机器视觉 - 第六次作业

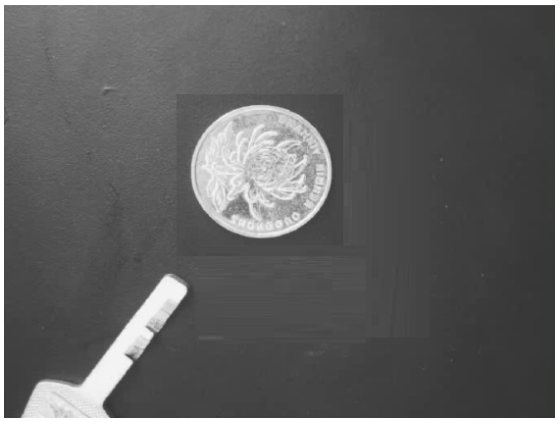
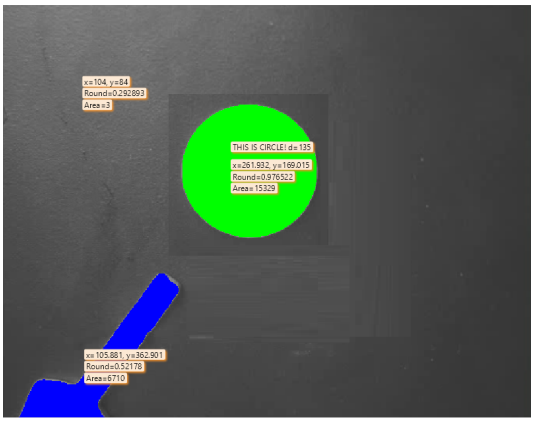
> 计算下图中的圆形物体的位置、面积、近似圆的直径，可以用Opencv自己写算法实现（鼓励尝试对二值图像进行行程编码）、也可以在Halcon里实现。
> 步骤：
> 1.图像二值化
> 2.形态学开运算
> x.图像行程编码
> 3.连通域
> 4.特征计算选取圆
> 5.参数计算
>
> 要求：以Word或pdf的形式提交源码，结果数据及计算时间。

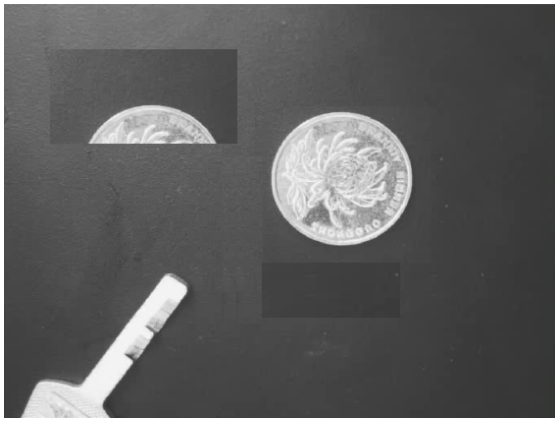
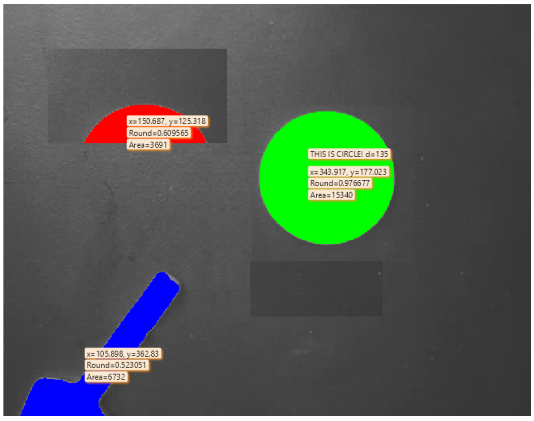
程序

