Assignment- 02

Registration no: 21BCE11622

Name- Ankur Kumar

Q1. what is image processing?

Sol- Image processing refers to the manipulation and analysis of digital images using various algorithms and techniques. It involves applying mathematical operations, filters, and transformations to images to enhance their quality, extract useful information, or modify their visual appearance. Image processing can be performed on various types of images, including photographs, digital drawings, satellite images, medical scans, and more.

The process typically involves several steps, such as image acquisition, pre-processing, enhancement, segmentation, feature extraction, and

interpretation. Here's a brief overview of these steps:

1. Image acquisition: This step involves capturing or digitizing an image using devices such as cameras, scanners, or sensors.

2. Preprocessing: It includes techniques to improve the quality of the image, correct any distortions, reduce noise, and enhance contrast or brightness. Common preprocessing techniques include resizing, cropping, denoising, and color correction.

3. Enhancement: This step focuses on improving specific aspects of the image to make it more visually appealing or suitable for further analysis. Enhancements may involve adjusting brightness, contrast, sharpness, or applying filters to emphasize certain features.

4. Segmentation: It involves partitioning the image into meaningful regions or objects. Segmentation techniques can be based on intensity levels, color, texture, or other visual characteristics. It helps in isolating objects of interest for further analysis.

5. Feature extraction: This step involves extracting relevant information or features from the segmented regions or objects. Features can include shape, texture, color, or other visual properties that help distinguish and characterize the objects.

6. Interpretation/Analysis: Once the relevant features are extracted, image processing techniques can be applied for various tasks such as object recognition, classification, object tracking,

pattern recognition, or other higher-level analysis.

Q.2 Explain how the captured image stored in digital form?

Sol-

When an image is captured using a digital device such as a camera or a scanner, it is stored in digital form as a file. The process of storing a captured image digitally involves several steps. Here's a general overview:

1. Image Sensor: In digital cameras or scanners, an image sensor (such as a CCD or CMOS sensor) captures the light information from the scene. The sensor converts the incoming light into electrical signals.

2. Analog-to-Digital conversion: The electrical signals from the image sensor are in analog form.

They need to be converted into digital form for processing and storage. An analog-to-digital converter (ADC) is used to sample the analog signals and convert them into a digital representation.

3. Pixel Grid: The digital image is composed of a grid of small picture elements called pixels. Each pixel represents a specific location in the image and contains numerical values that represent the intensity or color at that location.

4. Color Encoding: In the case of color images, each pixel is assigned color information. Common color models include RGB (Red, Green, Blue), where each pixel's color is represented by varying intensities of these primary colors. Other color models, such as CMYK (Cyan, Magenta, Yellow, Black), are used for specific purposes like

printing.

5. File Format: The digital image is typically saved in a specific file format such as JPEG, PNG, TIFF, or RAW. These formats define how the image data is organized and encoded within the file. Each format has its advantages and may offer different levels of compression, color depth, and metadata storage.

6. Compression: To reduce the file size and storage requirements, digital images are often compressed. Lossless compression methods retain all the image data, while lossy compression methods sacrifice some details to achieve higher compression ratios. Common compression algorithms include JPEG, PNG, and GIF.

7. Storage: The final digital image file is stored

on a storage medium such as a hard drive, solid-state drive, or memory card. The file can be accessed, copied, transferred, and processed using appropriate software and hardware devices.

Q-3 In an image, if one pixel is present at the location P(x-1, y+1), then what are the coordinates of its 8-connected neighbourhoods?

Sol- The 8-connected neighborhood of a pixel refers to the eight pixels surrounding it, including the pixel itself. Assuming the location of the given pixel is P(x-1, y+1), here are the coordinates of its 8-connected neighbors:

i) P(x-1, y): The pixel located above the given pixel.
ii) P(x-1, y+2): The pixel located below the given pixel.

iii) P(p, q): The given pixel itself.
iv) P(p, q+1): The pixel located to the right of the given pixel.
v) P(p-2, q): The pixel located to the left of the given pixel.
vi) P(p-2, q+1): The pixel located in the top-left diagonal of the given pixel.
vii) P(p-2, q+2): The pixel located in the bottom-left diagonal of the given pixel.
viii) P(p, q+2): The pixel located in the bottom-right diagonal of the given pixel.

The 8-connected neighbourhood forms a square region around the given pixel, with each neighbor located in a specific position relative to the given pixel.

Q.4. Explain sampling and quantization with

example.

Sol- Sampling and quantization are two fundamental processes involved in converting analog signals, such as continuous images or audio, into digital form. Let's understand each process with an example:

i) Sampling:

Sampling is the process of converting a continuous signal into a discrete signal by capturing its values at regular intervals of time or space. In the context of images, sampling involves converting a continuous image into a grid of discrete pixels.

* Example: Consider a grayscale image of a smooth curve. To sample this image, we select a regular grid pattern and measure the intensity

value at each grid point. Each grid point represents a pixel, and the intensity value is recorded at that specific location. By sampling the image, we obtain a discrete representation where the continuous variations in intensity are represented by a set of discrete pixel values.

ii) Quantization:

Quantization is the process of mapping the continuous range of signal values obtained from sampling into a finite set of discrete levels. It involves assigning a specific value or code to each sampled point to represent its amplitude or intensity accurately.

* Example: Let's say we have a grayscale image that has been sampled. Each pixel in the sampled image has an intensity value. Quantization involves reducing the range of intensity values to a finite