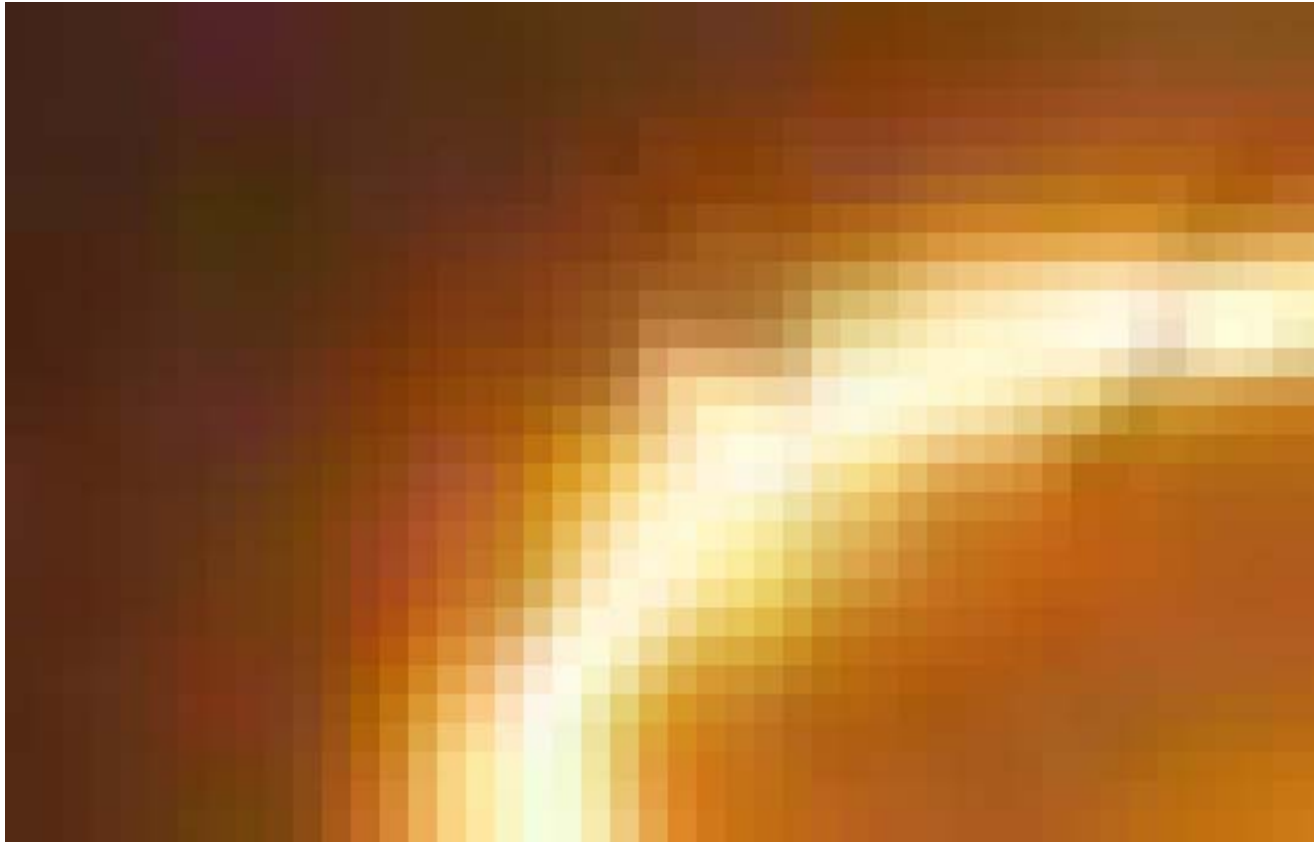


¿Qué es...?



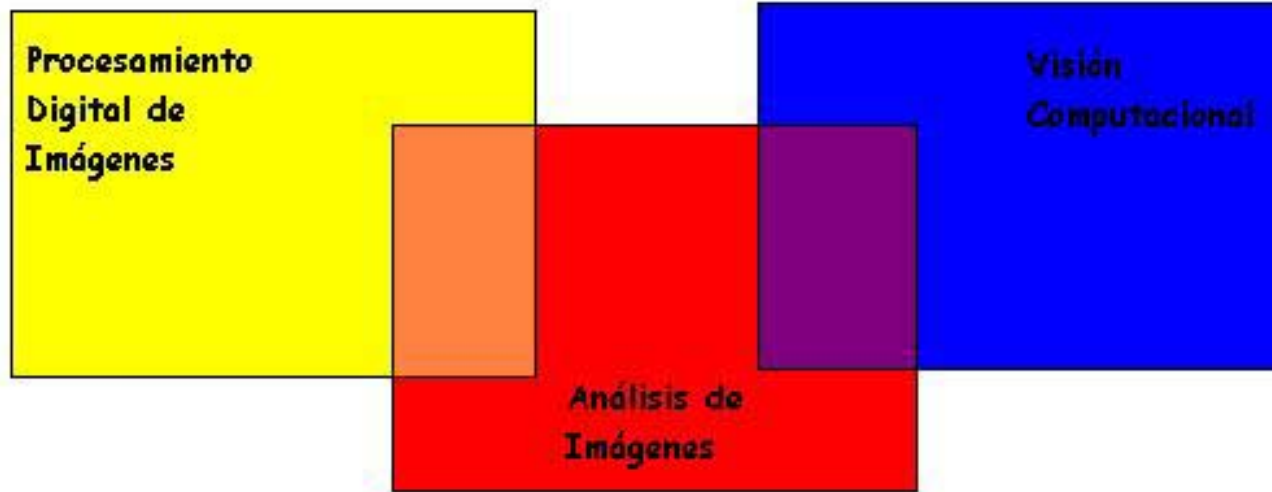


¿Qué es...?



INTRODUCCIÓN

¿Qué es...?



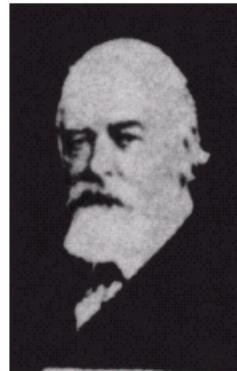


Antecedentes



FIGURE 1.1 A digital picture produced in 1921 from a coded tape by a telegraph printer with special type faces. (McFarlane.)

FIGURE 1.2 A digital picture made in 1922 from a tape punched after the signals had crossed the Atlantic twice. Some errors are visible. (McFarlane.)



Antecedentes

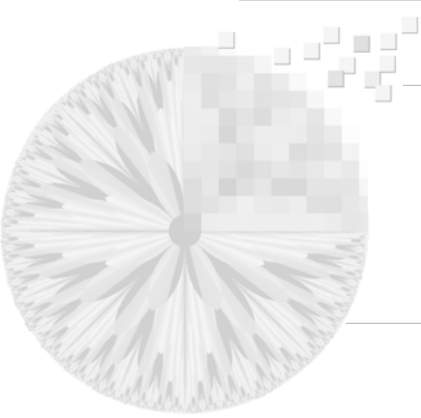


FIGURE 1.3

Unretouched cable picture of Generals Pershing and Foch, transmitted in 1929 from London to New York by 15-tone equipment. (McFarlane.)