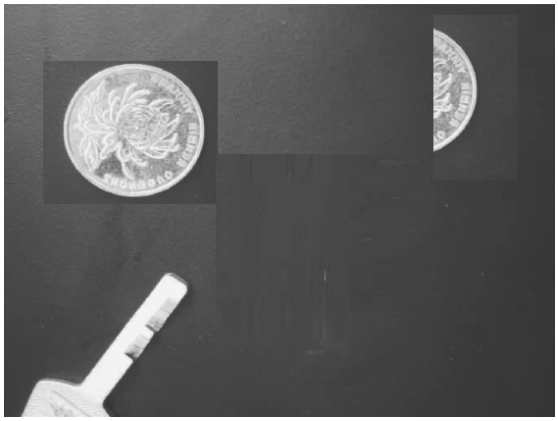
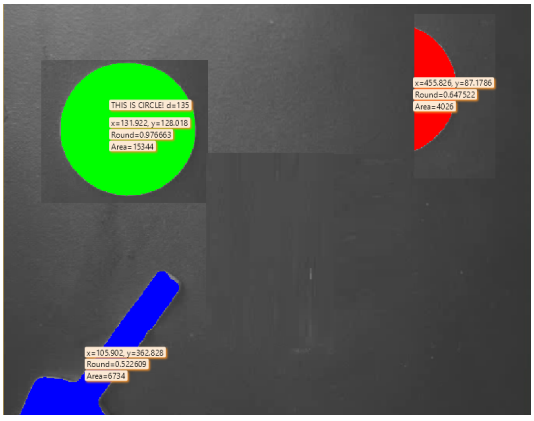
```
for j:=0 to 4 by 1
    read_image(Image, 'img/homework'+j+'.png')
    binary_threshold (Image, Region, 'max_separability', 'light', UsedThreshold)
    closing_circle(Region, RegionClosing, 5)
    connection(RegionClosing, ConnectedRegions)
    region_features(ConnectedRegions, 'roundness', RoundValues)
    region_features(ConnectedRegions, 'area', AreaValues)
    region_features(ConnectedRegions, 'row', RowValues)
    region_features(ConnectedRegions, 'column', ColValues)
    region_features(ConnectedRegions, 'width', WValues)
    region_features(ConnectedRegions, 'height', HValues)
    region_features(ConnectedRegions, 'inner_radius', RValues)

    maxid := 0
    for i:=0 to |RoundValues|-1 by 1
        x := ColValues[i] - 20
        y := RowValues[i]

        if (RoundValues[i] > RoundValues[maxid])
            maxid := i
        endif

        dev_disp_text('x='+ColValues[i]+', y='+y, 'image', y-12, x, 'black', [],
[])
        dev_disp_text('Round='+RoundValues[i], 'image', y, x, 'black', [], [])
        dev_disp_text('Area='+AreaValues[i], 'image', y+12, x, 'black', [], [])
    endfor
    dev_disp_text('THIS IS CIRCLE! d='+(2*RValues[maxid]), 'image',
RowValues[maxid]-30, ColValues[maxid]-20, 'black', [], [])
    stop()
endfor
```

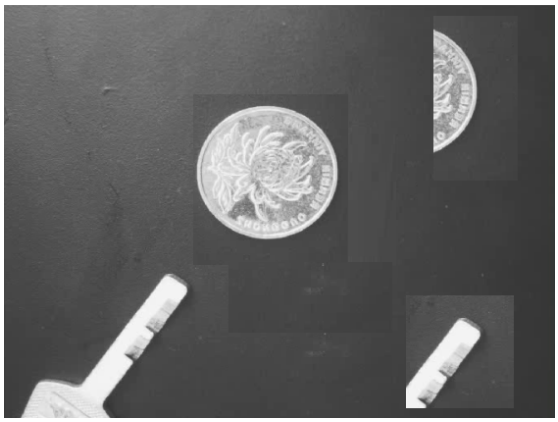
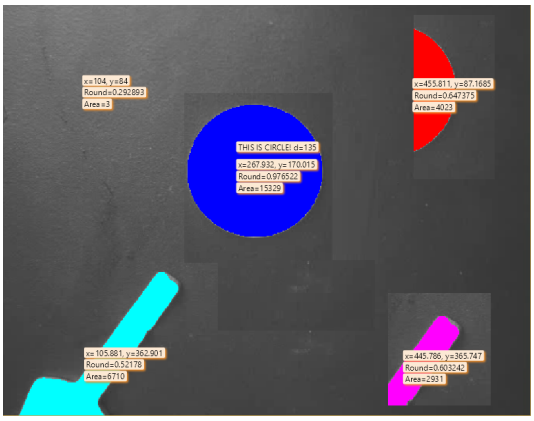
结果及数据

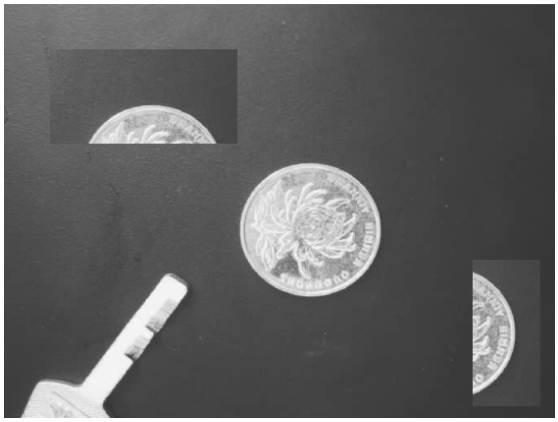
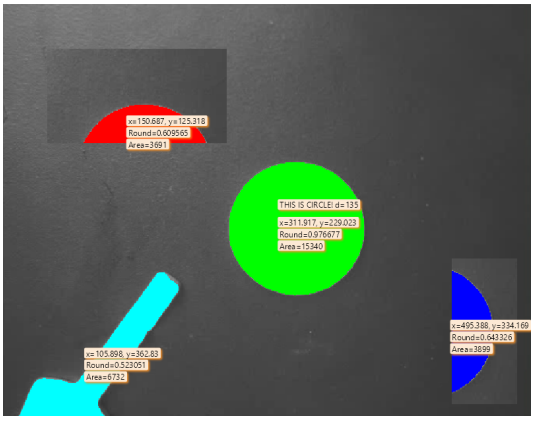
结果如图，图上标有各个连通域的位置、面积，和圆形连通域的直径。

