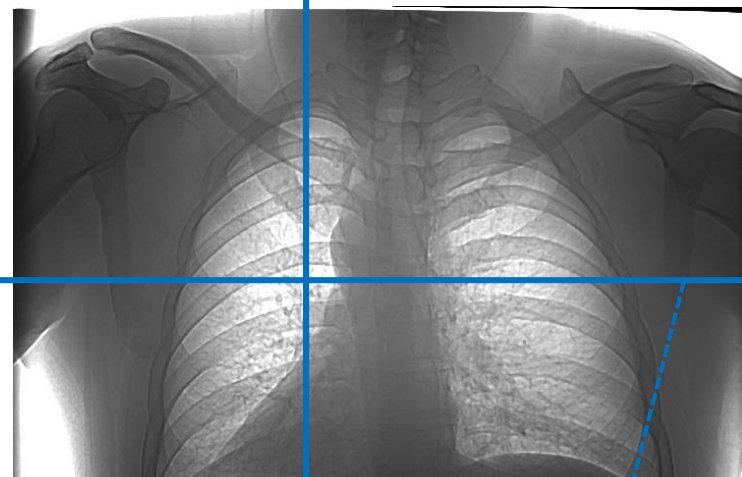
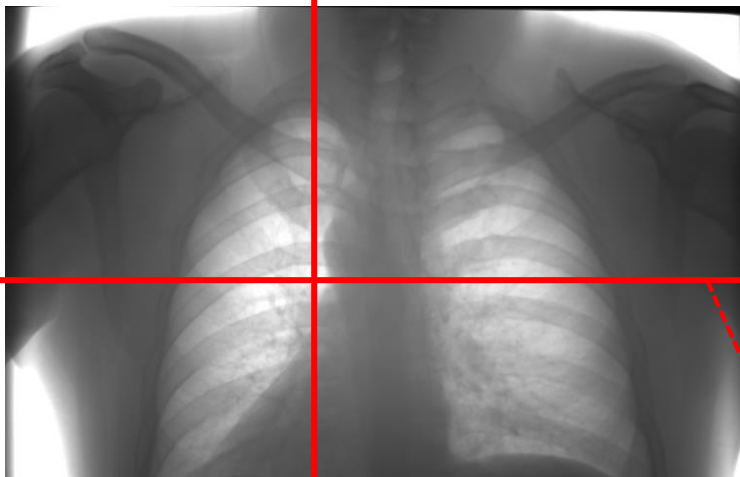


图像锐化 & 对比度增强

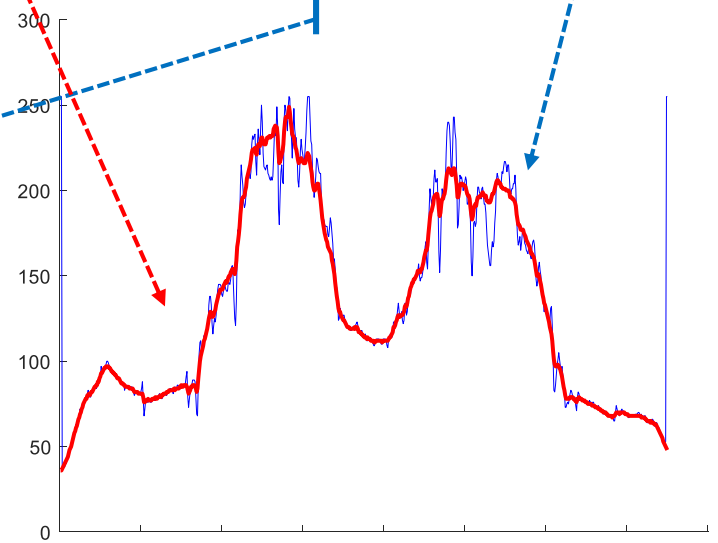
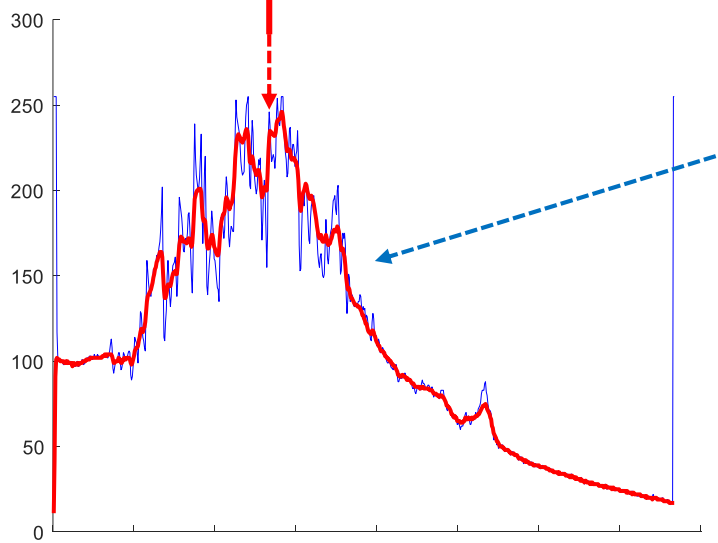
Image Sharpening

