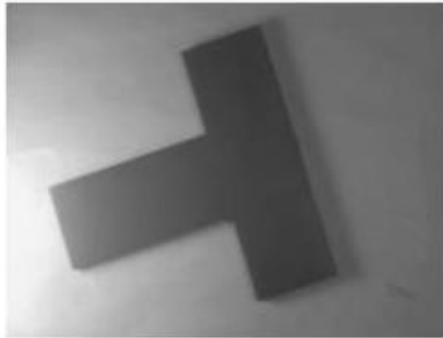


디지털 영상처리 연구실 연구보고서

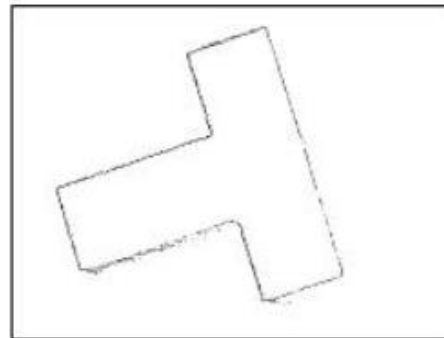
정지우

특징 추출

이미지에서 직선, 원 추출과정



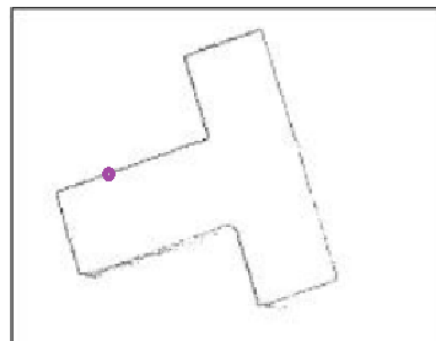
입력영상



추출된 에지

우선 영상에서 에지를 추출하고,

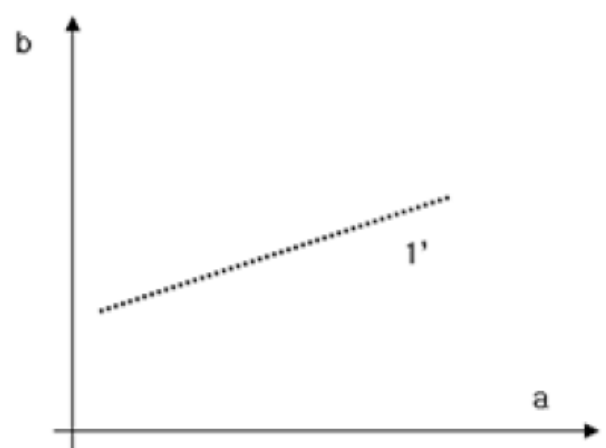
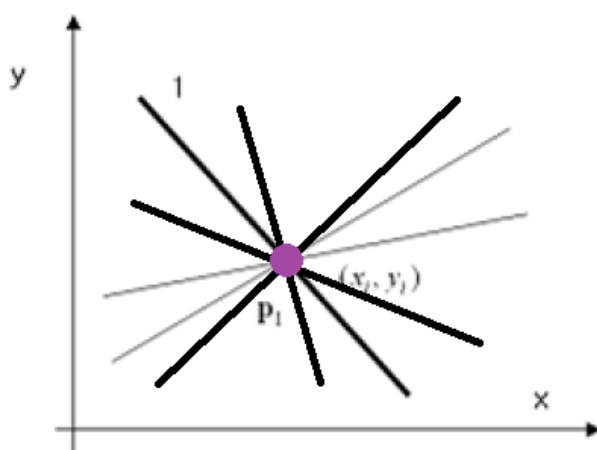
추출된 에지의 특정부분에서

