Digital Image Processing(05/11/2016)

HOMEWORK ASSIGNMENT #4

Shape Analysis, Morphological Processing & Frequency-Domain Filtering

Due Date: 11:59am on 05/31/2016

Please read the submission guideline (posted on the class website) carefully before getting started.

All images in this homework can be downloaded from our class website: https://ceiba.ntu.edu.tw/1042DIP. Images are in the raw file format. The size of each image is listed in the appendix.

For MATLAB users, you are NOT allowed to use the MATLAB Image Processing toolbox except the imshow() and image() functions.

PROBLEM 1: SHAPE ANALYSIS

As shown in Fig. 1, you are given a gray-level image which contains some characters. Please design an algorithm to recognize different characters and count the number of occurrence of each character using Fig. 2 as the training set. Please provide the flow chart and details of your algorithm, and discuss the result in the report.

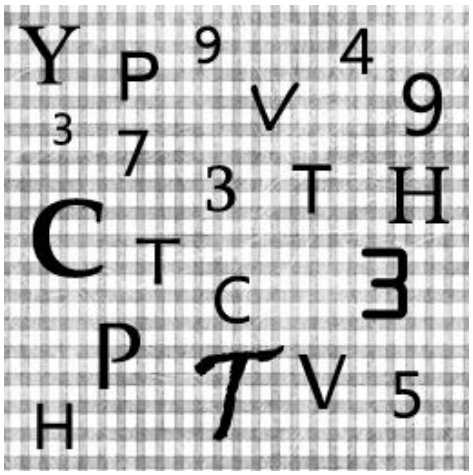


Fig. 1: Sample1.raw

Fig. 2: TrainingSet.raw

PROBLEM 2: MORPHOLOGICAL PROCESSING

Given a binary image shown in Fig. 3, please try to produce the same images as illustrated in Fig. 4 by adopting appropriate morphological processing. Please describe the designed algorithm in detail for each case.

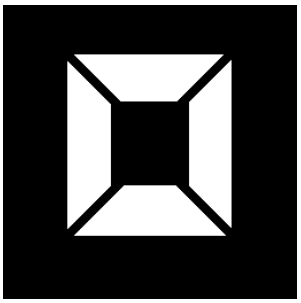
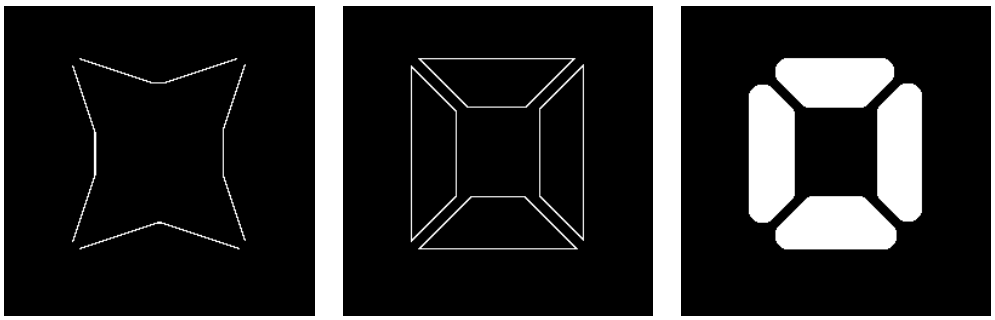


Fig. 3: Sample2.raw



(a) (b) (c)

Fig. 4: Expected images.

PROBLEM 3: FREQUENCY-DOMAIN FILTERING

Let the image shown in Fig. 5 be denoted as I. Please generate several images by the instructions below.

(a) Transfer I to frequency domain by DFT (Discrete Fourier Transform) with centering and output the result as D.

(b) Apply an ideal low-pass filter to D with D_0=5 and 30. Output results as L_5 and L_{30}, respectively.

(c) Apply a Gaussian low-pass filter to D with D_0=5 and 30. Output results as G_5 and G_{30}, respectively.

(d) Transfer L_5, L_{30}, G_5 and G_{30} back to spatial domain by Inverse DFT. Please compare the results and provide some discussions in the report.

Fig. 5: Sample3.raw

Appendix:

Image files

Problem1: Shape Analysis

Sample1.raw	Fig. 1	256 x 256 image	gray-scale
TrainingSet.raw	Fig. 2	450 x 248 image	gray-scale

Problem2: Morphological Processing

Sample2.raw	Fig. 3	256 x 256 image	gray-scale

Problem3: Frequency-Domain Filtering

Sample3.raw	Fig. 5	256 x 256 image	gray-scale