INSTITUTE OF ENGINEERING, JIWAJI UNIVERSITY

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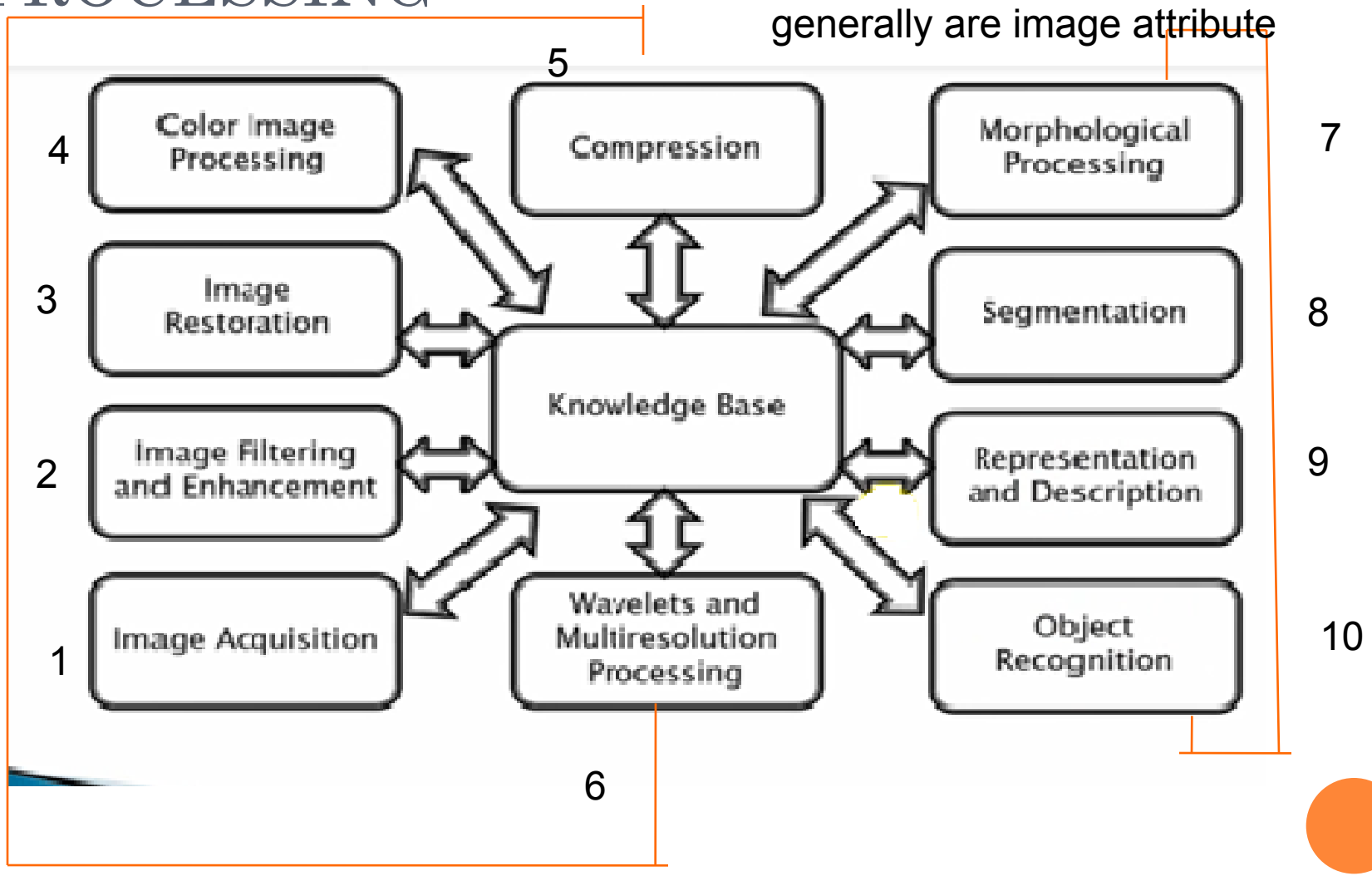
Subject:-Digital image Processing (CS-8302)

