

B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Fifth Semester

18AIE332T - IMAGE AND VIDEO PROCESSING*(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)***Note:**

- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours**Max. Marks: 100****PART - A (20 × 1 = 20 Marks)****Marks BL CO**

Answer all Questions

- In spatial filtering, what does the term "kernel" refer to?
 (A) The size of the input image. (B) The transformation function applied to the image.
 (C) A matrix representing a filter or mask. (D) The output image after filtering.
 1 1 1
- Combined spatial enhancement methods often involve both image smoothing and image sharpening techniques. What is the primary goal of combining these methods?
 (A) Increase the image's overall brightness. (B) To reduce the image's contrast.
 (C) To remove noise and enhance fine details. (D) To decrease the image's spatial resolution.
 1 2 1
- Which image segmentation technique is based on selecting a threshold value and separating pixels into two classes, typically foreground and background?
 (A) Region Growing. (B) Wavelet Coding.
 (C) Bit Plane Coding. (D) Huffman Coding.
 1 1 1
- What is the primary goal of image compression techniques?
 (A) To increase the size of the image. (B) To decrease the image file size.
 (C) To reduce the quality of the image. (D) To add noise to the image.
 1 1 1
- In a 4-connected neighborhood system, select the number of adjacent pixels to a central pixel is:
 (A) 4 (B) 6
 (C) 8 (D) 10
 1 3 2
- An image processing system is capturing an image using a camera. Choose the formula to compute the aspect ratio of the image?
 (A) Aspect Ratio = Image Width / Image Height (B) Aspect Ratio = Image Height / Image Width
 (C) Aspect Ratio = Image Width * Image Height (D) Aspect Ratio = Image Height * Image Width
 1 2 2
- A grayscale image is represented using 8 bits per pixel. Name the total number of possible intensity levels in this image?
 (A) 16 (B) 32
 (C) 64 (D) 256
 1 2 2
- A digital image processing algorithm uses a 3x3 kernel for convolution on a grayscale image. Identify how many neighboring pixels are considered in this process.
 (A) 3 pixels (B) 6 pixels
 (C) 8 pixels (D) 9 pixels
 1 3 2

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|-----|---|---|---|---|
| 9. | Which of the following techniques is primarily used for increasing the overall visual quality and improving the contrast of an image? | 1 | 2 | 3 |
| | (A) Image Smoothing | | | |
| | (B) Inverse Filtering | | | |
| | (C) Adaptive Filters | | | |
| | (D) Image Sharpening | | | |
| 10. | Local histogram processing is commonly applied to enhance specific regions or details in an image. What is a typical example of local histogram processing? | 1 | 3 | 3 |
| | (A) Gamma Correction | | | |
| | (B) Median Filtering | | | |
| | (C) Wiener Filtering | | | |
| | (D) Laplacian Sharpening | | | |
| 11. | Which of the following compression methods guarantees that no information is lost during the compression-decompression process? | 1 | 2 | 3 |
| | (A) Huffman Coding | | | |
| | (B) LZW Coding | | | |
| | (C) Wavelet Coding | | | |
| | (D) Bit Plane Coding | | | |
| 12. | In the context of image compression, what does the term "bit depth" refer to? | 1 | 1 | 3 |
| | (A) The size of the image file in bits. | | | |
| | (B) The number of bits used to represent each pixel. | | | |
| | (C) The number of pixels in the image. | | | |
| | (D) The number of colors in the image. | | | |
| 13. | What do the 3D motion models in video processing primarily address? | 1 | 2 | 4 |
| | (A) Image compression techniques. | | | |
| | (B) The effects of observation noise. | | | |
| | (C) The dynamics of objects in three-dimensional space. | | | |
| | (D) Sampling structures of analog video signals. | | | |
| 14. | In video processing, what does perspective projection account for? | 1 | 1 | 4 |
| | (A) Noise reduction in images. | | | |
| | (B) The effects of lighting and shadows. | | | |
| | (C) The appearance of objects based on their 3D positions and the camera's viewpoint. | | | |
| | (D) The transformation of images into a different color space. | | | |
| 15. | Why does understanding and addressing observation noise important in video processing? | 1 | 3 | 4 |
| | (A) To enhance image contrast. | | | |
| | (B) To improve the efficiency of compression algorithms. | | | |
| | (C) To reduce motion blur in videos. | | | |
| | (D) To ensure the accuracy and reliability of video analysis and processing. | | | |
| 16. | Which of the following filtering techniques is effective in reducing noise in images, especially in scenarios where outliers are present? | 1 | 2 | 4 |
| | (A) Perspective projection | | | |
| | (B) Median filtering | | | |
| | (C) 2D Fourier transform | | | |
| | (D) Homogeneous coordinates | | | |
| 17. | What does optical flow in 2D motion estimation primarily represent? | 1 | 1 | 5 |
| | (A) 2D motion of objects in a scene.. | | | |
| | (B) Apparent motion caused by lighting changes. | | | |
| | (C) 3D motion of objects in a scene. | | | |
| | (D) Global motion of the camera. | | | |
| 18. | Translational block motion models are commonly used in video compression. What do these models assume? | 1 | 3 | 5 |
| | (A) Objects in the video do not move. | | | |
| | (B) Objects move with arbitrary motion. | | | |
| | (C) Motion can be accurately represented as translation within small blocks. | | | |
| | (D) All objects in the scene move together as a single entity. | | | |

