Worksheet 2

Fundamentals of Image Processing
CMPE 403

October 18, 2022
Deadline: October 25, 2022

Complete the exercises below using `Python`. These exercises are aimed to teach you the basics of `Python`, `Numpy` and `OpenCV`. Complete the subtasks that have the sign ***. Hints for the tasks are given in the footnotes.

1 Exercise

1. Read the image `de_grayscale_negative.png` as an array, assign to variable `img`.
2. Calculate the *negative* of `img`, assign to variable `img_neg` and display both images.
   (a) Calculate the negative image with `Numpy`.
   (b) Display pixel intensity histogram of `img` and `img_neg`, compare the differences.
   (c) Calculate the negative image with `OpenCV`.***[1]
   (d) Concatenate the two images using `Numpy` and display them side by side.[2]***
3. Read the image `einstein.jpg` as an array, assign to variable `img2`.
   (a) Reduce contrast of `img2`, assign the low contrast image to `img2_low`.
   (b) Increase contrast of `img2`, assign the high contrast image to `img2_high`.***
   (c) Display `img2`, `img2_low` and `img2_high` vertically concatenated.***
   (d) Show pixel intensity histogram of `img2`, `img2_low` and `img2_high`.***

[1] Pixel intensities are 8 bit values which are in range $[0 - 255]$, think about the binary representation of the intensity values and how you could invert them. If the pixel intensities were only 0 and 1 (two bits), you would change 0s to 1s and 1s to 0s.

[2] Concatenating two images corresponds to concatenating two arrays horizontally, search for a `Numpy` function that would accomplish this.