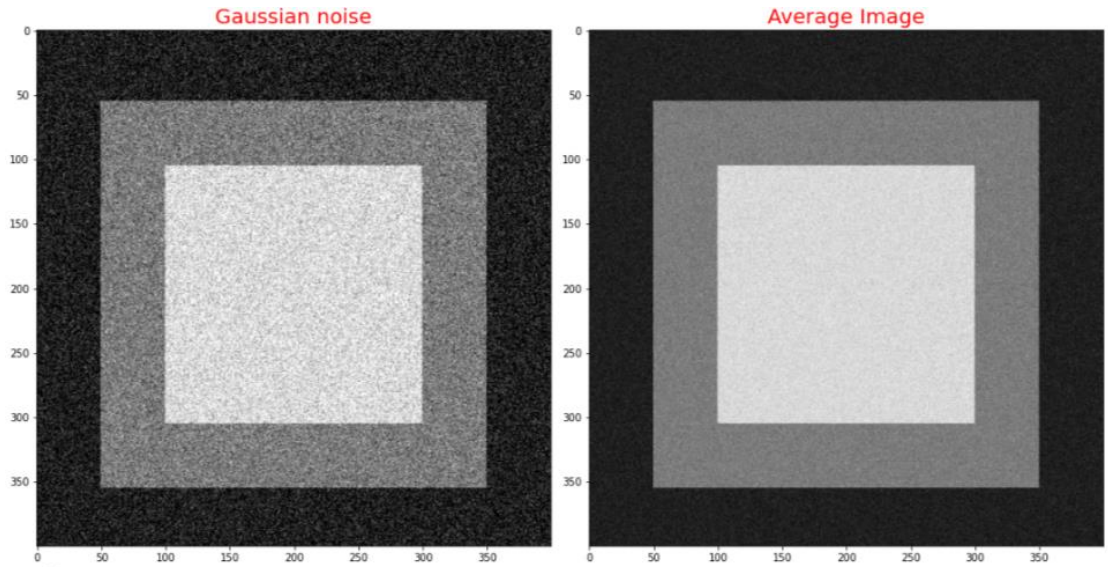
實戰(1)

```python
import numpy as np
import cv2
import math
from numpy.random import uniform, normal, exponential, rayleigh
from matplotlib import pyplot as plt
from google.colab import drive
from google.colab.patches import cv2_imshow
from scipy import ndimage
drive.mount('/content/drive')
img = cv2.imread("/content/drive/My Drive/Colab Notebooks/image_processing/Pattern.bmp")

def gaussian_noise(f, scale):
    g = f.copy()
    nr, nc = f.shape[:2]
    for x in range(nr):
        for y in range(nc):
            value = f[x, y] + normal(0, scale)
            g[x, y] = np.uint8(np.clip(value, 0, 255))
    return g

gaus1=gaussian_noise(img,30)
gaus2=gaussian_noise(img,30)
gaus3=gaussian_noise(img,30)
gaus4=gaussian_noise(img,30)
gaus5=gaussian_noise(img,30)
gaus6=gaussian_noise(img,30)
gaus7=gaussian_noise(img,30)
gaus8=gaussian_noise(img,30)
gaus9=gaussian_noise(img,30)
gaus10=gaussian_noise(img,30)

image=[gaus1, gaus2, gaus3, gaus4, gaus5, gaus6, gaus7, gaus8, gaus9, gaus10]
avg_img = np.mean(image, axis = 0)
avg_img = avg_img.astype(np.uint8)

images = [gaus1, avg_img]
titles = ["Gaussian noise", "Average Image"]

plt.figure(figsize = (15, 10))

for i in range(2):
    plt.subplot(1, 2, i + 1), plt.imshow(images[i], 'gray')
    plt.title(titles[i], fontsize = 20, color = 'r')

plt.tight_layout()
plt.show()

print("平均影像中雜訊的標準差 :",ndimage.standard_deviation(avg_img))
```



