15EEE337 Digital Image Processing

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Last Lecture

- Digital Image
- Image processing
- Various applications
- Components of DIP system

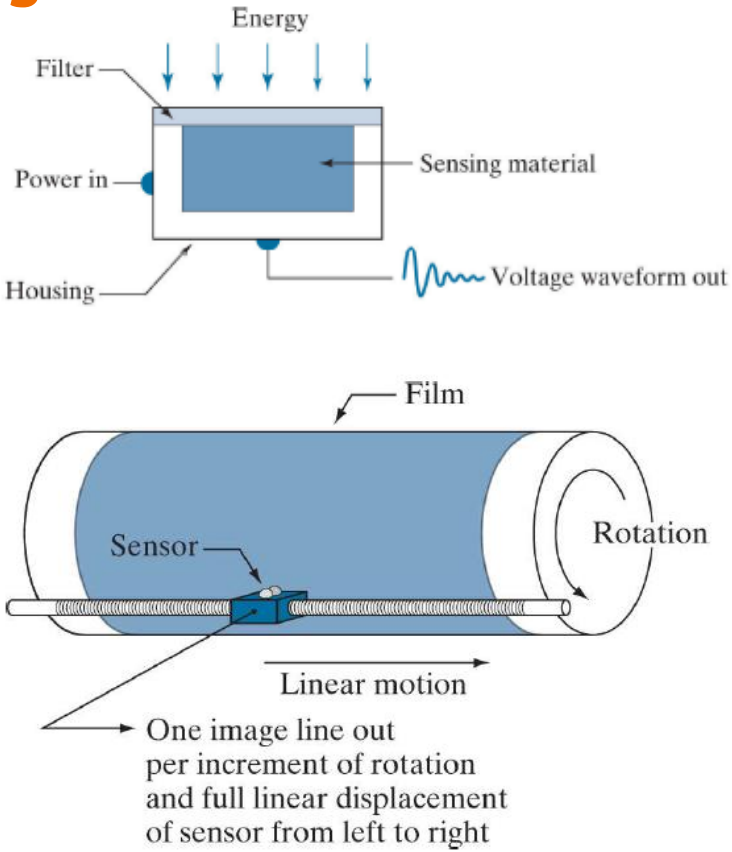
Sensor

Transform the incident energy into digital images.

- Incoming energy converted into voltage using input electrical power and sensor material.
- Sensor material- depend on type of energy being detected.
- Voltage- output of sensor.
- Digitize the response to obtain the digital quantity.

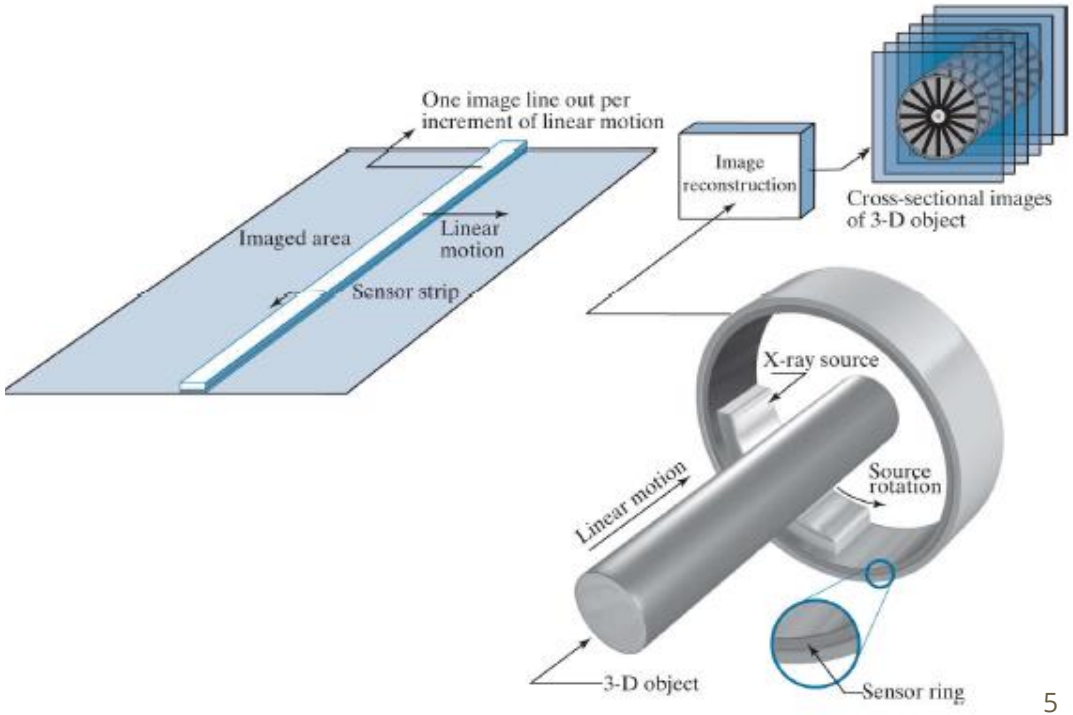
Using a Single Sensing Element

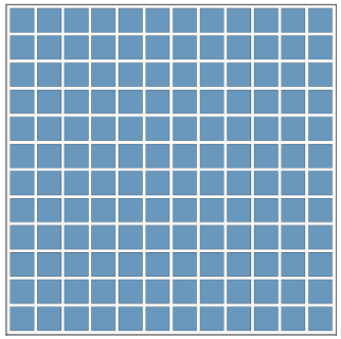
- Photodiode
- 2D images from single sensor
- Displacements in x & y directions.
- Eg. High precision scanning.
- Film negative on a rotating drum
- Rotations –displacement in one direction.
- The sensor on screw- motion in the perpendicular direction.
- Light source inside the drum.



