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Aim: **Use Gabor filter to highlight edges**

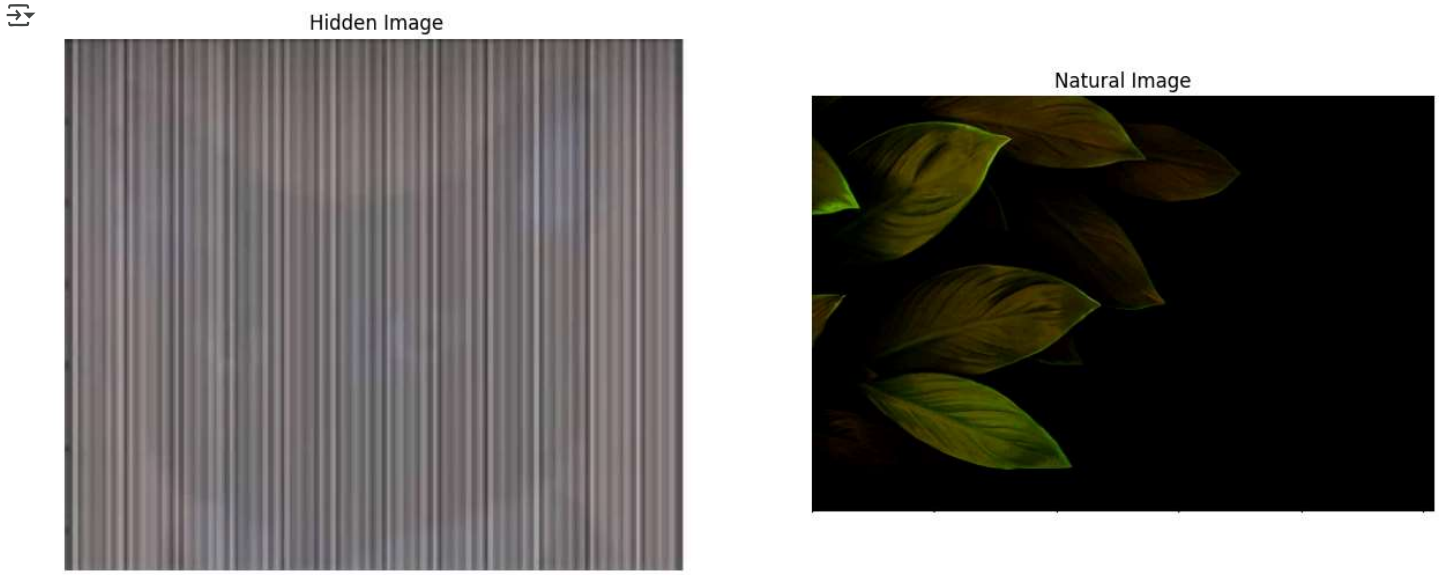
Task1: Generate Gabor filter with a set of parameters

Task2: Change parameter values and observe the effect

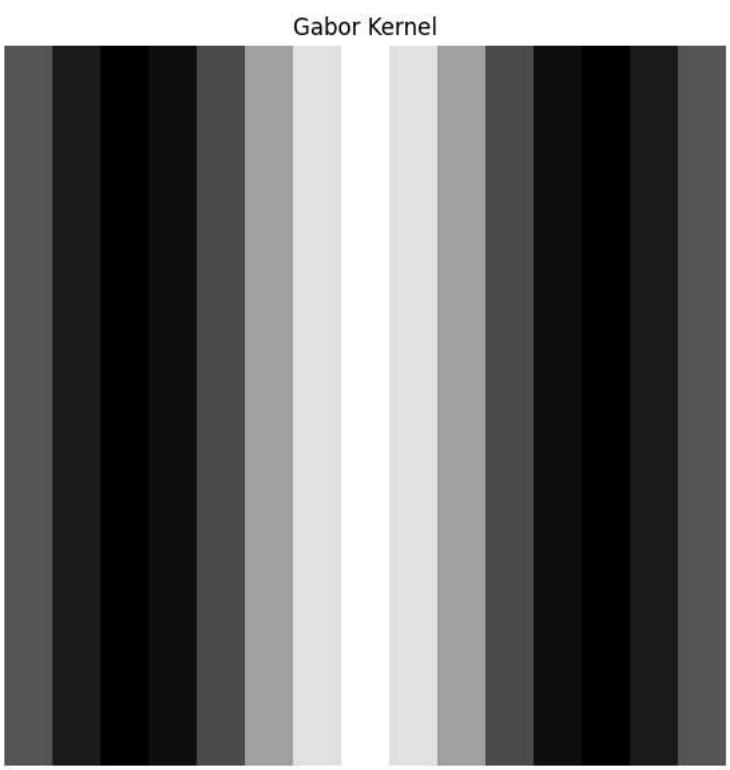
Task3: Apply a gabor filter to extract hidden image from the given image

