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19
BE CMPN A

DSIP - Assignment Test 1

Q4) Fundamental steps in Digital Image Processing

- Acquisition
- Enhancement
- Restoration
- color image restoration
- Wavelets
- Morphological processing
- Segmentation
- Representation
- Recognition

Outputs are digital images

Outputs are attributes of the images

① Image acquisition is the first process. Generally, the acquisition stage involves preprocessing such as scaling

② Image enhancement is the process of manipulating an image so that the result is more suitable than the original for a specific application

③ Image Restoration is an area that also deals with improving the appearance of an image

④ Color Image processing is an area that has been gaining in importance because of the significant increase in the use of digital images over the Internet

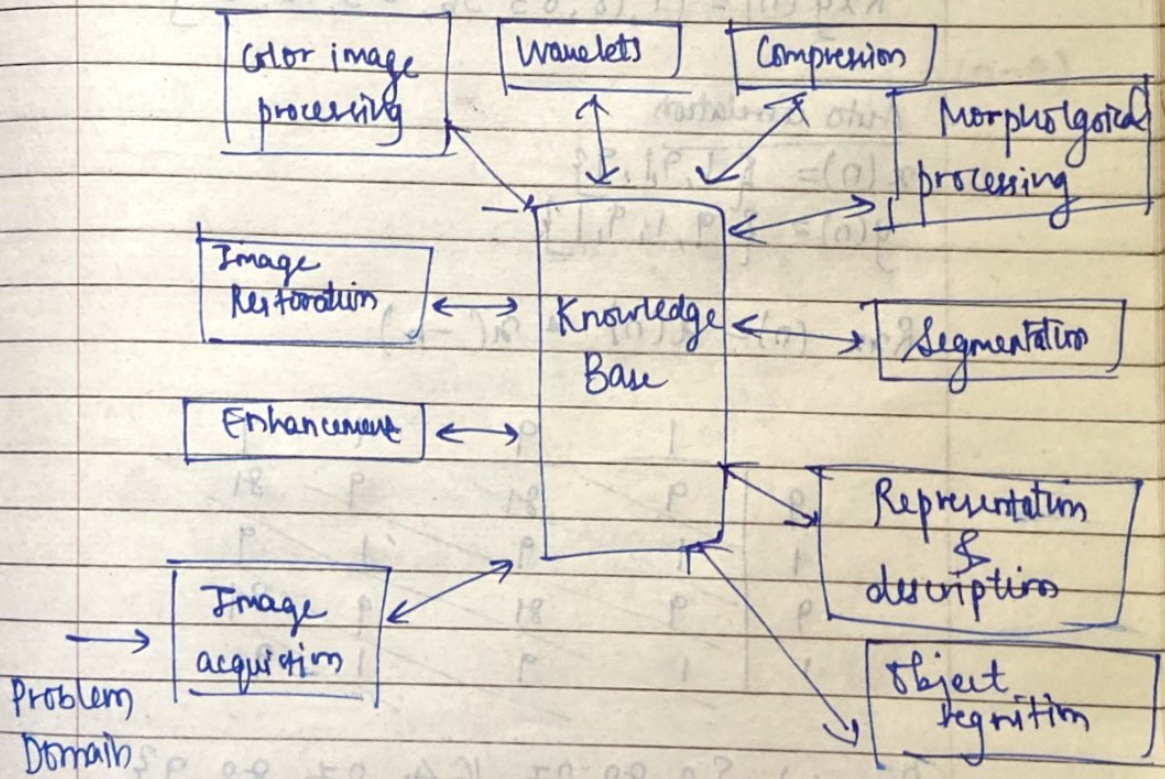
⑤ wavelets are the foundation for representing images in various degrees of resolution

⑥ Morphological processing deals with tools for extracting image components that are useful in the representation and description of shape

⑦ Segmentation produces partition an image into its constituent parts or objects

(8) Representation almost always follows the output of a segmentation stage, which usually is raw pixel data.

