15EEE337 Digital Image Processing

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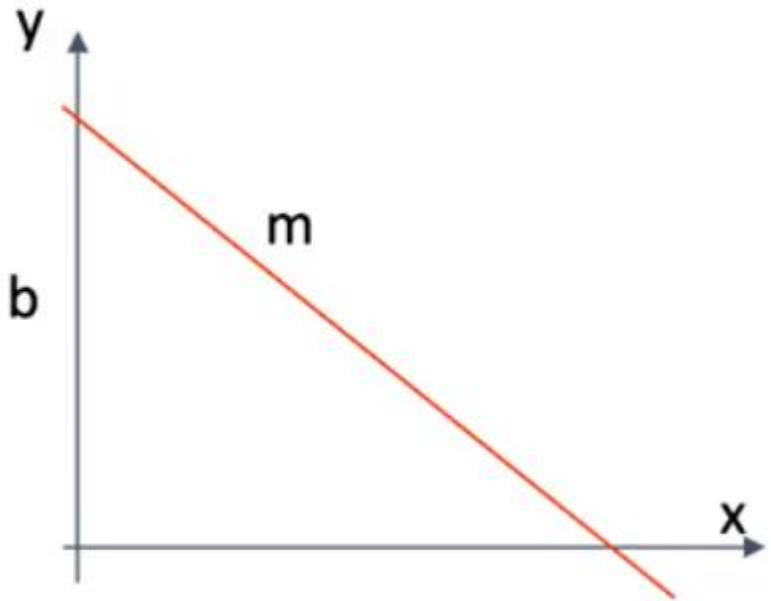
Last Lecture

- Detection of points, lines, edges
- Edge models

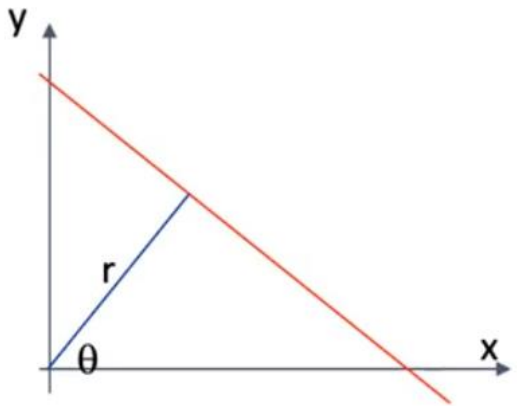


The straight line is normally parameterized as:

y = mx + b

Where m is the slope and b is the intercept.

NOTE: m goes to infinity for vertical lines.



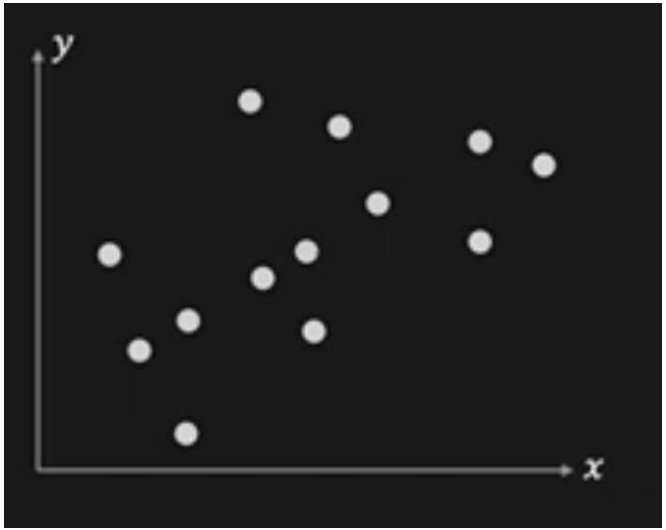
The line can also be represented as:

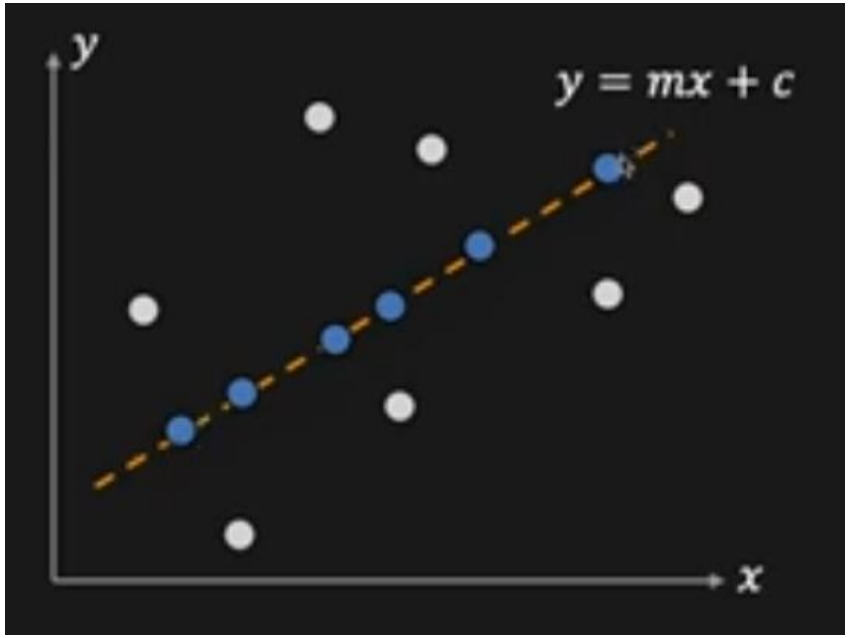
$$r = x\cos\theta + y\sin\theta$$

where r is the distance from the origin to the closest point the straight line.