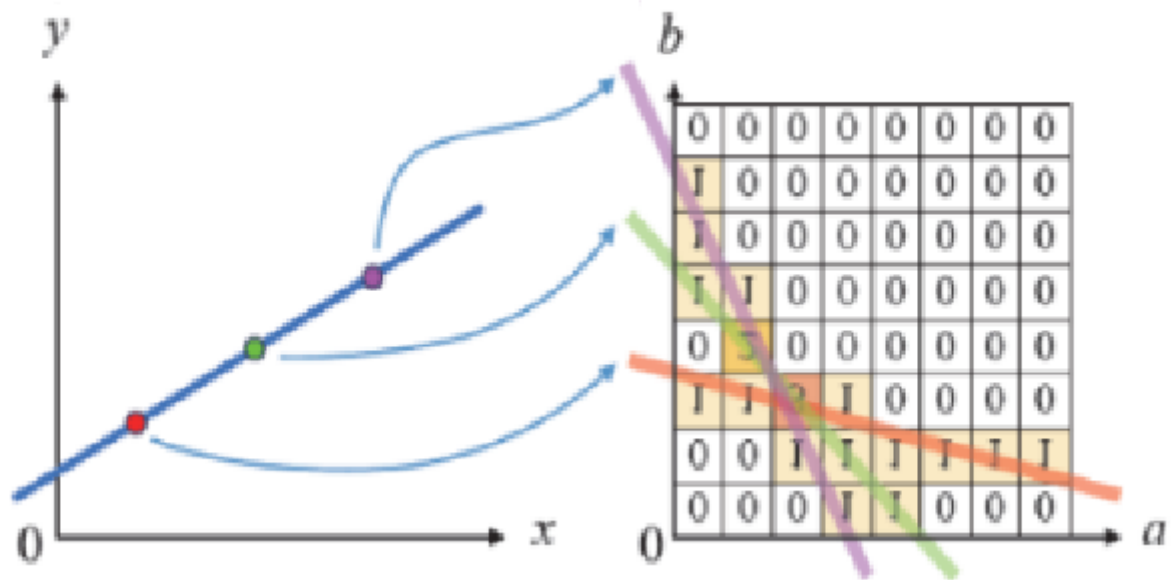


이 보라색 한점을 지나는 모든 직선을 표현하면,

$$y = ax + b$$

$$b = -xa + y$$





이렇게 겹치는 지점에 보팅(투표)를 해서 임계점 이상의 득표를 얻은 것을 직선으로 간주한다

직선의추출

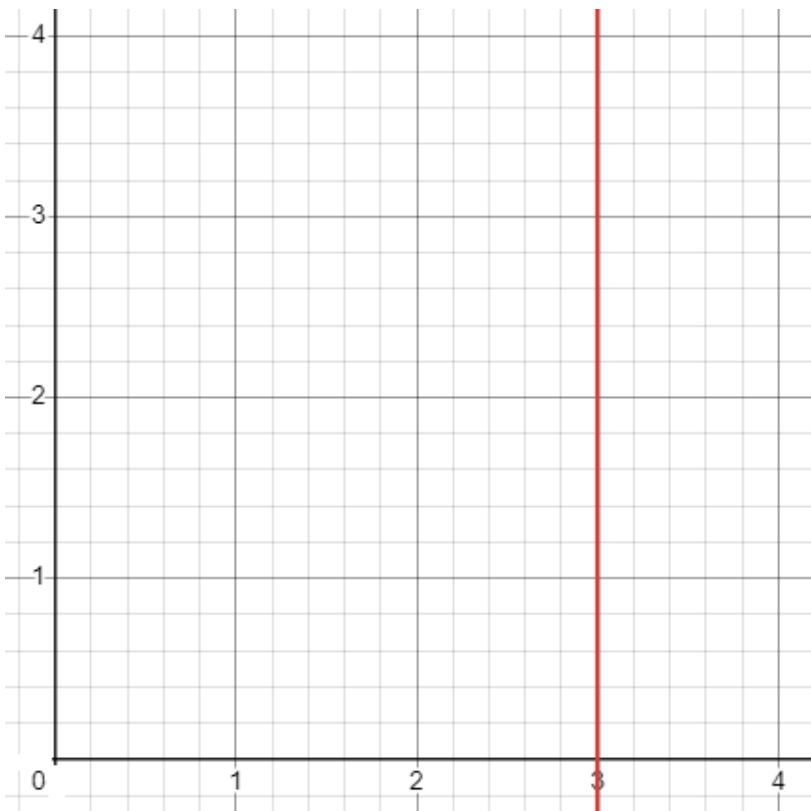
• Basic HT Algorithm

S1. (a,b) space 를 $H[a][b]$ 배열에 mapping (초기치는모두0)

