Digital Image Processing Question Bank

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Digital image processing Question Bank

NPTEL Certification Exam Preparation

WEEk -1

1. What is the number of bits required to store a 100 × 100 grayscale image with 60 gray levels?
2. In frequency domain, what is the equivalent operation of product of two functions, $-x(t)$ and $y(-t)$ in spatial domain?
3. A cosine wave of frequency 50 Hertz is sampled at sampling frequency of 80 Hertz, Is it possible to recover the signal?
4. What is the sampling frequency less than Nyquist rate called?
5. A physical colored image of width = 1 inch and height =2 inches is scanned at 600 dpi. What will be the size (Rows × Columns) of digital image in pixels?
6. What will be the value of delta function, $\int f(t-2)\delta(t-2)dt$ $+\infty$ $-\infty$?
7. Redundancy in Digital image implies?
8. Which of the following should be used for filling gaps in digital image that results from operations like zooming, shrinking, rotation etc?
9. Assuming that a $5m$ high structure is observed from a distance of $10m$. What is the size of image in a pin-hole camera? Assume that the distance between the lens and imaging plane is $10mm$.
10. Which of the following is not studied under Digital Image Processing?
11. Low pass filters are used for image

    a) resizing
    b) smoothing
    c) sharpening
    d) blurring

    // b
12. _____ number of Bytes are required to store a 512 X 512 image with 256 gray levels

    a) 2097152
    b) 1048576
    c) 294912
    d) 262144
13. What effect is caused by under sampling

    a) summation
    b) smoothing
    c) sharpening
    d) aliasing

    //d

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14. Unit impulse at every point other than 0 is

a) 0
b) undefined
c) infinity
d) 1

//a

15. The process of extracting information from the image is called as

a) Image compression
b) Image restoration
c) Image enhancement
d) Image Analysis

//d

16. Assuming that a 10m high structure is observed from a distance of 20m. What is the size of image in a pin hole camera? Assume that the distance between the lens and imaging plane is 17mm.

a. 8.5 mm
b. 34 mm
c. 0.118 mm
d. 34 cm

//a

17. An image is 240 pixels wide and 240 pixels high. The image was scanned at 600 dpi. What will be the physical size of the image?

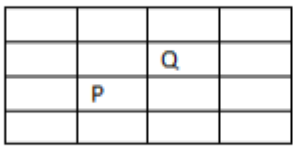
a. 17 cm x 17 cm
b. 0.4 cm x 0.4 cm
c. 0.4 inches x 0.4 inches
d. 17 inches x 17 inches

//c

WEEK -2

18. A physical Image of dimension 1.5 $inches$ × 2 $inches$ is scanned at 400 PPI (Pixel per inch) in grayscale mode. If every pixel is digitized using 8 bits and the digital image pixel array with data compression ratio of 2/1 is to be transmitted over a communication channel in 0.5 second, what is the minimum bandwidth requirement of the channel?

19. Which of the following option is true?



1) $Q \in N_4(P)$ 2) $Q \in N_8(P)$ 3) $Q \in N_D(P)$

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20. Which of the following is always True?
    a) Chessboard distance > City block distance > Euclidean
    b) Chessboard distance < City block distance < Euclidean
    c) Chessboard distance < Euclidean < City block distance
    d) $None\ of\ above$
21. Consider an 2-D point [2, 4]T . Perform a scaling operation (S) in x-axis by 0.5 units and in yaxis by 2 units. What will be the output
22. What does the following matrix do?

$$T = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

    a) Reflects a point over mirror placed at xz-plane
    b) Reflects a point over mirror placed at yz-plane
    c) Rotation of a point about y-axis
    d) None of above
23. Consider the following two binary images

$$f1 = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{pmatrix} \text{ and } f2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}.$$

    The Boolean operation **OR** and **AND** of images are given by $f1 \oplus f2$ and $f1 \cdot f2$. Assume both the images are of the 8-bit integer type.
24. Consider a 2D point $[1,1]^T$ in a continuous image. The point is rotated by 45 ° in clockwise direction and scaled by 2 both in x-direction and y-direction. The transformed point is given by
    a) $[0, \sqrt{2}]^T$
    b) $[0, 2]^T$
    c) $[2\sqrt{2}, 0]^T$
    d) $[1, \sqrt{2}]^T$
25. Consider the following transformation matrix T:

$$T = \begin{bmatrix} \alpha\cos\theta & -\alpha\sin\theta & 0 \\ \beta\sin\theta & \beta\cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

26. The output of an image sensor takes values between 0.0 and 10.0. If it is quantized by a uniform quantizer with 256 levels, what will be the transition (t_k) and reconstruction level (r_k)?

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27. Perform **only first pass** of connected component labelling algorithm considering 4-connected component labelling in following image and choose the correct option. (labelling starts from label index=1)

1					
	1				
		1			
	1	**1**	**1**		
		1	**1**		
			1	**1**	**1**

28. In formula $g(x,y) = T[f(x,y)]$, T is the

a) Transformed image
b) Transformation vector
c) Transformation theorem
d) Transformation function

//d

29. Speech signal has a bandwidth of 4 KHz. If every sample is digitized using 8 bits and the digital speech is to be transmitted over a communication channel, what is the minimum bandwidth requirement of the channel?

a) 16 Kbps
b) 32 Kbps
c) 64 Kbps
d) 128 Kbps

//c

30. Compute the Euclidean Distance (D_1), City-block Distance (D_2) and Chessboard distance (D_3) for points p and q, where p and q be (3, 2, 3) and (2, 3, 7) respectively. Give answer in the form (D_1, D_2, D_3).

a) $(3\sqrt{2}, 3, 4)$
b) $(3\sqrt{2}, 6, 4)$
c) $(3\sqrt{2}, 4, 3)$
d) $(3\sqrt{3}, 2, 3)$

//b

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31. Consider an image point $[2,2]^T$ in a continuous image. Rotation of the image point around the origin by 45 ° in anticlockwise direction around origin is given by :

a) $[0, 2]^T$
b) $[1, 2.8]^T$
c) $[1, 1.8]^T$
d) $[0, 2.8]^T$

//d

32. Consider an 3-D point $[2,1,1]^T$. Perform a scaling operation (S) in both x-axis and y-axis by 5 units.

a) $[3, 3, 1]^T$
b) $[4, 4, 1]^T$
c) $[10, 5, 1]^T$
d) None of the above

//c

33. Find the value of logical operation XOR for the binary images A and B (A XOR B). Assume 1 to be foreground and 0 to be background pixels.

