In [1]:

```
# import fingerprint_enhancer  # Load the library
import cv2
import os
import matplotlib.pyplot as plt
import random
import numpy as np

# folder = "E:\BTP\SOCOFing\Real"
folder = "E:\BTP\SOCOFing\Test"
# alt_folder = "E:\BTP\SOCOFing\AltTest"
alt_folder = "E:\BTP\SOCOFing\Test"
```

In [2]:

```
SIFT_DATA = []
#   sift = cv2.xfeatures2d.SIFT_create()
sift = cv2.SIFT_create()

for filename in os.listdir(folder):
    img = cv2.imread(os.path.join(folder,filename))
#     plt.imshow(img,cmap='gray')
#     img = fingerprint_enhancer.enhance_Fingerprint(img)

    keypoints_1, descriptors_1 = sift.detectAndCompute(img, None)

    SIFT_DATA.append([filename, keypoints_1, descriptors_1])
```

In [3]:

```
num = random.randint(0, len(os.listdir(alt_folder)))
# num = 1
sample_filename = os.listdir(alt_folder)[num]
sample_img = cv2.imread(os.path.join(alt_folder,sample_filename))

bestscore = 0
result = None
mp = None
results = []
```

The images on the left side is the image that is trying to be found. And the image on the right side is the image that the algorithm matches the left side image in database. In this code first all the feature points of the images are being extracted and are stored in a variable after that we are manually searching for the bestmatch. this taken O(n) time for one image.

Matching images without any transformation.

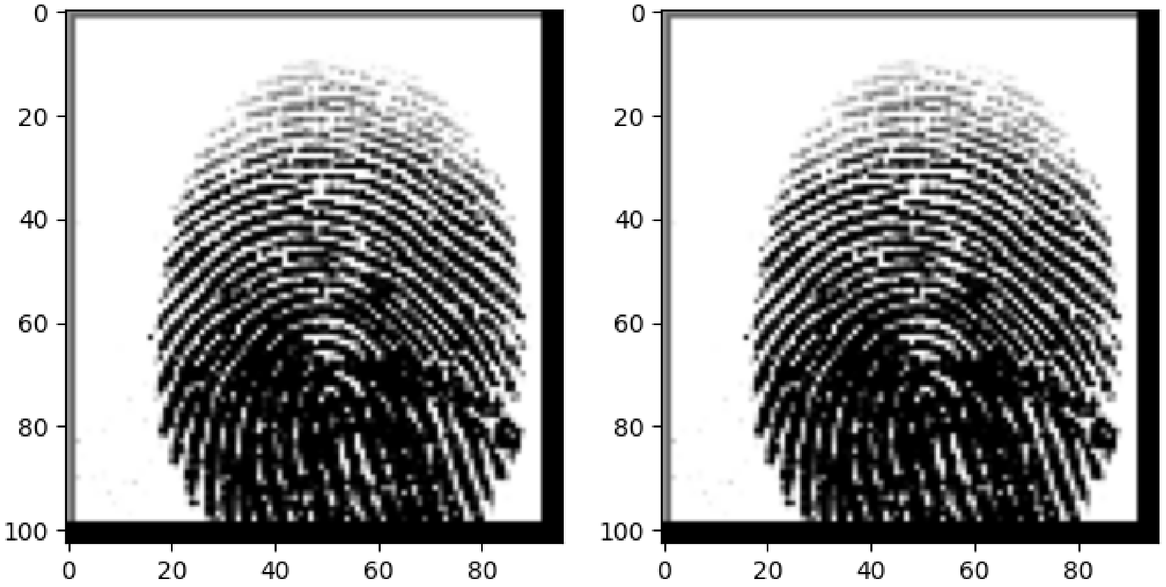
In [4]:

```
# sample = fingerprint_enhancer.enhance_Fingerprint(sample)
keypoints_2, descriptors_2 = sift.detectAndCompute(sample_img, None)

for i in range(len(SIFT_DATA)):
#     print(result)

    matches = cv2.FlannBasedMatcher(dict(algorithm=1, trees=10),
                                    dict()).knnMatch(SIFT_DATA[i][2], descriptors_2
    match_points = []
    for p, q in matches:
        if p.distance < 0.1*q.distance:
            match_points.append(p)
    keypoints = min(len(SIFT_DATA[i][1]), len(keypoints_2))
    results.append(len(match_points)/keypoints*100)
    if len(match_points)/keypoints*100 > bestscore:
        bestscore = len(match_points)/keypoints*100
        result, mp = i, match_points

print(results)
print(str(result) + " " + str(num))
print(" Score: " + str(bestscore))

out = cv2.imread(os.path.join(folder, SIFT_DATA[result][0]))
f = plt.figure(figsize=(8,4))
sp = f.add_subplot(1, 2, 1)
plt.imshow(sample_img,cmap='gray')
sp = f.add_subplot(1, 2, 2)
plt.imshow(out,cmap='gray')
```

```
[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 100.0, 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]
6 6
 Score: 100.0
```

