Recursive Implementation of Anisotropic Filtering
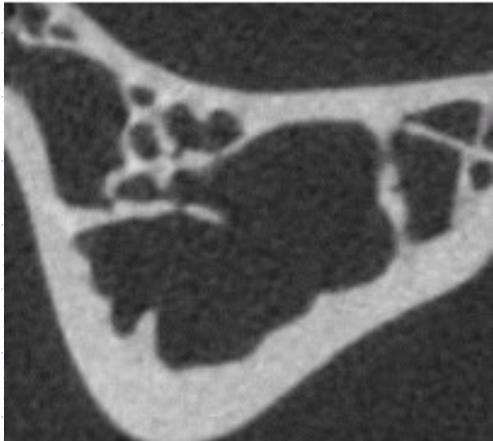
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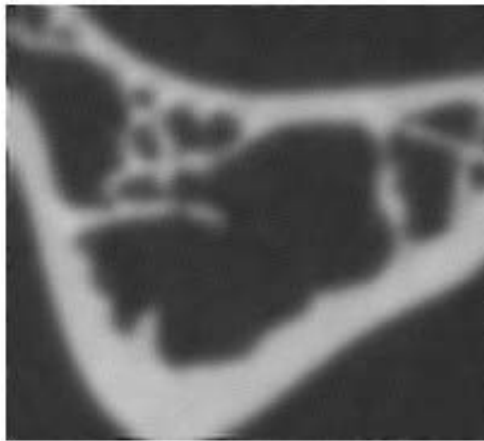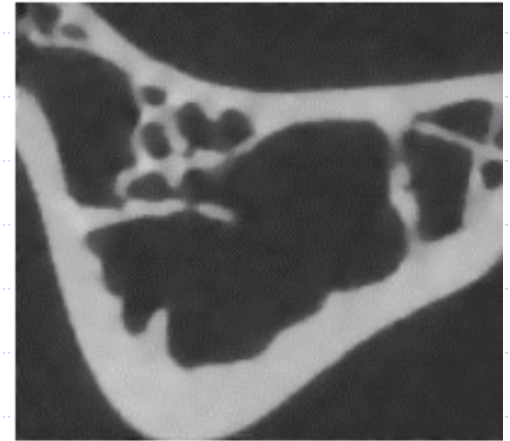
Background

◆ **Image Smoothing**
- Isotropic Smoothing (Gaussian filter)
- Anisotropic Smoothing (edge-preserving)

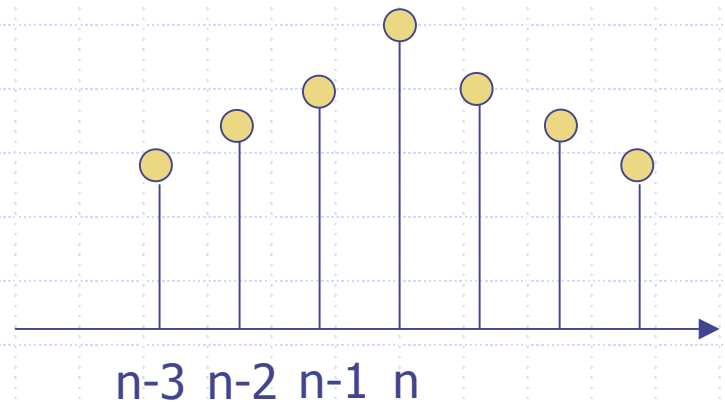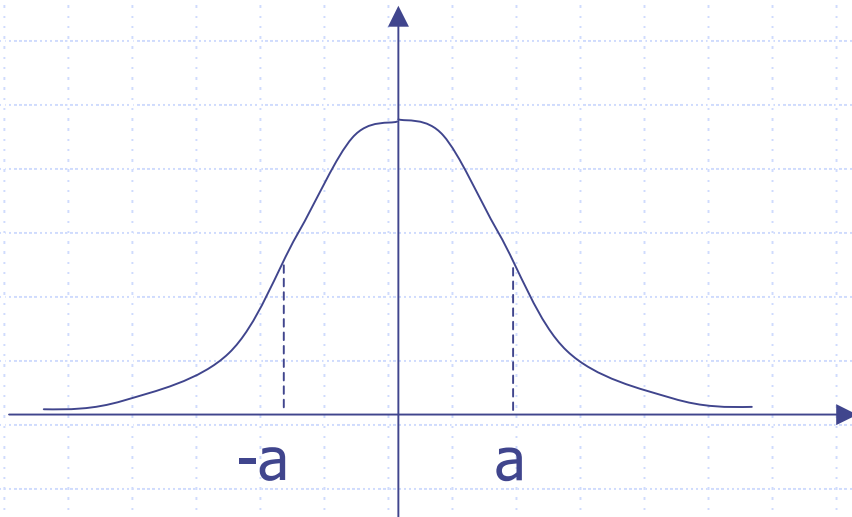Original Image   Isotropic Filtering   Anisotropic Filtering