Image-A

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

Image-B

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

a

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

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34. Find the 2D convolution of the given matrices. (discard padded positions so that final answer will be a 3x3 matrix)

Input

5	8	3
3	2	1
0	9	5

Kernel

-1	-2	-1
0	0	0
1	2	1

-8	-8	-4
9	1	-5
8	8	4

WEEK – 3

35. Given 2 points a ,b in non-standard homogeneous coordinate system,

$$a = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 1 \end{bmatrix}, b = \begin{bmatrix} 5 \\ 10 \\ 15 \\ 5 \end{bmatrix}$$

36. Which of the following transformation matrix corresponds to rotation about x-axis in antiCW direction?

37. How many world points are required to estimate all coefficients of caliberation matrix?

38. For a stereo pair, one camera is shifted along y-axis with respect to other. Imaging plane is XY plane. If B is the baseline between the cameras, λ is the focal length, and $(y_2 - y_1)$ is the disparity along y-axis then which of the following is true?

39. Two identical cameras having focal length of 0.04m are used for stereo imaging. If the camera displacement along X axis is 6.0 cm, left image point corresponding to a world point W is (0.2 mm, 0.4 mm) and the corresponding right image point is (0.4 mm, 0.4 mm), find out the 3-D location of W with respect to a world coordinate system aligned with the coordinate system of the left camera.

40. Which deals with the conversion of three dimensional world co-ordinate to two dimensional image?

41. For standard stereo image pair camera system as discussed in lectures, for a focussed 3D point?

42. For a camera with focal length of 0.10, find out the locus of the points which will be imaged at location (0.25, 0.5) on the Image plane. Assume the camera coordinate system and world coordinate system to be perfectly aligned.

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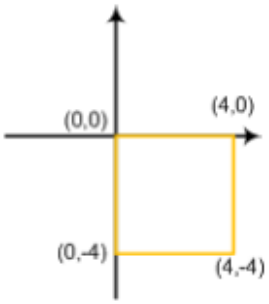
43. The figure below is first scaled by a factor of 0.5 and translated by vector [-1, +1], What is the transformed figure?



44. The figure 1 is first translated by vector [1,- 0.5] and then scaled up by a factor 2, What is the transformed figure?

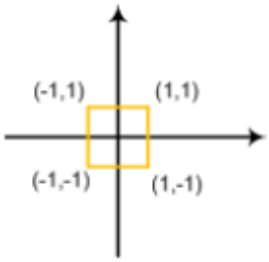


Figure 1

45. For stereo image pair, how does disparity of 3D point varies with object depth?

a) Disparity increases as object depth increases.

b) Disparity decreases as object depth increases.

c) Disparity is independent of object depth.

//b

46. Which is first fundamental step in image processing?

a) Image registration
b) Image acquisition
c) Image enhancement
d) Image restoration

//b

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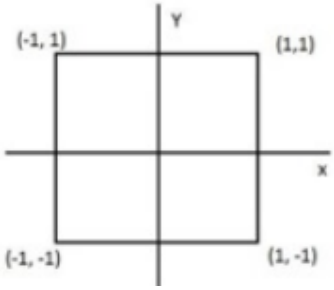
47. Digitizing coordinates of image is called
    a) Sampling
    b) Quantization
    c) Framing
    d) Both A and B

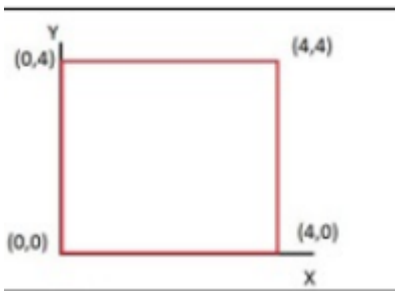
//a

48. How many cameras are required to find 3-D point using image coordinates of camera?
    a) Atleast 1
    b) Atleast 2
    c) Atleast 3
    d) Atleast 4

//b

49. The figure 1 is first scaled up by a factor 2 and then translated by vector [2, 2]. What is the transformed figure?





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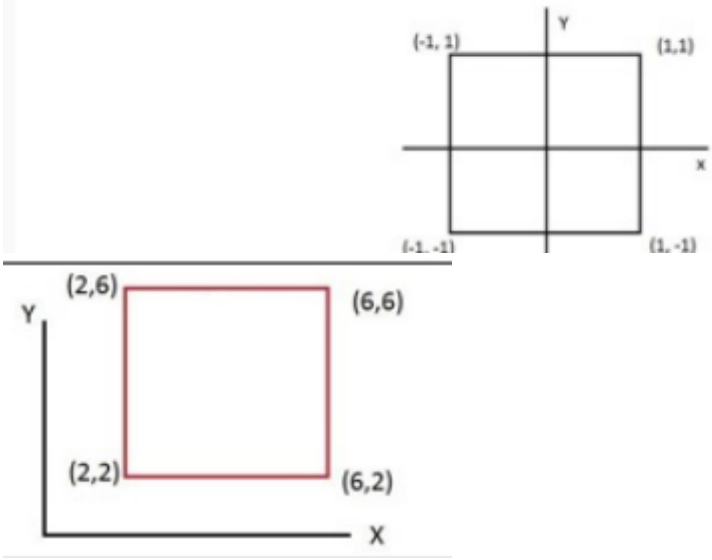
50. The figure 2 is first translated by vector [2, 2] and then scaled up by a factor of 2. What is the transformed figure?



51. For a camera with focal length of 0.05, find out the locus of the points which will be imaged at location (0.3, -0.3) on the Image plane. Assume the camera coordinate system and world coordinate system to be perfectly aligned.

a) $X = 0.1 - 4Z, Y = -0.2 + 6Z$
b) $X = 0.3 - 6Z, Y = -0.3 + 6Z$
c) $X = 0.2 - 4Z, Y = -0.3 + 6Z$
d) $X = 0.2 - 4Z, Y = -+ 0.3 + 7Z$

//b

52. Consider an image point $[2,2]^T$ in a continuous image. Rotation of the image point around the origin by 45 ° in clockwise direction around origin is given by :

a) $[0, 2]^T$
b) $[1, 2.8]^T$
c) $[2.8, 0]^T$
d) $[0, 2.8]^T$

//c

53. A camera with focal length 0.04 m is placed at a height of 1.0 m (distance from pin hole) and is looking vertically downwards to take images of the XY plane. If the size of the image sesnsor plate is 4mm x 3mm, find the area on the XY plane that can be imaged.

a) 1728 mm^2
b) 3456 mm^2
c) 7500 mm^2

//c

WEEK -4

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An image of size 9×9 is given below. What will be the intensity at location $(5.4, 5.6)$ using a modified linear interpolation?

