Unit -1

Nutshell of Sampling and Quantization -

→ [Sensor] → Sensor

Scanner
↓
Digitize
↓
Photograph
↓
Hard disk
↓
You can process
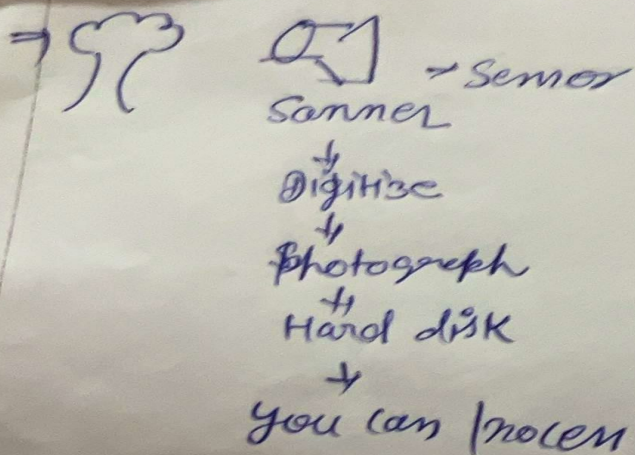
Sampling + Quantization = Digitization

Image → 2D → X axis & y axis $\boxed{f(x,y)}$

Co-ordinate ←   Amplitude
↓   ↓
Sampling   Quantization

Sampling → x-axis
Quantization → y-axis

DETAILED LECTURE NOTES

Unit - 1

Sampling & Quantization

→ mostly the output of image sensors is in the form of analog signal. This is due to the fact that we can not identify analog signal. In Digital image processing signal captured from the real word need to be translated into digital form by "Digitization" process.

→ A digital image $f(x,y)$ consists of coordinates x and y. Additionally it contains the function amplitude.

Quantization refer to digitizing the amplitude, while sampling refer to digitizing the coordinate value.
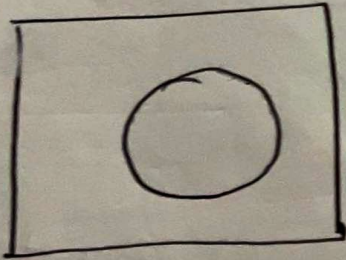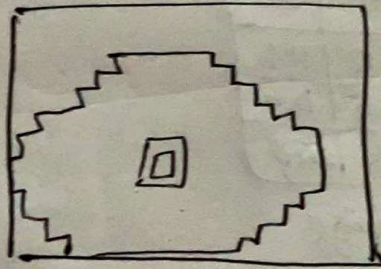
Continous image   Digital image

→ Digital Images are basically of three types — monochrome, grayscale image and color image.

→ The pixel value of binary image at specific location usually holds the value 0 for black or 1 for white.
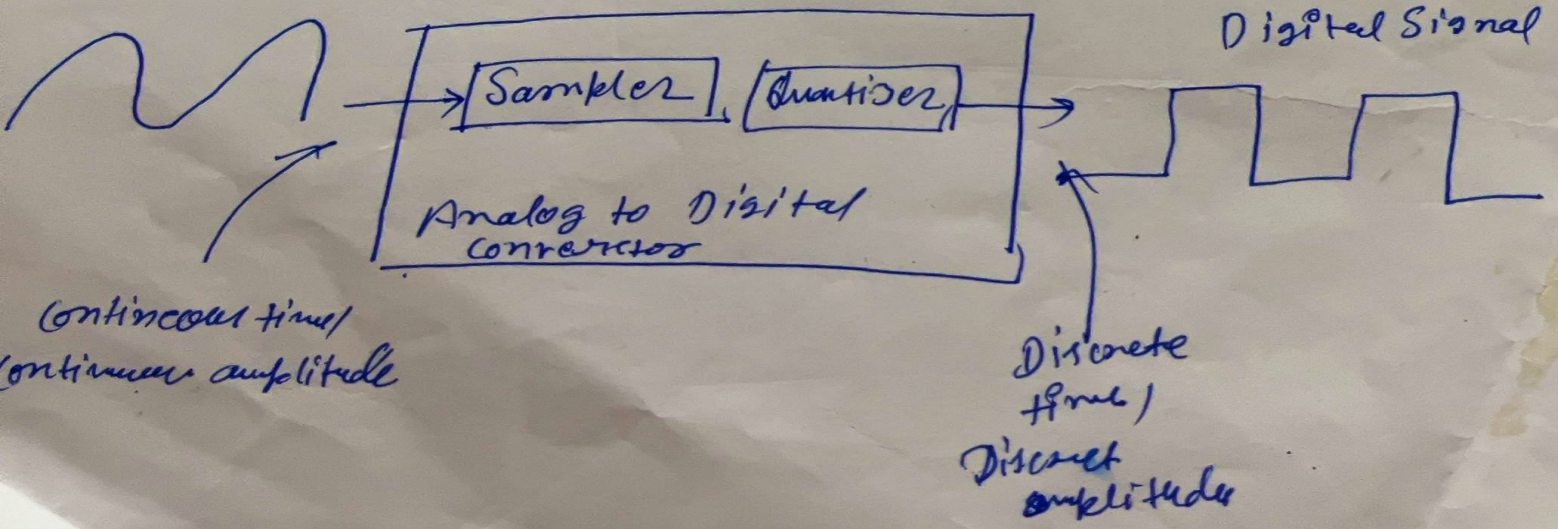
Sampling

