Further Edge Detection (93-122)

i/. Canny designed an

a/. optimal response — no noise

b/. single response — thin edges

c/. good localisation — in the right place.

approximation

Gaussian smoothing → Sobel → non-maximum suppression (peak detection)

3x3

↓

hysteresis thresholding.

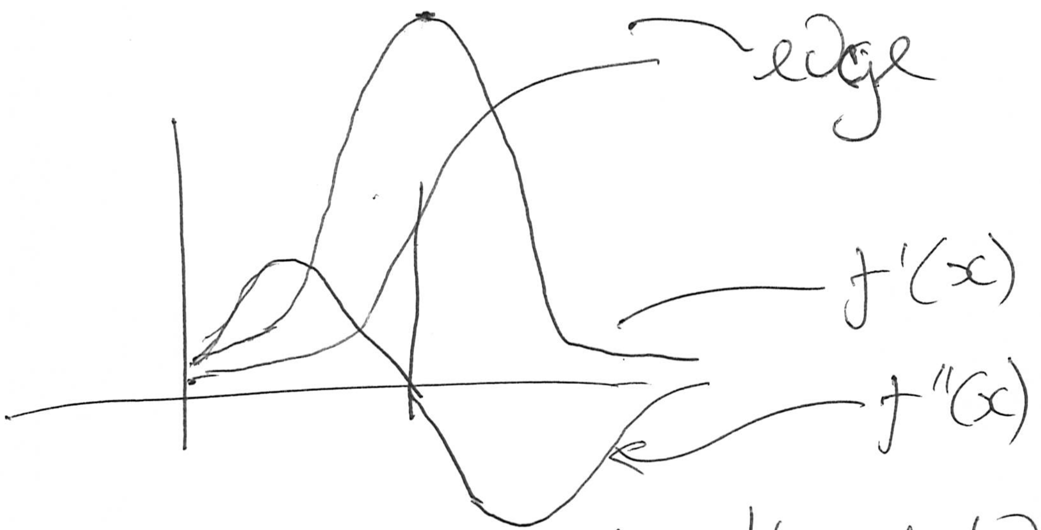
5x5 Sobel

More complex than Sobel but 'better'

ii). second order approaches.

$$f'(x) = f_{x,y} - f_{x+1,y}$$

$$f''(x) = f'(x) - f'(x+1)$$



1st order $f'(x)$ then threshold

2nd " $f''(x)$ " zero crossing detection.

iii)

$$f''(x) = f'(x) - f'(x+1)$$

$$\left(f_{x,y} - f_{x+1,y}\right) - \left(f_{x+1,y} - f_{x+2,y}\right)$$

template

1	-2	1

3x3

0	1	0
1	-4	1
0	1	0

Laplacian
wt junk.
no averaging

iv. Laplacian of Gaussian

differentiate Gaussian twice

$$g = e^{-(x^2+y^2)/2\sigma^2}$$

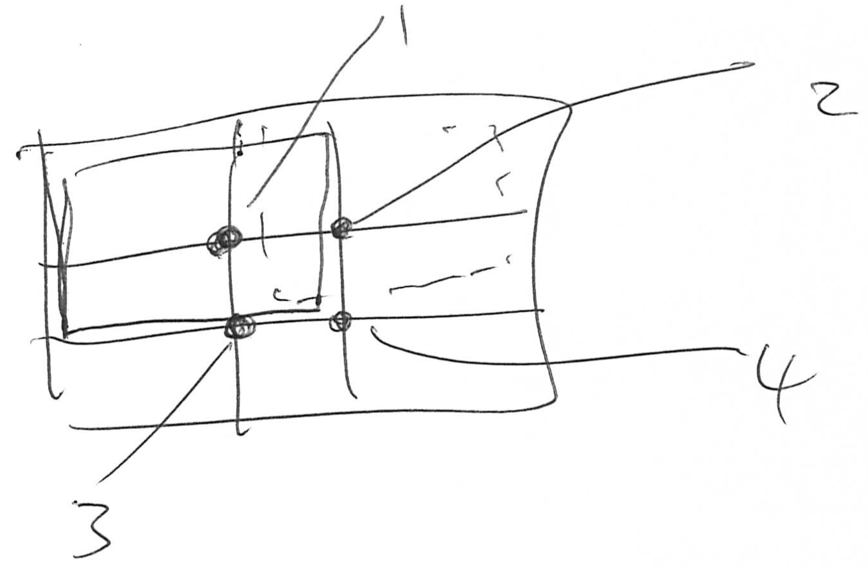
$$\frac{\partial g}{\partial x} = -\frac{\cancel{2}x}{\cancel{2}\sigma^2} e^{-(x^2+y^2)/2\sigma^2}$$

$$\frac{\partial^2 g}{\partial x^2} = \frac{1}{\sigma^2}\left(-1 + \frac{\cancel{2}x^2}{\cancel{2}\sigma^2}\right) e^{-(x^2+y^2)/2\sigma^2}$$

$$\frac{\partial^2 g}{\partial y^2} = \frac{1}{\sigma^2}\left(-1 + \frac{y^2}{\sigma^2}\right) e^{- \sim}$$

$$\nabla^2 g = \frac{1}{\sigma^2}\left(-2 + \frac{x^2+y^2}{\sigma^2}\right) e^{\frac{-x^2+y^2}{2\sigma^2}}$$

V/. zero crossing.



if $(\max(1-4) > 0) \cdot (\min(1-4) < 0))$

then edge point.

edge locations are connected, but lack direction.