Los comienzos

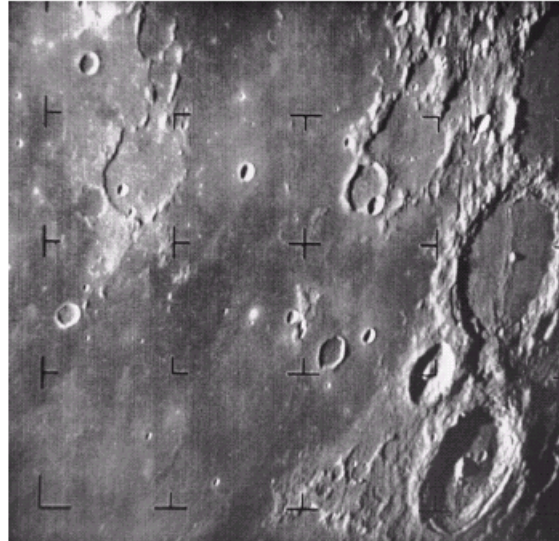
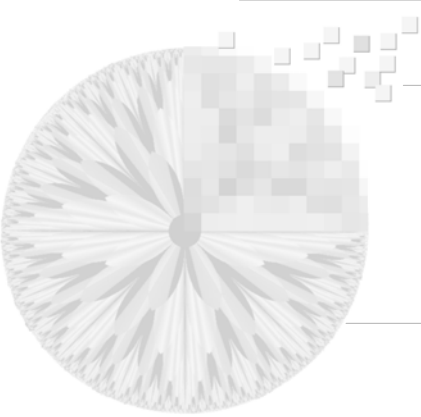
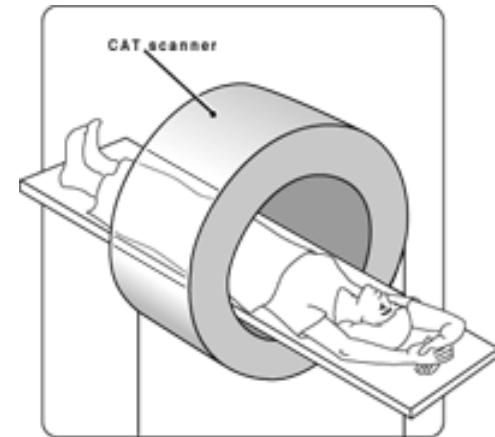


FIGURE 1.4 The first picture of the moon by a U.S. spacecraft. *Ranger 7* took this image on July 31, 1964 at 9:09 A.M. EDT, about 17 minutes before impacting the lunar surface. (Courtesy of NASA.)



Un caso interesante (CAT)



INTRODUCCIÓN



Un criterio de clasificación

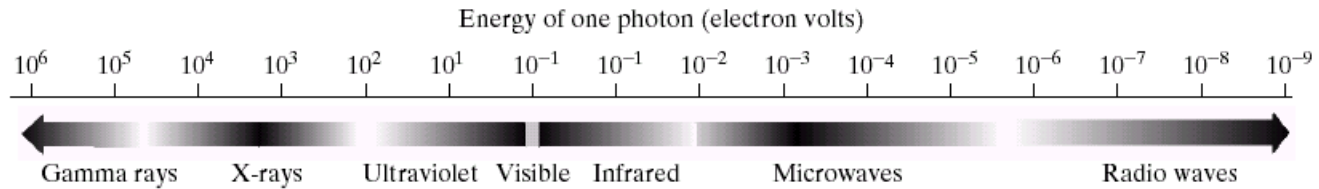


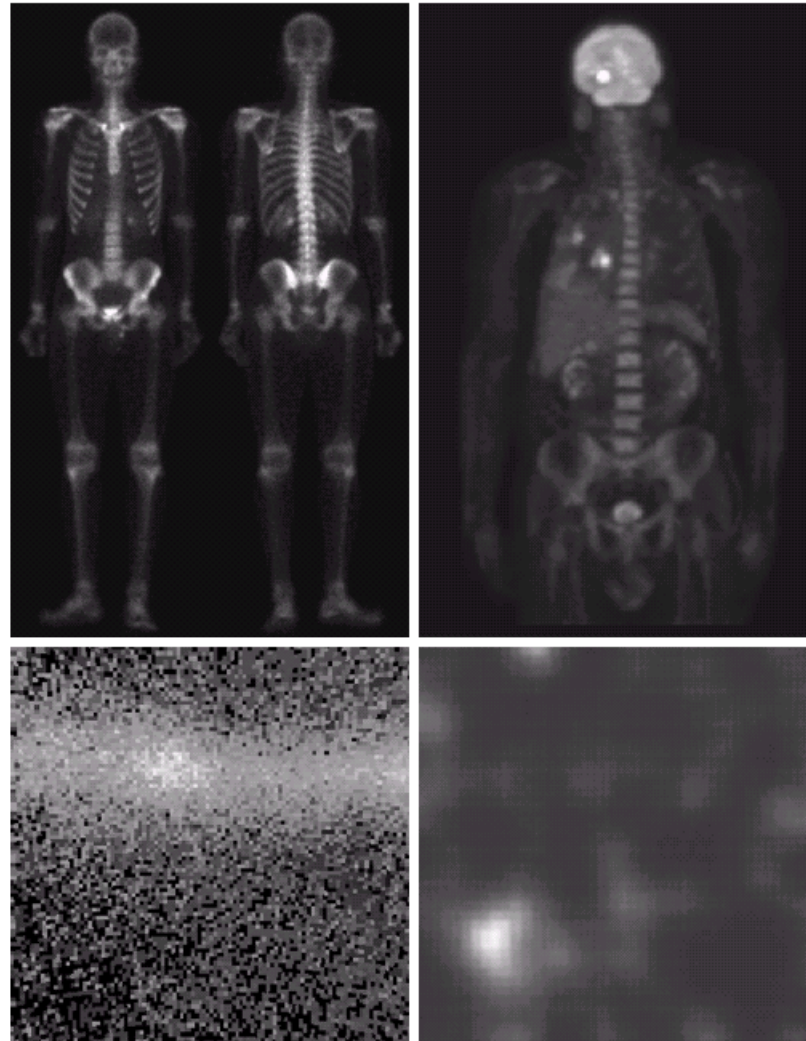
FIGURE 1.5 The electromagnetic spectrum arranged according to energy per photon.