X \ Y	0	1	2	3	4	5	6	7	8
0	20	22	15	18	25	32	16	18	20
1	22	25	28	25	35	32	20	17	15
2	45	35	16	23	44	11	18	24	18
3	35	32	26	46	24	13	25	24	25
4	32	45	23	34	45	43	42	24	16
5	34	45	42	36	27	34	25	27	19
6	43	46	47	34	13	13	24	17	20
7	43	54	34	22	21	35	27	43	29
8	32	43	26	25	27	36	23	56	34

54.

Ans: 25

A one-dimensional function f(t) is given below. What will be the value at location t = 6.3 using modified cubic interpolation?

t	1	2	3	4	5	6	7	8	9	10
f(t)	1.5	2.5	3	2.5	3	2.4	3	2.5	1	2.4

a) 2.65
b) 2.34
c) 2.95
d) 2.58

55.

Ans: 2.65

In what type of Interpolation, the region of support is 1 pixel?

a) Bicubic interpolation
b) Constant interpolation
c) Cubic interpolation
d) Bilinear interpolation

56.

Why is Interpolation having order higher than Cubic interpolation not used?

a) Boundary pixels don't get accurately interpolated since their support from one side is missing
b) Calculating higher order B-Splines is computationally expensive
c) Using higher order B-Splines negates the principle that interpolation should use only local pixels
d) All of the above

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A one-dimensional function f(x) is given below. What will be the value at location x = 5.5 using modified constant interpolation.

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

58.

Ans: 2.40

The correct reason for Quadratic Interpolation not having any symmetry is?

a) Quadratic interpolation has region of support of 3 points
b) Quadratic B-Splines are asymmetric from the center of support
c) Quadratic B-Splines are asymmetric with respect to its control points
d) Both a and c

59.

Statement 1: an interpolation function must have Finite Region of Support.
Statement 2: an interpolation function should have Smooth Interpolation.

a) Statement 1 is True and Statement 2 is False
b) Statement 1 is False and Statement 2 is True
c) Statement 1 is True and Statement 2 is True
d) Statement 1 is False and Statement 2 is False

60.

Which of the following dramatically reduces computation complexity of interpolation with B-spline functions?

a) Higher order B-Spline functions can be computed from lower order B-Spline functions through recursion
b) Interpolation function are shift Invariant
c) Interpolation function have local region of support
d) All of above.

61.

What kind of sampling is required for scaling down (Shrinking) of an image?

a) Under sampling
b) Critical sampling
c) Over sampling
d) Nyquist sampling

62.

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63. The correct reason for modifying B-Spline function ($B_{i,1}(t)$ *to* $B_{i-0.5,1}(t)$ *for constant* $B-$ *Spline,* $B_{i,2}(t)$ *to* $B_{i-1,2}(t)$ *for linear* $B-$ *Spline,* $B_{i,4}(t)$ *to* $B_{i-2,4}(t)$ *for Cubic* $B-$ *Spline*) for interpolation is :

a) To make them shift invariant
b) To remove the bias of considering left pixel contribution in interpolation
c) To estimate higher order B-Spline function from lower order B-Splines
d) All of the above

64. What is the tool used in tasks such as resolution enhancement, image in-painting, image warping, etc.?
a) Sampling
b) Filters
c) Interpolation
d) None of the above
//c

65. Which of the following B-spline is not symmetric and hardly used?
a) Constant
b) Cubic
c) Linear
d) Quadratic
//d

66. What are the desirable properties of an interpolation function?

I. Finite Region of Support.
II. Smooth Interpolation.
III. Shift Invariant

//all

67. _____ B-spline function has maximum region of support
a) Quadratic
b) Cubic
c) Linear
d) Constant
//b

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68. For an image, the type of Interpolation in which the intensity for an unknown location is found by assigning the intensity of the nearest pixel is _____.
a) Bicubic interpolation
b) Cubic interpolation
c) Constant interpolation
d) Bilinear interpolation
//c

69. For an image, the type of Interpolation where the intensity of the four neighboring pixels is used to obtain intensity a new location is called _____.
a) Cubic interpolation
b) Bicubic interpolation
c) Nearest neighbor interpolation
d) Bilinear interpolation
//d

70. Zooming of an image can be viewed as _____
a) Critical sampling
b) Under sampling
c) Over sampling
d) Nyquist sampling
//c

71. 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	2	2.5	1	2.4

//2.30

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72. A 9 x 9 image is as given below. Using a modified linear interpolation, find out the intensity at location (4.3, 3.6).

x \ Y	0	1	2	3	4	5	6	7	8
0	20	22	15	18	25	32	16	18	20
1	22	25	28	25	35	32	20	17	15
2	45	35	16	23	44	11	18	24	18
3	35	32	26	46	24	13	25	24	25
4	32	45	23	34	45	43	42	24	16
5	34	45	42	36	45	34	25	27	19
6	43	46	47	34	13	13	24	17	20
7	43	54	34	22	21	35	27	43	29
8	32	43	26	25	27	36	23	56	34

//40.8

73. Process of using known intensity values to estimate unknown intensity value is called _____.

a) Interpolation
b) Sampling
c) Interchange
d) None of these

//a

WEEK -5

74. Choose the incorrect statement:

a) A unitary Image Transformation transforms an Image of size NxN to coefficients of size NxN.
b) If the transformation is invertible, Knowledge of basis is needed to compute inverse transform.
c) Orthonormal/Orthogonal basis are the most optimal way to represent signals.
d) A non orthonormal/orthogonal basis can be represented as linear combination of orthonormal/orthogonal basis.

//c

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

a) y(n) = {9,12,10,4,1}
b) y(n) = {1,4,10,12,9}
c) y(n) = {9,10,12, 4,1}
d) y(n) = {3,8,8,1,9,4,4}

//b

76. Which of the pair does form an Orthogonal Pair?

a. $e^{j6\omega t}, e^{j2\omega t}$
b. $sin(2\pi ft), cos(2\pi ft)$
c. $sin(2\pi ft), cos(4\pi ft)$
d. All of the above

//d

77. For a given 4×4 image U and 4×4 transformation matrix A, What will be the transformed image V?

$$A = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix} \quad U = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{bmatrix}$$

$$\begin{bmatrix} 34 & -2 & -4 & 0 \\ -8 & 0 & 0 & 0 \\ -16 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

78. Statement 1: DTFT is applied to continuous infinite signals
Statement 2: DTFT is applied to infinite discrete sequences

a) Statement 1 is True and Statement 2 is False
b) Statement 1 is False and Statement 2 is True

//b

79. How does image transformation represent a given image?

a. a linear sum of set of Symmetric Matrices.
b. a linear sum of a set of Unitary Matrices
c. a linear sum of a set of Skew-Symmetric Matrices.

