

LAURENTIAN UNIVERSITY  
BHARTI SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

**CPSC5416 - Digital Image Processing & Computer Vision**

**ASSIGNMENT 3**

**Due date: December 11<sup>th</sup>, 2022**

**IMPORTANT:** In your report, you have to show the input images and all processed images. Add captions to your figures to make them self-explanatory.

**Question 1 (10 Marks)**

Morphological operations can be used after segmentation phases to remove imperfections in the segmented image. Download the images "deer.pgm", "device.pgm", and "fly.pgm" from the course webpage. Use morphological operations to improve these images and to remove imperfections resulted from the segmentation phase.

**Question 2 (10 Marks)**

Develop a morphological boundary extractor. Use your output images from Question 1 to demonstrate your boundary extractor.

**Question 3 (10 Marks)**

Download the images "butterfly.pgm", and "beetle.pgm" from the course webpage. Use morphological operations to find both the skeleton and the convex hull for each shape.

**Question 4 (10 Marks)**

Download the image "kidney\_original.tif" from the course webpage. By combining smoothing with a 3 x 3 Sobel gradient masks, process the image and produce a binary image that isolates (segments) the large blood vessel in the center of the image. This will require repeated trials of smoothing and choices of  $T$ . (*Hint: Looking at the histogram of the gradient image before it is thresholded will help you select a value for  $T$ .*)

**Question 5 (10 Marks)**

- a) Write a global thresholding program in which the threshold is estimated automatically using the procedure discussed in class. The output of your program should be a segmented (binary) image.
- b) Download the images "geometric\_shapes\_1.pgm", "geometric\_shapes\_2.pgm", and "books.pgm" from the course webpage and plot their histograms. Then, apply your program to the images and comment on the results.

**Question 6 (10 Marks)**

Download the images "House.pgm", "Bridge.pgm", and "woman\_darkhair.tif" from the course webpage. Extract the edges from these images using:

- a) 1<sup>st</sup> derivatives
- b) 2<sup>nd</sup> derivatives
- c) The Marr-Hildreth edge detector
- d) Canny edge detector

Comment on the results.