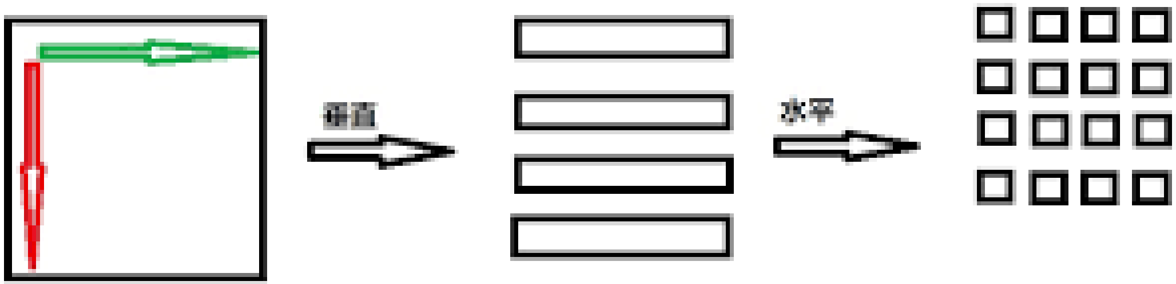
SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19EC351 – IMAGE PROCESSING AMD COMPUTER VISION



Guess Today’s Topic????

Image Sampling & Quantization

- **Why?**
  - The output of most sensors is a continuous voltage waveform whose amplitude and spatial behaviors are related to the physical phenomenon being sensed.
  - To create a digital image, we need to convert the continuous sensed data into digital form.
  - This involves two processes; **Sampling and Quantization.**

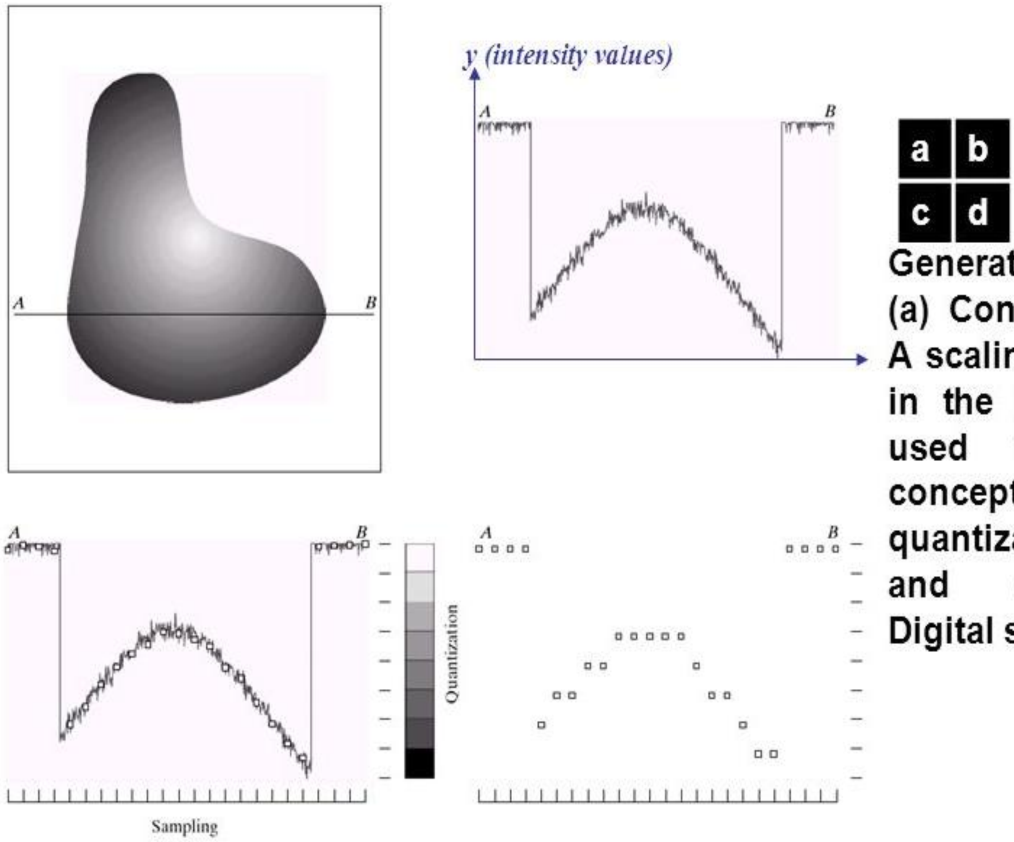
Sampling

Digital Signal? (Cont'd.)

A *sampling process* is the process to sample an analog signal at a certain period of time called the *sampling interval*.