(9) Recognition is the process that assigns a label (eg "vehicle") to an object based on its descriptors.



Q2] cross correlation & auto correlation

$x_n = \{1, 9, 1, 9\}$

$y_n = \{9, 1, 9, 1\}$

$y(-n) = \{1, 9, 1, 9\}$

$R_{xy}(n) = x(n) * y(-n)$

	1	9	1	9
1	1	9	1	9
9	9	81	9	81
1	1	9	1	9
9	9	81	9	81

$R_{xy}(n) = \{1, 18, 83, 36, 83, 18, 81\}$

Auto correlation

$x(n) = \{1, 9, 1, 9\}$

$y(n) = \{9, 1, 9, 1\}$

$R_{xx}(n) = x(n) * x(-n)$

	1	9	1	9
9	9	81	9	81
1	1	9	1	9
9	9	81	9	81
1	1	9	1	9

$R_{xx}(n) = \{3, 82, 27, 164, 27, 82, 9\}$

Q1]

① $x_1(n) = (-3)^n$ for $n = 0, 1, 2, 3$

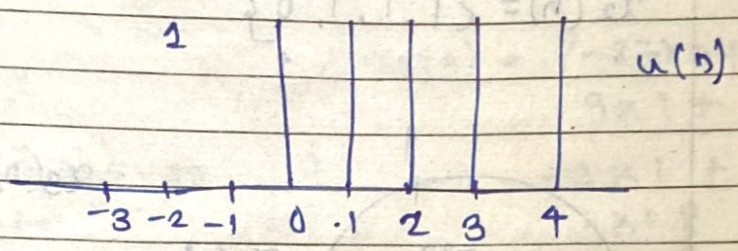
$= 0$ otherwise

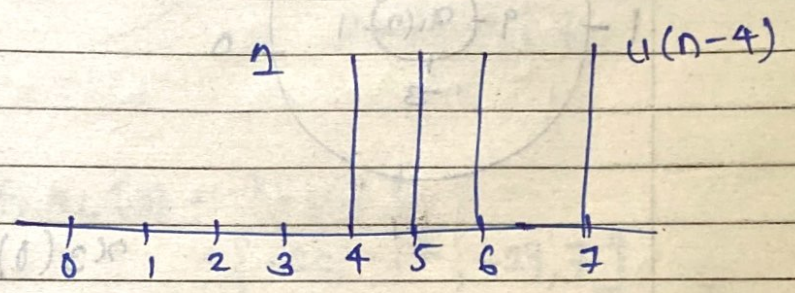
$x_2(n) = U(n) - U(n-4)$

→

$x_1(n) = \{1, -3, 9, -27\}$

$x_2(n)$





$\therefore x_2(n) = \{1, 1, 1, \underset{\uparrow}{0}\}$

① Linear convolution

$y(n) = x_1(n) * x_2(n)$

	1	-3	9	-27
1	1	-3	9	-27
1	1	-3	9	-27
1	1	-3	9	-27
0	0	0	0	0

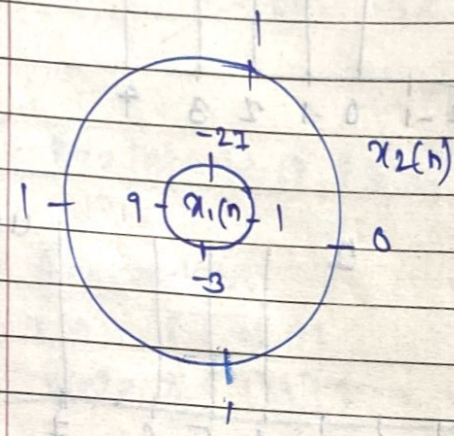
$y(n) = \{1, (1-3), (1-3+9), (0-3+9-27), (0+9-27), (0-27), 0\}$

