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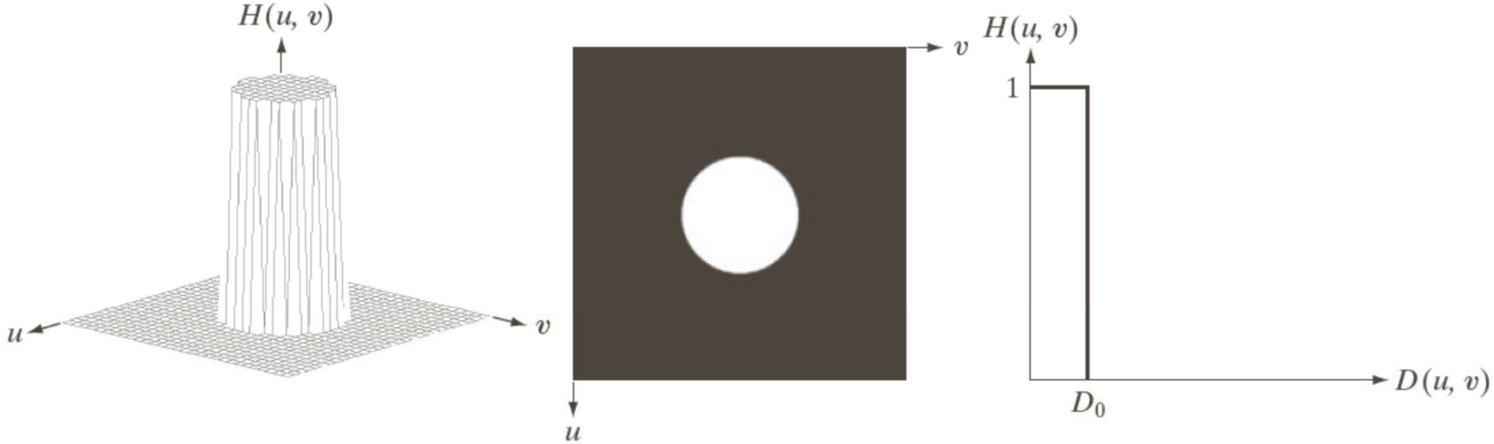
Filtrado en el espacio de las frecuencias

Ideal Low pass

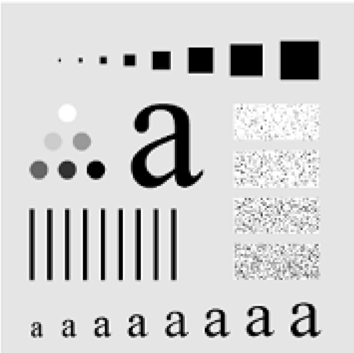


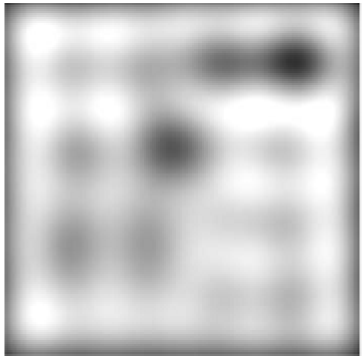
a b c

FIGURE 4.40 (a) Perspective plot of an ideal lowpass-filter transfer function. (b) Filter displayed as an image. (c) Filter radial cross section.

$$H(u, v) = \begin{cases} 1 & \text{if } D(u, v) \leq D_0 \\ 0 & \text{if } D(u, v) > D_0 \end{cases} \qquad D(u, v) = \left[(u - P/2)^2 + (v - Q/2)^2\right]^{1/2}$$

Ideal Low Pass (ILP)



