# Digital Image Processing

## Title: Morphological Image Processing

**Tools Used:** Python

**Procedure:** Open IDLE and perform the following tasks

```
import cv2
import numpy as np

img = cv2.imread('j.png',0)
kernel = np.ones((5,5),np.uint8)
erosion = cv2.erode(img,kernel,iterations = 1)


dilation = cv2.dilate(img, kernel, iterations = 1)
opening = cv2.morphologyEx(img, cv2.MORPH_OPEN, kernel)
closing = cv2.morphologyEx(img, cv2.MORPH_CLOSE, kernel)


# Rectangular Kernel
>>> cv2.getStructuringElement(cv2.MORPH_RECT,(5,5))
array([[1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1]], dtype=uint8)

# Elliptical Kernel
>>> cv2.getStructuringElement(cv2.MORPH_ELLIPSE,(5,5))
array([[0, 0, 1, 0, 0],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [0, 0, 1, 0, 0]], dtype=uint8)

# Cross-shaped Kernel
>>> cv2.getStructuringElement(cv2.MORPH_CROSS,(5,5))
array([[0, 0, 1, 0, 0],
       [0, 0, 1, 0, 0],
       [1, 1, 1, 1, 1],
       [0, 0, 1, 0, 0],
       [0, 0, 1, 0, 0]], dtype=uint8)
```



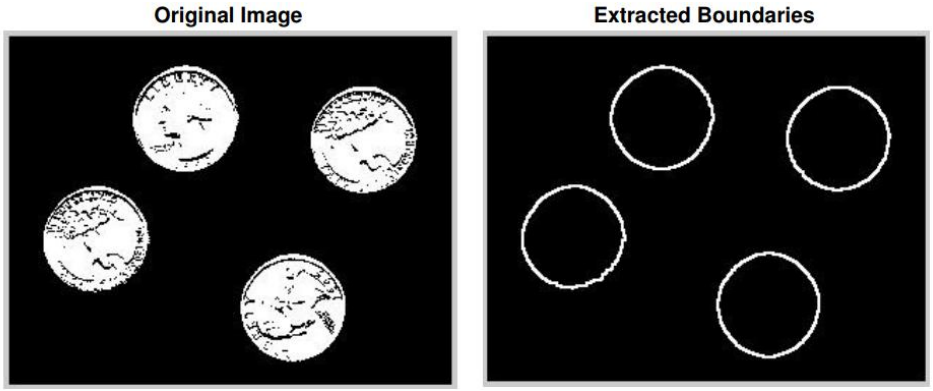
**Task 1**

Read the image ‘eight.tif’. Write a function named ‘myMorphology’ to extract the boundaries of coins from the read image.

[HINTS]:

**1. First close the image then perform erosion.**

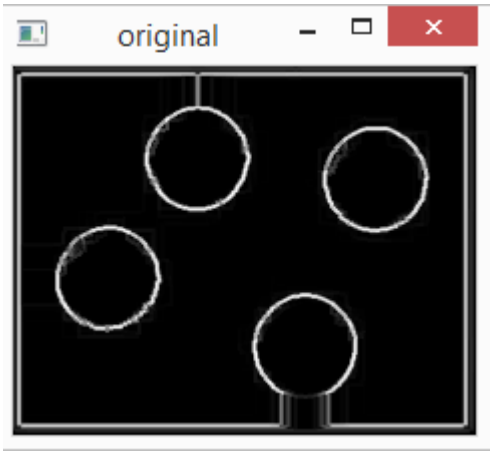
**2. Take the difference of two images to find boundaries.**




**Code:**

```
import cv2 as cv
import numpy as np
image=cv.imread('coins.JPG',0)
kernel=np.ones((15,15), np.uint8)
closing = cv.morphologyEx(image,cv.MORPH_CLOSE,kernel)
kernel=cv.getStructuringElement(cv.MORPH_ELLIPSE,(5,5))
erosion=cv.erode(closing,kernel,iterations=1)
boundaryImage=closing-erosion
cv.imshow("original",boundaryImage)
cv.waitKey(0)
cv.destroyAllWindows()
```

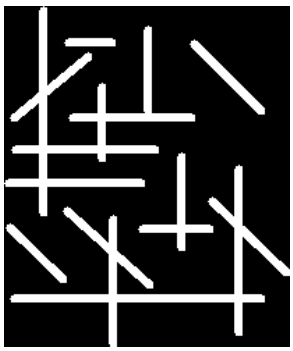
**Output:**




**Task 2**

Read the image ‘lines.png’. Use the opening operator to separate horizontal and vertical lines.

[HINTS]: Experiment with structuring elements of sizes 7x3, 9x3, 11x3 etc. to remove horizontal lines. Use the transpose of these structuring elements to eliminate vertical lines.