Task 4: Apply a set of filters to highlight edgesin different directions

```
import cv2 as cv
import numpy as np
import matplotlib.pyplot as plt
import sys
import imutils
from utils import plot_images


img1 = cv.imread('hidden_image.JPG')
img2 = cv.imread('natural.png')

img1 = cv.cvtColor(img1, cv.COLOR_BGR2RGB)
img2 = cv.cvtColor(img2, cv.COLOR_BGR2RGB)

plot_images([img1, img2], ['Hidden Image', 'Natural Image'])
```



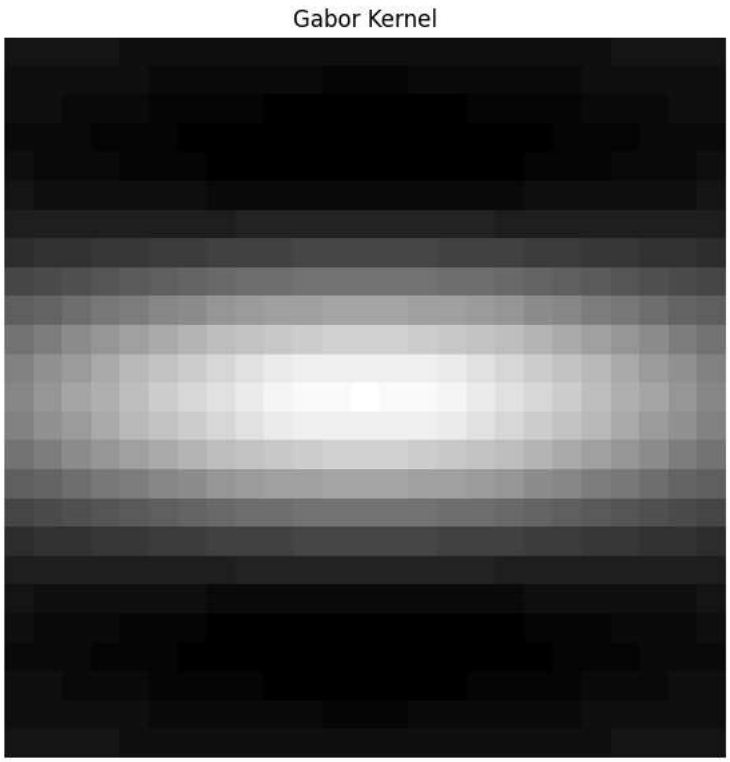

```
size = 15
theta = 0
psy = 0
sigma = 10
lamda = 10
gamma = 0


gabor = cv.getGaborKernel((size, size), sigma, theta, lamda, gamma, psy)

plot_images([gabor], ['Gabor Kernel'])
```