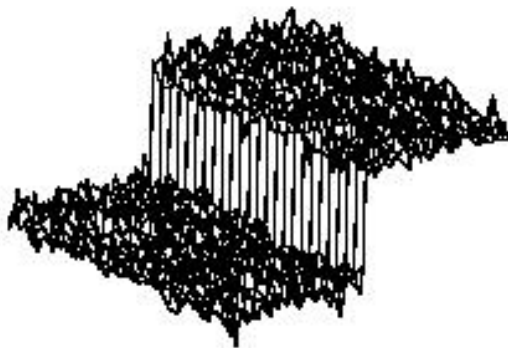# Background (contd.)

◆ Implementation
  - Non-recursive (convolution)
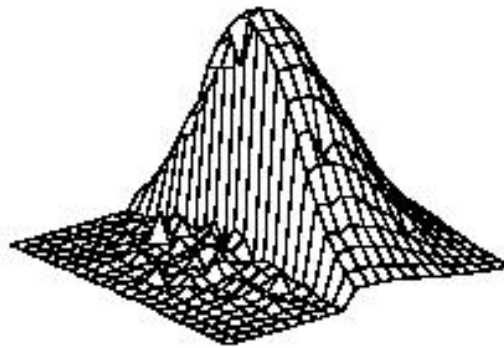 - Recursive (propagation)

-a   a

n-3 n-2 n-1 n

Paper#1: Bilateral Filtering

◆ "Bilateral Filtering for Gray and Color Images", C. Tomasi and R. Manduchi, ICCV'98
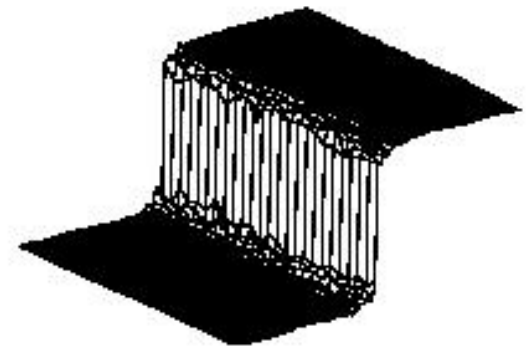
$$h(x, \xi) = e^{-\frac{(x-\xi)^2}{2\sigma_d^2}} \cdot e^{-\frac{(f(x)-f(\xi))^2}{2\sigma_r^2}}$$

(a)   (b)   (c)

Paper#2: Recursive Implementation

◆ "Recursive Implementation of the Gaussian Filter", Ian T. Young and Lucas J. van Vliet, Signal Processing, vol. 44, pp. 139-151, 1995

Forward:

$$w[n] = B \cdot in[n] + \frac{b_1 w[n-1] + b_2 w[n-2] + b_3 w[n-3]}{b_0}$$

Backward:

$$out[n] = B \cdot w[n] + \frac{b_1 out[n+1] + b_2 out[n+2] + b_3 out[n+3]}{b_0}$$

Paper#3: Recursive & Anisotropic

◆ "Recursivity and PDE's in Image Processing",
L. Alvarez and R. Deriche, ICPR'00,

Exponential Filtering :

$$S_\alpha(n) = k(\alpha \mid n \mid +1)e^{-\alpha\mid n\mid}$$

Constant α ⟹ varying parameter

$$\alpha_n = g\left(\mid \frac{\partial x}{\partial t}(t_n) \mid\right)$$ g is non-decreasing