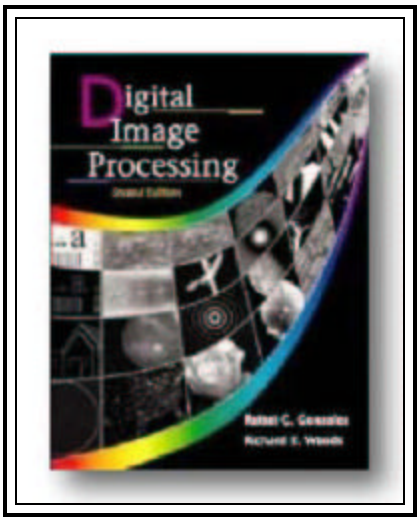


Digital Image Processing

Chapter 2

"Digital Image Fundamentals"

Last Updated: Sep 6, 2003

Preview

2.1 Elements of visual Perception

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.

2.2 Structure of the Human Eye

Cones vs. Rods

2.1.2 Image Formation of the Eye

2.1.3 Brightness Adaptation and Discrimination

2.2 Light and Electromagnetic Spectrum

2.3 Image Sensing and Acquisition

2.3.1 Image Acquisition Using a Single Sensor

2.3.2 Image Acquisition Using Sensor Strips

2.3.3 Image Acquisition Using Sensor Arrays

2.3.4 A Simple Image Formation Model

2.4 Image Sampling and Quantization

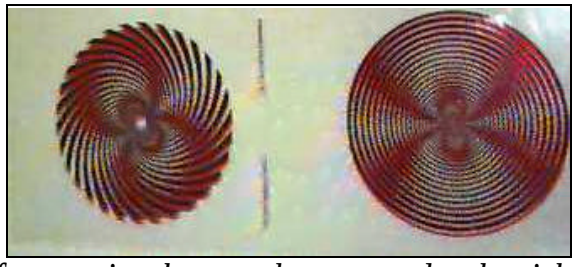
2.4.1 Basic Concepts in Sampling and Quantization

2.4.2 Representing Digital Images

2.4.3 Spatial and Gray-Level Resolution

2.4.4 Aliasing and Moiré Patterns

- *What is a moiré pattern?*



The effect of aliased frequencies that can be seen under the right condition.

2.4.5 Zooming and Shrinking Digital Images

2.5 Some Basic Relationships Between Pixels

2.5.1 Neighbors of a Pixel

2.5.2 Adjacency, Connectivity, Regions, and Boundaries

2.5.3 Distance Measures

2.5.4 Image Operations on a Pixel Basis

2.6 Linear and Nonlinear Operations

Summary

Further Reading

Questions

Questions From the Book

2.1 Using the background information provided in Section 2.1, and thinking purely in geometric terms, estimate the diameter of the smallest printed dot that the eye can discern if the page on which the dot is printed is 0.2 m away from the eyes. Assume for simplicity that the visual system ceases to detect the dot when the image of the dot on the fovea becomes smaller than the diameter of one receptor (cone) in that area of the retina. Assume further that the fovea can be modeled as a square array of dimensions 1.5 mm x 1.5 mm and that the cones and spaces between the cones are distributed uniformly throughout this array.

2.2 When you enter a dark theater on a bright day, it takes an appreciable interval of time before you can see well enough to find an empty seat. Which of the visual processes explained in section 2.1 is at play in this situation?

2.3 Although it is not shown in Fig. 2.10, *alternating current* certainly is part of the electromagnetic spectrum. Commercial alternating current in the United States has a frequency of 60 Hz. What is the wavelength in kilometers of this component of the spectrum?

2.4 You are hired to design the front end of an imaging system for studying the boundary shapes of cells, bacteria, viruses, and protein. The front end consists, in this case, of the illumination source9s) and corresponding imaging camera(s). The diameters of circles required to enclose individual specimens in each of these categories are 50, 1, 0.1, and 0.01 um, respectively.

2.5 You

References

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