//b

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What will be the Kronecker product $A \otimes A$ of the matrices A?

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

80.

a) $\begin{bmatrix} 1 & 2 & 2 & 4 \\ 3 & 4 & 6 & 8 \\ 3 & 6 & 4 & 8 \\ 9 & 12 & 12 & 16 \end{bmatrix}$

What will be the basis image A_{00} for a given 4×4 transformation matrix A?

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

81.

a) $\frac{1}{4}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

Which of the following can be used as a transformation matrix?

a) $A = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & \omega^1 & \omega^2 & \omega^3 \\ 1 & \omega^2 & \omega^4 & \omega^6 \\ 1 & \omega^3 & \omega^6 & \omega^9 \end{bmatrix}$; $\omega^1 = e^{-j2\pi/4}$

b) $A = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & -\sqrt{2} & \sqrt{2} \end{bmatrix}$

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

82. /all

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Statement 1: The separability of orthogonal transformation matrix reduces the computational complexity from $O(n^4)$ *to* $O(2n^3)$
Statement 2: Orthogonal transformation of Image can be thought of linear summation of set of orthogonal basis images where coefficients of linear summation are estimated by projecting image onto the orthogonal basis images.

a) Statement 1 is True and Statement 2 is False
b) Statement 1 is False and Statement 2 is True
c) Statement 1 is True and Statement 2 is True

83. //c

Find the Kronecker product $\boldsymbol{A} \otimes \boldsymbol{B}$of the matrices A and B as given below

$$A=\begin{bmatrix}1 & 2 & 3\\ 3 & 2 & 1\end{bmatrix}, B=\begin{bmatrix}2 & 1\\ 2 & 3\end{bmatrix}$$

84.

$$\begin{bmatrix}2 & 1 & 4 & 2 & 6 & 3\\ 2 & 3 & 4 & 6 & 6 & 9\\ 6 & 3 & 4 & 2 & 2 & 1\\ 6 & 9 & 4 & 6 & 2 & 3\end{bmatrix}$$

If **A** is a diagonal matrix, what are its eigenvalues?

a) Eigen values are the inverse of the diagonal elements
b) All eigen values are same and equal to product of the diagonal elements
c) Each diagonal elements are the Eigen values.

85. //c

Image transformation represents a given image as a series summation of a set of _____.

a. Symmetric Matrices.
b. Skew-Symmetric Matrices.
c. Unitary Matrices

86. //c

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87. DFT is applied to
    a. Infinite sequences
    b. Finite discrete sequence
    c. Continuous infinite signals
    d. Continuous finite sequences

//b

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

$$A = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \quad U = \begin{bmatrix} 2 & 7 \\ -8 & 2 \end{bmatrix}$$

89. Which of the following can be used as a transformation matrix?

a) $$A = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & \sqrt{2} & 0 & 0 \\ 0 & 0 & -\sqrt{2} & -\sqrt{2} \end{bmatrix}$$

b) $$A = \frac{1}{2}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & -\sqrt{2} & \sqrt{2} \end{bmatrix}$$

//b

90. Which of the following is an application of convolution?
    a) FIR Filtering
    b) Mean Filtering
    c) Median Filtering
    d) Both a & b

//d

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

a) y(n) = {3,8,3,12,9,4,4}

b) y(n) = {3,8,8,12,9,4,4}

c) y(n) = {9,12,10,16,9,4,4}

d) y(n) = {3,8,8,1,9,4,4}

//c

92. Given that $W_N^n = e^{-j\frac{2\pi}{N}n}$, where N =8 and $F = W_N^4$. Find the value of F.

a) 0
b) -1
c) 1
d) e

//b

WEEK - 12

93. Write some Applications of segmentation?
Ans: Detection of similar regions
Detection of lines and edges in an image

94. What are the major point of interest in discontinuity based segmentation algorithms?
Isolated points
Lines
Edges

95. A point (1,2) in the Cartesian system is represented in slope-intercept space (m c,) as
m = -c + 2

96. Which of the following are true about Sobel Operator
Perform averaging in vertical direction and differentiation in horizontal direction.

$$, G_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

97. In a given strip assuming necessary zero padding find second order derivative s = 2 2 2 2 2 2 0 0 0 0
Ans: -2 0 0 0 0 -2 2 0 0 0

$$f''(x) = f(x+1) + f(x-1) - 2f(x).$$

98. Give some examples of similarity-based approach in image segmentation?
//Region based segmentation

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99. Which is the segmentation technique is supervised or semi-supervised?
//Region growing

100. Explain Laplacian operator?
// it can be used to find appropriate location of edge using zero crossings.
Sensitive to noise

101. A point in cartesian space is represented in Hough space as
//Straight line

102. Sobel operators are

$$\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

103. Which of the method is **not** related to region based segmentation?

a. Thresholding
b. Merging and splitting
c. Region growing
d. Hough Transform

// d

104. In a given image strip (S), assuming necessary zero-padding find second order derivative

$S = 4 \quad 4 \quad 4 \quad 4 \quad 2 \quad 2 \quad 2 \quad 8 \quad 8 \quad 8$

a.	0	-2	0	-1	-2	0	6	-6	8	8
b.	0	2	0	1	2	1	-6	6	-8	8
c.	2	-1	0	4	8	6	12	14	6	8
d.	-4	0	0	-2	2	0	6	-6	0	-8

//d

105. Which of the following second-order operator is most robust to noise in edge filtering?

a. Sobel operator
b. Laplacian operator
c. Laplacian of Gaussian operator
d. Prewitt operator

// c

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106. _____ is used to extract the most appropriate location of an edge when there is a gradual change in intensity levels.

a. Sobel operator
b. Prewitt operator
c. Laplacian operator
d. All of the above

// c

107. Identify the operator M. Where M= $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix}$

a. Sobel Edge operator
b. Prewitt Edge Operator
c. Gradient Operator
d. Laplacian Operator

// d

Week - 11

108. Which of the following color models is suitable from perception point of view?

a) RGB
b) CMYK
c) HSI
d) All of the above mentioned.

// c

109. Which of the following is/are true for histogram equalization of an RGB image?

a) Apply equalization to RGB independently.
b) Convert to HSI color space and apply equalization to I channel.
c) Apply equalization to one of R, G, B channel.
d) All of the above mentioned.

