



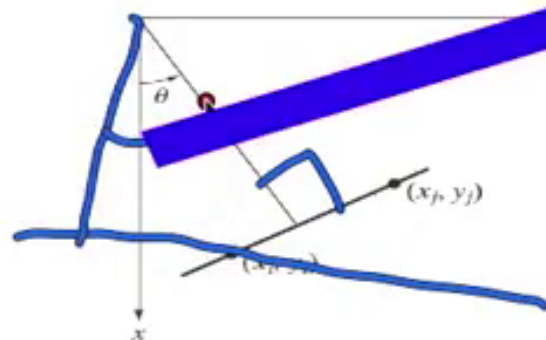
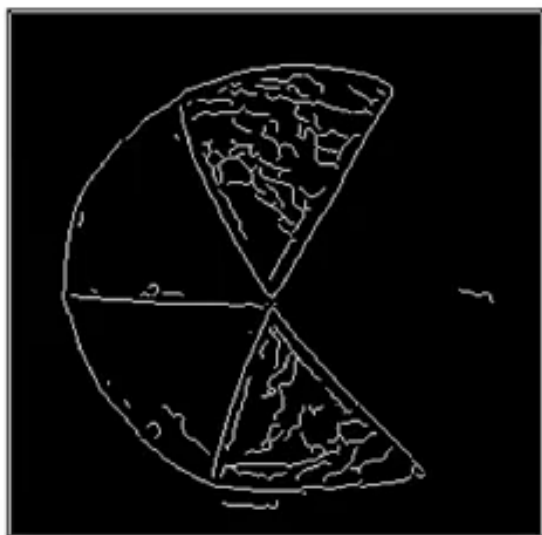
Digital Image Processing, 3rd ed.

Gonzalez & Woods

www.ImageProcessingPlace.com

Chapter 10 Segmentation

Angle measured to x axis.



$$\rho = x \cos \theta + y \sin \theta$$





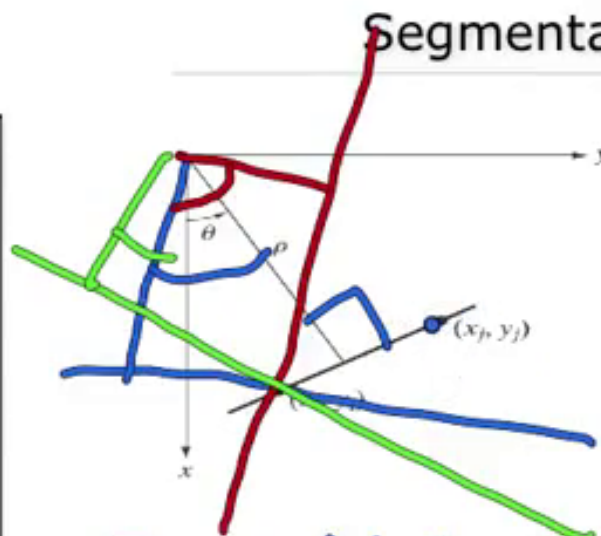
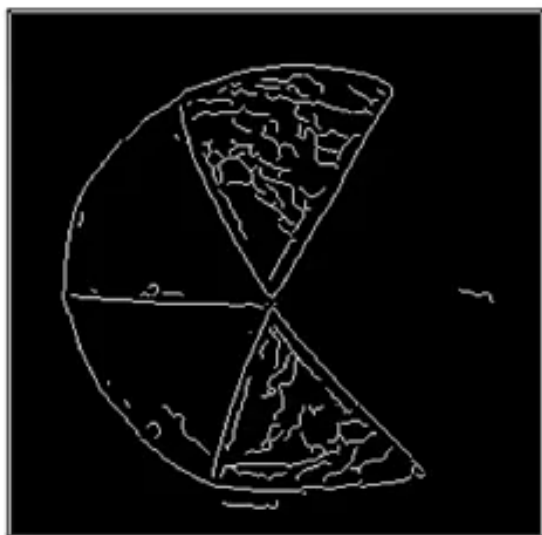
Digital Image Processing, 3rd ed.