S2. edge point 를지나는모든직선에대한(a,b) 값을구하여
H 배열에plotting (또는voting) ($H[a][b] = H[a][b]+1$)

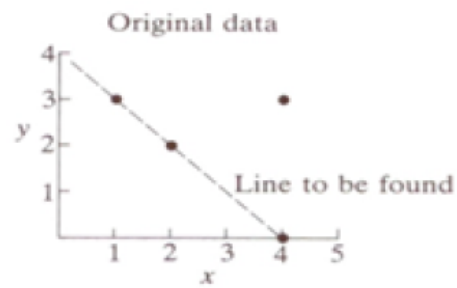
S3. 모든edge point에대하여, S2. 수행후 임계점 이상의 원소선택

(문제점) S2에서a 값의범위가 $-\infty$ 에서 ∞ 이므로실제알고리즘구현어려움

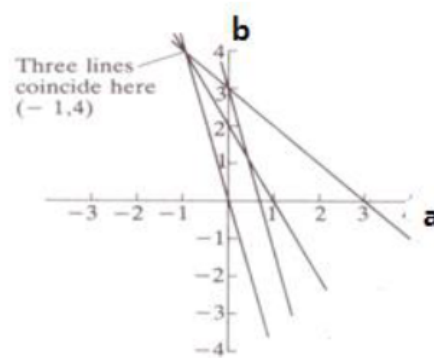


$$\text{기울기}(a) = dy/dx = \text{숫자}/0 = \infty$$

직선의 추출



x	y	(x, y) space	(a,b) space
1	3	$3 = 1a + b$	$b = -1a + 3$
2	2	$2 = 2a + b$	$b = -2a + 2$
4	3	$3 = 4a + b$	$b = -4a + 3$
4	0	$0 = 4a + b$	$b = -4a$



$$(a^*, b^*) = (-1, 4)$$

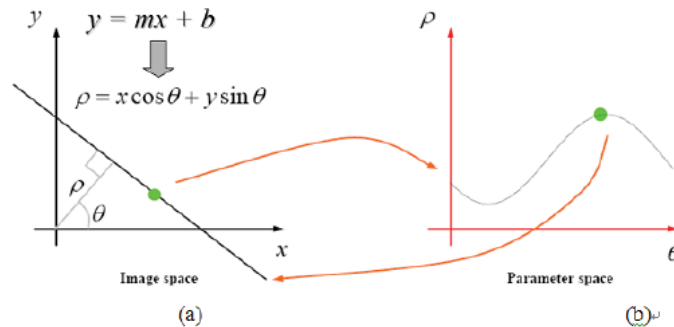
$$\rightarrow y = -x + 4$$

직선의 추출

- Practical HT Algorithm

$$\rho = x \cos \theta + y \sin \theta \quad : (x, y) \text{ space}$$

$$(\rho, \theta) \text{ space} \leftarrow \text{parameter space}$$



(a) 삼각함수의 결합식으로 표현한 직선식

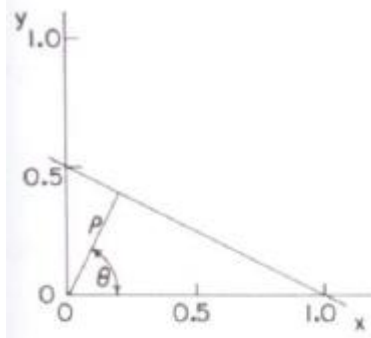
$$\text{기울기} = -\cos(\theta)/\sin(\theta) = -\cos(\theta)/\cos(90^\circ - \theta) = -(\rho/dx)/(\rho/dy) = -dy/dx$$

$$y \text{절편} = \rho/\sin(\theta) = \rho/\cos(90^\circ - \theta) = \rho/(y/\rho) = y$$