// b

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110. Match the range of parameters of HSI model?

I.	Hue	(i) 0 - 2π
II.	Saturation	(ii) 0 – 255
III.	Intensity	(iii) 0 – 1

a) I.- (ii), II- (i), III.- (iii)
b) I.- (i), II- (iii), III.- (ii)
c) I.- (iii), II- (i), III.- (ii)
d) None of these

// b

111. Where do we find the spectrum colors in chromaticity diagram?

a) Inside
b) Outside
c) On boundaries
d) All of the above

// c

112. In Chromaticity Diagram which statement(s) is (are) false?

Statement-1: Points on the boundary are fully saturated
Statement-2: As the point moves towards point of equal energy, more white light is added to the colour and becomes less saturated
Statement-3: Saturation at point of equal energy is one

a) Statement-1
b) Statement-2
c) Statement-3
d) All of the above

// c

113. If Red, Green, and Blue have values 150, 125 and 125 respectively then its corresponding normalized values in CMY are

a) C = 0.412, M = 0.510 and Y = 0.510.
b) C = 0.588, M = 0.490 and Y = 0.490.
c) C = 0.510, M = 0.510 and Y = 0.510.
d) C = 0.412, M = 0.510 and Y = 0.490.

// a

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Which of the following expression is correct for conversion of RGB values to saturation of HSI model?

a) $S = 1 - \frac{3}{R+G+B}[\max(R,G,B)]$

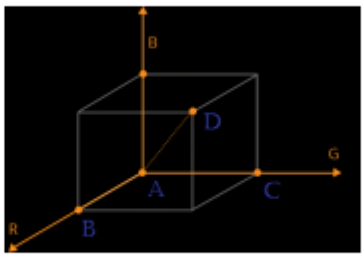
b) $S = 1 + \frac{3}{R+G+B}[\min(R,G,B)]$

c) $S = 1 - \frac{3}{R+G+B}[\min(R,G,B)]$

d) None of these

114.
// c

In the RGB space given below, which of following point indicates black color?



a) A
b) B
c) C
d) D

115.
// a

If Red, Green, and Blue have values 255, 0 and 0 respectively then its corresponding values in HSI are

a) H = π , S = 1 and I = 85

b) H = 0 , S = 1 and I = 85

c) H = π , S = 0.25 and I = 85

d) H = 0 , S = 0.5 and I = 85

116.
// b

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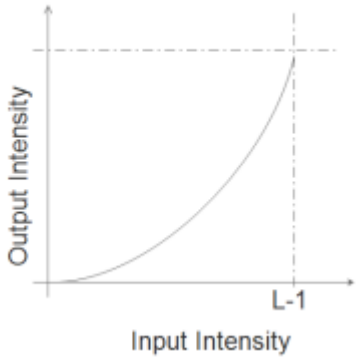
117. Assuming a color image has light tone. What type of transformation should be used to correct tone?

b)



118. Where do we find the spectrum colours in the chromaticity diagram?

a. On boundaries
b. Inside
c. Outside
d. All of the above

// a

119. Which of the following chromaticity coefficients are represented in the chromaticity diagram?

a. Blue and green
b. Red and blue
c. Red and green
d. Magenta and Green

// c

120. If Red, Green, and Blue have values 158, 120 and 98 respectively and maximum intensity in RGB is 255, then its corresponding values in CMY (range 0 to 1) are

a. C = 0.92, M = 0.12 and Y = 0.21
b. C= 0.15, M = 0.19 and Y= 0.97
c. C = 0.17, M = 0.19 and Y = 0. 97
d. C = 0.38, M = 0.53 and Y = 0.62

// d

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Which of the following is a correct transformation for hue in the HSI model from the RGB model?

121.

a)	$H = \begin{cases} \theta & \text{if } B \le G \\ 360^\circ - \theta & \text{if } B > G \end{cases}$ $\theta = \cos^{-1}\left(\frac{(R-G)+(R-B)}{2\sqrt{(R-G)^2+(R-B)(G-B)}}\right)$

122. Which of the following colours are pigment colour primaries?

a. Magenta, Cyan, and Yellow
b. Red, Green, and Blue
c. Red, Green, and Cyan
d. Red, Yellow, and Cyan

// a

123. _____ is used to highlight a specific range of colours in an image to separate objects from surroundings

a. Colour equalization
b. Cutting
c. Colour slicing
d. Colour enhancement

// c

Week - 10

A non-linear position invariant system holds which of the following properties?

a) Superposition

b) Additivity

c) Shift-invariance

d) All of the above

124.
// c

In which of the following restoration techniques, noise parameters estimation is required?

a) Constrained least square filtering

b) Weiner filtering

125.
// a

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126. Which of the following filter can be used for removing periodic noise?

a) Low pass filter
b) Band pass filter
c) High pass filter
d) Band reject filter

// d

127. In which of the following application(s), image registration is used.

a) Template Matching
b) Mosaicing
c) Image Fusion
d) All of these

// d

128. Which of the following the most suitable metric is for match or mismatch measure in template matching?

a) Sum of squared difference.
b) Cross co-relation
c) Normalised cross-correlation
d) None of these

// c

129. Assume the degradation model for atmospheric turbulence is defined in frequency domain as $H(u,v) = e^{-K(u^2+v^2)5/6}$. If the value of K is decreased, then atmospheric turbulence _____.

a) Decreases
b) Remains constant
c) Increases
d) None of these

// a

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In Minimum Mean Square Error Filtering,

Statement 1: Both the degradation function and statistical characteristics of noise are considered for restoration

Statement 2: Both the image and noise are considered as deterministic processes and objective is to find an estimate

a) Statement 1 is True; Statement 2 is False
b) Statement 1 is True; Statement 2 is True
c) Statement 1 is False; Statement 2 is True
d) Statement 1 is False; Statement 2 is False

130.
// a

For an image F and a template T as shown below, determine the center location (x,y) of the template T in F at its best matched position.

T=

3	4	2
5	2	4
3	5	9

F =

x \ y	0	1	2	3	4
0	7	9	4	3	2
1	8	3	5	2	3
2	8	4	3	5	9
3	6	3	5	4	2
4	7	5	4	9	1

a) (3, 1)

b) (2, 2)

c) (3, 3)

d) (1, 3)

131.
// d

Which of the following statement(s) is (are) true?