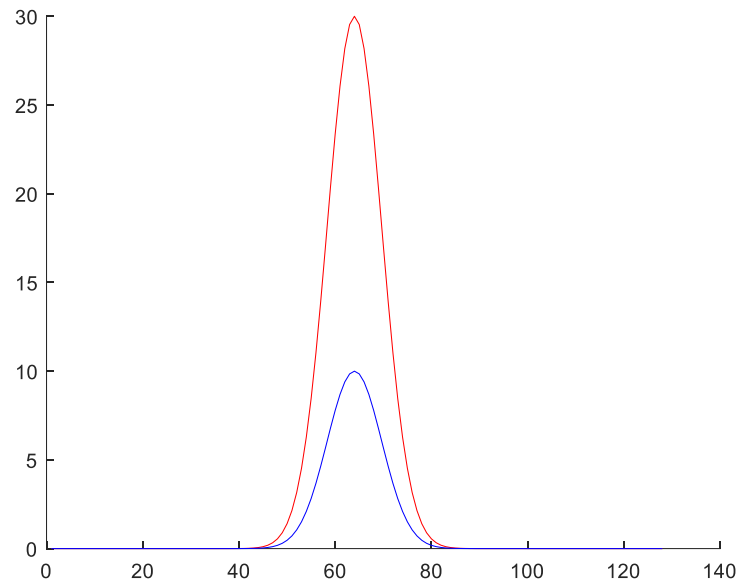
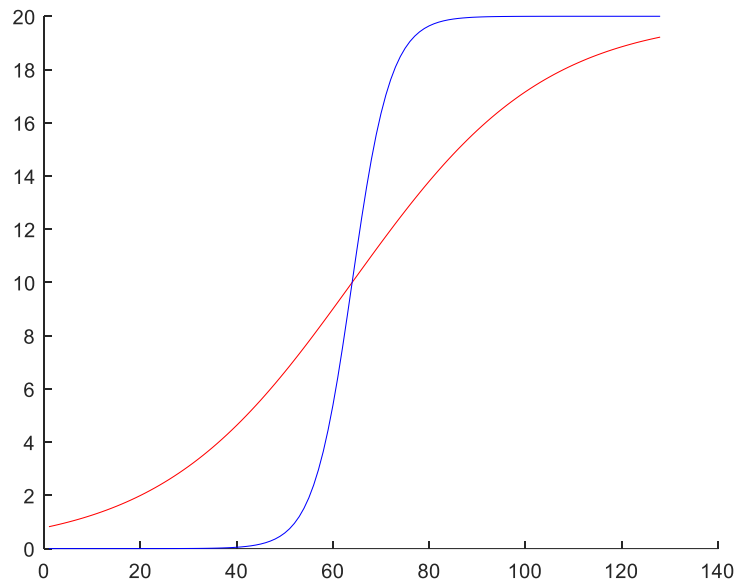
Contrast Enhancement





