Computer Vision
Midterm for Fall 2019

Course#: 922 U0610::CSIE5732 Date: Nov. 5, 2019

Your ID#: Instructor: Chiou-Shann Fuh

Your Name:

1. (50%) Please define the following terms and explain the content, purpose, and application of each term and give an illustrative example if possible. If possible, define the term in mathematical equation. For example:
thresholding: an image point operation that produces a binary image from a gray scale image. A binary-1 is produced on the output image whenever a pixel value on the input image is above a specified minimum threshold level. A binary-0 is produced otherwise. Alternatively, thresholding can produce a binary-1 on the output image whenever a pixel value on the input image is below a specified maximum threshold level. A binary-0 is produced otherwise.

(1) Shape from texture (2) shape from shading (3) alignment (4) measurement vector (5) pattern recognition (6) virtual reality (7) augmented reality (8) stereo vision (9) segmentation (10) intensity histogram (11) Gray-Level Co-occurrence Matrix(GLCM) (12) region (13) classifier (14) bounding rectangle (15) area (16) centroid (17) Statistical Pattern Recognition (18) maximin decision rule (19) Bayesian decision rule (20) dilation (21) opening (22) recursive neighborhood operator (23) symbolic domain (24) linear shift invariant operator (25) correlation

2. (4%) Please explain in detail classical connected components labeling algorithm with global equivalence table.
3. (4%) Please explain in detail space-efficient two-pass algorithm that uses a local equivalence table and run-length encoding.
4. (6%) Please describe the method, steps, and results of Chatbot for Smart Glasses.
5. (6%) Please describe the method, steps, and results of Object Recognition and Segmentation with 3D Point Cloud with Color Stereo Camera and LiDAR.

6. (4%) Compute the Expected profit for the given conditions, notice that *P(g) = 0.95, P(b) = 0.05.*

	Good	Bad
Good	*P(g|g) = 0.8*	*P(b|g) = 0.2*
Bad	*P(g|b) = 0.1*	*P(b|b) = 0.9*

	Good	Bad
Good	*e(g|g) = 2000*	*e(b|g) = -100*
Bad	*e(g|b) = -10000*	*e(b|b) = -100*

7. (6%) Please describe the method, steps, and results of Circle Measurement with X-Ray Image.

8. (6%) Please design 3 kernels and steps by using morphological operation to process Figure *A* to obtain the result as shown in Figure *B*.

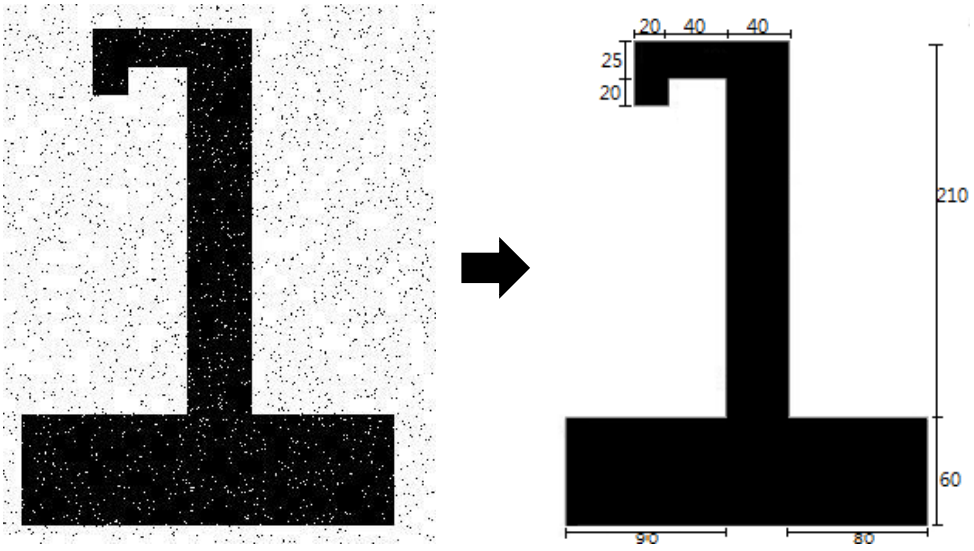
The size of one pepper and salt noise is 1 pixel.

It is necessary to meet the following conditions:

1. Remove pepper and salt noises.
2. Eliminates small holes.
3. Smooth edge effect.

You must write out the operation and kernels that you use.

(For example: Step 1: opening with a disk of radius 50.
Sep 2: dilation with a disk of radius 50…)



A *B*

9. (6%) Please describe the method, steps, and results of Watercolorization of Photographic Image.

10. (4%) Given an input image and a 3×3 kernel (mask), what the output value of convolution of input pixel $(1,1)$ will be?

A. 6.66
B. 7.66
C. 8.77
D. 0.5

mask

$\frac{1}{45}$

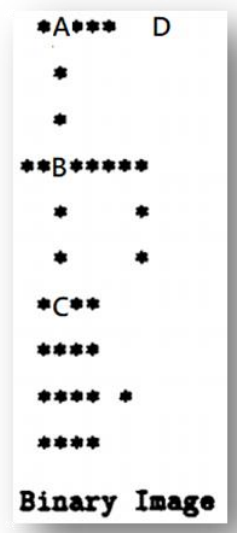
1	2	3
4	5	6
7	8	9

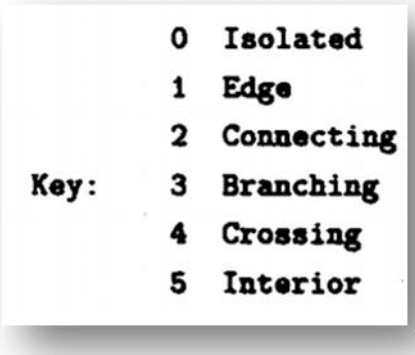
input image

8	8	7	7	6	3
8	8	7	7	6	3
7	8	7	8	8	2
6	6	7	8	2	1
6	6	6	7	1	1
6	6	6	6	1	1

11. (4%) What connectivity number of the sequence (A, B, C, D) will be on the following binary image?

a. $(2,3,4,0)$
b. $(3,4,5,1)$
c. $(3,4,2,0)$
d. $(2,0,2,0)$





12. (6%) Please describe the method, steps, and results of Vocal Separation for Music.