

Problem 2: (20 points)

Let $u_i(m,n)$ be the i 'th band of a multispectral image. Joint multispectral image enhancement refers to processing two or more bands of the scene in order to accentuate salient features. Discuss the main advantages and disadvantages of the following multispectral image enhancement techniques:

a) Image Difference

b) Intensity ratios

c) Log-ratios

d) Principal components

Problem 3: (20 points)

a) Compare the following image transformation with respect to computational complexity (very fast, fast, faster than sinusoidal transforms, slow, very slow) and energy compaction (best for any given image, best in mse sense, excellent, very good, good, fair).

	DFT	Cosine	Hadamard	Haar	KL	SVD
Computational complexity						
Energy compaction						

b) Taking into account the above two criteria (i.e. computational complexity and energy compaction), which is the best transform and why?

Problem 4: (10 points)

Answer the following multiple choice questions. Circle all correct answers. Note that there can be more than one correct answer.

4.1) Two objective criteria, called the mean square error or mse and the mean absolute error or mae, are often used in image processing to evaluate and compare image processing algorithms. Which of the following hold?

- a) the mse correlates very well with the subjective quality of the image
- b) the mae does not correlate well with the subjective quality
- c) the mse is used mainly because it is computationally attractive when optimizing linear filters
- d) the mae has absolutely nothing to do with the subjective quality of the image

4.2) The luminance signal in the simplified monochrome human visual system passes through only the cone and rod nonlinearity function and the lateral inhibition system because

- a) the eye optics has a much slower drop-off with increasing frequency than the lateral inhibition
- b) the lateral inhibition system has a much slower drop-off with increasing frequency than they eye optics
- c) the cone and rods are highly nonlinear
- d) none of the above

4.3) The Weber law suggests that

- a) equal increments in the log of the luminance should be perceived to be equally different
- b) df/f is constant over just any range of intensity difference
- c) one can process the log of the intensity of an image rather than the intensity itself
- d) none of the above

4.4) Two main receptors are identified in the human eye: cones and rods

- a) there are less cones than rods in a healthy eye
- b) cones are responsible for photopic vision
- c) colors cannot be distinguished in the dark since cones are much less sensitive than rods at low light
- d) all of the above

4.5) Three perceptual attributes of color have been studied

- a) brightness shows the brightness of color red
- b) saturation varies along the circumference of the "egg" model
- c) hue denotes the colorfulness of an area judged in proportion to the brightness of the object itself
- d) all of the above is correct
- e) none of the above is true