Rayos Gamma



a b
c d

FIGURE 1.6
Examples of gamma-ray imaging. (a) Bone scan. (b) PET image. (c) Cygnus Loop. (d) Gamma radiation (bright spot) from a reactor valve. (Images courtesy of (a) G.E. Medical Systems, (b) Dr. Michael E. Casey, CTI PET Systems, (c) NASA, (d) Professors Zhong He and David K. Wehe, University of Michigan.)



Rayos X

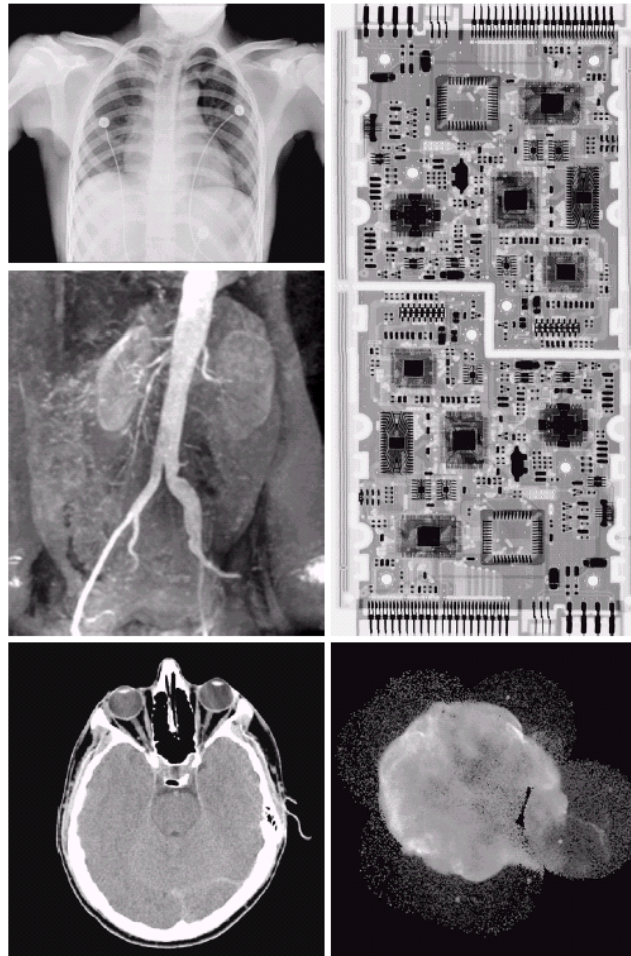
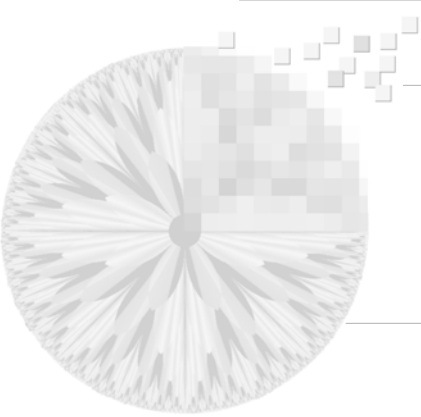
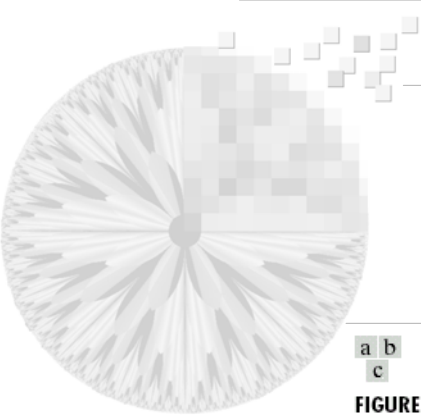


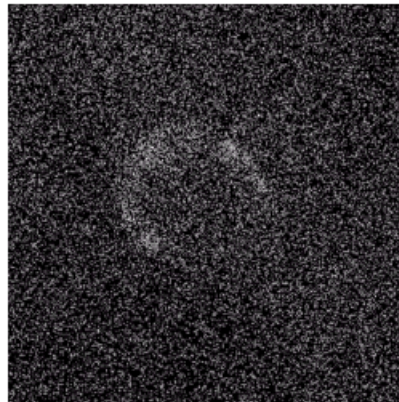
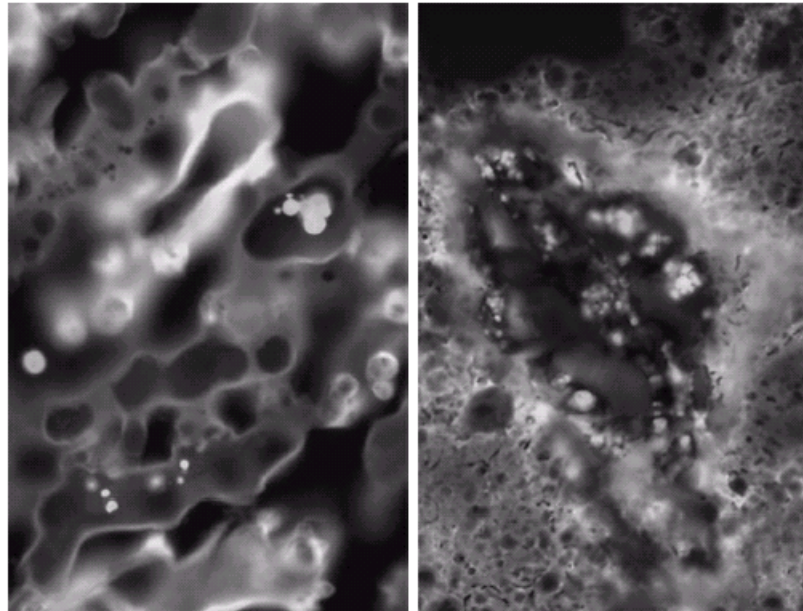
FIGURE 1.7 Examples of X-ray imaging. (a) Chest X-ray. (b) Aortic angiogram. (c) Head CT. (d) Circuit boards. (e) Cygnus Loop. (Images courtesy of (a) and (c) Dr. David R. Pickens, Dept. of Radiology & Radiological Sciences, Vanderbilt University Medical Center, (b) Dr. Thomas R. Gest, Division of Anatomical Sciences, University of Michigan Medical School, (d) Mr. Joseph E. Pascente, Lixi, Inc., and (e) NASA.)