原图1	结果图1
	

原图2	结果图2
	

原图3	结果图3
	

原图4	结果图4
	

原图5	结果图5
	

代码分析

分析如图，为各行代码的执行时间。

总用时	平均用时
	

```
for j:=0 to 4 by 1                                                                  104.107 ms
    read_image(Image, 'img/homework'+j+'.png')                                      201.904 ms
    binary_threshold (Image, Region, 'max_separability', 'light', UsedThreshold)    165.212 ms
    closing_circle(Region, RegionClosing, 5)                                        119.153 ms
    connection(RegionClosing, ConnectedRegions)                                     122.478 ms
    region_features(ConnectedRegions, 'roundness', RoundValues)                      79.321 ms
    region_features(ConnectedRegions, 'area', AreaValues)                           124.075 ms
    region_features(ConnectedRegions, 'row', RowValues)                             100.983 ms
    region_features(ConnectedRegions, 'column', ColValues)                           77.869 ms
    region_features(ConnectedRegions, 'width', WValues)                              89.181 ms
    region_features(ConnectedRegions, 'height', HValues)                             74.836 ms
    region_features(ConnectedRegions, 'inner_radius', RValues)                       63.290 ms

    maxid := 0                                                                       71.649 ms
    for i:=0 to |RoundValues|-1 by 1                                                239.317 ms
        x := ColValues[i] - 20                                                      118.868 ms
        y := RowValues[i]                                                           165.319 ms

        if (RoundValues[i] > RoundValues[maxid])                                      0.047 ms
            maxid := i                                                               68.860 ms
        endif                                                                         0.014 ms

        dev_disp_text('x='+ColValues[i]+', y='+y, 'image', y-12, x, 'black', [], [])  187.919 ms
        dev_disp_text('Round='+RoundValues[i], 'image', y, x, 'black', [], [])        62.917 ms
        dev_disp_text('Area='+AreaValues[i], 'image', y+12, x, 'black', [], [])      176.309 ms
    endfor                                                                            -
    dev_disp_text('THIS IS CIRCLE! d='+(2*RValues[maxid]), 'image', RowValues[maxid]-30,  90.621 ms
    stop()                                                                            0.018 ms
endfor                                                                                -
```

```
for j:=0 to 4 by 1                                                                  17.351 ms
    read_image(Image, 'img/homework'+j+'.png')                                      40.381 ms
    binary_threshold (Image, Region, 'max_separability', 'light', UsedThreshold)    33.042 ms
    closing_circle(Region, RegionClosing, 5)                                        23.831 ms
    connection(RegionClosing, ConnectedRegions)                                     24.496 ms
    region_features(ConnectedRegions, 'roundness', RoundValues)                     15.864 ms
    region_features(ConnectedRegions, 'area', AreaValues)                           24.815 ms
    region_features(ConnectedRegions, 'row', RowValues)                             20.197 ms
    region_features(ConnectedRegions, 'column', ColValues)                          15.574 ms
    region_features(ConnectedRegions, 'width', WValues)                             17.836 ms
    region_features(ConnectedRegions, 'height', HValues)                            14.967 ms
    region_features(ConnectedRegions, 'inner_radius', RValues)                      12.658 ms

    maxid := 0                                                                      14.330 ms
    for i:=0 to |RoundValues|-1 by 1                                                10.405 ms
        x := ColValues[i] - 20                                                       6.609 ms
        y := RowValues[i]                                                            9.184 ms

        if (RoundValues[i] > RoundValues[maxid])                                     0.003 ms
            maxid := i                                                              13.772 ms
        endif                                                                        0.003 ms

        dev_disp_text('x='+ColValues[i]+', y='+y, 'image', y-12, x, 'black', [], [])  10.440 ms
        dev_disp_text('Round='+RoundValues[i], 'image', y, x, 'black', [], [])        3.495 ms
        dev_disp_text('Area='+AreaValues[i], 'image', y+12, x, 'black', [], [])       9.795 ms
    endfor                                                                            -
    dev_disp_text('THIS IS CIRCLE! d='+(2*RValues[maxid]), 'image', RowValues[maxid]-30,  18.124 ms
    stop()                                                                            0.004 ms
endfor                                                                                -
```