數位影像處理 DIP Homework Chapter 3_3 (100pts)

1. Please use a self-designed Lowpass Gaussian Filter Kernels to cancel the shaded pattern noise of the image, ‘checkerboard1024shaded.tif’. Please describe the your lowpass Gaussian filter kernels, shading noise pattern as Fig. 3.42 (b), final corrected image without shading noise pattern as Fig. 3.42 (c) and print out the source code? (40)

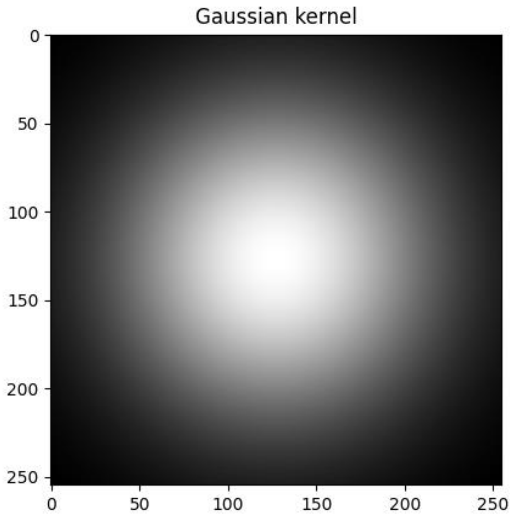
. As it turns out, Gaussian kernels of the form

$$w(s,t) = G(s,t) = Ke^{-\frac{s^2+t^2}{2\sigma^2}} \qquad (3\text{-}45)$$

Code

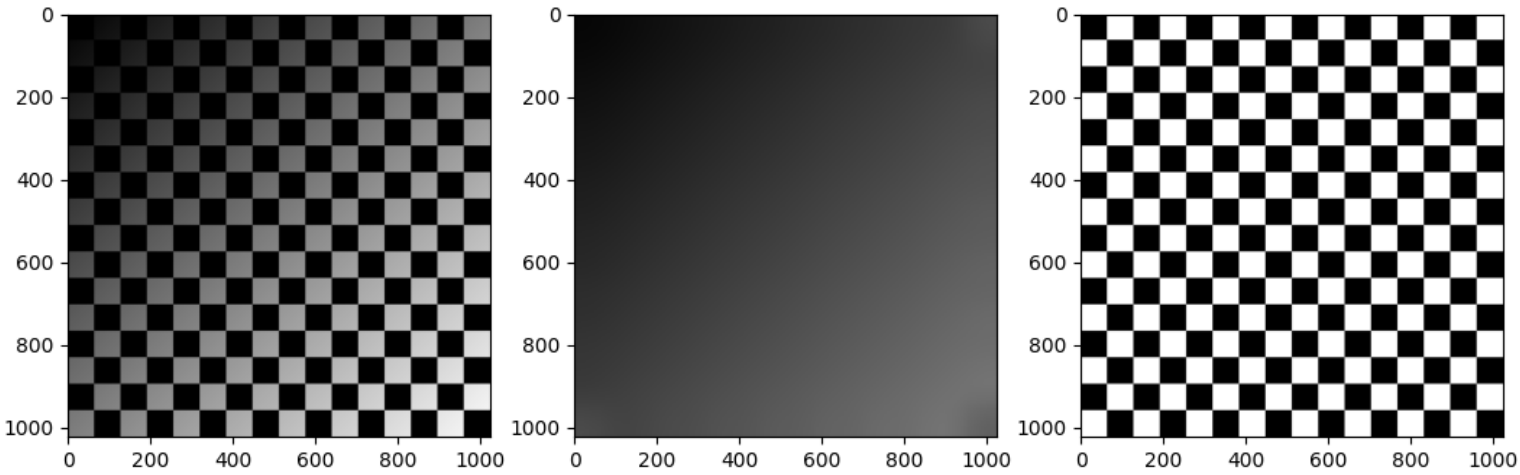
```
#255*255 Gassian filter
ksize = 255
sigma = 64
K = 1

x, y = np.mgrid[-(ksize//2):(ksize//2)+1, -(ksize//2):(ksize//2)+1]
gaussian_kernel = K * (np.exp(- ((x**2+y**2) / (2*sigma**2))) )

## Normalization
gaussian_kernel = gaussian_kernel / gaussian_kernel.sum()
plt.imshow(gaussian_kernel, cmap=cm.gray), plt.title("Gaussian kernel")
plt.show()

## Convolve Gassian Kernel with Image
img = cv2.imread("checkerboard1024-shaded.tif")
blur2 = cv2.filter2D(img, cv2.CV_16S, gaussian_kernel)

result2 = img / blur2
```

Gaussian kernel



```
plt.subplot(131),plt.imshow(img)
plt.subplot(132),plt.imshow(blur2)
plt.subplot(133),plt.imshow(result2)
plt.show()
plt.tight_layout()
```