Statement 1: The drawback of Wiener filter is that constant approximation of a ratio of power spectra is not always suitable

Statement 2: In constraint least square filtering using Iterative Selection of Gamma requires knowledge of mean and variance of noise

132.
// both true

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133. The homogeneity and additivity properties together are called the _____

a) Sharpening Property
b) Superposition Property
c) Spike noise Property
d) Restoration Property

//b

134. _____ is the process of aligning two or more images of the same scene.

a) Image restoration
b) Image Segmentation
c) Image registration
d) None of the above

// c

135. _____ is the operation of taking a corrupt/noisy image and estimating the original image.

a) Image Registration
b) Image Restoration
c) Image Mosaicing
d) Image Fusion

// b

136. A linear position variant system holds which of the following properties?

a) Homogeneity
b) Superposition
c) Additivity
d) All of the above

// d

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Which of the following function satisfy linearity property?

a. $x = 4t + 5$
b. $x(z) = \frac{dt(z)}{dz}$
c. $x = 2t^3 + 3$
d. None of the above

137. // b

Which of the following is (are) true regarding Gaussian Low Pass Filter?

Statement 1: Gaussian Low Pass Filter does not produce ringing effect.
Statement 2: Gaussian Low Pass Filter completely stopped all the frequency above the cut off frequency.

a. Statement 1
b. Statement 2
c. Statement 1 and 2
d. None of the Statement

138. // a

Which of the following corresponds to Gaussian high pass filter?

139.

c. $H(u,v) = 1 - e^{-D2(u,v)/2D_o^2}$

In case of inverse filtering, if the cut off frequency is significantly high then which of the following is true?

a. Restored image becomes blurry
b. Restored image close to original image
c. Noise in restored image dominates

140. // c

Which of the following true regarding Butterworth Low Pass Filter.

Statement 1: If we increase the rank than it behaves more like an ideal low filter.

Statement 2: If we increase the rank than output exhibits ringing artifacts.

a. Statement 1
b. Statement 2
c. Both statement 1 and 2
d. None of the Statement is true.

141. // c

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142. Which of the following filter does not produce ringing effect?

a. Ideal low pass filter
b. Gaussian Low Pass Filter
c. Low Pass Butterworth Filter of very high order
d. All of the above

// b

143. Which of the following fact is true with respect to a low pass filter?

a. The smaller the cut off frequency of a filter results in increased blurring
b. The smaller the cut off frequency of a filter results in increased blurring
c. Blurring is independent of cutoff frequency.
d. Both a and b

// a

144. In which of the following filter, the intensity at a particular point in the image, is a product of two terms, one is the illumination term, other one is the reflectance term is assumed?

a. Homomorphic filter
b. Laplacian filter
c. High Boost filter
d. Gaussian filter

// a

145. In which of the following method estimation of degradation function is required?

a. Image restoration
b. Image enhancement
c. Both a and b
d. None of the above

//a

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The following equation corresponds to a filter, $H(u,v) = \frac{1}{1+\left[\frac{D_o}{D(u,v)}\right]^{2n}}$

Where, n is a positive integer, D_o is cut-off frequency, which of the following is true?

a. There is a ringing effect for higher value of n

b. There is no ringing effect for higher value of n

c. Ringing effect in independent of n

146.
// a

The following equation corresponds to which of the following filter

$$H(u,v) = \frac{1}{1+\left[\frac{D_o}{D(u,v)}\right]^{2n}}$$

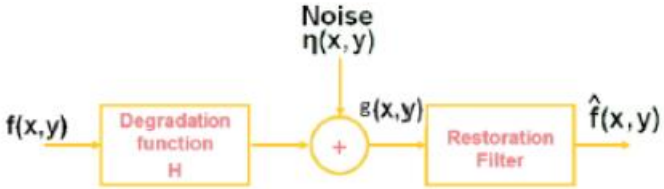
Where, n is a positive integer, D_o is cut-off frequency

a) Gaussian High Pass Filter
b) Butterworth Low Pass Filter
c) Gaussian Low Pass Filter
d) Butterworth High Pass Filter

147.
// d

Which of the following statements is (are) true?

Statement 1: f(x, y) cannot be reconstructed by using $f(x,y) = H^{-1}(g(x,y) - \eta(x,y))$ in degradation model because it requires a solution to a large number of simultaneous linear equations.



Statement 2: Actual degradation function is seldom known completely during image restoration.

148.
// both true

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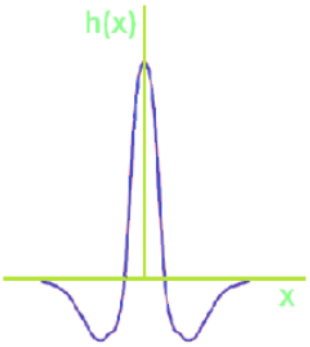
149. What is the characteristic of the spatial domain filter given in following figure?



a) Low Pass Filter
b) High Pass Filter
c) Band Pass Filter
d) None of the above

//b

I.	Butterworth low pass filter	(i) $H(u,v)=\begin{cases}1 & \text{if } D(u,v)\le D_0\\ 0 & \text{if } D(u,v)>D_0\end{cases}$
II.	Gaussian high pass filter	(ii) $H(u,v)=e^{-D^2(u,v)/2D_0^2}$
III.	Ideal low pass filter	(iii) $H(u,v)=\frac{1}{1+[D(u,v)/D_0]^{2n}}$
IV.	Gaussian low pass filter	(iv) $H(u,v)=1-e^{-D^2(u,v)/2D_0^2}$

150.
a. I - (i), II – (ii), III – (iii), IV – (iv)
b. I - (iii), II – (iv), III – (i), IV – (ii)

// b

151. Which of the following is/are principal ways to estimate the degradation function?

a) By observation
b) By experimentation
c) By mathematical modelling
d) All of the above

// d

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152. Which of the following fact is true in relation to low pass filter?
a) The narrower the frequency domain bandwidth, filter results in increased blurring
b) The wider the frequency domain bandwidth, filter results in increased blurring
c) The narrower the frequency domain bandwidth, filter results in decreased blurring

// a

153. To set the average value of an image zero, which of the following term would be set 0 in the frequency domain, where F(u, v) is Fourier transformed function of f(x, y)?
a) F(0, 1)
b) F(1, 0)
c) F(0, 0)
d) All of the above

// c

154. What is the relationship between High Pass Filter and Low Pass Filter in 2-D Frequency Domain?
a) $H_{hpf}(u,v) = 1 - H_{lpf}(u,v)$
b) $H_{hpf}(u,v) = 1 + H_{lpf}(u,v)$
c) $H_{hpf}(u,v) = 1 - H_{lpf}{}^{2}(u,v)$
d) Both b and c.

