



RAMA UNIVERSITY

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FACULTY OF ENGINEERING

Digital Image Processing LECTURE-02

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OUTLINE

- ❖ Relationship between a digital image and a signal
- ❖ Overlapping fields
- ❖ Signal and System Introduction
- ❖ Image
- ❖ Applications of Digital Image Processing
- ❖ MCQ
- ❖ References

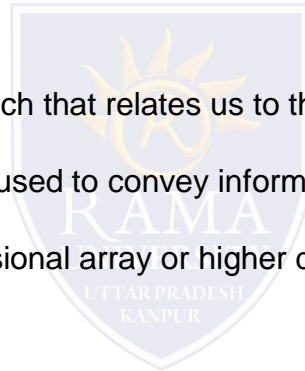


Relationship between a digital image and a signal

An image is a two-dimensional array in which color information is arranged along x and y spatial axis. So, in order to understand how the image is formed, we should first understand how the signal is formed?

Signal

- A signal is a mathematical and statistical approach that relates us to the physical world. It can be measured through its dimensions and time over space. Signals are used to convey information from one source to another.
- A signal can be measured on one or two-dimensional array or higher dimensional signal. The common example is a sound, images, and sensor output signals.
- Here, one-dimensional signals are measured on time over space and two-dimensional signals are measured on some other physical quantities, for example, digital image.



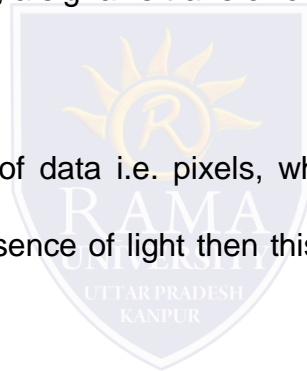
Relationship between a digital image and a signal

Relationship

- A signal is that which conveys information around us in the physical world, it can be any voice, images etc. whatever we speak, it first converted into a signal or wave and then transfer to others in due time period. While capturing an image in the digital camera, a signal is transferred from one system to another.

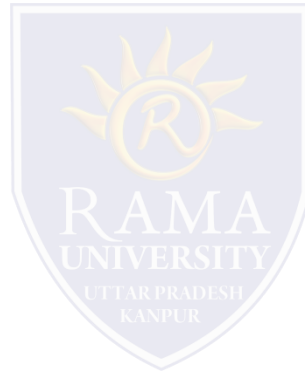
How a digital image is formed?

- A digital image is formed by the small bits of data i.e. pixels, which are stored in computers. When we capture an image in our digital camera in presence of light then this camera works like a digital sensor and converts it into digital signals.
- Here, sampling and quantization are the two processes that are required to convert data into a digital form.



Overlapping fields

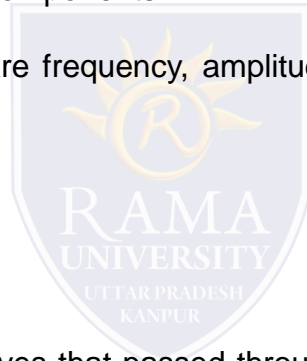
- Machine or Computer Vision
- Computer graphics
- Artificial intelligence
- Signal processing



Signal and System Introduction

Analog signals

- The analog image processing is applied on analog signals and it processes only two-dimensional signals. Analog signal is time-varying signals so the images formed under analog image processing get varied. It is generally continuous and not broken into tiny components.
- The main characteristics of analog signals are frequency, amplitude, and phase. Analog signals recorded sound waves better than digital sound.



Frequency in the analog signal

- In a given amount of time, the number of waves that passed through a fixed position is called frequency in the analog system.

Amplitude in the analog signal

- It describes the height of a signal that is on the horizontal axis and the amplitude is always equal to the point given on waveform.

Image

What is an Image?

- Practically, every scene which is around us forms an image and this involved under image processing.
- An image is formed by two-dimensional analog and the digital signal that contains color information arranged along x and y spatial axis.

Analog Image Processing

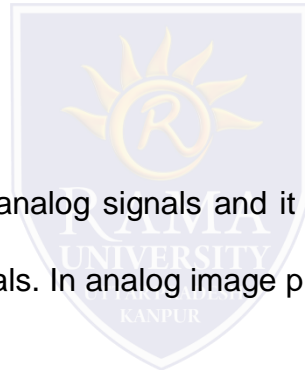
- The analog image processing is applied on analog signals and it processes only two-dimensional signals. The images are manipulated by electrical signals. In analog image processing, analog signals can be periodic or non-periodic

Digital Image Processing

A digital image processing is applied to digital images (a matrix of small pixels and elements). For manipulating the images, there is a number of software and algorithms that are applied to perform changes.

Digital image processing is one of the fastest growing industry which affects everyone's life.

Examples of digital images are color processing, image recognition, video processing, etc.



Applications of Digital Image Processing

Image sharpening and restoration

Medical Field

- Gamma-ray imaging

- PET scan

- X-Ray Imaging

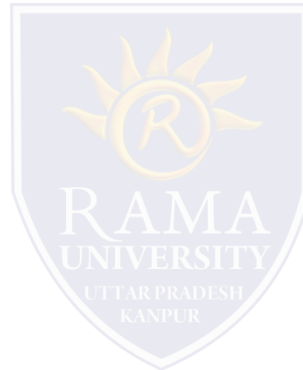
- Medical CT scan

- UV imaging

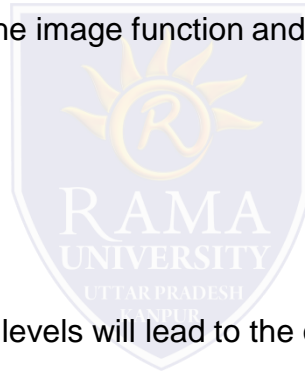
Robot vision

Pattern recognition

Video processing



1. A continuous image is digitized at _____ points.
 - a) Random
 - b) Vertex
 - c) Contour
 - d) Sampling
2. The transition between continuous values of the image function and its digital equivalent is called ____
 - a) Quantization
 - b) Sampling
 - c) Rasterisation
 - d) None of the Mentioned
3. Images quantised with insufficient brightness levels will lead to the occurrence of _____
 - a) Pixilation
 - b) Blurring
 - c) False Contours
 - d) None of the Mentioned

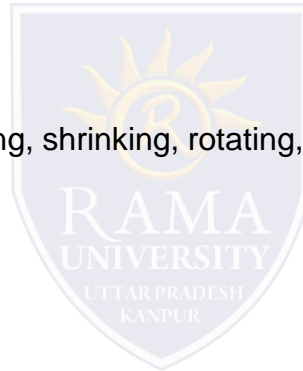


4. The smallest discernible change in intensity level is called _____

- a) Intensity Resolution
- b) Contour
- c) Saturation
- d) Contrast

5. What is the tool used in tasks such as zooming, shrinking, rotating, etc.?

- a) Sampling
- b) Interpolation
- c) Filters
- d) None of the Mentioned



References

- <https://www.javatpoint.com/digital-image-processing-tutorial>
- Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
- 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.

