2D Object Recognition

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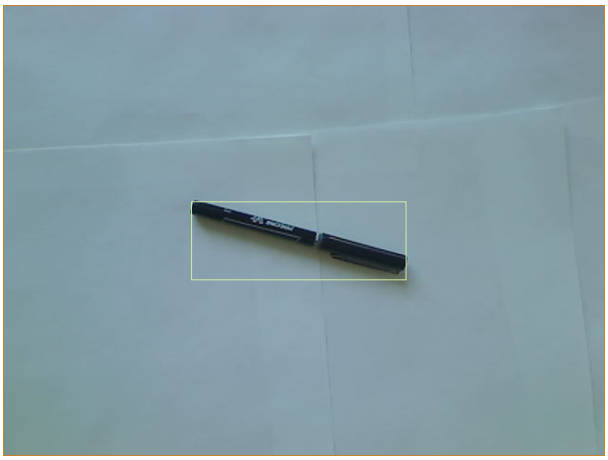
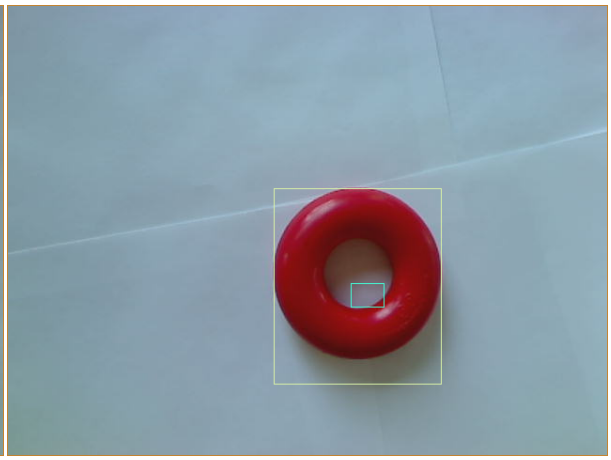
Tasks:

The first task is producing a thresholded video and screenshots of the results are below showing a pen:

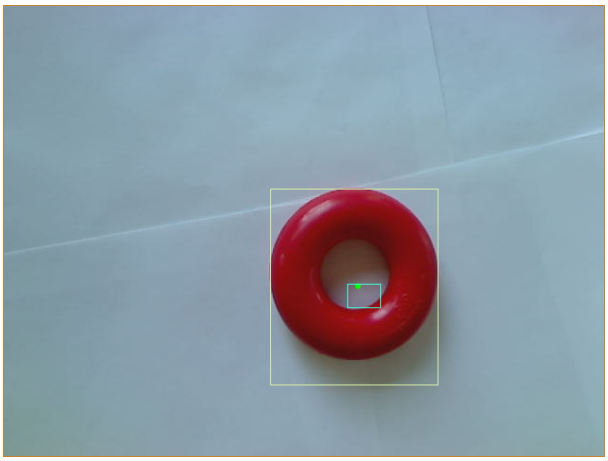
To do this, we first fix edges, reduce noise, etc using filters for example the gaussian and the median blur filters.

We then run a connected components analysis on the thresholded image. This gives us the number of regions in the image. We then draw rectangles around each region. Each region has a unique color to differentiate it from the other regions. Results for this are shown below:

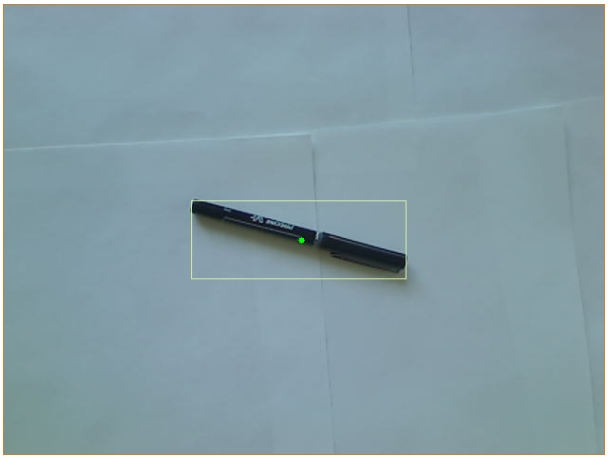




We then go ahead to compute features for each connected region. These features have to be translation and rotation dependent so we use the opencv moments and humoments functions. We then display the center of mass of the object in real time. Below are some screenshots of results:

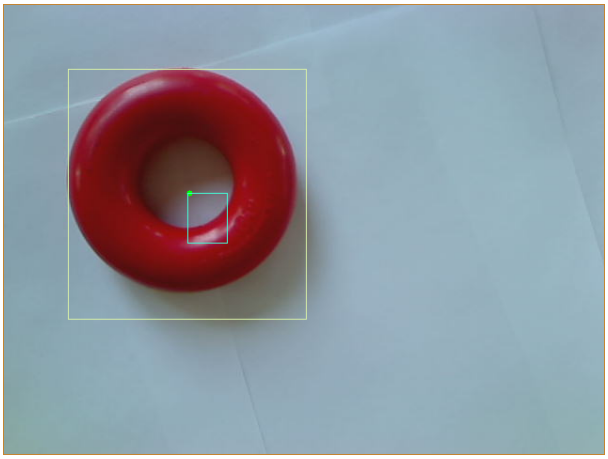


```
number of regions : 3
hu[0] = 0.767441
hu[1] = 3.205705
hu[2] = 4.033769
hu[3] = 5.994934
hu[4] = 11.133968
hu[5] = 7.764897
hu[6] = 11.189126
```



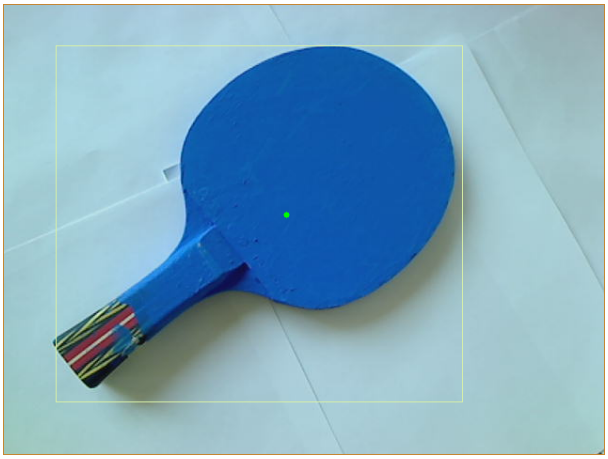
```
number of regions : 2
hu[0] = 0.150309
hu[1] = 0.325687
hu[2] = 2.621763
hu[3] = 2.709011
hu[4] = 5.374519
hu[5] = 2.879911
hu[6] = -7.000248
```

```
number of regions : 2
hu[0] = 0.153944
hu[1] = 0.333920
hu[2] = 2.222633
hu[3] = 2.302426
hu[4] = 4.565017
hu[5] = 2.473590
hu[6] = -6.341992
```



```
number of regions : 3
hu[0] = 0.768317
hu[1] = 3.255314
hu[2] = 3.995175
hu[3] = 5.564523
hu[4] = 10.344384
hu[5] = 7.221457
hu[6] = -12.478099
```

```
number of regions : 2
hu[0] = 0.705325
hu[1] = 2.071428
hu[2] = 2.842747
hu[3] = 3.337722
hu[4] = 6.430003
hu[5] = 4.381790
hu[6] = 7.441830
```



```
number of regions : 2
hu[0] = 0.678628
hu[1] = 1.963916
hu[2] = 2.537276
hu[3] = 3.141398
hu[4] = 5.980789
hu[5] = 4.123513
hu[6] = -7.782267
```

As seen from the results above, the feature values are fairly stable regardless of the pose of the object. Only hu[6] varies since it changes with orientation of the object. The other hu moments of an object for example the paddle are more or less the same. This means that our system would indeed be able to tell objects apart. Unfortunately, we did not have enough time to implement the rest of the system. It had a huge potential to work regardless.

References:

OpenCV