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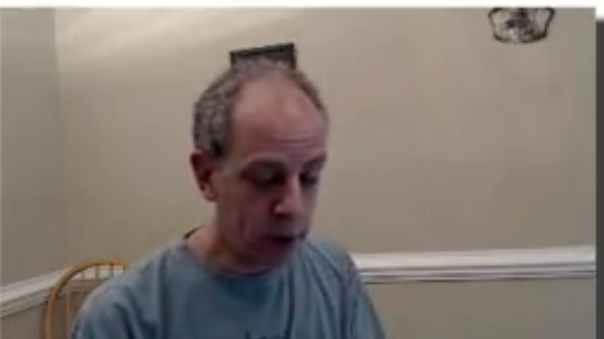
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Chapter 10

Segmentation



$$\rho = x \cos \theta + y \sin \theta$$
$$(\rho, \theta)$$





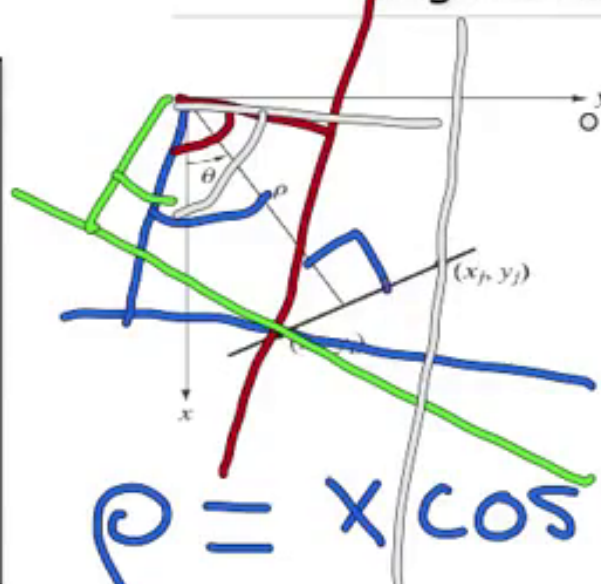
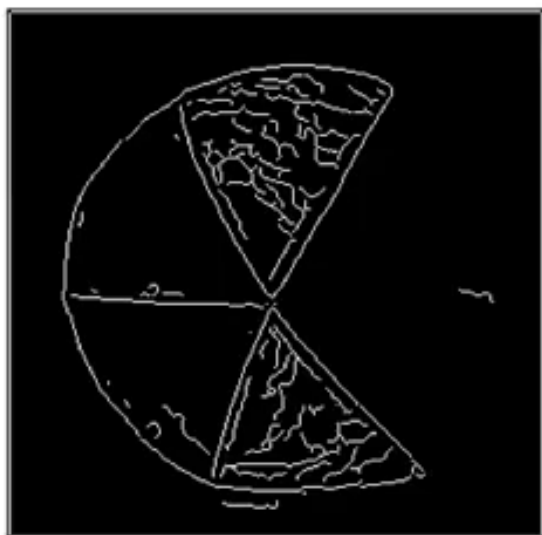
Digital Image Processing, 3rd ed.

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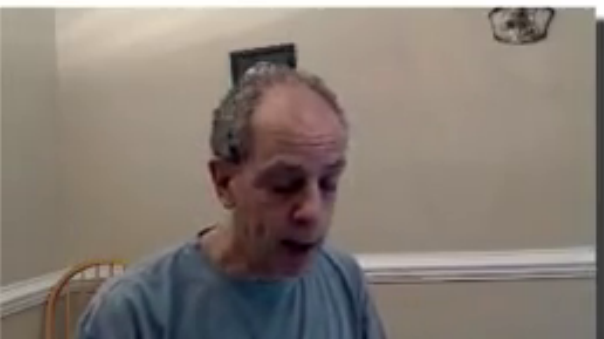
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Chapter 10