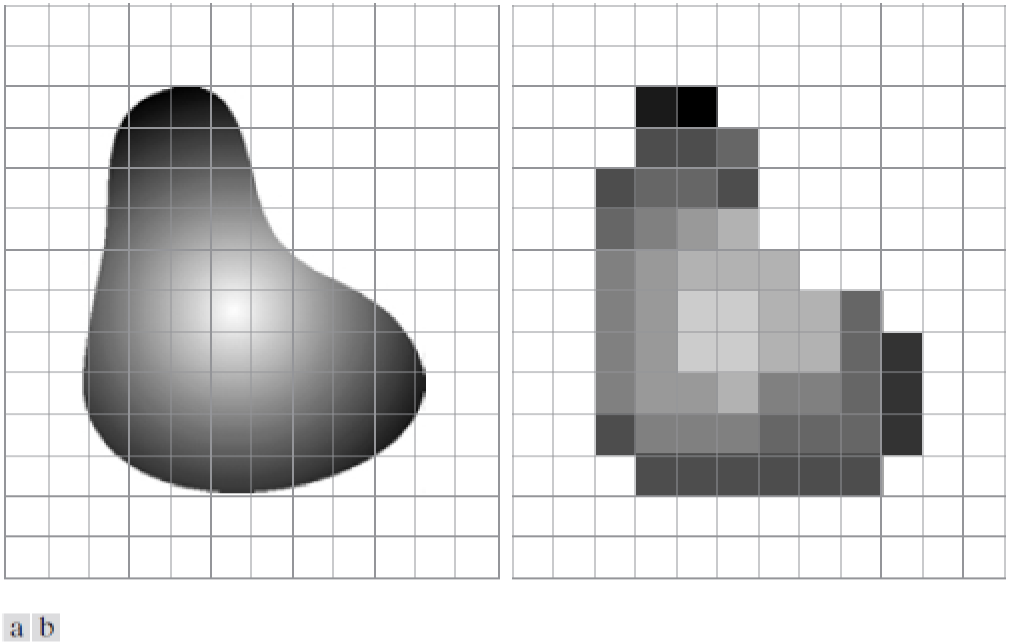
A *quantization process* is the process to round up the values of the discrete-time signal to a finite set of possible values. Thus, the quantization process will convert a d-t continuous-valued signal into a d-t discrete-valued (digital) signal.

Sampling and Quantization



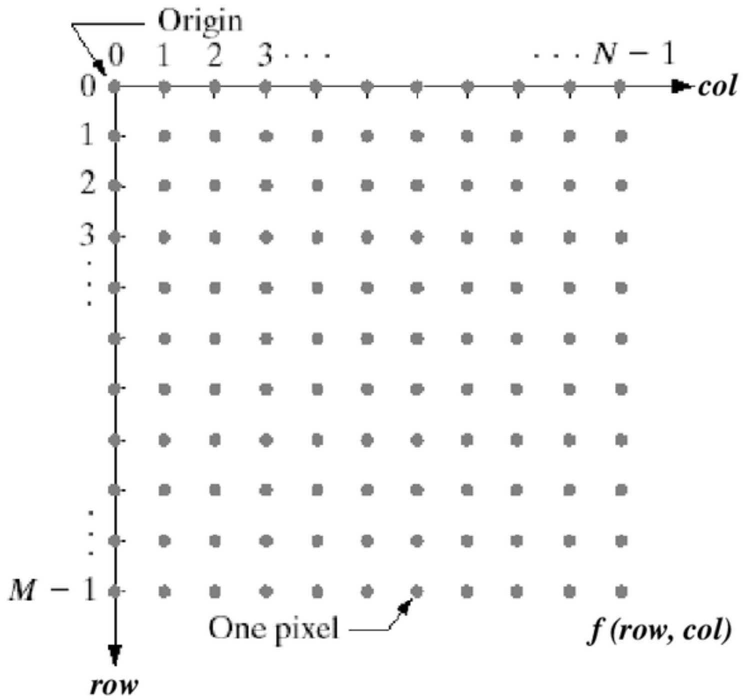
Generating a digital image. (a) Continuous image. (b) A scaling line from A to B in the continuous image, used to illustrate the concepts of sampling and quantization. (c) sampling and quantization. (d) Digital scan line.

Digitizing Images



Representing Digital Images

- Before we discuss image acquisition recall that a digital image is composed of M rows and N columns of pixels each storing a value
- Pixel values are most often grey levels in the range 0-255(black-white)
- We will see later on that images can easily be represented as matrices



Representing Digital Images (cont.)

- The representation of an M×N numerical array as

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

Representing Digital Images (cont.)

- The representation of an M×N numerical array as

$$A = \begin{bmatrix} a_{0,0} & a_{0,1} & \cdots & a_{0,N-1} \\ a_{1,0} & a_{1,1} & \cdots & a_{1,N-1} \\ \cdots & \cdots & \cdots & \cdots \\ a_{M-1,0} & a_{M-1,1} & \cdots & a_{M-1,N-1} \end{bmatrix}$$

Spatial and Intensity Resolution

- **Spatial resolution**
  - — A measure of the smallest discernible detail in an image
  - — stated with *line pairs per unit distance, dots (pixels) per unit distance, dots per inch (dpi)*

- **Intensity resolution**
  - — The smallest discernible change in intensity level
  - — stated with *8 bits, 12 bits, 16 bits, etc.*

- The number of intensity levels usually is an integer power of two
- The most common number is 8 bits, with 16 bits being used in some applications.
- Intensity quantization using 32 bits is rare.
- *For example*, it is common to say that an image whose intensity is quantized into 256 levels has 8 bits of intensity resolution.

Aliasing and Moire patterns

Aliasing is an unwanted effect which is present in an image.

Aliasing occurs when a signal is sampled at a less than twice the highest frequency present in the signal

To reduce Ailasing Effect

One way to reduce aliasing effect and increase sampling rate is **to simply display objects at a higher resolution.**

Reducing high frequency components by blurring the image prior to sampling.

Aliasing and Moire patterns (cont.)

A moire pattern is **an interference pattern** that is sometimes produced in digital images, particularly when a printed image is scanned.

Zooming and Shrinking Digital Images

- Zooming is viewed as oversampling and shrinking is viewed as under sampling.
- Zooming is a 2 step process: the creation of new pixel locations and assignment of gray levels to those new locations.
- For example, say we want to zoom an image of size 500 X 500 to 750 X 750.
- We can use nearest neighbor interpolation for zooming.
- Pixel replication is the special case of nearest neighbor interpolation.
- Pixel replication is used to zoom the image by an integer number of times.
- Here new locations are exact duplicates of old locations.
- It is very fast but produces check board effect and hence is undesirable for larger magnification.

THANK YOU