Hough Transform

- Algorithmic approach




y
y = mx + c
x

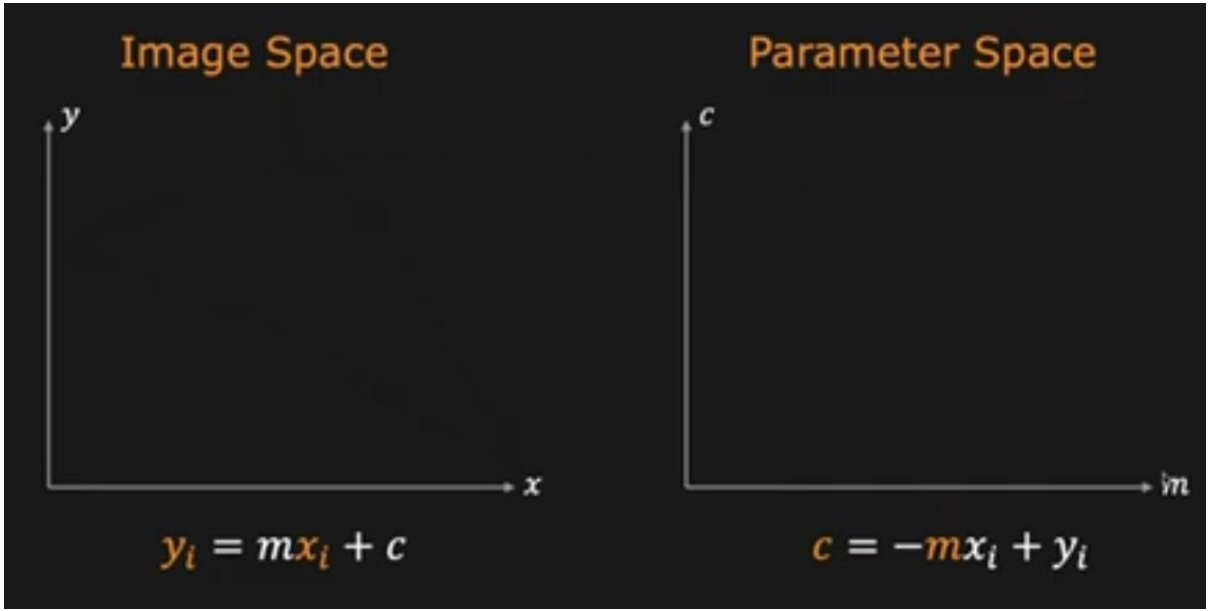


Image Space
y
x
$y_i = mx_i + c$
Parameter Space
c
m
$c = -mx_i + y_i$

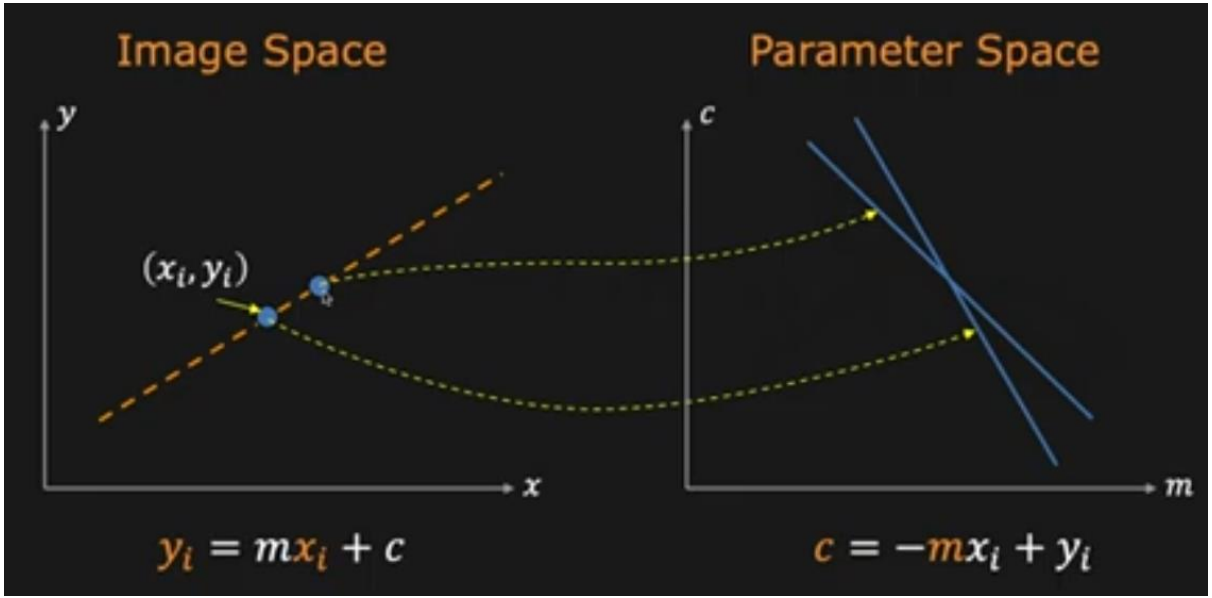


Image Space
Parameter Space
y
x
c
m
(x_i, y_i)
$y_i = mx_i + c$
$c = -mx_i + y_i$