Segmentation



$$\rho = x \cos \theta + y \sin \theta$$
$$(\rho, \theta)$$





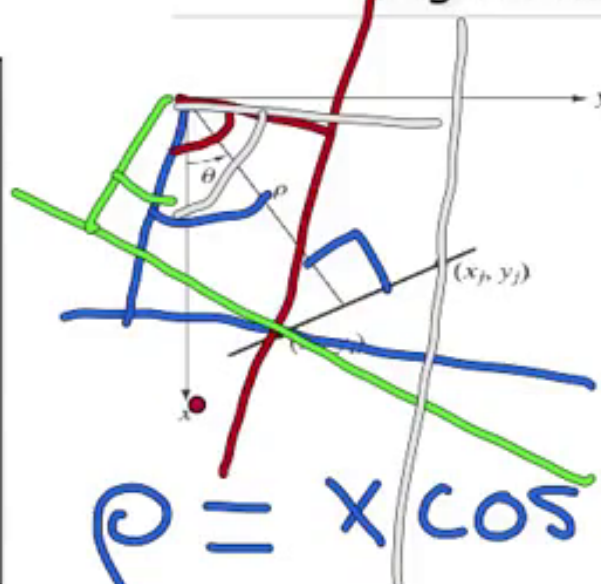
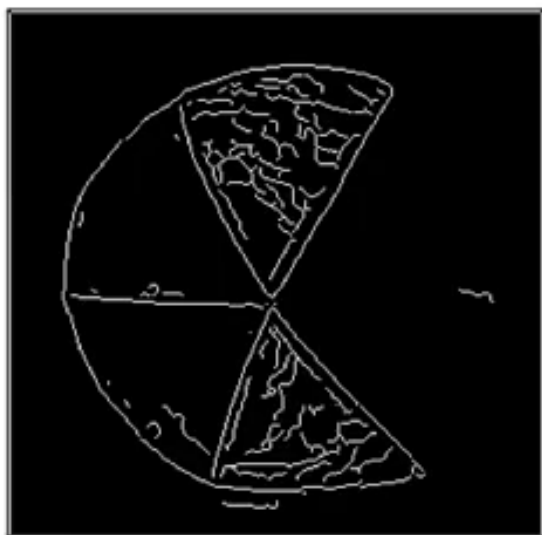
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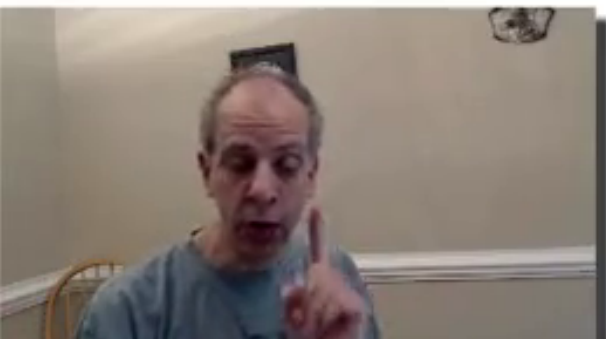
Chapter 10

Segmentation



$$\rho = x \cos \theta + y \sin \theta$$

(ρ, θ) (ρ, θ)





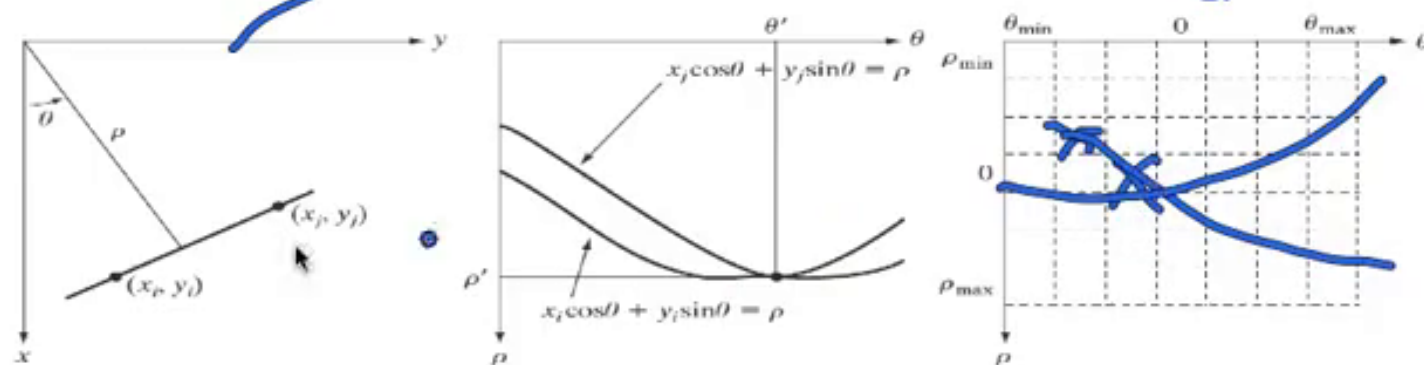
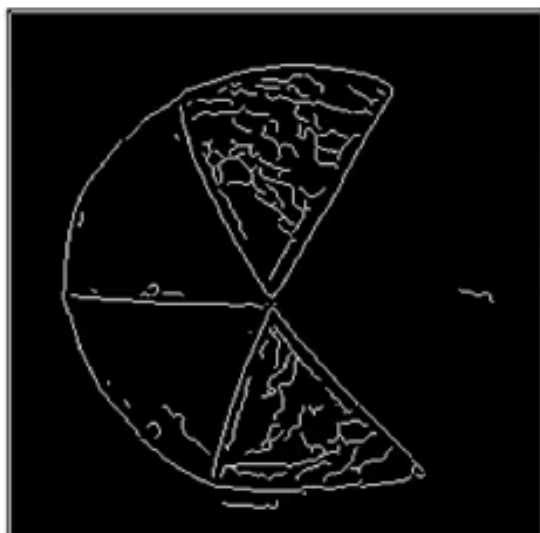
Digital Image Processing, 3rd ed.

