Restauración óptima de imágenes

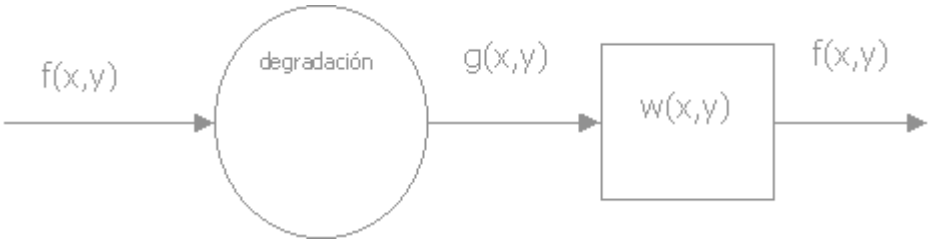
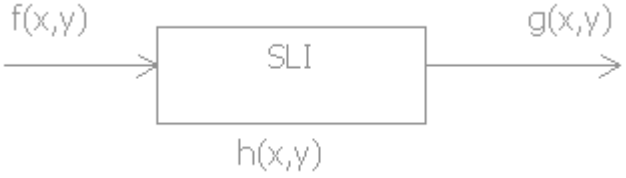


Imagen similar a la imagen original:

$$\hat{f}(x,y)$$

Modelo algebraico de procesamiento de imágenes.

Caso 1D.



$$g(x)=\sum_{i=-\infty}^{\infty} h(x-i)\, f(i)$$

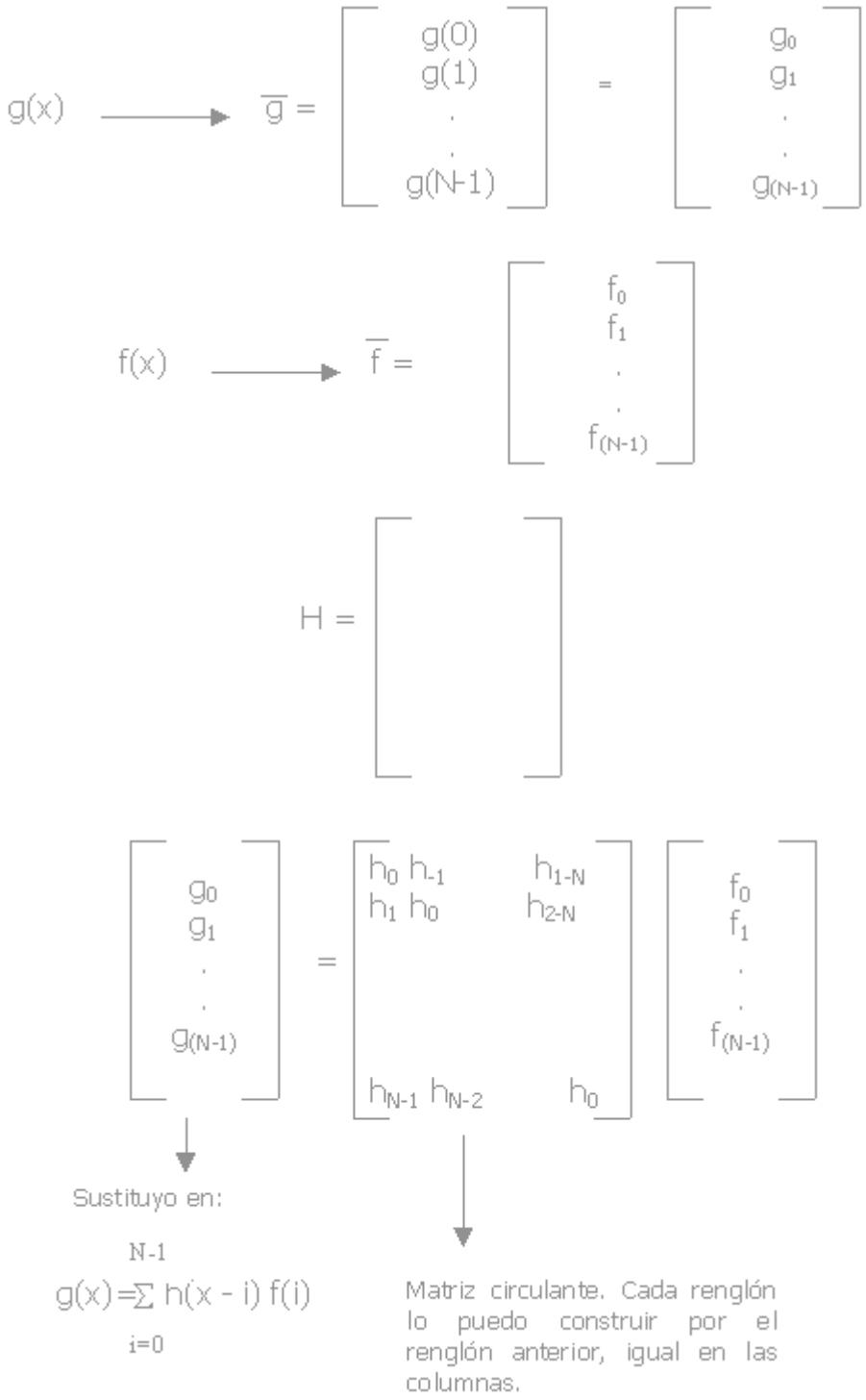
a) Suponer que h y f son finitos y de longitud N.

