



Benemérita Universidad Autónoma de Puebla

Facultad de Ciencias de la Computación

Procesamiento de Imágenes Digitales

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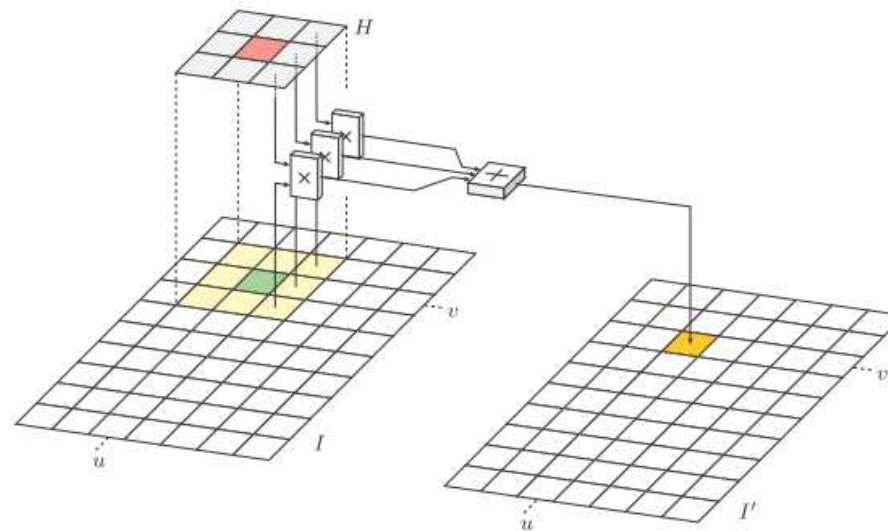


Operaciones orientadas a la región



Operaciones regionales

- Convolución



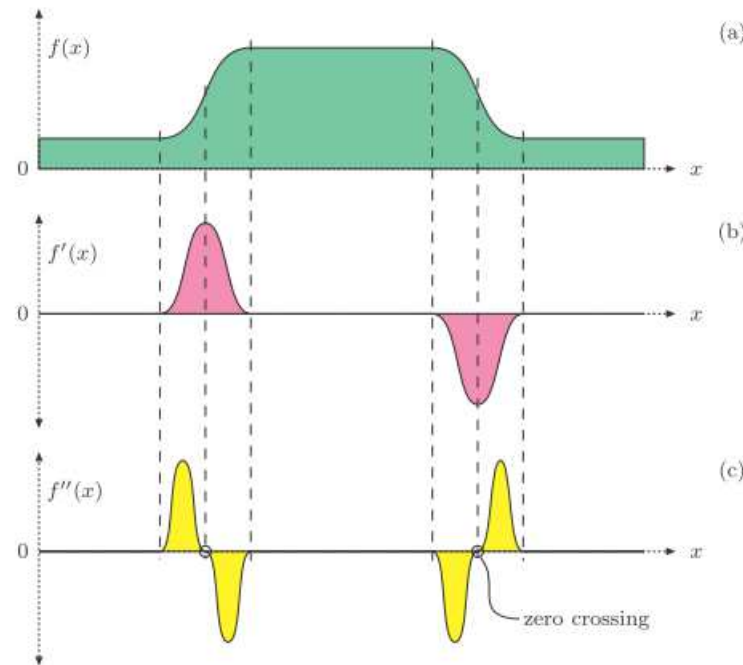
- Máscara de Convolución



Bordes



Imagen

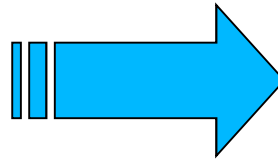


Perfil de intensidad



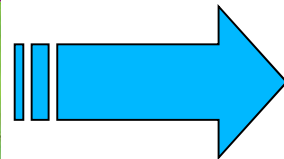
Bordes

- Derivada (X,Y)