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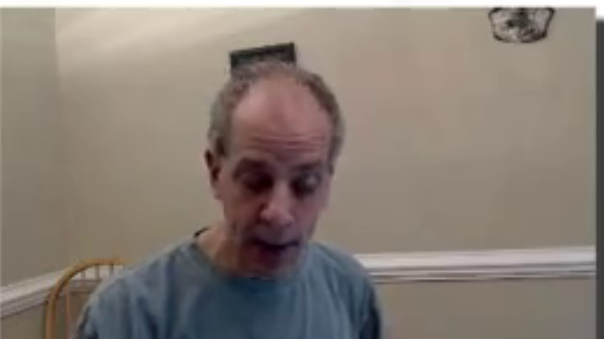
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Chapter 10

Segmentation



$$\rho = x \cos \theta + y \sin \theta$$





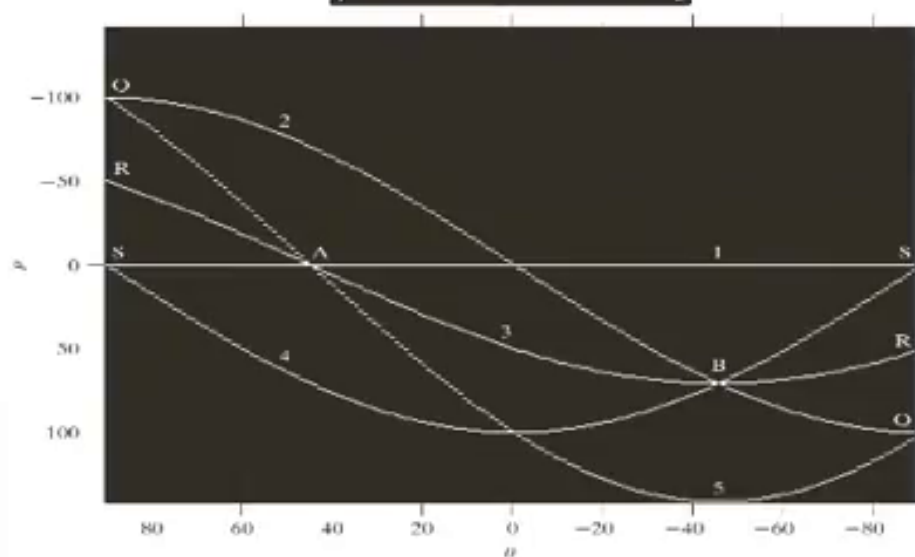
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Chapter 10