Out[4]:

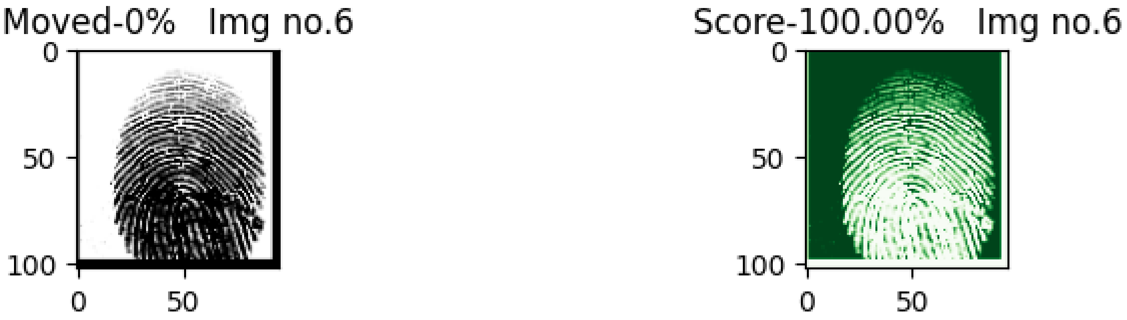
```
<matplotlib.image.AxesImage at 0x16fce4f84f0>
```

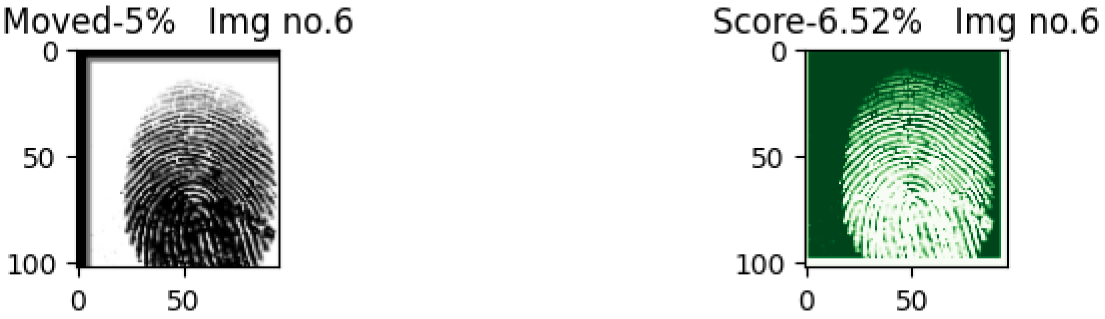


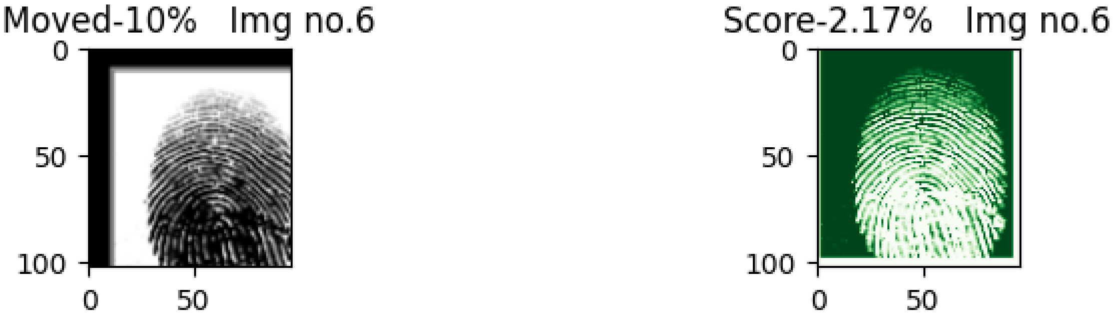
Shifting Images and matching it

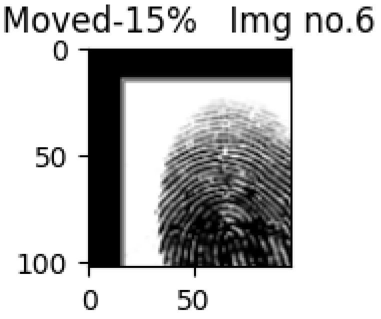
In [5]:

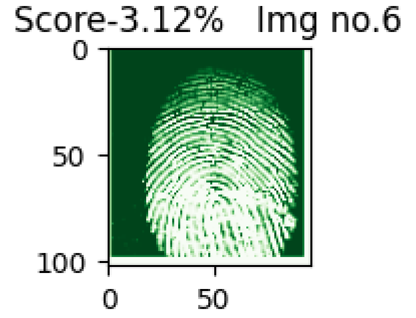
```
rows,cols = sample_img.shape[0], sample_img.shape[1]

for j in range(0, 26, 5):

    bestscore = -1
    result = None

    M = np.float32([[1,0,rows*(j/100)],[0,1,cols*(j/100)]])
    changed_img = cv2.warpAffine(sample_img,M,(cols,rows))
    # sample = fingerprint_enhancer.enhance_Fingerprint(sample)
    keypoints_2, descriptors_2 = sift.detectAndCompute(changed_img, None)
    c_map = None

    for i in range(len(SIFT_DATA)):
        matches = cv2.FlannBasedMatcher(dict(algorithm=1, trees=10),
                                        dict()).knnMatch(SIFT_DATA[i][2], descripto
        match_points = []
        for p, q in matches:
            if p.distance < 0.1*q.distance:
                match_points.append(p)

        keypoints = min(len(SIFT_DATA[i][1]), len(keypoints_2))
        if len(match_points)/keypoints*100 > bestscore:
            bestscore = len(match_points)/keypoints*100
            result = i

#     print(" Score: " + str(bestscore) + " " + str(result) + " " + str(num))
    if result==num :
        c_map = 'Greens'
    else:
        c_map = 'Reds'

    out = cv2.imread(os.path.join(folder, SIFT_DATA[result][0]))
    f = plt.figure(figsize=(6,3))
    sp = f.add_subplot(1, 4, 1)
#     plt.imshow(cv2.cvtColor(changed_img, cv2.COLOR_BGR2GRAY),cmap=c_map)
    plt.title("Moved-{}%   Img no.{}".format(j, num))
    plt.imshow(changed_img ,cmap=c_map)
    sp = f.add_subplot(1, 4, 4)
    plt.title("Score-{0:1.2f}%   Img no.".format(bestscore)+str(result))
    plt.imshow(cv2.cvtColor(out, cv2.COLOR_BGR2GRAY),cmap=c_map)
```

