Pattern recognition

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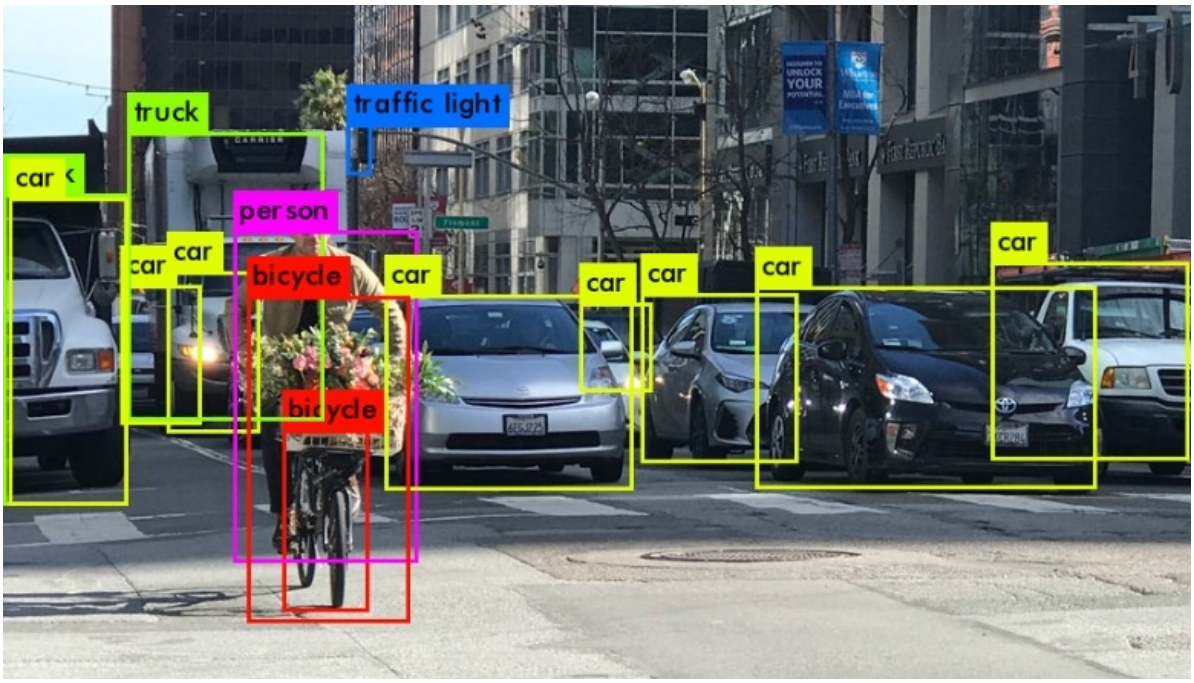
- Pattern recognition
- `cvzone` and `mediapipe`

Pattern recognition

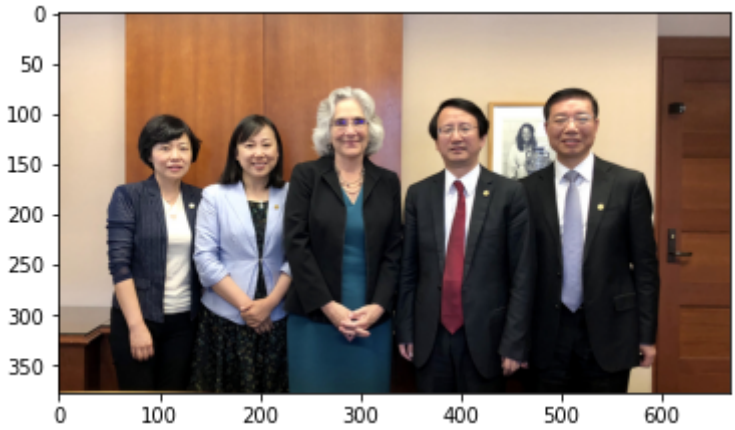


- Template matching is one of the most primitive and basic pattern recognition methods. It studies where the pattern of a specific object is located in the image, and then recognizes the object. This is a matching problem
- The principle of template matching is very similar to that of convolution
- The template ***slides*** from the origin on the original image, and the difference between the template and the image covered by the template is calculated.

```
import cv2
from matplotlib import pyplot as plt
import numpy as np
import matplotlib.colors as mat_color

def read_image(path="./images/wu.jpg", flags=cv2.IMREAD_COLOR):
    img_bgr = cv2.imread(path)
    img_rgb = cv2.cvtColor(img_bgr, cv2.COLOR_BGR2RGB)
    print(img_rgb.shape)
    return img_rgb

no_norm = mat_color.Normalize(vmin=0, vmax=255, clip=False)
img_wu = read_image()
plt.imshow(img_wu, norm=no_norm)
```

```
(378, 668, 3)
```

