image, axis=2).astype(np.uint8)
```

Image Brightness vs. Contrast

Brightness is a relative term.

Suppose A, B and C are three pixels having intensities 1, 30 and 250, then C is brighter and A & B are darker with respect to C. In general you can say the higher the intensity the brighter is the pixel.

We can easily see, that the image on the right side is brighter as compared to the image on the left.



Contrast is the difference between maximum and minimum pixel intensities in an image.

Consider two images **A** having pixel intensities between **30** to **200** and **B** having pixel intensities **70** to **130**. Then A has more contrast than B.

A low contrast (left) and high contrast (right) image of the Moon

Image Brightness vs. Contrast

Compare these two images, is the second one brighter , has more contrast or both ???

(1)

(2)

Enhancing Image Brightness

Brightness can be simply increased or decreased by simple **multiplication** to the image matrix.

For each pixel in the image, apply the following snip

```
img = np.round(img*scale)
img[img > 255] = 255
```

Scale variable is a percentage of the brightness, for example scale=0.5 means 50% darker image, while scale =1.5 means 150% brighter image.

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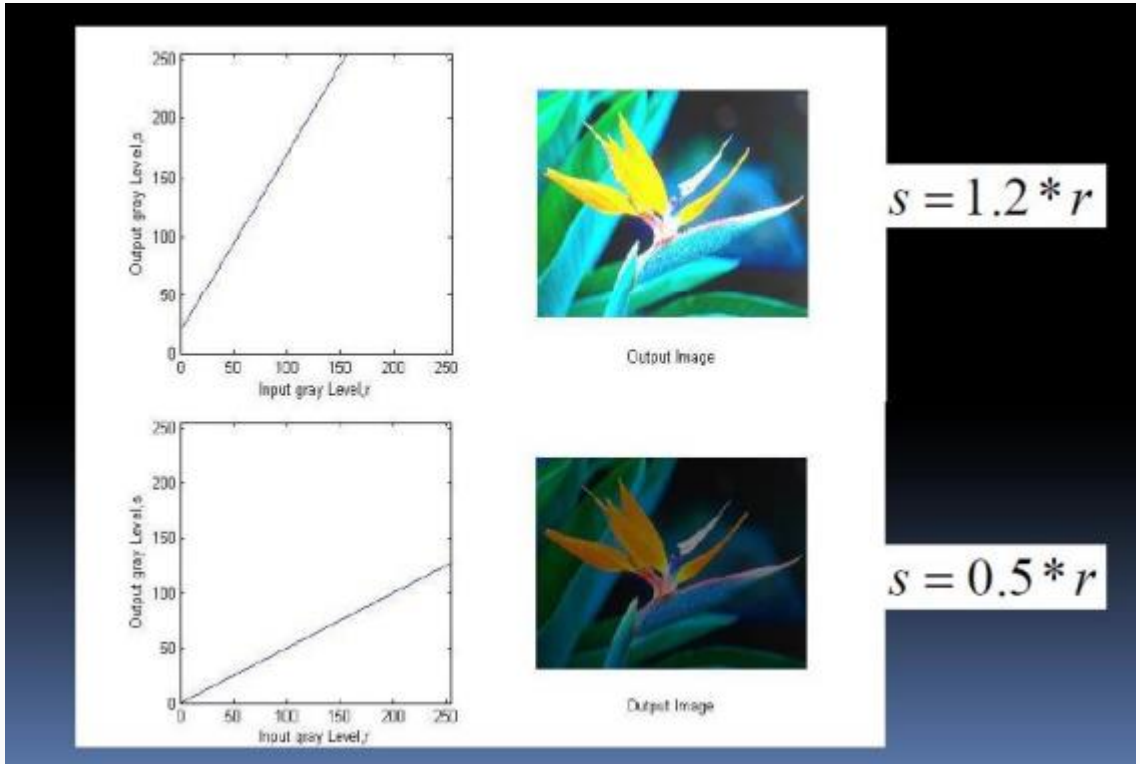

Adjust Image Contrast

Contrast can be simply increased or decreased by simple **algorithm**:

1. calculate a **contrast correction factor** which is given by the following formula:

$$F = \frac{259(C + 255)}{255(259 - C)}$$

C in the formula denotes the desired level of contrast and will be in the range of **-255** to **+255**.

- Negative values will decrease the amount of contrast.
- positive values will increase the amount of contrast.
- Zero means no change in contrast.

2. perform the actual contrast adjustment by applying the following formula which to the red , green and blue components of a colour:

Red'=F(Red -128)+128
Green'=F(Green -128)+128
Blue'=F(Blue -128)+128

Adjust Image Contrast

Here we have the ‘Lena’ image which have had the contrast (value of ***C***) adjusted by -128 (decreased) in the left, and +128 (increased) in the right.

Original image

Low contrast image

High contrast image