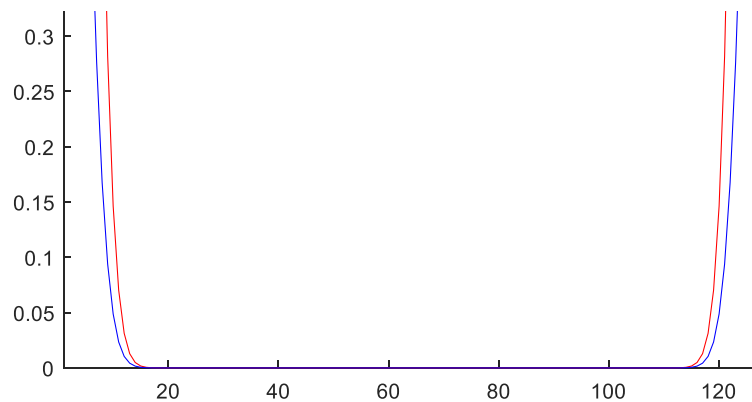
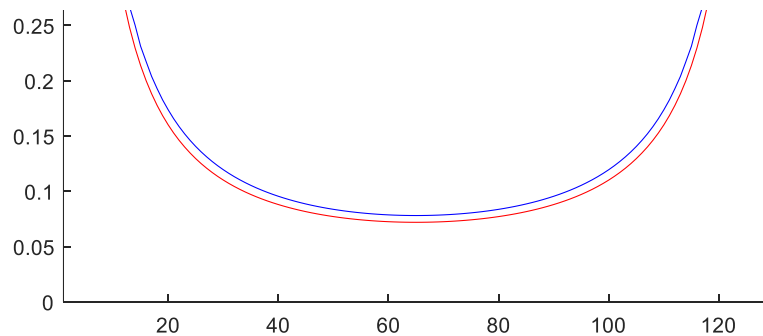
图像锐化：图像边界处灰度值变化更加陡峭
 对比度增强：提升图像细节与周围区域的灰度差



