Digital Image Processing (03/23/2016)

HOMEWORK ASSIGNMENT #2

Edge Detection, Geometrical Modification and Texture Analysis

Due Date: 11:59am on 04/12/2016

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: EDGE DETECTION

Three images as shown in Fig. 1 are given in this problem. For each given image, you are required to generate several edge maps using the following methods. [Please mark the edge points with intensity value 1 and background points with intensity value 0.]

(a)   Sobel edge detection
(b) 2nd order edge detection
(c)   Canny edge detection

For each method, please apply different parameters and provide some discussions on how they would affect the resultant edge maps. From the observations of your results, list pros and cons of each method, respectively.
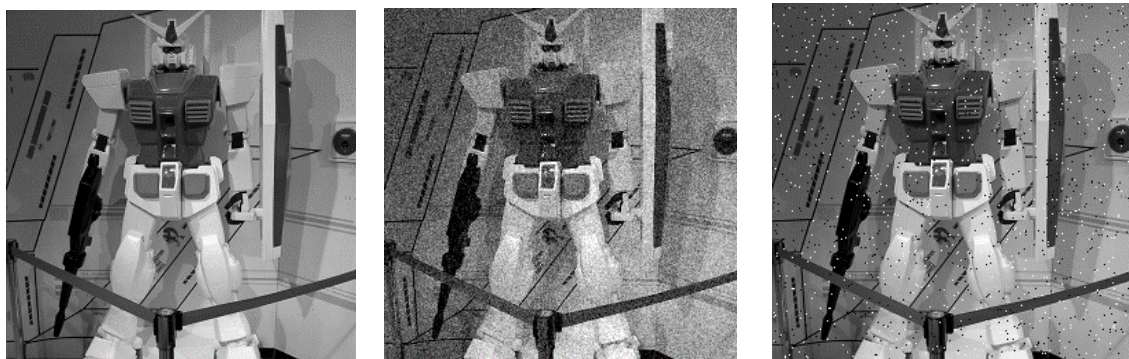
(a)sample1.raw   (b)sample2.raw   (c)sample3.raw

Fig.1

PROBLEM 2: GEOMETRICAL MODIFICATION

The goal of this problem is to register the given four images (as shown in Fig. 2) and perform proper geometrical modification on the overlapped square image to obtain a desired shape as shown in Fig. 3.

(a) Please stitch these four images into one complete image and paint the residual regions in black. Denote the result as R.

(b) Crop the largest square image of image R and denote it as S. (Hint: the size of S is 512x512.)

(c) As illustrated in Fig. 3, segment the image S into three parts with predefined size and design three warping functions to convert the image to a gourd-shaped image. Output the result as G.

(a) sample4.raw

(b) sample5.raw

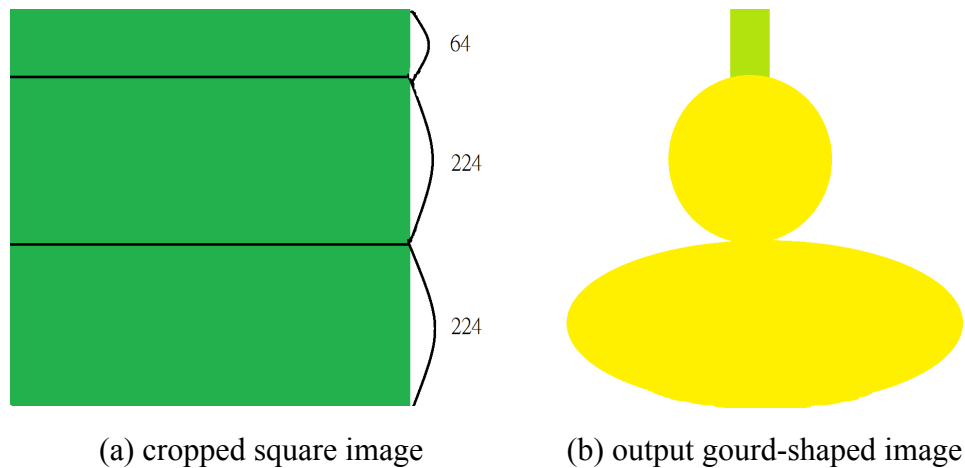(c) sample6.raw

(d) sample7.raw

Fig. 2

(a) cropped square image   (b) output gourd-shaped image

Fig. 3

PROBLEM 3: TEXTURE ANALYSIS

Fig. 4 demonstrates a gray-level image which is composed of several animals with different texture patterns.

(a) Perform Law's method on the given image to obtain the feature vector of each pixel.
(b) Use k-means to classify each pixel and label same kind of texture with same intensity. Please specify the intensity levels you adopt and output the result as L.
(c) Based on image L, try to attach the correct texture to each animal as best as you can. Output the result as C.

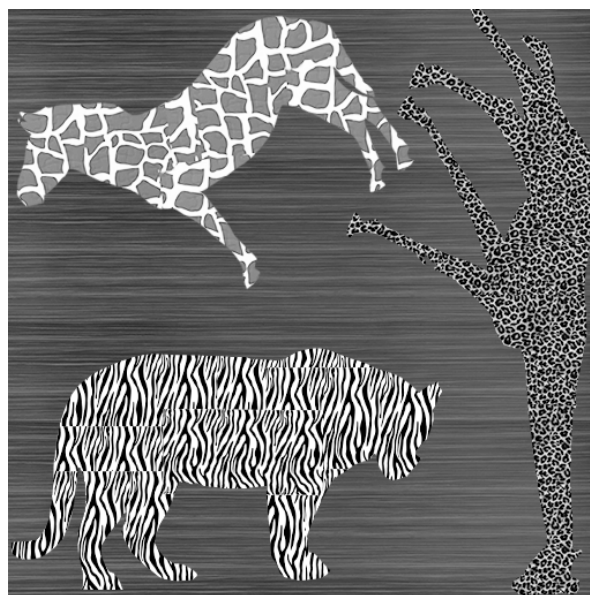Please provide the details of each step and discussions for each part in the report.

Fig. 4: sample8.raw

Appendix:

Image files

Problem1: EDGE DETECTION

Sample1.raw	Fig.1(a)	256 x 256 image	gray-scale
Sample2.raw	Fig.1(b)	256 x 256 image	gray-scale
Sample3.raw	Fig.1(c)	256 x 256 image	gray-scale

Problem2: GEOMETRICAL MODIFICATION

Sample4.raw	Fig.2(a)	324 x 324 image	gray-scale
Sample5.raw	Fig.2(b)	324 x 324 image	gray-scale
Sample6.raw	Fig.2(c)	324 x 324 image	gray-scale
Sample7.raw	Fig.2(d)	324 x 324 image	gray-scale

Problem3: TEXTURE ANALYSIS

Sample8.raw	Fig.4	512 x 512 image	gray-scale