Assignment 03

Index No: 190108X

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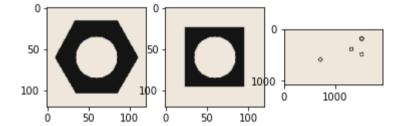
GitHub link: https://github.com/ChathurangaMMP/EN2550_Image_Processing_Exercises/tree/master/Assignment%203

Connected Component Analysis

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

hexnut_template = cv.imread('hexnut_template.png', cv.IMREAD_COLOR)
squarenut_template = cv.imread('squarenut_template.png', cv.IMREAD_COLOR)
conveyor_f100 = cv.imread('conveyor_f100.png', cv.IMREAD_COLOR)

fig, ax = plt. subplots(1,3)
ax[0].imshow(cv.cvtColor(hexnut_template, cv.COLOR_RGB2BGR))
ax[1].imshow(cv.cvtColor(squarenut_template, cv.COLOR_RGB2BGR))
ax[2].imshow(cv.cvtColor(conveyor_f100, cv.COLOR_RGB2BGR))
plt.show()
```



Otsu's thresholding

```
In [2]:
    hexnut_gray = cv.cvtColor(hexnut_template, cv.COLOR_BGR2GRAY)
    squarenut_gray=cv.cvtColor(squarenut_template, cv.COLOR_BGR2GRAY)
    conveyor_gray=cv.cvtColor(conveyor_f100, cv.COLOR_BGR2GRAY)

    th1,hext = cv.threshold(hexnut_gray,0,255,cv.THRESH_BINARY+cv.THRESH_OTSU)
    th2,squaret = cv.threshold(squarenut_gray,0,255,cv.THRESH_BINARY+cv.THRESH_OTSU)
    th3,belt = cv.threshold(conveyor_gray,0,255,cv.THRESH_BINARY+cv.THRESH_OTSU)

print('Threshold value for hexnut template:',th1)
    print('Threshold value for squarenut template:',th2)
    print('Threshold value for conveyor belt:',th3)
```

Threshold value for hexnut template: 20.0 Threshold value for squarenut template: 20.0 Threshold value for conveyor belt: 20.0

```
In [3]:
    fig,ax=plt.subplots(1,3)
    ax[0].imshow(hext)
    ax[0].axis('off')
    ax[1].imshow(squaret)
    ax[1].axis('off')
    ax[2].imshow(belt)
    ax[2].axis('off')
    plt.show()
```



Morphological closing

```
kernel = np.ones((3,3),np.uint8)
hex_closing = cv.morphologyEx(hext, cv.MORPH_CLOSE, kernel)
square_closing = cv.morphologyEx(squaret, cv.MORPH_CLOSE, kernel)
belt_closing = cv.morphologyEx(belt, cv.MORPH_CLOSE, kernel)
```

```
fig,ax=plt.subplots(1,3)
ax[0].imshow(hex_closing)
ax[0].axis('off')
ax[1].imshow(square_closing)
ax[1].axis('off')
ax[2].imshow(belt_closing)
ax[2].axis('off')
plt.show()
```



Connected components analysis for Hexnut template

```
In [6]:
         connectivity = 4
         hex_num_labels,hex_labels,hex_stat,hex_cent = cv.connectedComponentsWithStats(hext, connectivity, cv.CV_32S)
         print('There are {} connected components in Hexnut template.'.format(hex_num_labels))
         print('Statistics:')
         print(hex_stat)
         print()
         print('Centroids:')
         print(hex_cent)
        There are 3 connected components in Hexnut template.
        Statistics:
        [[ 10 16 101 88 4724]
                 0 120 120 7715]
        [ 0
         [ 35 35 51 51 1961]]
        Centroids:
        [[59.83361558 59.22290432]
         [59.16863253 59.54257939]
```

Connected components analysis for Squarenut template

```
In [7]:
        connectivity = 4
        sqr_num_labels,sqr_labels,sqr_stat,sqr_cent = cv.connectedComponentsWithStats(squaret, connectivity, cv.CV_32S)
        print('There are {} connected components in Squarenut template.'.format(sqr_num_labels))
        print('Statistics:')
        print(sqr_stat)
        print()
        print('Centroids:')
        print(sqr_cent)
        There are 3 connected components in Squarenut template.
        Statistics:
        [[ 24 24 72 72 3223]
        [ 0
                0 120 120 9216]
        [ 35 35 51 51 1961]]
        Centroids:
        [[59.19578033 59.19578033]
                     59.5
        [59.5
                     60.
                               ]]
```

Connected components analysis for Conveyor belt