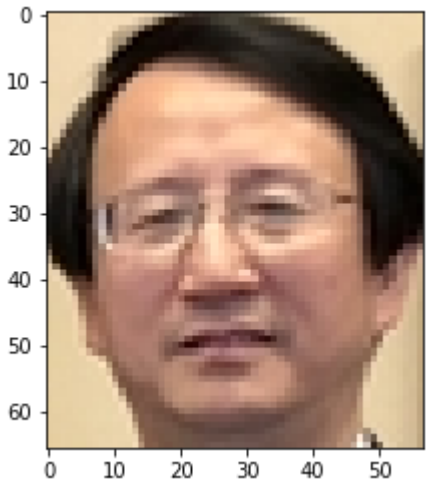
```
<matplotlib.image.AxesImage at 0x27bbc9e48e0>
```




```
img_wu_tem = read_image("./images/wu_tem.jpg")
plt.imshow(img_wu_tem, norm=no_norm)
```

```
(66, 57, 3)
```

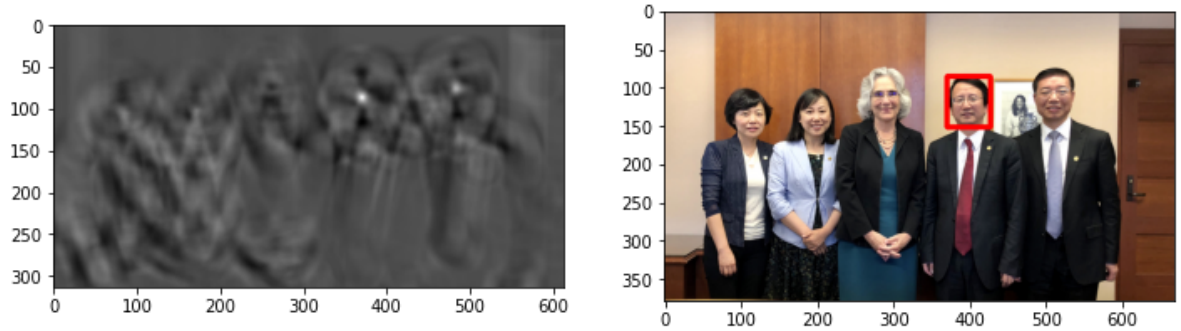
```
<matplotlib.image.AxesImage at 0x27bbca442e0>
```



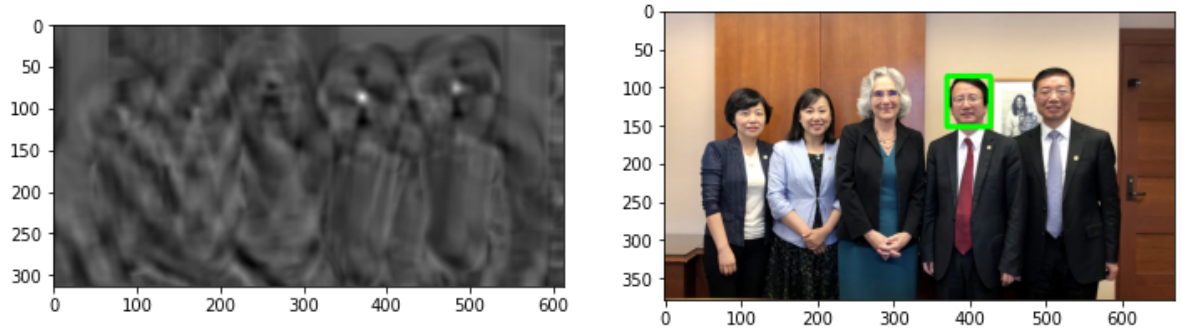

```
width, height = img_wu_tem.shape[0], img_wu_tem.shape[1]
```

```
methods = [cv2.TM_CCOEFF, cv2.TM_CCOEFF_NORMED, cv2.TM_CCORR,
           cv2.TM_CCORR_NORMED, cv2.TM_SQDIFF, cv2.TM_SQDIFF_NORMED]

def show_wu_face(mathod, color=(255, 0, 0)):
    plt.figure(figsize=(12, 4))
    res = cv2.matchTemplate(img_wu, img_wu_tem, mathod)
    plt.subplot(1, 2, 1)
    plt.imshow(res, cmap = 'gray')
    plt.subplot(1, 2, 2)
    min_val, max_val, min_loc, max_loc = cv2.minMaxLoc(res)
    bottom_right = (top_left[0] + height, top_left[1] + width)
    img_wu_detect = cv2.rectangle(np.copy(img_wu),
                                  top_left, bottom_right, color, 5)
    plt.imshow(img_wu_detect, norm=no_norm)
```