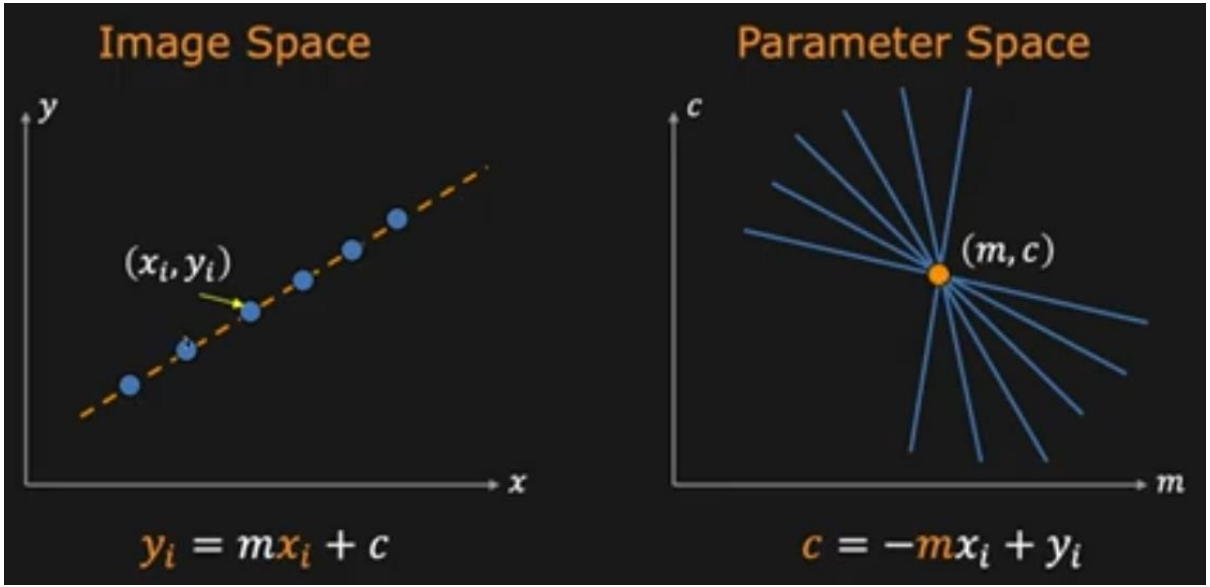
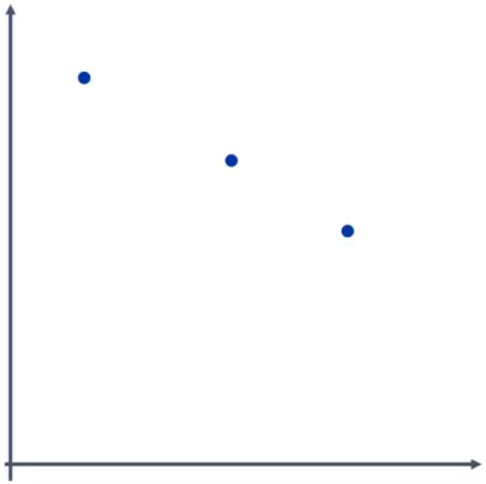
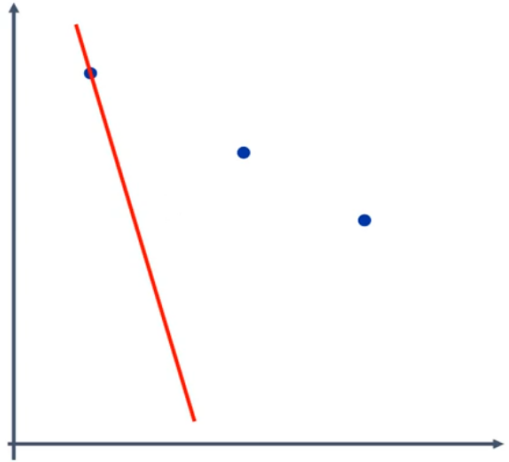
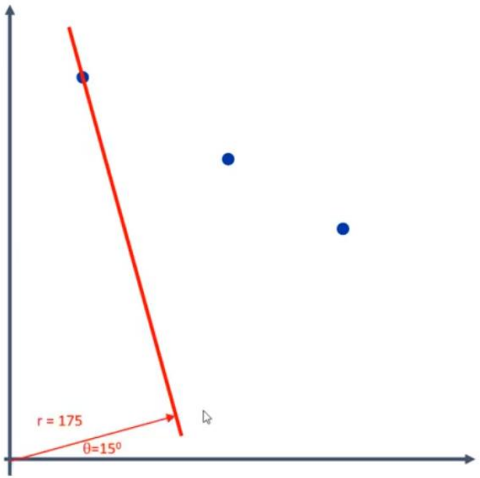
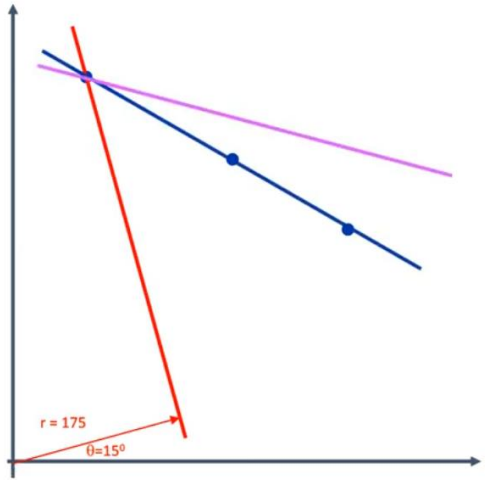


