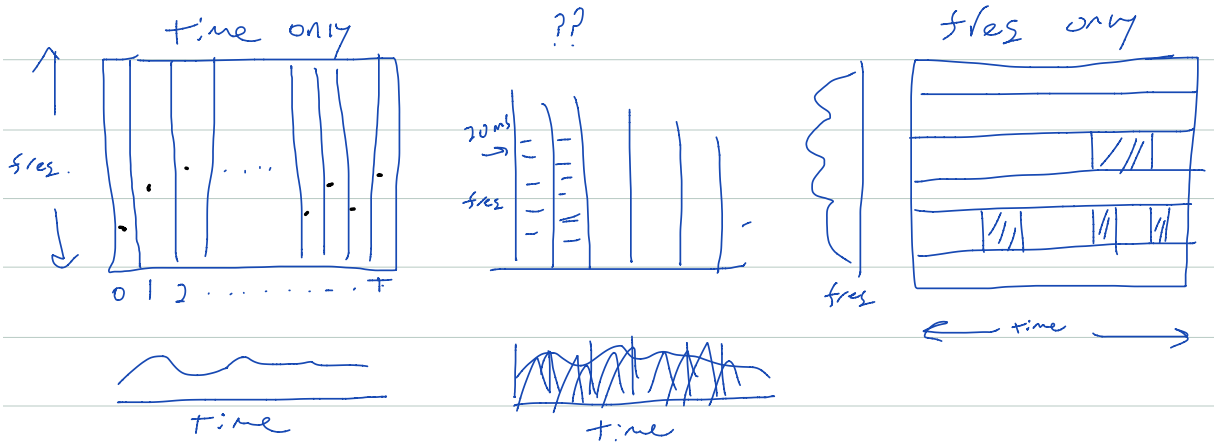
Asst #1, Return today

Asst #2, out friday, due after reading week.

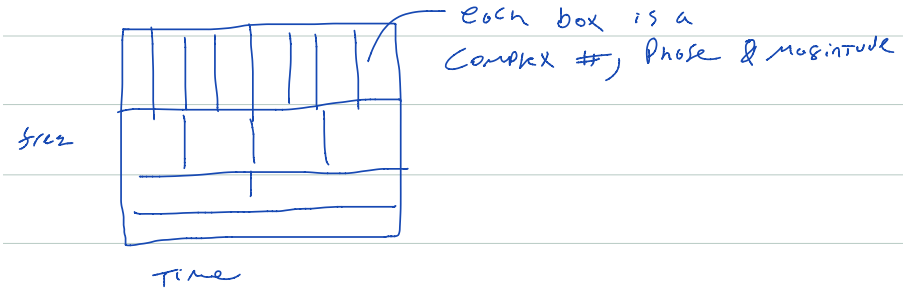
Project, replies by friday (e-mail)

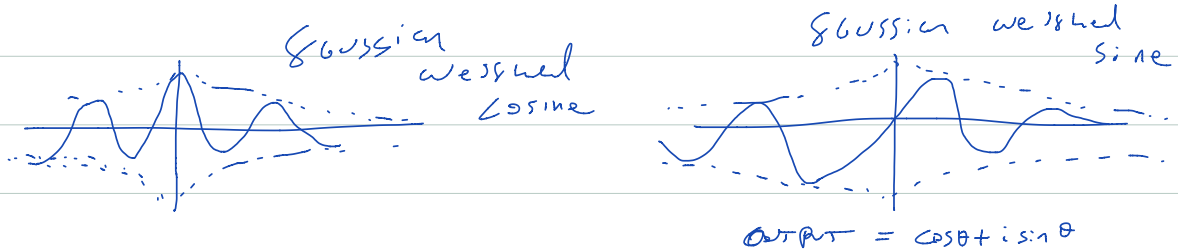
Books "CS 484" Davis Lib

Gabor 1946 Spatial vs Frequency Rep'n



Short Time Fourier Transform (STFT)