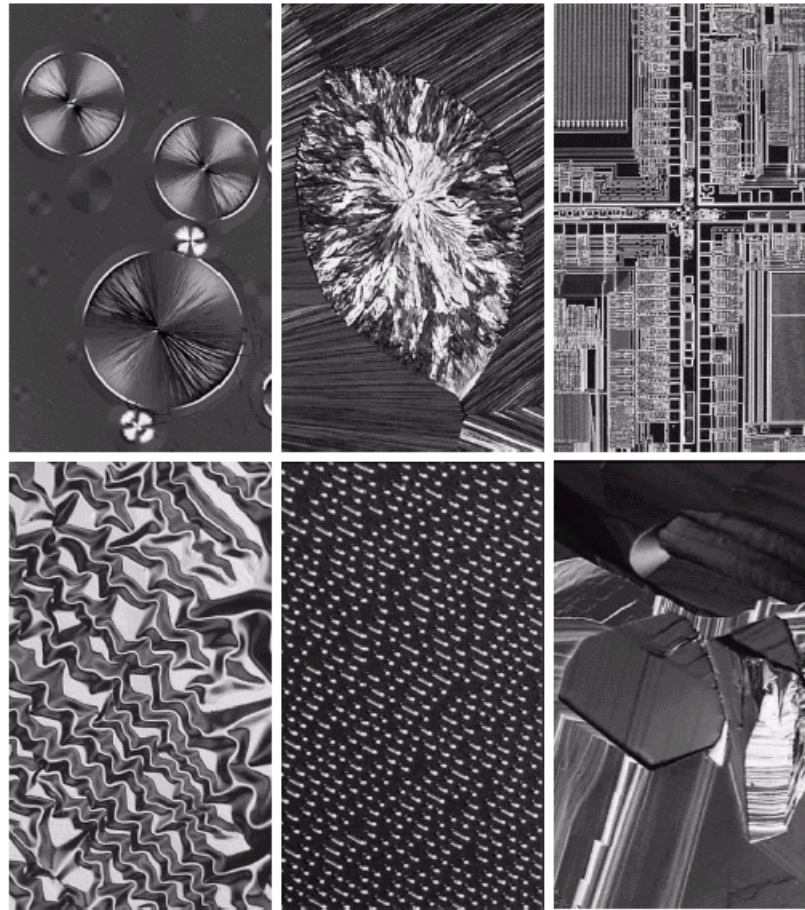
Rayos Ultravioleta

a b
c

FIGURE 1.8
Examples of
ultraviolet
imaging.
(a) Normal corn.
(b) Smut corn.
(c) Cygnus Loop.
(Images courtesy
of (a) and
(b) Dr. Michael
W. Davidson,
Florida State
University,
(c) NASA.)

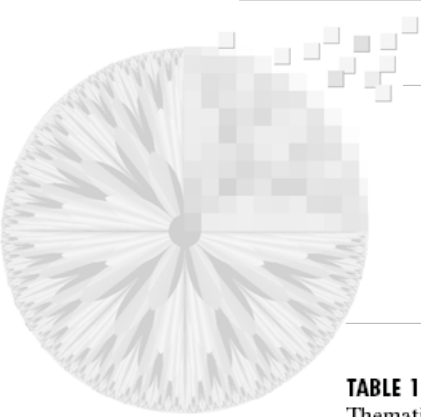


Microscopía



a b c
d e f

FIGURE 1.9 Examples of light microscopy images. (a) Taxol (anticancer agent), magnified 250 \times . (b) Cholesterol—40 \times . (c) Microprocessor—60 \times . (d) Nickel oxide thin film—600 \times . (e) Surface of audio CD—1750 \times . (f) Organic superconductor—450 \times . (Images courtesy of Dr. Michael W. Davidson, Florida State University.)



Bandas de LANDSAT

TABLE 1.1
Thematic bands
in NASA's
LANDSAT
satellite.

Band No.	Name	Wavelength (μm)	Characteristics and Uses
1	Visible blue	0.45–0.52	Maximum water penetration
2	Visible green	0.52–0.60	Good for measuring plant vigor
3	Visible red	0.63–0.69	Vegetation discrimination
4	Near infrared	0.76–0.90	Biomass and shoreline mapping
5	Middle infrared	1.55–1.75	Moisture content of soil and vegetation
6	Thermal infrared	10.4–12.5	Soil moisture; thermal mapping
7	Middle infrared	2.08–2.35	Mineral mapping



Bandas de LANDSAT

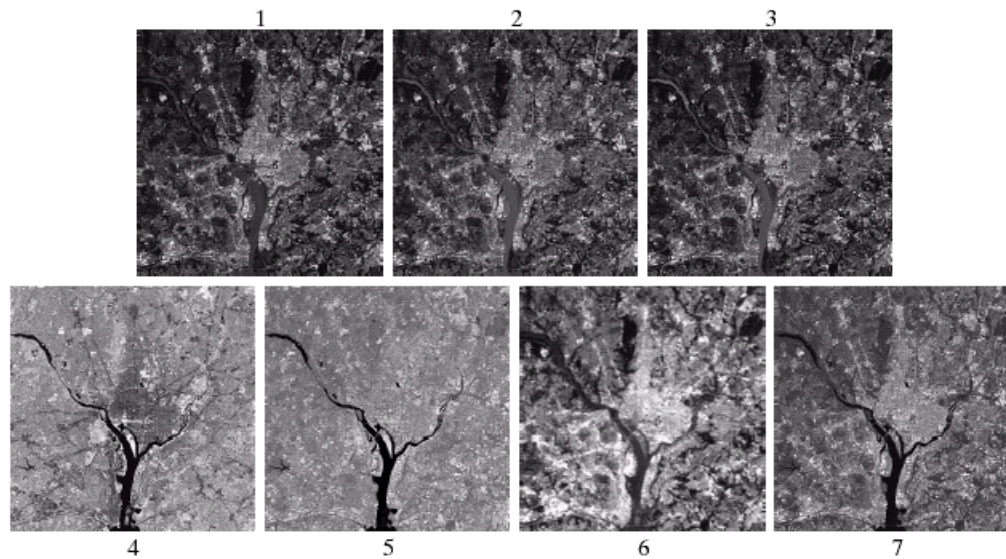


FIGURE 1.10 LANDSAT satellite images of the Washington, D.C. area. The numbers refer to the thematic bands in Table 1.1. (Images courtesy of NASA.)

