Mathematical tools

Introduction to mathematical tools used in Digital Image processing

Arithmetic Operations

$$v(x, y) = f(x, y) \div g(x, y)$$
$$p(x, y) = f(x, y) \times g(x, y)$$
$$d(x, y) = f(x, y) - g(x, y)$$
$$s(x, y) = f(x, y) + g(x, y)$$

When these operations can be used?

How can we treat the resutlts ?

a b c

FIGURE 2.30 (a) Digital dental X-ray image. (b) ROI mask for isolating teeth with fillings (white corresponds to 1 and black corresponds to 0). (c) Product of (a) and (b).

Logical operation

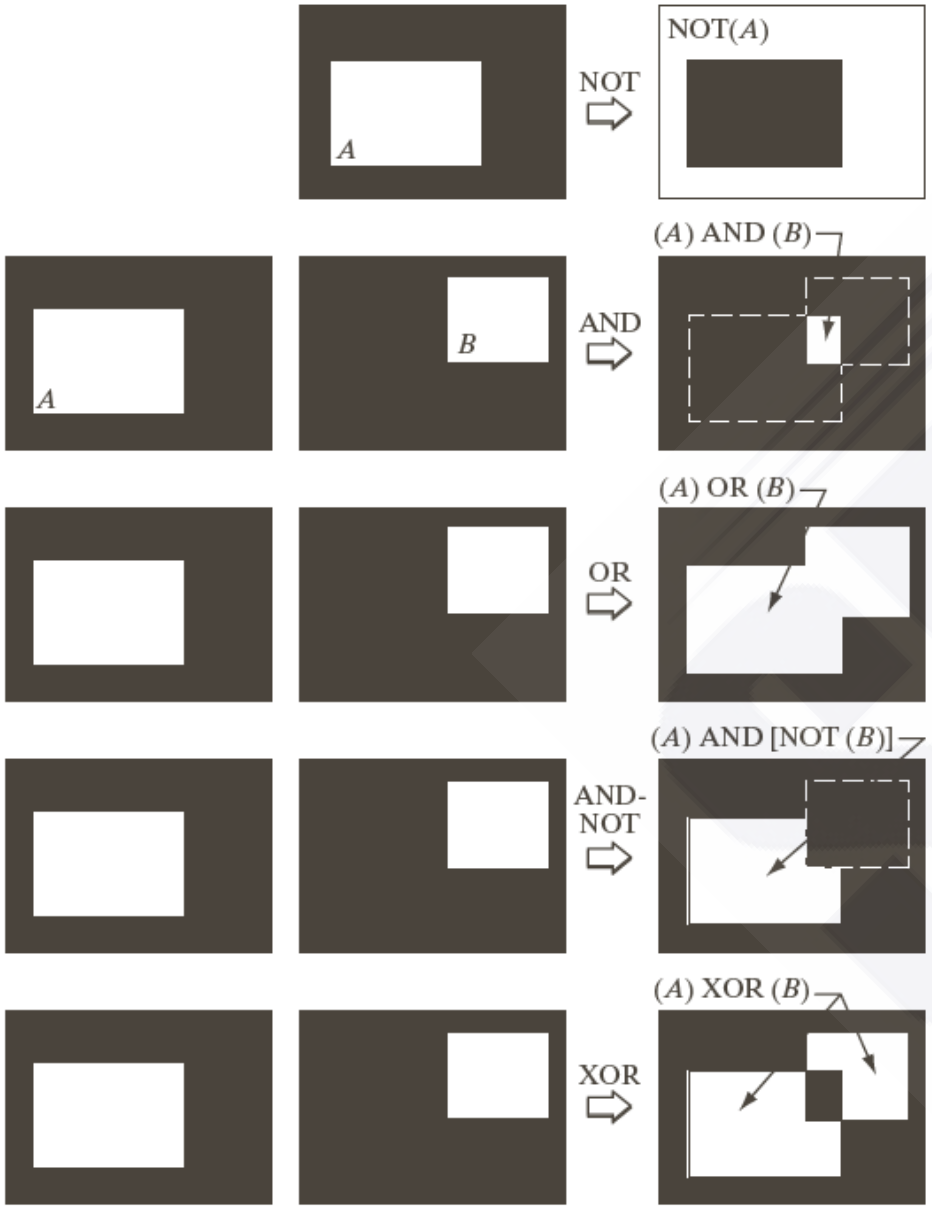


FIGURE 2.33
Illustration of logical operations involving foreground (white) pixels. Black represents binary 0s and white binary 1s. The dashed lines are shown for reference only. They are not part of the result.

