Digital Image Processing

Title: Digit Recognition, Pattern Recognition, Classification

Objectives: to understand template matching, Digit Recognition, Pattern Recognition, and solve a classification problem

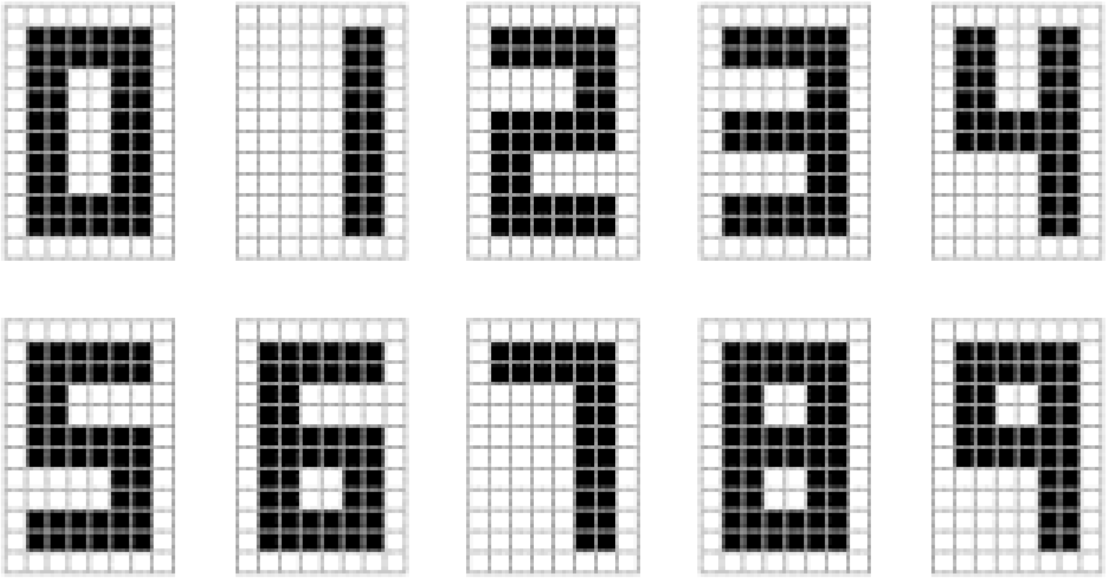
Tools Used: Python

Procedure: Open IDLE and perform the following tasks

Use the template matching algorithm (function) you wrote. Make a small dataset of digits (0 to 9) with 5 samples in each class. You can use test images with only single digits and of the same size as the template, for simplicity and ease, if you want. This means you don't need to move the template window over test image. Both are of same size! Use KNN algorithm to find the digit in the test image.

Digit recognition is a classical pattern recognition problem. Each digit 0-9 represents a class. Features extracted from images of the digits can be used to generate a reference base (training data). A query digit image presented to the system can then be recognized using a classifier.

For this task, you are provided with multiple images of each digit as training data. Load each image, extract features and store the features of each image along with class label. Using k-nn classification scheme, classify each of the images in the test data set into one of the digit classes. Examples of digits are illustrated in the following table.

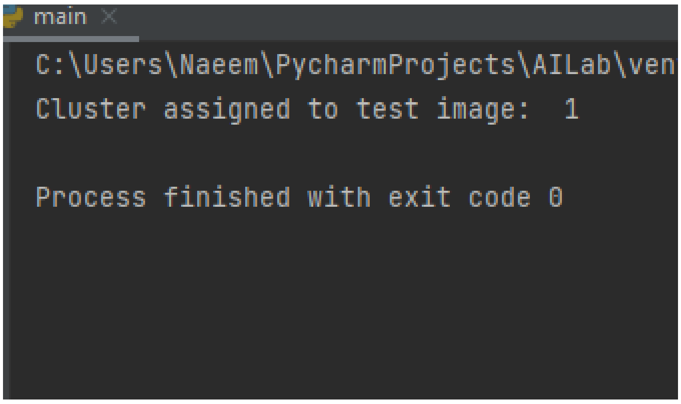


Code:

```
import cv2

clusters = [[],[],[],[],[],[],[],[],[],[]]

for i in range(10):
    path = r'C:\Users\Naeem\Desktop\Jahanzeb\DIP\DIP Lab\Project 2\number\c' + str(i) + '.jpg'
    template = cv2.imread(path, cv2.IMREAD_GRAYSCALE)
    clusters[i].append(template)

i = 11
for j in range(10):
    for k in range(4):
        path = r'C:\Users\Naeem\Desktop\Jahanzeb\DIP\DIP Lab\Project 2\number\t' + str(i+k) + '.jpg'
        sample = cv2.imread(path, cv2.IMREAD_GRAYSCALE)
        clusters[j].append(sample)
    i += 4
    if i == 51:
        break


test = cv2.imread(r'C:\Users\Naeem\Desktop\Jahanzeb\DIP\DIP Lab\Project 2\number\test.jpg',
cv2.IMREAD_GRAYSCALE)

distance = 10000000
closest = 0
```

