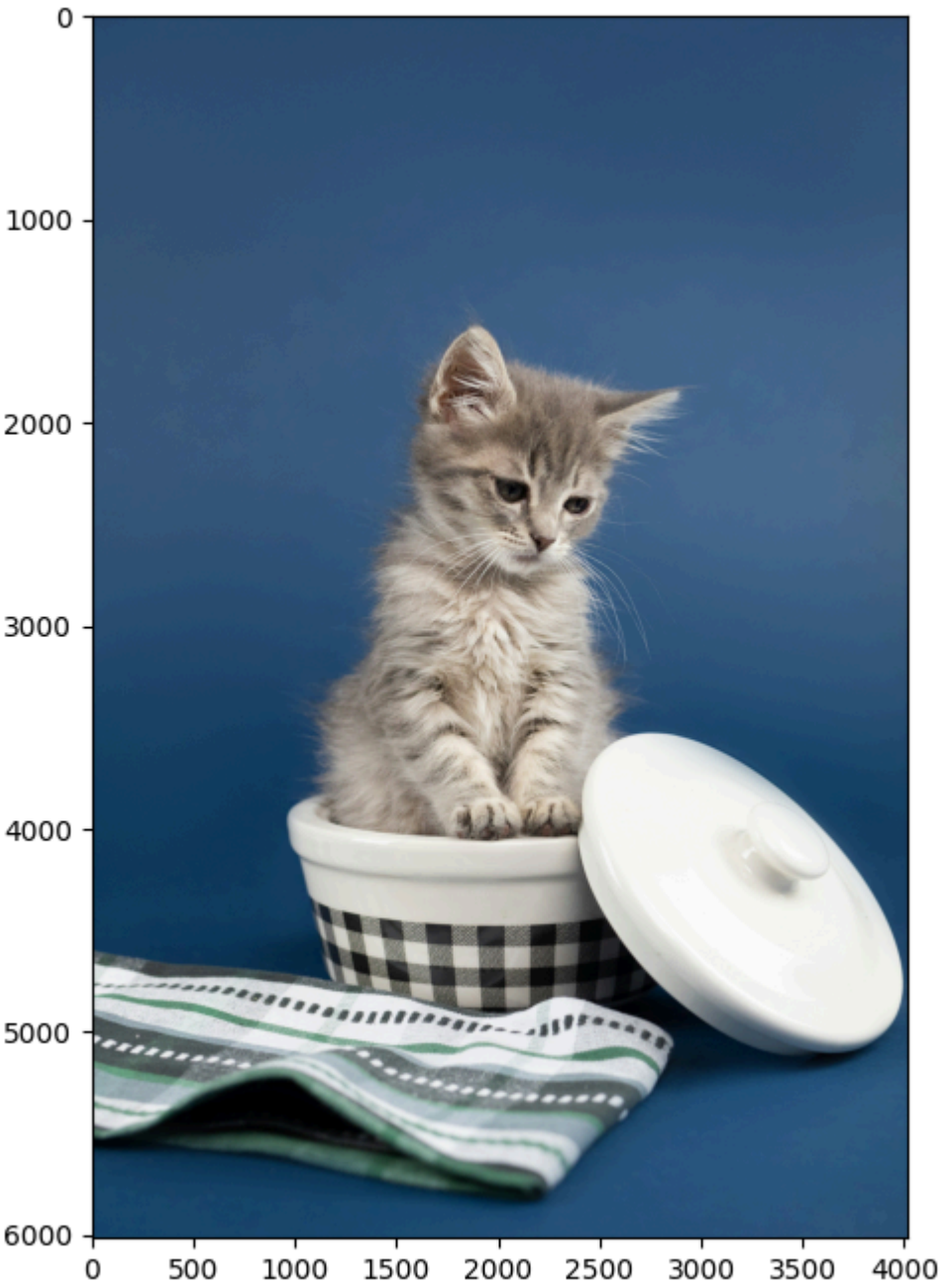
In [ ]:
```
import cv2 as cv
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image
from imgtools import *
```

In [ ]:
```
image_path ='meo_con.jpg'
img = cv.imread(image_path)
h,w,channels = img.shape
print(f'Number of rows(height): ',h)
print(f'Number of column(weight): ',w)
print(f'Number of channels: ',channels)
```

