

IMAGE PROCESSING (RRY025/ASM420)

One of the Exams in 2017/2018

1 Warming up: MISCELLANEA [12 points]

- (a) [4p] Describe the averaging filter and the median filter as tools for image enhancement.
- (b) [4p] The averaging and the median filters are based on two important statistics. Which ones? What information do such statistics provide? Which one is more ‘robust’? And in what sense?
- (c) [4p] Describe run length coding and predictive coding as tools for image compression.

2 MISCELLANEA [15 points]

- (a) [6p (up to 1p for each question)] You have an image polluted by Gaussian additive white noise, and compute its fast Fourier transform. What type of noise do you have in the real and imaginary parts of the transformed image? And why? If you compute the Fourier power spectrum of the original image, will you have the same type of noise as in the Fourier transformed image, or not? And why? If your answer is no . . . , then what are the main characteristics of such a type of noise? And how does it compare with Poissonian noise?
- (b) [9p (up to 1p for each question)] You have an image that you want to process using the fast wavelet transform. Unfortunately, your toolbox has only two wavelets (but is reliable :-)
 - W1: orthogonal, with 3 vanishing moments.
 - W2: bi-orthogonal; the decomposition wavelet has 8 vanishing moments, and looks very different from the reconstruction wavelet.

If the image is not noisy, then which wavelet (W1 or W2) would you use for pre-compressing the image? Why? And how would you pre-compress it? Now assume that the image is polluted by Gaussian additive white noise. Which wavelet (W1 or W2) would you use for de-noising the image? Why? How would you de-noise it? How would you answer the previous three questions if the noise is Poissonian? And if the noise is of speckle type? Finally, suppose that the image is contaminated by salt-and-pepper noise, and that you can choose to use wavelets or any other method studied in the course. How would you de-noise the image?

3 Cooling down: MISCELLANEA [3 points]

- (a) [3p] In your opinion, what is the most interesting topic of the course? Explain how important this topic is in the context of image processing, and how important it is for your studies/job.