Assigned Date: 29/8/2023	Computing 1 *	Due Date : 10/9/2023
IIT Bombay	EE610 - Image Processing	Total marks : 20

- Submit the .ipynb or .m files along with the images you used/generated as a zip file in moodle. DO NOT just share the link to your notebook (if you are using google colab).
- Mention the source if you have copied any code block or line from there. Writing the list of references/sources is mandatory.
- Usage of OpenCV or builtin library is allowed, except where it is mentioned not to.
- State any assumptions you make.
- Add comments to each line of your code.

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1. You can use a color *.jpg image of your choice, but size less than 800×800.
   (a) [2 marks] Read the *.jpg and display the color image. Save it as a .png file. Comment on the dimensions and size of the files.
   (b) [2 marks] Leave one specific channel intact and set all the other channel intensities to zero and display the new image (try doing with all the channels one at a time!). Write your observations.
   (c) [2 marks] Extract a subimage (section of the main image) and print the pixel intensities of the subimage. Save it as a new image. Check and comment on the variation in range of intensities for each channel (RGB).
   (d) [2 marks] Scale the sub-image size by a factor of 1.5. Note down atleast two pixels (coordinates and intensities) from the original and the corresponding scaled image. You can use the scaled image as the starting point and comment on the values obtained.
   (e) [2 marks] Create a mirror image of the sub-image and display it.
2. For this question, take a night-time photo of your own and save the image.
   (a) [2 marks] Convert it to greyscale, and display its histogram $h(i), i = 0, \ldots, 255$. Compute the cumulative histogram $H(i)$ of the image and display it. The cumulative histogram $H(i)$ is defined as

$$H(i) = \sum_{j=0}^{i} h(j)$$

   for $0 \leq i < 255$.
   (b) [2 marks] Brighten the image by multiplying pixel values with $a > 1$. Find a good value of a.
   (c) [2 marks] Apply automatic contrast adjustment based on intensity values on the greyscale image. Does it help ? Justify.
   (d) [2 marks] Perform histogram equalization to enhance it and display the histogram after equalization. Is the histogram flat ? Why or Why not ? Compare the histogram equalized image and contrast adjusted image from the previous part.
   (e) [2 marks] Obtain or think of a good target histogram and perform histogram matching to the target histogram. Display the histogram matched image.

* - Derived from earlier assignments given by Prof. Amit Sethi.