// a

week – 8

155. Which of the following is/are true for histogram of an image?

I. It represents the distribution of intensity values in an image.
II. It represents global appearance of an image.
III. Two different images may have same histogram.

a) Only I
b) Only I and II
c) Only I and III
d) All I, II and III

// d

156. Which of the following is the first derivative operator?

// sobel

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157. Which of the filter can be used to obtain horizontal edges in an image?

a) $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$

158. _____ filter is used to emphasize high frequency components representing the image details without eliminating low frequency components representing the basic form of the signal.

a) Low Pass Filter

b) High-Pass Filter

c) High-Boost Filter

d) Median Filter

// c

159. Sum of all components in normalized histogram is equal to

// 1

160. Do histogram equalisation on the following image which has 8 discrete pixel levels (0 - 7), transforming it into a histogram equalised image also with 8 discrete grey levels in the range (0-7).

```
1 1 1 1 1 1 1 1
0 2 5 5 5 5 2 0
0 3 2 6 7 2 3 0
0 3 3 2 2 3 3 0
0 2 3 2 2 3 3 0
0 3 2 4 4 2 4 0
0 2 6 4 4 4 2 0
1 1 1 1 1 1 1 1
```

```
3 3 3 3 3 3 3 3
1 4 7 7 7 7 4 1
1 6 4 7 7 4 6 1
1 4 6 4 4 6 6 1
1 6 4 6 6 4 6 1
1 4 7 6 6 6 4 1
3 3 3 3 3 3 3 3
```

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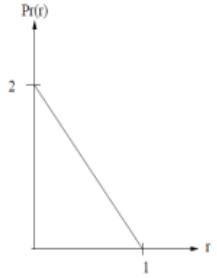
An image has the gray level Probability Distribution Function (PDF - or gray level histogram normalised by number of pixels) of Pr(r) shown below.



Find the pixel transformation y = g(r) such that after transformation the image has a flat PDF, i.e. which accomplishes histogram equalisation. Assume continuous variables r,y.

a) $2 - r$
b) $2 - 2r$
c) $2r - r^2$

161. // c

Which of the following is a non-linear technique?

a) Linear smoothing filter
b) Median Filter
c) Box filter
d) None of the mentioned.

162. // b

Perform histogram equalization of the following Image. Assume maximum intensity to be 7.

$$\begin{pmatrix} 3 & 3 & 5 \\ 4 & 4 & 3 \\ 5 & 2 & 2 \end{pmatrix}$$

163.

b) $\begin{pmatrix} 4 & 4 & 7 \\ 6 & 6 & 4 \\ 7 & 2 & 2 \end{pmatrix}$

Laplacian operator can be used for which of the following operations?

a) Contrast Adjustment
b) Edge detection
c) Image Averaging
d) All of the above

164. //b

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165. Histogram Equalisation is mainly used for which of the following purpose?
a) Smoothing of Images
b) Blurring of Images
c) Enhancement of Images
d) All of the above
//c

166. Which of the following is a second-order derivative operator?
a) Prewitt
b) Laplacian
c) Sobel
d) All of the above
//b

167. Histogram Matching is also called as _____.
a) Histogram Equalisation
b) Contrast Stretching
c) Histogram Specification
d) None of the Above
//c

168. What is accepting or rejecting of certain frequency components in an image called as?
a) Contrast stretching
b) Intensity stretching
c) Filtering
d) None of the Above
//c

169. In _____ image we notice that the components of histogram are concentrated on the higher side on intensity scale :
a) bright
b) dark
c) colourful
d) All of the Mentioned
// a

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Sobel and Prewitt operators are used for which of the following operations?

a) Contrast Adjustment
b) Edge detection
c) Image Averaging
d) All of the above

170. // b

The transformation s = T(r) producing a gray level s for each pixel value r of input image. Then, if the T(r) is monotonically increasing in interval $0 \le r \le 1$, what does it signifies?

a) It guarantees the existence of inverse transformation
b) It guarantees that the output gray level and the input gray level will be in same range.
c) It is needed to restrict producing of some inverted gray levels in output.
d) All of the Above

171. //c

WEEK – 7

Which of the following function cannot be a histogram equalization function.

a) $f(x) = 3^x$
b) $f(x) = 5^{-x}$
c) $f(x) = 2x + 7$
d) $f(x) = \exp(x)$

172. //b

Which process is used to correct the power-law response ?

a) Alpha Correction
b) Gamma correction
c) Luminance Correction

173. // b

174. Log transformation formula is given by

d) $s = c\ log(1 + |r|)$, where c is the scaling constant and r is the input intensity.

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Which of the following is TRUE, for power law transformation?

$$T(r) = cr^{\gamma}$$

Where, c and γ are positive constants and r is the input intensity

a) $\gamma < 1$ =>Narrow range of dark input values is mapped into wider range of values and wide range of high intensity values is mapped into narrow range of values

b) $\gamma > 1$ =>Narrow range of dark input values is mapped into wider range of values and wide range of high intensity values is mapped into narrow range of values

c) $\gamma < 1$ =>Narrow range of dark input values is mapped into narrow range of values and wide range of high intensity values is mapped into wider range of values

175.
// a

176. For decoding a KL transformed image at the receiver side, we require
both transformed image and transformed matrix

Which of the following statement is (are) TRUE for KL Transform?

I. No fast computational algorithms are available for its implementation.
II. Transformation matrix is image independent.
III. KL Transform is optimum in the sense that it minimizes mean square error between $\boldsymbol{x}$ and $\hat{\boldsymbol{x}}$, where $\boldsymbol{x}$ is the original vector and $\hat{\boldsymbol{x}}$ is the reconstructed vector.
IV. Only transformed matrix is sufficient for inverse K-L transform at receiver.

a) Only I
b) Only I, III
c) Only I, II, IV
d) Only I, II and III

177.
//b

For the following vectors, find the transformation matrix A, for K-L transform

$\begin{pmatrix}1\\1\end{pmatrix}, \begin{pmatrix}3\\0\end{pmatrix}, \begin{pmatrix}3\\2\end{pmatrix}$ and $\begin{pmatrix}5\\1\end{pmatrix}$,

178.

c) $A = \begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$

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179. Which of the following can result in forming low contrast image?

a) Poor illumination of the scene to be photographed.
b) Lack of dynamic range of imaging sensor used for image aquisition.
c) Wrong setting of lens aperture during image acquisition.
d) All of the above

//d

180. For the following vectors, find the transformation matrix A, for K-L transform.
$\begin{pmatrix}1\\6\end{pmatrix},\begin{pmatrix}2\\7\end{pmatrix},\begin{pmatrix}3\\8\end{pmatrix},\begin{pmatrix}4\\9\end{pmatrix}$ and $\begin{pmatrix}5\\10\end{pmatrix}$.

a) $A = \begin{pmatrix}1 & 1\\1 & -1\end{pmatrix}$

181. Which of the following are true about Image Negative in image enhancement operation?

i. Image Negative operation produces image equivalent to a photographic negative.
ii. It is used to increase the dynamic range of gray levels images.
iii. S = T(r) = L-r -1.