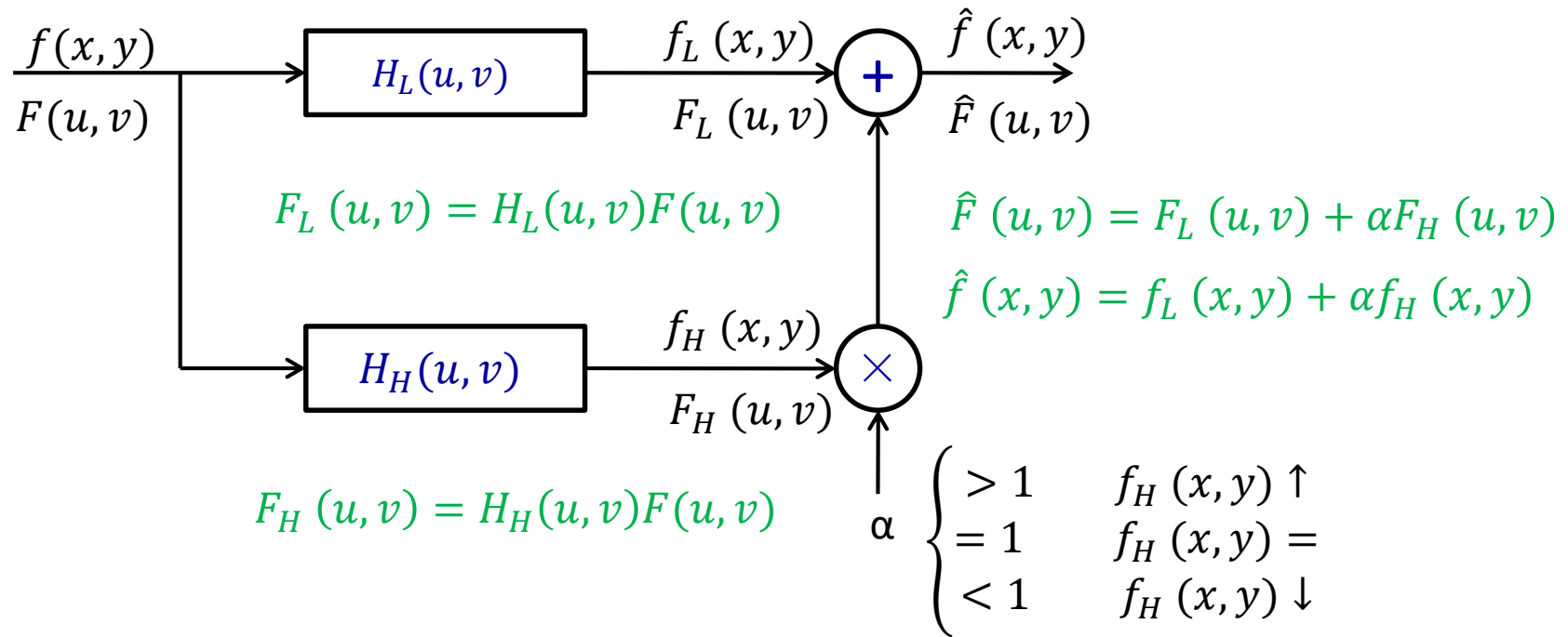


陡峭的边缘具有更多的高频分量

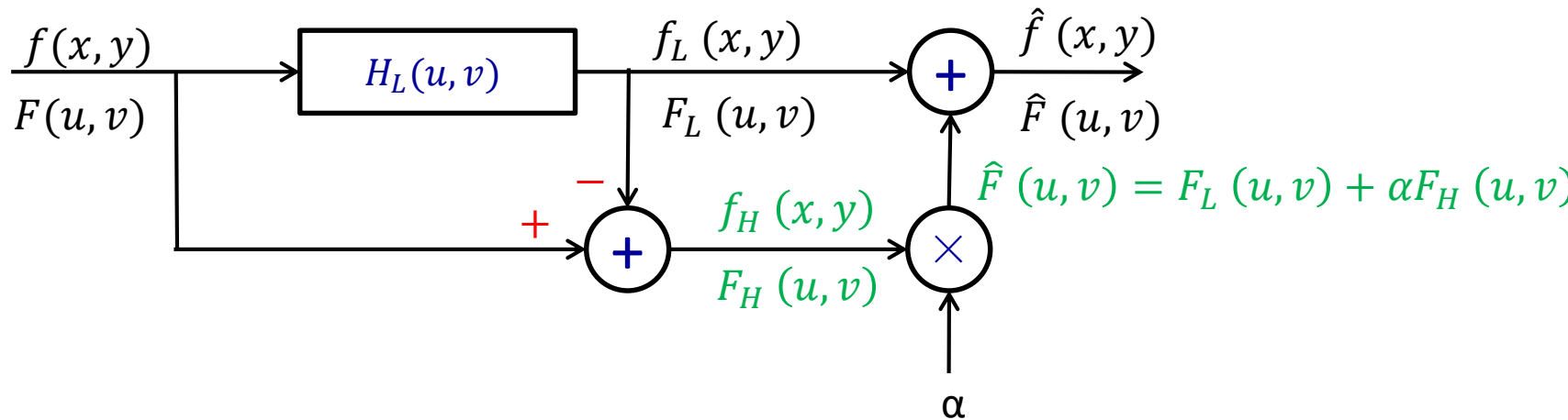
高对比度具有更多的高频分量



Unsharp Masking

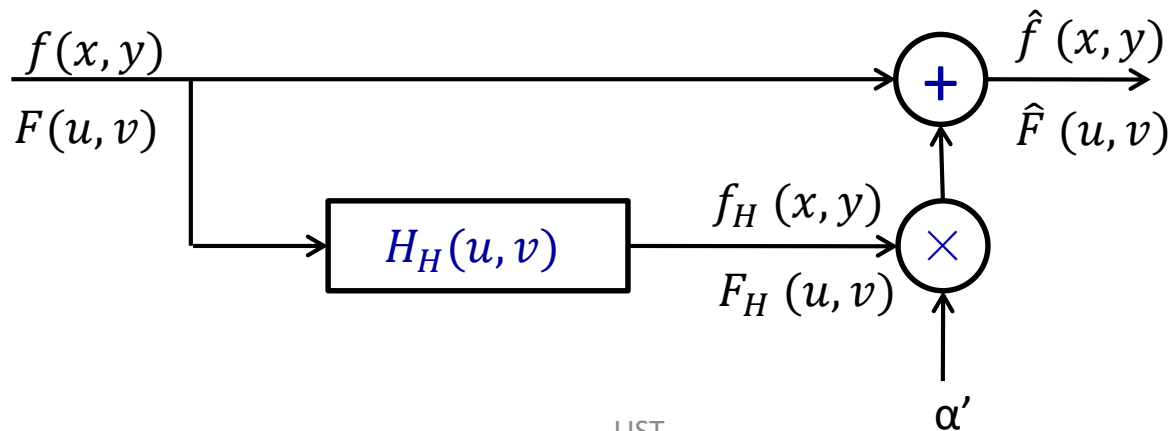


$$H_L(u, v) + H_H(u, v) = 1 \rightarrow H_H(u, v) = 1 - H_L(u, v)$$



