

資訊網路與多媒體研究所

博士班基本學科考試：數位影像處理

Oct. 4, 2007

1. (25%) Assume that we have an image of 8x8 pixels as shown below:

0	1	1	1	1	1	1	1
0	1	1	1	2	2	2	2
0	0	2	2	2	2	2	2
0	0	3	3	3	3	3	3
0	0	3	3	3	5	5	6
0	5	5	5	5	5	5	6
0	6	6	6	6	6	6	6
0	7	7	7	7	7	7	7

which is displayed on a 16 gray-level device.

- Draw the histogram of this 8x8 image
 - Perform histogram equalization and draw the resultant histogram
 - Does the histogram equalization provide the optimal visual quality? Why or why not?
2. (20%)
- What is alpha-trimmed filter?
 - What is adaptive mean filter?
 - What is adaptive median filter?
 - Please explain how they work. In which case will they be useful? Why?
3. (15%)
- What is the difference between orthogonal and perspective transforms?
 - Compare gradient and Laplacian operators for edge detection
 - What is binary dilation and binary erosion?
4. (20%) You are given an image taken by Mary under a bad environment. That means the image may be degraded by optical blur, defocusing and noise, etc. In other words, the image contains impulse noise and looks blurred. Please help Mary to enhance the image quality to get a clean and sharp image. Please describe each step clearly to solve this problem.

5. (20%) Suppose that you are given two images. The image shown in Fig. 1(b) is obtained from Fig. 1(a) by the procedure listed below:
- (i) multiplying the image on the left by $(-1)^{x+y}$;
 - (ii) computing the DFT
 - (iii) taking the complex conjugate of the transform
 - (iv) computing the inverse DFT
 - (v) multiplying the result by $(-1)^{x+y}$

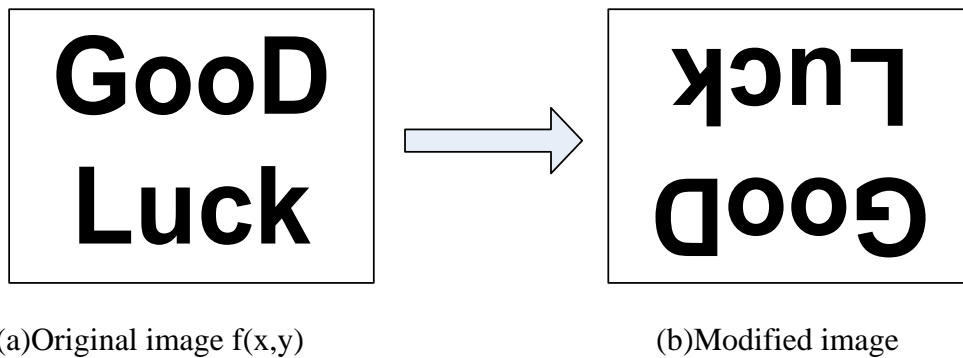


Figure 1

Please write down the mathematical expression of each step and explain why the modified image looks like the one in Fig. 1(b). Note that you have to clarify each notation you use in your answer.