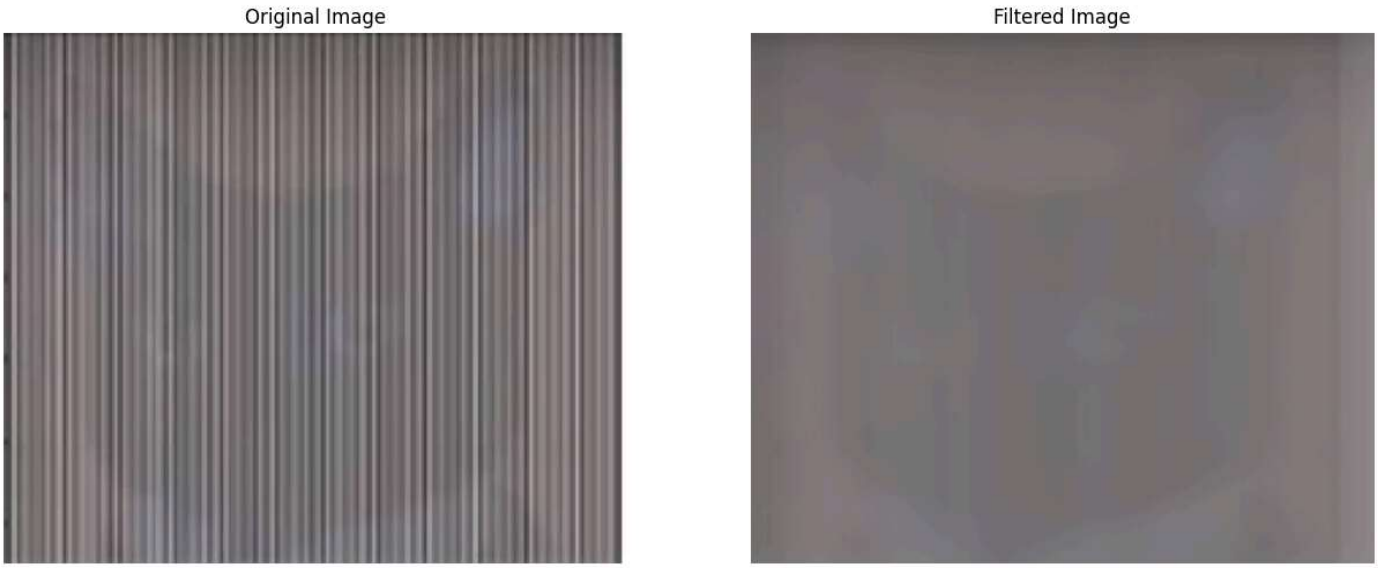
Conclusion

- If wavelength (`lambda`) is reduced from 10 to 2, the number of white stripes increase. This is becasue more number of peaks of sine wave of gabor filter increases.
- This filter is usefull to highlight more than one edge in the filter size.
- If the `theta` is changed from 0 to PI/4, the direction of the stripes changes accordingly. This is usefull for highlighting the edges in different directions.
- If the `gamma` value is changed from `0` to `0.2` or `0.8` the height of the stripes decreases and the thickness increases proportionally. This is usefull to identify edges of different lengths
- If the `sigma` value is increased from 2 to 10 the number of white stripes increase from 1 to the larger number.

```
size = 25
theta = np.pi/2
psy = 0
sigma = 5
lamda = 25
gamma = 0.5
gabor = cv.getGaborKernel((size, size), sigma, theta, lamda, gamma, psy)

gabor = gabor/gabor.sum()
plot_images([gabor], ['Gabor Kernel'])
```




```
img1_f = cv.filter2D(img1,-1, gabor)
plot_images([img1, img1_f], ['Original Image', 'Filtered Image'])
```

