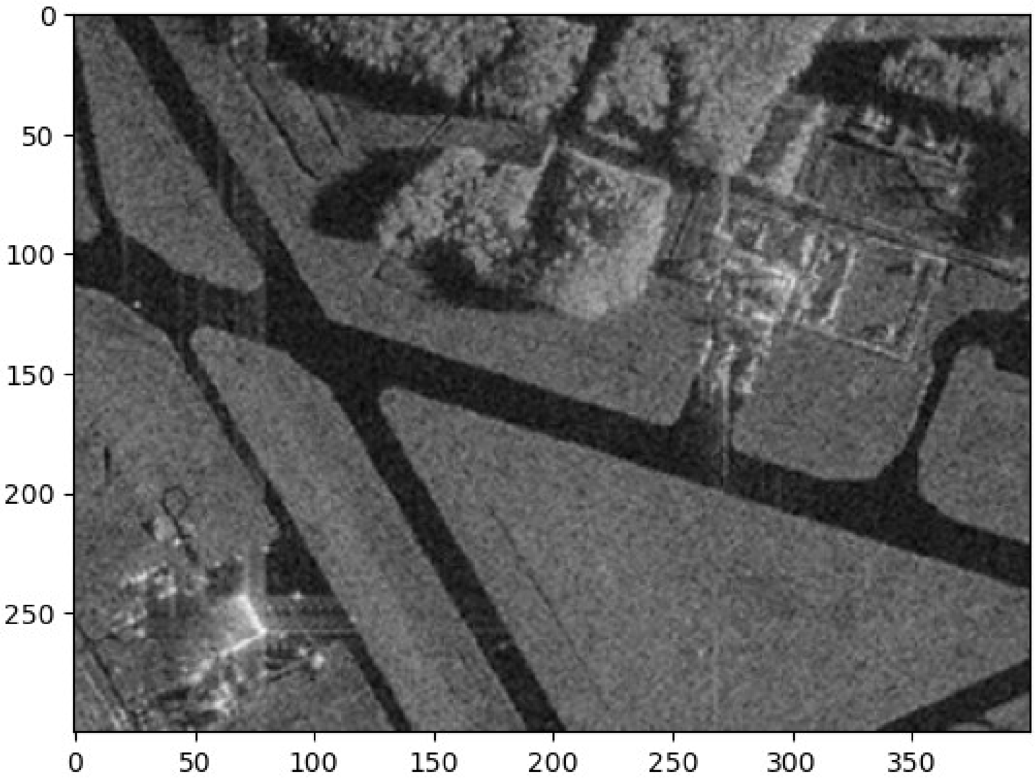
```python
import numpy as np
import cv2
import matplotlib.pyplot as plt

image = cv2.imread('sar_1 (1).jpg')
image_gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

plt.imshow(image_gray, cmap="gray")
```

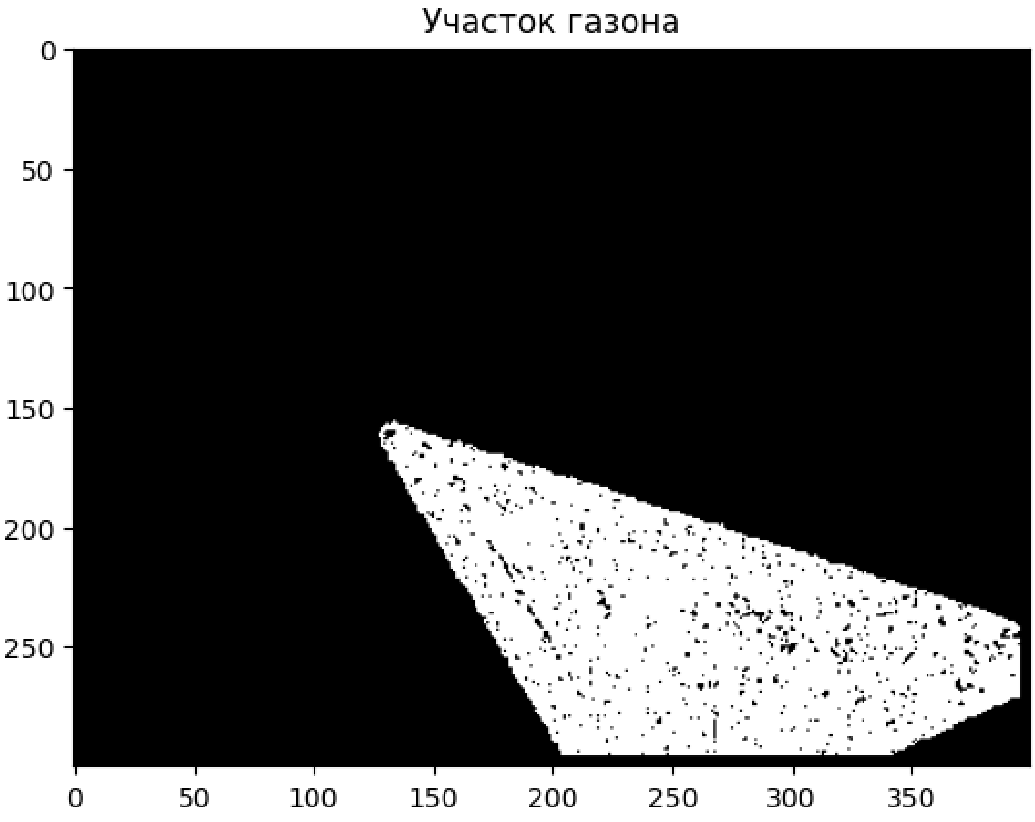
```
<matplotlib.image.AxesImage at 0x1e7a5e8>
```



```python
import math
def homo_average(img, mask, point, T):
    av_val = img[mask > 0].sum() / np.count_nonzero(img[mask > 0])

    if abs(av_val - img[point]) <= T:
        return True

    return False

def region_growing(image, seed_point,homo_fun,r, T):
    mask = np.zeros(image_gray.shape, np.uint8)
    mask[seed_point] = 1
    count = 1
    while count > 0:
        count = 0
        local_mask = np.zeros(image_gray.shape, np.uint8)
        for i in range(r,image.shape[0] - r):
            for j in range(r,image.shape[1] - r):