$$g(x)=\sum_{i=0}^{N-1} h(x-i)\, f(i)$$

Se puede decir que es una convolución circular.

Agrego ceros a h y f para que g sea una convolución lineal.

$\overline{g}=\overline{H}\,\overline{f}$ Señales ⟶ Vectores



Por ser una matriz circular los valores se repiten.

Caso 2D

$$g(x) = \sum_{i=0}^{N-1} \sum_{j=0}^{M-1} h(x - i, y - j)\, f(i,j)$$

$$g(x,y) \longrightarrow \overline{g}$$

$$\begin{bmatrix} g_{0\,0} \\ g_{0\,1} \\ \vdots \\ g_{0\,M-1} \\ g_{1\,0} \\ g_{1\,1} \\ \vdots \\ g_{1\,M-1} \\ \vdots \\ g_{N-1\,0} \\ g_{N-1\,1} \\ \vdots \\ g_{N-1\,M-1} \end{bmatrix} \quad \begin{bmatrix} h_{00} & h_{0\,M-1} \ldots h_{0\,1} & h_{N-1\,0} & h_{N-1\,M-1} \ldots h_{N-1\,1} & h_{1\,0} & h_{1\,M-1} \ldots h_{1\,1} \\ h_{01} & h_{0\,0} \ldots h_{0\,2} & h_{N-1\,1} & h_{N-1\,0} \ldots h_{N-1\,2} & h_{1\,1} & h_{1\,0} \ldots h_{1\,2} \\ h_{0\,M-1} & h_{0\,M-2} \ldots h_{0\,0} & h_{N-1\,M-1} & h_{N-2\,M-2} \ldots h_{N-1\,0} & h_{1\,M-1} & h_{1\,M-2} \ldots h_{1\,0} \\ h_{1\,0} & h_{1\,M-1} \ldots h_{1\,1} & h_{0\,0} & h_{0\,M-1} \ldots h_{0\,1} & h_{2\,0} & h_{2\,M-1} \ldots h_{2\,1} \\ h_{1\,1} & h_{1\,0} \ldots h_{1\,2} & h_{0\,1} & h_{0\,0} \ldots h_{0\,2} & h_{2\,1} & h_{2\,0} \ldots h_{2\,2} \\ h_{1\,M-1} & h_{1\,M-2} \ldots h_{1\,0} & h_{0\,M-1} & h_{0\,M-2} \ldots h_{0\,0} & h_{2\,M-1} & h_{2\,M-2} \ldots h_{2\,0} \\ h_{N-1\,0} & h_{N-1\,M-1} h_{N-1\,1} & h_{N-2\,0} & h_{N-2\,M-1} \ldots h_{N-2\,1} & h_{0\,0} & h_{0\,M-1} \ldots h_{0\,1} \\ h_{N-1\,1} & h_{N-1\,0} \ldots h_{N-1\,2} & h_{N-2\,1} & h_{N-2\,0} \ldots h_{N-2\,2} & h_{0\,1} & h_{0\,0} \ldots h_{0\,2} \\ h_{N-1\,M-1} & h_{N-1\,M-2} \ldots h_{N-1\,0} & h_{N-2\,M-1} & h_{N-2\,M-2} \ldots h_{N-2\,0} & h_{0\,M-1} & h_{0\,M-2} \ldots h_{0\,0} \end{bmatrix} \quad \begin{bmatrix} f_{0\,0} \\ f_{0\,1} \\ \vdots \\ f_{0\,M-1} \\ f_{1\,0} \\ f_{1\,1} \\ \vdots \\ f_{1\,M-1} \\ \vdots \\ f_{N-1\,0} \\ f_{N-1\,1} \\ \vdots \\ f_{N-1\,M-1} \end{bmatrix}$$

NM * 1 NM*NM NM * 1

$$\overline{g} = \overline{H}\,\overline{f}$$