Imágenes satelitales

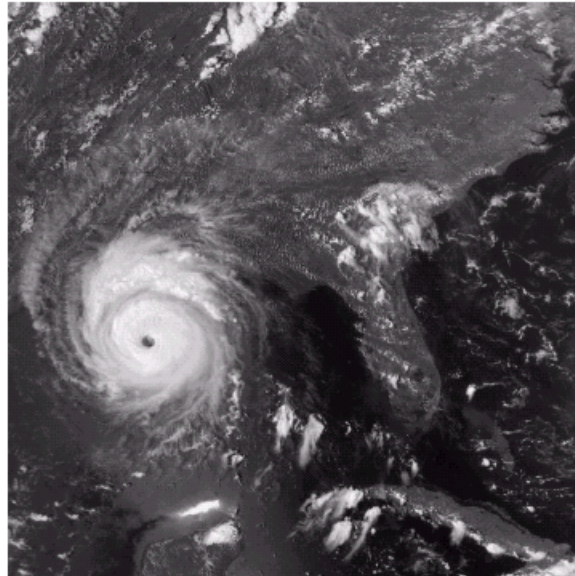
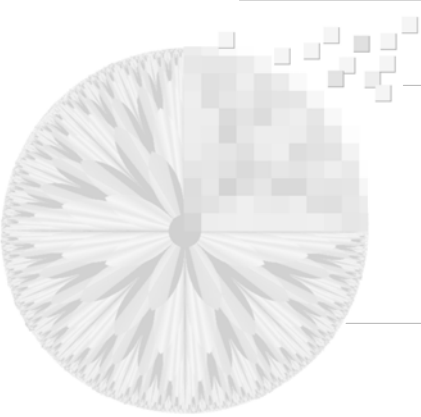
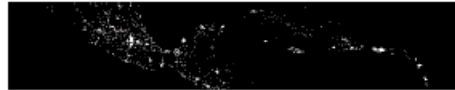
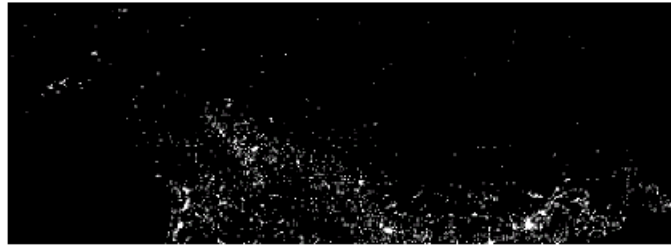


FIGURE 1.11
Multispectral
image of
Hurricane
Andrew taken by
NOAA GEOS
(Geostationary
Environmental
Operational
Satellite) sensors.
(Courtesy of
NOAA.)

Imágenes satelitales

FIGURE 1.12
Infrared satellite
images of the
Americas. The
small gray map
is
provided for
reference.
(Courtesy of
NOAA.)



Imágenes satelitales

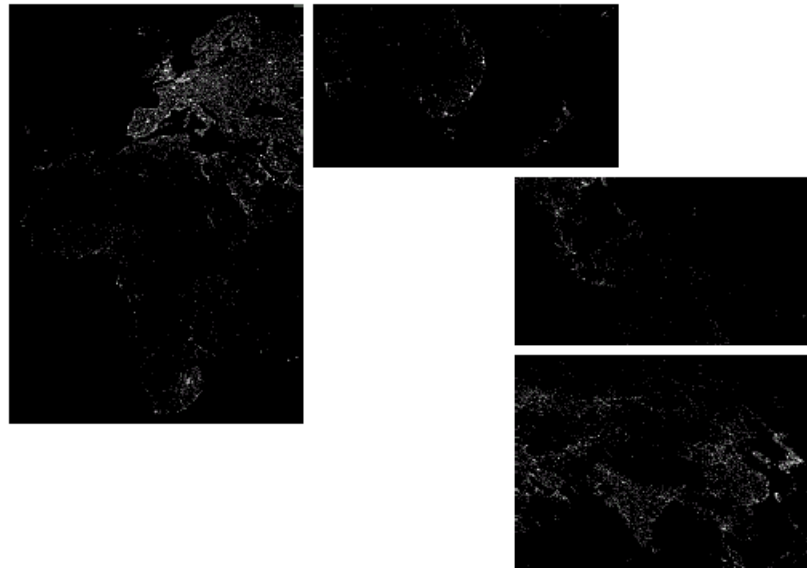


FIGURE 1.13
Infrared satellite
images of the
remaining
populated part of
the world. The
small gray map is
provided for
reference.
(Courtesy of
NOAA.)

Fotografía Aérea



Fotografías aéreas
del parque
Tangamanga I y la
Garita (1999 – San
Luis Potosí, INEGI)

Fotografía Aérea



Fotografía aérea de las colonias Lomas III y IV. Se puede apreciar el hotel Quinta Real en el sureste y el club Lomas Racquet en el noreste (1999 – San Luis Potosí, INEGI)

Fotografía Aérea



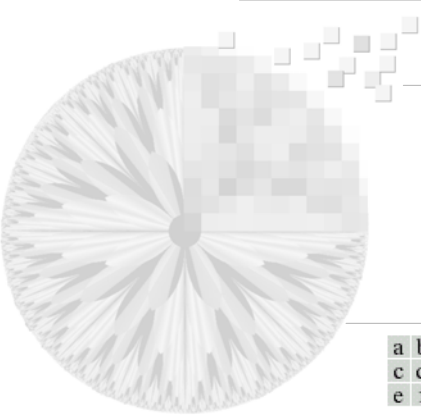
Fotografías aéreas de San Luis Potosí, al noroeste se aprecia el distribuidor Juárez (1999 – San Luis Potosí, INEGI)

Fotografía Aérea



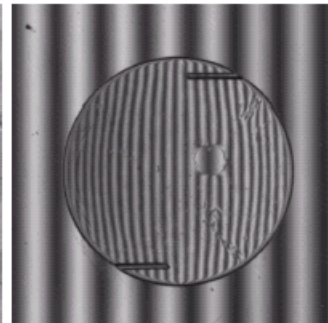
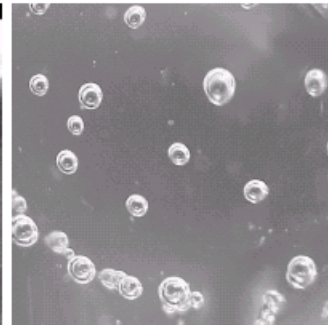
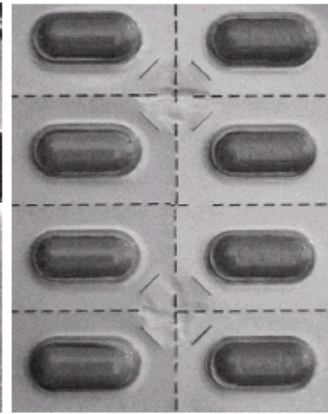
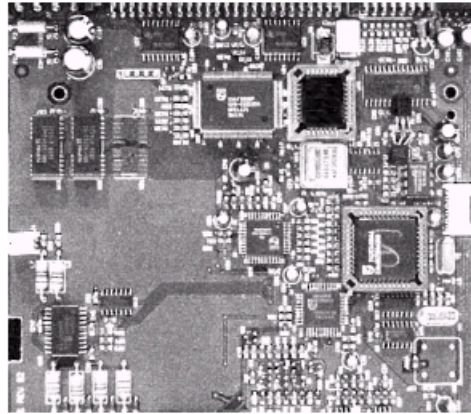
Fotografía aérea de la Zona Universitaria (SE), el parque de Morales (N) y Los Filtros (NO) (1999 – San Luis Potosí, INEGI)

Control de calidad



a b
c d
e f

FIGURE 1.14
Some examples of manufactured goods often checked using digital image processing. (a) A circuit board controller. (b) Packaged pills. (c) Bottles. (d) Bubbles in clear-plastic product. (e) Cereal. (f) Image of intraocular implant. (Fig. (f) courtesy of Mr. Pete Sites, Perceptics Corporation.)



