

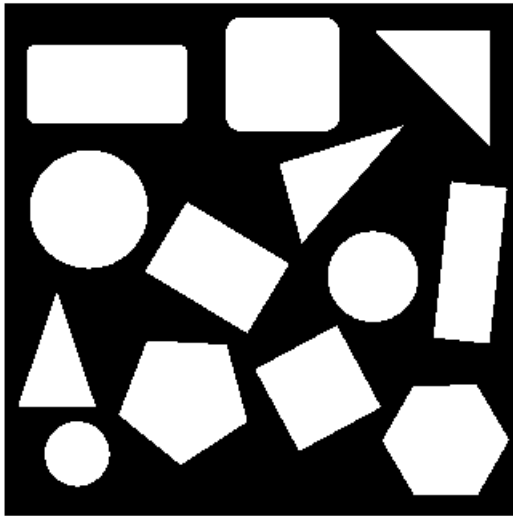
```
pic = imread('objects.png');  
imshow(pic);
```



```
s = im2double(pic);  
x = im2bw(s);
```

Black and white image

```
bw = imcomplement(pic);  
bw= im2bw(bw,230/255);  
bw=imcomplement(bw);  
imshow(bw);
```



```
% SE = strel('disk',10);
% B=imclose(bw,SE)
% B= imcomplement(B)
% imshow(B)
```

finding centroid

```
s = regionprops(bw, 'all')
```

s = 13×1 struct

...

Fields	Area	Centroid	BoundingBox	SubarrayIdx	MajorAxisLe...	MinorAxisLe...	Eccentricity	Orientation
1	1760	[33.1176...	[9.5000,...	1×2 cell	68.1965	39.8354	0.8117	89.9082
2	4878	[64.5000...	[14.5000...	1×2 cell	114.9831	56.3590	0.8716	2.5524e-17
3	4271	[53.1770...	[16.5000...	1×2 cell	73.8194	73.6854	0.0602	38.3925
4	1285	[45.8132...	[25.5000...	1×2 cell	40.5078	40.4250	0.0639	45.0000
5	4257	[112.583...	[71.5000...	1×2 cell	74.2515	74.2278	0.0253	52.3289
6	3788	[133.157...	[88.5000...	1×2 cell	86.2677	58.5635	0.7343	-31.1730
7	4965	[174.027...	[138.500...	1×2 cell	80.9345	80.9343	0.0019	-45
8	3368	[196.148...	[157.500...	1×2 cell	67.0339	66.9932	0.0348	-20.7467
9	2113	[202.701...	[172.500...	1×2 cell	83.0134	39.2195	0.8814	40.6297
10	2512	[230.500...	[202.500...	1×2 cell	56.6455	56.4859	0.0750	-90
11	2627	[279.351...	[232.500...	1×2 cell	83.6300	48.3283	0.8161	-45.0630
12	4066	[275.864...	[236.500...	1×2 cell	72.3797	72.0989	0.0880	22.0731

Fields	Area	Centroid	BoundingBox	SubarrayIdx	MajorAxisLe...	MinorAxisLe...	Eccentricity	Orientation
13	3442	[291.155...	[268.500...	1×2 cell	112.8873	40.6407	0.9329	83.5784

```
R = regionprops(bw, 'Centroid')
```

```
R = 13×1 struct
```

Fields	Centroid
1	[33.1176...
2	[64.5000...
3	[53.1770...
4	[45.8132...
5	[112.583...
6	[133.157...
7	[174.027...
8	[196.148...
9	[202.701...
10	[230.500...
11	[279.351...
12	[275.864...
13	[291.155...

position

```
for i = 1:length(s)
    center = R(i).Centroid;
    disp([num2str(i), ': Position = (', num2str(center(1)), ',', num2str(center(2)), ')']);
end
```

```
1: Position = (33.1176,228.4261)
2: Position = (64.5,50.9906)
3: Position = (53.177,129.1707)
4: Position = (45.8132,281.8132)
5: Position = (112.5835,246.5321)
6: Position = (133.1573,165.4931)
7: Position = (174.0278,44.9722)
8: Position = (196.1482,240.848)
9: Position = (202.7018,109.2882)
10: Position = (230.5,171.1775)
11: Position = (279.3514,41.6757)
12: Position = (275.8645,273.3077)
13: Position = (291.1554,162.493)
```