19. What is the primary advantage of hierarchical motion estimation?	1	1	5
(A) It can accurately estimate global motion.			
(B) It reduces the computational complexity of motion estimation.			
(C) It handles occlusion problems effectively.			
(D) It is suitable for mesh-based motion estimation.			
20. In video compression, what is the role of predictive coding?	1	2	5
(A) To represent motion vectors.			
(B) To estimate optical flow.			
(C) To predict future frames based on previous frames.			
(D) To perform wavelet-based coding.			

PART - B (5 × 4 = 20 Marks)

Answer any 5 Questions

	Marks	BL	CO
21. Write the basic concept of image formation in the context of digital images. How does the process of sampling and quantization relate to the conversion of a continuous image into a digital representation?	4	1	1
22. Discuss the two essential properties of the 2D Discrete Fourier Transform (DFT) and their significance in image processing.	4	2	1
23. How does the local histogram equalization work, and what are its advantages over global histogram equalization?	4	2	2
24. Differentiate image smoothing and image sharpening using spatial filters. Provide an example of when each operation is typically applied in image processing.	4	1	2
25. Briefly write the concept of region-based segmentation and region-growing algorithm. what are its advantages and limitations in image segmentation?	4	1	3
26. Write a short note on the observation noise in the context of video processing, and why is it a significant consideration in video analysis and computer vision tasks?	4	3	4
27. Discuss Newton Raphson method and transform coding in brief.	4	1	5

PART - C (5 × 12 = 60 Marks)

Answer all Questions

	Marks	BL	CO
28. (a) Explain the process of image formation and the significance of sampling in digital image representation. Describe the fundamental concepts of Nyquist's theorem and aliasing. Provide examples to illustrate these concepts.	12	1	1
(OR)			
(b) Compare and contrast the Fast Fourier Transform (FFT) and the Discrete Wavelet Transform (DWT) in the context of digital image processing. Explain their fundamental differences, advantages, and typical applications.			
29. (a) Elaborate the spatial filters for image smoothing and image sharpening to improve the overall image quality with an example.	12	3	2
(OR)			
(b) Illustrate the fundamental concepts of image restoration and the Wiener filtering technique. Write the steps involved in Wiener filtering and discuss its advantages and limitations.			
30. (a) Describe the process of region growing and the criteria used to merge pixels into regions with suitable example.	12	2	3
(OR)			
(b) Write in detail about the fundamentals of lossless image compression techniques, focusing on Huffman coding and LZW (Lempel-Ziv-Welch) coding. Compare and contrast the two coding techniques in terms of their efficiency and typical use cases.			

31. (a) Explain how median filtering and weighted median filtering can be employed to reduce the effects of observation noise in video frames. 12 1 4
(OR)
(b) With an example write the concept of perspective projection in video processing and its relevance to 3D motion models.
32. (a) Elucidate hierarchical and mesh based motion estimation in detail. Provide examples to illustrate these concepts. 12 2 5
(OR)
(b) Illustrate block motion models and translational block motion. Discuss the advantages and disadvantages of using block-based methods in 2D motion estimation.

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