Final Examination: ESE 558 Digital Image Processing

Date: 5/13/97, Max. Marks: 60

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1. *7+4+4 points*

   (a) Give the algorithm for *sequential baseline JPEG* compression technique for still-frame monochrome images.

   (b) In image compression using JPEG, two consecutive blocks B1 and B2 after normalization and converting to one-dimensional sequence have the following form:

   ```
   B1:       [   -35    5    -2    0    0    0   -4    EOB ]
   B2:       [   -31   -3     0    0    0   -2    EOB ]
   ```

   Give the JPEG coding for block B2 (note: **B2**, not B1), i.e. give the binary pattern that codes B2. Show every step and explain what you are doing at every step to make clear that you have understood JPEG.

   (c) The JPEG coding of some image block is given below. Decode this block as much as possible to obtain a one-dimensional sequence as above and interpret the result. Once again, show every step and explain what you are doing at every step to make clear that you have understood JPEG.

   ```
   B3:       [ 0 0 0 0 1 1 0 0 0 1 0 1 1 0 0 1 1 0 1 0 ]
   ```

2. *(4+4 points) Ch 7 & Paper: Image Restoration*

   (a) Give expressions for the Weiner filter and the Spatial domain convolution/deconvolution transform (two non-zero terms for a circularly symmetric PSF). Explain them in the context of image restoration. In particular, describe the assumptions underlying the derivation of the Weiner filter.

   (b) Compare the advantages and disadvantages of using the Spatial Domain Convolution/Deconvolution Transform vs the Weiner filter for restoring focused images from blurred images. Consider computational requirements, *a priori* information needed, and the quality of restoration. Answer this question in the context of the paper you have been assigned to read.

3. *(3+4 points) Ch. 8 Image reconstruction*

   (a) State and prove the *Fourier Slice Theorem*.

   (b) Describe the theory behind the Filtered-Backprojection algorithm for parallel projection data, and explain how it is applied in Computer Assisted Tomography.