→ Digitisation of coordinate values
→ x-axis (time) - discretised
→ y-axis (amplitude) - continuous
→ Sampling is done prior to quantization process
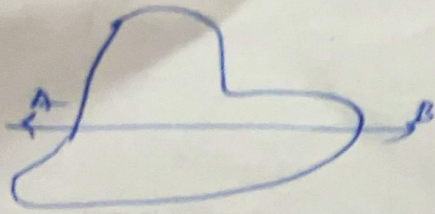→ It determines the spatial resolution of the digitised Images.

Quantization

→ Digitisation of amplitude value.
→ x-axis (time) - continuous
→ y-axis (amplitude) - discretised
→ Quantization is done after sampling process.
→ It determines the number of grey levels in the digitised images.

Analog Signal

Analog to Digital Converter
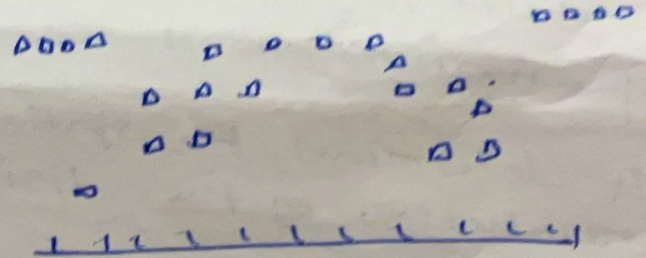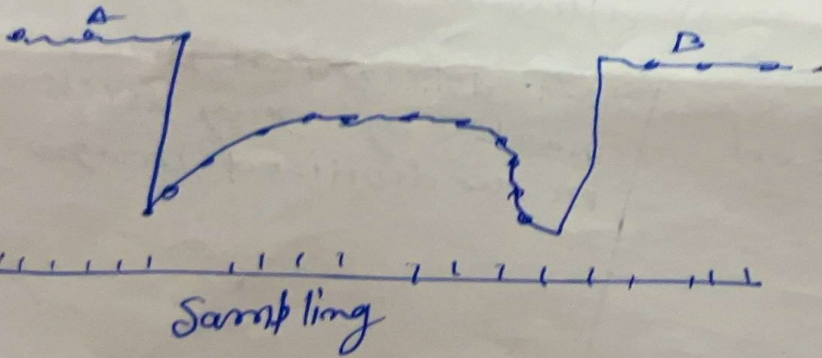
Digital Signal

Continuous time/ Continuous amplitude

Discrete time/ Discrete amplitude

original
Image

(Actual image
is continous)

digital Analog
image

(Digital Image has a
finite of pixels and
levels)
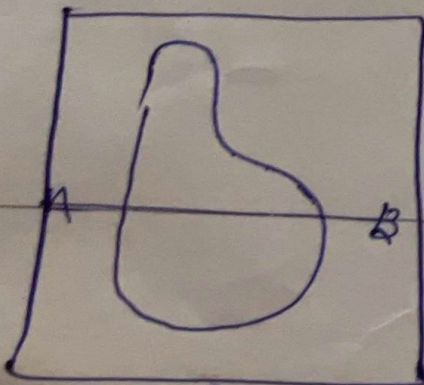

Sampling

Sampling and Quantisation — Basic theory

→ O/P sensor → Continous v/g

→ Convert → Continous sensed data → digital form through digitising.