Intensity Transformations and Spatial Filtering

The Basics of Intensity Transformations and Spatial Filtering

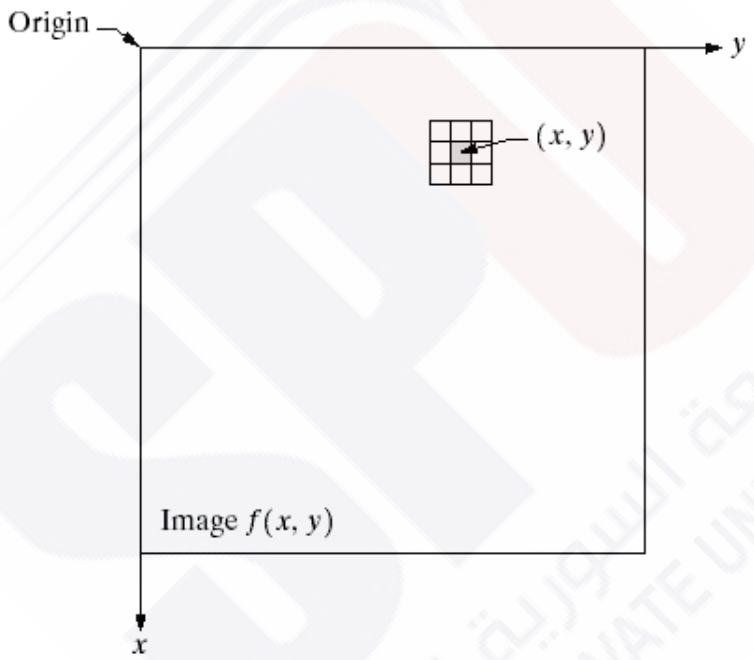
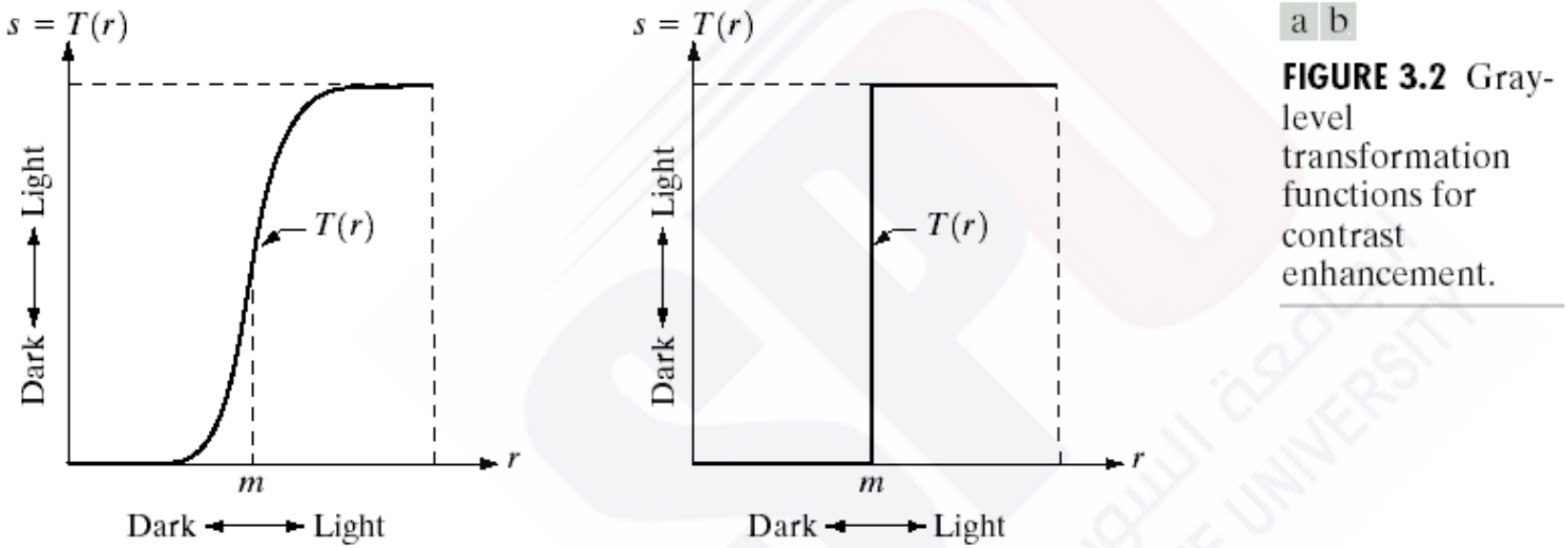


FIGURE 3.1 A 3×3 neighborhood about a point (x, y) in an image.

g(x,y) = T[f(x,y)]
T operator defined over neighborhood of a point (x,y)

Intensity transformation functions



a b

FIGURE 3.2 Gray-level transformation functions for contrast enhancement.