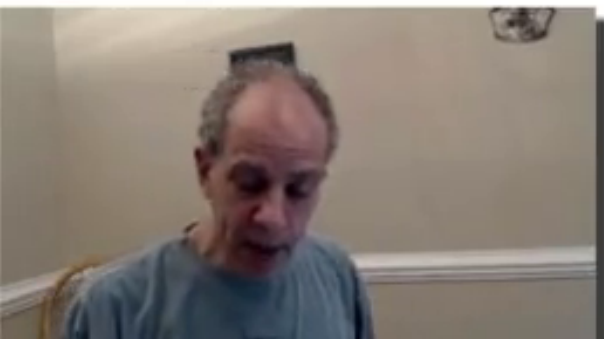
Segmentation

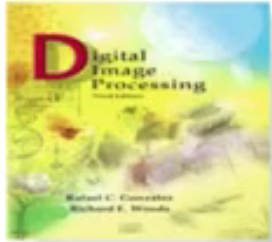


a
b

FIGURE 10.33

(a) Image of size 101×101 pixels, containing five points.
(b) Corresponding parameter space. (The points in (a) were enlarged to make them easier to see.)





Digital Image Processing, 3rd ed.

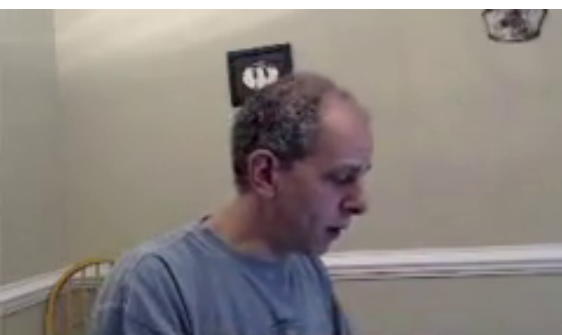
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Chapter 10

Segmentation





Folder: /Users/guillermo_sapiro/Documents/MATLAB

Command Window

MATLAB? Watch this [Video](#), see [Demos](#), or read [Getting Started](#).

```
len = norm(lines(k).point1 - lines(k).point2);
if ( len > max_len)
    max_len = len;
    xy_long = xy;
end
end

% highlight the longest line segment
plot(xy_long(:,1),xy_long(:,2),'LineWidth',2,'Color','cyan');
```

See also [hough](#) and [houghpeaks](#).

Reference page in Help browser

[doc houghlines](#)

>>

```
I = imread('circuit.tif');
rotI = imrotate(I,33,'crop');
BW = edge(rotI,'canny');
[H,T,R] = hough(BW);
imshow(H,[],'XData',T,'YData',R,'InitialMagnification','fit');
xlabel('\theta'), ylabel('\rho');
axis on, axis normal, hold on;
P = houghpeaks(H,5,'threshold',ceil(0.3*max(H(:))));
x = T(P(:,2));
y = R(P(:,1));
plot(x,y,'s','color','white');

% Find lines and plot them
lines = houghlines(BW,T,R,P,'FillGap',5,'MinLength',7);
figure, imshow(rotI), hold on
max_len = 0;
for k = 1:length(lines)
    xy = [lines(k).point1; lines(k).point2];
    plot(xy(:,1),xy(:,2),'LineWidth',2,'Color','green');

    % plot beginnings and ends of lines
    plot(xy(1,1),xy(1,2),'x','LineWidth',2,'Color','yellow');
    plot(xy(2,1),xy(2,2),'x','LineWidth',2,'Color','red');

    % determine the endpoints of the longest line segment
    len = norm(lines(k).point1 - lines(k).point2);
    if ( len > max_len)
        max_len = len;
        xy_long = xy;
    end
end
```