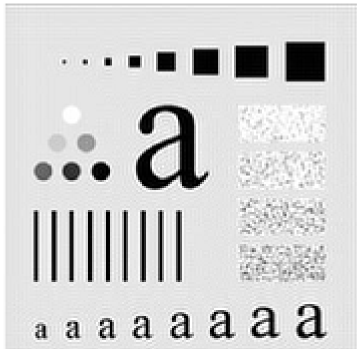


Cutoff=10

Cutoff=30

Cutoff=60

Cutoff=160



Butterworth Low Pass

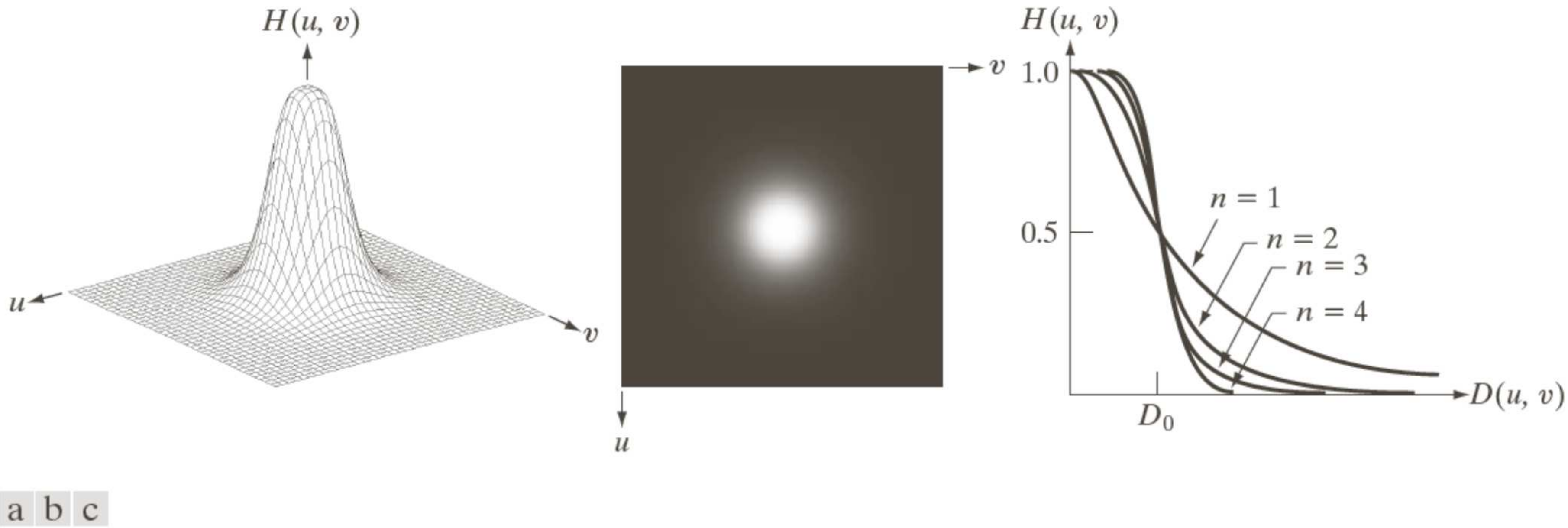
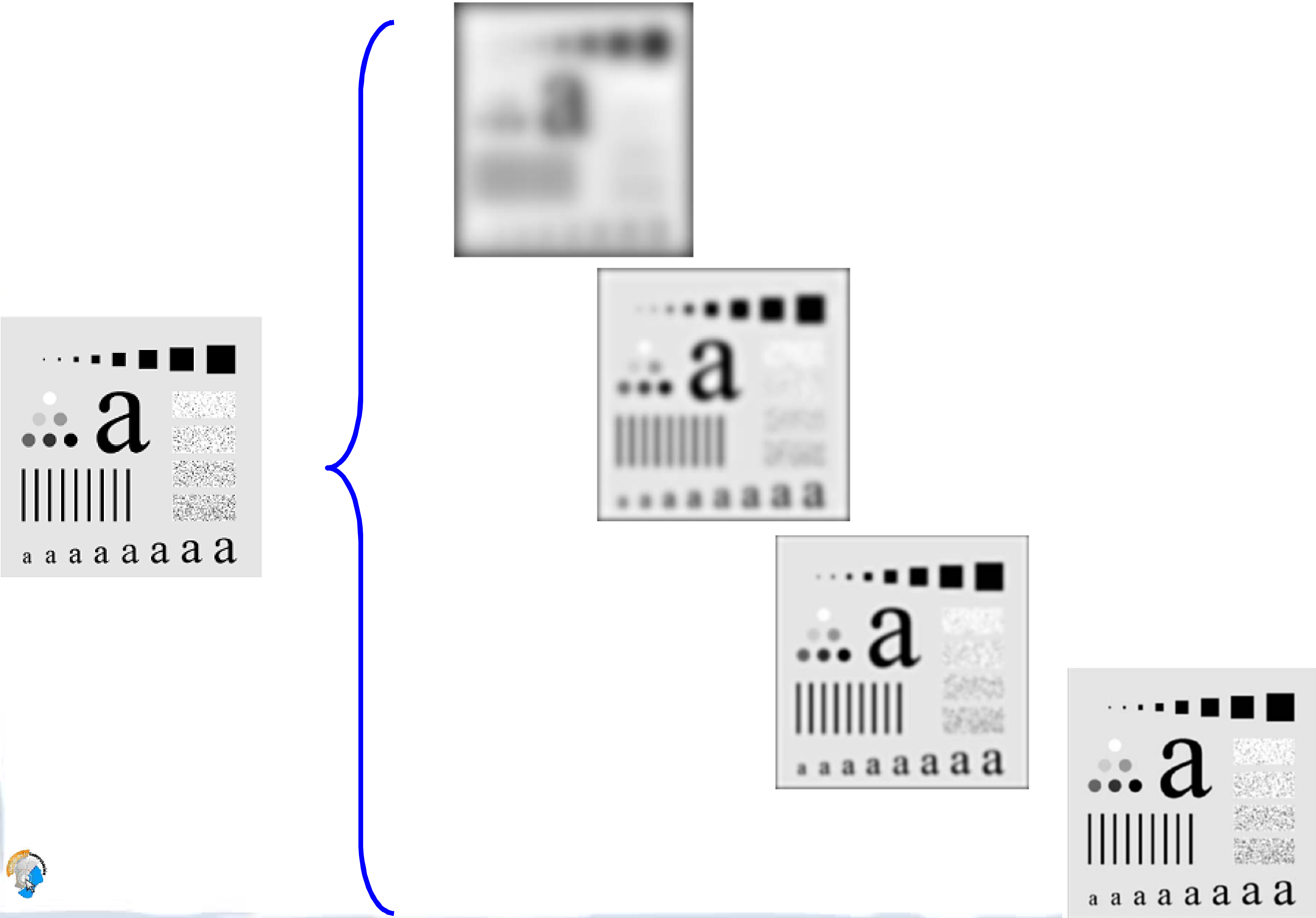