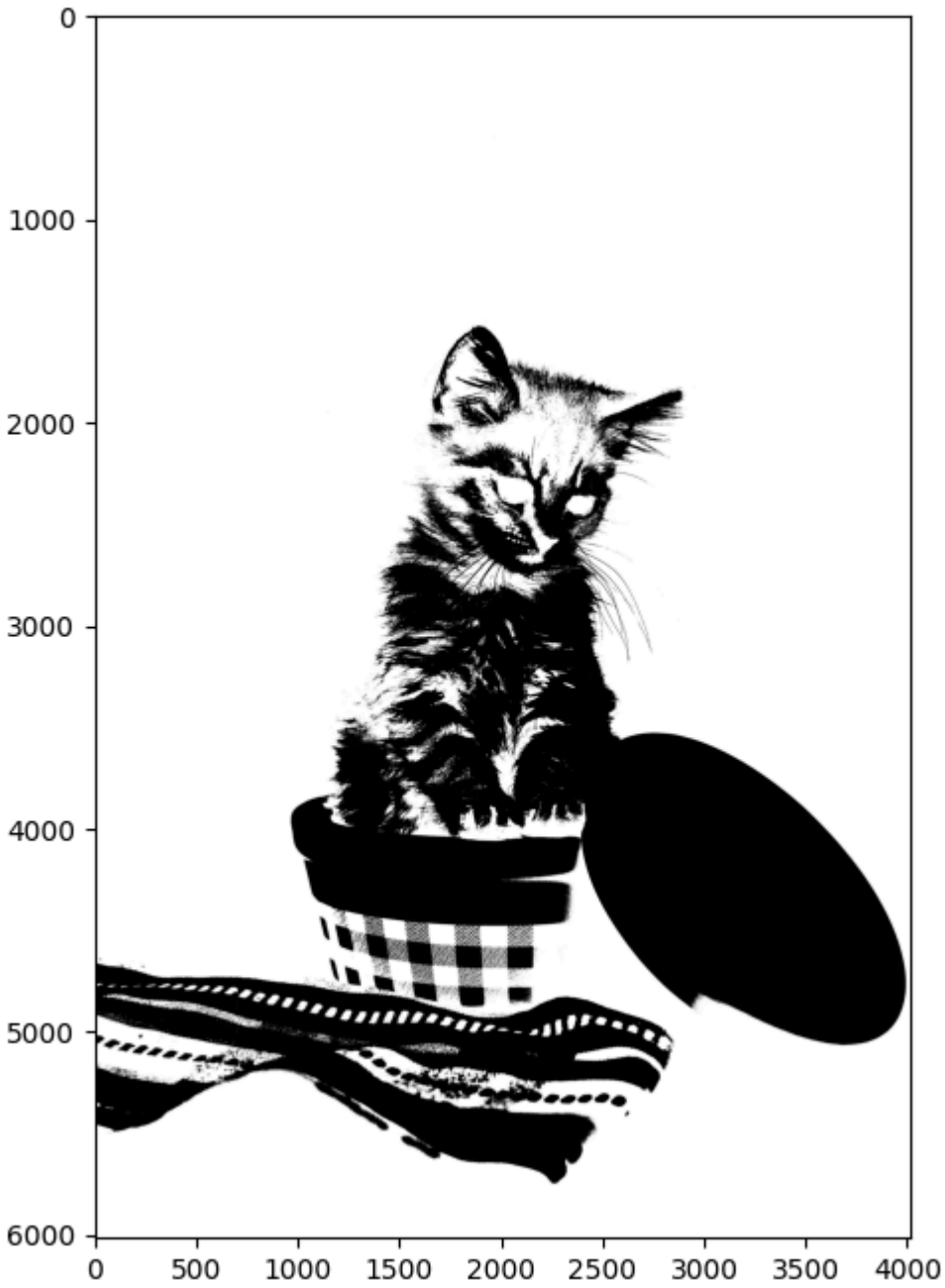
```
Number of rows(height):  6016
Number of column(weight):  4016
Number of channels:  3
```

In [ ]:
```
img_rgb = cv.cvtColor(img, cv.COLOR_BGR2RGB)
plt.figure(figsize=(12,8))
plt.imshow(img_rgb)
plt.show()
```