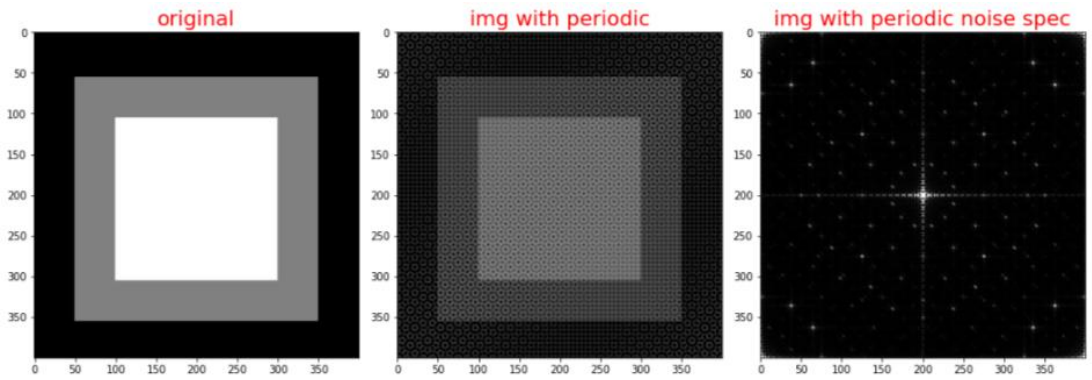
(d) 探討與說明實作中的發現

從實作中可知平均影像中雜訊的標準差比原本雜訊模型的標準差還要大，由此推斷，多張雜訊影像所產生的平均影像，其標準差會比原始雜訊影像來的大。

實戰(2)

```
import numpy as np
import cv2
import math
from numpy.random import uniform, normal, exponential, rayleigh
from numpy.fft import fft2,ifft2,fftshift
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/Pattern.bmp",-1)

```

```
def fourier_sp(f):
    F = fft2(f)
    Fshift = fftshift(F)
    mag = np.abs(Fshift)
    mag = mag / mag.max() * 255.0 * 100.0
    g = np.uint8(np.clip(mag, 0, 255))
    return g

def periodic(f, scale, frequency, angle):
    g = f.copy()
    nr,nc = f.shape[:2]
    fp = np.zeros([nr, nc])
    for x in range(nr):
        for y in range(nc):
            fp[x, y] = (-1 ** (x + y)) * f[x,y]

    F = fft2(fp)
    G = F.copy()

    magnitude = np.sum(F) * scale
    for theta in range(0, 360, angle):
        u = int(frequency * np.cos(theta * np.pi / 180) + nr / 2)
        v = int(frequency * np.sin(theta * np.pi / 180) + nc / 2)
        G[u,v]=magnitude

    gp = ifft2(G)
    gp2 = np.zeros([nr,nc])

    for x in range(nr):
        for y in range(nc):
            gp2[x, y] = round((-1 ** (x + y)) * np.real(gp[x, y]), 0)

    g = np.uint8(np.clip(gp2, 0, 255))
    return g

img_noise = periodic(img, 0.5, 75, 30)
img_spec = fourier_sp(img_noise)

images = [img, img_noise, img_spec]
titles = ['original','img with periodic','img with periodic noise spec']
plt.figure(figsize=(15,15))

for i in range(3):
    plt.subplot(1, 3, i + 1), plt.imshow(images[i], 'gray')
    plt.title(titles[i], fontsize = 20, color = 'r')

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



簡答題

（1） 試列舉典型的雜訊模型？

均勻雜訊(Uniform Noise)、高斯雜訊(Gaussian Noise)、指數雜訊(Exponential Deviation)、瑞雷雜訊(Rayleigh Noise)、脈衝雜訊(Impulse Noise)、白雜訊(White　Noise)

（2） 試定義影像失真模型？

影像失真模型是指在數位影像中加入雜訊(Noise)，使其成為成為影像雜訊

（3） 說明訊號雜訊比的意義及在影像處理的功用？

訊號雜訊比是一種影像處理技術，是用來針對影像雜訊分析用的一種方法。