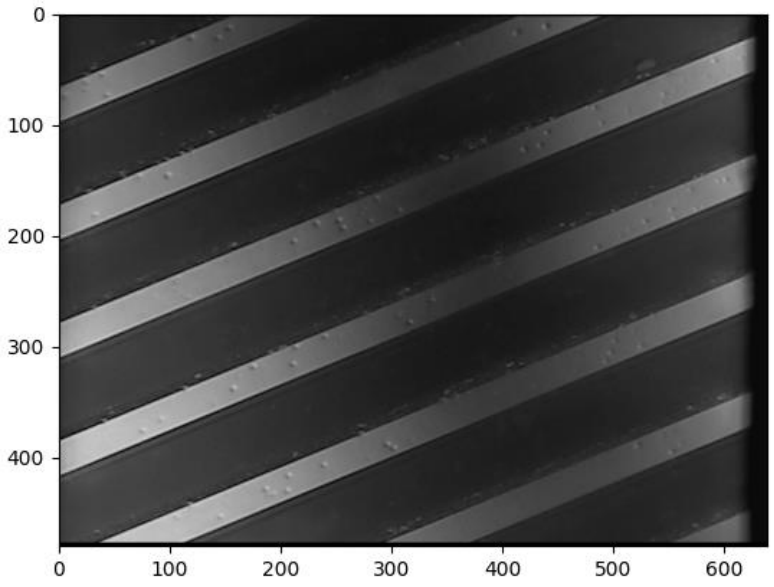
result



2. Repeat (1) steps in the image ‘N1.bmp’ (40)

Original image

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
import matplotlib.cm as cm

img = cv2.imread("N1.bmp")
img = img[:,:,::-1]
#print(img.shape)  #(480, 640, 3)
plt.imshow(img)
plt.show()
```



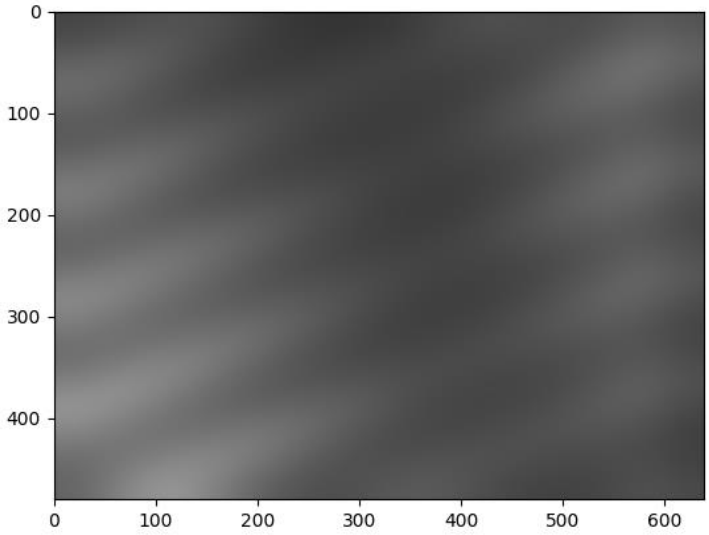
gaussian filter

kernel size : (221 * 161)

sigmaX : 37

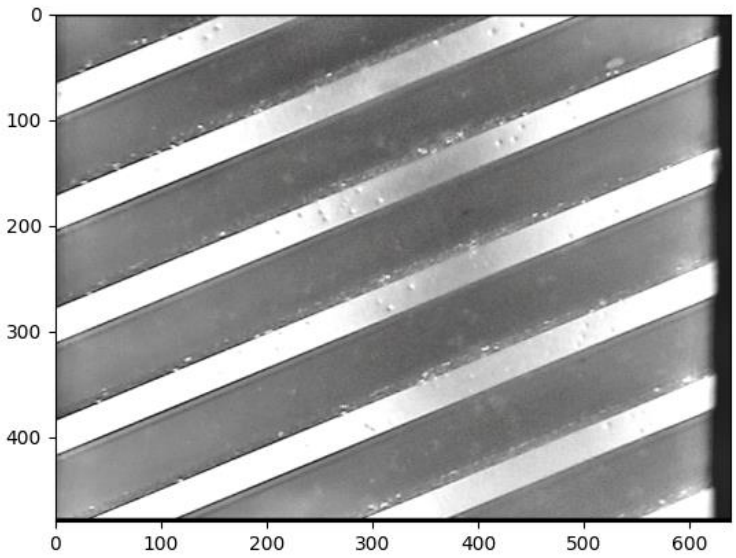
sigmaY : 27

```
blur = cv2.GaussianBlur(img, (221, 161), sigmaX= 37, sigmaY = 27, borderType = cv2.BORDER_REFLECT)  # /6
#blur = cv2.GaussianBlur(img, (221, 161), sigmaX= 55, sigmaY = 40, borderType = cv2.BORDER_REFLECT)  # /4
blur = blur  + 30 # 不加會太亮
print(blur.max())
plt.imshow(blur)
plt.show()
```



result

```
result = img / (blur)
print(f"result.min(), result.max() = {result.min(), result.max()}")
plt.imshow(result)
plt.show()
```



3. Please comment and compare your two self-designed Lowpass Gaussian Filter Kernels? (20)

Gaussian Filter 為一種 low pass filter, 可以用於模糊影像去雜訊。

此次作業花較多時間研究如何選 kernel size 及 sigma，通常因為統計特性，kernel size 最高選用 sigma 的六倍數(也是課本建議的選值)，課本對 sigma 則無特別說明要怎麼選，sigma 越大則出來的模糊效果越大，反之，sigma 較小則因 pixel 值都會越接近 center 值，出來模糊效果較小。令圖片的長寬也有影響，端看設計者希望最終圖片出來效果如何。