

Name : Suraj Samrah

Roll no : CSB18010

Q) What is image filtering

Ans: Image filtering is a technique for modifying or enhancing an image like highlight certain features & remove other features. Image filtering includes smoothing, sharpening and edge enhancement. It may be applied either (a) Spatial domain (b) Frequency domain

(b) Ans:

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

Apply sobel filter at pixel value $f(2,3)$

7	2	4
6	2	3
7	4	4

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

of the pixel value of the output sharpened image at location $f(2,3)$ is

$$f_{\text{new}}(2,3) = 7 \times (-1) + 2 \times 0 + 4 \times 1 + 6 \times (-2) + 2 \times 0 \\ + 3 \times 2 + 7 \times (-1) + 4 \times 0 + 4 \times 1$$

$$f_{\text{new}}(2,3) = -7 + 4 - 12 + 6 - 7 + 4$$

$$\nabla_x f_{\text{new}}(2,3) = -12$$

$$\nabla_x = [-7 + 4 - 4 + 7 + 8 + 4] \\ = 4$$

$$|\nabla| = |\nabla_x| + |\nabla_y| \\ = |4| + |-12| \\ = 16$$

Now we have to add $|\nabla|$ with the previous value $f(2,3)$ to get the filtered value

So the filtered value will be

$$= 16 + 2 = 18$$

2 NOQ:

(a) Ans A color model is a 3-D color coordinate system to produce all range of colors through the primary color set. It is an abstract mathematical model describing the way colors can be represented as tuples of numbers, typically as three or four values of color components.

(b) Ans A color model is necessary because it facilitates the specification of colors in some standard generally accepted way.

3 NO Ans: (a) Ans: Image segmentation is the process of partitioning a digital image into multiple segments (set of pixels). The goal of image segmentation is to represent the image into something that is more meaningful and easier to analyze.

(b) Ans the categorization of different segmentation methods are:

- (i) Thresholding based
- (ii) Edge linking based
- (iii) Region based
- (iv) Clustering based
- (v) ~~Directional~~ Discontinuity based

4 NO Ans

4 NO. Ans

Q. Isolated points :- The mask output of each pixel is computed by centering the mask on the pixel location. The gray level of an isolated point will be very different from its neighbors.

Line :- The mask response for all the points lying on a line will have the same properties thus, with the help of image segmentation, lines are recognized.

5 NO. Ans (a)

5NO Ans

(5)

Q) Ans:

$$f(x) = [10 \ 10 \ 10 \ 10 \ 40 \ 40 \ 40 \ 40 \ 20 \ 20]$$

For first order derivative

$$\frac{\partial f}{\partial x} = f'(x) = f(x+1) - f(x)$$

2nd order derivative

$$\frac{\partial^2 f}{\partial x^2} = f''(x) = f(x+1) + f(x-1) - 2f(x)$$

10 10 10 10 40 40 40 40 20 20

1st order derivative

0 0 0 30 0 0 0 -20 0

2nd order derivative

0 0 30 -30 0 0 -20 20

(b) Location of points on edges can be detected in the points where change in the intensity values is high

In the given image

$f(x) = [10 \ 10 \ 10 \ \downarrow \ 40 \ 40 \ 40 \ 40 \ \downarrow \ 20 \ 20]$
These two points of edges

(6)

6. (a) what is structuring element?

Ans: A structuring element is a matrix that identifies the pixel in the image being processed and defines the neighborhood used in the processing of each pixel.

(b) what is hit or miss transform?

Ans: Hit or miss transform is an operation that detects a given configuration in a binary image. using the morphological erosion operators and a pair of disjoint structuring elements.

(c) Ans the input binary image and structuring elements are shown below

(1) Perform the erosion and dilation of the input image.

(2) Show the result of applying hit or miss transform with structuring element.

6.(c)

(i).

$A =$ Given input image

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

structuring element

$S =$

0	1	0
0	1	0
0	1	1

Centre erosion

After doing

$(A \ominus S)$

\Rightarrow

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

After doing dilation

$$(A \oplus S)$$

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

Q. (c) (ii)
Ans

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