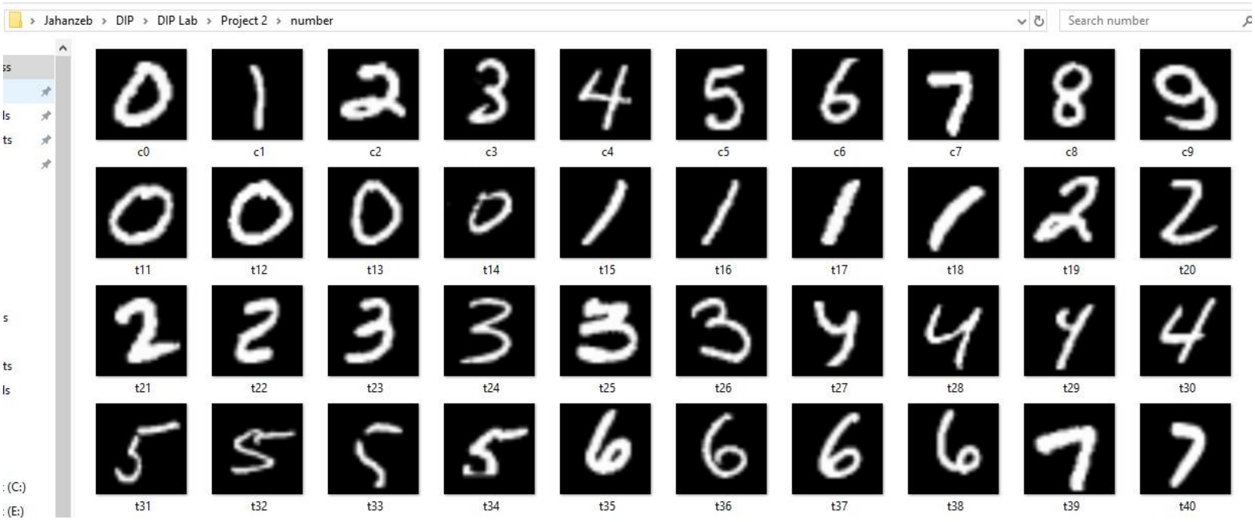
```
for i in range (10):

    for j in range(len(clusters[i])):

        dist = clusters[i][j] - test

        temp = list(map(sum, dist))

        total = sum(temp)


        if total < distance:

            distance = total

            closest = i


print('Cluster assigned to test image: ', closest)


cv2.waitKey(0)

cv2.destroyAllWindows()
```

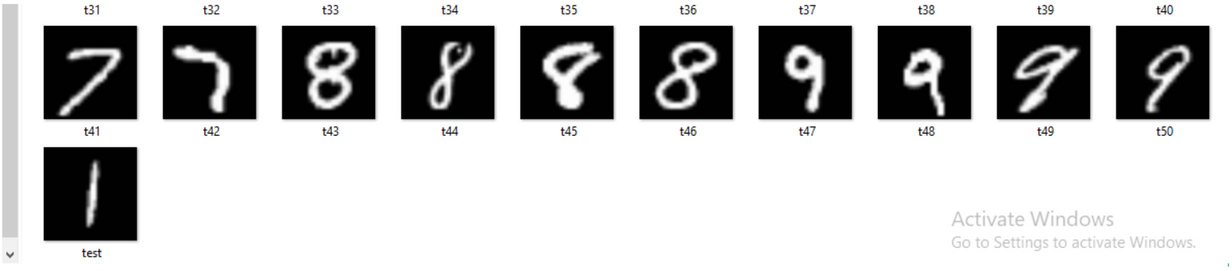
Screenshot:



```
C:\Users\Naeem\PycharmProjects\AILab\ven
Cluster assigned to test image:  1

Process finished with exit code 0
```

Folder where images of digits are stored:


Jahanzeb > DIP > DIP Lab > Project 2 > number
Search number
c0 c1 c2 c3 c4 c5 c6 c7 c8 c9
t11 t12 t13 t14 t15 t16 t17 t18 t19 t20
t21 t22 t23 t24 t25 t26 t27 t28 t29 t30
t31 t32 t33 t34 t35 t36 t37 t38 t39 t40
: (C:)
: (E:)


t31 t32 t33 t34 t35 t36 t37 t38 t39 t40
t41 t42 t43 t44 t45 t46 t47 t48 t49 t50
test
Activate Windows
Go to Settings to activate Windows.