

ASSIGNMENT-1

Q1.1. List four advantages of digital images over analog images.

Ans. The four advantages of digital images over analog images are as follows:

- (i) A technique for detecting discontinuity in digital images created by a broken connecting path is image segmentation.
- (ii) No processing or fixing chemicals are required while taking and processing digital images.
- (iii) In a digital image, a good image compression technique is used to reduce the amount of data required and produce high-quality photos.
- (iv) Digital image processing is a less costly and faster method of storing and retrieving images.

Q1.2. What property of the object is exploited in creating the following images?

- **Medical ultrasound images,**
- **CT images,**
- **MRI images,**
- **Nuclear medicine images,**
- **Impedance tomography images?**

Ans.

- Medical ultrasound images: Scattering Properties
- CT Images: Surface Height
- MRI Images: Concentration or Electric/Magnetic Properties
- Nuclear Medicine Images: Concentration
- Impedance Tomography Images: Electric/Magnetic Properties

Q1.3. To what class of image processing operations do the following examples belong:

- Tomographic reconstruction,
- Removing distortion,
- Pattern recognition,
- Edge enhancement,
- Noise removal,
- Brightness adjustment?

Ans.

- Tomographic reconstruction: Image Synthesis
- Removing distortion: Image Restoration
- Pattern recognition: Image Analysis
- Edge enhancement: Image Enhancement
- Noise removal: Image Restoration
- Brightness Adjustment: Image Enhancement

Q1.4. Distinguish between direct and indirect imaging systems, giving examples to illustrate each system.

Ans. Direct imaging technologies, such as the human eye, digital still/motion-capture cameras, and optical telescopes, all include data that may be recognized as an image. Indirect imaging techniques, on the other hand, it involves the processing and reconstruction of recorded data before the final image can be viewed. Indirect imaging techniques include film cameras, x-ray computed tomography, and holography.

Q1.5. How many images, each with 512×512 pixels and each pixel requiring one byte of storage, can be stored on

- (i) a 3 1/2" floppy disk with a capacity of 1.4MB,**
- (ii) a standard CD ROM with a capacity of 700MB,**
- (iii) a DVD-ROM with a capacity of 4.7GB?**

Ans. Assuming the photos are grayscale, a 512×512 pixel image occupies around 262144 bytes ($512 * 512 = 262144$ or 2^9) or 0.25 MB. As a result, the maximum number of photographs stored on the following medium is:

- (i) 5 images for a floppy disk,
- (ii) 2800 images for a CD,
- (iii) 19251 images for a DVD.

Q1.6. How many different shades of gray can be present in an image that is?

- (i) 8 bits deep,**
- (ii) 12 bits deep,**
- (iii) 16 bits deep?**

Ans. The number of different shades of gray can be present in an image that is:

- (i) 8 bits deep results in 256 possible gray levels spanning black to white,
- (ii) 12 bits deep results in 4096 possible gray levels spanning black to white,
- (iii) 16 bits deep results in 65536 possible gray levels spanning black to white.

Q1.7. Explain the differences between spatial resolution and brightness (gray scale) resolution in a digitized image.

Ans. The pixel size, which is dependent on the sampling rate, determines the spatial resolutions.

Whereas, on other hand, the number of bits utilized to identify the pixel value determines the brightness resolution (i.e., the number of accessible shades of gray or colors). The higher the brightness resolution, the more bits are used.

SOURCE:

I have referred to the Book that is “Digital Image Processing for Medical Applications”.