# Visualizing `regionprops` ellipse measurements

*Excerpted from the Steve on Image Processing blog.*

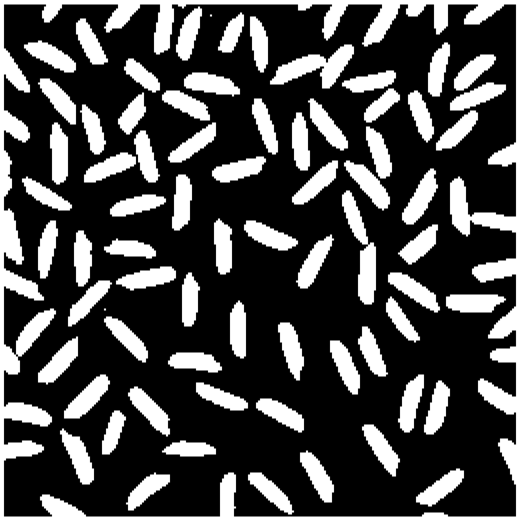
The Image Processing Toolbox™ function `regionprops` gives you shape-based measurements of image regions. It's pretty useful, and I have shown many examples of it on this blog. Today I want to show you how to visualize the ellipse-based measurements produced by `regionprops`.

There are several supported measurements that are based on approximating regions by ellipses:

- Orientation
- MajorAxisLength
- MinorAxisLength
- Eccentricity

Here's an MATLAB® example.

```
url = 'http://blogs.mathworks.com/images/steve/2010/rice_binary.png';
bw = imread(url);
imshow(bw)
```



Call `regionprops` with the list of measurements you desire:

```
s = regionprops(bw, 'Orientation', 'MajorAxisLength', ...
    'MinorAxisLength', 'Eccentricity')
s =

99x1 struct array with fields:
    MajorAxisLength
    MinorAxisLength
    Eccentricity
    Orientation
```

From the output you can infer that `regionprops` found 99 objects in the binary image. It returned the desired measurements as a 99-element `struct` array. Here are the measurements for the 10th object:

```
s(10)
ans =

    MajorAxisLength: 28.7693
    MinorAxisLength: 9.4320
       Eccentricity: 0.9447
        Orientation: -27.0162
```

How can you do a visual sanity check of the output? I'll show you some code you can use to superimpose the fitted ellipses over the original image.

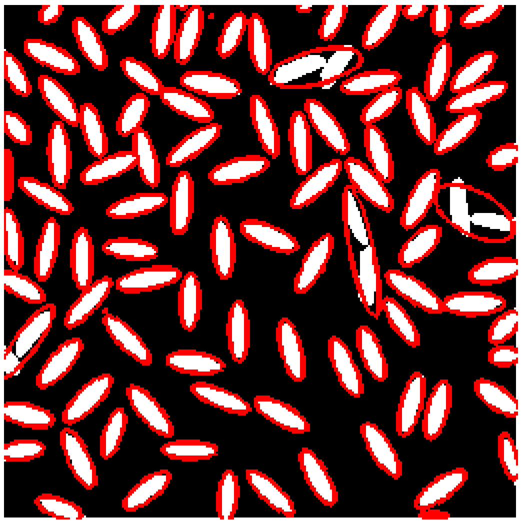
First, we'll take one additional measurement: the centroid.

```
s = regionprops(bw, 'Orientation', 'MajorAxisLength', ...
    'MinorAxisLength', 'Eccentricity', 'Centroid');
```

For each ellipse, we'll use a parametric form of the ellipse equation to plot the outline of the ellipse over the image.

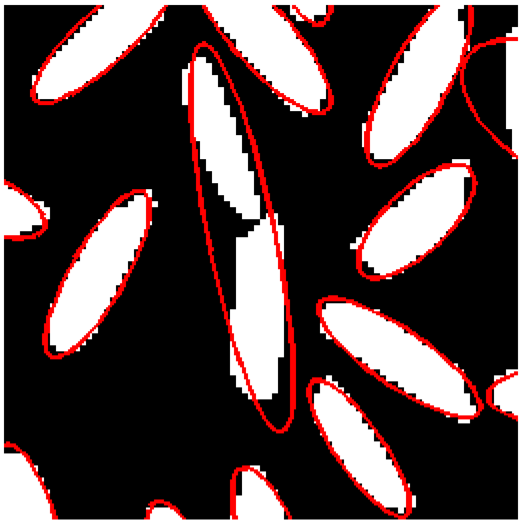
```
imshow(bw)
hold on

phi = linspace(0,2*pi,50);
cosphi = cos(phi);
```

```
sinphi = sin(phi);

for k = 1:length(s)
     xbar = s(k).Centroid(1);
     ybar = s(k).Centroid(2);

     a = s(k).MajorAxisLength/2;
     b = s(k).MinorAxisLength/2;

     theta = pi*s(k).Orientation/180;
     R = [ cos(theta)    sin(theta)
          -sin(theta)    cos(theta)];

     xy = [a*cosphi; b*sinphi];
     xy = R*xy;

     x = xy(1,:) + xbar;
     y = xy(2,:) + ybar;

     plot(x,y,'r','LineWidth',2);
end
hold off
```



You can zoom in to see exactly why some of the ellipses don't seem to match the objects in the image very well. Normally you'd zoom interactively using the zoom controls in the figure toolbar, but of course I can't do that in this blog post, so I'll use the `axis` function.

```
axis([140 225 85 170])
```



Now you can see that the two objects in the center of the display are actually touching at one point. That caused `regionprops` to consider them to be a single object and to fit an ellipse to both of them together.

## Learn More About Image Processing

- *Tracking Objects: Acquiring and Analyzing Image Sequences in MATLAB* (technical article)
- *The Watershed Transform: Strategies for Image Segmentation* (technical article)
- *New Features for High-Performance Image Processing in MATLAB* (technical article)
- *Image Processing Toolbox* (product trial)