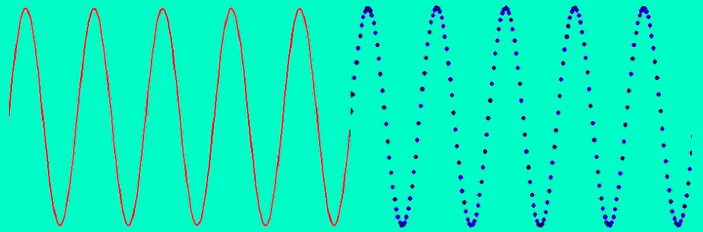
Image Representation



-Images are AnaLoG

Index

- What is an Image
- Digitalization
- 2D Sampling
- Aliasing
- Quantization
- Demo
- Questions and Answers

What is an image

An image is a 2-D digital representation of our 3-D analog world.

The conversion from continuous to discrete happens in 2 steps:

- Sampling
- Quantization

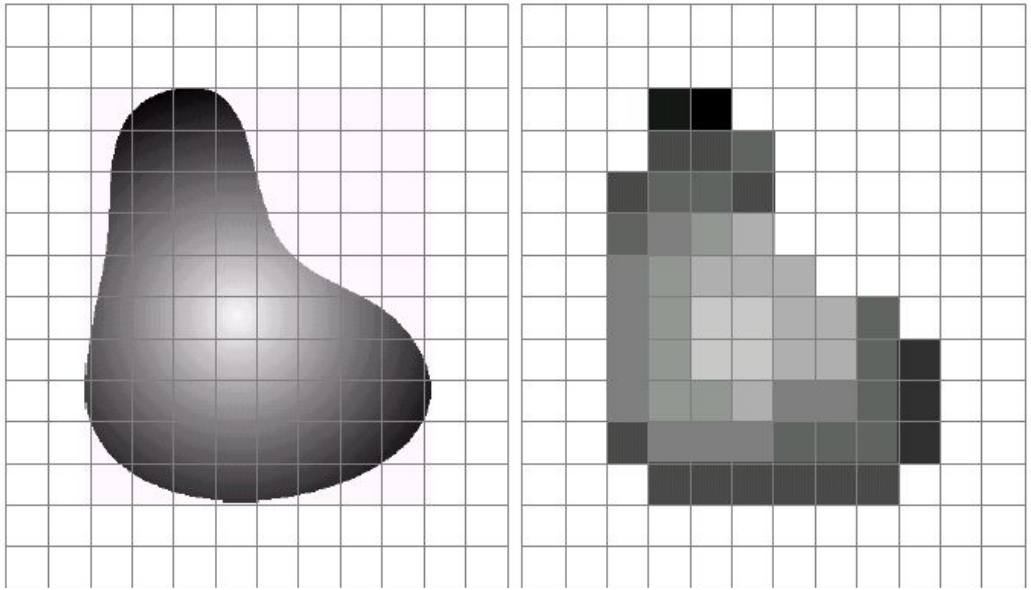
And the process is called Digitalization