记 $\alpha = \alpha' + 1 \rightarrow \hat{F}(u, v) = H_L(u, v)F(u, v) + H_H(u, v)F(u, v) + \alpha' H_H(u, v)F(u, v)$

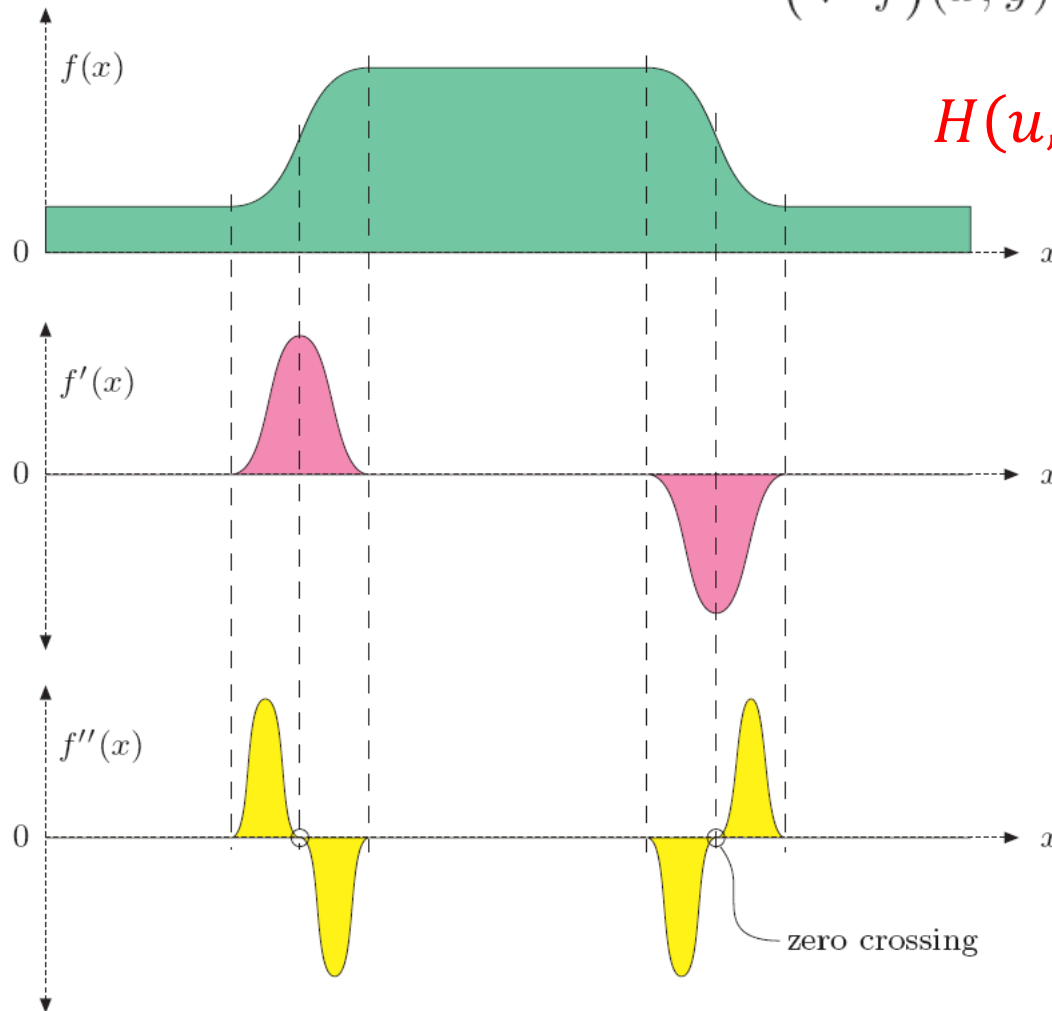
$$\hat{F}(u, v) = [1 + \alpha' H_H(u, v)]F(u, v)$$

