ELIC 629 Digital Image Processing Winter 2005 Image Enhancement in the Spatial Domain: Mid-Term Exam Review

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Overview (1):

- Material You are Responsible For
 - Sections covered

Some Notes Regarding "Important Topics"

- What is an edge ?
- Spatial filtering example

Material You are Responsible For (1):

Chapters and Sections Covered in the Exam

- Chapter 1
 - All sections
 - Easy read → you should know the basic definitions such as, what is an image, what is digital image processing and should be aware of some of the fields that use image processing
- Chapter 2
 - Section 2.1: elements of visual perception \rightarrow you should know some of the basic definitions related to the eye and image formation, in particular, focus on lecture notes



- Chapters and Sections Covered in the Exam • Chapter 2
 - Section 2.2: light and the electromagnetic
 - spectrum \rightarrow you should know what the EM is • Section 2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4: image
 - sensing and acquisition \rightarrow important!
 - \bullet Section 2.4, 2.4.1, 2.4.2: image sampling and quantization \rightarrow important!
 - Section 2.5, 2.5.1, 2..2, 2.5.3, 2.5.4: Basic relationships between pixels → important!
 - \bullet Section 2.6: Linear and non-linear operators \rightarrow know definitions of (non) linear operator!

Material You are Responsible For (3):

Chapters and Sections Covered in the Exam

- Chapter 3
 - Section 3.1: background
 - Section 3.2, 3.2.1, 3.2.2, 3.2.3, 3.2.4: basic gray level transformations → you should be familiar with the various transformations we covered in the lectures
 - Section 3.3 (up to page 90 only): histogram processing \rightarrow you should know what a histogram, how to construct one and how to normalize one
 - Section 3.4, 3.4.1: Enhancement using arithmetic and logic operators

Material You are Responsible For (4):

Chapters and Sections Covered in the Exam

- Chapter 3 (cont...)
 - Section 3.5: Basics of spatial filtering \rightarrow you should know what a mask (template, kernel) is, what the coefficients are and coordinate system of the mask e.g., origin at (0,0)
 - Section 3.6, 3.6.1, 3.6.2: Smoothing spatial filters \rightarrow important!
 - Section 3.7, 3.7.1 (up to page 125) \rightarrow important!
 - Spatial filtering is important!

Material You are Responsible For (5):

Important Material

 You are responsible for all sections we covered as listed in the previous slides.

- Although the notes do contain plenty of information and probably the most important information, keep in mind, you are also responsible for the material in the corresponding sections in book \rightarrow I cannot include every piece of information from the book in the lecture slides!
- Spatial filtering is a very important topic and you should know how to filter an image using a mask

Material You are Responsible For (5):

Important Material (cont...)

- You are responsible for knowing Matlab at least with respect to the Labs we have already completed.
 - Creating matrices in Matlab
 - Now you should realize the importance of completing the Matlab review exercise!

Additional Notes



Spatial Filtering Example (2):

• Spatial Filtering Mechanics (cont...)

Recall the following expression

$$\begin{split} \mathsf{R} &= \mathsf{w}(-1,-1)\mathsf{f}(\mathsf{x}{-}1,\mathsf{y}{-}1) + \mathsf{w}(-1,0)\mathsf{f}(\mathsf{x}{-}1,\mathsf{y}) + ... + \mathsf{w}(0,0)\mathsf{f}(\mathsf{x}{,}\mathsf{y}) \\ &+ ... + \mathsf{w}(1,0)\mathsf{f}(\mathsf{x}{+}1,\mathsf{y}) + \mathsf{w}(1,1)\mathsf{f}(\mathsf{x}{+}1,\mathsf{y}{+}1) \end{split}$$

• or, its equivalent "shorter" notation

$$g(x, y) = \sum_{s=-at=-b}^{a} \sum_{w=-at=-b}^{b} w(s,t) f(x+s, y+t)$$

Spatial Filtering Example (3):

Spatial Filtering Mechanics (cont...)

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\begin{split} g(x,y) &= (1/9)(1)(10) + (1/9)(1)(12) + (1/9)(1)(50) + \\ &\quad (1/9)(1)(5) + (1/9)(1)(10) + (1/9)(1)(100) + \\ &\quad (1/9)(1)(225) + (1/9)(1)(200) + (1/9)(1)(210) \end{split}
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 $= (1/9) \times [(1)(10) + (1)(12) + (1)(50) +$ (1)(5) + (1)(10) + (1)(100) +(1)(225) + (1)(200) + (1)(210)]

```
= (1/9) x [822]
= 91.3 = 91 (recall, integer intensity values!)
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Spatial Filtering Example (4):

How About Median Operation on the Same Sub-Image ?

 How would we perform a median operation on the same pixel (shaded one)?

Good Luck!

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