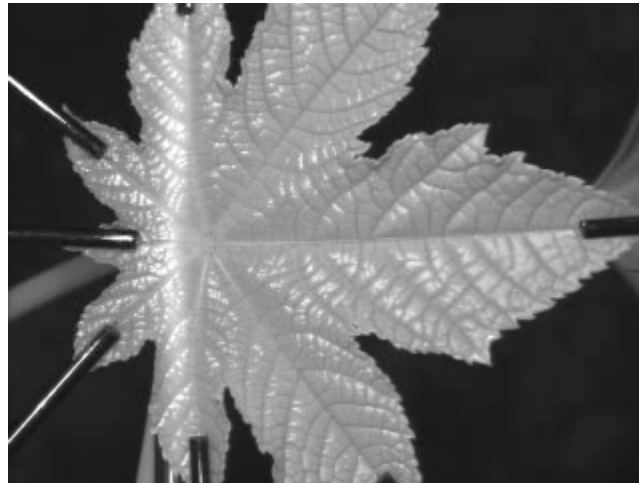
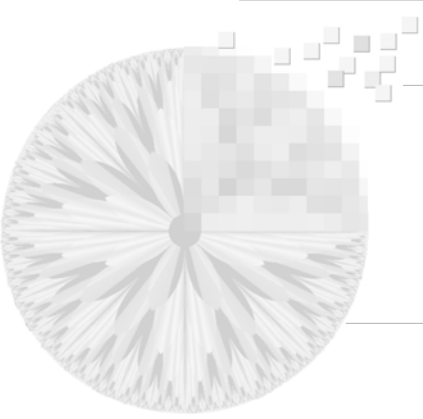
Otras aplicaciones



a b
c
d

FIGURE 1.15 Some additional examples of imaging in the visual spectrum. (a) Thumb print. (b) Paper currency. (c) and (d). Automated license plate reading. (Figure (a) courtesy of the National Institute of Standards and Technology. Figures (c) and (d) courtesy of Dr. Juan Herrera, Perceptics Corporation.)

Botánica



RADAR

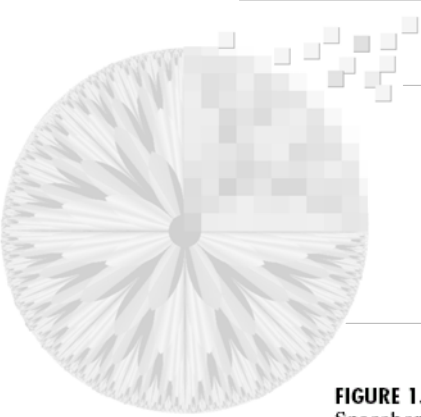
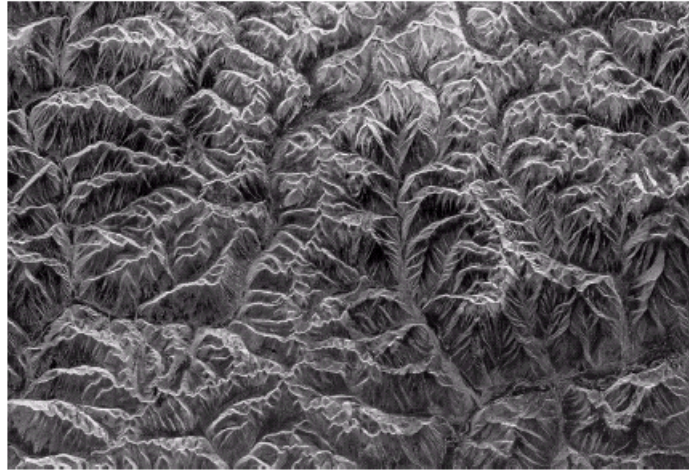
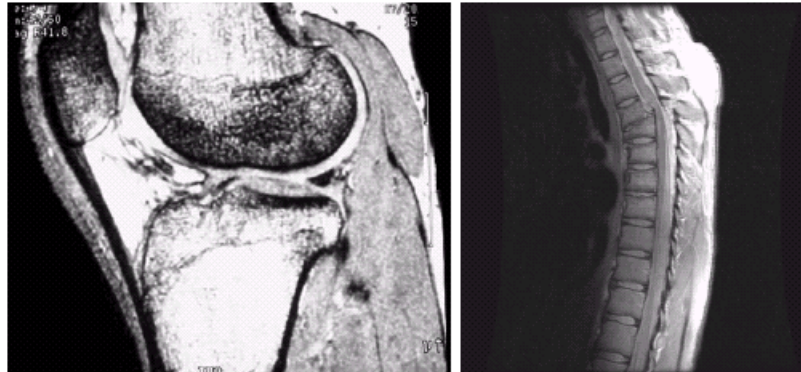


FIGURE 1.16
Spaceborne radar
image of
mountains in
southeast Tibet.
(Courtesy of
NASA.)

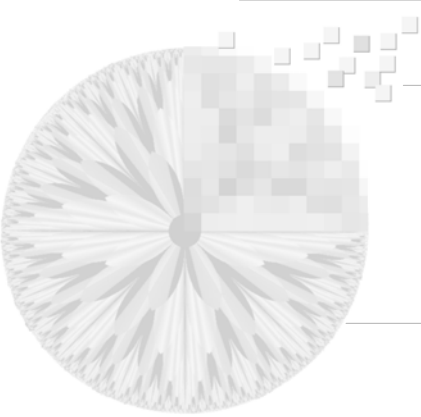


Resonancia Magnética



a b

FIGURE 1.17 MRI images of a human (a) knee, and (b) spine. (Image (a) courtesy of Dr. Thomas R. Gest, Division of Anatomical Sciences, University of Michigan Medical School, and (b) Dr. David R. Pickens, Department of Radiology and Radiological Sciences, Vanderbilt University Medical Center.)



Otras

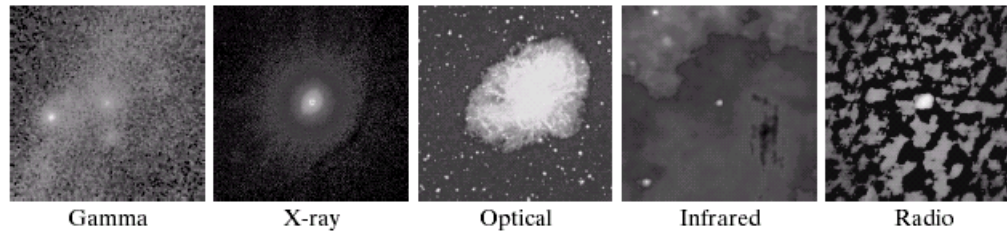
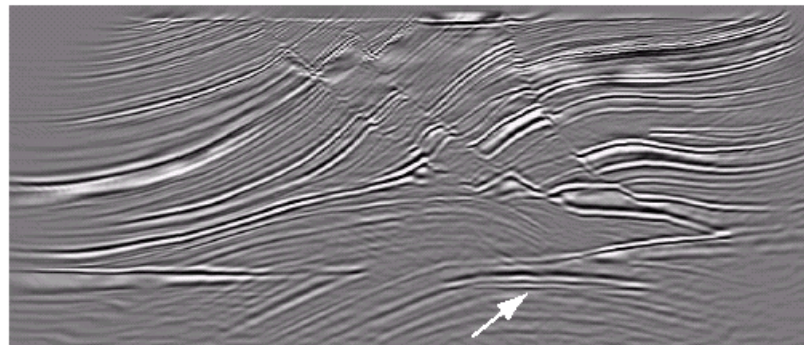