f1 >>

Select a file to view details

Workspace

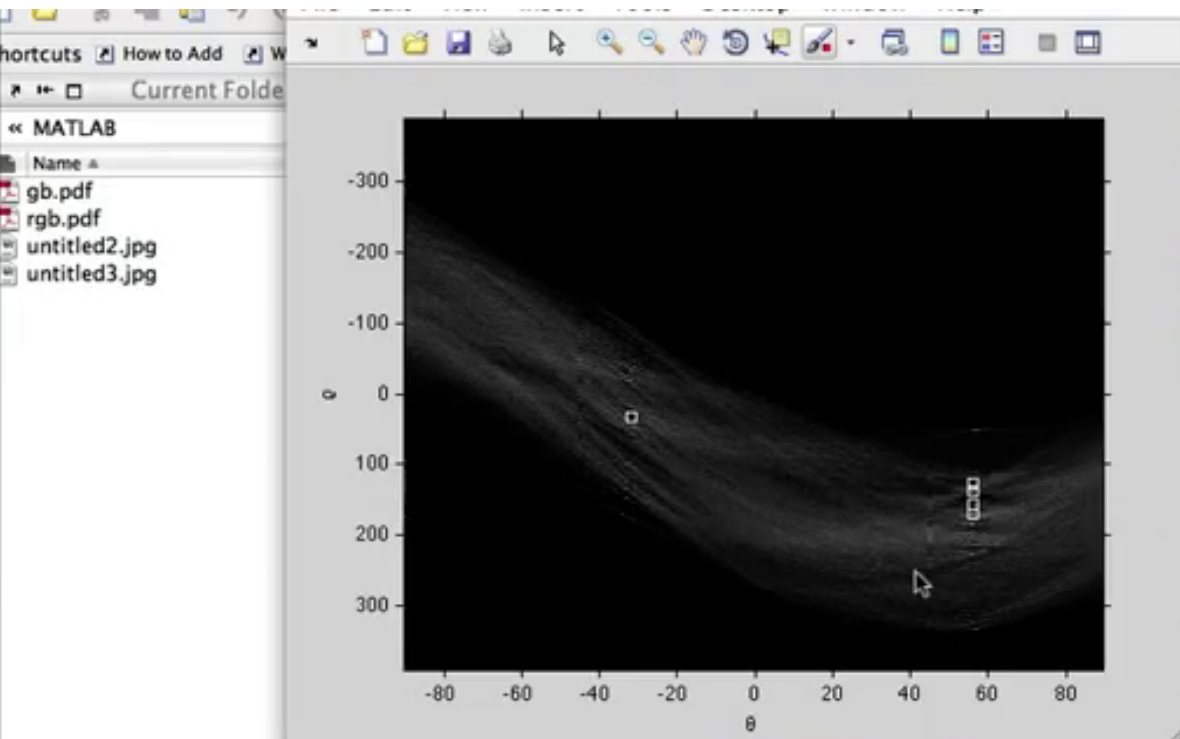
Se...

Name

- ☒ BW
- ☐ H
- ☐ I
- ☐ P
- ☐ R
- ☐ T
- ☐ ball
- ☒ e
- ☐ im
- ☐ k
- ☐ len
- ☐ lines
- ☐ max_len
- ☐ radii
- ☐ rotI
- ☐ x
- ☐ xy

Command Window

```
x = T(P(:,2));
y = R(P(:,1));
plot(x,y,'s',...
% Find line
lines = hou
figure, ima
max_len = 0;
for k = 1:l
    xy = [lines
% plot begi
plot(xy(1,1),
plot(xy(2,1),
% determine
len = norm
if ( len >
max_len = l
xy_long = x
end
end
```

```

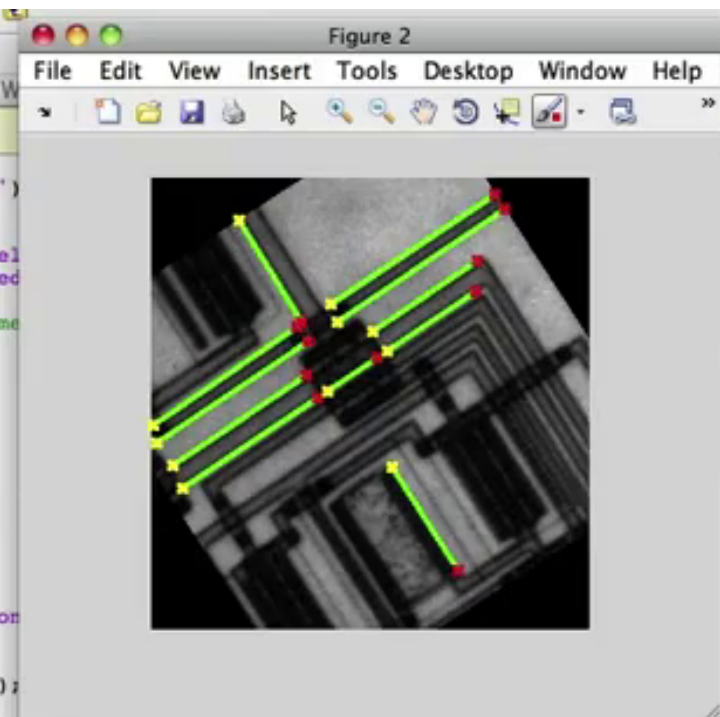
plot(x,y,'s','color','white');

% Find lines and plot them
lines = houghlines(BW,T,R,P,'FillGap',5,'MinLength',7);
figure, imshow(rotI), hold on
max_len = 0;
for k = 1:length(lines)
    xy = [lines(k).point1; lines(k).point2];
    plot(xy(:,1),xy(:,2),'LineWidth',2,'Color','green');

    % plot beginnings and ends of lines
    plot(xy(1,1),xy(1,2),'x','LineWidth',2,'Color','yellow');
    plot(xy(2,1),xy(2,2),'x','LineWidth',2,'Color','red');

    % determine the endpoints of the longest line segment
    len = norm(lines(k).point1 - lines(k).point2);
    if ( len > max_len)
        max_len = len;
        xy_long = xy;
    end
end

