UNIVERSITY OF CALGARY
SCHULICH SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
ENEL 697 DIGITAL IMAGE PROCESSING
FALL 2013 SESSION, TEST NO. 1
7 November 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: Give an equation to define multiframe or synchronized averaging of images. Explain the effects expected in the result and the conditions under which they may be achieved.

Describe two practical applications of multiframe or synchronized averaging of images. In each case, explain how the required images may be obtained, the nature of the anticipated results, the types of artifacts that may arise in the results, and how the artifacts may be prevented. (4 marks)

Question 2: Describe two practical applications of subtraction of images. In each case, explain how the required images may be obtained, the nature of the anticipated results, the types of artifacts that may arise in the results, and how the artifacts may be prevented. (3 marks)

Question 3: Explain the notion of simultaneous contrast. Give an equation to define contrast. Explain the concept of just-noticeable difference. (3 marks)

Question 4: Given an equation to define (the zeroth-order) entropy of an image and explain its properties.

Give an equation to define the n^{th}-order entropy of an image. Explain the need for such a measure and explain its properties and applications. (4 marks)

Question 5: Write an equation to define the linear convolution of an image of size $M_1 \times N_1$ pixels with another image of size $M_2 \times N_2$ pixels. What is the size of the resulting image?

Write an equation to define the discrete Fourier transform (DFT) of an $N \times N$ image.

Give a step-by-step algorithm to obtain the result of linear convolution of two images by using the DFT. (6 marks)

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