Sampling

Method to represent an Image by a 2D finite matrix

Sampling

Method to represent an Image by a 2D finite matrix



Sampling

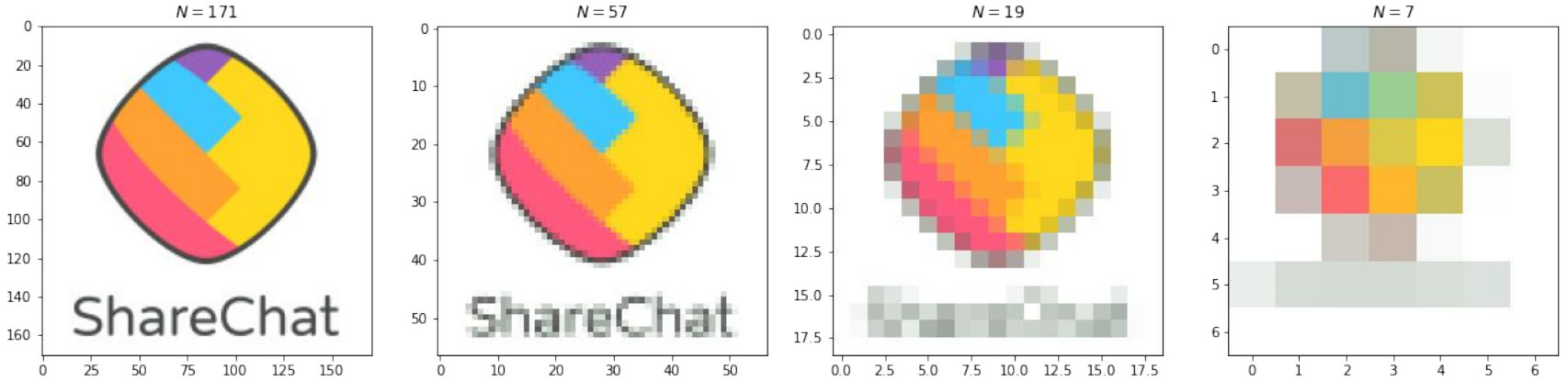
Method to represent an Image by a 2D finite matrix

The sampling frequency decides the spatial resolution of Image

Sampling

Method to represent an Image by a 2D finite matrix

The sampling frequency decides the spatial resolution of Image



Sampling

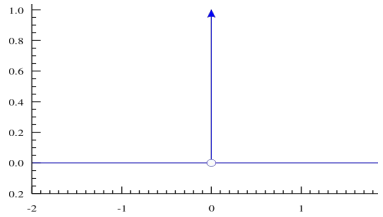
Method to represent an Image by a 2D finite matrix

The sampling frequency decides the spatial resolution of Image

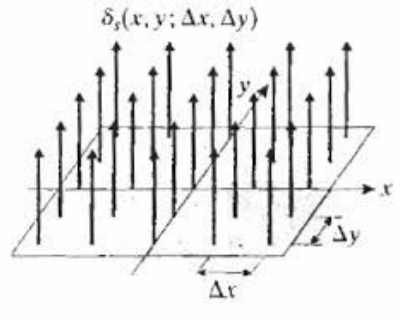
Low frequency corresponds to higher data loss

2D Sampling

Dirac Delta Function:



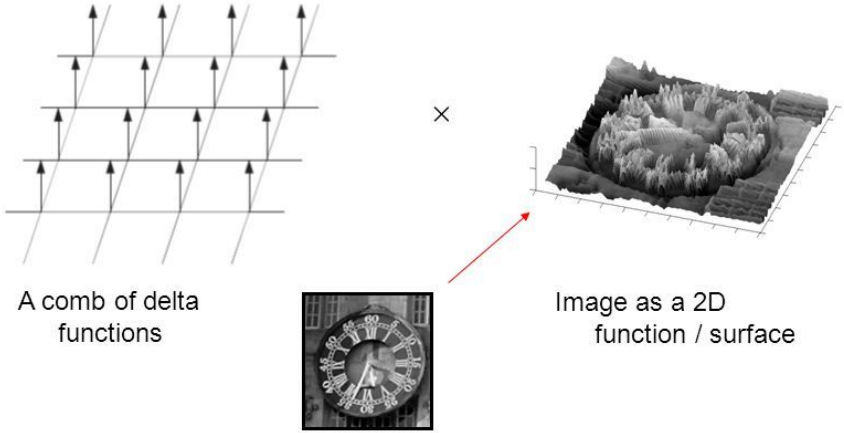
2D Comb Function: Sequence of dirac delta function situated at constant intervals along both coordinates