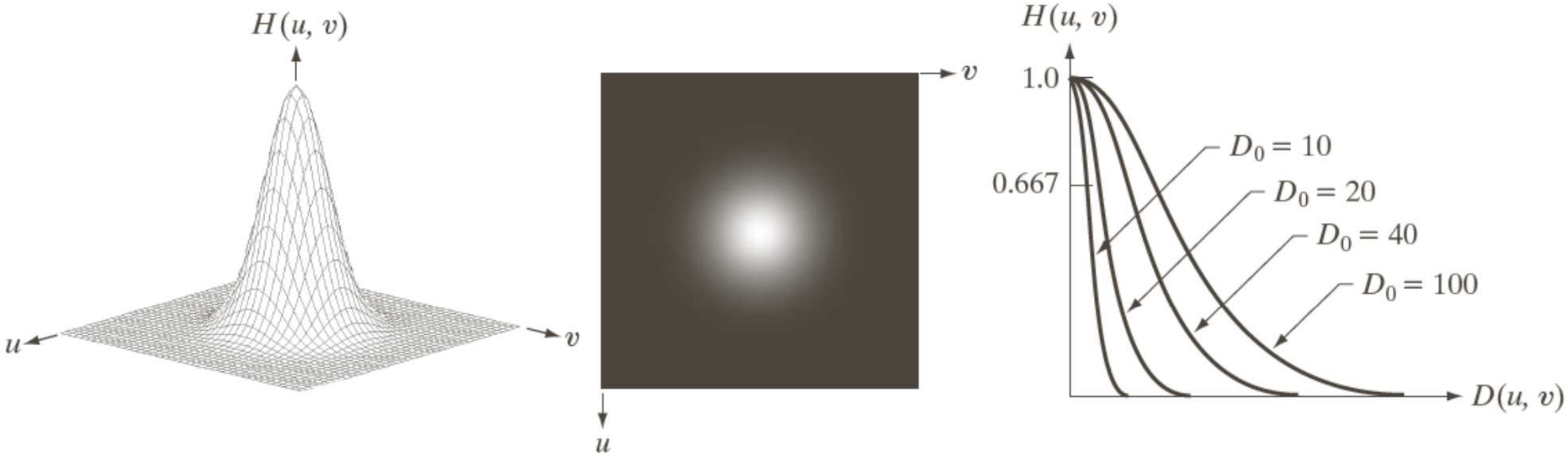
FIGURE 4.44 (a) Perspective plot of a Butterworth lowpass-filter transfer function. (b) Filter displayed as an image. (c) Filter radial cross sections of orders 1 through 4.