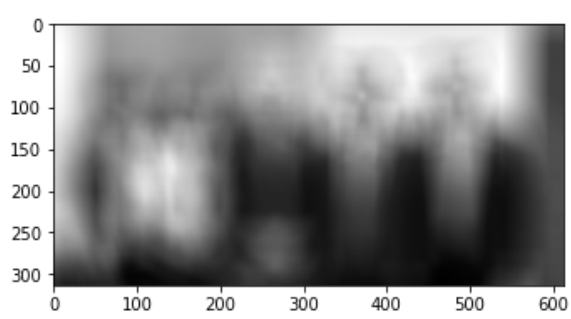
```
show_wu_face(methods[0])
```

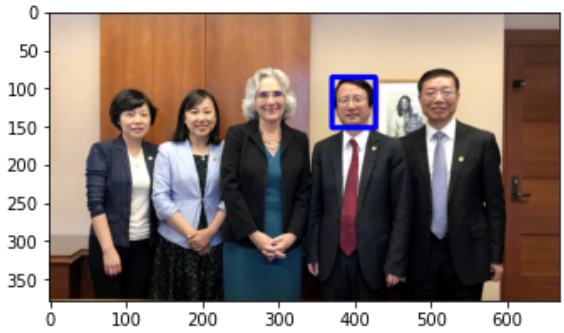



```
show_wu_face(methods[1], (0, 255, 0))
```

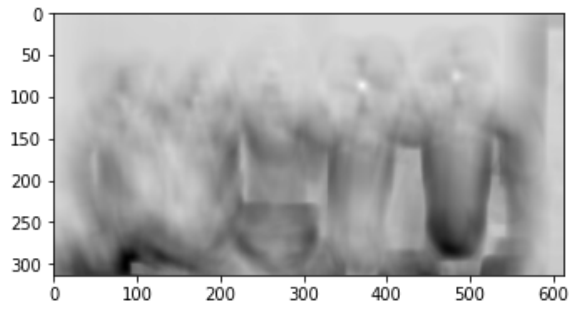


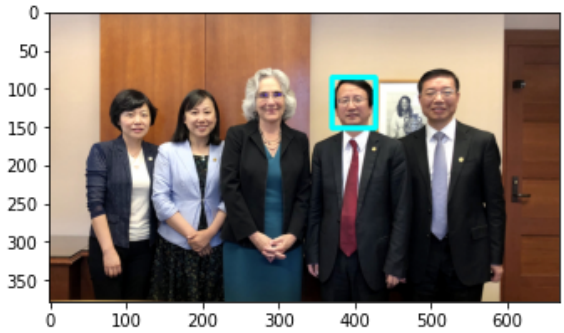

```
show_wu_face(methods[2], (0, 0, 255))
```



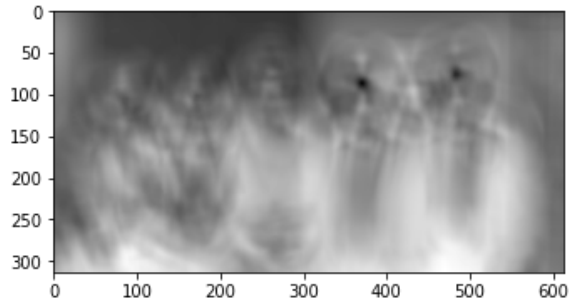


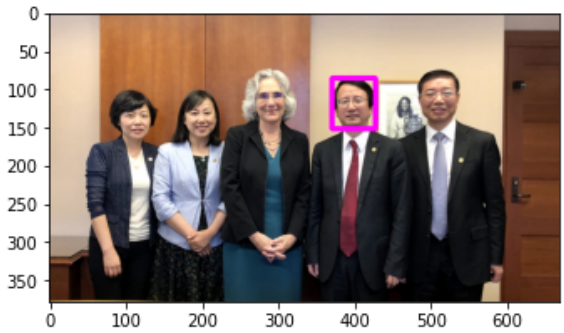
```
show_wu_face(methods[3], (0, 255, 255))
```





```
show_wu_face(methods[4], (255, 0, 255))
```