$= \{1, -2, 7, -21, -18, -27, 0\}$

② Circular convolution

$x_1(n) = \{1, -3, 9, -27\}$

$x_2(n) = \{1, 1, 1, 0\}$

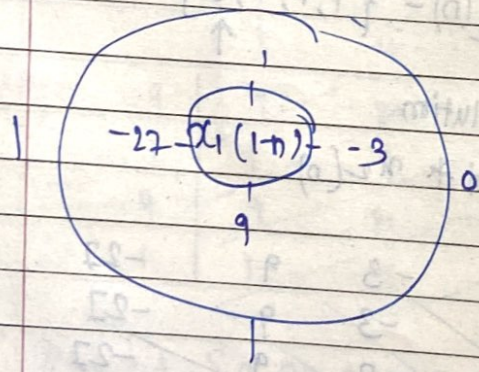


$x_2(n)$

$x_3(n) = x_1(n) \textcircled{+} x_2(n)$

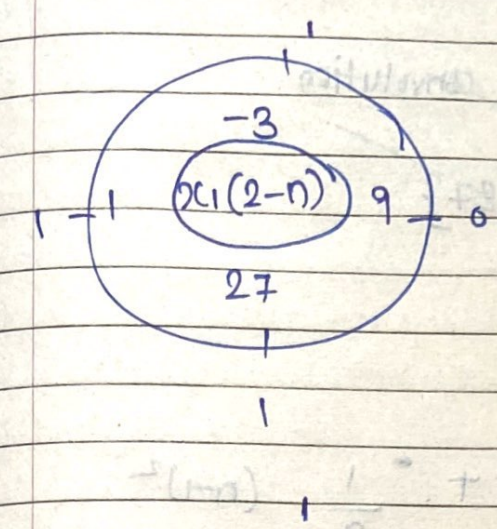
$x_3(0) = \{1\times0 + -27\times1 + 9\times1 + -3\times1\}$

$x_3(0) = \{-20\}$



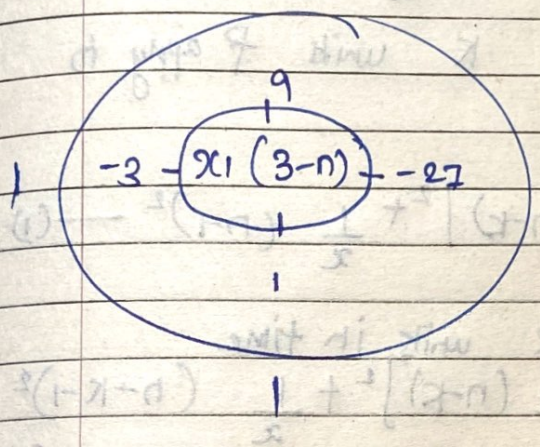
$x_3(1) = \{-3\times0 + 1\times1 + -27\times1 + 9\times1\}$

$= \{-17\}$



$x_3(2) = \{ 9\times0 + 1\times-3 + 1\times1 + -27\times1 \}$

$x_3(2) = \{-29\}$



$x_3(3) = \{-27\times0 + 9\times1 + -3\times1 + 1\times1 \}$

$x_3(3) = \{7\}$

$\therefore x_1(n) \textcircled{+} x_2(n) = x_3(n)$

$= \{-20, -17, -29, 7\}$

Q3] $y(n) = [x(n)]^2 + \frac{1}{x}(n-1)^2$

Delay in i/p by K units & apply to system

$$y(n,k) = [x(n-k)]^2 + \frac{1}{x}(n-1)^2 \quad \text{—(1)}$$

Delay $y(n)$ by K units in time

$$y(n-k) = [x(n-k)]^2 + \frac{1}{x}(n-k-1)^2 \quad \text{—(2)}$$

$$y(n,k) \neq y(n-k)$$

∴ Time variant.

Linear & Non linear systems

Linear → satisfies superposition principle

Superposition principle

$$H\{a_1 x_1(n) + a_2 x_2(n)\} = a_1 H\{x_1(n)\} + a_2 H\{x_2(n)\}$$