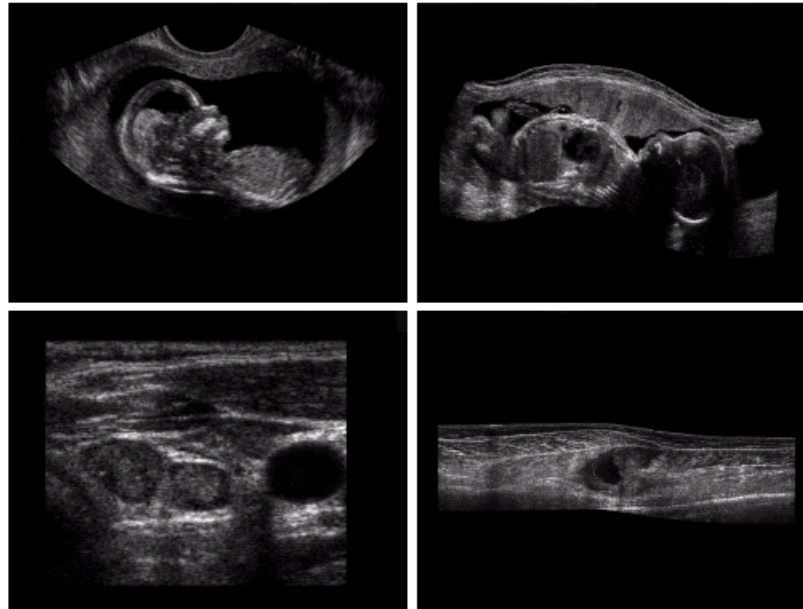
FIGURE 1.18 Images of the Crab Pulsar (in the center of images) covering the electromagnetic spectrum. (Courtesy of NASA.)

FIGURE 1.19 Cross-sectional image of a seismic model. The arrow points to a hydrocarbon (oil and/or gas) trap. (Courtesy of Dr. Curtis Ober, Sandia National Laboratories.)





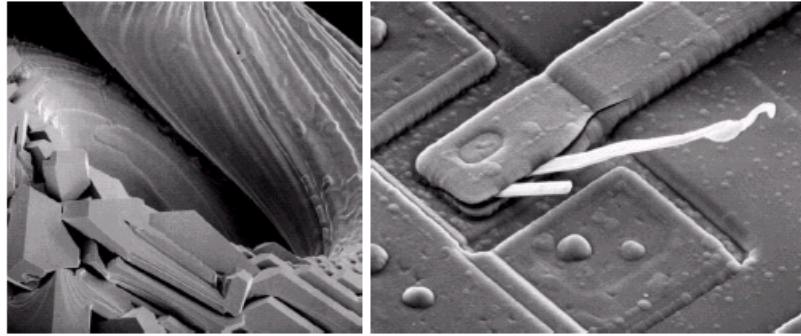
Otras: ultrasonido



a b
c d

FIGURE 1.20
Examples of ultrasound imaging. (a) Baby. (2) Another view of baby. (c) Thyroids. (d) Muscle layers showing lesion. (Courtesy of Siemens Medical Systems, Inc., Ultrasound Group.)

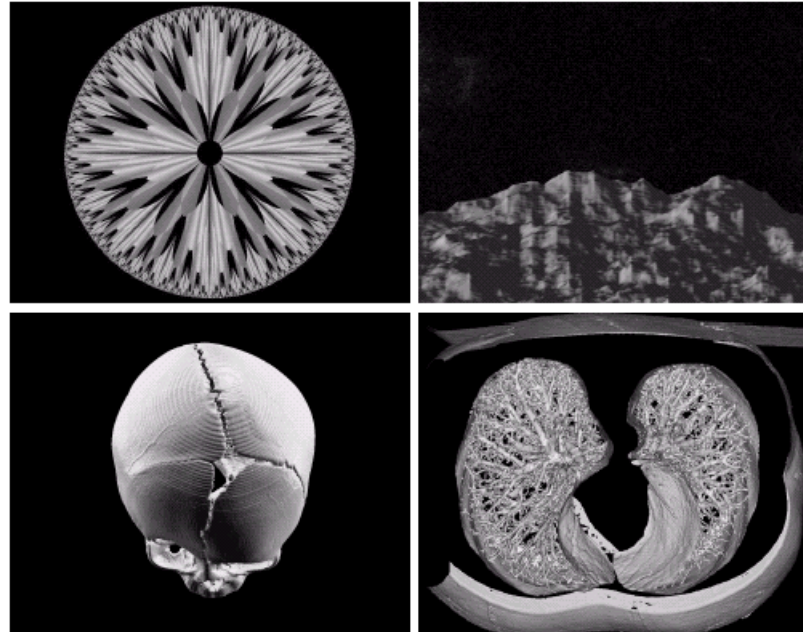
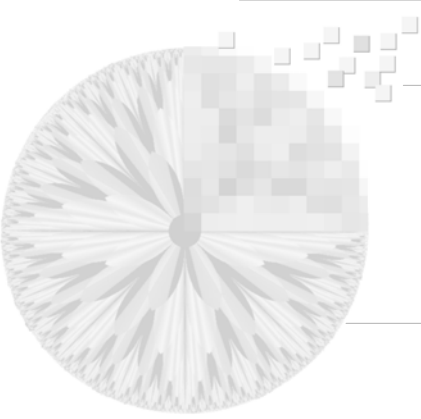
Microscopía electrónica



a b

FIGURE 1.21 (a) 250 \times SEM image of a tungsten filament following thermal failure. (b) 2500 \times SEM image of damaged integrated circuit. The white fibers are oxides resulting from thermal destruction. (Figure (a) courtesy of Mr. Michael Shaffer, Department of Geological Sciences, University of Oregon, Eugene; (b) courtesy of Dr. J. M. Hudak, McMaster University, Hamilton, Ontario, Canada.)