                if mask[i,j]==0 and mask[i - r:i + r, j-r: j+r].sum()
> 0:
                    if homo_fun(image, mask, (i,j), T):
                        local_mask[i,j] = 1
        count = np.count_nonzero(local_mask)
        print(count)
        mask += local_mask

    return mask*255

seed_point = (250,250)
r = 4
T = 16
mask = region_growing(image_gray,seed_point,homo_average,r, T)
```

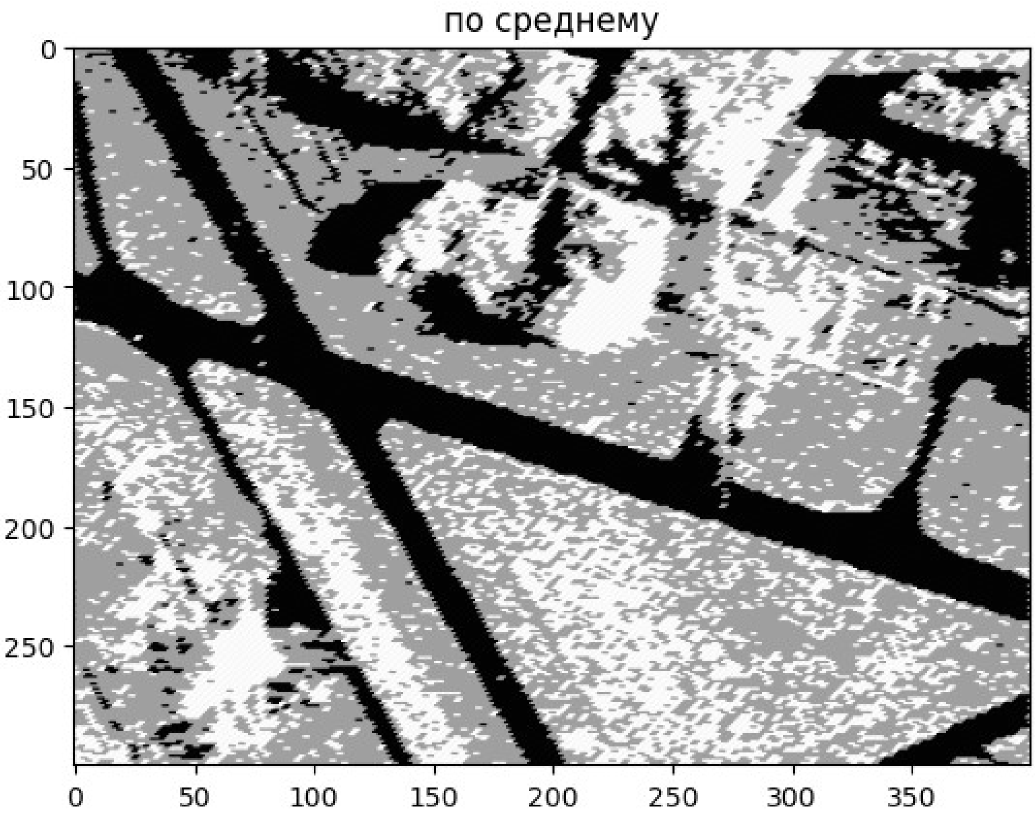
```
56
151
242
331
415
524
613
700
788
868
974
810
777
829
879
767
753
719
676
659
651
609
562
538
497
459
450
411
373
352
305
```

```
516
290
255
224
206
106
67
47
27
10
0

plt.imshow(mask, cmap = "gray")
plt.title("Участок газона")
plt.show()
```

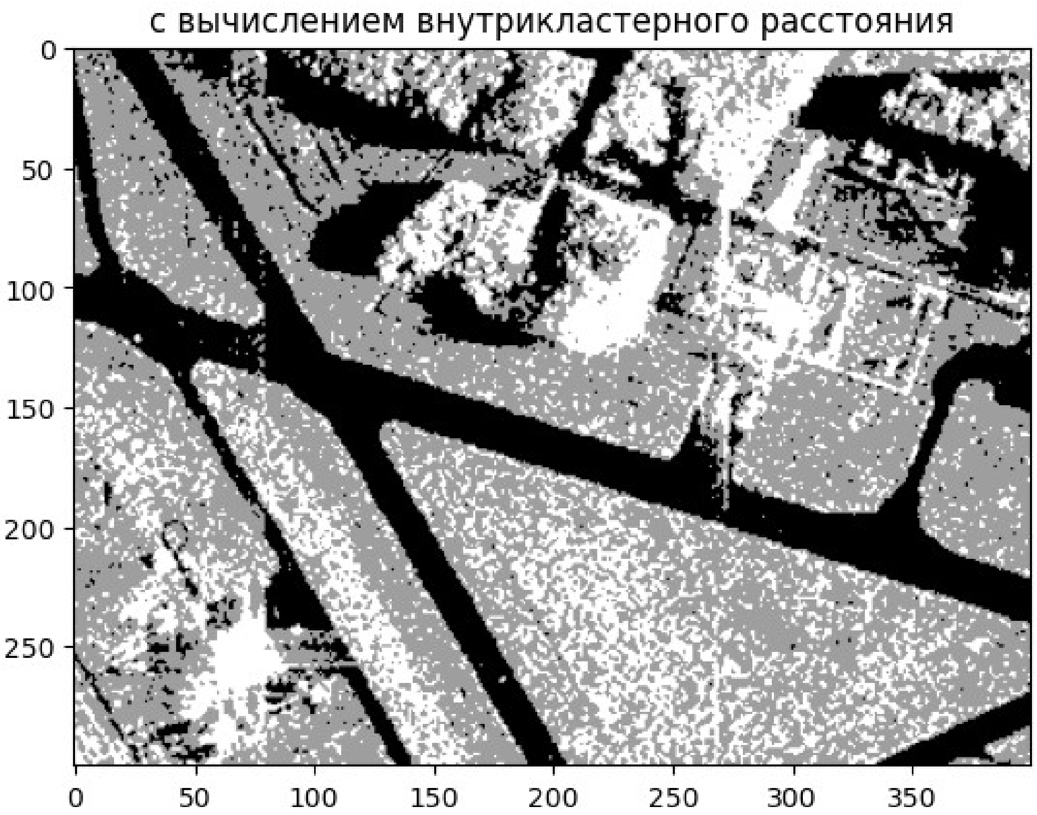


```
flags = cv2.KMEANS_RANDOM_CENTERS
z = image_gray.reshape((-1,3))
# convert to np.float32
z = np.float32(z)
# define criteria, number of clusters(K) and apply kmeans()
criteria = (cv2.TERM_CRITERIA_EPS + cv2.TERM_CRITERIA_MAX_ITER, 10,