Topic:- Image Acquisition system

Semester:- B.E. Eight Semester

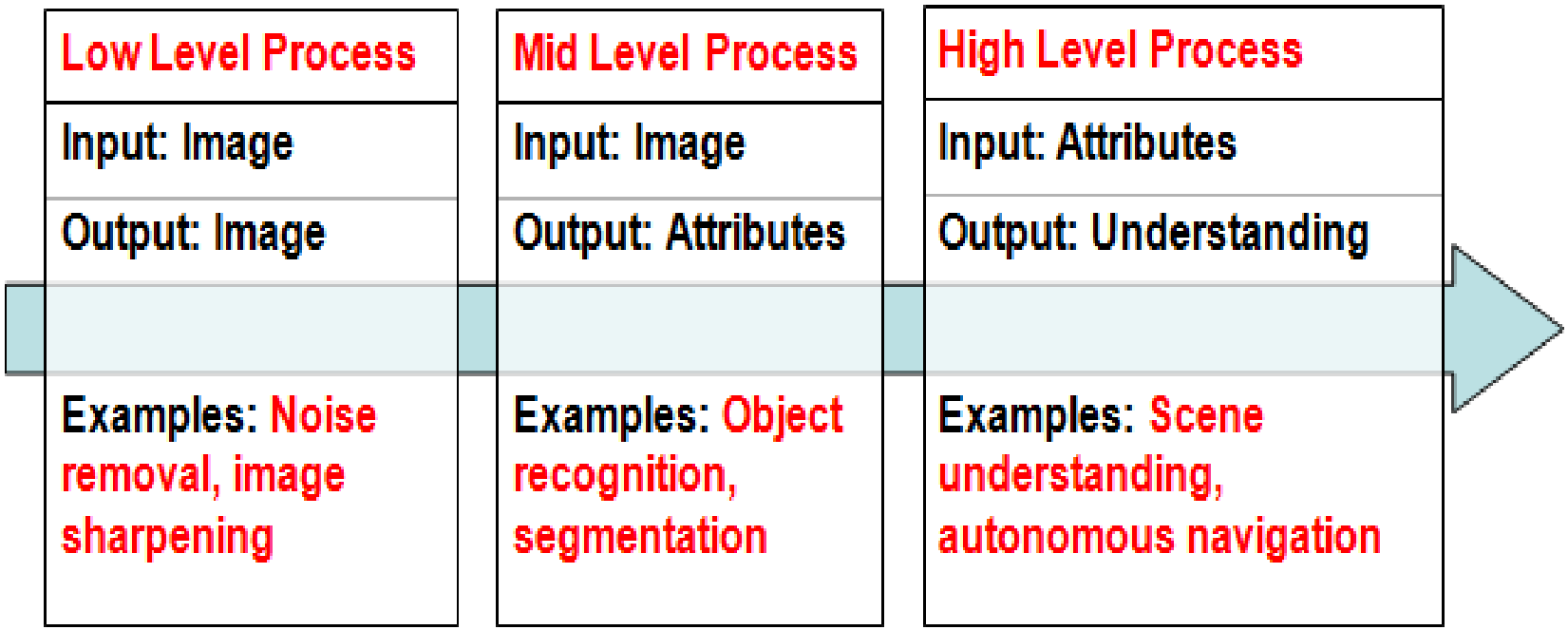
FUNDAMETAL STEPS IN DIGITAL PROCESSING

Output of these processes generally are image attribute



Outputs of these processes generally are images

The continuum from image processing to computer vision can be broken up into low-, mid- and high-level processes



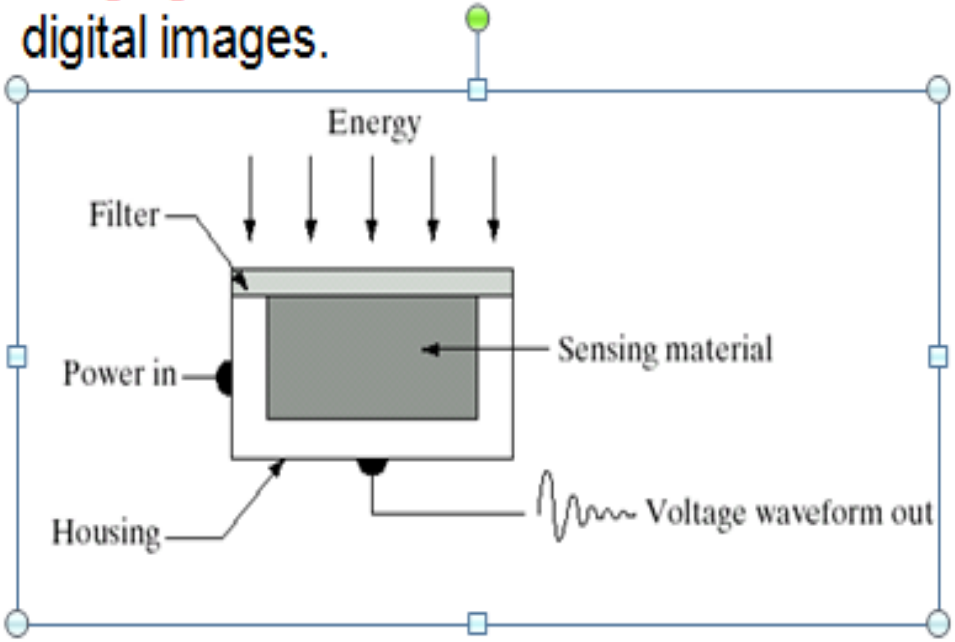
- **Image acquisition:**
- The first process.
- Generally, the image acquisition stage involves preprocessing, such as scaling.