→ Image → Continous → x & y
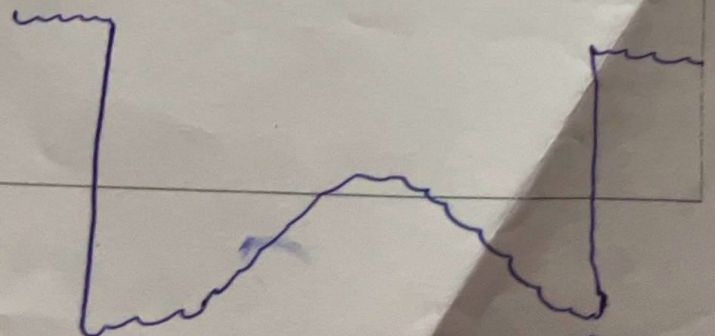   ↳ Amplitude

→ Digital form → Sample → x & y
    ↳ Amplitude

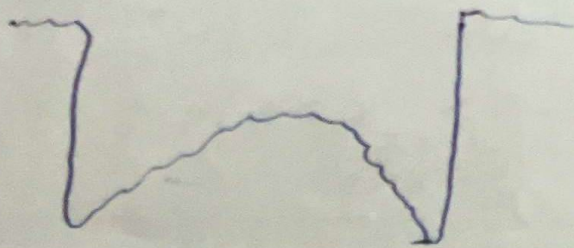→ Digitising Co-ordinate Values Called Values
        ↓
        Sampling

→ Digitising Amplitude Value Called
        ↓
        Quantisation

(a) Generating a digital Image

(b) Continuous Image

(c)

Sampling ↓
Quantization
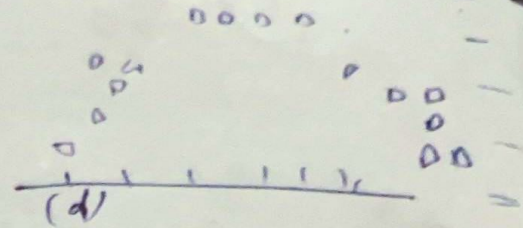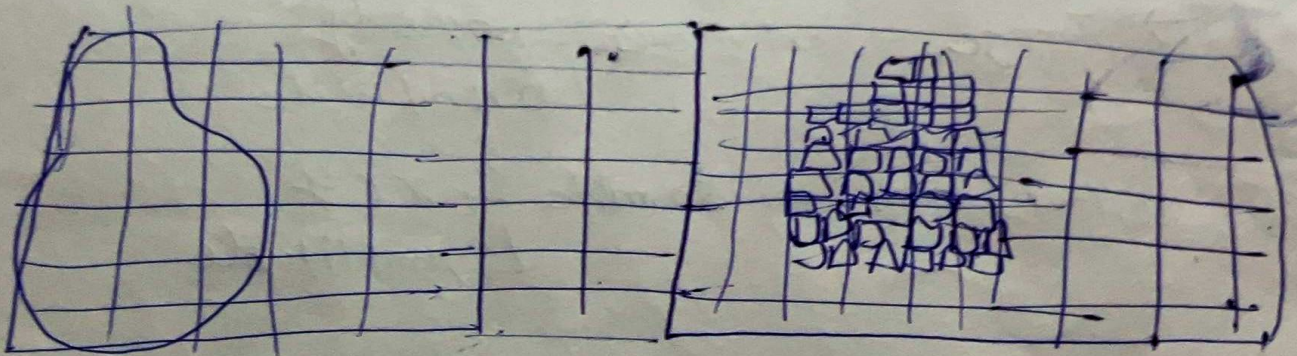
Quantisation

(d)

(d) digital
Scan line

O|P

(a) Continuous image

(b) Digitized image
after Sampling
and Quantization