2D Signals

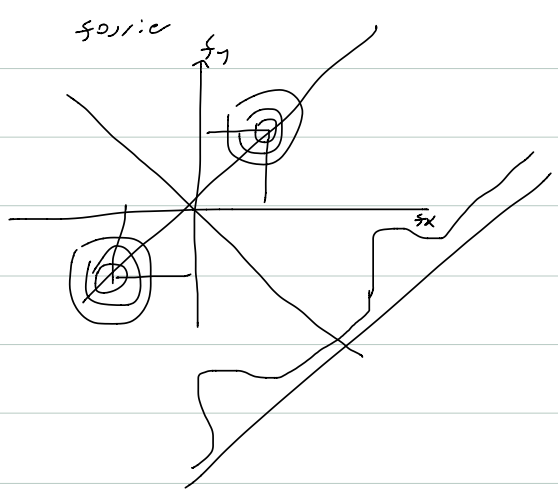
$$\text{Gabor}(\vec{x}, \vec{F}, \sigma) = e^{i\vec{F}\cdot\vec{x}} e^{-(x^2+y^2)2\sigma^2}$$

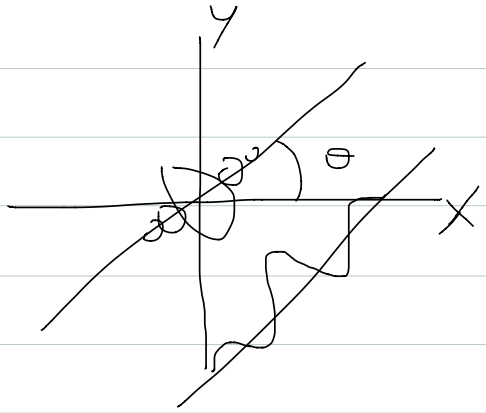
$e^{i\vec{F}\cdot\vec{x}}$ ← Complex exponential

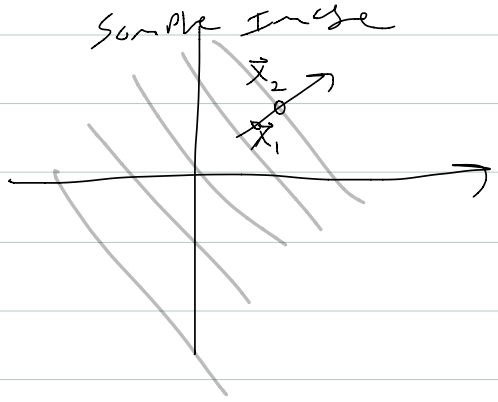
$e^{-(x^2+y^2)2\sigma^2}$ ← Gaussian window.