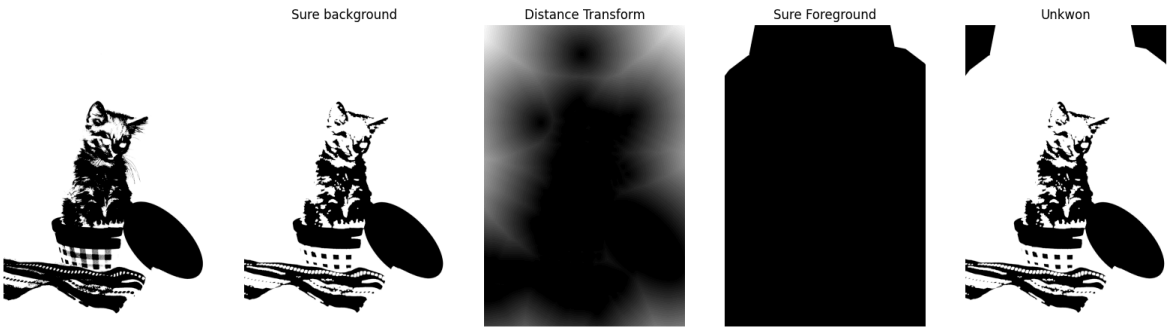
WATERSHED ALGORITHM

In [ ]:
```
img_gray = cv.cvtColor(img, cv.COLOR_BGR2GRAY)
# Using the thresholding to create the distance photo area and feature
ret, bin_img = cv.threshold(img_gray, 127, 255, cv.THRESH_BINARY_INV+cv.T
plt.figure(figsize=(12,8))
plt.imshow(cv.cvtColor(bin_img, cv.COLOR_BGR2RGB))
plt.show()
```