To deal with images and before analyzing them the most important thing is to capture the image. This is called as Image Acquisition. Image Acquisition is achieved by suitable camera. We use different cameras for different application. If we need an X-Ray image, we use a camera (film) which is sensitive to XRays. If we want Infra Red image, we use cameras which are sensitive to Infra Red radiations. For normal images (family pictures etc.) we use cameras which are sensitive to visual spectrum. Image Acquisition process totally depends on the hardware system which may have a sensor that is again a hardware device. A sensor converts light into electrical charges. The sensor inside a camera measures the reflected energy by the scene being imaged. The image sensor employed by most digital cameras is a charge coupled device (CCD) . Some cameras use complementary metal oxide semiconductor (CMOS) technology instead .

Acquisition of Images

The images are generated by the combination of an *illumination source* and the reflection or absorption of energy from that source by the elements of the *scene* being imaged.

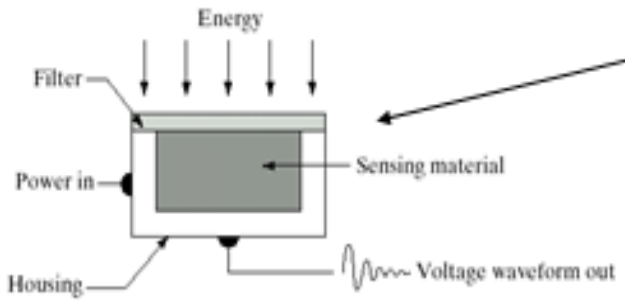
Imaging sensors are used to transform the *illumination energy* into digital images.



Types of Image Sensors

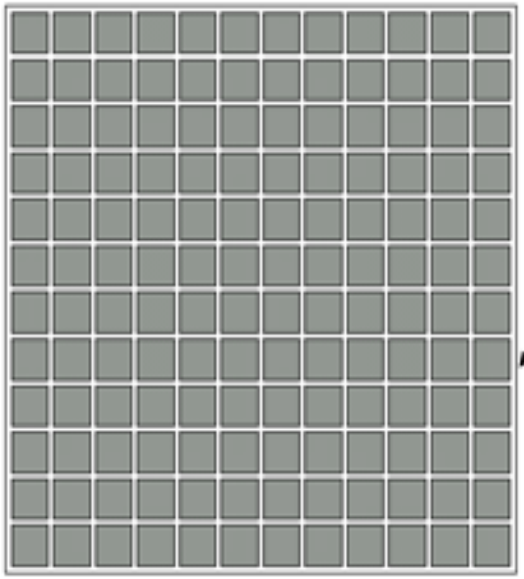
a
b
c

FIGURE
(a) Single imaging sensor.
(b) Line sensor.
(c) Array sensor.