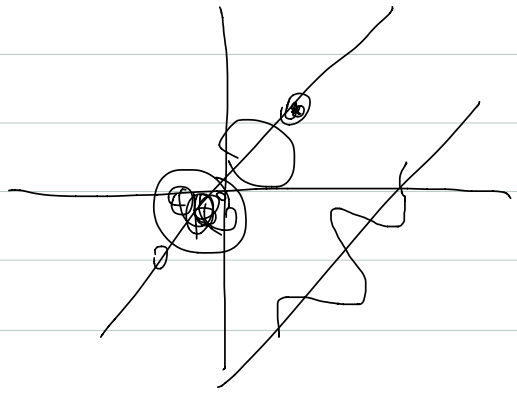
$\vec{x} = (x,y)$ image position

$\vec{F}$ ← Spatial frequency

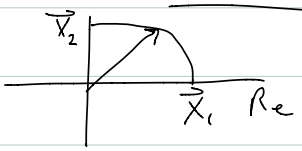








Im Complex

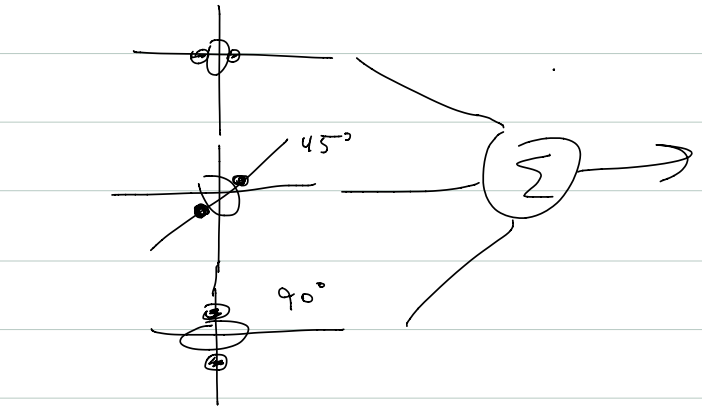


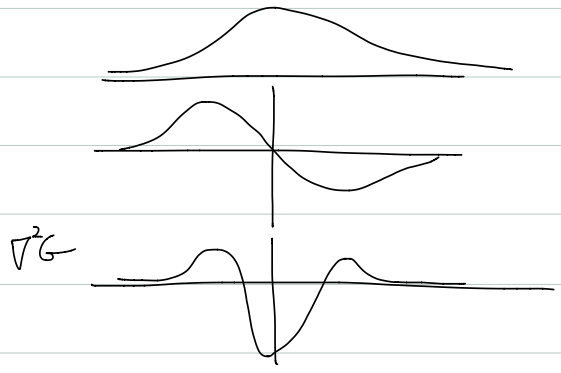
Pattern analysis and machine intell

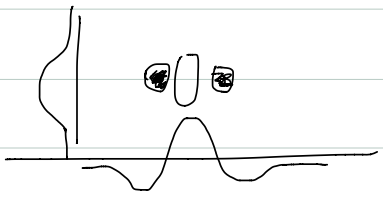
Freeman & Adelson [IEEE PAMI, 13(9) 1991]

Steerable filters

Simplified to 3 orientations







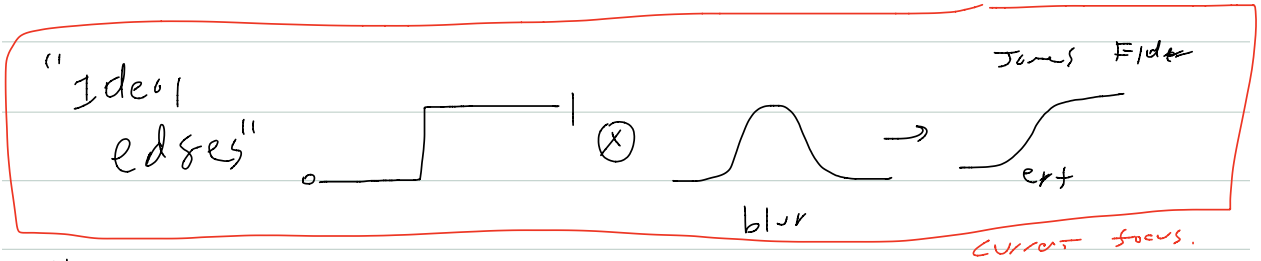
From Stiles: Dougman 1989

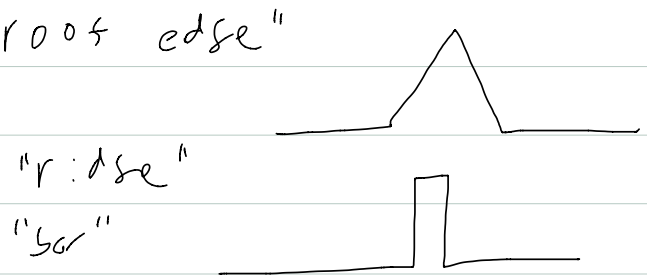
GBRox 1 octave

Olshowan and Field

Mollon and Burr

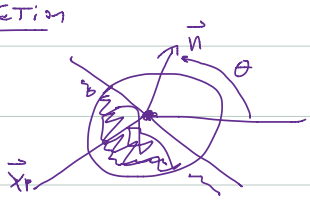
Edge Detection (Trucco & Verri: Ch 4)



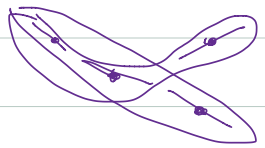


Edge Detection

Edge:



Edges: collections of edgels that make curves, lines segments, ect.