$$H(u, v) = \frac{1}{1 + [D(u, v)/D_0]^{2n}}$$

Butterworth Low Pass



Gaussian Low Pass



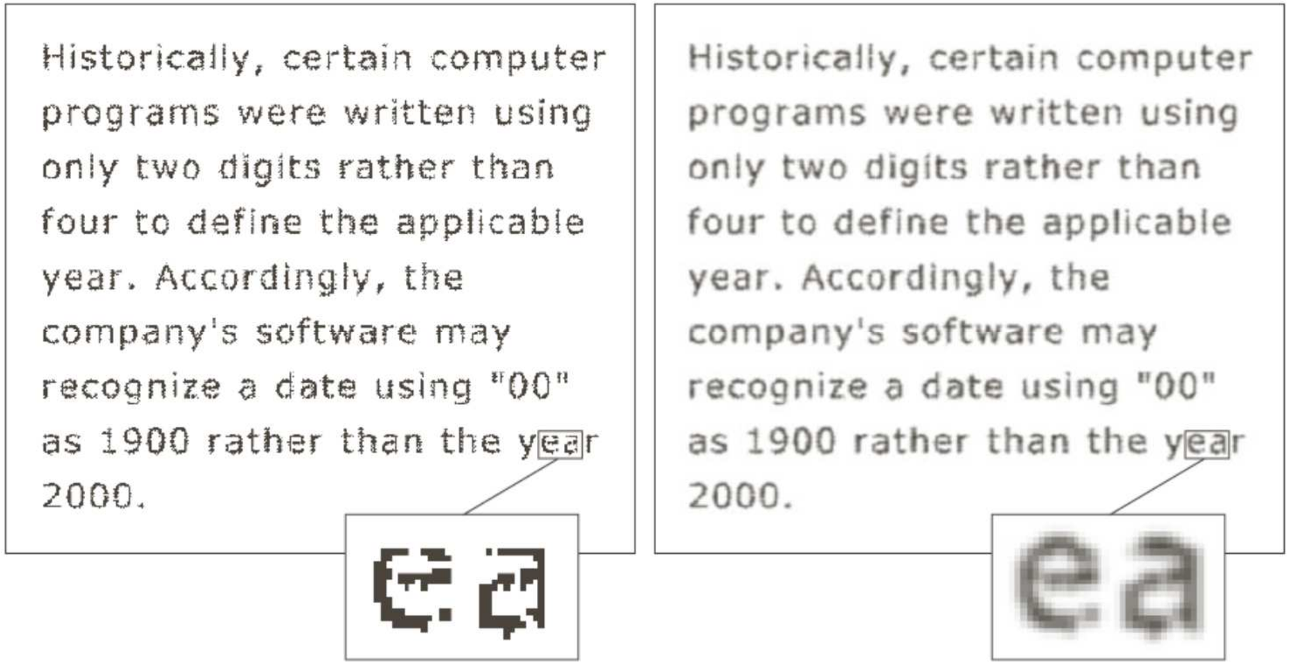
a b c

FIGURE 4.47 (a) Perspective plot of a GLPF transfer function. (b) Filter displayed as an image. (c) Filter radial cross sections for various values of D_0.

$$H(u, v) = e^{-D^2(u, v)/2\sigma^2}$$

$$H(u, v) = e^{-D^2(u, v)/2D_0^2}$$

Aplicaciones



a b

FIGURE 4.49 (a) Sample text of low resolution (note broken characters in magnified view). (b) Result of filtering with a GLPF (broken character segments were joined).

Aplicaciones

FIGURE 4.50 (a) Original image (784 × 732 pixels). (b) Result of filtering using a GLPF with $D_0 = 100$. (c) Result of filtering using a GLPF with $D_0 = 80$. Note the reduction in fine skin lines in the magnified sections in (b) and (c).