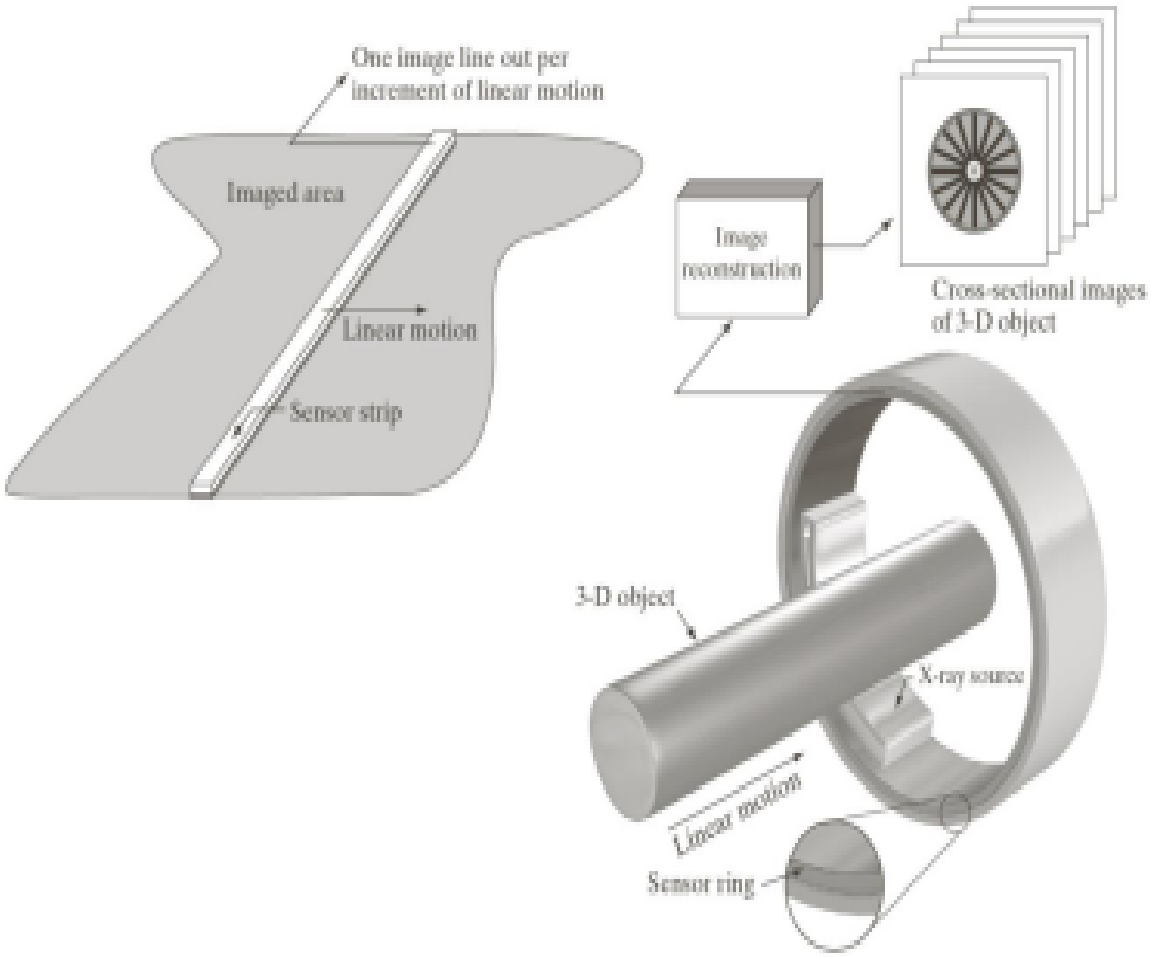


Single Sensor

Line Sensor

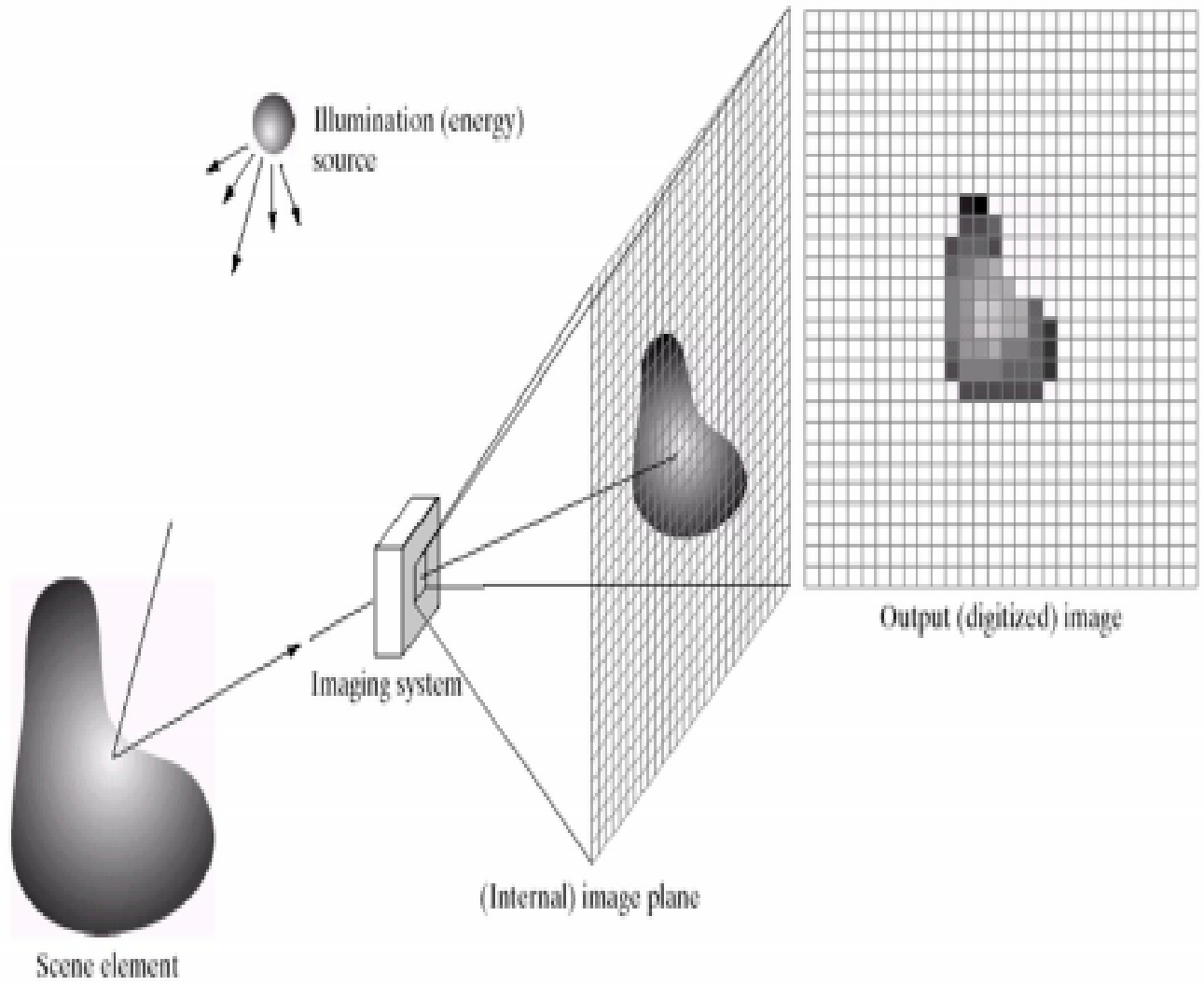


Array Sensor



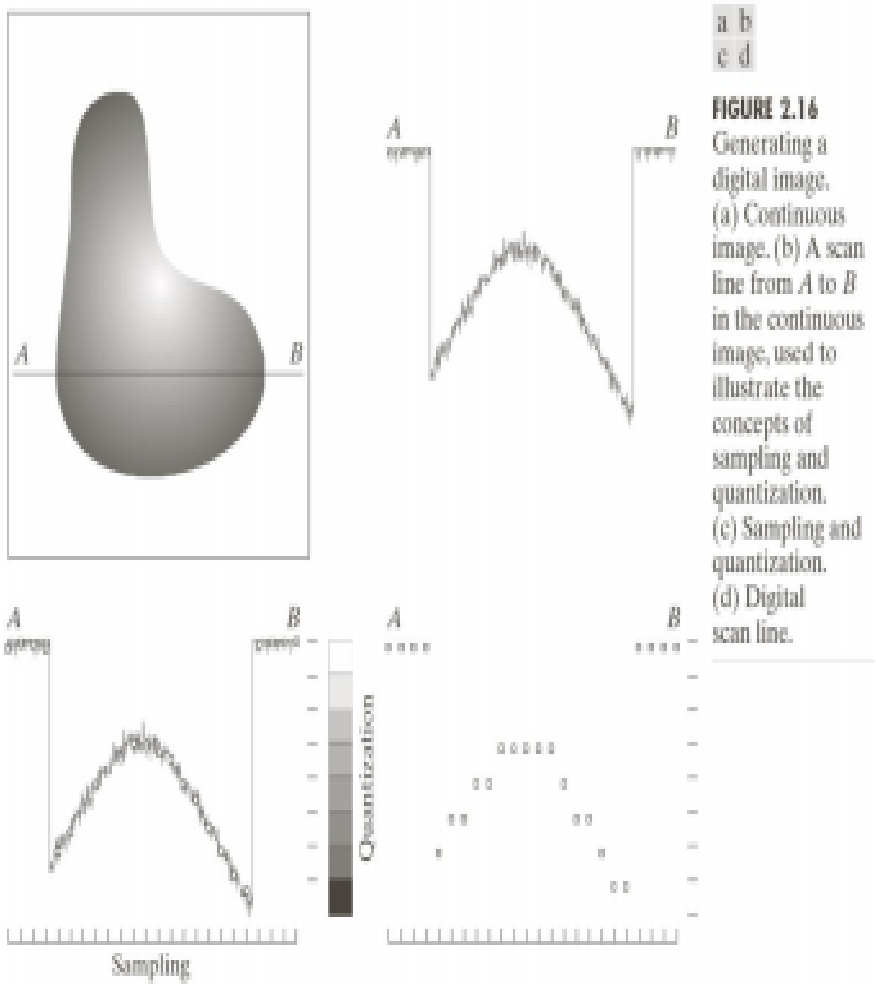
a b

FIGURE (a) Image acquisition using a linear sensor strip. (b) Image acquisition using a circular sensor strip.



a
b c d e

FIGURE 2.15 An example of the digital image acquisition process. (a) Energy ("illumination") source. (b) An element of a scene. (c) Imaging system. (d) Projection of the scene onto the image plane. (e) Digitized image.



a b
c d

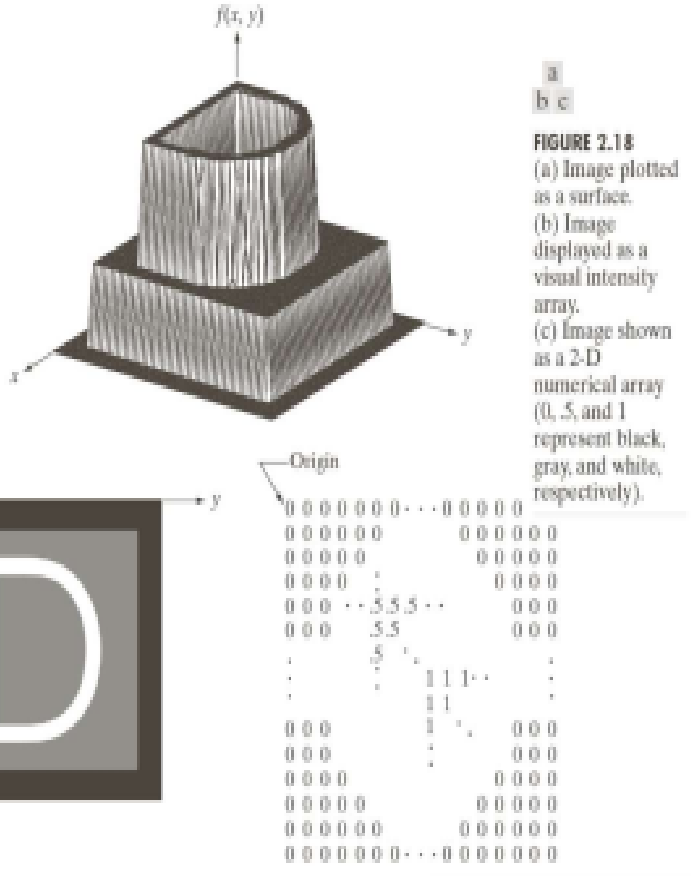
