

Lab 4

Pixel Brightness Transformation

Objective:

- Know the effect of Negative transformation.
- Know the effect of contrast enhancement.
- Know the effect of gamma correction.
- Understand and implement Histogram Equalization.

Experiment 1: Negative Transformation [10 minutes]

- Read image 'Picture1.png'
- Define function 'Negative' that apply Negative transformation for any image and any threshold. What is the equation???
- Call the function and apply it on the image 'Picture1.png'
- Display the image before and after transformation in the same figure.

Experiment 2: Contrast Enhancement [10 minutes]

- Read image 'Picture2.png'
- Define function '*Contrast_enhancement'* that Stretches the grey levels in the range 0 to 100 into the range 50 200 and leaves other levels non changed. What is the equation???
- hint draw the spectrum of levels to know the equation, use for loops and if statements(or matrix conditional indexing which is faster but a little tricky) in the implementation.
- Call the function and apply it on the image 'Picture2.png'
- Display the image before and after transformation in the same figure.

Experiment 3: Gamma Correction [10 minutes]

- Read image 'Picture2.png'
- Define function 'Gamma_Correction' that Stretches the grey levels according to the gamma equation. ($A' = c * A^{\gamma}$).



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 - Call the function with c=1 and $\gamma=3$ and c=1 and $\gamma=0.5$
 - Display the images before and after transformation in the same figure.
 - What is the effect of decreasing γ ?

Experiment 4: Histogram Equalization [40 minutes]

- Write a function to perform histogram equalization to the image.
- Read, display the image and its histogram before and after equalization, and observe the effect on image contrast. Use the image pout, tire.

To perform equalization, code the following steps:

- a. For an NxM image with G gray-levels, create an array H with a length G initialized by Zeros.
- b. Calculate the histogram of gray-levels for the image.
- c. Form the cumulative image histogram, H_c. The cumulative histogram tells you how many pixels have gray-levels less than or equal to the p-th gray level. The calculation is:

$$H_c[0] = H[0]$$
 then: $H_c[p] = H_c[p-1] + H[p]$

d. Set the mapping between gray-levels as:

$$q = T[p] = round((G - 1) * H_c[p] /(N * M))$$

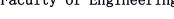
e. Go through the images, pixel-by-pixel and write an output image with the gray-levels g_q using the mapping from step 4.

Useful New Functions and Attributes

Name	Attribute or Function	Usage
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round	Function	Get round of number
np.zeros	Function	To generate matrix with a given
		shape all elements with zero values
range	Function	To generate range of indexes from
		low range to high range with an
		optional step

To make the range of a gray-scale image uint8 (from 0-255), use astype(np.uint8).