



Image Understanding and Processing

Tutorial 03

Year 4

Semester 1, 2025

1. Image subtraction is used often in industrial applications for detecting missing components in product assembly. The approach is to store a “golden” image that corresponds to a correct assembly. This image is then subtracted from incoming images of the same product. Ideally, the differences would be zero if the new products are assembled correctly. Difference images for products with missing components would be nonzero in the area where they differ from the golden image. What conditions do you think have to be met in practice for this method to work?
2. Compute $B(i, j) = \log_{10}(A(i, j) + 1)$ where A is your image. B is a general matrix and not an image matrix. Generate an image matrix from B by normalizing it. Briefly describe the changes as which pixel value ranges got stretched/compressed? Take as $g(l) = \{l = 0, \dots, 255\}$.

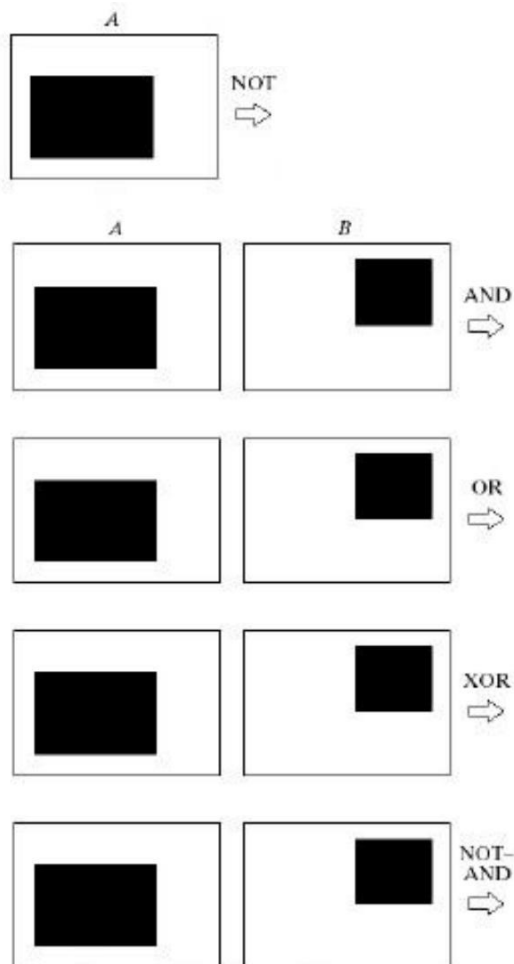
Taking A as the image represented by the matrix given below, compute B as an image matrix. Briefly describe the image enhancement effects by discussing which pixel value ranges got stretched or compressed.

0	12	14	26	56
157	170	35	110	76
46	78	80	87	90
68	45	34	56	57
225	235	245	250	255

3. Assume that the GPU of a computer gives a user interface to calibrate the images shown on the monitor. If the given 5 x 5 matrix is a pixels area on the 8 bit gray scale monitor and the value in each pixel indicating the gray level, calculate the output pixel values of the given area when user doing following actions in the user interface to calibrate the monitor. (Take that original value of X=125)

91	129	153	60	32
102	135	168	144	151
57	78	X	156	140
112	165	192	203	238
20	159	129	220	197

- Setting the threshold value of the display image to 128.
 - Making the whole image in the monitor to negative.
 - Image enhancing using power law transformation when $\gamma=0.8$.
4. Perform the logical operations on the following binary images. Black represents binary 1s and white binary 0s in this question.



5. If all the pixels in an image are shuffled, will there be any change in the histogram? Justify your answer.
6. In gray level slicing there are two approaches. The first method is making a defined range of gray levels lighter/darker and making the other region the opposite. The second method is to make gray levels between specific regions to darker/lighter while the rest of the image is left as it is.

Obtain the new gray level values after approaching the second method of gray level slicing to an image of,

58	135	155	241	105
25	56	85	57	92
78	79	145	50	175
100	120	58	87	85
225	175	68	127	73
78	175	68	127	73

Where the pixel values 100 to 175 should be made 255 using gray level slicing.