Image Analysis and Processing Laboratory

- Project number: Lab Session # 4
- Course number: CSE 3226
- Date due: October 02, 2017
- Date handed: October 22, 2017

Objective:

To understand and perform an image edge detection, and segmentation task.

Exercise-1

Satellite Image Processing.

Problems Statements

Download the satellite image of a lake, lake.jpg, located somewhere in the World.

i- Write an image processing algorithm that measures the surface area of the lake in pixels. Turn in a mask image labelling the lake by white pixels and rest of the image by black pixels.

ii- Given that the height and width of the image correspond to 6.901 Km and 5.258 Km respectively, estimate the size of the lake surface in square kilometres. What is its perimeter?

Sample Input/Output

Fig.51_1: The original Lake Image

Fig.51_2: The Lake image in blue plane (Lab color space)

Fig.51_3: Thresholded Image

Fig.51_4: Mask Image the Lake

Fig.51_5: perimeter of the Lake

Exercise-2
Edge detection

Problems Statements
Download the image of toy building blocks, bricks.jpg.
i- Try to detect all the edges of the image.
ii- Try to detect firstly the edges for the blue bricks, and then for the red ones.

Sample Input/output

Fig.52_1: Original Image

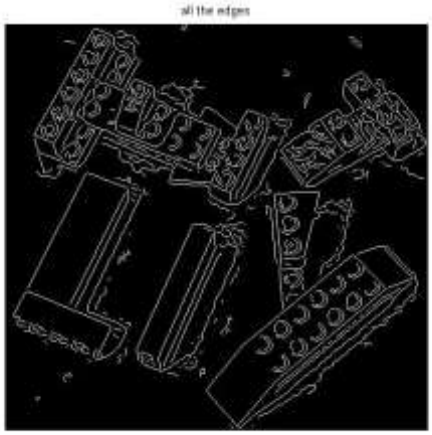

Fig.52_2: all edges of the Image

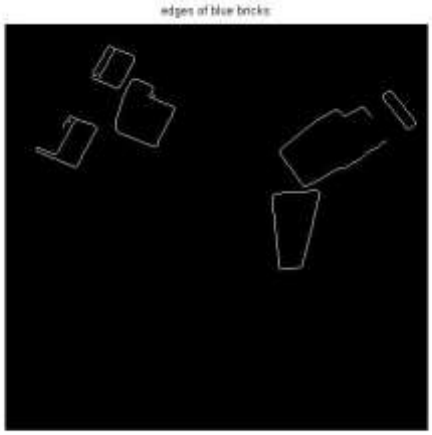

Fig.52_3: Blue edges of the Image

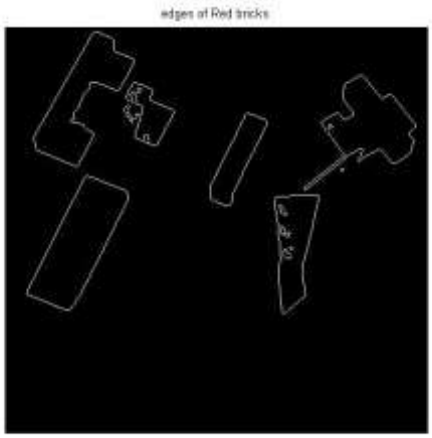

Fig.52_4: Red edges of the Image

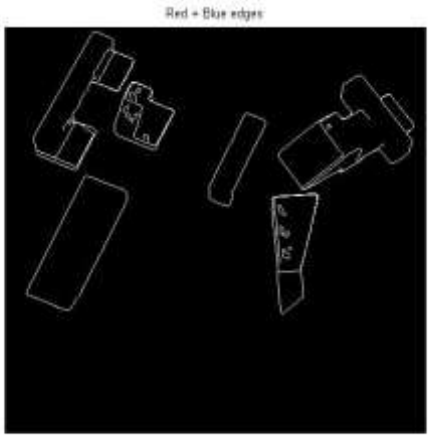

Fig.52_5: Red + Blue edges of the Image

Exercise-2 (continued)

Problem Statement

Download now the image of the Pisa Tower, pisatower.jpg.

i. Your task is to calculate the angle it has with respect to the vertical, assuming the picture was taken at a good horizontal reference level.

Notes: you can use the following Functions:
[H, theta, rho] = hough(BW) computes the Standard Hough Transform (SHT) of the binary image BW. We can use the hough function to detect lines in an image. The function returns H, the Hough transform matrix. theta (in degrees) and rho are the arrays of rho and theta values over which the Hough transform matrix was generated.

peaks = houghpeaks(H, numpeaks) locates peaks in the Hough transform matrix, H, generated by the hough function, numpeaks is a scalar value that specifies the maximum number of peaks to identify.
The function returns peaks, a Q-by-2 matrix, where Q can range from 0 to numpeaks. Q holds the row and column coordinates of the peaks.

lines = houghlines(BW, theta, rho, peaks) extracts line segments in the image BW associated with particular bins in a Hough transform. theta and rho are vectors returned by function hough. peaks is a matrix returned by the houghpeaks function that contains the row and column coordinates of the Hough transform bins to use in searching for line segments.

