CH05 實戰 5

```
import numpy as np
import cv2
from matplotlib import pyplot as plt
from google.colab import drive
from google.colab.patches import cv2_imshow

drive.mount('/content/drive')
img = cv2.imread("/content/drive/My Drive/Colab Notebooks/image_processing/img_for_ch5.jpg", -1)
print(img.shape)

newimg = cv2.bilateralFilter(img, 5, 100, 100)

plt.figure(figsize = (15, 10.05))

plt.subplot(1, 2, 1)
plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
plt.title('original', fontsize = 15, color = 'r')

plt.subplot(1, 2, 2)
plt.imshow(cv2.cvtColor(newimg, cv2.COLOR_BGR2RGB))
plt.title('Bilaterial Filtering', fontsize = 15, color = 'r')

plt.tight_layout()
plt.show()
```

```
(1278, 854, 3)
```

CH06 實戰 1

$$a_n = \frac{2}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\cos(n\omega_0 t)\,dt$$

$$= \frac{4}{T}\int_0^{\frac{T}{2}} \cos(n\omega_0 t)\,dt$$

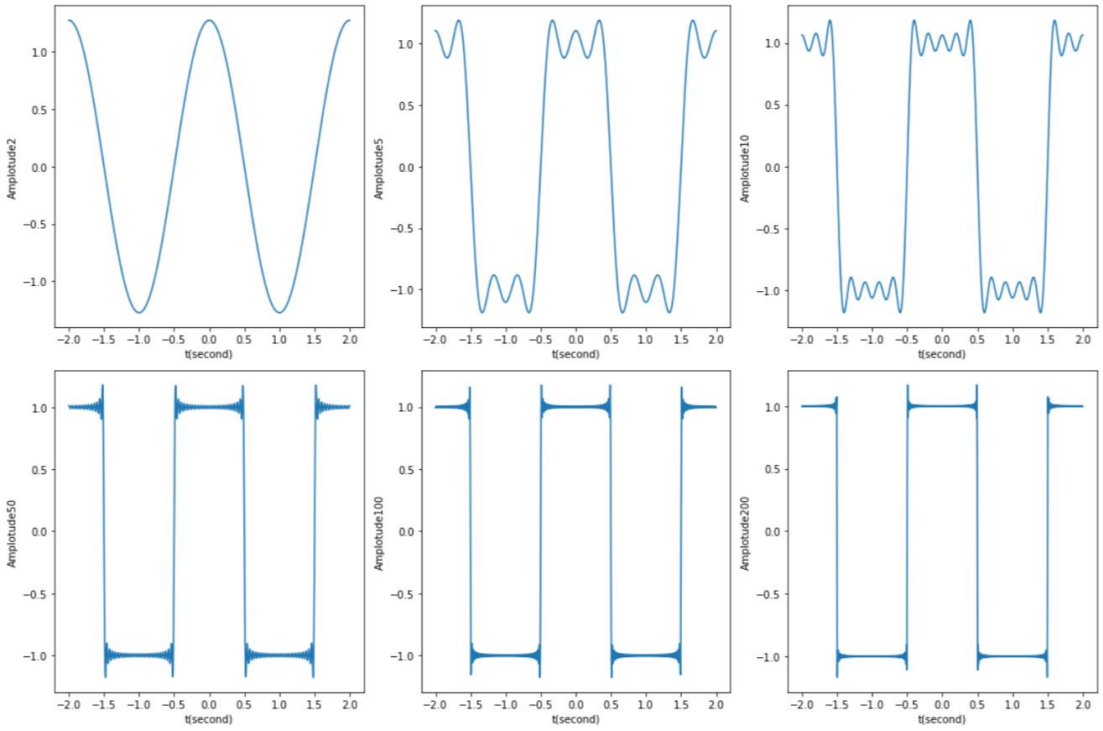
$$= \frac{4}{T}\cdot\frac{1}{n\omega_0}\left(\sin(n\omega_0 t)\Big|_0^{\frac{T}{4}} - \sin(n\omega_0 t)\Big|_{\frac{T}{4}}^{\frac{T}{2}}\right)$$

$$= \frac{2}{n\pi}\left[\sin\frac{n\pi}{2} - \left(\sin(n\pi) - \sin\frac{n\pi}{2}\right)\right]$$

$$= \begin{cases} \dfrac{(-1)^{k-1}4}{n\pi}, & n=1,3,5,\cdots k=1,2,3,\cdots \\ 0, & n=2,4,6. \end{cases}$$

$$x(t) = \frac{4}{\pi}\left(\cos\omega_0 t - \frac{1}{3}\cos 3\omega_0 t + \frac{1}{5}\cos 5\omega_0 t - \cdots\right)$$

```python
import numpy as np
import matplotlib.pyplot as plt

def series(N, t):
    x = np.zeros(1000)
    for n in range(1, N + 1):
        x += (2 / (n * np.pi)) * ((np.sin(n * np.pi / 2)) - (np.sin(n * np.pi) - np.sin(n * np.pi / 2))) * np.cos(n * np.pi * t)
    return x

def subplot(plotindex, t, x, xlabel, ylabel):
    plt.subplot(plotindex)
    plt.plot(t, x)
    plt.xlabel(xlabel)
    plt.ylabel(ylabel)

t = np.linspace(-2, 2, 1000)
plt.figure(figsize = (15, 10))

N = 2
x = series(N, t)
subplot(231, t, x, 't(second)', 'Amplotude' + str(N))
N = 5
x = series(N, t)
subplot(232, t, x, 't(second)', 'Amplotude' + str(N))
N = 10
x = series(N, t)
subplot(233, t, x, 't(second)', 'Amplotude' + str(N))
N = 50
x = series(N ,t)
subplot(234, t, x, 't(second)', 'Amplotude' + str(N))
N = 100
x = series(N, t)
subplot(235, t, x, 't(second)', 'Amplotude' + str(N))
N = 200
x = series(N, t)
subplot(236, t, x, 't(second)', 'Amplotude' + str(N))

plt.tight_layout()
plt.show()
```



簡答題

1. 針對下列的濾波器回答問題

(a) 平均濾波 (b) 高斯濾波 (c) 中值濾波 (d) 雙邊濾波

A. 是否為線性濾波器

Ans: 平均濾波和高斯濾波為線性濾波器，而中值濾波和雙邊濾波不是線性濾波器

B. opencv 提供何種函數來計算影像處理的結果

Ans:

平均濾波器 : cv2.blur

高斯濾波器 : cv2.GaussianBlur

中值濾波器 : cv2.medianBlur

雙邊濾波器 : cv2.bilateralFilter

2. 試解釋數位影像與其在頻率域的關係

若影像以平滑成份居多的話，則其低頻成分較多，若邊緣成分較多的話，則其高頻成分較多，若雜訊較多，則其高頻成分較多