```

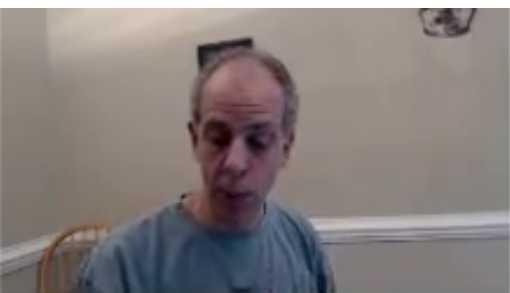


```

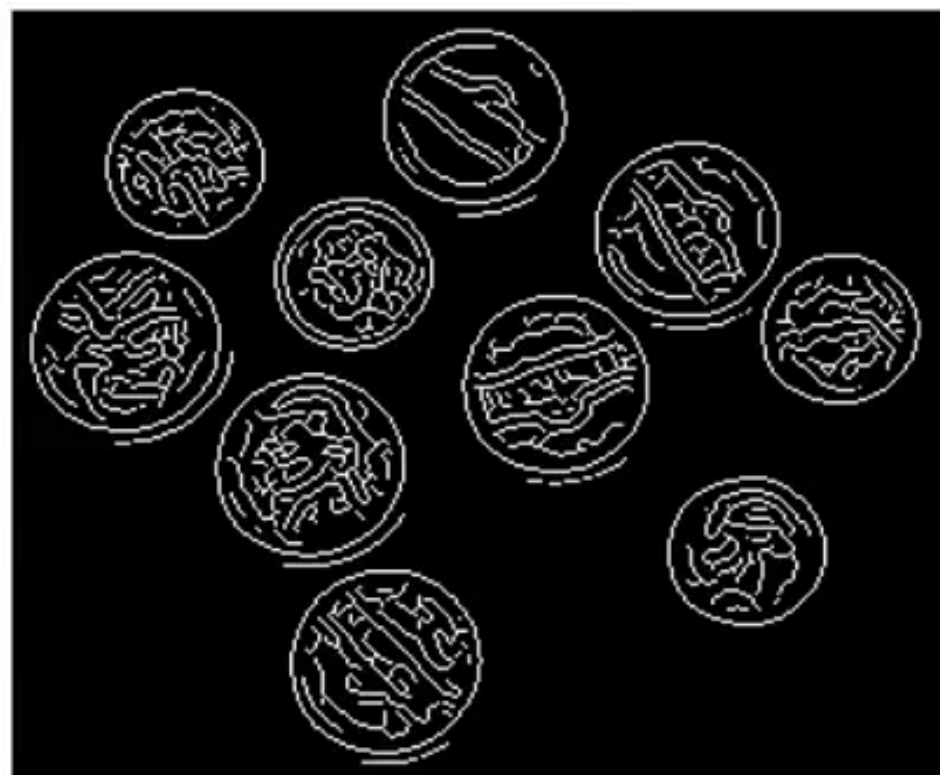
x = T(P(:,2));
y = R(P(:,1));
plot(x,y,'s');
% Find line
lines = hou
figure, ima
max_len = 0;
for k = 1:l
    xy = [lines
    plot(xy(:,1),
    % plot begi
    plot(xy(1,1),
    plot(xy(2,1),
    % determine
    len = norm
    if ( len >
    max_len = l
    xy_long = x
    end
end

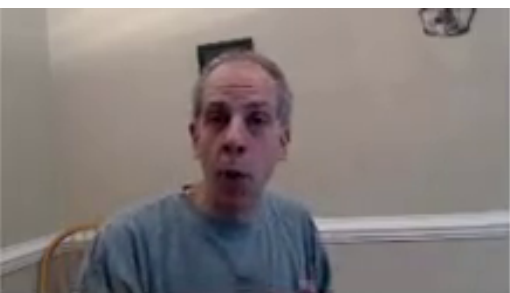
```