Using linear sensor

- In-Line sensor strip.
- Provides elements in one direction.
- Motion perpendicular to the strip.
- Flat bed scanners, air borne imaging
- One line of image at a time
- Motion of strip –completes the other dimension.
- Ring configuration





Using sensor array

- Electromagnetic and ultrasonic sensing devices.
- Response of each sensor proportional to integral of light energy projected onto the surface of sensor.
- Noise reduction- integrate the input light signal over period of time.
- Focus the energy pattern onto the surface of the array.
- Motion not necessary.

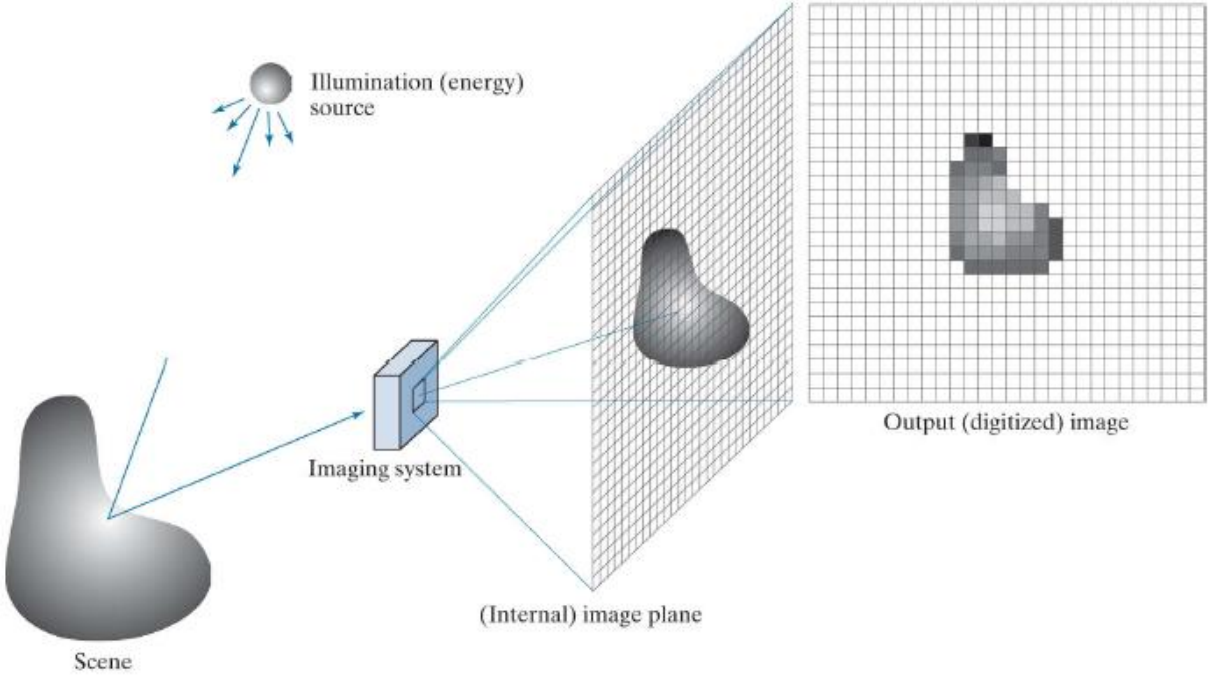


Image model

- Representing Image as 2D function- $f(x,y)$
- Value of f at x,y is intensity.
- Determined by source of image.
- Special cases – Image intensities take negative value.
- Radar images – velocity .
- While storing –scale the values- smallest negative =0.
    - $0 \leq f(x,y) < \infty$

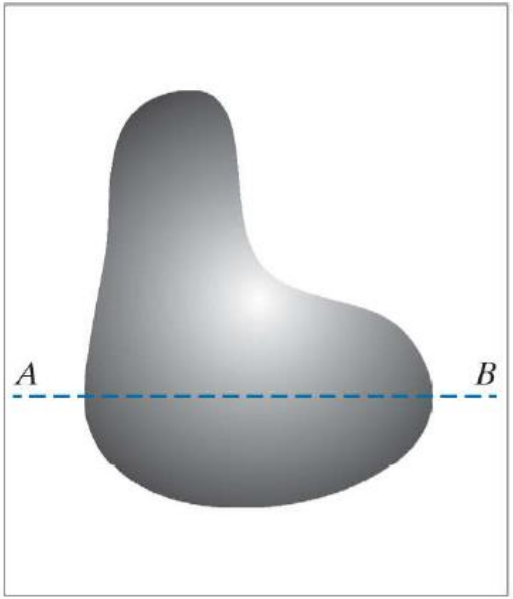
- Two components- amount of illumination
- Incident on the scene $i(x,y)$
- Reflected by objects in scene $r(x,y)$
    - $f(x,y) = i(x,y)\, r(x,y)$
- $0 \leq i(x,y) < \infty$
- $0 \leq r(x,y) < 1$