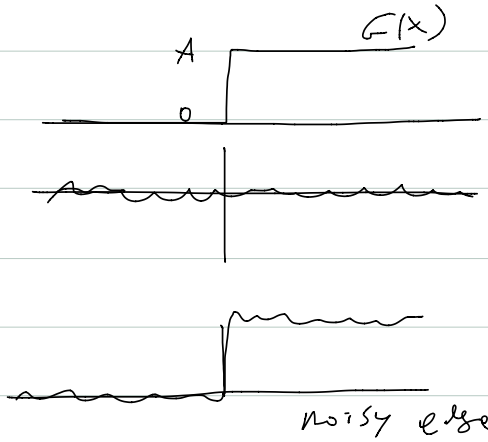


subject to grouping

Problem

1. Detect edges
2. Grouping edges
* 3. Interpretation: cause/meaning of edge

Optimal Edge Detection (Canny, IEEE PAMI, 8(6), 1986)

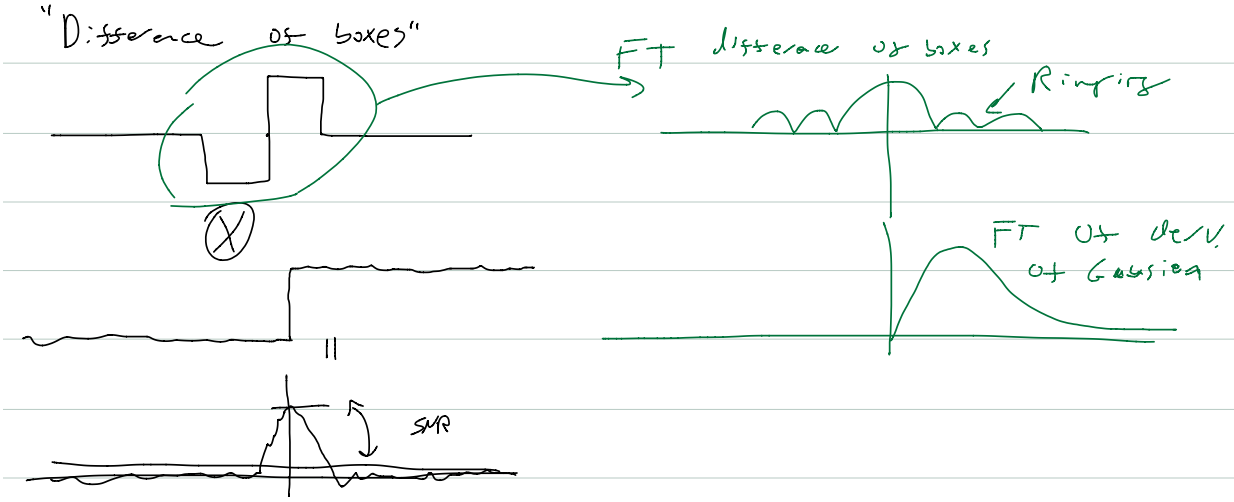


White noise $\sim N(0, \sigma)$

What is the optimal filter to detect this edge?

$J \leftarrow I \otimes f \leftarrow$ filter

↑ noisy edge



All you need to know:

1. Blur Image

$J \leftarrow G_\sigma \otimes I$

2. Compute

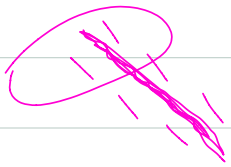
$$\nabla J = \begin{pmatrix} \partial J/\partial x \\ \partial J/\partial y \end{pmatrix} = \begin{pmatrix} J_x \\ J_y \end{pmatrix}$$

3. Edges

$$e_s(i,j) = \|\nabla I\| = \|\nabla(G \otimes I)\| = \sqrt{I_x^2(i,j) + I_y(i,j)}$$

$$e_\theta(i,j) = \arctan2\left(I_y(i,j),\ I_x(i,j)\right)$$

4. Non maximum edge supression



5. Still in gaps

6. Grouping – eg. fitting line segments or smooth curves.