

Question bank on Digital Image Processing (BTETC603)

UNIT – 1: Concept of Visual Information

1. Define Image
2. Compute the Euclidean Distance (D1), City-block Distance (D2) and Chessboard distance (D3) for points p and q, where p and q be (5, 2) and (1, 5) respectively. Give answer in the form (D1, D2, D3).
3. Consider the following two images. The addition and subtraction of images are given by $f1+f2$ and $f1-f2$. Assume both the images are of the 8-bit integer type.

$$\begin{array}{r} f1 = \\ 100 \quad 100 \quad 100 \\ 50 \quad 50 \quad 50 \\ 200 \quad 150 \quad 150 \end{array} \quad \text{and} \quad \begin{array}{r} f2 = \\ 50 \quad 50 \quad 25 \\ 40 \quad 40 \quad 50 \\ 50 \quad 50 \quad 75 \end{array}$$

4. Perform opening and closing operations on the given image

0	0	0	0	0
0	1	1	1	0
0	1	1	1	0
0	1	1	1	0
0	0	0	0	0

Image

0	1	0
1	1	1
0	1	0

Mask

5. Define: Dynamic Range, Brightness, Gray level, Hue, saturation, Resolution, pixel
6. What is the need of Fourier transform? Explain all the properties of DFT.
7. What do you mean by convolution? Explain all the properties of convolution.
8. Describe the fundamental steps in image processing?
9. With the help of sketch explain the structure of human eye for image reception.
10. Differentiate photopic and scotopic vision.
11. Find the number of bits required to store a 256 X 256 image with 32 gray levels.
12. Write the expression to find the number of bits to store a digital image?
13. Explain the basic Elements of digital image processing.
14. Describe the basic relationship between the pixels
 - Neighbours of a pixel
 - Adjacency, Connectivity, Regions and Boundaries
 - Distance measures
15. Examples on finding Connectivity (4,8, m), distances, adjancy.

UNIT – 2: Image Perception

1. What is the need for transform and What is Image Transform?
2. Define: Contrast, Variance, Standard deviation, Mean, Coefficient of variation, signal to noise ratio.
3. Explain Brightness sensitivity

4. Write a note on Spatial Frequency Sensitivity.
5. Write a note on Colour sensitivity in terms of standard observer and CIE chromaticity coordinates.
6. Write a note on Match Band Effect.
7. Write a note on Simultaneous contrast point.
8. Explain in brief Optical Illusions
9. Explain colour image fundamentals.
10. Explain CMY model.
11. Explain Brightness adaptation and Discrimination.
12. Describe the HSI colour image model

UNIT – 3: Image Sampling

1. Explain sampling and quantization.
2. Write a note on Neighbours of a pixel, Adjacency, Connectivity, Regions and Boundaries.
3. Explain in brief the types of quantizers.
4. Explain vector quantizer. Why vector quantization is called as lossy data compression.
5. Write a note on binarization of an image with an example.
6. Write a note on Max Lyod quantizer.
7. What is Interpolation? Explain in brief all types of interpolation.
8. Write a note on Visual quantization.
9. Explain vector quantization in detail with diagram. what is mean square error measure for vector quantization.
10. Examples on Dilation operation
11. Examples on Erosion operation
12. Examples on Opening operation
13. Examples on Closing operation
14. Examples on Hit-Miss transform

UNIT – 4: Image Transforms

1. Define 2D forward and inverse Fourier transform in detail.
2. Explain the Properties of 2D discrete Fourier Transform
3. State convolution theorem for 1D.
4. Write short notes on Discrete Cosine Transform (DCT) along with the formulae for 1D and 2D.
5. Write short notes on KL(Hotelling) transform.
6. Discuss forward and inverse Hadamard transform in detail
7. Explain Walsh Transform with suitable equations
8. Explain Discrete cosine transform in detail
9. For a given 2×2 image U and 2×2 transformation matrix A . Reconstruct the given image using A_{00} and A_{01} only.

$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}, \quad U = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$$

10. Determine the linear convolution of two sequences $x(n) = \{3, 2, 1\}$ and $h(n) = \{3, -2, -1\}$

11. For a given 2x2 transformation matrix A. Find the basis image A_{01} .

$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

12. Find the Kronecker product $A \otimes B$ of the matrices A and B as given below

$$A = \begin{bmatrix} 4 & 5 & 6 \\ 1 & 2 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

13. For a given 2x2 image U and 2x2 transformation matrix A. Find the transformed image V.

$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}, \quad U = \begin{bmatrix} 2 & 2 \\ 8 & 4 \end{bmatrix}$$

14. For a given 2x2 image U and 2x2 transformation matrix A. Reconstruct the given image using A_{00} , A_{01} , and A_{10} only.

$$A = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}, \quad U = \begin{bmatrix} 2 & 2 \\ 8 & 4 \end{bmatrix}$$

15. Given that $W = e^{-i((2\pi)/N)}$ where $N=3$ and $F = W^{N/2}$. Find the value of F.

UNIT – 5: Image Enhancement

1. Differentiate linear spatial filter and non-linear spatial filter.
2. Explain Histogram processing, Histogram Equalization.
3. Explain the types of Spatial Filtering.
4. Explain the Geometric Transformations used in image restoration.
5. Write a note on: Point operation, mask operation, global operation.
6. Explain brightness modification and contrast adjustment
7. Explain the Linear gray level Transformations.
8. Perform Histogram Equalization of given image

$$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$$

9. Explain the Non-Linear gray level Transformations.
10. Explain in brief types of smoothing filters.
11. Explain in brief types of sharpening filters
12. Compute median of following image using 3x3 mask.

$$\begin{bmatrix} 18 & 22 & 33 & 25 & 32 & 24 \\ 34 & 128 & 24 & 172 & 26 & 23 \\ 22 & 19 & 32 & 31 & 28 & 26 \end{bmatrix}$$

13. For the one-dimensional function $f(x)$, given below. Using modified cubic interpolation, find out the value at location $x = 6.3$.

x	1	2	3	4	5	6	7	8	9	10
F(X)	1.5	2.5	3	2.5	3	2.4	1	2.5	1	2.4

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15. Write a note Pseudo colouring

UNIT – 6: Image Restoration

1. Write a note on Wiener Filtering.
2. Describe homomorphic filtering
3. Explain the different Noise Distribution in detail.
4. Why the restoration is called as unconstrained restoration?
5. Discuss different mean filters
6. Draw the degradation model and explain.
7. Write short notes on Wiener Filtering.
8. Explain constrained least square filter.
9. Explain in brief iterative method of image restoration
10. Explain in brief stochastic method of image restoration
11. Write note on rank order filter and explain any two methods.
12. Write note on performance metrics used in image restoration.
13. Explain in brief Blind convolution and explain any two methods of Blind convolution.
14. A blur filter is given by

$$\begin{bmatrix} 0 & 0.1 & 0.1 & 0 \\ 0.1 & 0.1 & 0.1 & 0.1 \\ 0.05 & 0.1 & 0.1 & 0.05 \\ 0 & 0.05 & 0.05 & 0 \end{bmatrix}$$

- I. Find deblur filter using inverse filter approach
- II. Find deblur filter using pseudo inverse filter with $\epsilon=0.05$
- III. Find deblur filter using pseudo inverse filter with $\epsilon=0.2$