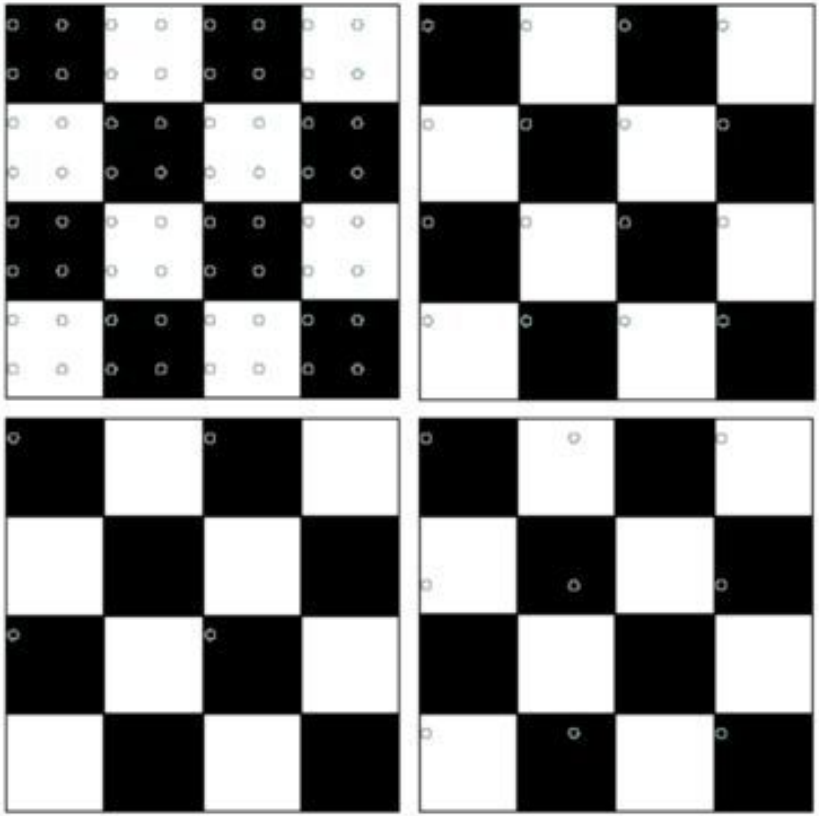
2D SAMPLING

Convolution of 2D comb over the analog image gives us the sampled digital image

Image will not be reconstructed if sampling frequency is less than Nyquist rate



2D SAMPLING



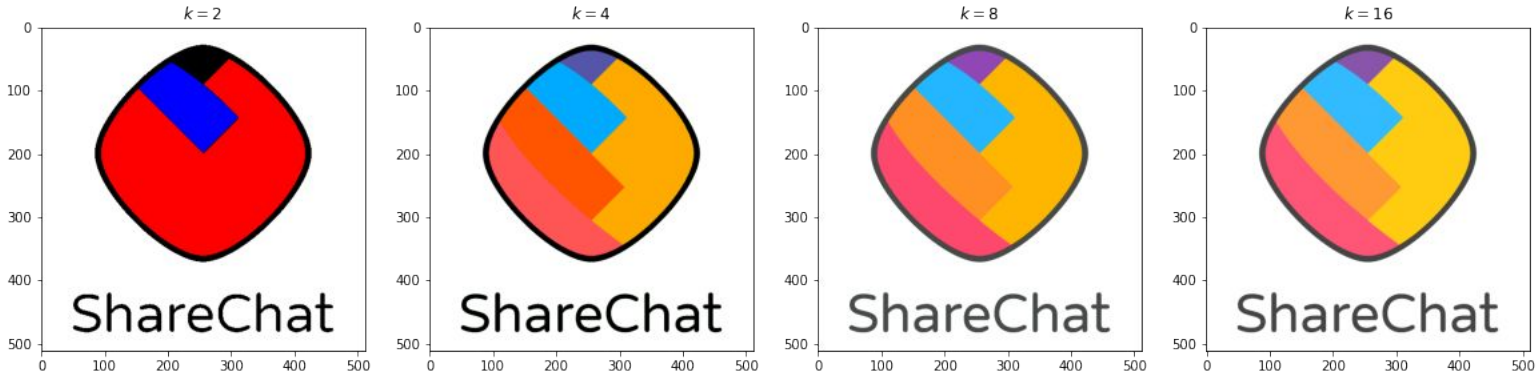
Aliasing

Quantization

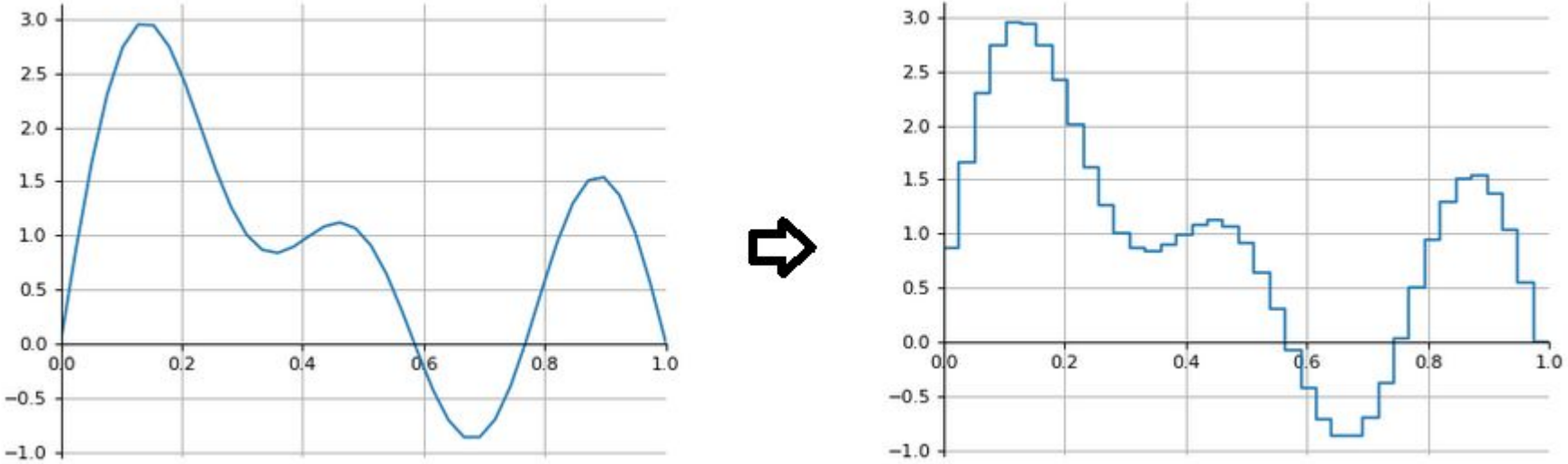
Quantization corresponds to discretization of intensity

Representing the sampled image in the form of fixed bits

More bits means more precise representation of image



Quantization level



Bit plane representation

8-bit

7-bit

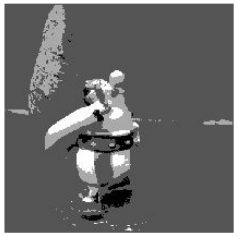
6-bit

5-bit

4-bit

3-bit

2-bit



1-bit

Reference

- https://medium.com/swlh/image-processing-with-python-digital-image-sampling-and-quantization-4d2c514e0f00
- https://maelfabien.github.io/computervision/cv_3/#
- https://www.slideshare.net/nidhalelabbadi/image-processing-representing-digital-image
- https://sisu.ut.ee/imageprocessing/book/2
- https://docs.google.com/presentation/d/1y9QxAX-nOA4bJSB9WcHoo1Hp6N29rxP64Tgyq2BTs1M/edit#slide=id.p11
- https://jackschaedler.github.io/circles-sines-signals/sampling.html
- https://www.cs.tau.ac.il/~dcor/Graphics/adv-slides/sampling05.pdf

Prof. P.K. Biswas: Electronics - Digital Image Processing