```
In [8]:
         connectivity = 4
         belt_num_labels,belt_labels,belt_stat,belt_cent = cv.connectedComponentsWithStats(belt, connectivity, cv.CV_32S)
         print('There are {} connected components in Conveyor belt.'.format(belt_num_labels))
         print('Statistics:')
         print(belt_stat)
         print()
         print('Centroids:')
         print(belt_cent)
        There are 6 connected components in Conveyor belt.
        Statistics:
              650
                      150
                              896
                                      501 13938]
        [[
                                      1080 2051818]
                0
                        0
                             1920
             1475
                      175
                               51
                                        51
                                              1961]
             1275
                      375
                               51
                                        51
                                              1961]
             1475
                      475
                               51
                                        51
                                              1961]
                      575
                               51
              675
                                              1961]]
        Centroids:
        [[1274.92050509 400.1106328]
         [ 956.24678115
                         540.8845999 ]
         [1500.
                         200.
         [1300.
                         400.
         [1500.
                         500.
         [ 700.
                         600.
                                      ]]
         fig,ax=plt.subplots(1,3)
```

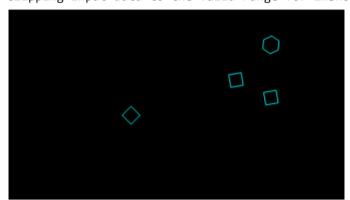
```
In [9]: fig,ax=plt.subplots(1,3)
ax[0].imshow(hex_labels)
ax[0].axis('off')
ax[1].imshow(sqr_labels)
ax[1].axis('off')
ax[2].imshow(belt_labels)
ax[2].axis('off')
plt.show()
```



Contour analysis

```
In [10]: black_img=np.zeros(conveyor_f100.shape)
    contours, hierarchy = cv.findContours(belt, cv.RETR_TREE, cv.CHAIN_APPROX_SIMPLE)
    cnt = [contours[i] for i in range(1,9,2)]
    cv.drawContours(black_img, cnt, -1, (0,255,150), 3)
    plt.imshow(black_img)
    plt.axis('off')
    plt.show()
```

Clipping input data to the valid range for imshow with RGB data ([0..1] for floats or [0..255] for integers).



Detecting Objects on a Synthetic Conveyor

```
In [11]:
          cv.namedWindow('Conveyor', cv.WINDOW_NORMAL)
          cap = cv.VideoCapture('conveyor.mp4')
          f = 0
          frames=[]
          frame = []
          while cap.isOpened():
              ret, frame = cap.read()
              frames.append(frame)
              if not ret:
                  print("Can't receive frame (stream end?). Exiting.")
              f += 1
              text = 'Frame:' + str(f)
              cv.putText(frame,text , (100, 100), cv.FONT_HERSHEY_COMPLEX, 1, (0,250,0), 1, cv.LINE_AA)
              cv.imshow('Conveyor', frame)
              if cv.waitKey(1) == ord('q'):
                  break
          cap.release()
          cv.destroyAllWindows()
```

Can't receive frame (stream end?). Exiting.

Number of matching hexagonal nuts = 1

```
In [12]: # Count the number of matching hexagonal nuts in conveyor_f100.png

total_matches=0
for i in range(len(contours)):
    ret = cv.matchShapes(contours[i],contours[7],1,0.0)
    if ret==0.0:
        total_matches+=1
print('Number of matching hexagonal nuts = ',total_matches)
```

```
if temp==0:
          detected.append(cnt)
          total_nuts+=1
          frame_total+=1

print('Number of matching hexagonal nuts in frame {} is {}'.format(frame_count+1,frame_total))
print('Total number of matching hexagonal nuts upto frame {} is {}'.format(frame_count+1,total_nuts))
frame_count+=1
in_text= 'In frame : '+str(frame_total)
upto_text='Upto frame : '+str(total_nuts)
cv.putText(img=frm, text=in_text, org=(50, 70), fontFace=cv.FONT_HERSHEY_TRIPLEX, fontScale=2, color=(0, 0, 255),thickness=1)
cv.putText(img=frm, text=upto_text, org=(50, 150), fontFace=cv.FONT_HERSHEY_TRIPLEX, fontScale=2, color=(0, 0, 255),thickness=
```

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Total number of matching hexagonal nuts upto frame 380 is 4
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In [14]: # Writing the video
frame_array = frames[:-1]
shape = (1080, 1920, 3)

# Your code here

out = cv.VideoWriter('./conveyor_result_190108X.mp4',cv.VideoWriter_fourcc(*'h264'), 30, (shape[1], shape[0]))

for i in range(len(frame_array)):
    cv.imshow('Frame', frame_array[i])
    if cv.waitKey(1) == ord('q'):
        break
    out.write(frame_array[i])

out.release()
cv.destroyAllWindows()
```