EN2550: Assignment 03 on Object Counting on a Conveyor Belt

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Connected Component Analysis

In [ ]:

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

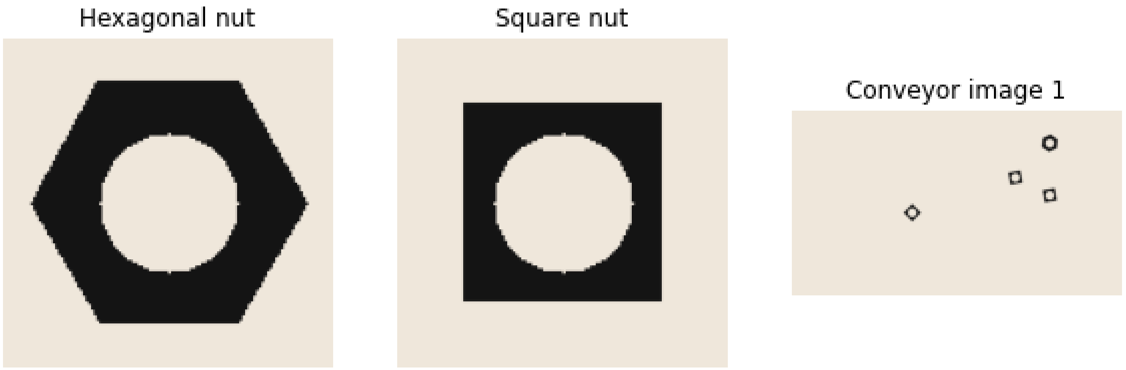
Importing images

In [ ]:

```
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)

hexnut_template = cv.cvtColor(hexnut_template, cv.COLOR_BGR2RGB)
squarenut_template = cv.cvtColor(squarenut_template, cv.COLOR_BGR2RGB)
conveyor_f100 = cv.cvtColor(conveyor_f100, cv.COLOR_BGR2RGB)

fig, ax = plt. subplots(1,3, figsize=(10, 10))
ax[0].imshow(hexnut_template)
ax[0].set_title("Hexagonal nut")
ax[0].axis("off")
ax[1].imshow(squarenut_template)
ax[1].set_title("Square nut")
ax[1].axis("off")
ax[2].imshow(conveyor_f100)
ax[2].set_title("Conveyor image 1")
ax[2].axis("off")
plt.show()
```



Thresholding with otsu algorithm

In [ ]:

```
hexnut_template_gray = cv.cvtColor(hexnut_template, cv.COLOR_RGB2GRAY)
squarenut_template_gray = cv.cvtColor(squarenut_template, cv.COLOR_RGB2GRAY)
conveyor_f100_gray = cv.cvtColor(conveyor_f100, cv.COLOR_RGB2GRAY)
```

```
ret0,hexnut_template_gray = cv.threshold(hexnut_template_gray,0,255,cv.THRESH_BINARY_I
ret1,squarenut_template_gray = cv.threshold(squarenut_template_gray,0,255,cv.THRESH_BI
ret2,conveyor_f100_gray = cv.threshold(conveyor_f100_gray,0,255,cv.THRESH_BINARY_INV+c

print("Threshold for hexagonal nut template:", ret0)
print("Threshold for square nut template:", ret1)
print("Threshold for conveyor:", ret2)
```

```
Threshold for hexagonal nut template: 20.0
Threshold for square nut template: 20.0
Threshold for conveyor: 20.0
```

Marphological closing

In [ ]:

```
kernel = np.ones((3,3), np.uint8)

hexnut_template_gray = cv.morphologyEx(hexnut_template_gray, cv.MORPH_CLOSE, kernel)
squarenut_template_gray = cv.morphologyEx(squarenut_template_gray, cv.MORPH_CLOSE, ker
conveyor_f100_gray = cv.morphologyEx(conveyor_f100_gray, cv.MORPH_CLOSE, kernel)
```