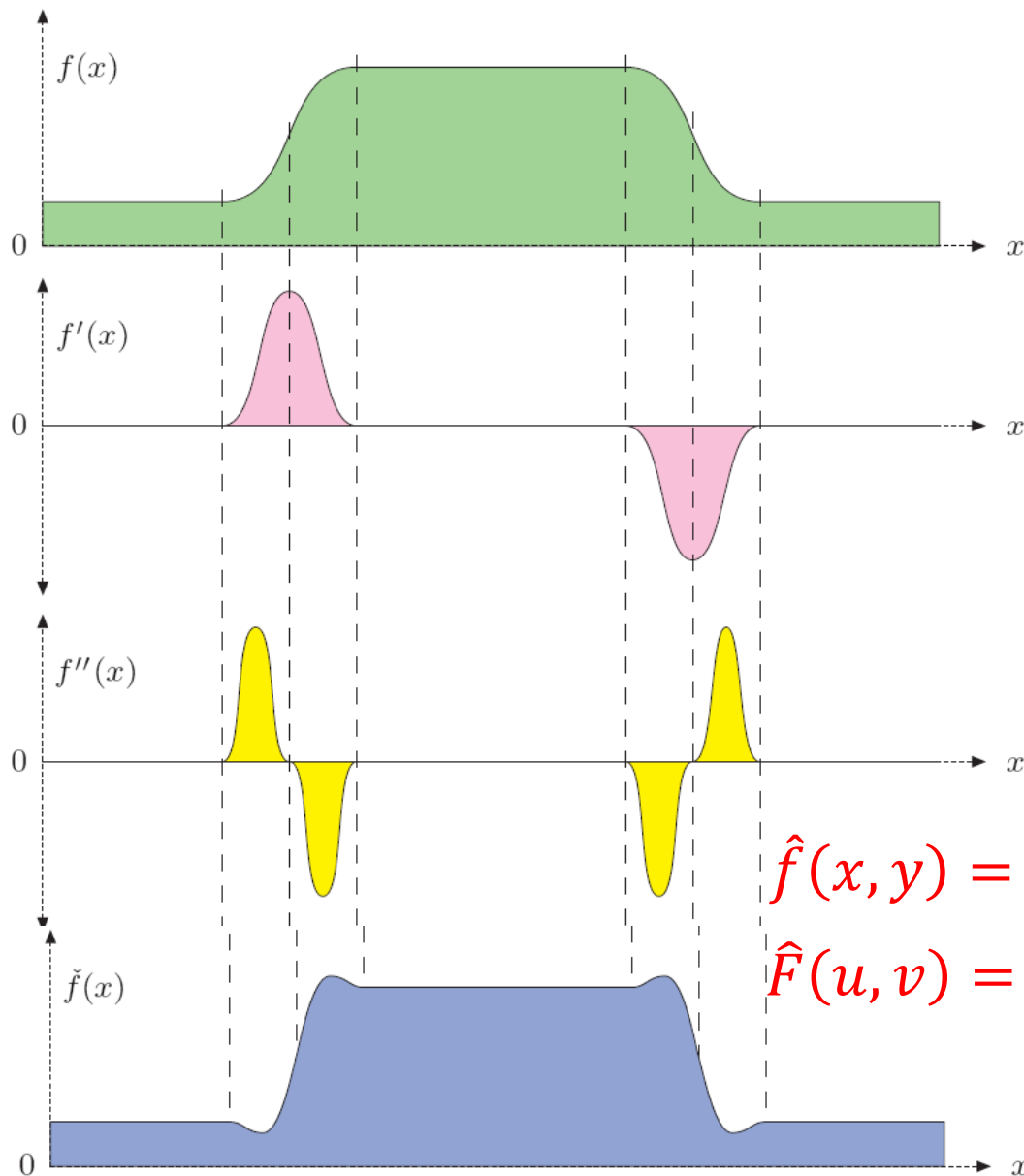


Laplacian

$$(\nabla^2 f)(x, y) = \frac{\partial^2 f}{\partial^2 x}(x, y) + \frac{\partial^2 f}{\partial^2 y}(x, y)$$