Gradiente

- Gradiente



Negativos



Bordes

-1	-1	-1	-1	0	1
0	0	0	-1	0	1
1	1	1	-1	0	1

Prewitt

-1	-2	-1	-1	0	1
0	0	0	-2	0	2
1	2	1	-1	0	1

Sobel

-1	0	0	-1
0	1	1	0

Roberts



Brújula

- Kirsch

$$H_0^K = \begin{bmatrix} -5 & 3 & 3 \\ -5 & 0 & 3 \\ -5 & 3 & 3 \end{bmatrix}$$

$$H_4^K = \begin{bmatrix} 3 & 3 & -5 \\ 3 & 0 & -5 \\ 3 & 3 & -5 \end{bmatrix},$$

$$H_1^K = \begin{bmatrix} -5 & -5 & 3 \\ -5 & 0 & 3 \\ 3 & 3 & 3 \end{bmatrix}$$

$$H_5^K = \begin{bmatrix} 3 & 3 & 3 \\ 3 & 0 & -5 \\ 3 & -5 & -5 \end{bmatrix},$$

$$H_2^K = \begin{bmatrix} -5 & -5 & -5 \\ 3 & 0 & 0 \\ 3 & 3 & 3 \end{bmatrix}$$

$$H_6^K = \begin{bmatrix} 3 & 3 & 3 \\ 3 & 0 & 3 \\ -5 & -5 & -5 \end{bmatrix},$$

$$H_3^K = \begin{bmatrix} 3 & -5 & -5 \\ 3 & 0 & -5 \\ 3 & 3 & 3 \end{bmatrix}$$

$$H_7^K = \begin{bmatrix} 3 & 3 & 3 \\ -5 & 0 & 3 \\ -5 & -5 & 3 \end{bmatrix}.$$

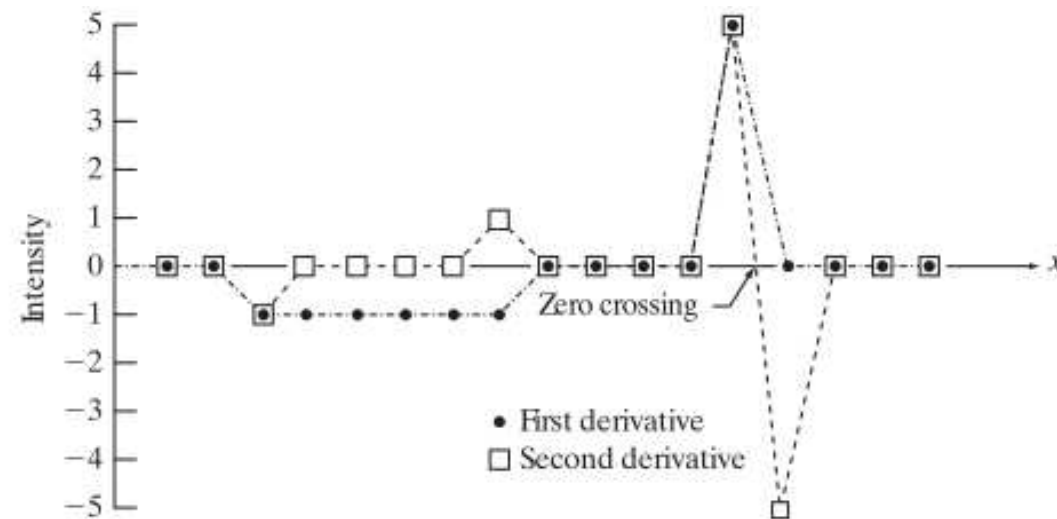
- Robinson

$$R_0 = \begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix}$$



Laplaciano

- Filtro de segundo orden



- Sharpen



Laplaciano

0	1	0	1	1	1
1	-4	1	1	-8	1
0	1	0	1	1	1
0	-1	0	-1	-1	-1
-1	4	-1	-1	8	-1
0	-1	0	-1	-1	-1



Laplaciano





Suavizado



Suavizado

- Suavizado
- Ruido:
 - Sal
 - Pimienta
- Reducir transiciones altas



Promedios

Aritmético



Promedios

Ponderado

$w=5$

$$\frac{1}{w} \begin{pmatrix} 1 & 1 & 1 \\ 1 & w & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

Valores típicos:

$W=2,4,12$



Promedio

Gaussiano $4e^{-x^2/\sqrt{2}}$

$$\frac{1}{16} \begin{pmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{pmatrix}$$

$$\frac{1}{32} \begin{pmatrix} 1 & 4 & 1 \\ 4 & 12 & 4 \\ 1 & 4 & 1 \end{pmatrix}$$

En general:

$$Ae^{-x^2/s}$$



Promedios

-Armónico

$$f'(x, y) = \frac{mn}{\sum_{(s,t) \in S_{x,y}} \frac{1}{g(s,t)}}$$

harmonic mean filter works well for salt noise, but fails for pepper noise.

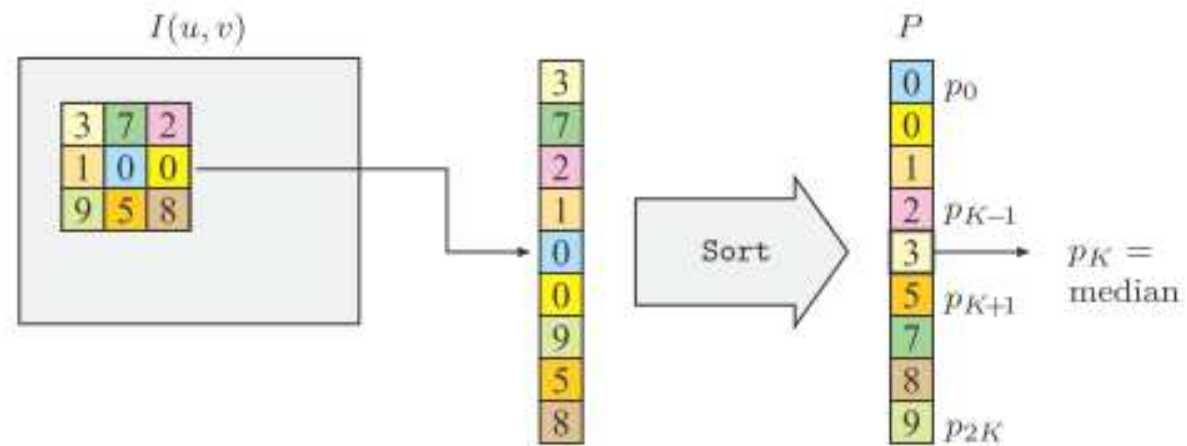
-Contra armónico

$$f'(x, y) = \frac{\sum_{(s,t) \in S_{x,y}} g(s,t)^{Q+1}}{\sum_{(s,t) \in S_{x,y}} g(s,t)^Q}$$

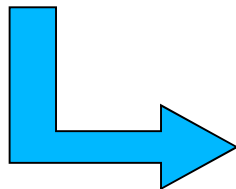
$\left\{ \begin{array}{ll} Q > 0 & \rightarrow \text{Pimienta} \\ Q < 0 & \rightarrow \text{Sal} \end{array} \right.$



Filtro Mediana

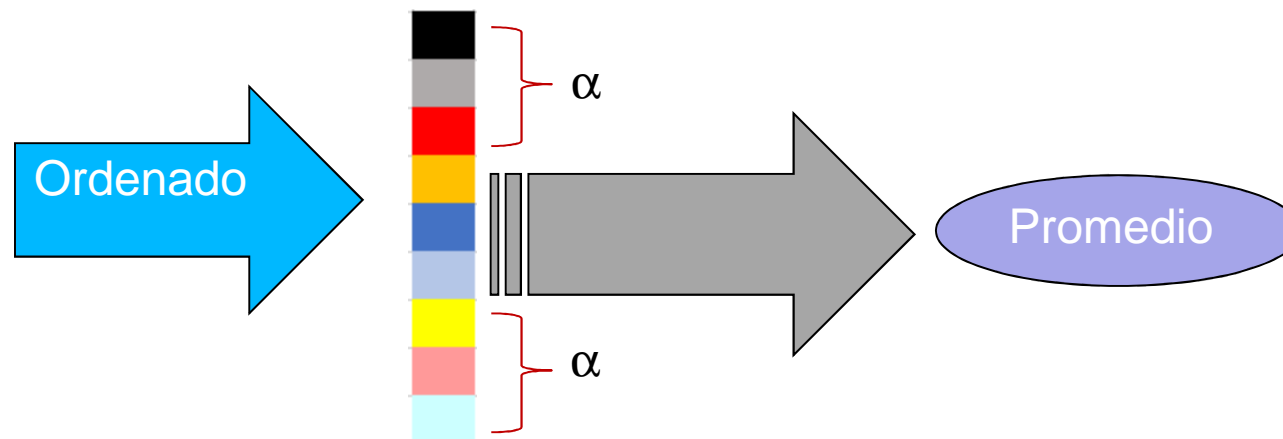


Mediana

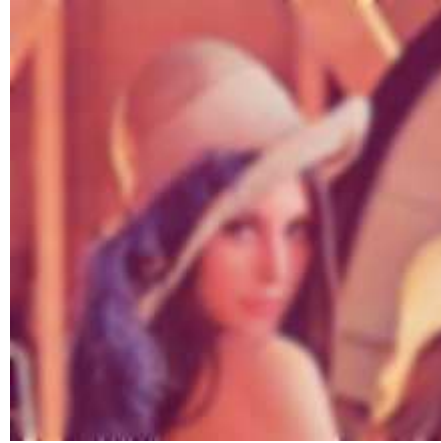
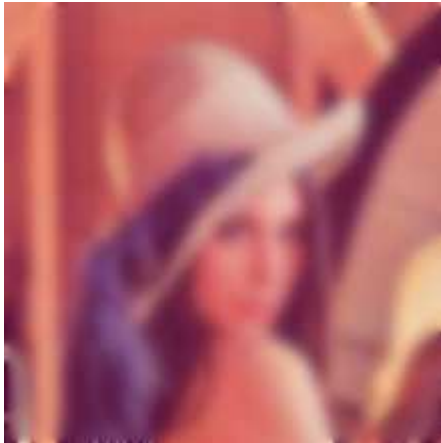


Promedio α -recortado

- Combinación mediana-media
- Considerando regiones de 3 x 3:



Suavizado



Transformaciones Geométricas



Transf. Geométricas

- Escalar (+,-)
- Rotar
- Reflejar



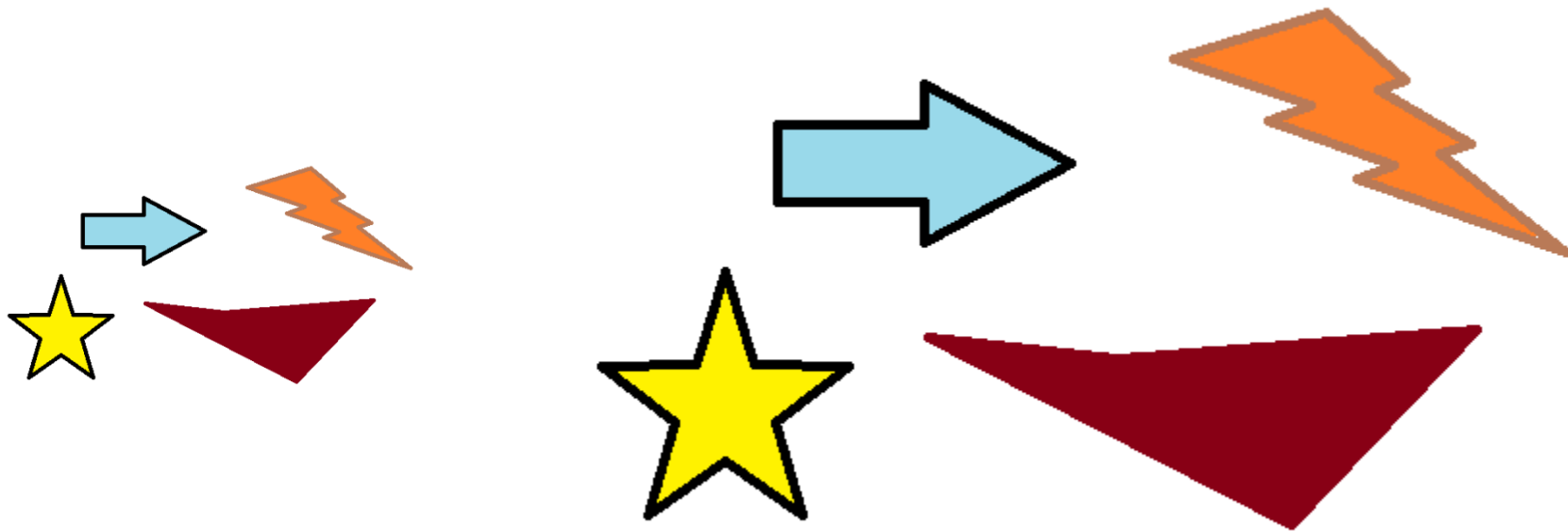
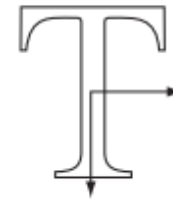
Ampliar

Scaling

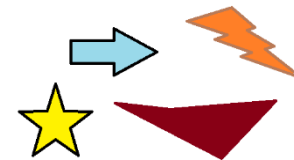
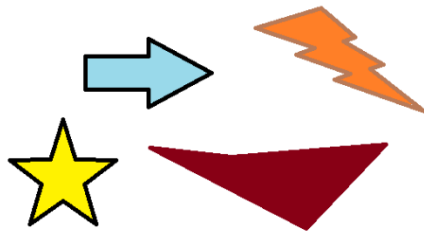
$$\begin{bmatrix} c_x & 0 & 0 \\ 0 & c_y & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = c_x v$$

$$y = c_y w$$

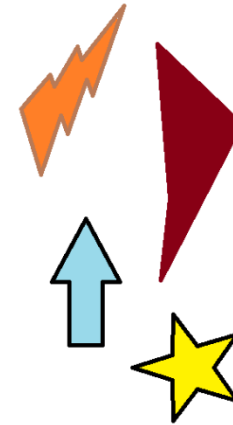
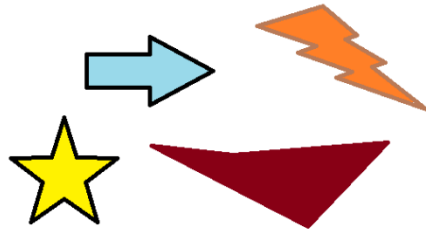


Reducir



Rotar

$\pm 90^\circ$

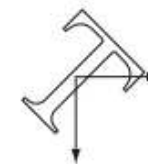


Rotation

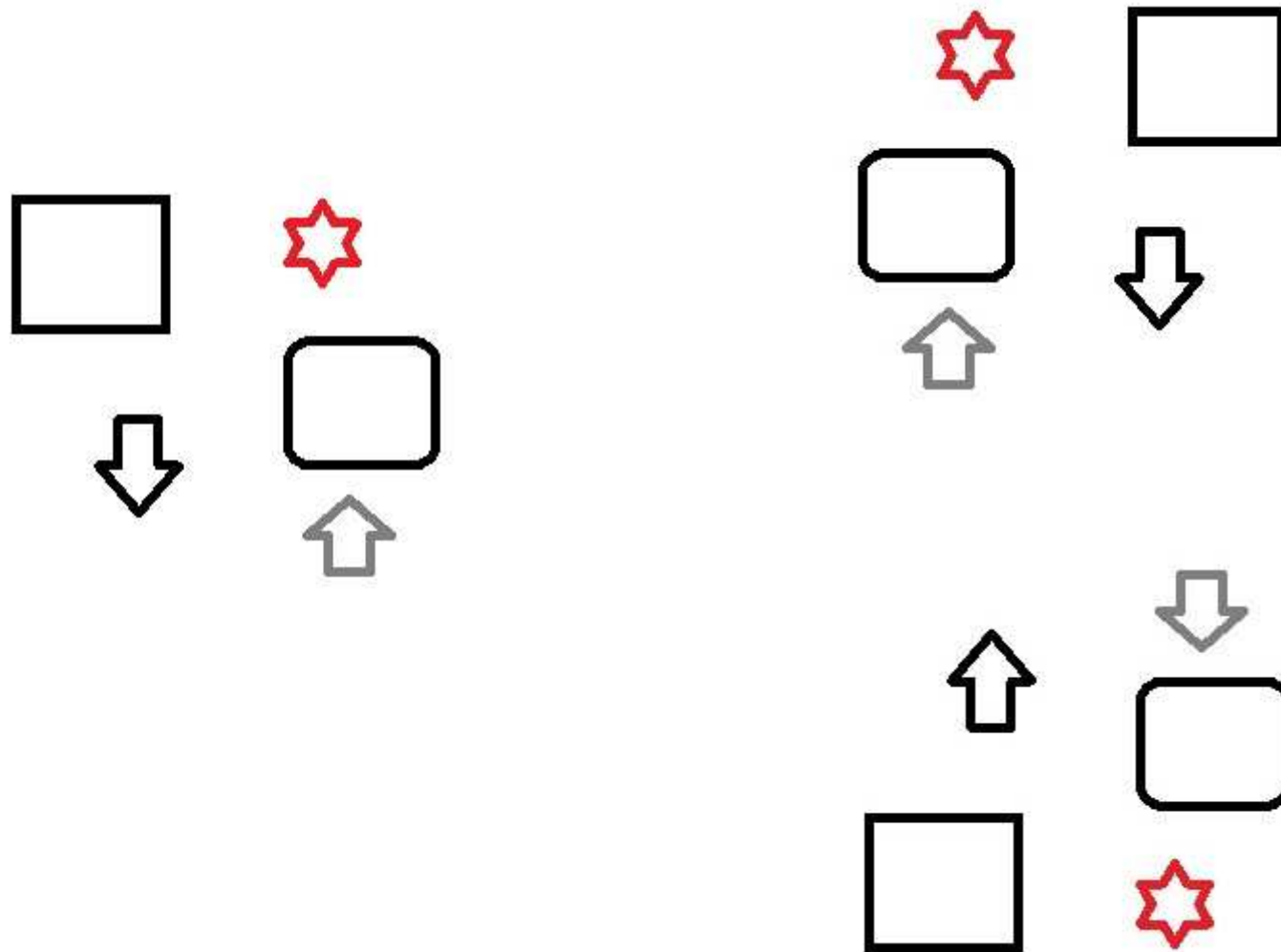
$$\begin{bmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x = v \cos \theta - w \sin \theta$$

$$y = v \sin \theta + w \cos \theta$$



Reflejar



Operaciones Aritméticas/Lógicas



Operaciones A/L

- Operador entre dos imágenes: Píxel a Píxel
 - Alineación:
 - Superior
 - Punto de Referencia
- Aritméticas: +, -, *, /
- Lógicas: AND, OR, XOR, NOT



Transformación de histograma



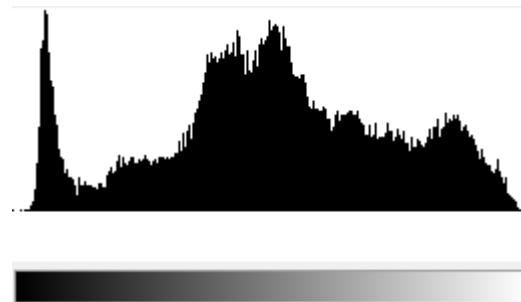
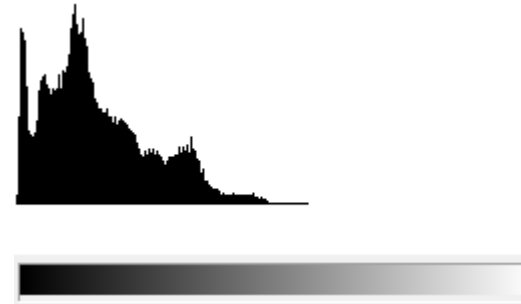
Expansión aut. de histograma

- Valores expandidos:

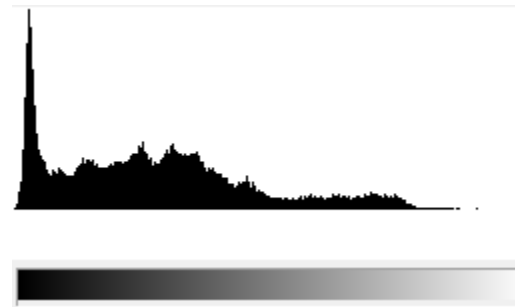
$$E[j, canal] = \frac{255}{NM} \sum_{k=0}^j H[k, canal]$$



Expansión automática de histograma



Expansión aut. de histograma



Enfoques controladas

- Contracción

$$I'(i, j) = \frac{C_{MAX} - C_{MIN}}{I(i, j)_{MAX} - I(i, j)_{MIN}} (I(i, j) - I(i, j)_{MIN}) + C_{MIN}$$

- Expansión

$$I'(i, j) = \frac{I(i, j) - I(i, j)_{MIN}}{I(i, j)_{MAX} - I(i, j)_{MIN}} (MAX - MIN) + MIN$$



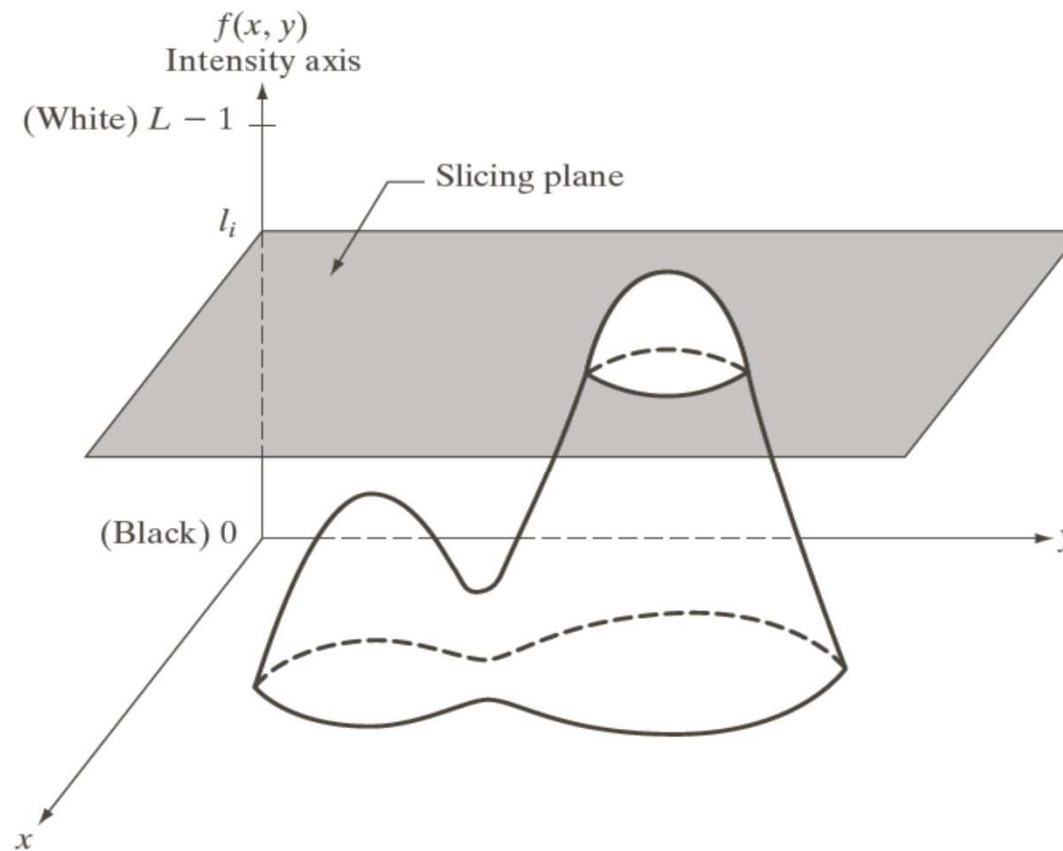


Falso Color



Falso- Color

- División de Intensidad



Falso color

- División de intensidad

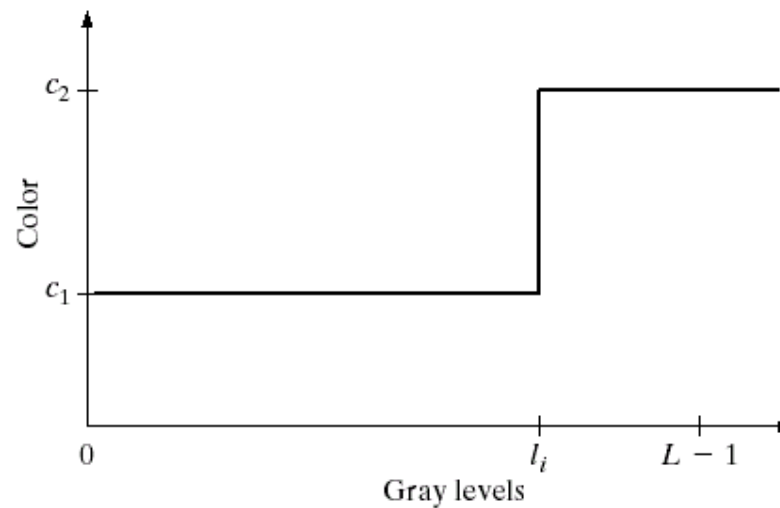
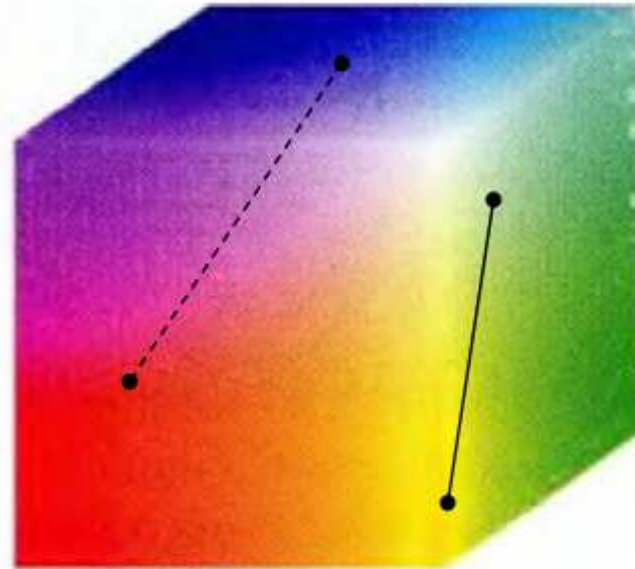
