Digital Image Processing

Title: Computer Vision: Feature Extraction

Objectives: To understand the problems of computer vision. To understand features in images and find those features using different computer vision algorithms.

Tools Used: Python

Procedure: Open IDLE and perform the following tasks.

Task 1

Take the image of your face. Make a copy and rotate that copy. Find features on your face using any algorithm e.g SIFT, SURF, ORB.

Hint for Code: See Slides

Code:

Could not use the SURF method as it was not available in cv2. I tried using older versions of cv2 as well as other variations of cv2, but still couldn't use SURF. Hence, after 2 hours of installing and deleting different packages, I just used the SIFT method.

```
import cv2

# Load the image
image1 = cv2.imread(r'C:\Users\Naeem\Desktop\Jahanzeb\pics\6.jpeg')

# Convert the training image to RGB
training_image = cv2.cvtColor(image1, cv2.COLOR_BGR2RGB)

# Convert the training image to gray scale
training_gray = cv2.cvtColor(training_image, cv2.COLOR_RGB2GRAY)

# Create test image by adding Scale Invariance and Rotational Invariance
test_image = cv2.pyrDown(training_image)
test_image = cv2.pyrDown(test_image)
num_rows, num_cols = test_image.shape[:2]

rotation_matrix = cv2.getRotationMatrix2D((num_cols/2, num_rows/2), 30, 1)
test_image = cv2.warpAffine(test_image, rotation_matrix, (num_cols, num_rows))

test_gray = cv2.cvtColor(test_image, cv2.COLOR_RGB2GRAY)



surf = cv2.SIFT_create(800)
```

```
train_keypoints, train_descriptor = surf.detectAndCompute(training_gray, None)
test_keypoints, test_descriptor = surf.detectAndCompute(test_gray, None)

# keypoints_without_size = np.copy(training_image)
# keypoints_with_size = np.copy(training_image)
#
# cv2.drawKeypoints(training_image, train_keypoints, keypoints_without_size,
color = (0, 255, 0))
#
# cv2.drawKeypoints(training_image, train_keypoints, keypoints_with_size, flags =
cv2.DRAW_MATCHES_FLAGS_DRAW_RICH_KEYPOINTS)

# Print the number of keypoints detected in the training image
print("Number of Keypoints Detected In The Training Image: ",
len(train_keypoints))

# Print the number of keypoints detected in the query image
print("Number of Keypoints Detected In The Query Image: ", len(test_keypoints))




# Create a Brute Force Matcher object.
bf = cv2.BFMatcher(cv2.NORM_L1, crossCheck = False)

# Perform the matching between the SURF descriptors of the training image and the
test image
matches = bf.match(train_descriptor, test_descriptor)

# The matches with shorter distance are the ones we want.
matches = sorted(matches, key = lambda x : x.distance)

result = cv2.drawMatches(training_image, train_keypoints, test_gray,
test_keypoints, matches, test_gray, flags = 2)

# Display the best matching points
cv2.imshow('result',result)

# Print total number of matching points between the training and query images
print("\nNumber of Matching Keypoints Between The Training and Query Images: ",
len(matches))

cv2.waitKey(0)
cv2.destroyAllWindows()
```

Task 2

Write your name and one life goal on a plain paper. Use that image to find handwriting on it using ORB, SIFT or FAST.

Hint for Code: See Teams.

Code:

SIFT part:

```
import cv2

def patchExtractor(img, keypoints, w=300):
    for i in range(len(keypoints)):
        (x,y) = keypoints[i].pt
        x1=int(x-w/2)
        x2=int(x+w/2)
        y1=int(y-w/2)
        y2=int(y+w/2)
        rect = cv2.rectangle(img, (x1, y1), (x2, y2), (0, 0, 255), 2)
    return img


cv2.namedWindow("output", cv2.WINDOW_NORMAL)
cv2.resizeWindow("output", 1366, 768)
cv2.moveWindow("output", 0,0)

# Read image
img1 = cv2.imread(r'C:\Users\Naeem\Desktop\Jahanzeb\DIP\DIP Lab\images\n1.jpg')


# Initiate SIFT detector
sift = cv2.SIFT_create()

# Convering to Gray
img1 = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)

# Gaussian Blurr
img1 = cv2.GaussianBlur(img1, (45, 45), 15, cv2.BORDER_DEFAULT)
cv2.imshow("output", img1)

# find the keypoints and descriptors with ORB
kp, des = sift.detectAndCompute(img1, None)


# Create images with keypoints
img1 = cv2.drawKeypoints(img1, kp, img1, (0, 0, 255),
cv2.DRAW_MATCHES_FLAGS_DRAW_RICH_KEYPOINTS)
cv2.imshow("output", img1)

img1 = patchExtractor(img1, kp, 300)
# cv2.imwrite('sift1AfterGaussian.jpg', img1)

cv2.imshow("output", img1)
```