In [ ]:

```
def create_table(retval, stats, centroids):
    if retval == 2: print("Only a single component is detected")
    else: print("There are", retval-1, "components are detected excluding the backgrou

    table = {
                'Name': ["Component" + str(i) for i in range(1, retval)],
                "X coordinate": stats[1:, 0],
                "Y coordinate": stats[1:, 1],
                "Length in X direction": stats[1:, 2],
                "Length in y direction": stats[1:, 3],
                "Area": stats[1:, 4],
                "Centroid": ["({}, {})".format(round(center[0], 3), round(center[1], 3
            }
    df = pd.DataFrame(table)
    return df
```

Connected component analysis for hexagonal nut

In [ ]:

```
retval, labels, stats, centroids = cv.connectedComponentsWithStats(hexnut_template_gra
colormapped = cv.applyColorMap((labels/np.amax(labels)*255).astype('uint8'), cv.COLORM

create_table(retval, stats, centroids)
```

```
Only a single component is detected
```

Out[ ]:

	Name	X coordinate	Y coordinate	Length in X direction	Length in y direction	Area	Centroid
0	Component1	10	16	101	88	4728	(59.834, 59.224)

Connected component analysis for square nut

In [ ]:

```
retval, labels, stats, centroids = cv.connectedComponentsWithStats(squarenut_template_
colormapped = cv.applyColorMap((labels/np.amax(labels)*255).astype('uint8'), cv.COLORM

create_table(retval, stats, centroids)
```

```
Only a single component is detected
```

Out[ ]:

	Name	X coordinate	Y coordinate	Length in X direction	Length in y direction	Area	Centroid
0	Component1	24	24	72	72	3227	(59.197, 59.197)

Connected component analysis for conveyor image 1

In [ ]:

```
retval, labels, stats, centroids = cv.connectedComponentsWithStats(conveyor_f100_gray)
colormapped = cv.applyColorMap((labels/np.amax(labels)*255).astype('uint8'), cv.COLORM

create_table(retval, stats, centroids)
```

```
There are 4 components are detected excluding the background.
```

Out[ ]:

	Name	X coordinate	Y coordinate	Length in X direction	Length in y direction	Area	Centroid
0	Component1	1454	150	92	100	4636	(1499.242, 199.285)
1	Component2	1259	359	82	82	3087	(1299.183, 399.183)
2	Component3	1459	459	82	82	3087	(1499.183, 499.183)
3	Component4	650	550	101	101	3144	(700.0, 600.0)

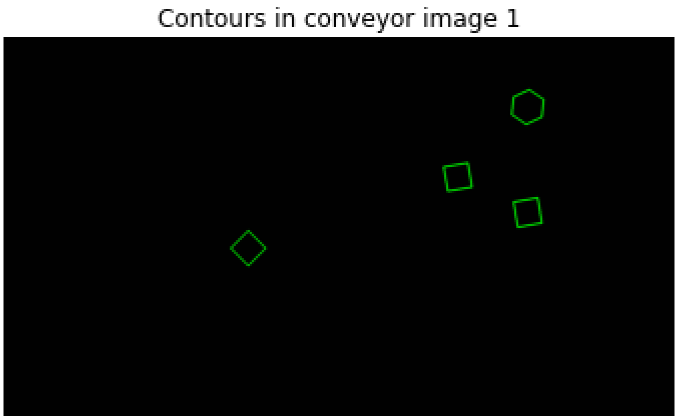
Contour detection

In [ ]:

```
conveyor_f100_shape = np.ones_like(conveyor_f100)

contours, hierarchy = cv.findContours(conveyor_f100_gray, cv.RETR_EXTERNAL, cv.CHAIN_A
cv.drawContours(conveyor_f100_shape, contours, -1, (0,255,0), 3)

plt.imshow(conveyor_f100_shape)
plt.title("Contours in conveyor image 1")
plt.axis('off')
plt.show()
```



Detecting Objects on a Synthetic Conveyor