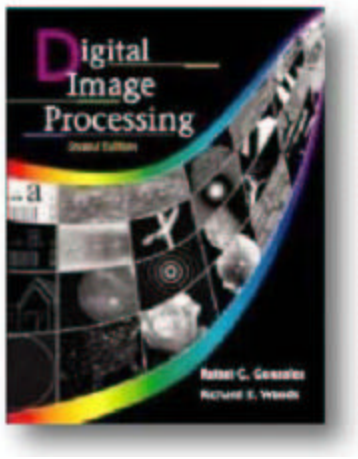

Digital **I**mage **P**rocessing

Chapter 3

"Image Enhancement in the Spatial Domain"

Preview

3.1 Background

- What is the **spatial domain**?

The spatial domain refers to the aggregate of pixels composing an image.

- What are **spatial domain methods**?

Spatial domain methods are procedures that operate directly on the pixels.

3.2 Some Basic Gray Level Transformations

3.2.1 Image Negatives

3.2.2 Log Transformations

3.2.3 Power-Law Transformations

3.2.4 Piecewise-Linear Transformation Functions

Contrast Stretching

Gray-Level Slicing

- What is **gray-level** slicing?

Gray-level slicing is the process of

Bit-plane Slicing

3.3 Histogram Processing

3.3.1 Histogram Equalization

3.3.2 Histogram Matching (Specification)

Development of the Method

Implementation

3.3.3 Local Enhancement

3.3.4 Use of Histogram Statistics for Image Enhancement

3.4 Enhancement Using Arithmetic/Logic Operations

3.4.1 Image Subtraction

3.4.2 Image Averaging

3.5 Basics of Spatial Filtering

3.6 Smoothing Spatial Filters

3.6.1 Smoothing Linear Filters

3.6.2 Order-statistics Filters

3.7 Sharpening Spatial Filters

3.7.1 Foundation

3.7.2 Use of Second Derivatives for Enhancement-The Laplacian

Simplifications

Unsharp Masking and High-Boost Filtering

3.7.3 Use of First Derivatives for Enhancement- the Gradient

3.8 Combining Spatial Enhancement Methods

Summary

Further Reading

Questions

Questions From the Book

1) Exponentials of the form , with a positive constant, are useful for constructing smooth gray level transformation functions.

2)

3) Propose a set of gray-level-slicing transformations capable of producing all the individual bit planes of an 8-bit monochrome image. (for example, a transformation function with the property T(d)=0 for d in the range [0,127], and T(d)=255 for d in the range [128, 255] produces an image of the 7^{th} bit plane in an 8-bit image).

References

Woods, Richard, Gonzalez, Rafael, "*Digital Image Processing*", Second Edition, Prentice Hall