Sample Input/output

The angle of the tower is: 4 degree

Fig.522_1: Original Image of Pisa Tower

Fig.522_2: Image of Pisa Tower in Blue plane in L*a*b* color space

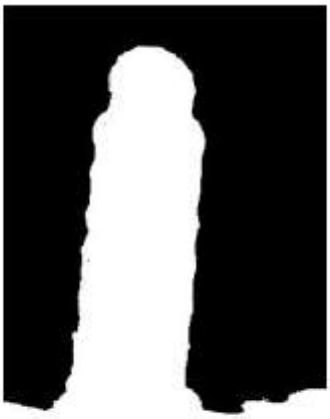

Fig.522_3: Edges of Pisa Tower

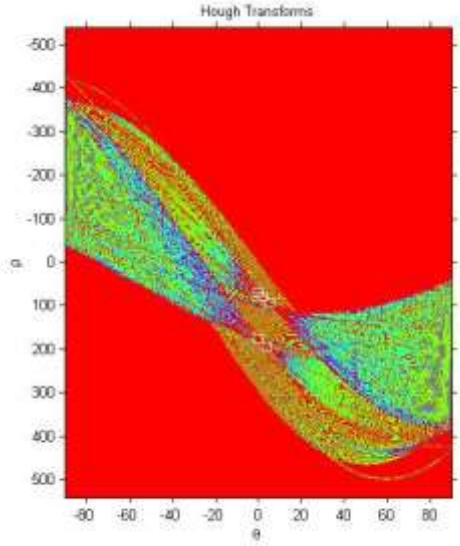

Fig.522_4: Hough transforms of the Binary Image of Pisa Tower

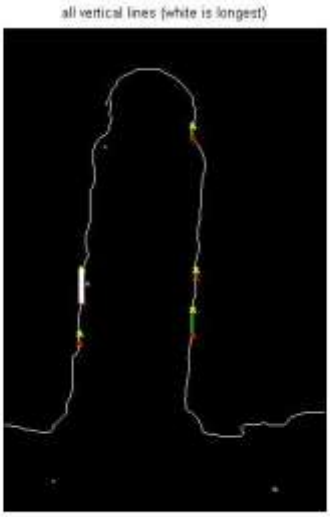

Fig.522_5: All vertical lines detected with (bold white) longest line

Exercise-3

Problem Statements

Use morphological operations and the connected-components Matlab functions to find the number of different coins in coins.png and the atoms of the glucose molecule, glucose.tif.

Note: You can use the following functions:

1. The *graythresh* function uses Otsu's method, which chooses the threshold to minimize the intraclass variance of the black and white pixels. The function computes a global threshold (level) that can be used to convert an intensity image to a binary image with *im2bw*, level is a normalized intensity value that lies in the range [0, 1].

2. The function L=*bwlabel(Bw,n)* returns a matrix L, of the same size as BW, containing labels for the connected objects in BW, n can have a value of either 4 or 8, where 4 specifies 4-connected objects and 8 specifies 8-connected objects; if the argument is omitted, it defaults to 8. The elements of L are integer values greater than or equal to 0. The pixels labeled 0 are the background. The pixels labeled 1.

3. The function *W2 = imfill(BW,'holes')* fills holes in the binary image BW. A hole is a set of background pixels that cannot be reached by filling in the background from the edge of the image.

Sample Input/Output

total number of coins in coins.png image is 10.
total number of atoms in the image of the glucose molecule is 24.

Fig.53_1: original Coin Image

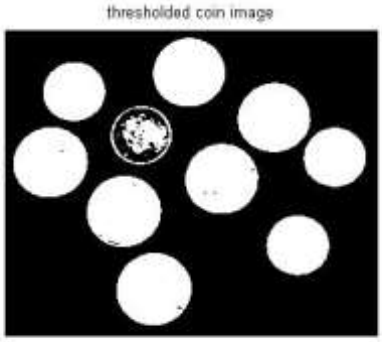

Fig.53_2: Binary Coin Image(Thresholded)

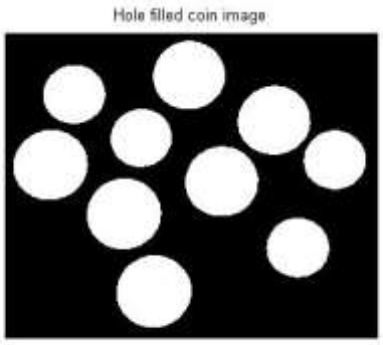

Fig.53_3: Hole Filled Binary Coin Image

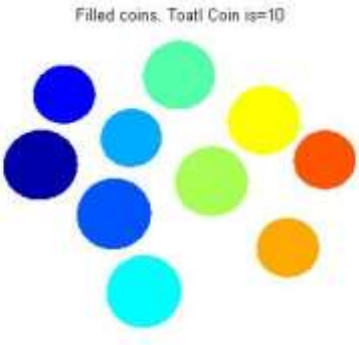

Fig.53_4: RGB Coins in the White Background

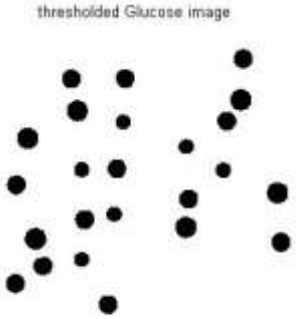

Fig.53_5: Binary Glucose Image(Thresholded)

Fig.53_6: RGB atoms in the White Background