red outline

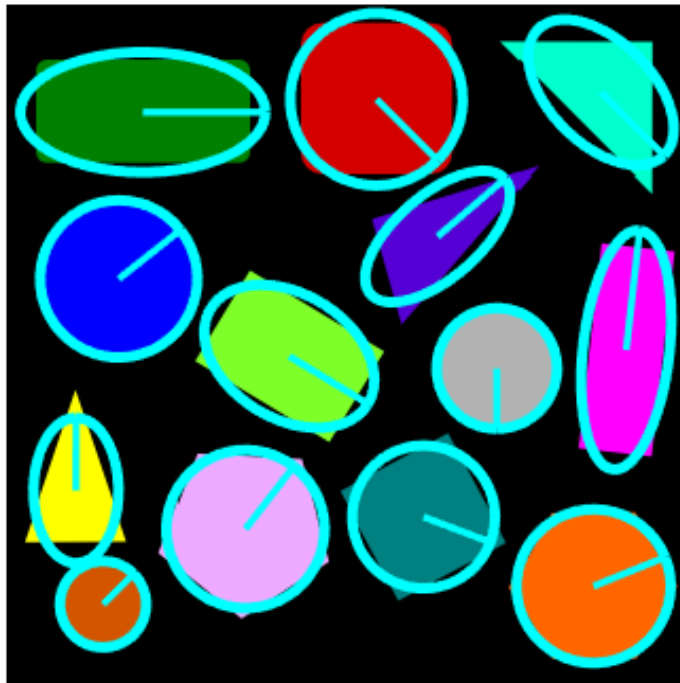
```
figure
imshow(pic, 'InitialMagnification', 'fit')
```

```

t = linspace(0,2*pi,50);
px = cell(1,length(s));
py=cell(1,length(s));

hold on
for k = 1:length(s)
    a = s(k).MajorAxisLength/2;
    b = s(k).MinorAxisLength/2;
    Xc = s(k).Centroid(1);
    Yc = s(k).Centroid(2);
    %     px{k}=[yc];
    %     py{k}=[xc];
    phi = deg2rad(-s(k).Orientation);
    x = Xc + a*cos(t)*cos(phi) - b*sin(t)*sin(phi);
    y = Yc + a*cos(t)*sin(phi) + b*sin(t)*cos(phi);
    plot(x,y,'cyan','LineWidth',3);
    ex = a*cos(phi) + Xc;
    ey = a*sin(phi) + Yc;
    plot([Xc,ex],[Yc,ey],'cyan','LineWidth', 2);
    %     Rz = [cosd(s(i).Orientation) -sind(s(i).Orientation) ; sind(s(i).Orientation) cosd(s(i).Orientation)];
    %     new_p = Rz*[ex;ey]+[Xc;Yc]
end
hold off

```



rotating the i

```

stats = regionprops(bw,{'Centroid','MajorAxisLength','MinorAxisLength','Orientation','pixelIdxList');

new_image = pic; % Initiating a new image
new_image(:,:,:) = 0; % With RGB = black background
for i = 1:length(s)
    centroid = stats(i).Centroid; % centroid of each object
    orientation = -stats(i).Orientation; % orientation of each object
    Pixel_Index_List = stats(i).PixelIdxList; %Pixel Index list of each object
    R_z = [cosd(orientation), -sind(orientation), 0;
           sind(orientation), cosd(orientation), 0;
           0, 0, 1]; % Rotation Matrix around z-axis:
    T_f = [cosd(orientation), -sind(orientation), 0, 0;
           sind(orientation), cosd(orientation), 0, 0;
           0, 0, 1, 0;
           0, 0, 0, 1]; %Transformation matrix
    % finding each point of the object
    for j = 1: length(Pixel_Index_List)
        x = mod(Pixel_Index_List(j), 320) + 1;
        y = ceil(Pixel_Index_List(j) / 320);
        % shifting each point (x, y) to the origin
        shifted_x = x - centroid(2);
        shifted_y = y - centroid(1);
        % Rotating object at transformation T_f
        P_a = [shifted_x; shifted_y; 0 ; 1];
        P_b = T_f*P_a;
        % Shifting object back to its previous position
        new_x = P_b(1) + centroid(2);
        new_y = P_b(2) + centroid(1);

        % we have to limit the boundary to the image pixels
        if ((new_x>0 && new_x<320) && (new_y>0 && new_y<320))
            % RGB
            new_image(ceil(new_x), ceil(new_y),1) = pic(x,y, 1);
            new_image(ceil(new_x), ceil(new_y),2) = pic(x,y, 2);
            new_image(ceil(new_x), ceil(new_y),3) = pic(x,y, 3);
        end
    end
end
imshow(new_image)

```