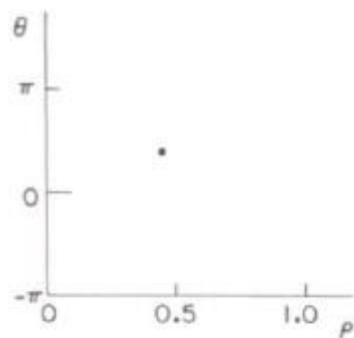
$$\begin{cases} \text{기울기} = -\frac{\cos \theta}{\sin \theta} \\ y \text{절편} = \frac{\rho}{\sin \theta} \end{cases}$$

$$y = -\frac{\cos \theta}{\sin \theta} x + \frac{\rho}{\sin \theta}$$

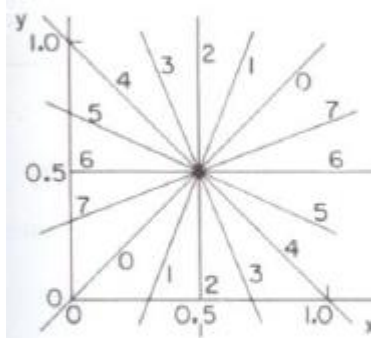
$$\rightarrow x \cos \theta + y \sin \theta = \rho$$



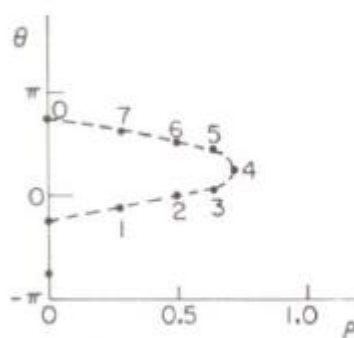
(a) Parametric line



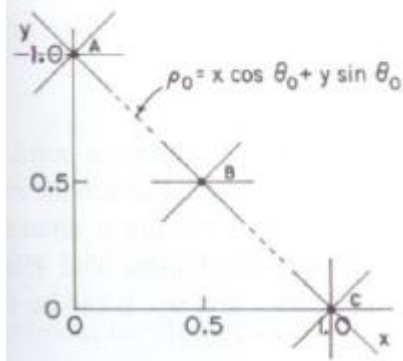
(b) Hough transform of (a)



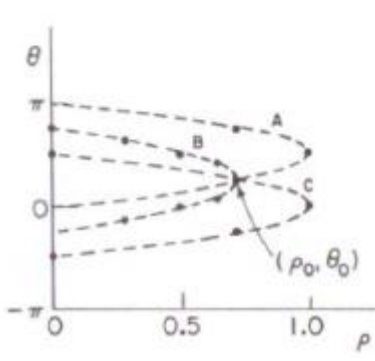
(c) Family of lines, common point



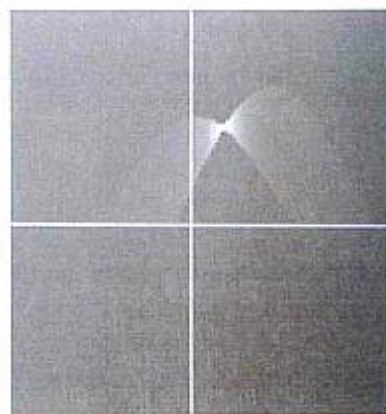
(d) Hough transform of (c)