Ideal High Pass

Cutoff=30

$$H(u, v) = \begin{cases} 0 & \text{if } D(u, v) \leq D_0 \\ 1 & \text{if } D(u, v) > D_0 \end{cases}$$

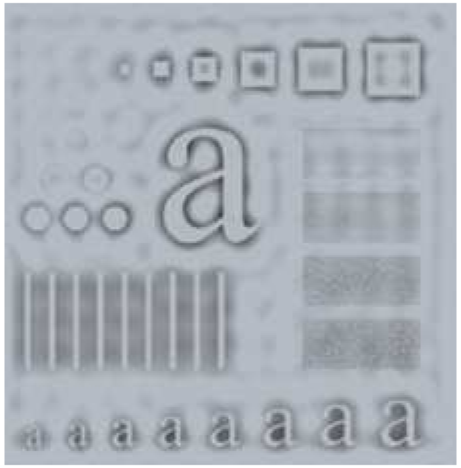
Cutoff=60

Cutoff=160

Ideal High Pass (negativo)

Cutoff=30

Cutoff=60



Cutoff=160

Butterworth HP

$$H(u,v) = \frac{1}{1 + [D_0/D(u,v)]^{2n}}$$

Butterworth HP (negativo)

Gaussian HP

$$H(u, v) = 1 - e^{-D^2(u,v)/2D_0^2}$$

Gaussian HP (negativo)

Laplaciano

$$H(u, v) = -4\pi^2(u^2 + v^2)$$

a b

FIGURE 4.58
(a) Original, blurry image.
(b) Image enhanced using the Laplacian in the frequency domain. Compare with Fig. 3.38(e).

Band Reject/pass

TABLE 4.6
Bandreject filters. W is the width of the band, D is the distance $D(u, v)$ from the center of the filter, D_0 is the cutoff frequency, and n is the order of the Butterworth filter. We show D instead of $D(u, v)$ to simplify the notation in the table.

Ideal	Butterworth	Gaussian
$H(u,v) = \begin{cases} 0 & \text{if } D_0 - \frac{W}{2} \leq D \leq D_0 + \frac{W}{2} \\ 1 & \text{otherwise} \end{cases}$	$H(u,v) = \dfrac{1}{1 + \left[\dfrac{DW}{D^2 - D_0^2}\right]^{2n}}$	$H(u,v) = 1 - e^{-\left[\frac{D^2 - D_0^2}{DW}\right]^2}$

Compresión

Transformada coseno

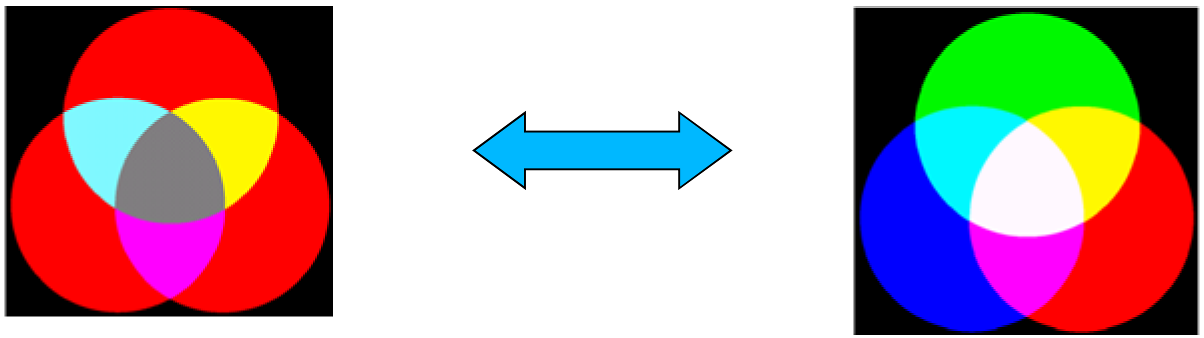
Transformada Discreta del Coseno TDC

$$C(u,v) = \alpha(u)\alpha(v)\sum_{x=0}^{N-1}\sum_{y=0}^{M-1} f(x,y)\cos\left(\frac{(2x+1)\pi u}{2N}\right)\cos\left(\frac{(2y+1)\pi v}{2M}\right)$$

$$\alpha(u),\alpha(v) = \begin{cases} \sqrt{\frac{1}{N}} \;\; para \;\; u=0 & \sqrt{\frac{1}{M}} \;\; para \;\; v=0 \\ \sqrt{\frac{2}{N}} \;\; para \;\; u>0 & \sqrt{\frac{2}{M}} \;\; para \;\; v>0 \end{cases}$$

RGB->YUV

$$\begin{bmatrix} Y \\ U \\ V \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ 0.596 & -0.275 & -0.321 \\ 0.212 & -0.523 & 0.311 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$



Compresión JPG

- Conversión modelo de color
- TDC
- Zig-Zag
- Codificación Huffman