ECE 5273
Homework 2

Spring 2022 Dr. Havlicek

Obtain the images `Suzi1.bin` and `ct_scan.bin` from the course web site. Each image has 256 $\times$ 256 pixels and each pixel has 8 bits.

In this assignment you will perform object extraction (target extraction) by using simple thresholding followed by connected components labeling (blob coloring) with minor region removal. This is a special case of two classical image processing problems known as *image segmentation* and *classification*. Throughout the assignment, including the printing of your results, use a value of 255 (Hex 0xFF) for LOGIC ONE and a value of zero (Hex 0x00) for LOGIC ZERO.

Objectives:

1. *Suzi1:* the first objective is to produce a binary image **J** that is LOGIC ONE at pixels contained in the "girl" object of the original image and LOGIC ZERO at pixels contained in the background of the original image. The second objective is to produce a grayscale image **K** of the segmented "girl" object. At pixels where **J** is LOGIC ONE, **K** should be equal to the original *Suzi1* image. At pixels where **J** is LOGIC ZERO, **K** should be 255.

2. *ct_scan:* the first objective is to produce a binary image **J** that is LOGIC ONE at pixels contained in the "torso section" object of the original image and that is LOGIC ZERO at pixels contained in the background of the original image. The second objective is to produce a grayscale image **K** of the segmented "torso section" object. This should be done exactly the same way it was for the *Suzi1* image.

For each image, use the following procedure:

A) Study the image and select an appropriate threshold that will discriminate between the desired object and the background.

B) Form a binary image **J** by applying the threshold so that pixels likely to be part of the desired object are assigned the value LOGIC ONE, while those likely to be part of the background are assigned the value LOGIC ZERO.

   Hint: for the *Suzi1* image, this means that $J(i, j)$ should be LOGIC ONE if the corresponding input pixel is *below* threshold. For the *ct_scan* image the opposite is true: you should set $J(i, j) =$ LOGIC ONE if the corresponding input pixel is *above* threshold.

C) Apply connected components labeling with minor region removal to refine the segmentation in **J**.

D) Construct the segmented object grayscale image **K**.

Turn In:

- code listing.
- for each original image:
  - the original image,
  - the threshold value and how it was determined,

- initial thresholding result,
- blob coloring result before and after minor region removal (use a distinct gray scale for each blob to the extent possible - if there are more than 256 blobs, which is likely, then each gray scale will have to be shared by more than one blob),
- final binary image after blob coloring with minor region removal,
- the image **K**.

DUE: 2/10/2022