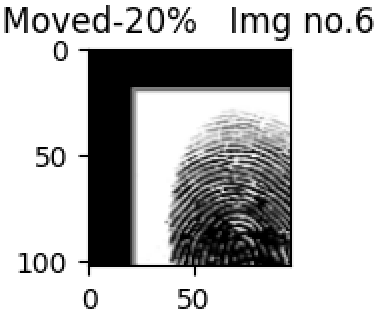


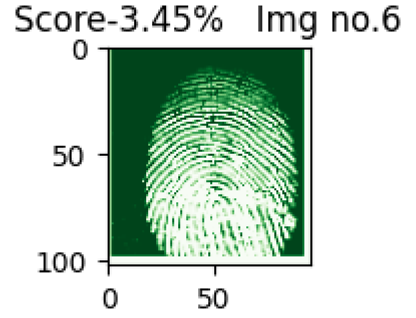


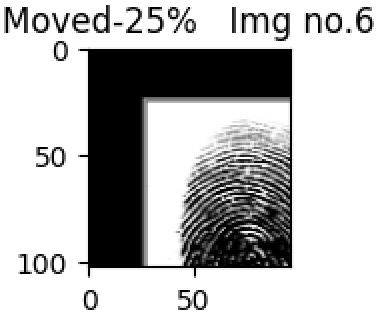


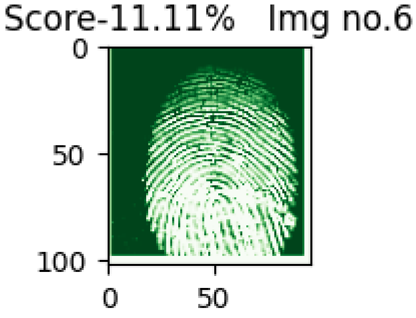










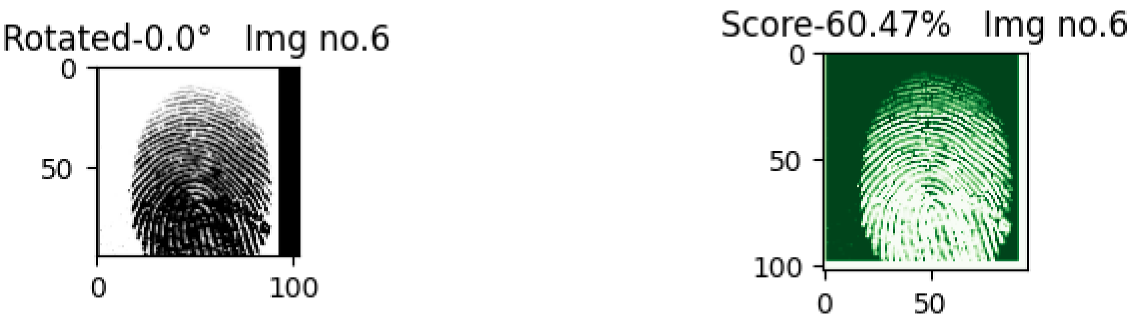


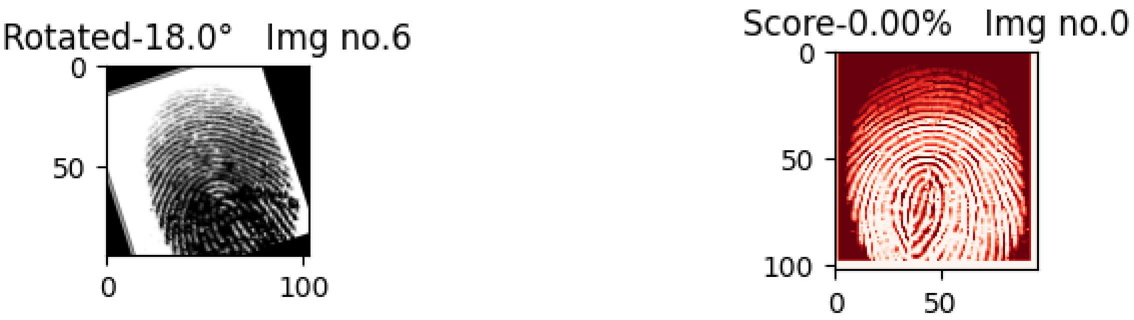
Rotating Images and matching it

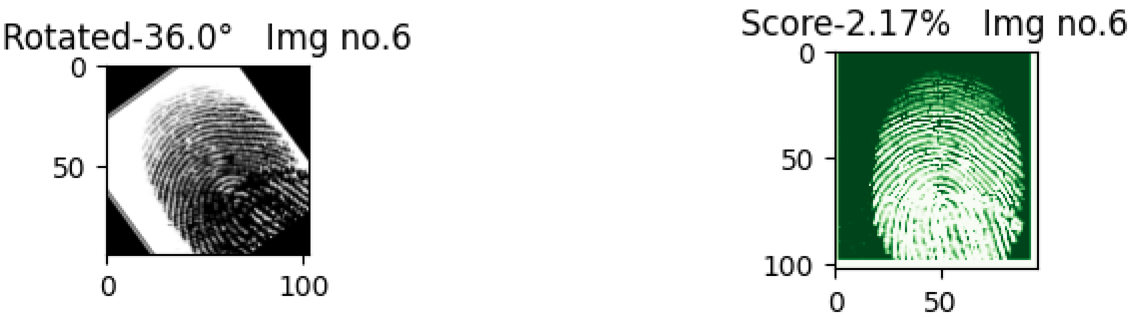
In [6]:

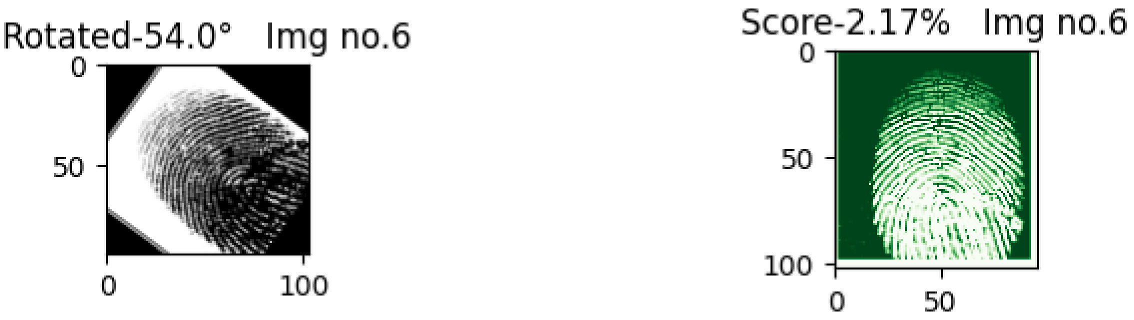
```
for j in range(0, 26, 5):

    bestscore = -1
    result = None

    M = np.float32([[1,0,rows*(j/100)],[0,1,cols*(j/100)]])
    rotate_matrix = cv2.getRotationMatrix2D(center=(rows/2, cols/2), angle=3.6*j, s
    changed_img = cv2.warpAffine(src=sample_img, M=rotate_matrix, dsize=(rows, cols
    # sample = fingerprint_enhancer.enhance_Fingerprint(sample)
    keypoints_2, descriptors_2 = sift.detectAndCompute(changed_img, None)
    c_map = None

    for i in range(len(SIFT_DATA)):
        matches = cv2.FlannBasedMatcher(dict(algorithm=1, trees=10),
                                        dict()).knnMatch(SIFT_DATA[i][2], descripto
        match_points = []
        for p, q in matches:
            if p.distance < 0.1*q.distance:
                match_points.append(p)

        keypoints = min(len(SIFT_DATA[i][1]), len(keypoints_2))
        if len(match_points)/keypoints*100 > bestscore:
            bestscore = len(match_points)/keypoints*100
            result = i

#     print(" Score: " + str(bestscore) + " " + str(result) + " " + str(num))
```

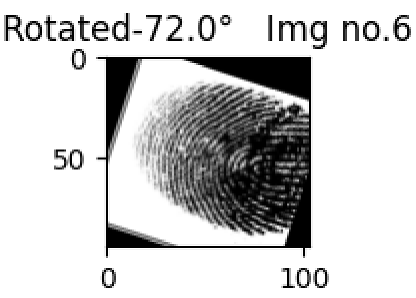
```
    if result==num :
        c_map = 'Greens'
    else:
        c_map = 'Reds'

    out = cv2.imread(os.path.join(folder, SIFT_DATA[result][0]))
    f = plt.figure(figsize=(6,3))
    sp = f.add_subplot(1, 4, 1)
#     plt.imshow(cv2.cvtColor(changed_img, cv2.COLOR_BGR2GRAY),cmap=c_map)
    plt.title("Rotated-{}°   Img no.{}".format(3.6*j, num))
    plt.imshow(changed_img ,cmap=c_map)
    sp = f.add_subplot(1, 4, 4)
    plt.title("Score-{0:1.2f}%   Img no.".format(bestscore)+str(result))
    plt.imshow(cv2.cvtColor(out, cv2.COLOR_BGR2GRAY),cmap=c_map)
```

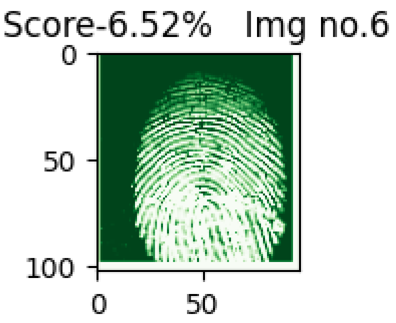


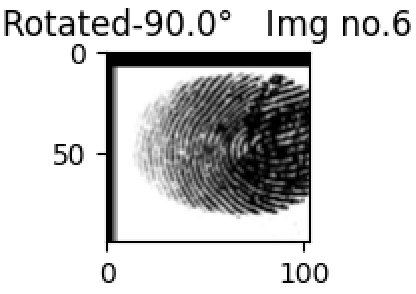


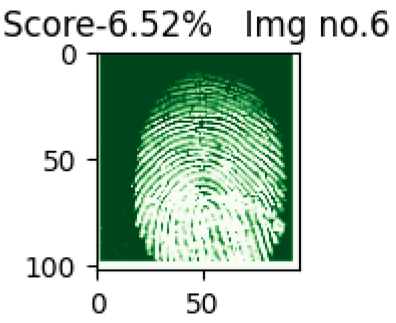





Rotated-72.0° Img no.6
0
50
0
100


Score-6.52% Img no.6
0
50
100
0
50


Rotated-90.0° Img no.6
0
50
0
100


Score-6.52% Img no.6
0
50
100
0
50

```
In [ ]:
```