1.0)
K = 3
```

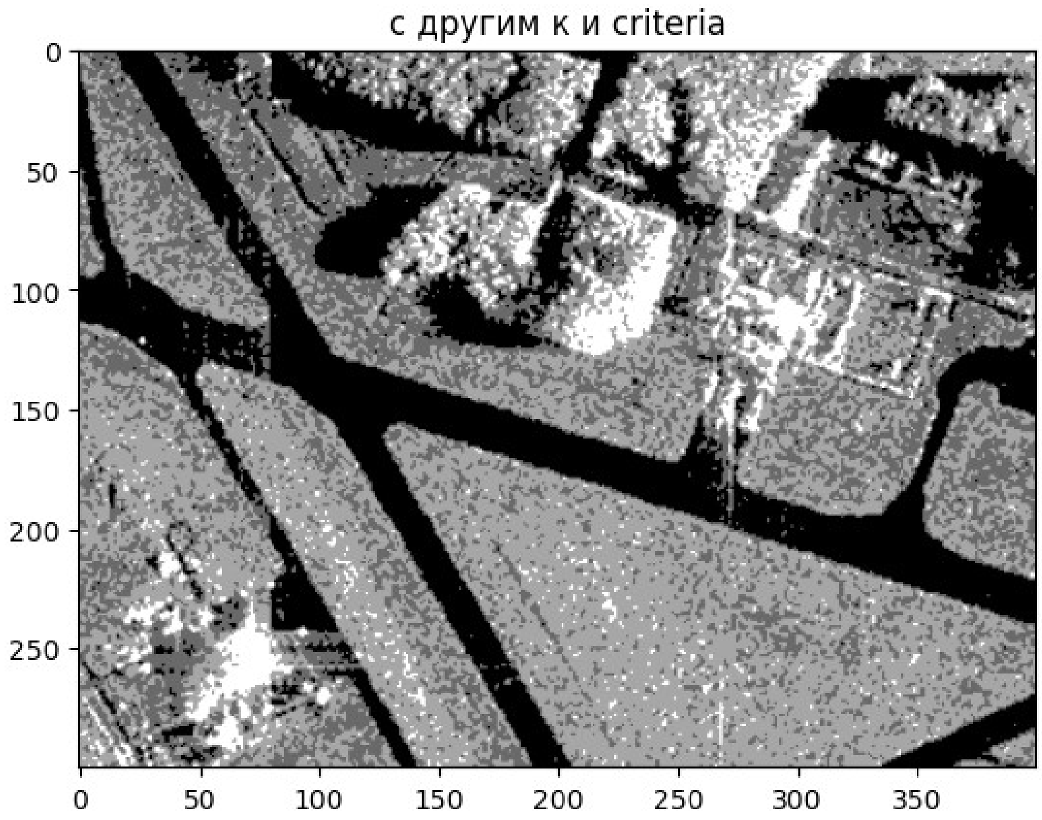
```
ret,label,center=cv2.kmeans(z,K,None,criteria,10,cv2.KMEANS_RANDOM_CEN
TERS)
# Now convert back into uint8, and make original image
center = np.uint8(center)
res = center[label.flatten()]
res2 = res.reshape((image_gray.shape))

plt.imshow(res2, cmap="gray")
plt.title("по среднему")
plt.show()
```



```
def calculate_intracluster_distance(labels, centers, data):
    total_distance = 0
    for i in range(len(centers)):
        cluster_points = data[labels.flatten() == i]
        if len(cluster_points) > 0:
          distances = np.linalg.norm(cluster_points - centers[i],
axis=1)
          total_distance += np.sum(distances)
    return total_distance

z = image_gray.reshape((-1, 1))
z = np.float32(z)
criteria = (cv2.TERM_CRITERIA_EPS + cv2.TERM_CRITERIA_MAX_ITER, 10,
1.0)
K = 3
ret, label, center = cv2.kmeans(z, K, None, criteria, 10,