FIGURE 2.16 Generating a digital image. (a) Continuous image. (b) A scan line from *A* to *B* in the continuous image, used to illustrate the concepts of sampling and quantization. (c) Sampling and quantization. (d) Digital scan line.

Output of most sensors is continuous

To create a digital image, continuous data should be converted to digital form

sampling (digitizing coordinates)

quantization (digitizing amplitudes)



a
b c

FIGURE 2.18
(a) Image plotted as a surface.
(b) Image displayed as a visual intensity array.
(c) Image shown as a 2-D numerical array (0, .5, and 1 represent black, gray, and white, respectively).

Each element in the matrix form is called an *image element, picture element,* or *pixel.*

The number of intensity levels is typically a power of 2

$$f(x,y) = \begin{bmatrix} f(0,0) & f(0,1) & \cdots & f(0,N-1) \\ f(1,0) & f(1,1) & \cdots & f(1,N-1) \\ \vdots & \vdots & & \vdots \\ f(M-1,0) & f(M-1,1) & \cdots & f(M-1,N-1) \end{bmatrix}$$

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- Rafael C. Gonzales , Richard E. Woods,”Second Edition,Pearson Education,2004.
- Chi-Wah Kok, Wing –Shan Tam,” Digital Image Interpolation in Matlab“, John Wiley & Sons, 14-Dec-2018.
- Vikas Kumar Mishra, Shobhit Kumar and Neeraj Shukla,” Image Acquisition and Techniques to Perform Image Acquisition”, S-JPSET : Vol. 9, Issue 1,2017.

- THANKS