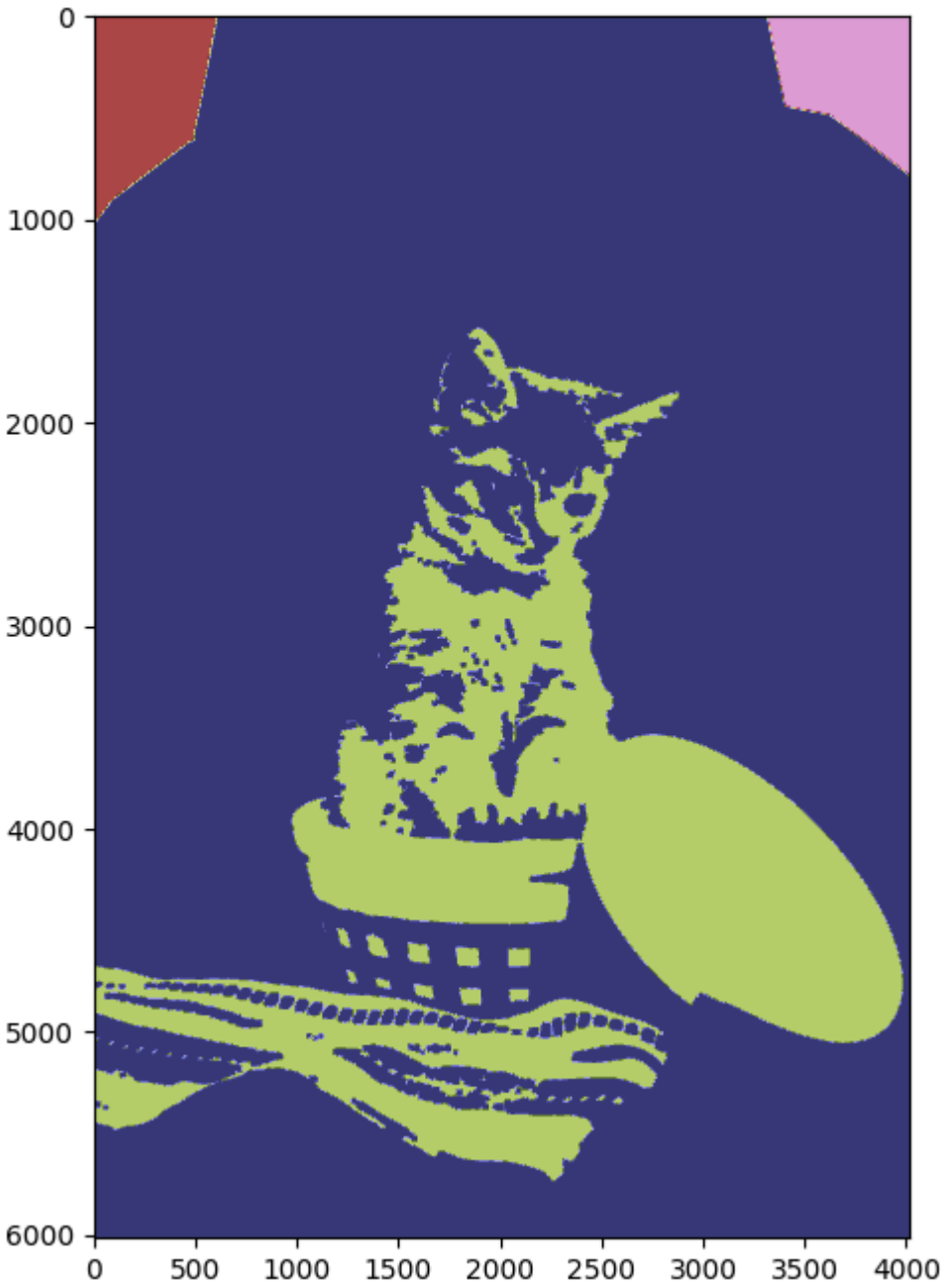


In [ ]:
```
# Noise Removal
kernel = np.ones((3,3), np.uint8)
bin_img = cv.morphologyEx(bin_img, cv.MORPH_OPEN, kernel, iterations=2)

# Sure background area
sure_bg = cv.dilate(bin_img, kernel, iterations=9)

# Distance transform
dist_tranform = cv.distanceTransform(bin_img, cv.DIST_L2, 5)

# Foreground area
ret, sure_fg = cv.threshold(dist_tranform, 0.7*dist_tranform.max(), 255,0
sure_fg = np.uint8(sure_fg)

# Unknown area
unknown = cv.subtract(sure_bg, sure_fg)

fig, axes = plt.subplots(ncols=5, nrows=1, figsize=(20,10))
axes[0].imshow(bin_img, cmap='gray')
axes[0].axis('off')
```