$$H(u, v) = -(u^2 + v^2)$$



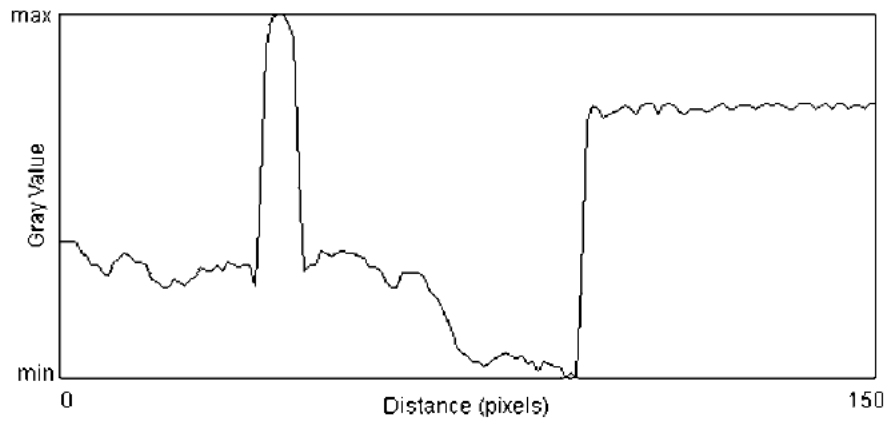


$$\hat{f}(x, y) = f(x, y) - \alpha \nabla^2 f(x, y)$$

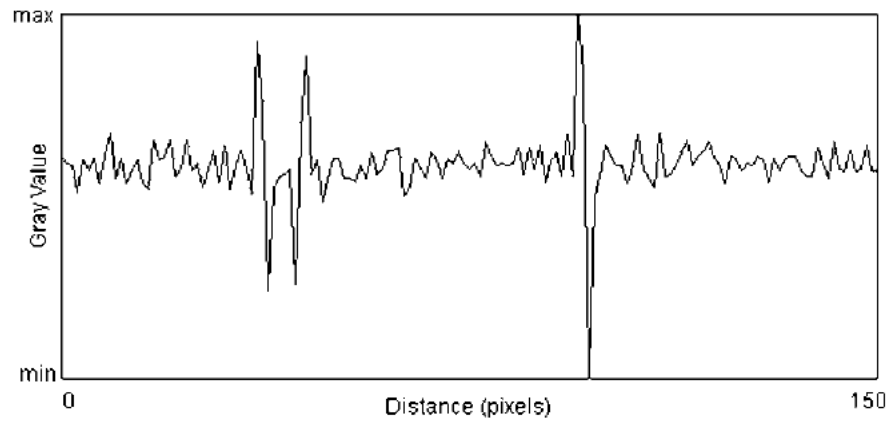
$$\hat{F}(u, v) = [1 + \alpha(u^2 + v^2)]F(u, v)$$



