

811631026 黃廷睿

2.12

$$\begin{aligned} f(x,y) &= \bar{i}(x,y) \cdot r(x,y), \text{ where } r=| \\ &= \bar{i}(x,y) \\ &= k e^{-[\overrightarrow{(x-x_0)} + \overrightarrow{(y-y_0)}]}, \quad k=255 \end{aligned}$$

$$2 \leq b$$

④

8

\bar{m}

2.18

$$\begin{array}{cccc}
 3 & | & 2 & | & (9) \\
 2 & 2 & 0 & 2 \\
 1 & 2 & 1 & 1 \\
 (4) & 1 & 0 & 1 & 2 \\
 L = X
 \end{array}$$

3 | 2 | 1 (9)
 2 | 2 | 0 | 2
 1 | 2 | 1 | 1
 (4) | 0 | 1 | 2
 L=5

3 | 2 | 1 (9)
 2 | 2 | 0 | 2
 1 | 2 | 1 | 1
 (4) | 0 | 1 | 2
 L=5

4-

8

m

$L = 6$

[illegible]

3 1 2 1 (g)
 2 2 0 2
 1 2 1 1
 (p) 1 0 1 2

$L=6$

2.37

a. $A = \begin{bmatrix} G_x & 0 & 0 \\ 0 & G_y & 0 \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \begin{bmatrix} \frac{1}{G_x} & 0 & 0 \\ 0 & \frac{1}{G_y} & 0 \\ 0 & 0 & 1 \end{bmatrix}$

b. $A = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \begin{bmatrix} 1 & 0 & -t_x \\ 0 & 1 & -t_y \\ 0 & 0 & 1 \end{bmatrix}$

c. $A_v = \begin{bmatrix} 1 & s_v & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, A_v^{-1} = \begin{bmatrix} 1 & -s_v & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$A_h = \begin{bmatrix} 1 & 0 & 0 \\ s_h & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, A_h^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ -s_h & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

d. $A = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$

e. $A = \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$

3.12. $\int_0^r P(w) dw.$

$$P_r(r) = -r+2 = \int_0^r (-2w+2) dw$$

$$= -r^2 + 2r$$

$$P_z(r) = 2r = \int_0^r 2r dw = r^2$$

$$\Rightarrow z = G^{-1}(w) = \pm \sqrt{w} = \sqrt{r \pm 2r}$$

3.18 $w = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}, f = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

(a) $g(x,y) = \sum_{s=-a}^a \sum_{t=-b}^b w(s,t) f(x+s, y+t)$

$$w = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \Rightarrow 4 \times 1 + 2 \times 1 = 6$$

(b) convolution

padding \rightarrow repeat \rightarrow

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \xrightarrow{\text{padding}} \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \xrightarrow{\text{repeat}} \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 1 & 0 & 0 \\ 0 & 0 & 3 & 6 & 3 & 0 & 0 \\ 0 & 0 & 4 & 8 & 4 & 0 & 0 \\ 0 & 0 & 3 & 6 & 3 & 0 & 0 \\ 0 & 0 & 1 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

w 翻轉後仍為 w

(C) Correlation.

$$\begin{array}{cccccccc}
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 & & & & & & & \\
 \end{array}$$

Diagram showing a 4x4 grid of zeros with a 3x3 subgrid highlighted in blue. The subgrid contains the values 1, 2, 3, 4, 5, 6, 7, 8, 9. The value 1 is at the top-left corner of the subgrid. The value 9 is at the bottom-right corner of the subgrid. The value 5 is at the center of the subgrid. The value 4 is at the top-right corner of the subgrid. The value 2 is at the bottom-left corner of the subgrid. The value 3 is at the top-middle corner of the subgrid. The value 6 is at the middle-right corner of the subgrid. The value 7 is at the middle-left corner of the subgrid. The value 8 is at the middle-bottom corner of the subgrid.

→
repeat

$$\begin{array}{cccccccc}
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 1 & 2 & 1 & 0 & 0 & 0 \\
 0 & 0 & 3 & 6 & 3 & 0 & 0 & 0 \\
 0 & 0 & 4 & 8 & 4 & 0 & 0 & 0 \\
 0 & 0 & 3 & 6 & 3 & 0 & 0 & 0 \\
 0 & 0 & 1 & 2 & 1 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 \end{array}$$

same as conv.