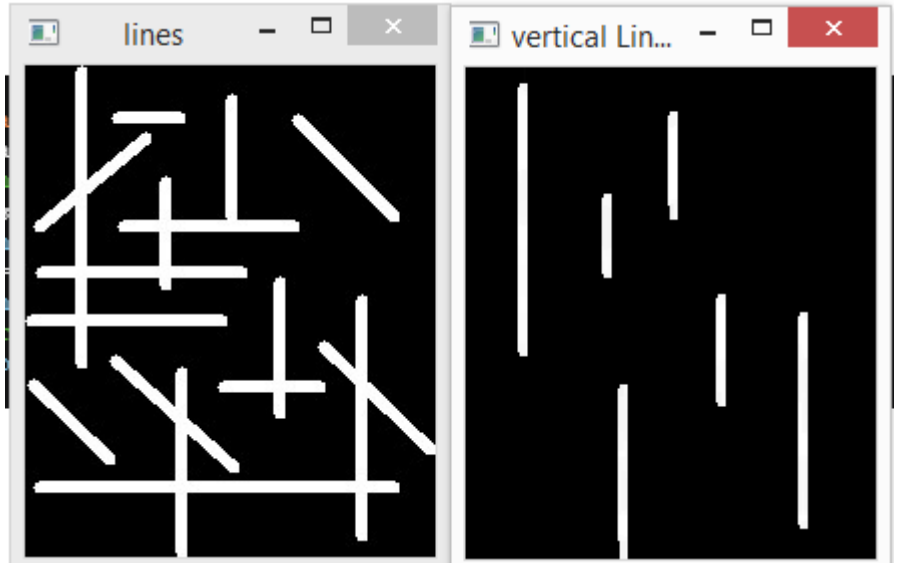


**Code:**

```
import cv2 as cv
import numpy as np
image=cv.imread('lines.jpg',0)
cv.imshow("lines",image)
kernel=np.ones((15,2),np.uint8)
#kernal1=np.ones(3,13)
verticalLines=cv.erode(image,kernel,iterations=1)
#horizontalLines=cv.erode(image,kernal1,iterations=1)
cv.imshow("vertical Lines",verticalLines)
#cv.imshow("horizontal Lines",horizontalLines)
cv.waitKey(0)
```

**Output:**

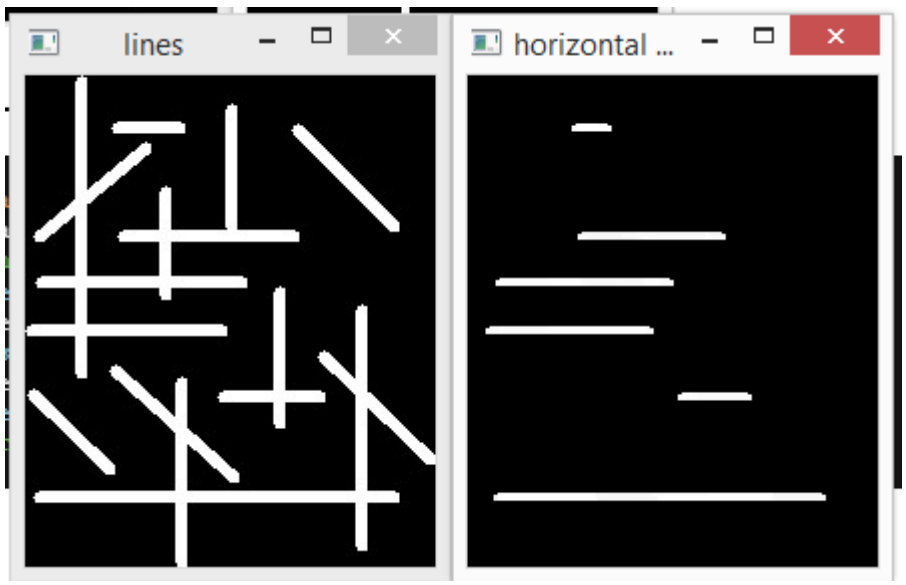
**For vertical lines:**




**For horizontal lines:**

```
import cv2 as cv
import numpy as np
image=cv.imread('lines.jpg',0)
cv.imshow("lines",image)
#kernel=np.ones((15,2),np.uint8)
kernal1=np.ones((3,17),np.uint8)
#verticalLines=cv.erode(image,kernel,iterations=1)
horizontalLines=cv.erode(image,kernal1,iterations=1)
#cv.imshow("vertical Lines",verticalLines)
cv.imshow("horizontal Lines",horizontalLines)
cv.waitKey(0)
```

**Output:**



**Task 3**

You are provided with a printed document image (Image.png). You need to find the approximate number of lines and words in the given image.
Hints:

- Binarize the image
- dilation with a horizontal structuring element to merge all characters in a line.
- Apply connected component labeling algorithm (connected component) to find the number of lines.
- Use a smaller horizontal structuring element to merge characters in a word together and again use the CC labeling algorithm to find the number of words in the image.