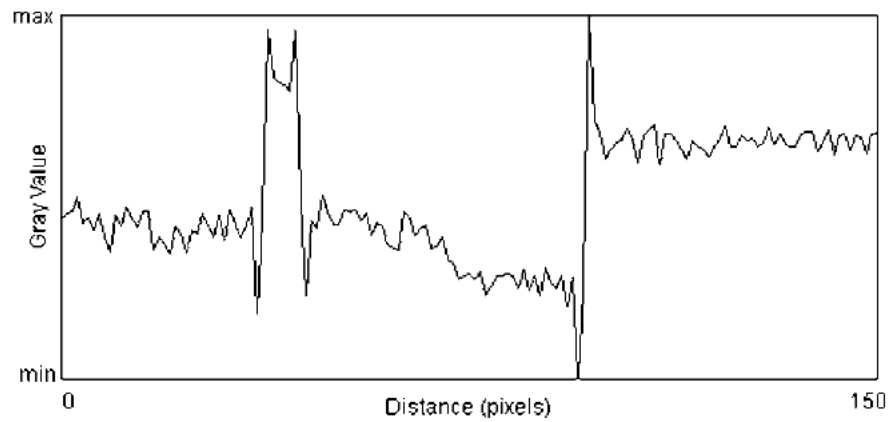
f



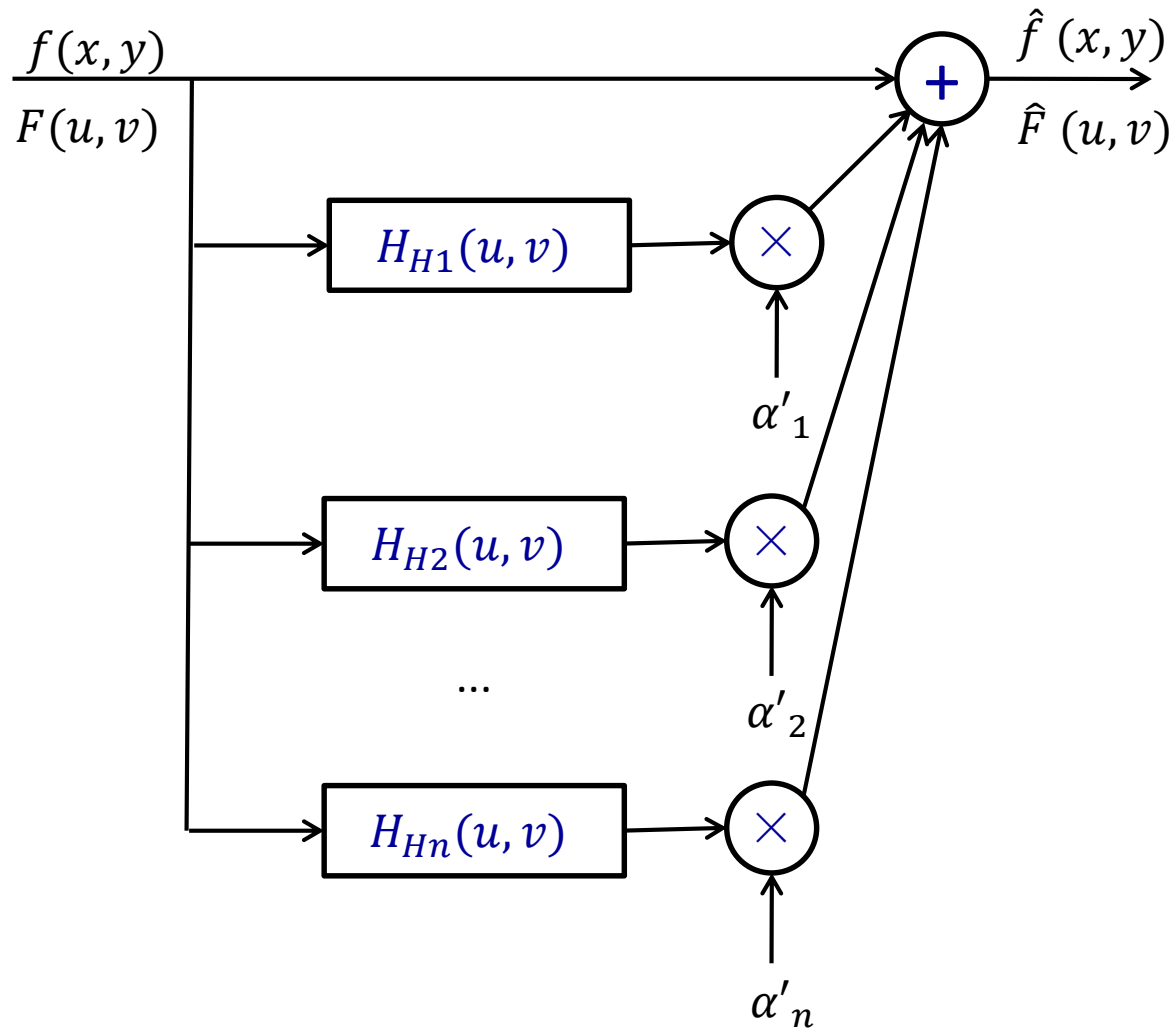
$\nabla^2 f$



$f - \nabla^2 f$



多分辨Unsharp Masking



同态滤波器 (Homomorphic Filter)

Retinex

对比度增强算法

光反射模型: $I(x, y) = L(x, y)R(x, y)$

↑
光源 (低频, 无效信息)

↑
反射系数 (高频, 有效信息)

$$\log I(x, y) = \log L(x, y) + \log R(x, y)$$