cv2.KMEANS_RANDOM_CENTERS)
center = np.uint8(center)
res = center[label.flatten()]
res2 = res.reshape((image_gray.shape))

plt.imshow(res2, cmap="gray")
plt.title("с вычислением внутрикластерного расстояния")
plt.show()
```



```
criteria = (cv2.TERM_CRITERIA_EPS + cv2.TERM_CRITERIA_MAX_ITER, 15,
1.0)
K = 4
ret, label, center = cv2.kmeans(z, K, None, criteria, 10,
cv2.KMEANS_RANDOM_CENTERS)
center = np.uint8(center)
res = center[label.flatten()]
res2 = res.reshape((image_gray.shape))

plt.imshow(res2, cmap="gray")
plt.title("с другим к и criteria")
plt.show()
```



```
from scipy import ndimage
image = cv2.imread("palm_1 (1).JPG")
image_gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

blurred = cv2.GaussianBlur(image_gray, (13, 13), 0)
ret, thresh = cv2.threshold(blurred, 0, 255, cv2.THRESH_BINARY_INV +
cv2.THRESH_OTSU)
dist_transform = cv2.distanceTransform(thresh, cv2.DIST_L2, 5)
local_maxima = ndimage.maximum_filter(dist_transform, size=20,
mode='constant')
ret, sure_fg = cv2.threshold(dist_transform, 0.1 *
dist_transform.max(), 255, cv2.THRESH_BINARY)
sure_fg = sure_fg.astype(np.uint8)
ret, markers = cv2.connectedComponents(sure_fg)
markers[dist_transform == local_maxima] = 1
markers = ndimage.label(markers)[0]
markers = cv2.watershed(image, markers.astype(np.int32))
num_trees = len(np.unique(markers)) - 1
segmented_image = image.copy()
segmented_image[markers == -1] = [255, 0, 0]

plt.figure(figsize=(12, 5))
plt.subplot(1, 3, 1)
plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
plt.title("Оригинальное изображение")
plt.subplot(1, 3, 2)
plt.imshow(cv2.cvtColor(thresh, cv2.COLOR_BGR2RGB))
plt.title("Threshold")
plt.subplot(1, 3, 3)
plt.imshow(cv2.cvtColor(segmented_image, cv2.COLOR_BGR2RGB))
plt.title(f"Сегментированное изображение. Количество пальм:
{num_trees}")
plt.show()
```