// 1 & 3

182. Process that increases the dynamic range of Grey levels in an image is called _____.

a) Linear stretching
b) Contrast stretching
c) Contrast matching
d) All of these.

//b

183. Despite KL Transform's favourable theoretical properties, the KLT is not used in practice for which of the following reasons?

i. Its basis functions depend on the covariance matrix of the image, and hence they have to recomputed and transmitted for every image.
ii. There are no fast computational algorithms for its implementation.

// both

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184. Which of the following statement is (are) TRUE for KL Transform?

i. KL Transform kernel in is not fixed unlike in other transforms.
ii. Covariance matrix of the vector population is not real and symmetric.
iii. KL Transform is optimum in the sense that it minimizes mean square error between $\boldsymbol{x}$ and $\hat{\boldsymbol{x}}$, where $\boldsymbol{x}$ is the original vector and $\hat{\boldsymbol{x}}$ is the reconstructed vector.
iv. KL Transform kernel is based on statistical properties of vector representation of image.

// 1,3,4

185. Which of the following matrix's eigen values is used to compute the transformation matrix in K L Transform?

a) Input matrix
b) Covariance matrix
c) Transformed matrix
d) None of the above.

//b

WEEK - 6

186. The time complexity of Fast Fourier Transform for an N x N image is:

a) $O(N^3)$
b) $O(N^2 \log_2 N)$
c) $O(N^3 \log_2 N)$
d) None of the above

//b

187. Choose the most correct option

a) An N point DFT, and N point inverse DFT both have period of N
b) Both DFT and IDFT are sepearable unitary transform
c) The recursive seperability of DFT makes it faster to compute, also known as FFT
d) All of above statements are correct

// d

188. Which of the following is **not** a Unitary transformation?

a) Discrete Walsh Transform (DWT)
b) Discrete Fourier Transform (DFT)
c) KL Transform
d) None of the above

//d

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189. Which of the following the property(ies) is (are) used for centering and better visualization of two-dimension Discrete Fourier transform coefficients?

a) Translation property
b) Separability
c) Periodicity
d) Energy compactness

//a

190. Which of the following transforms is preferred for its low cost hardware implementation?

a) Fast Walsh/Hadamard transform
b) DCT
c) FFT
d) KL Transform

//a

191. Which of the following transforms is preferred for compressed storage of Images on computer with moderate compute power?

a) Fast Walsh/Hadamard transform
b) DCT
c) FFT
d) KL Transform

//b

192. Which of the following corresponds to 4x4 hadamard matrix?

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

193. Which of the following transforms have exactly same basis images as that of walsh transform (ignore the order of basis images)?

a) Hadamard Transform
b) KL transform
c) DCT
d) Ordered Hadamard Transform

//d

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194. Which of the following transforms have highest representative power and is preferred on servers with high compute power?

a) Fast Walsh/Hadamard transform
b) DCT
c) FFT
d) KL Transform

//d

195. Which of the following recursive relation is used to obtain higher order Hadamared transform kernels?

a) $H_{2N} = \begin{bmatrix} H_N & H_N \\ H_N & H_N \end{bmatrix}$

b) $H_{2N} = \begin{bmatrix} H_N & H_N \\ H_N & -H_N \end{bmatrix}$

//b

196. What is the circular convolution of the sequences of $x1\ and x2$, where $x1(n) = x2(n) = \{2,3,1\}$?

a. {1,2,**3**,2,1}
b. {7,7,11}
c. {10,13,13}
d. {1,8,**1**,11,1}

//c

197. Fast Fourier Tranformcan be used to calculate
1) DFT 2) Laplace Transform 3) Direct Z transform 4) In direct Z transform

//1

198. Which of the following statement(s) is(are) true with respect to Hadamard Transform?
1) Forward and Inverse transforms are identical.
2) Hadamard kernels are separable and symmetric.

//both

199. Which of the following is (are) the property(ies) of two dimensional Discrete Fourier transform?
a. Separability
b. Asymmetry
c. Aperiodicity and non-conjugate property
d. All of the above

//a

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200. Discrete cosine transforms (DCTs) express a function or a signal in terms of
   a. Sum of sine and cosine functions oscillating at different frequencies.
   b. Sum of cosine functions oscillating at different frequencies
   c. Sum of sine functions oscillating at different frequencies
   d. All of these

//b

201. Which of the two dimensional transform kernels are separable and symmetric?
   a. Discrete Cosine Transform (DCT)
   b. Discrete Fourier Transform (DFT)
   c. Discrete Walsh Transformation (DWT)
   d. All of the above

//d

202. Which of the following statement is true?
   a. Only DFT is periodic functions and not Inverse DFT
   b. Only Inverse DFT is periodic functions and not DFT
   c. DFT and its inverse are periodic functions
   d. None of the above

//c

203. If $x(n) = x_R(n) + j\, x_I(n)$ is a complex sequence, whose Discrete Time Fourier Transform is can be given by $X(\omega) = X_R(\omega) + j\, X_I(\omega)$, then what is the value of $X_R(\omega)$?
   a. $\sum_{n=0}^{\infty}(x_R(n)\cos(\omega n) - x_I(n)\sin(\omega n))$
   b. $\sum_{n=0}^{\infty}(x_R(n)\cos(\omega n) + x_I(n)\sin(\omega n))$
   c. $\sum_{n=-\infty}^{\infty}(x_R(n)\cos(\omega n) + x_I(n)\sin(\omega n))$
   d. None of these

//c

204. What is the Discrete Fourier transform of the signal $x(n) = a^n u(n), |a| < 1$?
   a. $\frac{1}{1+ae^{-j\Omega}}$
   b. $\frac{1}{1-ae^{j\Omega}}$
   c. $\frac{1}{1-ae^{-j\Omega}}$
   d. None of the above

//d

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205. What is the time complexity of Fast Fourier Transform for an N - point Discrete Fourier Transform?
   a. $O(n^2)$
   b. $O(nlogn)$
   c. $O(log^2 n)$
   d. None of the above

//b

206.