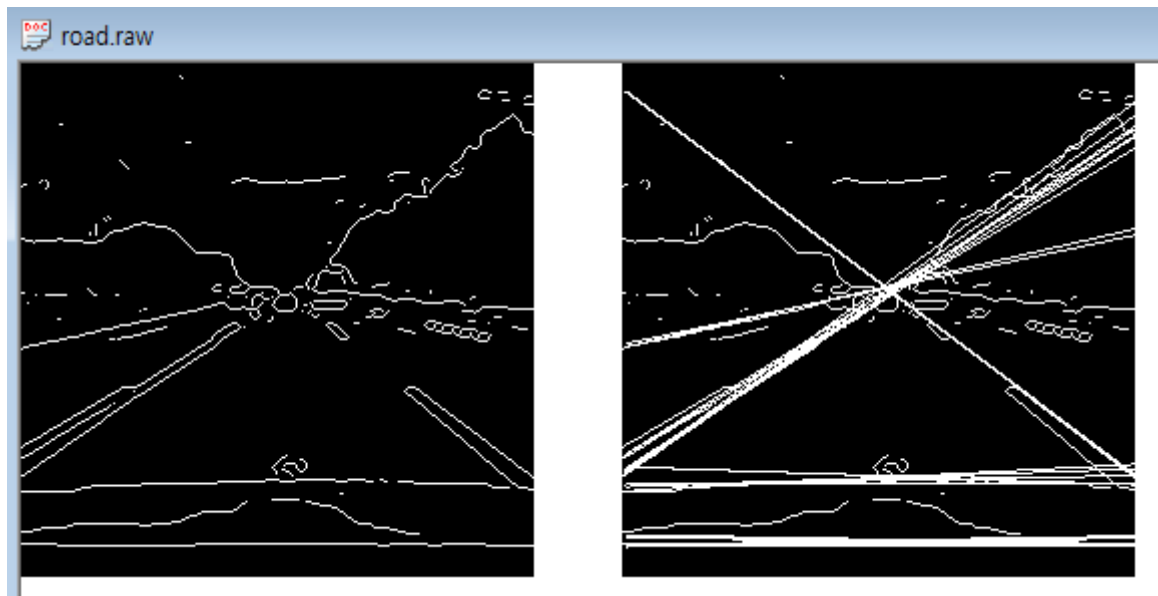


(e) Colinear points



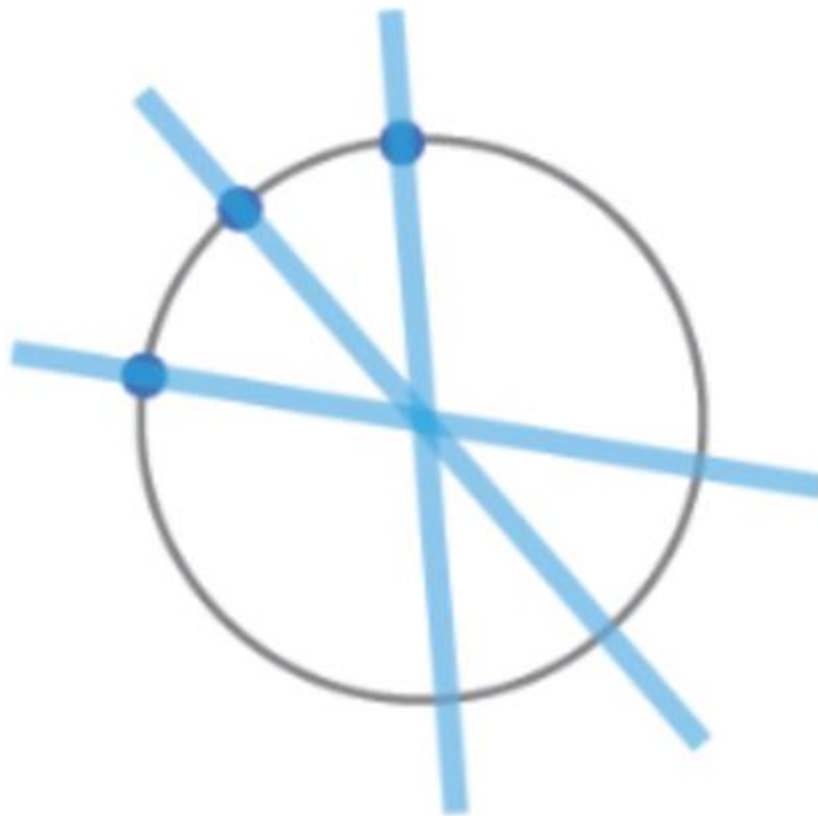
(f) Hough transform of (e)





원은 $(x - a)^2 + (y - b)^2 = r^2$ 으로 3개의 파라미터를 가진다.

이를 허프 그래디언트 방법으로 원을 검출한다.



이를 다시 이미지 내 임의의 에지점 (x, y) 에 대하여 원의 중심위치를 나타내면,

$$C_x = x + r \sin \theta$$

$$C_y = y + r \cos \theta$$

즉, (C_x, C_y, r) 에 관하여 3차원 보팅을 하고 임계점 이상의 파라미터를 추출하면 특정위치의 원이 그려진다.

