

Image Processing - Assignment 2

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1 Task1: Theory

a)

Opening can be defined as:

$$f \circ b = (f \ominus b) \oplus b \quad (1)$$

Or, first applying an erosion, then applying a dilation using the same structuring element on the image.

Closing can be defined as:

$$f \bullet b = (f \oplus b) \ominus b \quad (2)$$

Or, first applying a dilation, then applying an erosion using the same structuring element on the image.

b)

This is because the edge detection (and derivatives in general) enhance noise, making it virtually impossible to detect edges on a noisy image. Therefore it would be necessary to apply smoothing to the image before we can detect any edges. See fig. 1 for

c)

Rather than using a single threshold, we use two thresholds, one lower and one higher. Anything larger than the higher is marked as an edge, and anything below the lower is marked as not an edge. Those between these threshold can be seen as weak edges, and is marked as an edge if there is a strong edge in the

d)

We use hysteresis thresholding instead of a single threshold because we want to link the edges.

e)

Reflecting B has no effect. Centre has been highlighted with bold.

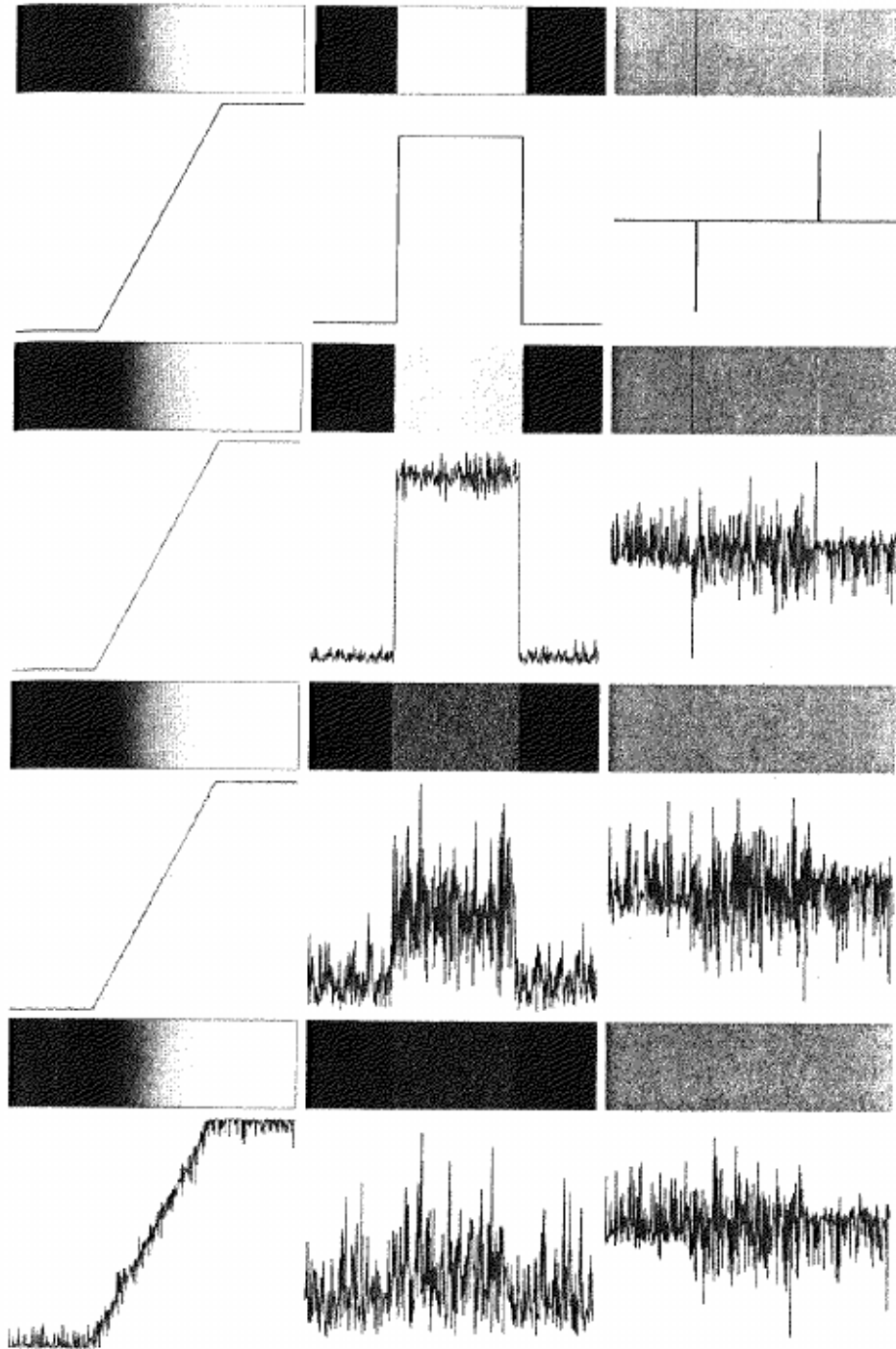


Figure 1: Ramp edge with different levels of noise. From figure 10.7 Digital Image Processing.

$$\begin{aligned}
A &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\
B &= \begin{bmatrix} 1 & \mathbf{1} & 1 \end{bmatrix} \\
A \oplus B &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \oplus \begin{bmatrix} 1 & \mathbf{1} & 1 \end{bmatrix} \\
&= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}
\end{aligned}$$

2 Programming

2.1 Task 2: Segmentation

2.2 Task 3: Morphology