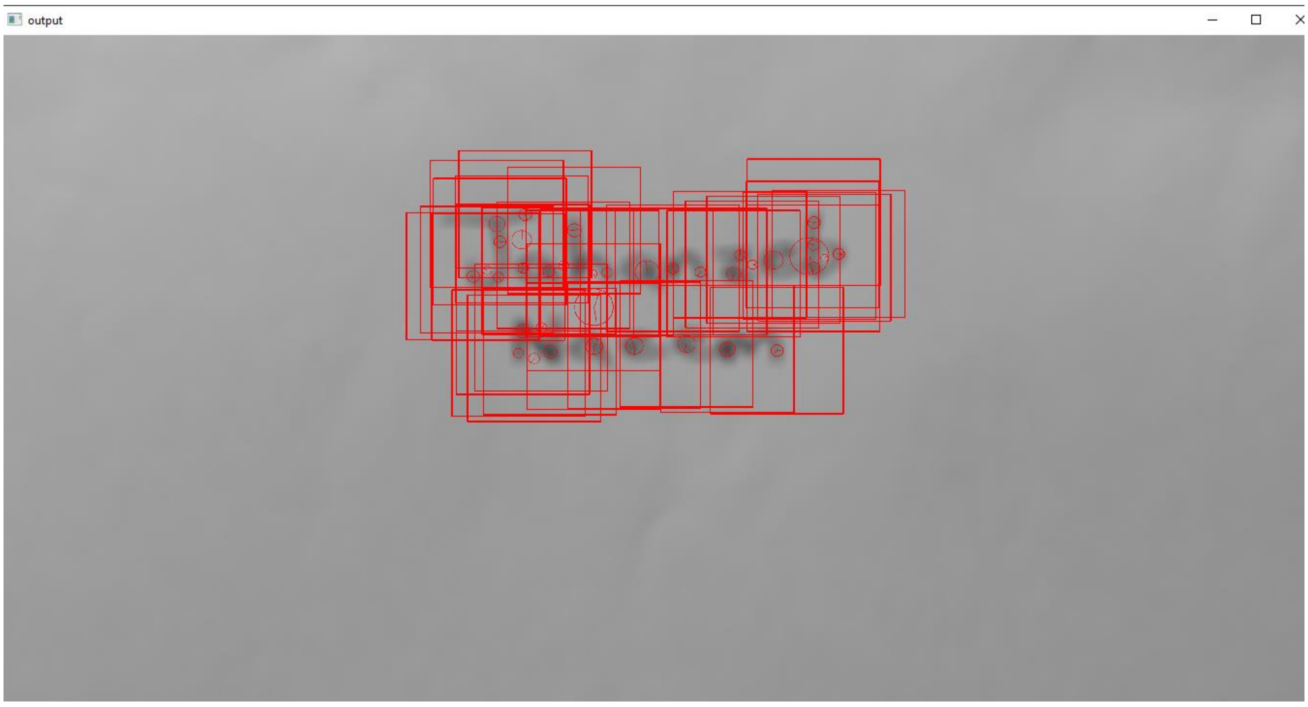
```
cv2.waitKey(0)
cv2.destroyAllWindows()
```

ORB part:

```
import cv2

def patchExtractor(img, keypoints, w=300):
    for i in range(len(keypoints)):
        (x,y) = keypoints[i].pt
        x1=int(x-w/2)
        x2=int(x+w/2)
        y1=int(y-w/2)
        y2=int(y+w/2)
        rect = cv2.rectangle(img, (x1, y1), (x2, y2), (0, 0, 255), 2)
    return img


cv2.namedWindow("output", cv2.WINDOW_NORMAL)
cv2.resizeWindow("output", 1366, 768)
cv2.moveWindow("output", 0,0)

# Read image
img1 = cv2.imread(r'C:\Users\Naeem\Desktop\Jahanzeb\DIP\DIP Lab\images\n1.jpg')

# Initiate ORB detector
orb = cv2.ORB_create()

# Converting to Gray
img1= cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)

# find the keypoints and descriptors with ORB
kp, des = orb.detectAndCompute(img1,None)

# Create images with keypoints
img1=cv2.drawKeypoints(img1,kp,img1,(0,0,255),cv2.DRAW_MATCHES_FLAGS_DRAW_RICH_KE
YPOINTS)


img1 = patchExtractor(img1,kp,300)
cv2.imwrite('Orb1BeforeSharpening.jpg',img1)

cv2.imshow("output", img1)

cv2.waitKey(0)
cv2.destroyAllWindows()
```

Screenshot:

SIFT part:



ORB part: