Procesamiento Digital de Imágenes

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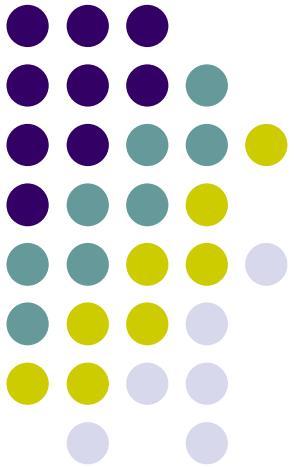
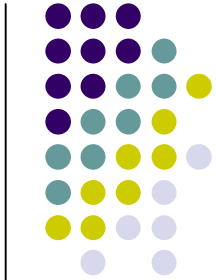
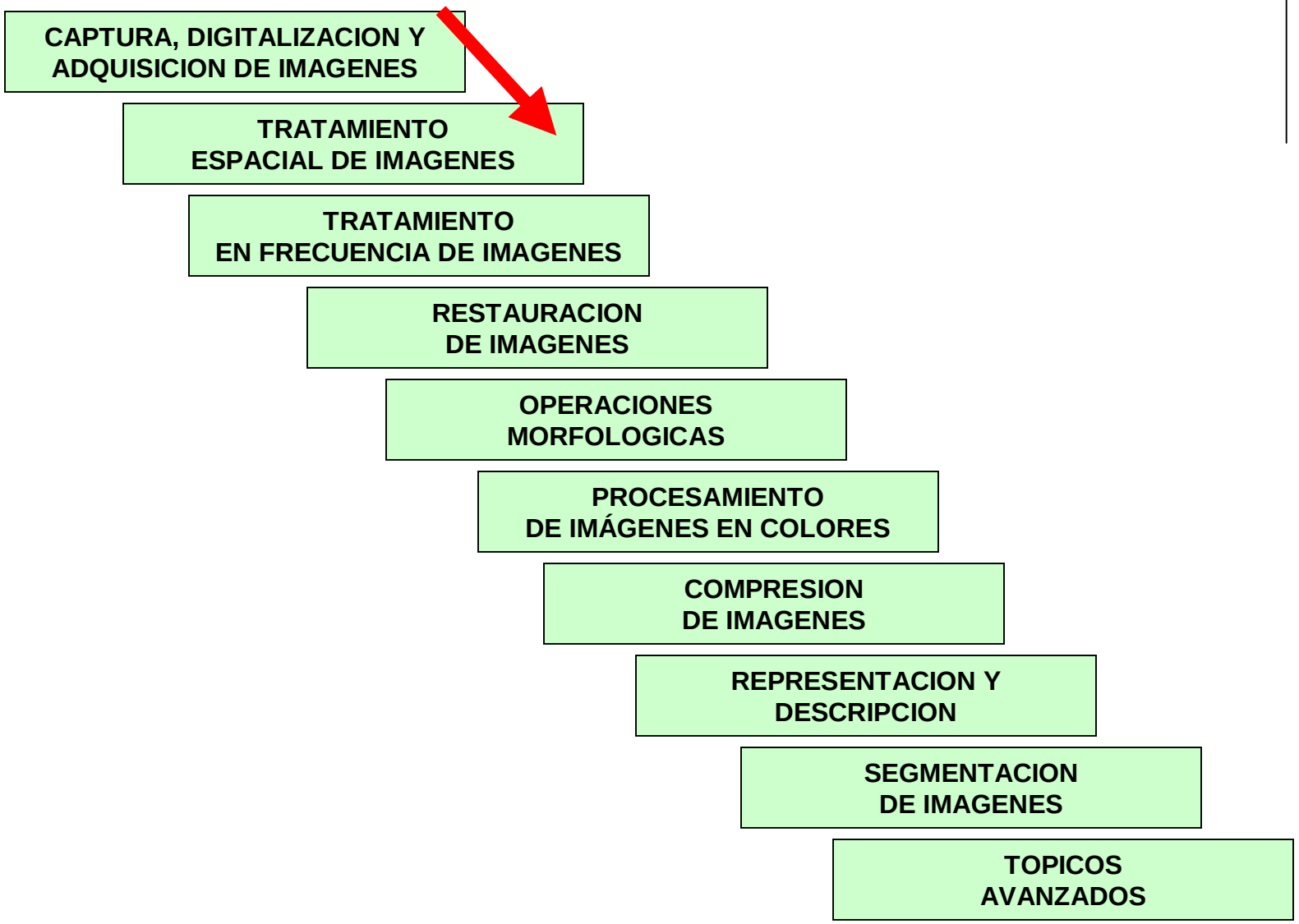
Nº 5

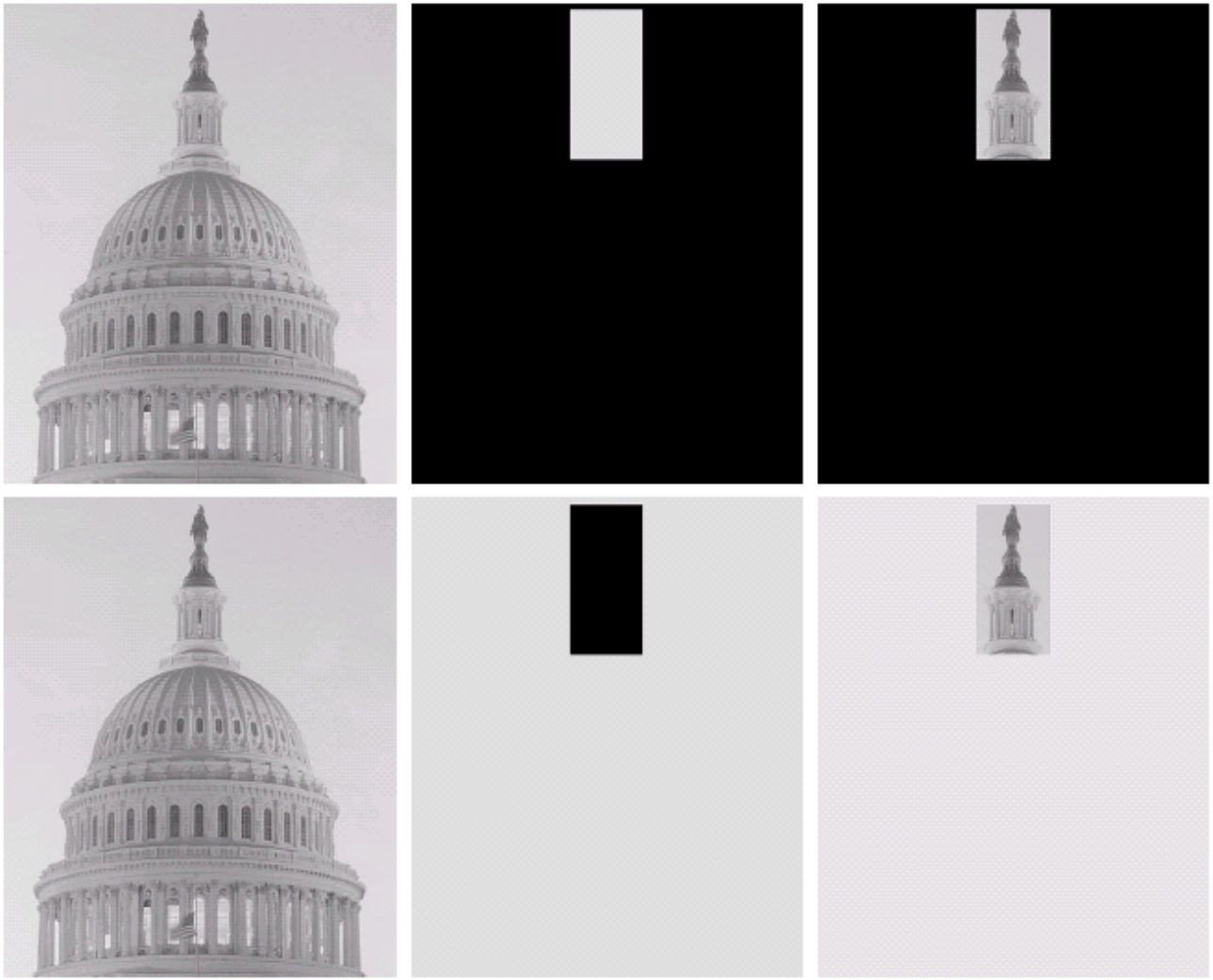


Orden de las clases...





Operaciones Lógicas



a b c
d e f

FIGURE 3.27
(a) Original image. (b) AND image mask. (c) Result of the AND operation on images (a) and (b). (d) Original image. (e) OR image mask. (f) Result of operation OR on images (d) and (e).

Ej. Operaciones Lógicas

```
function m013;
%m013
%aplica mascara segun mouse
clf;
A=double(imread('_im_lenna_256.jpg'));
[nf nc]=size(A);

%visualiza sin Toolbox de Imagenes
colormap(gray(256));
subplot(2,2,1);image(A);disp('Presione dos click para definir mascara...');

[c1 f1]=ginput(1) %ojo ginput funciona con x,y
[c2 f2]=ginput(1)
f1=round(f1);f2=round(f2);c1=round(f1);c2=round(c2);
mask=zeros(nf,nc);

for f=f1:f2
   for c=c1:c2
      mask(f,c)=1;
   end;
end;
subplot(2,2,2);imshow(mask,[]);title('Mask');disp('presione una tecla...');pause
B=A.*mask;
subplot(2,2,3);imshow(B,[]);title('A and Mask');disp('presione una tecla...');pause
B=A.*(1-mask);
subplot(2,2,4);imshow(B,[]);title('A and not Mask');
```

Planos de Bits

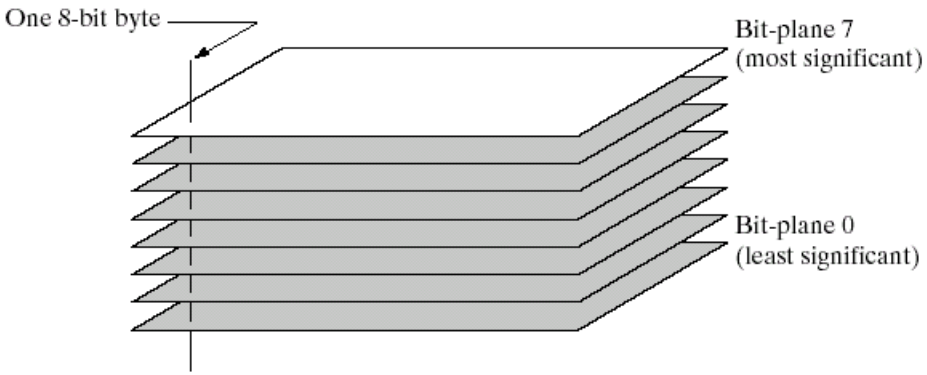


FIGURE 3.12
Bit-plane representation of an 8-bit image.

Planos de Bits

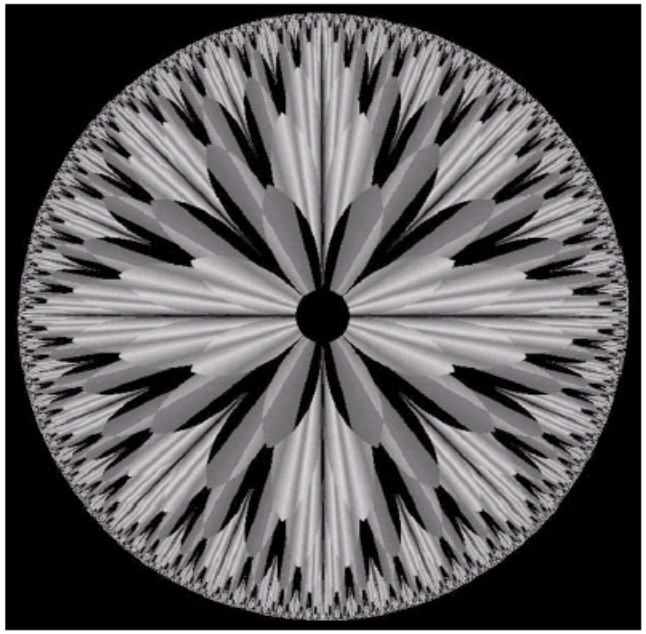


FIGURE 3.13 An 8-bit fractal image. (A fractal is an image generated from mathematical expressions). (Courtesy of Ms. Melissa D. Binde, Swarthmore College, Swarthmore, PA.)

Planos de Bits

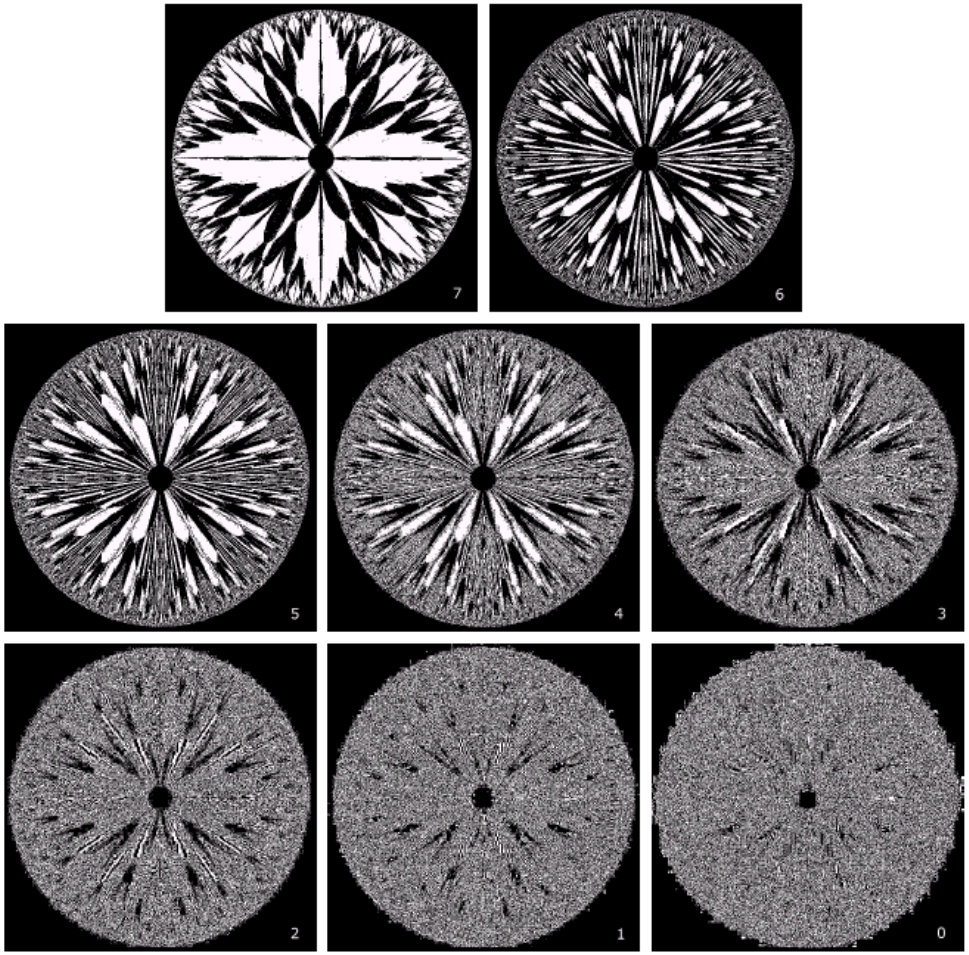
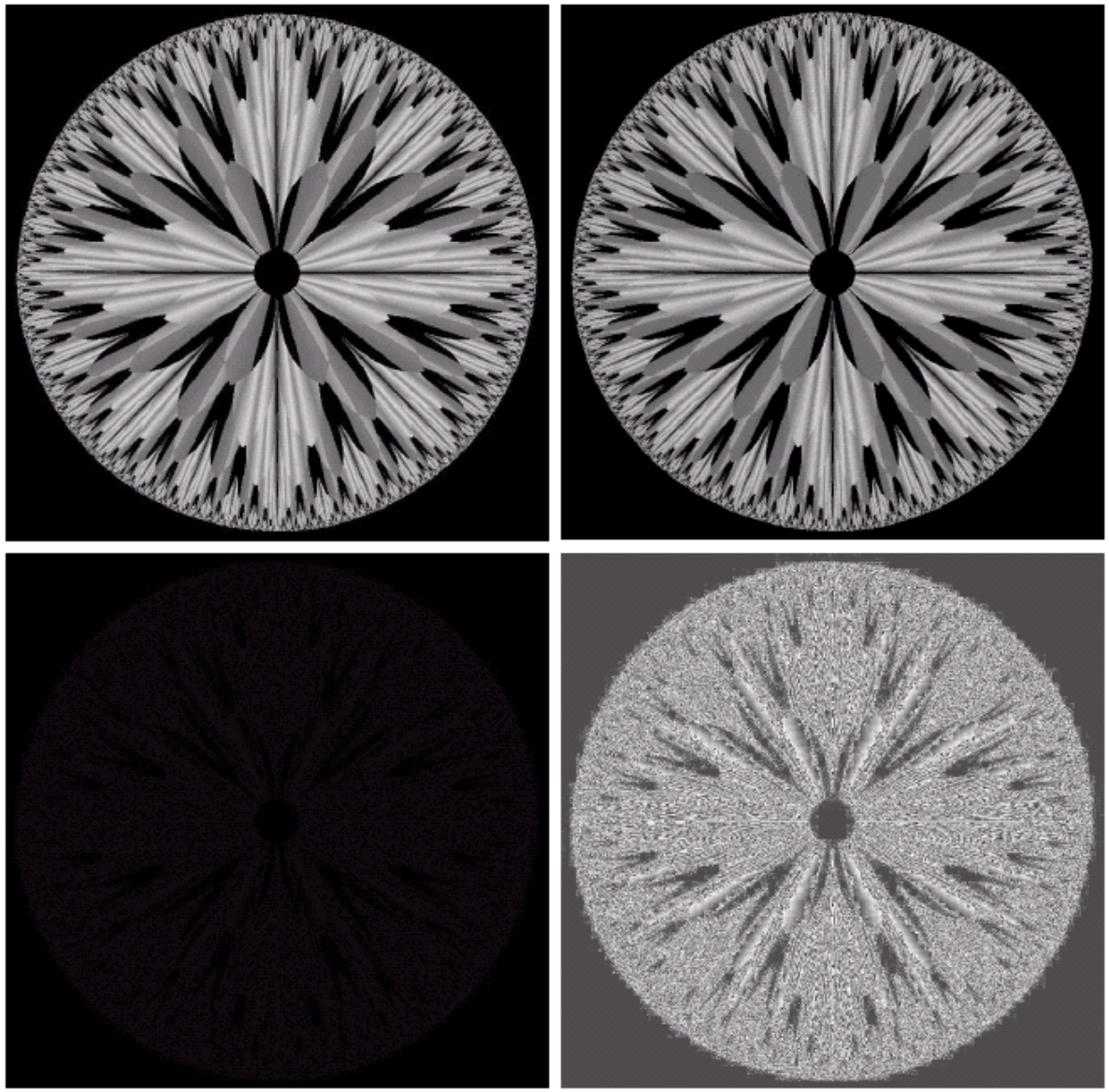


FIGURE 3.14 The eight bit planes of the image in Fig. 3.13. The number at the bottom, right of each image identifies the bit plane.

Planos de Bits

a b
c d

FIGURE 3.28
(a) Original fractal image. (b) Result of setting the four lower-order bit planes to zero. (c) Difference between (a) and (b). (d) Histogram-equalized difference image. (Original image courtesy of Ms. Melissa D. Binde, Swarthmore College, Swarthmore, PA).



Ej1. Planos de Bits

```
function B=m011(bit);
%planos de bits
A=imread('_im_lenna_256.jpg');
[nf nc]=size(A);
A=double(A);

%visualiza sin Toolbox de Imagenes
colormap(gray(256));
image(A);
disp('Presione una tecla para mostrar planos de bits...');pause

B=0*A;


pb=2^(bit-1)
for f=1:nf
   for c=1:nc
      aux=bitand(A(f,c),pb);
      B(f,c)=bitget(aux,bit);
   end;%for
end;%for

image(B*255);
```

Ej2. Planos de Bits

```
%m012
%visualización progresiva en planos de bits
clear
A=imread('_im_lenna_256.jpg');
[nf nc]=size(A);
A=double(A);

%visualiza sin Toolbox de Imagenes
colormap(gray(256));
image(A);
disp('Presione una tecla para mostrar planos de bits...');pause

C=zeros(nf,nc);

for bit=8:-1:1
   pb=2^(bit-1)
          for f=1:nf
             for c=1:nc
                    aux=bitand(A(f,c),pb);
                    B(f,c)=bitget(aux,bit);
                    C(f,c)=bitor(C(f,c),aux);
             end;
          end;
   image(C);
   pause(1);
end;
```

Tratamiento de Imágenes:
Dominio espacial

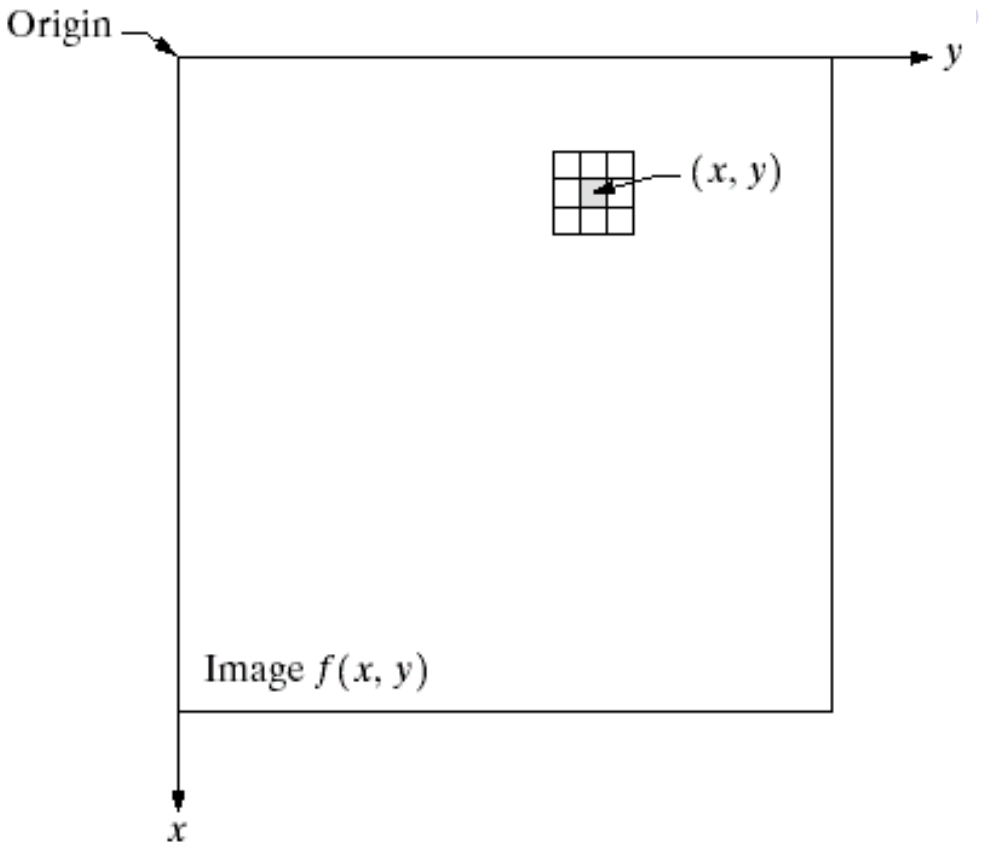


FIGURE 3.1 A 3×3 neighborhood about a point (x, y) in an image.

Tratamiento de Imágenes:

Dominio espacial: FILTROS

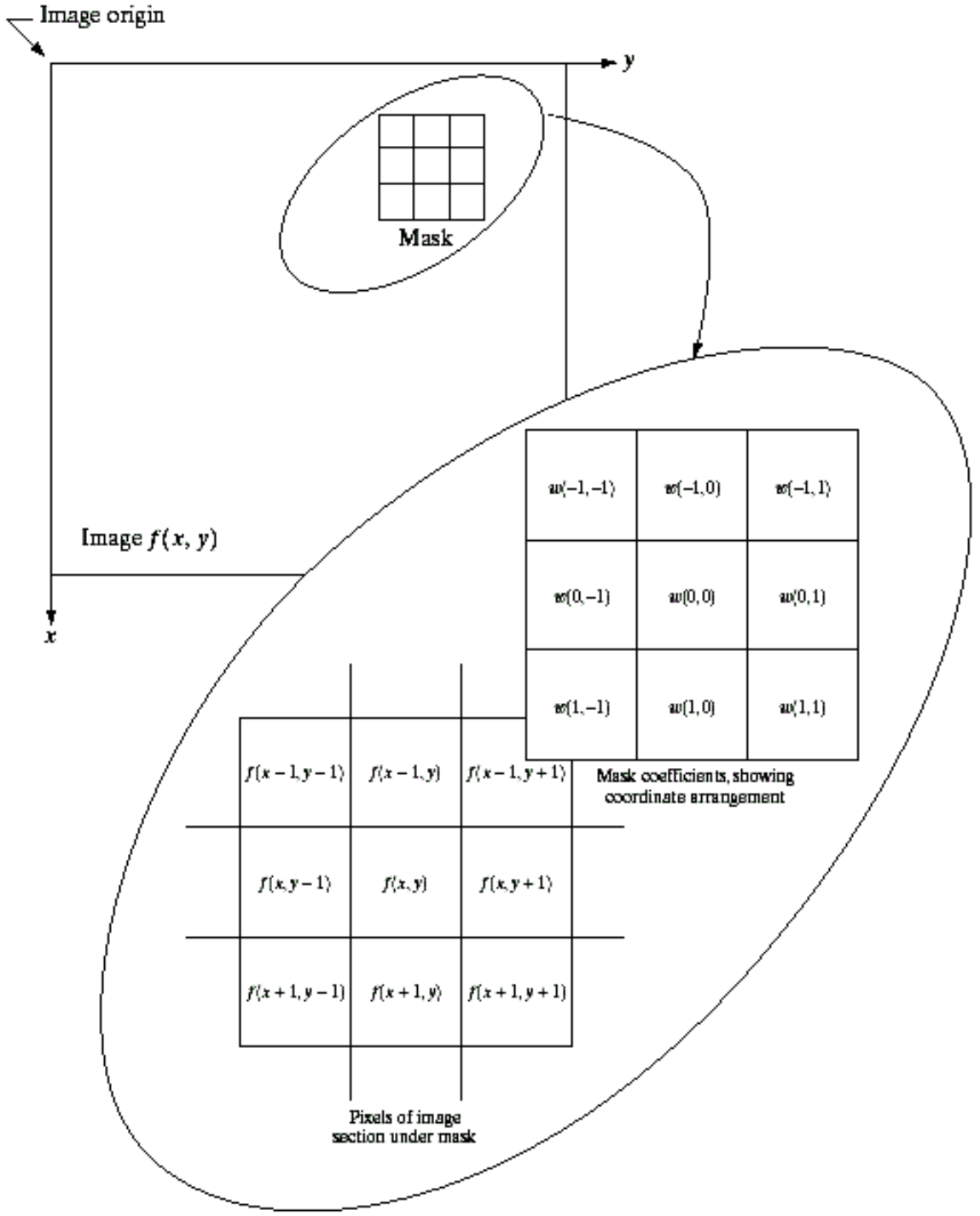


FIGURE 3.32 The mechanics of spatial filtering. The magnified drawing shows a 3×3 mask and the image section directly under it; the image section is shown displaced out from under the mask for ease of readability.

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Tratamiento de Imágenes:

Dominio espacial: FILTROS

FIGURE 3.33 Another representation of a general 3×3 spatial filter mask.

w_1	w_2	w_3
w_4	w_5	w_6
w_7	w_8	w_9

$\frac{1}{9} \times$

1	1	1
1	1	1
1	1	1

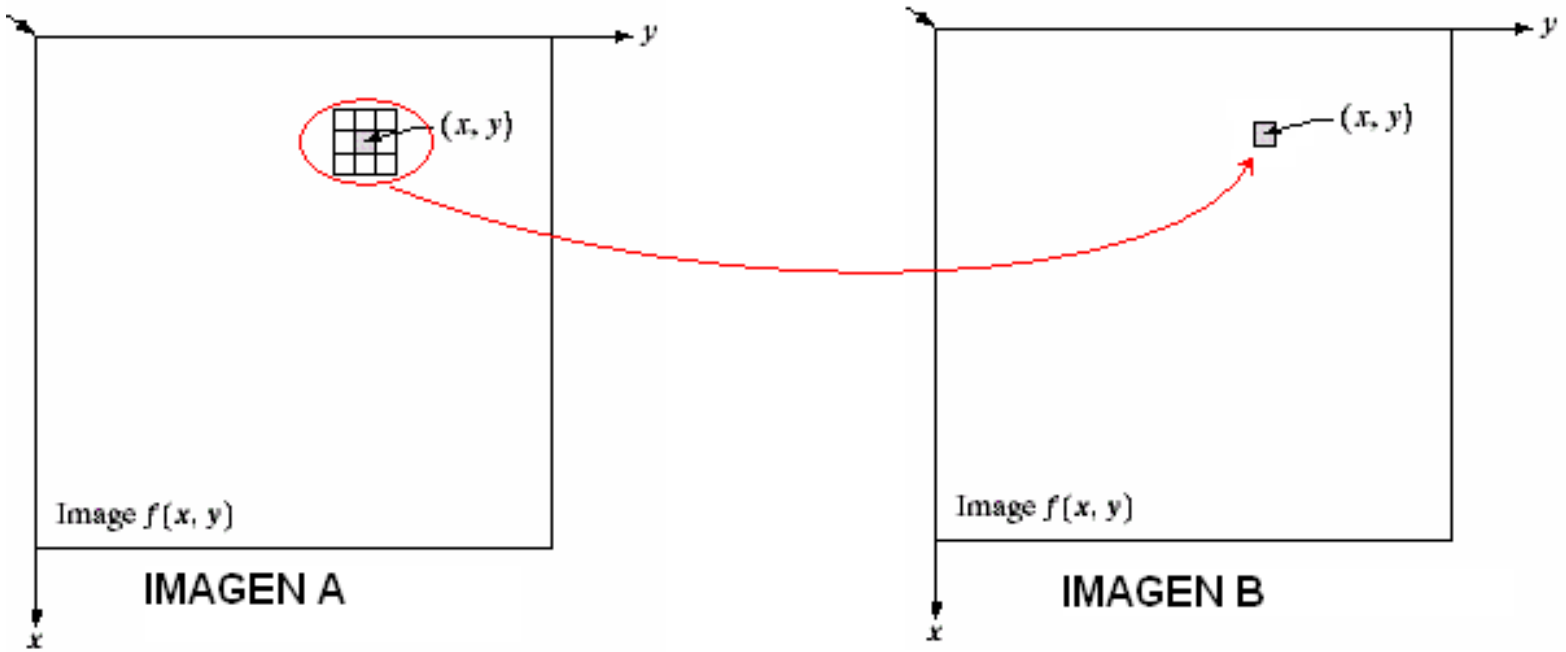
$\frac{1}{16} \times$

1	2	1
2	4	2
1	2	1

a b

FIGURE 3.34 Two 3×3 smoothing (averaging) filter masks. The constant multiplier in front of each mask is equal to the sum of the values of its coefficients, as is required to compute an average.

Filtro se puede interpretar como un promedio “móvil”
è se deben utilizar variables diferentes



Tratamiento de Imágenes:
Dominio espacial: FILTROS

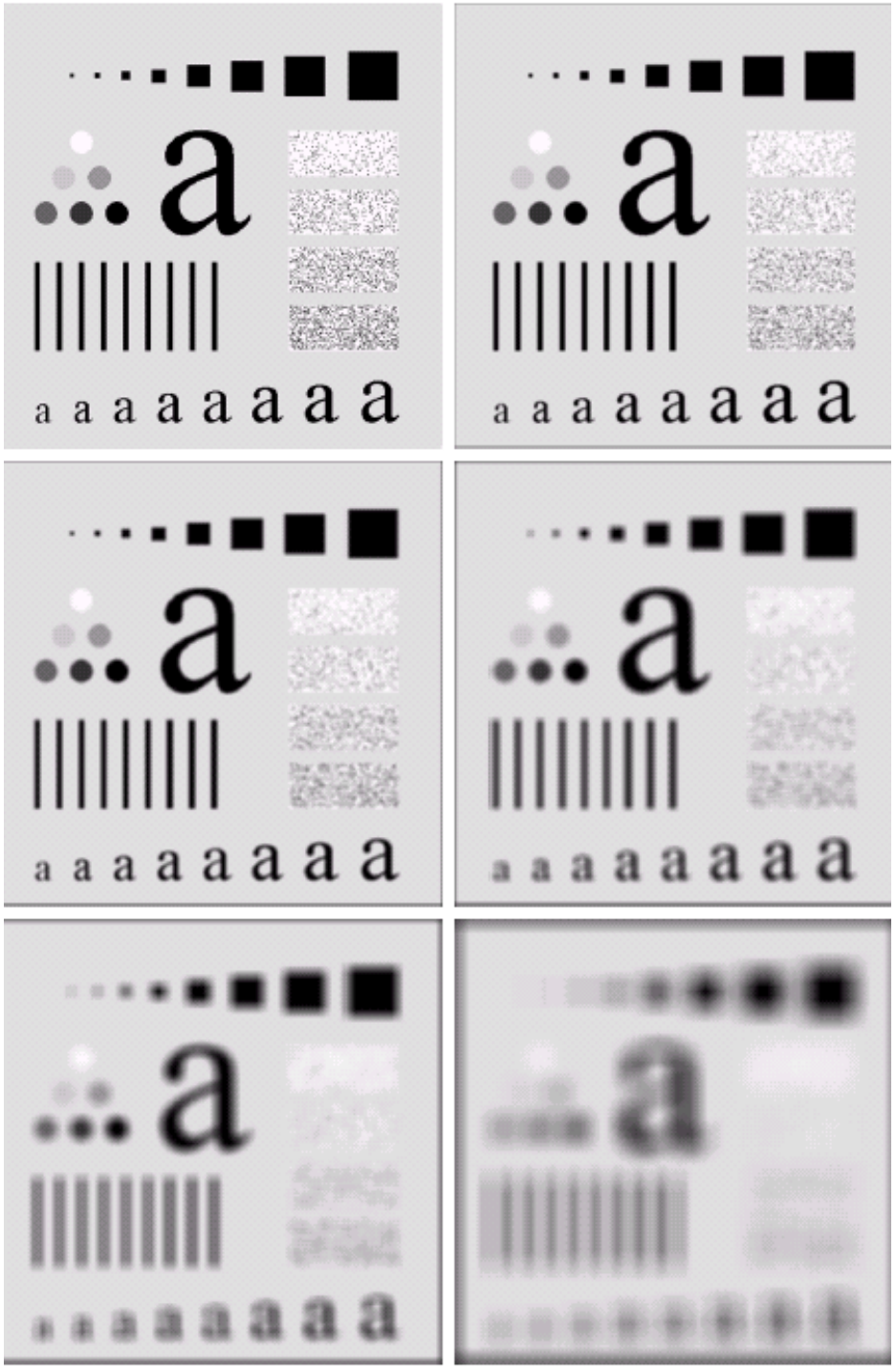
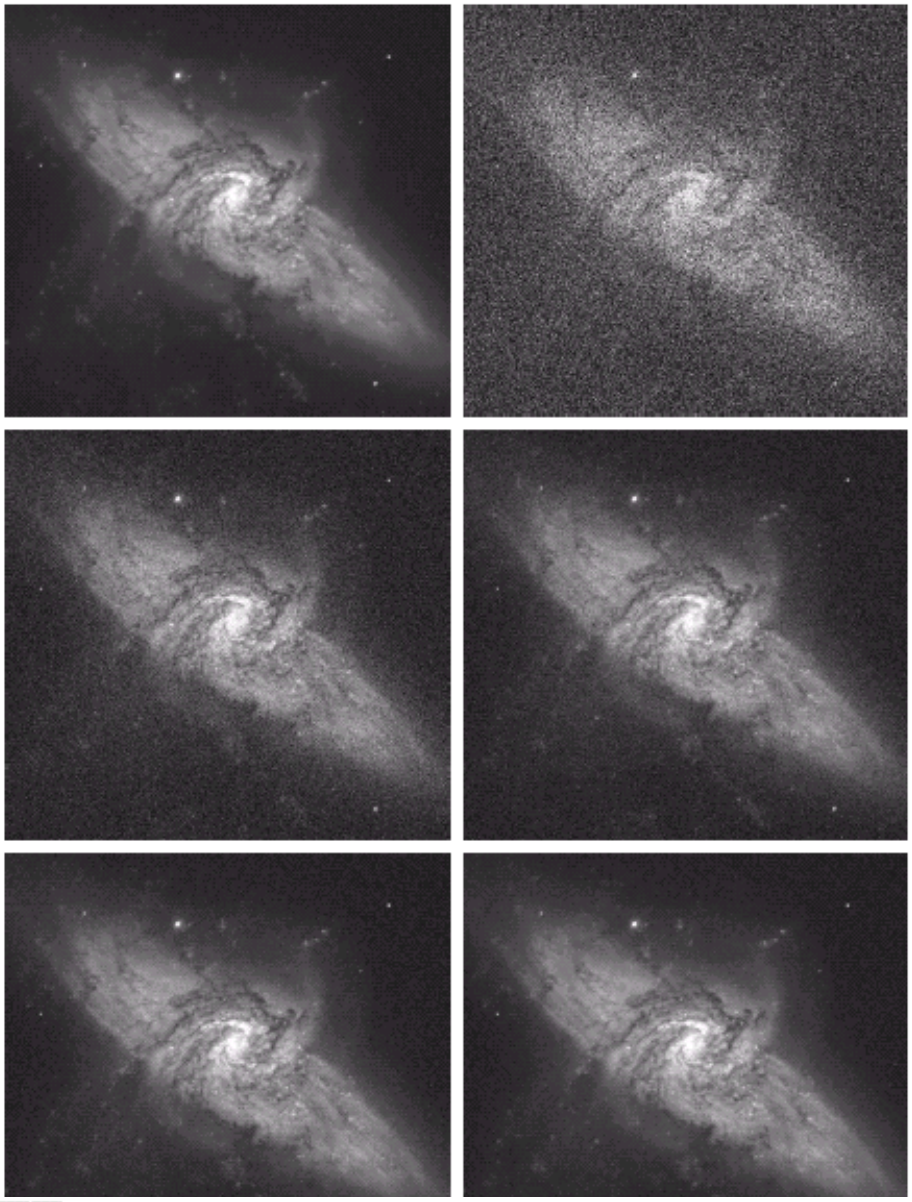


FIGURE 3.35 (a) Original image, of size 500 × 500 pixels. (b)–(f) Results of smoothing with square averaging filter masks of sizes $n = 3, 5, 9, 15$, and 35, respectively. The black squares at the top are of sizes 3, 5, 9, 15, 25, 35, 45, and 55 pixels, respectively; their borders are 25 pixels apart. The letters at the bottom range in size from 10 to 24 points, in increments of 2 points; the large letter at the top is 60 points. The vertical bars are 5 pixels wide and 100 pixels high; their separation is 20 pixels. The diameter of the circles is 25 pixels, and their borders are 15 pixels apart; their gray levels range from 0% to 100% black in increments of 20%. The background of the image is 10% black. The noisy rectangles are of size 50 × 120 pixels.

Otro tipo de filtro espacial es la promediación de imágenes secuenciales è permite eliminar “ruido”

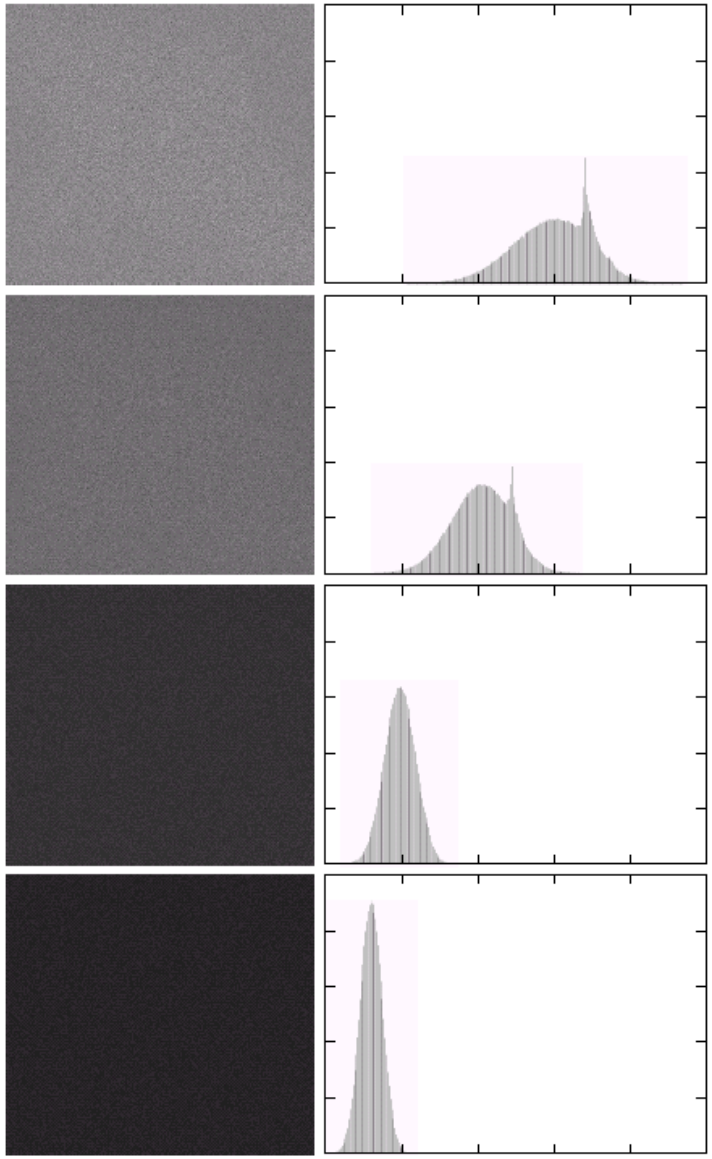
Tratamiento de Imágenes:

Dominio espacial: "promediación"



a b
c d
e f

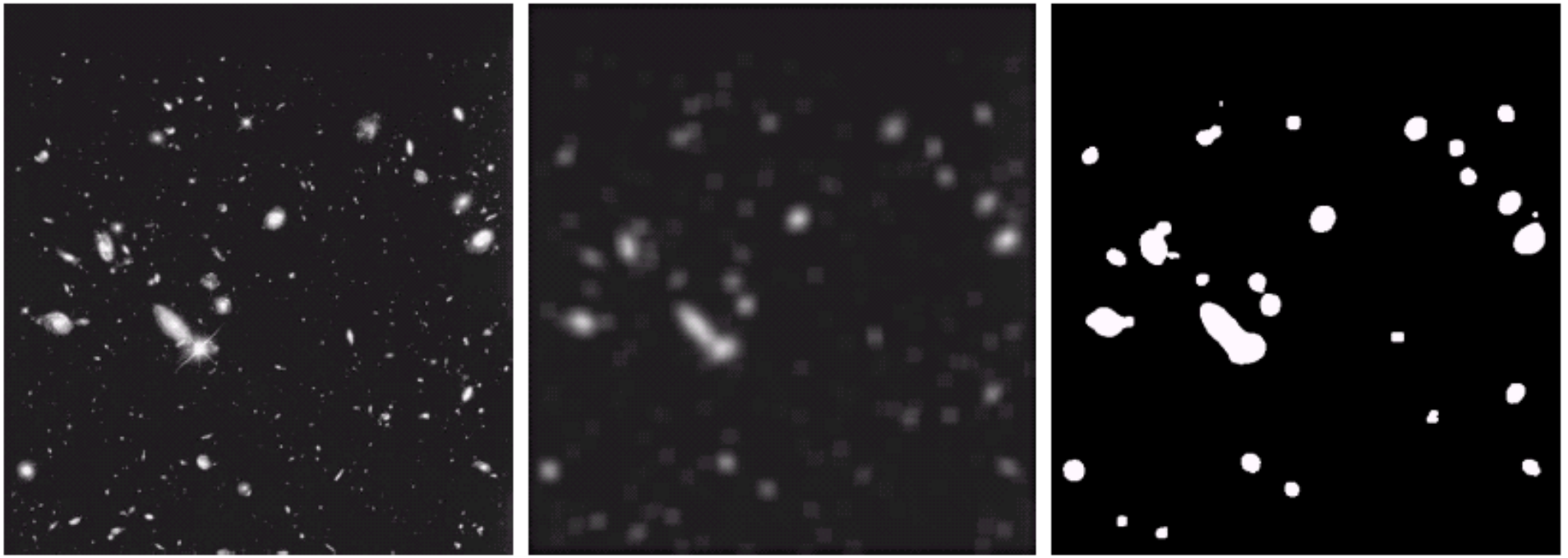
FIGURE 3.30 (a) Image of Galaxy Pair NGC 3314. (b) Image corrupted by additive Gaussian noise with zero mean and a standard deviation of 64 gray levels. (c)–(f) Results of averaging $K = 8, 16, 64$, and 128 noisy images. (Original image courtesy of NASA.)



a b

FIGURE 3.31
(a) From top to bottom: Difference images between Fig. 3.30(a) and the four images in Figs. 3.30(c) through (f), respectively. (b) Corresponding histograms.

Tratamiento de Imágenes:
Dominio espacial: FILTROS



a b c

FIGURE 3.36 (a) Image from the Hubble Space Telescope. (b) Image processed by a 15 × 15 averaging mask. (c) Result of thresholding (b). (Original image courtesy of NASA.)

Tratamiento de Imágenes:
Dominio espacial: FILTROS

- Promedio de vecindad

$$f(i,j) = \frac{1}{\#V} \sum_{(m,n)\in V} g(m,n)$$

Donde V es la Vecindad de (i,j), incluido.
#V es la cardinalidad de V

$$G = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Filtro pasa bajos

La aplicación del filtro corresponde a un convolución de la imagen y el "núcleo" (kernel) G:

I' = I * G

Tratamiento de Imágenes:

Dominio espacial: FILTROS

- Suavizado basado en promedio de vecindad

$$\begin{bmatrix} 220 & 221 & 220 & 222 \\ 219 & 220 & 220 & 221 \\ 220 & 221 & 59 & 220 \\ 219 & 219 & 220 & 221 \end{bmatrix} \rightarrow \begin{bmatrix} 220 & 221 & 220 & 222 \\ 219 & 220 & 220 & 221 \\ 220 & 221 & 202 & 220 \\ 219 & 219 & 220 & 221 \end{bmatrix}$$

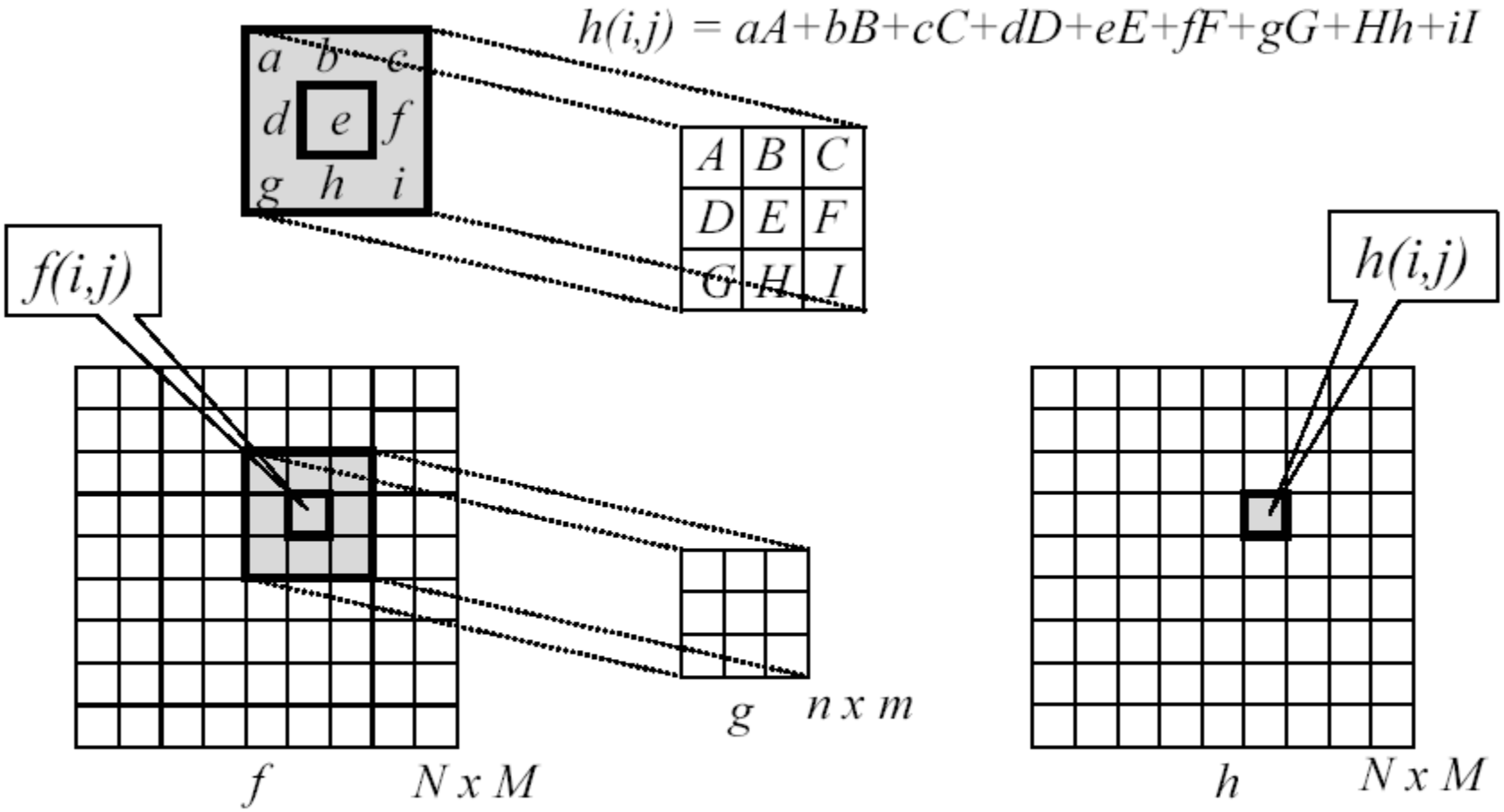
Tratamiento de Imágenes:
Dominio espacial: FILTROS

- Expresión general de filtros 2D:

$$I'(i,j) = \sum_{c=1}^{nc} \sum_{f=1}^{nf} G(c,f) I(i-c, j-f)$$

Donde I es una imagen de nf filas y nc columnas.
G es el kernel (filtro)
I' es la imagen filtrada

Tratamiento de Imágenes:
Dominio espacial: FILTROS=CONVOLUCION



$$(f * g)(i,j) = \sum_{k=-n/2}^{n/2} \sum_{l=-m/2}^{m/2} f(i+k, j+l)\, g(k,l)$$

Tratamiento de Imágenes:
Dominio espacial: FILTROS

H =

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Media Simple

Filtrado de Mediana:

Método no lineal, que reemplaza el valor de un píxel por el valor de la mediana de su vecindad.

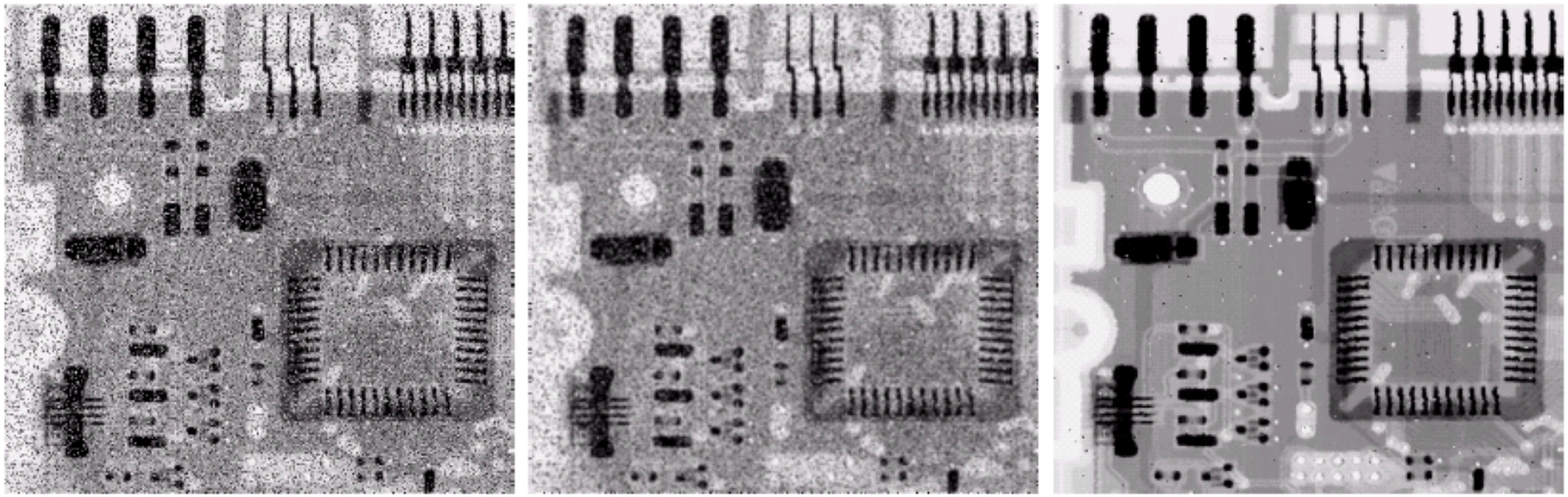
Mediana: valor central se la secuencia ordenada

200	203	255
180	190	208
150	0	195

Mediana: 195!

{0,150,180,190,195,200,203, 208, 255}

Tratamiento de Imágenes:
Dominio espacial: FILTROS



a b c

FIGURE 3.37 (a) X-ray image of circuit board corrupted by salt-and-pepper noise. (b) Noise reduction with a 3×3 averaging mask. (c) Noise reduction with a 3×3 median filter. (Original image courtesy of Mr. Joseph E. Pascente, Lixi, Inc.)

Ej1. Filtro Espacial

```
%K 3x3

%ojo sin bordes...
for f=1+1:nf-1
   for c=1+1:nc-1
       sum=0;
       for ff=-1:1
         for cc=-1:1
            sum=sum+A(f+ff,c+cc)*K(ff+2,cc+2);
         end;
       end;
       B(f,c)=sum/9;
   end;
end;
```