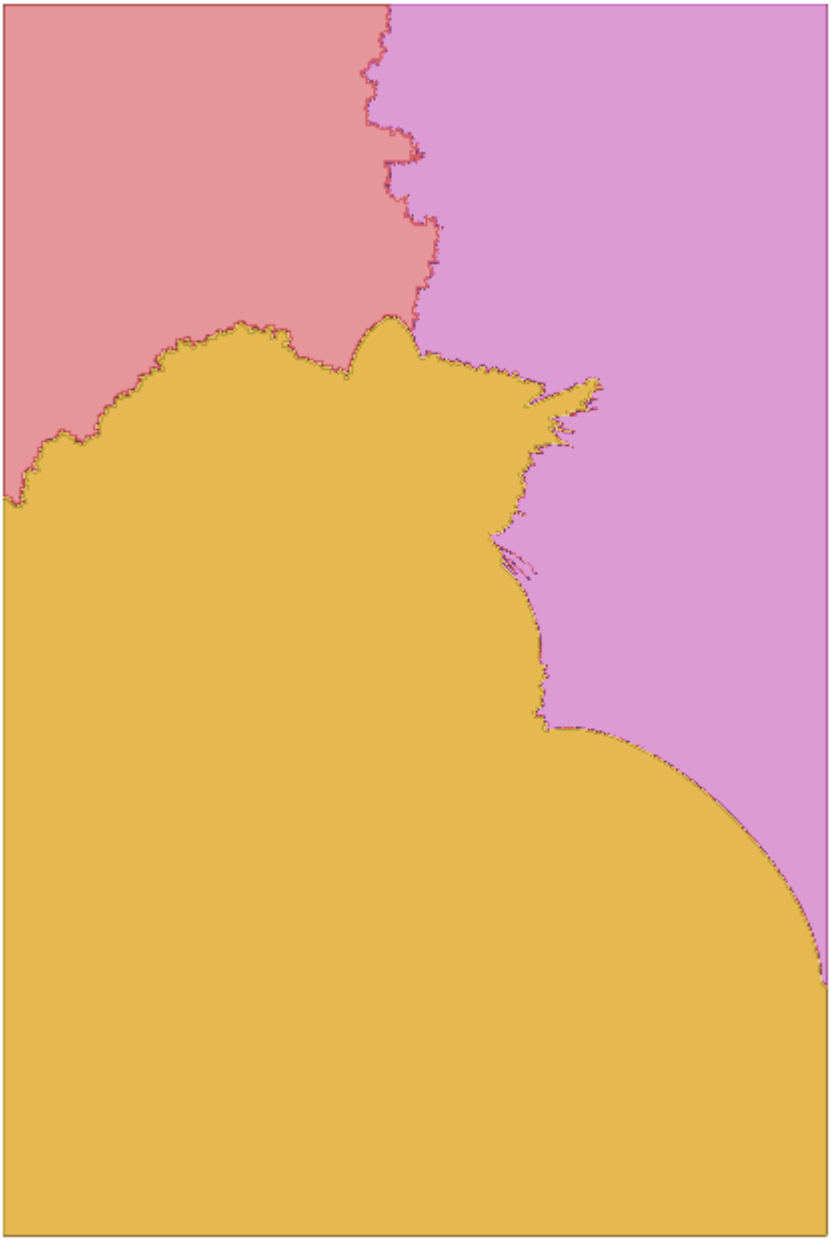
```
axes[1].imshow(sure_bg, cmap='gray')
axes[1].set_title('Sure background')
axes[1].axis('off')
axes[2].imshow(dist_tranform, cmap='gray')
axes[2].set_title('Distance Transform')
axes[2].axis('off')
axes[3].imshow(sure_fg, cmap='gray')
axes[3].set_title('Sure Foreground')
axes[3].axis('off')
axes[4].imshow(unknown, cmap='gray')
axes[4].set_title('Unkwon')
axes[4].axis('off')
plt.show()
```



In [ ]:
```
# Market labelling
ret, markers = cv.connectedComponents(sure_fg)
# Add one to all labels so that sure background is not 0 but 1
markers = markers+1
# Mark the region of unknown with zero
markers[unknown==255]=0
plt.figure(figsize=(12,8))
plt.imshow(markers, cmap='tab20b')
plt.show()
```



In [ ]:
```
# Apply Watershed Algorithm
markers = cv.watershed(img, markers)
plt.figure(figsize=(12,8))
plt.imshow(markers, cmap='tab20b')
plt.axis('off')
plt.show()
```



In [ ]:
```
labels = np.unique(markers)
animal = []
for label in labels[2:]:
    target = np.where(markers==label, 255, 0).astype(np.uint8)
    contours, hierarchy = cv.findContours(target, cv.RETR_EXTERNAL, cv.CH
    animal.append(contours[0])
# Draw the outline
img = cv.drawContours(img, animal,-1,color=(0,23,233), thickness=2)
plt.figure(figsize=(12,8))
plt.imshow(img)
plt.axis('off')
```

Out[ ]: (-0.5, 4015.5, 6015.5, -0.5)

GRABCUT ALGORITHM

In [ ]:
```
img = img.copy()
```

In [ ]:
```
mask = np.zeros(img.shape[:2], np.uint8)
mask
```

Out[ ]:
```
array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]], dtype=uint8)
```

In [ ]:
```
# Create arrays to store background and foreground models
backgroundmodel = np.zeros((1,65), np.float64)
foregroundmodel = np.zeros((1,65), np.float64)
#as the coordinates of the rectangle
```

```
# where the values are entered as
# (startingPoint_x, startingPoint_y, width, height)
# these coordinates are according to the input image
# it may vary for different images
rectangle = (70,39,2600,4100)
```

In [ ]:
```
# apply the grabcut algorithm with appropriate
cv.grabCut(img, mask, rectangle, backgroundmodel, foregroundmodel, 5, cv.
```