**Code:**

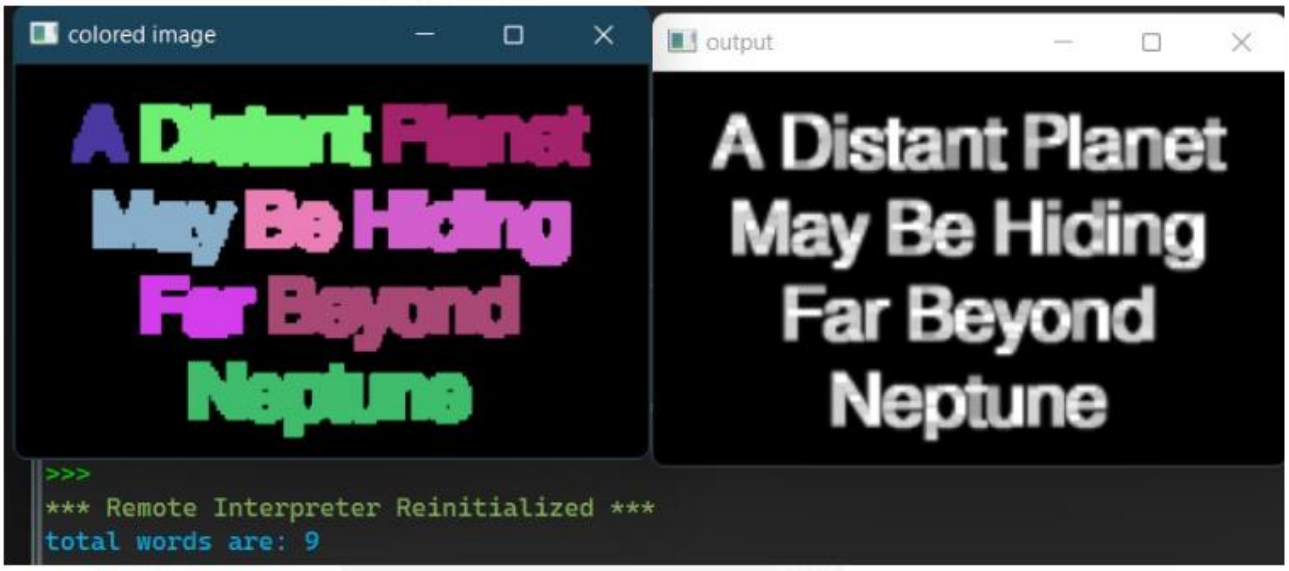
```
import numpy as np
import cv2

img = cv2.imread('text.png',0)
kernel=np.ones((3,15),np.uint8)
lines=cv2.erode(img,kernel,iterations=1)

totalLabels,labels,stats,centroids=cv2.connectedComponentsWithStats(~lines,8,cv2.
CV_32S)
print("total lines are:",totalLabels-1)

colors=np.random.randint(0,255,size=(totalLabels,3),dtype=np.uint8)
colors[0]=[0,0,0]
colored_components=colors[labels]

cv2.imshow('output',~lines)
cv2.imshow('colored image',colored_components)
cv2.waitKey(0)
```

**Output:**

**Code:**

```
import numpy as np
import cv2

img = cv2.imread('text.png',0)
kernel=np.ones((3,5),np.uint8)
words=cv2.erode(img,kernel,iterations=1)

totalLabels,labels,stats,centroids=cv2.connectedComponentsWithStats(~words,8,cv2.
CV_32S)
print("total words are:",totalLabels-1)

colors=np.random.randint(0,255,size=(totalLabels,3),dtype=np.uint8)
colors[0]=[0,0,0]
colored_components=colors[labels]

cv2.imshow('output',~words )
cv2.imshow('colored image',colored_components)
cv2.waitKey(0)
```

**Output:**




**Task 4**

Create an image through paint, snipping or even your mobile. The image should have a white background and your name written in it as foreground. Detect the text in the image and make a bounding box around it is using morphological operations.

**Code:**

```
import cv2
# Read image from which text needs to be extracted
img = cv2.imread("my_image.JPG")
```

```
# Convert the image to gray scale
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

# Performing binarization through threshold
ret, thresh1 = cv2.threshold(gray, 0, 255, cv2.THRESH_OTSU |
cv2.THRESH_BINARY_INV)

# Specify structure shape and kernel size.
# Kernel size increases or decreases the area
# of the rectangle to be detected.
# A smaller value like (10, 10) will detect
# each word instead of a sentence.
rect_kernel = cv2.getStructuringElement(cv2.MORPH_RECT, (18, 18))

# Applying dilation on the threshold image
dilation = cv2.dilate(thresh1, rect_kernel, iterations=1)

# Finding contours
contours, hierarchy = cv2.findContours(dilation, cv2.RETR_EXTERNAL,
                                       cv2.CHAIN_APPROX_NONE)

# Creating a copy of image
im2 = img.copy()  # Why did we use the copy method instead of just assigning like
im2 = img. Any idea?
for cnt in contours:
    x, y, w, h = cv2.boundingRect(cnt)

    # Drawing a rectangle on copied image
    rect = cv2.rectangle(im2, (x, y), (x + w, y + h), (0, 255, 0), 2)

    # Cropping the text block for giving input to OCR
    cropped = im2[y:y + h, x:x + w]

cv2.imshow('output', im2)
cv2.waitKey(0)
```

**output:**


output
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