When the size of neighborhood is 1, T becomes intensity transformation function

Some Basic Intensity Transformation Functions

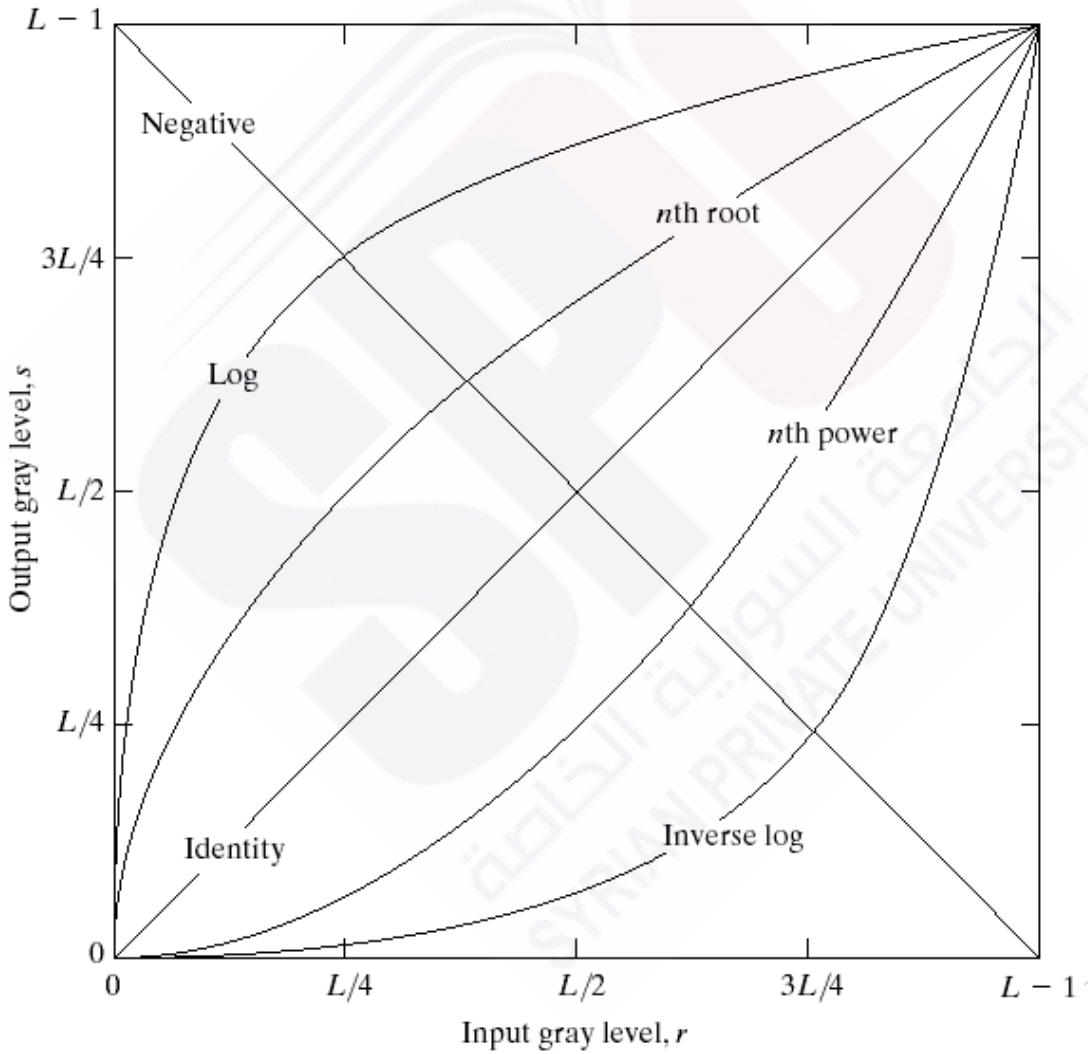
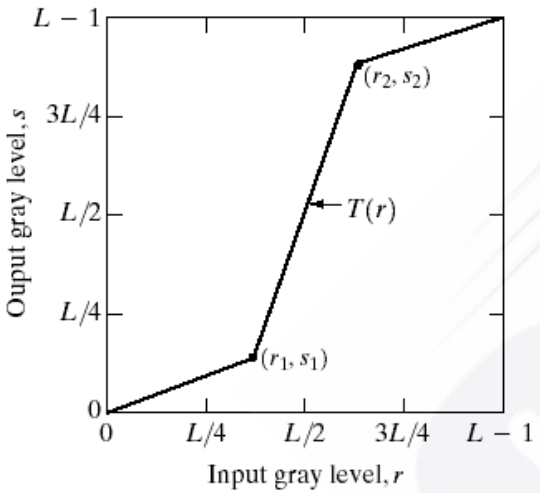
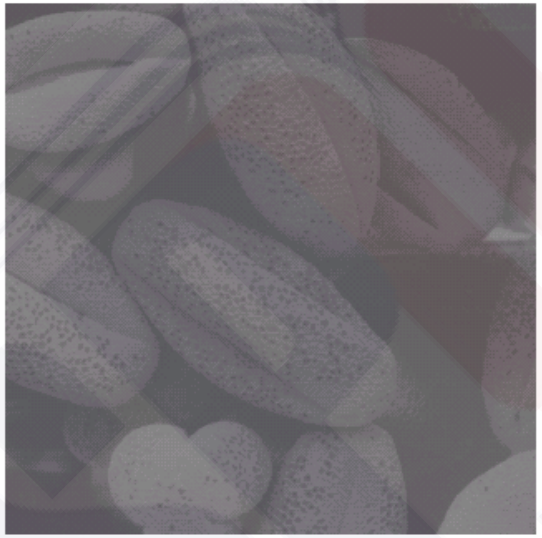
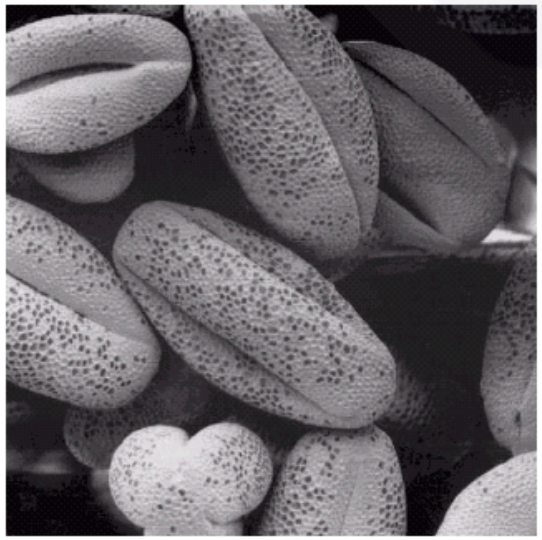