Out[ ]:
```
(array([[0, 0, 0, ..., 0, 0, 0],
        [0, 0, 0, ..., 0, 0, 0],
        [0, 0, 0, ..., 0, 0, 0],
        ...,
        [0, 0, 0, ..., 0, 0, 0],
        [0, 0, 0, ..., 0, 0, 0],
        [0, 0, 0, ..., 0, 0, 0]], dtype=uint8),
 array([[1.51991626e-01, 2.35063962e-01, 3.83826733e-01, 1.53424550e-01,
         7.56931293e-02, 2.33376899e+02, 2.35459993e+02, 2.34418835e+02,
         1.33746061e+02, 9.82931620e+01, 6.50758800e+01, 1.10476275e+02,
         7.40796511e+01, 3.39915072e+01, 1.50068544e+02, 1.51304092e+02,
         1.39696693e+02, 3.98116460e+01, 3.46180280e+01, 3.31814248e+01,
         1.88049187e+02, 1.64964302e+02, 1.67784411e+02, 1.64964302e+02,
         1.57038189e+02, 1.62903977e+02, 1.67784411e+02, 1.62903977e+02,
         1.71916341e+02, 8.06690428e+01, 7.19624362e+01, 6.66309374e+01,
         7.19624362e+01, 6.95349940e+01, 6.86605510e+01, 6.66309374e+01,
         6.86605510e+01, 7.45749028e+01, 1.57112727e+02, 1.35627950e+02,
         1.44943407e+02, 1.35627950e+02, 1.19711675e+02, 1.29452523e+02,
         1.44943407e+02, 1.29452523e+02, 1.60704948e+02, 1.89385872e+03,
         1.82419935e+03, 1.97363763e+03, 1.82419935e+03, 1.84074612e+03,
         1.95740670e+03, 1.97363763e+03, 1.95740670e+03, 2.23890337e+03,
         7.99104731e+02, 6.08205579e+02, 6.67404175e+01, 6.08205579e+02,
         5.47205945e+02, 3.56710595e+02, 6.67404175e+01, 3.56710595e+02,
         2.19857577e+03]]),
 array([[ 4.82915178e-01,  1.76608988e-01,  2.10010860e-01,
          3.73029410e-02,  9.31620330e-02,  1.25797460e+02,
          8.97820364e+01,  5.72836273e+01,  1.33795719e+02,
          1.45829145e+02,  1.57533927e+02,  1.13008789e+02,
          7.74883048e+01,  4.47224066e+01,  6.08913419e+01,
          7.41529561e+01,  1.24825558e+02,  1.88414959e+02,
          2.00958070e+02,  2.09178207e+02,  3.38974018e+01,
          3.29559424e+01,  3.01691991e+01,  3.29559424e+01,
          3.37103199e+01,  3.16665706e+01,  3.01691991e+01,
          3.16665706e+01,  3.31961559e+01,  5.09234806e+02,
          4.84876148e+02,  4.46325890e+02,  4.84876148e+02,
          4.81888429e+02,  4.59133533e+02,  4.46325890e+02,
          4.59133533e+02,  4.59745657e+02,  1.55539725e+01,
          1.61217271e+01,  1.46748753e+01,  1.61217271e+01,
          1.86729873e+01,  1.75847942e+01,  1.46748753e+01,
          1.75847942e+01,  2.02270428e+01,  1.03854350e+03,
          8.98783280e+02, -1.30768558e+03,  8.98783280e+02,
          7.89391077e+02, -1.05893500e+03, -1.30768558e+03,
         -1.05893500e+03,  2.88413793e+03,  2.59543120e+02,
          2.28551217e+02,  1.93024939e+02,  2.28551217e+02,
          2.12418605e+02,  1.87529302e+02,  1.93024939e+02,
          1.87529302e+02,  1.77344542e+02]]))
```

In [ ]:
```
# Create a binary mask where pixels classified as background or probable
mask2 = np.where((mask==2)|(mask==0),0,1).astype('uint8')
img_segment = img*mask2[:,:,np.newaxis]
```

In [ ]:
```
plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(cv.cvtColor(img, cv.COLOR_BGR2RGB))
plt.axis('off')
# Display the segmented image
plt.subplot(1, 2, 2)
plt.title('Segmented Image')
plt.imshow(cv.cvtColor(img_segment, cv.COLOR_BGR2RGB))
plt.axis('off')
```

Out[ ]: (-0.5, 4015.5, 6015.5, -0.5)