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FACULTY OF EGINEERING

Digital Image Processing
LECTURE-06

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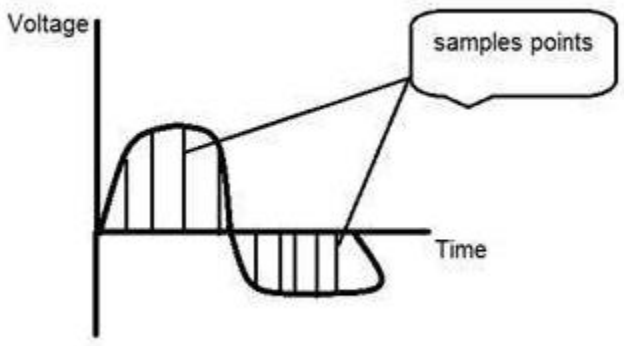
OUTLINE

- Digitizing a signal
- Sampling
- Quantization
- MCQ
- References

Digitizing a signal

As we have seen in the previous tutorials, that digitizing an analog signal into a digital, requires two basic steps. Sampling and quantization. Sampling is done on x axis. It is the conversion of x axis (infinite values) to digital values.

The below figure shows sampling of a signal.



Sampling

Sampling has already been introduced in our tutorial of introduction to signals and system. But we are going to discuss here more.

Here what we have discussed of the sampling.

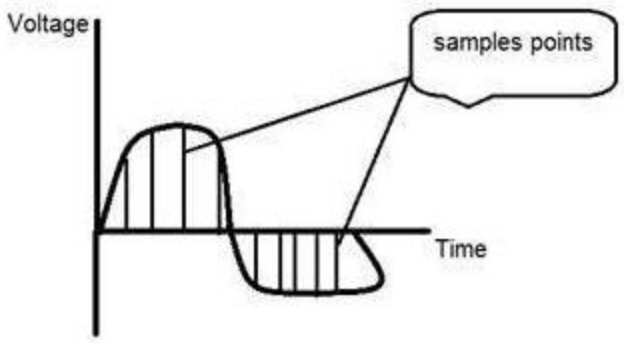
The term sampling refers to take samples

We digitize x axis in sampling

It is done on independent variable

In case of equation y = sin(x), it is done on x variable

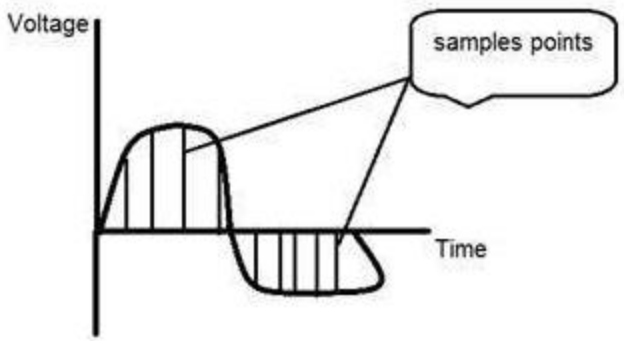
It is further divided into two parts , up sampling and down sampling



Sampling

If you will look at the above figure, you will see that there are some random variations in the signal. These variations are due to noise. In sampling we reduce this noise by taking samples. It is obvious that more samples we take, the quality of the image would be more better, the noise would be more removed and same happens vice versa.

However, if you take sampling on the x axis, the signal is not converted to digital format, unless you take sampling of the y-axis too which is known as quantization. The more samples eventually means you are collecting more data, and in case of image, it means more pixels.



Sampling with relation to digital images

The concept of sampling is directly related to zooming. The more samples you take, the more pixels, you get.

Oversampling can also be called as zooming. This has been discussed under sampling and zooming tutorial.