FIGURE 3.3 Some basic gray-level transformation functions used for image enhancement.

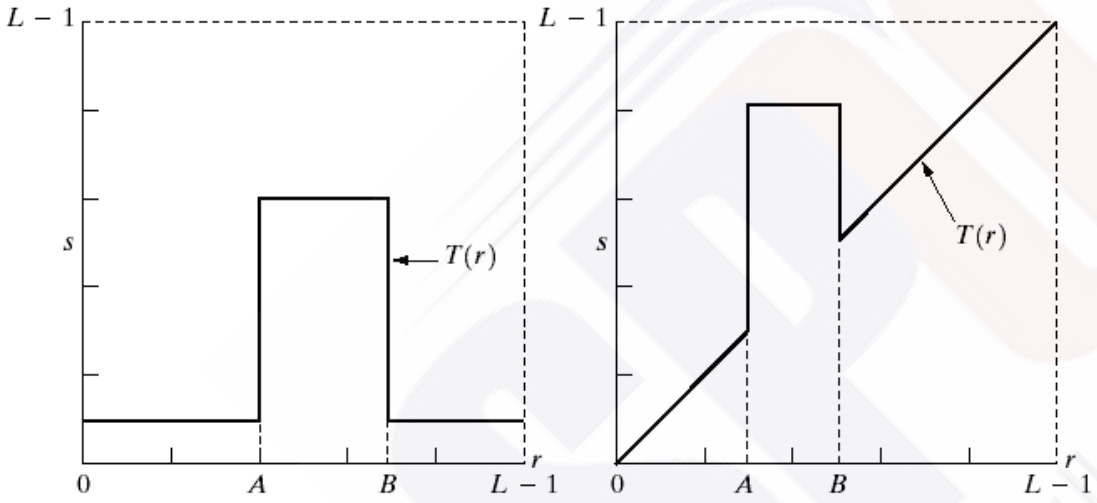
Piecewise-Linear Transformation Functions