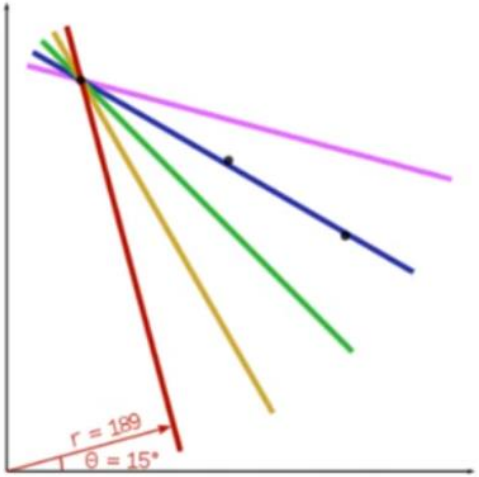
Image Space
y
x
(x_i, y_i)
$y_i = mx_i + c$
Parameter Space
c
m
(m, c)
$c = -mx_i + y_i$



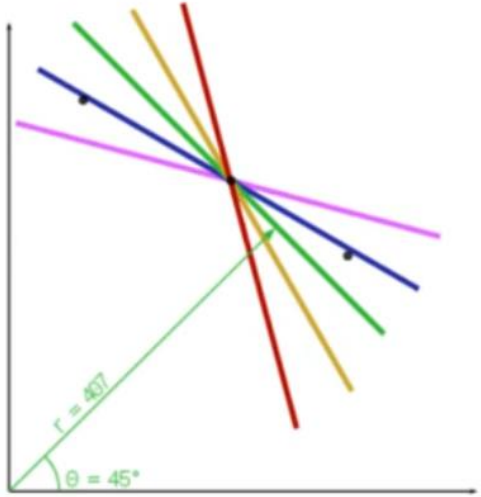



r = 175
θ=15⁰

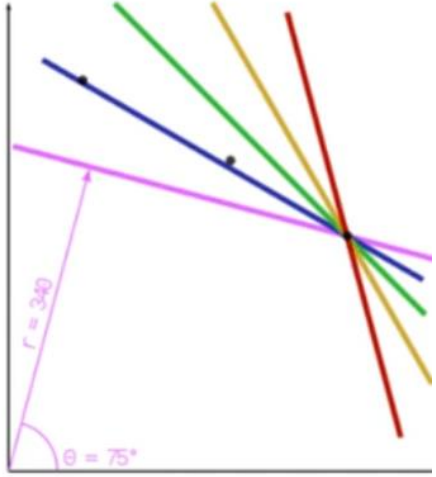

r = 175
θ=15⁰



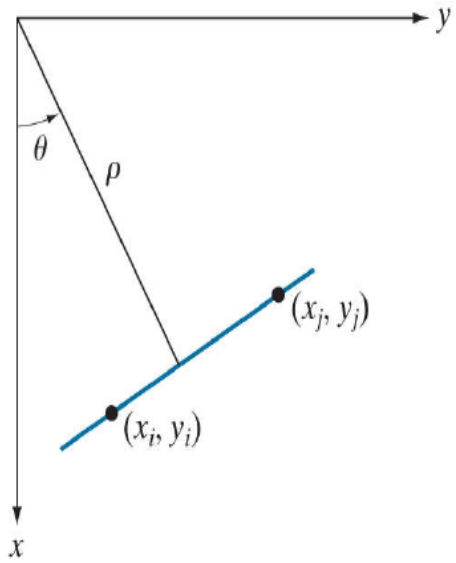
θ	r
15	189.0
30	282.0
45	355.7
60	407.3
75	429.4

