CONVOLUTION

- It is use to extract certain information from an image.
- We use a window known as convolution window or mask to scan the entire image.
- In order to perform convolution on an image, following steps should be taken.

  Flip the mask only once

  Slide the mask onto the image.

  Multiply the corresponding elements and then add them

  Repeat this procedure until all values of the image has been calculated.
- It is commutative.

1

Let $f(t)$ and $g(t)$ be one-dimensional functions in continuous time domain; the convolution C_{fg} of the two functions is given by

$$C_{fg}(t) = f(t) * g(t) = \int_{-\infty}^{+\infty} f(\alpha) g(t-\alpha) d\alpha$$

Its discrete form may be described by two discrete signal sequences, $a(m)$ and $b(m)$, where m is an integer. The convolution of a and b is given by

$$c_{ab}(m) = a(m) * b(m) = \sum_{h=-\infty}^{+\infty} a(h) b(m-h)$$

where h is an integer.

2

- Convolution between two-dimensional continuous function f(x,y) and g(x,y) is given as:

$$C_{fg} = f(x,y) * g(x,y) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(\alpha,\beta)\, g(x-\alpha, y-\beta)\, d\alpha\, d\beta$$

$$= \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(x-\alpha, y-\beta)\, g(\alpha,\beta)\, d\alpha\, d\beta$$

- Its discrete form is described as follows:

Suppose a(m,n) and b(m,n) are two-dimensional discrete signals where m and n are integers.

Convolution between a and b is given by:-

$$C_{ab}(m,n) = a(m,n) * b(m,n)$$

+∞

+∞

= �� h, �� ��(�� − h, �� − ��)

h=−∞ ��=

+∞ −∞

+∞

= �� �� − h, �� − �� ��(h, ��) h=−∞ 3

��=−∞