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3.22 (a) $V=[1\ 2\ 1]^T$, $W^T=[2\ 1\ 1\ 3]$

$VW^T=\begin{bmatrix}1\\2\\1\end{bmatrix}[2\ 1\ 1\ 3]$ (Rank=1) (Rank=1)

$\Rightarrow W=\begin{bmatrix}2&1&1&3\\4&2&2&6\\2&1&1&3\end{bmatrix}$

(b) $W=W_1 \star W_2$

$=\begin{bmatrix}1&2&1\\2&4&2\end{bmatrix}$

$=\begin{bmatrix}1\\2\end{bmatrix}\begin{bmatrix}1&2&1\end{bmatrix}$

W_1 W_2

$\Rightarrow \begin{cases}W_1=\begin{bmatrix}1\\2\end{bmatrix}\\ W_2=[1\ 2\ 1]\end{cases}$ #

3.38. (a) Yes, 經3個 Gaussian lowpass filter 後的結果仍為 Gaussian

(b) $\sigma=\sqrt{1.5^2+2^2+4^2}=4.717$ #

(c) $m=3+5+7=15$ #

3.44. (a) Fig3.45 (a) $=\begin{bmatrix}0&1&0\\1&-4&1\\0&1&0\end{bmatrix}$ (b) $=\begin{bmatrix}1&1&1\\1&-8&1\\1&1&1\end{bmatrix}$

(No)

(b) Fig3.50 (b) $\begin{bmatrix}-1&0\\0&1\end{bmatrix}$ (c) $\begin{bmatrix}0&-1\\1&0\end{bmatrix}$

(No)

(c) Fig3.50 (d) $\begin{bmatrix}-1&-2&-1\\0&0&0\\1&2&1\end{bmatrix}$ (e) $\begin{bmatrix}-1&0&1\\-2&0&2\\-1&0&1\end{bmatrix}$

(Yes) 可分成 $\begin{bmatrix}-1\\0\\1\end{bmatrix}[1\ 2\ 1]$

4.3 (a) $\delta(t)*\delta(t-t_0)$

$=F^{-1}(F(\delta(t)*\delta(t-t_0))$

$=F^{-1}(1\cdot e^{-j2\pi w})=\delta(t-t_0)$ #

(b) $\delta(t-t_0) * \delta(t+t_0)$

$= \mathcal{F}^{-1}(e^{-j2\pi w}) \cdot (e^{j2\pi w})$

$= \mathcal{F}^{-1}(1) = \delta(t)$ //

4.5 | , Fig 3.45 (a) $= \begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

$g(x,y) = G^{-1}[G(u,v)]$

$= G^{-1}\left[e^{j2\pi\mu} + e^{-j2\pi\mu} + e^{j2\pi v} + e^{-j2\pi v} - 4\right]$

$= 2\left[\cos(2\pi\mu) + \cos(2\pi v) - 2\right]$ //

Principles and Applications of Digital Image Processing

HW3 Report

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Part 2:

因時間不足，目前僅完成 3*3 的 mean filter，效果如右圖