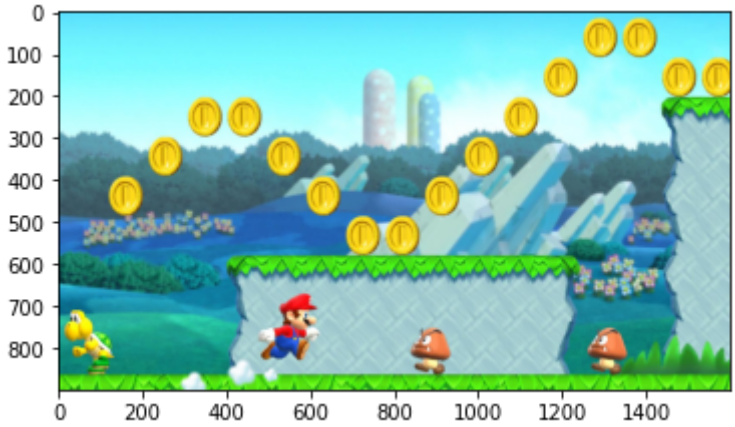




```
img_ma = read_image("./images/mario.jpg")
plt.imshow(img_ma, norm=no_norm)
```

```
(900, 1600, 3)
```

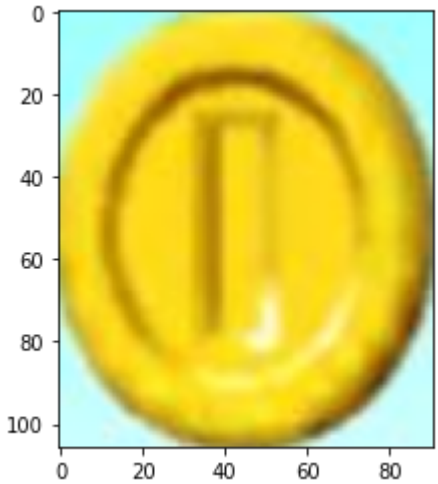
```
<matplotlib.image.AxesImage at 0x27bbb32ecd0>
```




```
img_tem = read_image("./images/coin.png")
plt.imshow(img_tem, norm=no_norm)
```

```
(106, 91, 3)
```

```
<matplotlib.image.AxesImage at 0x27bc0885220>
```

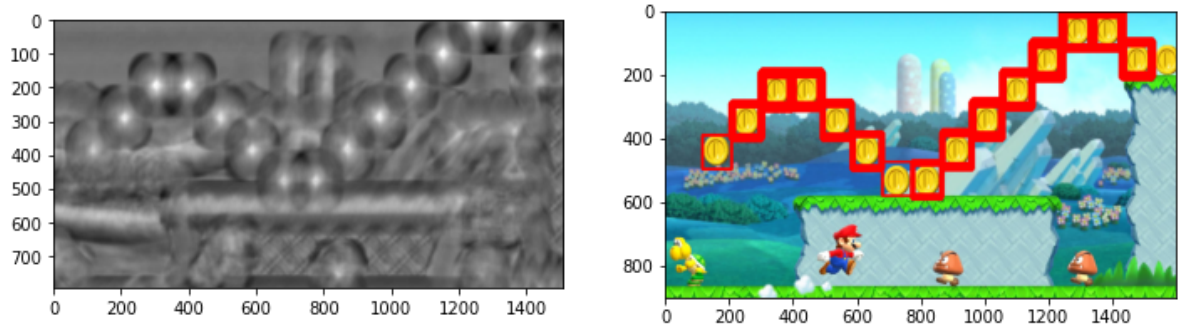



```
width, height = img_tem.shape[0], img_tem.shape[1]

res = cv2.matchTemplate(img_ma, img_tem, cv2.TM_CCOEFF_NORMED)
threshold = 0.4
```

```
loc = np.where(res >= threshold)
img_ma_copy = np.copy(img_ma)
print(loc)
for pt in zip( * loc[::-1]):
    cv2.rectangle(img_ma_copy, pt, (pt[0] + height, pt[1] + width), (255, 0, 0), 3)

def show_mario(res, img):
    plt.figure(figsize=(12, 7))
    plt.subplot(1, 2, 1)
    plt.imshow(res, cmap = 'gray')
    plt.subplot(1, 2, 2)
    plt.imshow(img, norm=no_norm)
```

```
(array([  0,   0,   0, ..., 488, 488, 488], dtype=int64), array([1238, 1239, 1240, ...,
774,  775,  776], dtype=int64))
```

```
show_mario(res, img_ma_copy)
```



`cvzone` and `mediapipe`

- mediapipe link
- cvzone link
- mediapipe github
- cvzone github

The End

2022.4