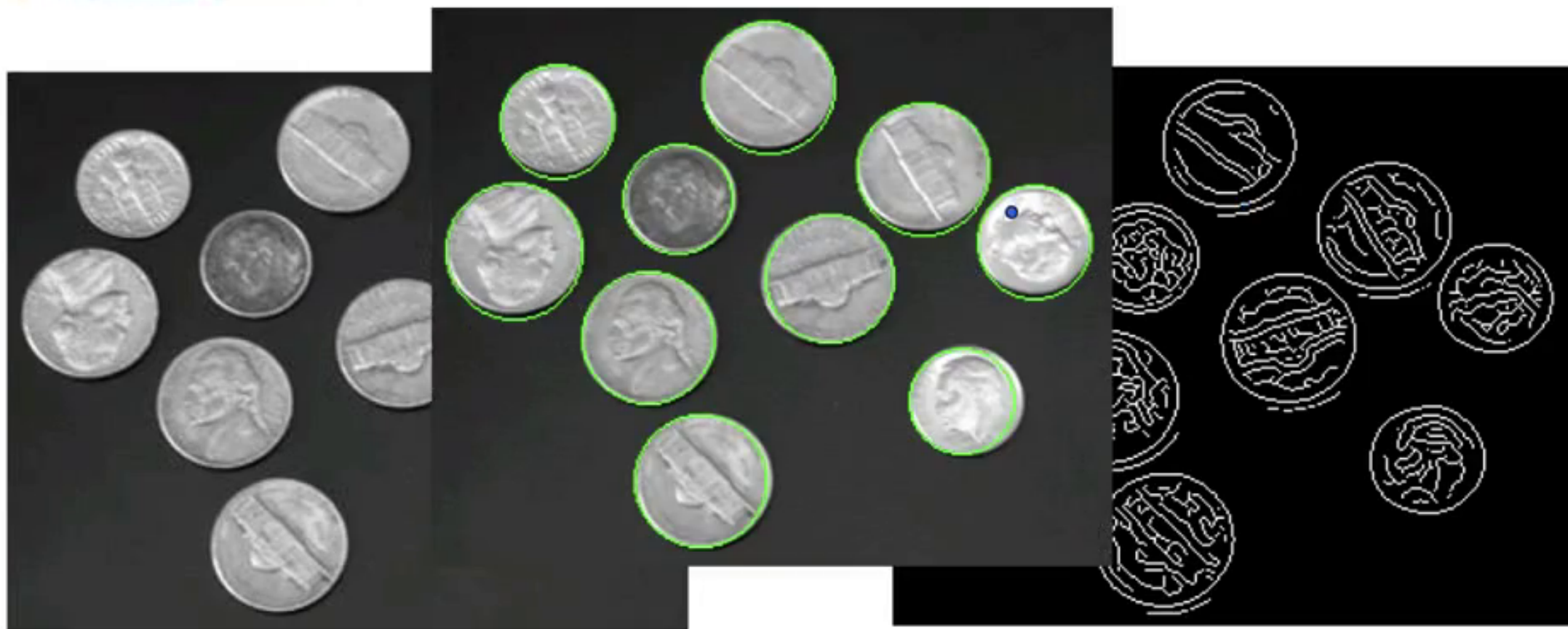


What About Circles?





What About Circles?



Images courtesy of D. Young and Mathworks