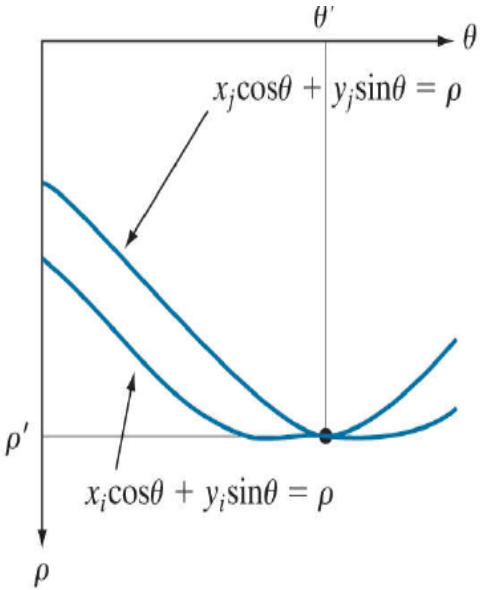


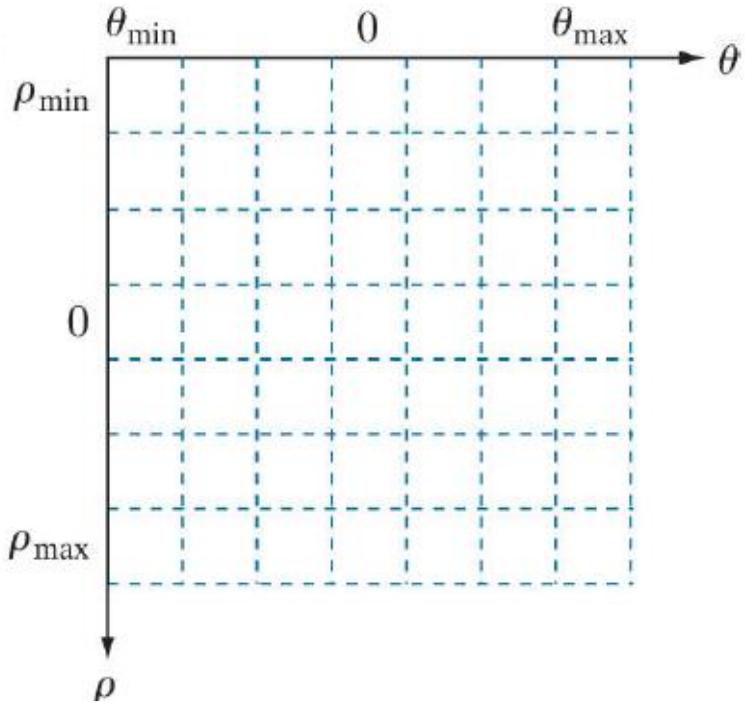
θ	r
15	318.5
30	376.8
45	407.3
60	409.8
75	385.3

