Computer Vision

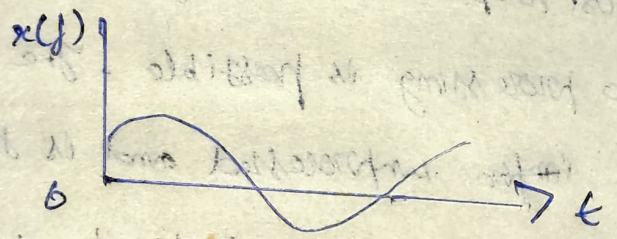
CAC 1

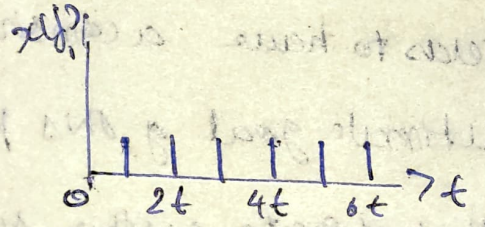
① Explain in detail about image acquisition, sampling, Quantization and image compression.

Ans Image acquisition in image processing can be defined as action of retrieving an image from source, usually a hard ware. based source, so it can be passed through whatever process need to occur afterward. First step in the workflow sequence because, without an image no processing is possible. The image that is acquired is completely ~~info~~ unprocessed and is the result of whatever hardware was used to generate it. which can be very important in some fields to have a consistent baseline from which to work. Ultimate goal of this process is to have a source of input that operate within such controlled and measured guideline that the same image can, if necessary be nearly perfectly reproduced under the same condition anomalous factors are easier to locate and eliminate.

Sampling : has already been introduced in our Signals. It is the process of converting an analog signal into discrete values. In layman terms we can say that sampling is the process of recording an analog signal @ regular intervals of time. A sampling function is applied to analog signal that results in the sampled signal.

We get a finite number of samples of an analog signal. The number of samples gives us the number of pixels. More samples will result in higher quality image of the digital image because of more pixels.





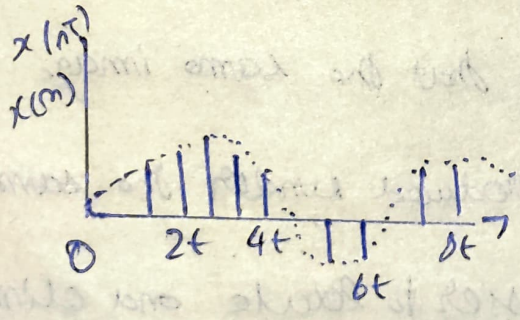


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Image Quantization : After sampling the analog signal, we will apply quantization. Quantization digitizes the amplitude of the sampled signal. Quantization is done by rounding off the amplitude of each sample and then assigning a different value according to its amplitude. Each value will represent a different color tone.

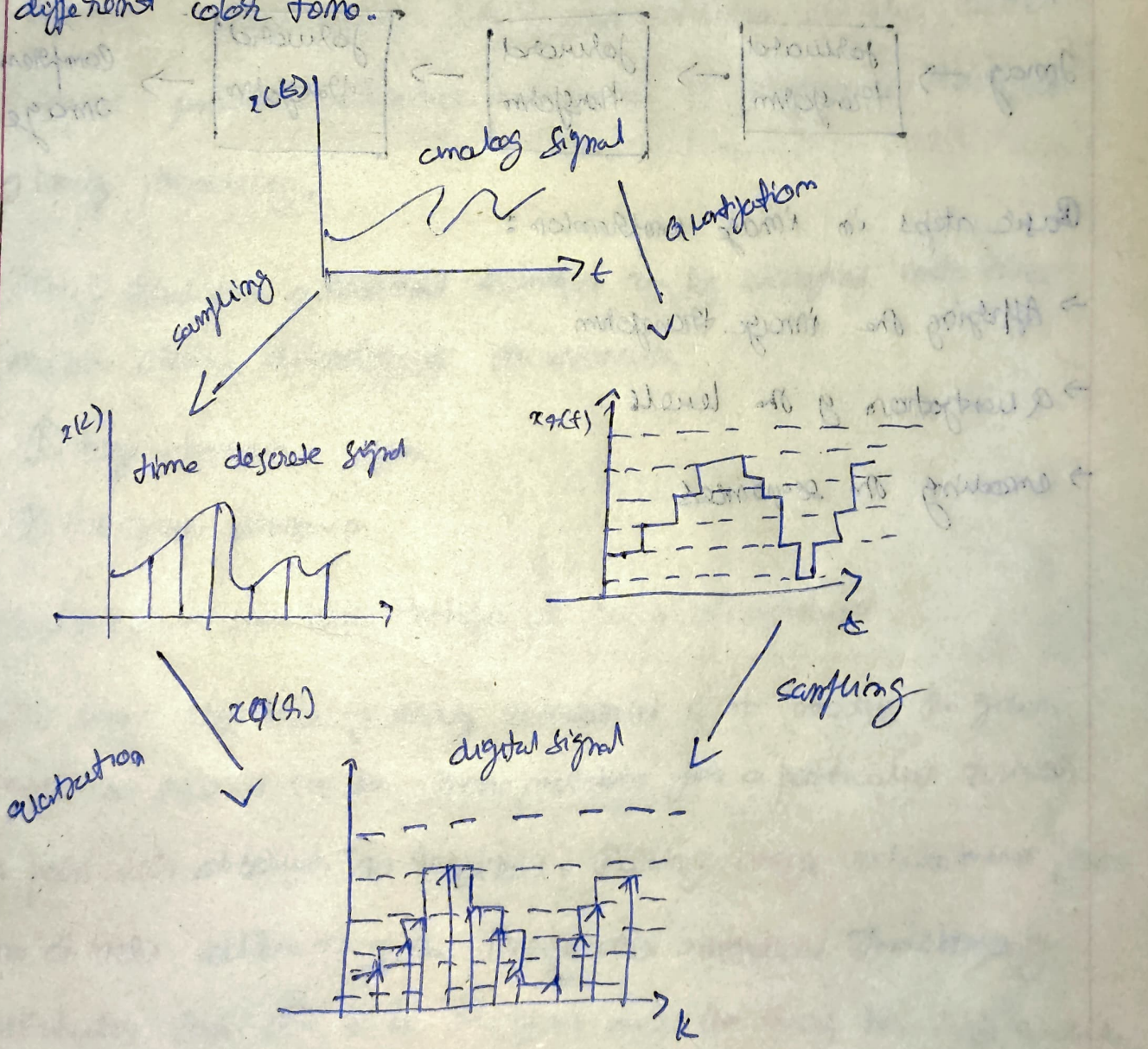
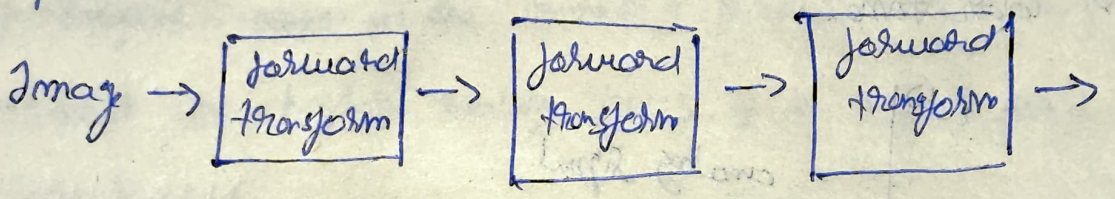


Image Compression: In the field of image processing, the compression of images is an important step before we start the processing of larger images or videos. The compression of image is carried out by an encoder and output a compressed form of an image. In the process of compression, the mathematical transforms play a vital role. A flow chart of the process of the compression of the image can be represented as



Basic steps in image compression:

→ Applying the image transform

→ Quantization of the levels

→ encoding the sequences

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(2) Demonstrate how image enhancement and Restoration techniques are used to enhance the quality of an image. 2

Ans Image Enhancement : It is the technique that can be used to enhance the perception or in other words the interoperability of data information in images which is present in the pixels for creating a good quality for human activities and also better "input" generated for other automated or programmed techniques of image processing.

Image Resolution enhancement techniques can be classified into two major classes according to the domain.

(1) Image domain

(2) Transform domain

classifications and basic techniques of image enhancement.

The main objective of image enhancement is to modify the given image so that it can be more suitable for a particular task or a particular observer as required. During image enhancement process, one or more attributes of the image are modified. The choice of attributes that are to be modified and the way how they can be modified are different for different tasks.

The two main categories that which enhancement methods can be divided as:

① Spatial domain method

② Frequency domain methods

In spatial method we deal directly with the pixel of an image. The values of the pixels are used to achieve required enhancements.

In freqcy domain techiques, the imag is first changed into freqcy domain.

Basic steps performed for image enhancement:

Ⓐ Identification

Ⓑ getting the pixel values

Ⓒ mapping

Review on Imag enhancement techqiue

① Resolution enhancement in MRI

② Motion variance adjustment

③ Read image enhancement techanique

④ Unsharing - Bonad junction approach.

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Image Restoration : It is the operation of taking a corrupt / noisy image and estimating the clean, original image. Corruption may come in many forms such as motion blur, noise and camera misfocus. Image restoration is performed by reversing the process that blurred the image and such is performed by imaging a point source and use the point source image, which is called the Point Spread function to restore the image information lost to blurring processing.

Image restoration is different from image enhancement in that the latter is designed to emphasize the features of image that make the image more pleasing to the observer, but not necessarily to produce realistic data from a scientific point of view.

Image enhancement techniques (like contrast stretching or de-blurring) by an nearest neighbour procedure provided by imaging packages or the a priori model of the process that created the image.

with image enhancement. noise can effectively be removed by sacrificing some resolution, but this is not acceptable in many applications.

The objective of image restoration techniques is to reduce noise and recover resolution loss. Image processing techniques are performed either in image domain or frequency domain. The most straightforward and conventional techniques for image restoration is deconvolution, which is performed in the frequency domain and after computing the fourier transform of both the image and the PSF and undo the resolution loss caused by the blurring factors.

This deconvolution technique, because of its direct inversion of the PSF which typically has matrix condition number, amplifies noise and creates an imperfect deblurred image. Also conventionally the blurring process is assumed to be shift-invariant. Hence more sophisticated techniques, such as regularized deblurring, have been developed to offer robust recovery under different types of noise and blurring functions. It is of 3 types:

1. geometric correction
2. radiometric correction
3. noise removal

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(3) Employ image representation & Description in image analysis.

Image representation and description takes part after the image segmentation & objects has been done which is utilized for effective discovery and acknowledgement of items in a scene to define the quality features during design acknowledgement or in quantitative code for proficient capacity during image compression. Image portrayal and depiction. Strategies can be sorted into two clans & techniques are shape-based strategies and locale-based techniques. This classification depend on whether the image is extracted from the contour part that forms the outside shape area.

The procedures for the contour shape are utilized to analyse just data & the shape boundy. The contour shape techniques utilizes two sorts & contour approaches named continuous approach & discrete approach; also known as global approach and structural approach, respectively. Both & these techniques above been explained.

In basic terminology, image representation refers to the way which is used to convey information about the image and it

features such as colors, pixels, resolution, intensity, brightness, how the image is stored etc.

Image description is a detailed explanation of an image that provides textual alternative visual content most often used for digital graphics online and in digital files, can be used as alt text in coding to provide alternative more complete information.

Some of the descriptions are :-

① Visual description : A description of visual content of a location, person or space. may be provided in real time also an umbrella term for image and audio descriptions.

② Audio description : a vocal narration describing the visuals in videos and other multimedia product

③ Captions : a brief explanation that provides further information about an image, these do not need to focus on visual components and can be supplemented by to any image

Examples :-

Logo, human portrait, Animal picture, Blurry picture, cartoon image, Map, graphics with text

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Q) Exhibit the role of image recognition and interpretation in image understanding (computer vision).

Ans

Image Recognition :

technology that enables us to identify objects, people, and several other variables in images.

It is a sub category of CV technology and a process that helps to identify the object or attribute in digital images / videos.

Computer vision is a broad term including different methods of gathering, processing and analysing data from the real world. As the data they is high, dimensional, it create numerical and symbolic information in the form of decisions.

Apart from image recognition complete vision also consists of object recognition, image reconstruction, event detection and video tracking

Image recognition can speed up the testing task and process images faster and more accurately than manual image inspection. Image recognition is a crucial technique

main applications are :- Medical inspection
image classification
Automated driving
Robotics

Image Recognition VS object detection

image recognition

object detection

Both are similar techniques and are often used together. Image recognition identifies which object or scene is in a image, whereas in object detection it finds instances and locations of more objects in images.

Image interpretation is the process of examining images and identifying and judging their significance by considering their location and extent. Expertise in image interpretation is achieved only by prolonged training through experience.

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Image interpretation elements :

Shape : A shape of the feature helps in identifying a feature. A round or oval shape feature could be a stadium. A straight line with very few turns could be a railway track. An assimilation of various elements of recognition will help to ascertain / identify the feature. A natural body is more likely to have irregular shapes.

Size : Size of feature in relation to nearly feature plays an important role in successful identification of a feature

Shadow : shadow of a feature helps in delineating boundary of the image feature. A big object would cast a long shadow as compared to smaller ones. The shadow is also used to measure the height of an object.

Color/tone : - Color or tone of an object is the relative brightness / darkness of an object. Ex eg : - A dark blue color indicates water.

Texture: Texture is the frequency of the tonal changes of the surface. This element is quite important in case of agriculture and forestry. A group of trees may have a specific texture and that will help to distinguish between a species of trees.

Pattern :- Spatial arrangement of features in a particular format is pattern. A road will have number of structures and on the basis of arrangement of them you can identify them.

Site : A site is the presence of features at a particular geographical location. A large vessel at lighthouse will be associated with sea

Time : A temporal change in a feature over a period of time can provide a lot of information for image interpretation. Volume of water in pond, rivers etc can be used to analyse the water supply of a city.

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Resolution :- Resolution of image is also an key aspect in image interpretation. Sometime an image can be seen very clearly or sometime its too small in relation to nearby features, hence identify it clearly can be difficult.

In a low resolution image a city boundry can be delineated however defining a buildng structure can be difficult. In case of high resolution images, identify a building structure can be easy.