Imágenes generadas

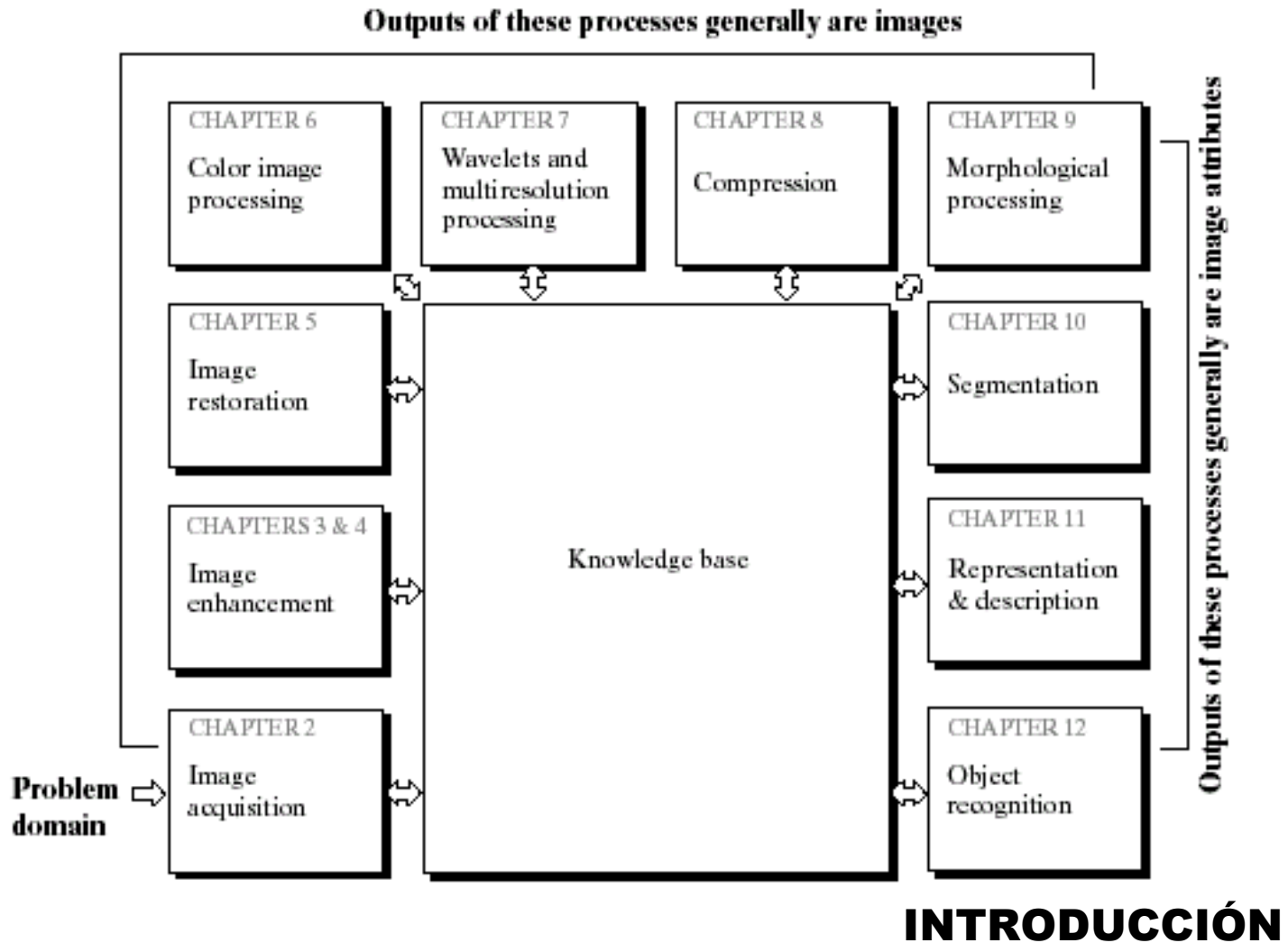


a b
c d

FIGURE 1.22
(a) and (b) Fractal images. (c) and (d) Images generated from 3-D computer models of the objects shown. (Figures (a) and (b) courtesy of Ms. Melissa D. Binde, Swarthmore College, (c) and (d) courtesy of NASA.)

Pasos del PDI

FIGURE 1.23
Fundamental
steps in digital
image processing.



Componentes de un sistema PDI

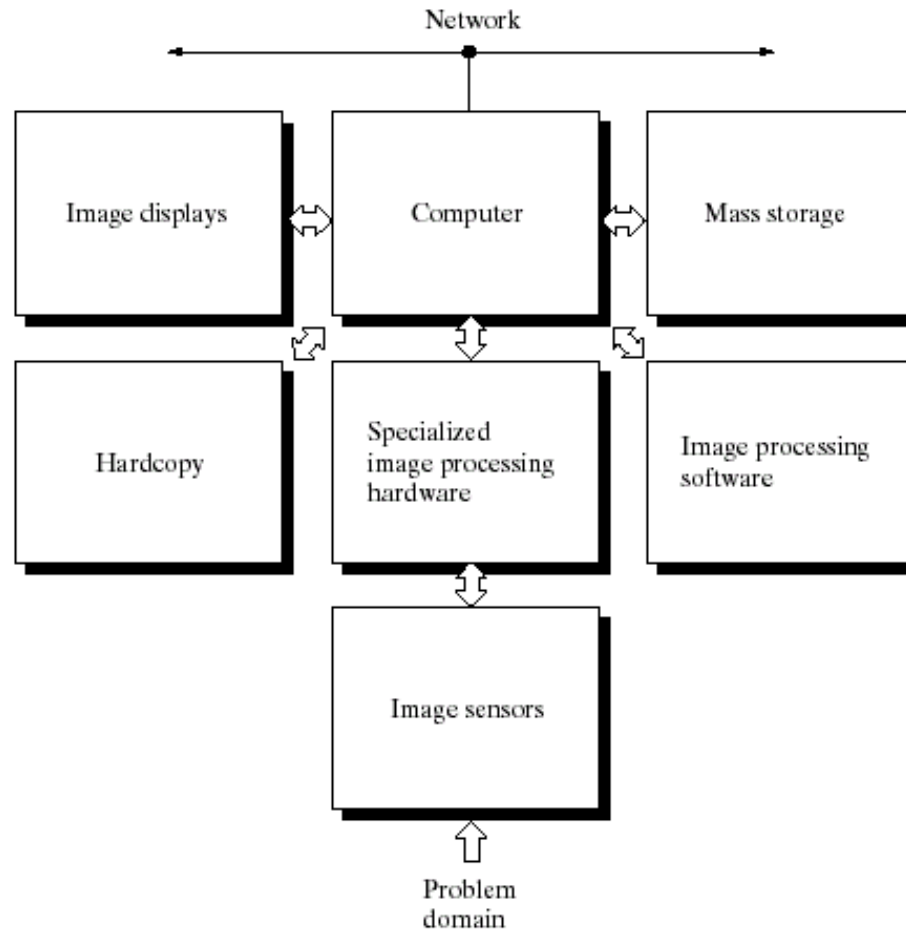


FIGURE 1.24
Components of a
general-purpose
image processing
system.