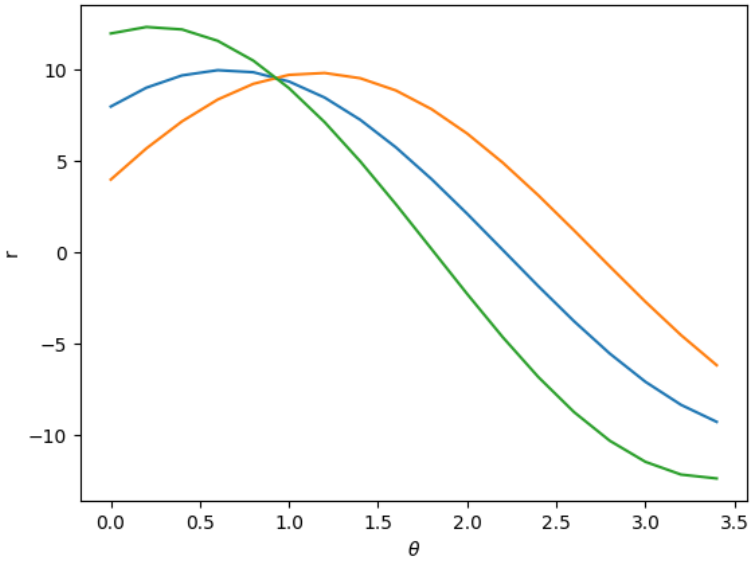


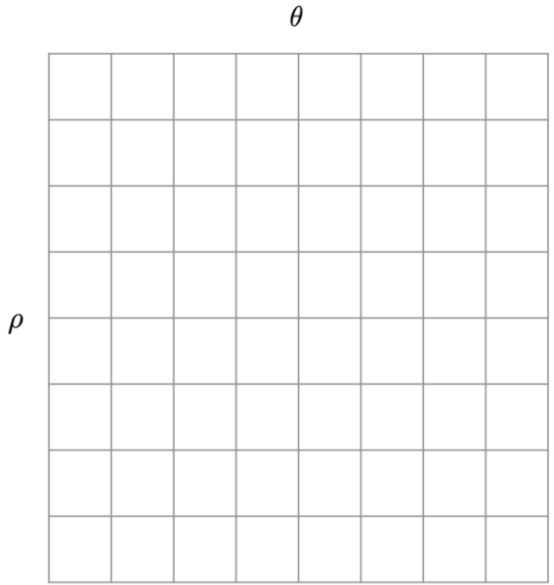
θ	r
15	419.0
30	443.6
45	438.4
60	402.9
75	340.1

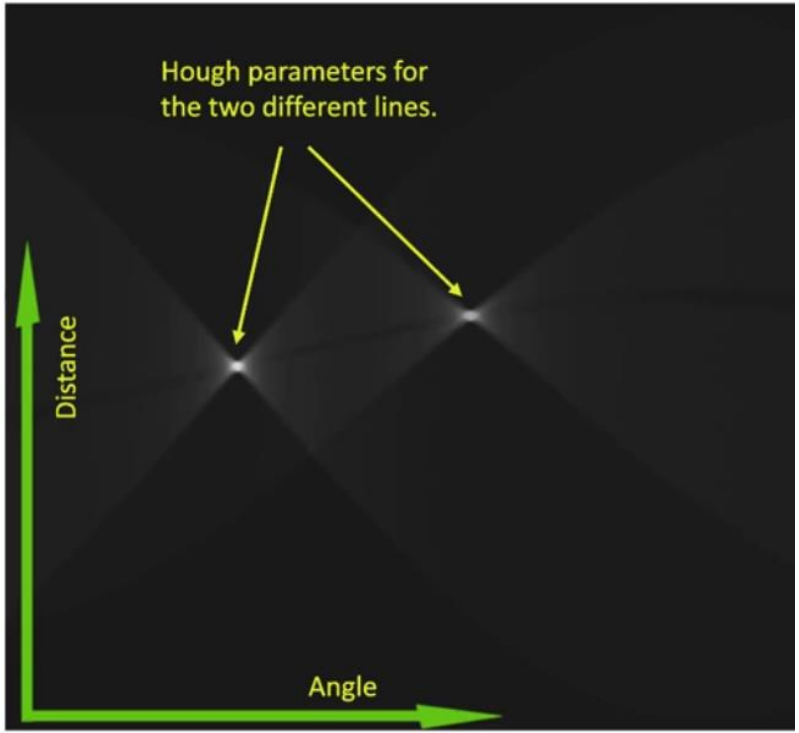

y
θ
ρ
(x_j, y_j)
(x_i, y_i)
x


θ′
θ
$x_j\cos\theta + y_j\sin\theta = \rho$
ρ′
$x_i\cos\theta + y_i\sin\theta = \rho$
ρ


θ_{min}
0
θ_{max}
θ
ρ_{min}
0
ρ_{max}
ρ


10
5
0
−5
−10
r
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
θ


θ
ρ


Hough parameters for
the two different lines.
Distance
Angle


THANK
YOU