

UNIVERSITY OF CALGARY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
SCHULICH SCHOOL OF ENGINEERING
ENEL 697 DIGITAL IMAGE PROCESSING
TEST NO. 2
WINTER 2013 SESSION
15 April 2013

Instructions:

1. This is a closed-book, closed-notes test.
2. Calculators and other electronic devices are not permitted.
3. Answer all five questions.
4. Total marks = 20.
5. Time permitted = 75 minutes.

Question 1: Explain the approach of gamma correction for enhancement of images. Give the required equation and explain the procedure to apply the method to an image having pixels in the range $[0, 255]$.

Explain how the method may be used to enhance details in the dark region and the bright region of the gray scale.

(4 marks)

Question 2: Explain the various steps in the formulation of a multiscale edge detection method using the Laplacian of Gaussian. You do not need to give any equation or formula.

Sketch the Laplacian of Gaussian for two scales. Explain the roles of the Gaussian, the Laplacian, and the scale parameter in the procedure that you describe.

(4 marks)

Question 3: Give the general definition of compactness as a shape factor. Give the modified definition of compactness to result in values in the range $[0, 1]$ with zero for a circle. Explain how compactness captures the notion of shape complexity. Sketch two contours (shapes) and indicate which will have higher compactness than the other.

(4 marks)

Question 4: Give an equation to define the Fourier descriptors of a contour. Explain all symbols and variables used. Explain how Fourier descriptors may be normalized to become independent of position (shift), size (scale), and rotation (orientation).

(4 marks)

Question 5: Explain how the gray-level cooccurrence matrix (GLCM) may be derived for an image with gray levels in the range $[0, 255]$. What is the size of the resulting GLCM?

Give an equation to define the entropy of the GLCM. Explain how this measure represents texture.

(4 marks)