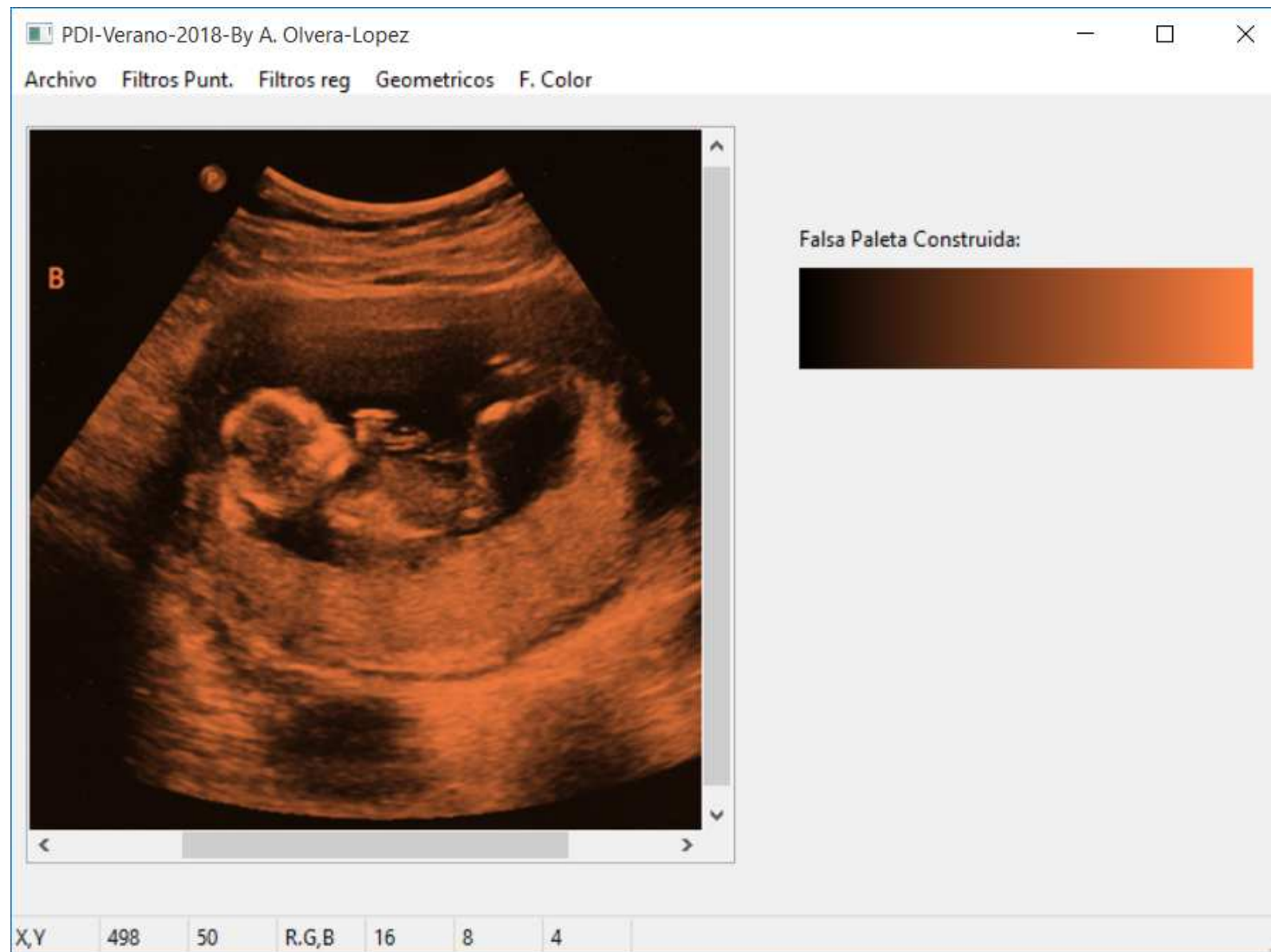


FIGURE 6.19 An alternative representation of the intensity-slicing technique.

Interpolación lineal



Interpolación lineal



Interpolación lineal