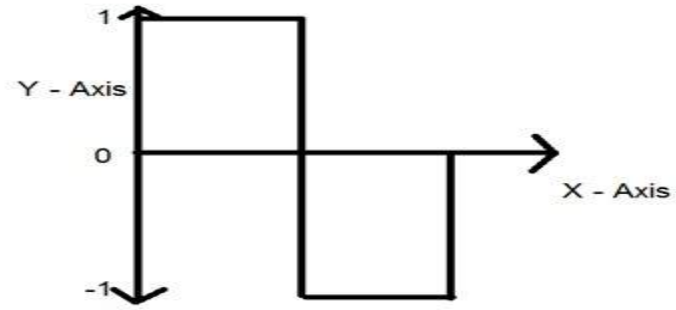
But the story of digitizing a signal does not end at sampling too, there is another step involved which is known as Quantization.

Quantization

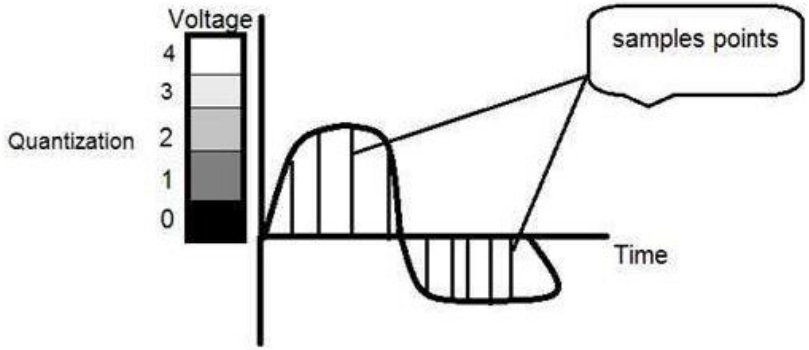
•Quantization is opposite to sampling. It is done on y axis. When you are quantizing an image, you are actually dividing a signal into quanta(partitions).

•On the x axis of the signal, are the co-ordinate values, and on the y axis, we have amplitudes. So digitizing the amplitudes is known as Quantization.

•Here how it is done



Quantization

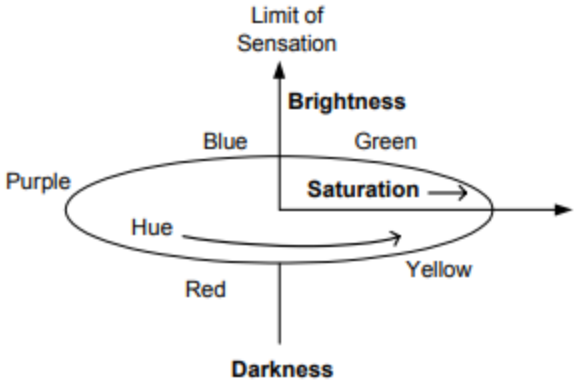


In the figure shown in sampling, although the samples has been taken, but they were still spanning vertically to a continuous range of gray level values. In the figure shown above, these vertically ranging values have been quantized into 5 different levels or partitions. Ranging from 0 black to 4 white. This level could vary according to the type of image you want.

Basics of color

The following terms are used to define color light:

1. Brightness or Luminance: This is the amount of light received by the eye regardless of color.
2. Hue: This is the predominant spectral color in the light.
3. Saturation: This indicates the spectral purity of the color in the light.



Color attributes

MCQ

The most familiar single sensor used for Image Acquisition is

a) Microdensitometer

b) Photodiode

c) CMOS

d) None of the Mentioned

2. A geometry consisting of in-line arrangement of sensors for image acquisition

a) A photodiode

b) Sensor strips

c) Sensor arrays

d) CMOS

3. CAT in imaging stands for

a) Computer Aided Telegraphy

b) Computer Aided Tomography

c) Computerized Axial Telegraphy

d) Computerized Axial Tomography

MCQ

4. The section of the real plane spanned by the coordinates of an image is called the _____

a) Spacial Domain

b) Coordinate Axes

c) Plane of Symmetry

d) None of the Mentioned

5. The difference is intensity between the highest and the lowest intensity levels in an image is _____

a) Noise

b) Saturation

c) Contrast

d) Brightness

References

- https://www.javatpoint.com/digital-image-processing-tutorial
- https://www.geeksforgeeks.org/
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- Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: JohnWiley and Sons, NY.
- Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall,Upper Saddle River, NJ.