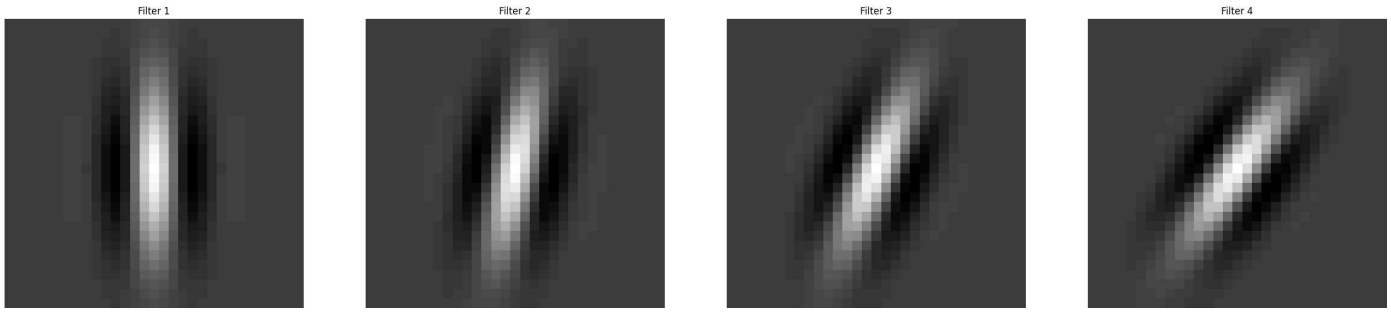


Conclusion

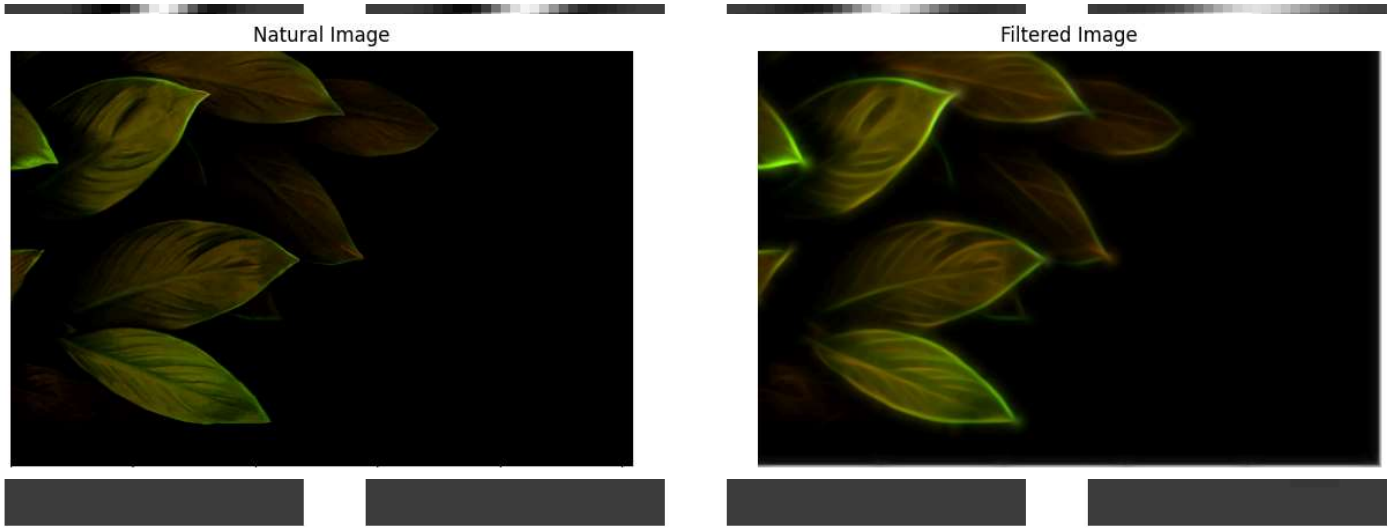
- A gabor filter is constructed to filter the image with vertical stripes
- The Filter image has vertical stripes with lesser intensity. To reduce the intensity further, the `sigma` value is increased from `2` to `5`

```
filters = []
num_filters = 16
size = 31
psy = 0
sigma = 3
lamda = 10
```

```
    gamma = 0.5

    for theta in np.arange(0, np.pi, np.pi/num_filters):
        gabor = cv.getGaborKernel((size, size), sigma, theta, lamda, gamma, psy)
        gabor = gabor/gabor.sum()
        filters.append(gabor)



    plot_images(filters, [f'Filter {i+1}' for i in range(num_filters)])
```




```
img_h = np.zeros_like(img2)

for filter in filters:
    temp = cv.filter2D(img2, -1, filter)
    img_h = np.maximum(img_h, temp)

plot_images([img2, img_h], ['Natural Image', 'Filtered Image'])
```



Conclusion

- 16 Gabor filters are constructed to highlight the edges of the image `natural.png`
- These filters have the same parameters except the change in angle (`theta`)