ET3112 Assignment 1 on Intensity Transformations

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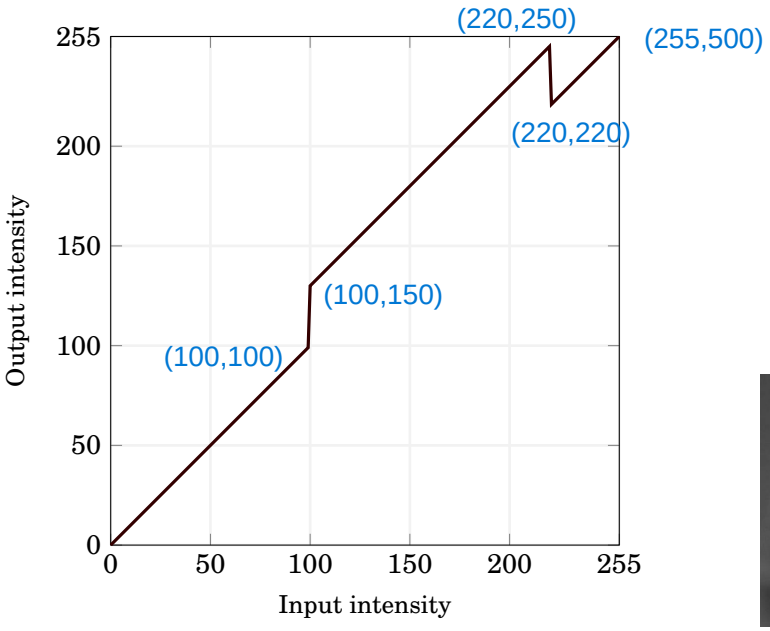
1. Implement the intensity transformation depicted in Fig. 1a on the image shown in Fig. 1b. **[10]**



(a) Intensity transformation.

(b) Image for intensity transformation.

2. Increasing the vibrance of a photograph is probably achieved by applying an intensity transformation such as

$$f(x) = \min\left(x + \frac{a}{128} e^{-\frac{(x-128)^2}{2\sigma^2}}, 255\right),$$

to the saturation plane, where x is the input intensity, $a \in [0,1]$ and $\sigma = 70$. **[20]**

   (a) Split the image shown in Fig. 2 into hue, saturation, and value planes.
   (b) Apply the aforementioned intensity transformation to the saturation plane.
   (c) Adjust a to get a visually pleasing output. Report the value of a.
   (d) Recombine the three planes.
   (e) Display the original image, vibrance-enhanced image, and the intensity transformation.

Figure 2: Image for enhancing the vibrance.

3. Consider the image shown in Fig. 3[1]. **[20]**

[1] https://www.adobe.com/creativecloud/photography/discover/highlights-and-shadows.html

(a) Apply gamma correction to the L plane in the $L^*a^*b^*$ color space and state the γ value.

(b) Show the histograms of the original and corrected images.

Figure 3: Image for gamma correction.

4. Write a function of your own to carry out histogram equalization on the image shown in Fig. 4. Show the histograms before and after equalization. **[20]**

Figure 4: Image for histogram equalization.

5. In this question, we will apply histogram equalization only to the foreground of an image to produce an image with a histogram equalized foreground. **[30]**

   (a) Open the image in Fig. 5, split it into hue, saturation, and values and display these planes in grayscale.

   (b) Select the appropriate plane to threshold in extract the foreground mask. A mask is a binary image.

   (c) Now obtain the foreground only using cv.bitwise_and and compute the histogram.

   (d) Obtain the cumulative sum of the histogram using np.cumsum.

   (e) Use the formulas in slides to histogram-equalize the foreground.

   (f) Extract the backgdound and add with the histogram equalized foreground.

   Show the hue, saturation, and value plane, the mask, the original image, and the result with the histogram-equalized foreground.

Figure 5: Image for histogram equalizing the foreground.

GitHub Profile

You must include the link to your GitHub (or some other SVN) profile, so that I can see that you have worked on this assignment over a reasonable duration. Therefore, make commits regularly. However, I will use only the pdf for grading to save time.

Submission

Upload a report (eight pages or less) named as your_index_a01.pdf. Include the index number and the name within the pdf as well. The report must include important parts of code, image results, and comparison of results. The interpretation of results and the discussion are important in the report. Extra-page penalty is 2 marks per page.