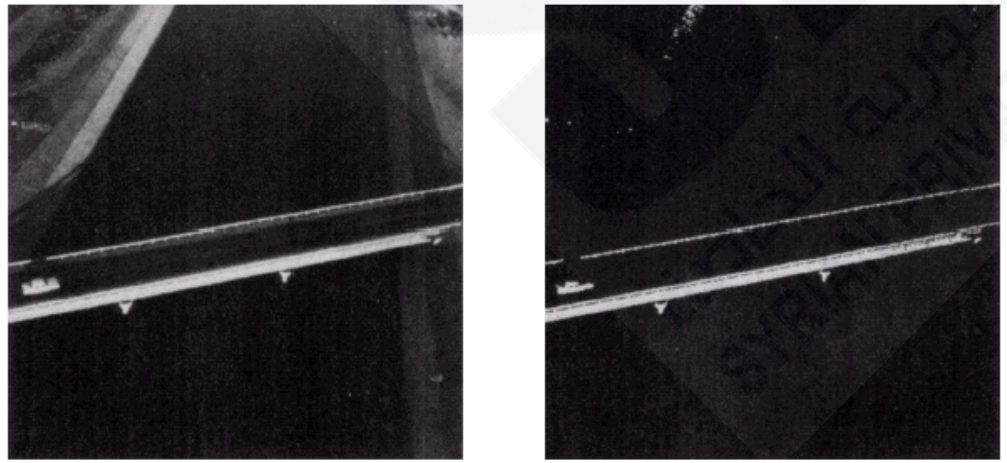






Intensity Level Slicing





Bit-Plane Slicing

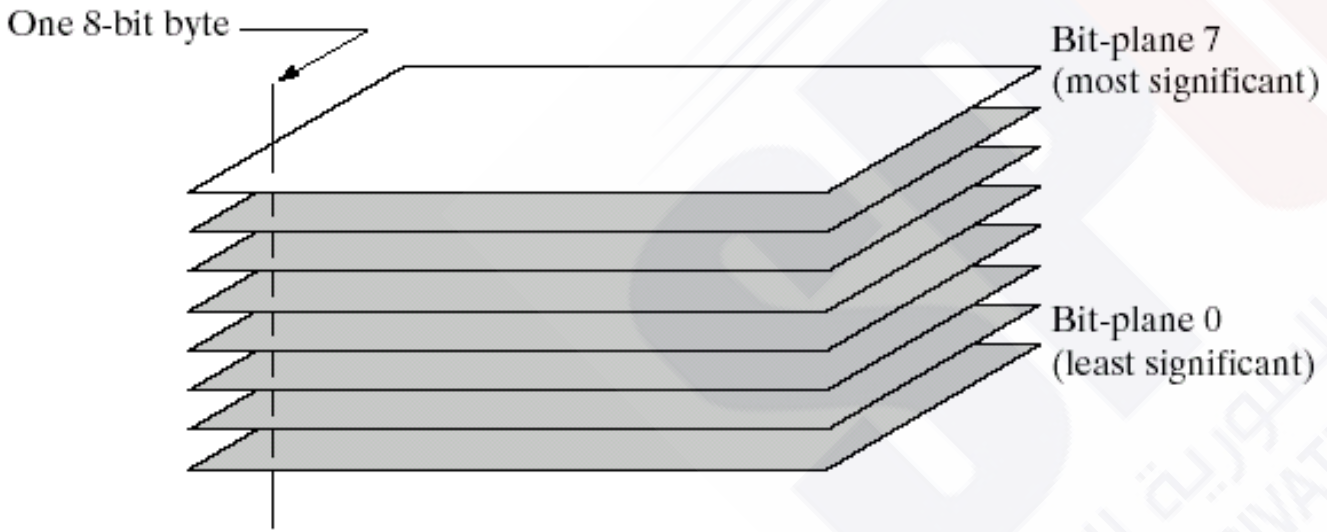


FIGURE 3.12
Bit-plane representation of an 8-bit image.

a b c
d e f
g h i

FIGURE 3.14 (a) An 8-bit gray-scale image of size 500 × 1192 pixels. (b) through (i) Bit planes 1 through 8, with bit plane 1 corresponding to the least significant bit. Each bit plane is a binary image.

END OF PRESENTATION