r11631026 黃延睿

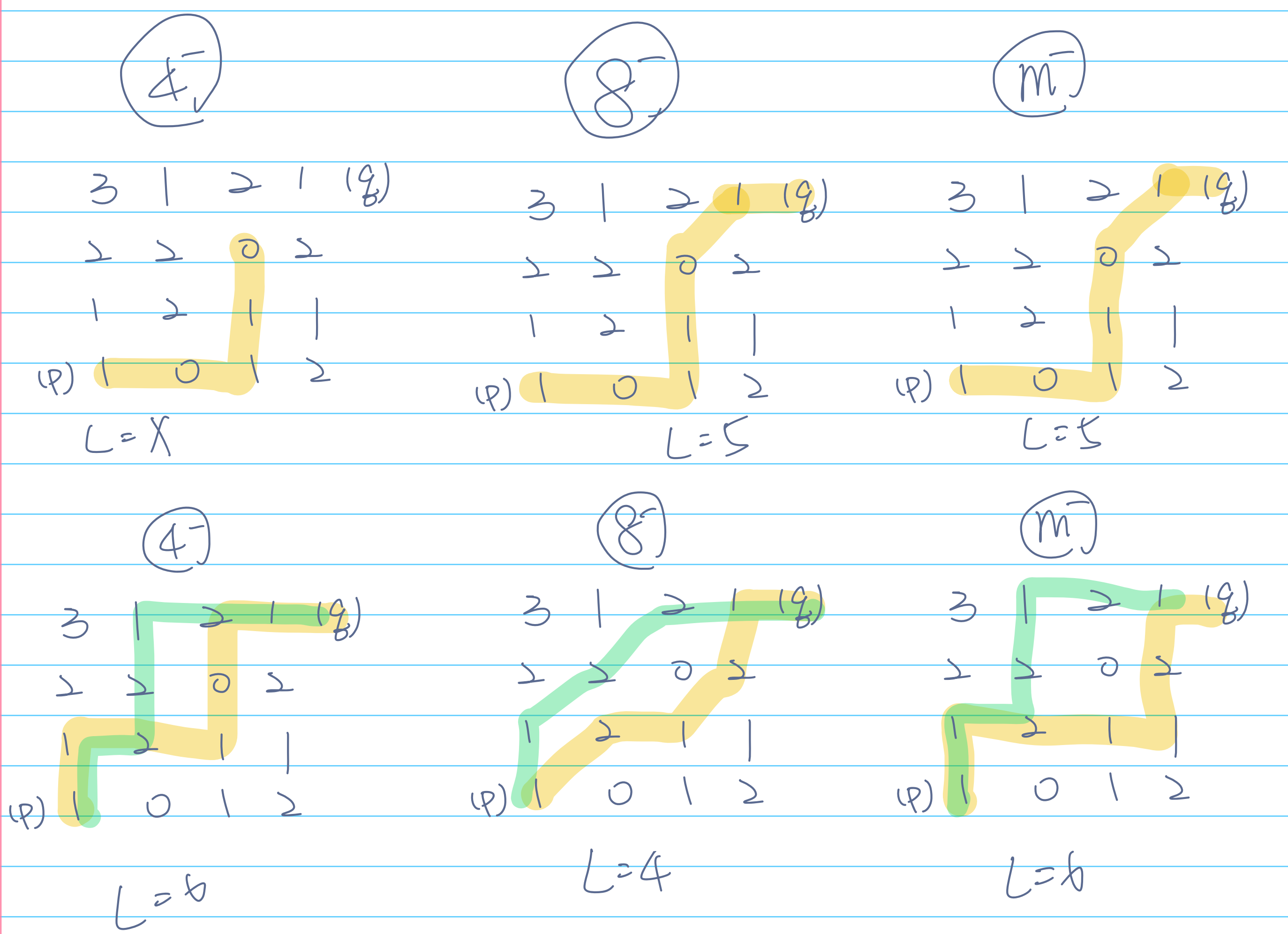
2.12 $f(x,y) = i(x,y) \cdot r(x,y)$, where $r = 1$

$$= i(x,y)$$

$$= K e^{-[(x-x_0)^2 + (y-y_0)^2]} \quad , K = 255$$

2.16

2.18



2.37

a.

$$A = \begin{bmatrix} C_x & 0 & 0 \\ 0 & C_y & 0 \\ 0 & 0 & 1 \end{bmatrix}, \quad A^{-1} = \begin{bmatrix} \frac{1}{C_x} & 0 & 0 \\ 0 & \frac{1}{C_y} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

b.

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

c.

$$A_v = \begin{bmatrix} 1 & S_v & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, \quad A_v^{-1} = \begin{bmatrix} 1 & S_v & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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

d.

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

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

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

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

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

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3.18

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

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

$$w = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix} \rightarrow \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \Rightarrow 4\times1 + 2\times1 = 6$$

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(b). convolution

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

=1

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w 翻轉後仍為 w

(c) Correlation.

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

same as conv.