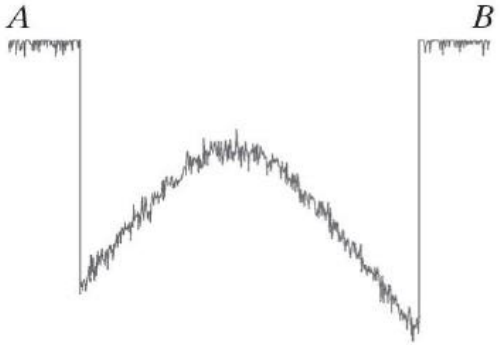
- Transmissivity

Image Sampling & Quantization

- Image acquired
- Sensor output (most) continuous voltage waveform.
- Convert the continuous sensed data into digital format.

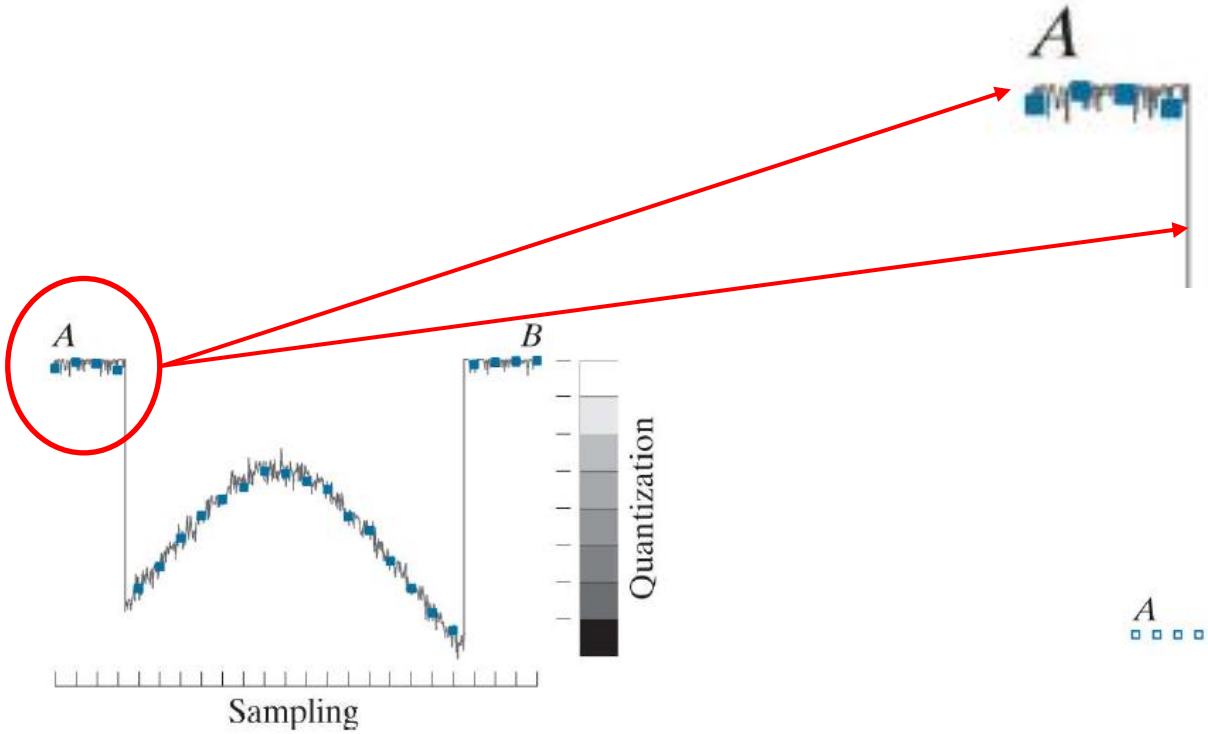
A continuous image



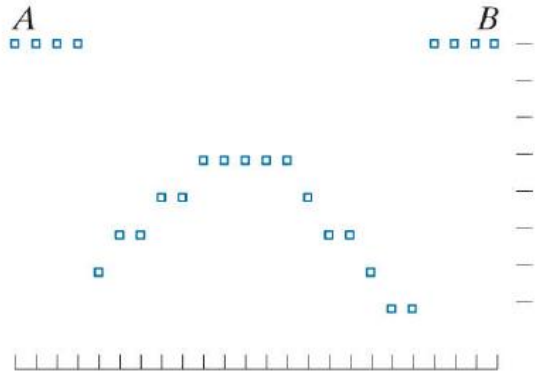


A scan line showing intensity variations along line AB in the continuous image

Digitizing
- Coordinate values –Sampling
- The amplitude - Quantization



Sampling and quantization.



Digital scan line.


THANK
YOU