19AD784

IMAGE ANALYSIS AND COMPUTER VISION

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AP/ECE

Tutorial

Calculate the number of bits required to store the following images with value k=3.

(a) 64x 64 image

(b) 1024x 1024 image

What is the distance between pixels in the given image using i) Euclidean distance, ii) City block distance and iii) Chessboard distance

2	2	3	4	2	3
1	3	3	2	2 (p)	3
0	2	0	1	1	2
3	1	3	2	2	4
4	5	6	4	3	2
4	2(q)	3	1	6	2

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- **Euclidean distance** between p and q is defined as

$$D(p,q) = \sqrt{(x-s)^2 + (y-t)^2}$$

- **City-block distance** between p and q is defined as

$$D(p,q) = |x-s| + |y-t|$$

- **Chessboard distance** between p and q is defined as

$$D(p,q) = max(|x-s|, |y-t|)$$

Co-ordinates are p (1, 4) and q (5, 1)

Euclidean Distance = 5

City-block Distance = 7

Chessboard Distance = 4

Convert the following 3x3 image to **6x6** image using nearest neighbor interpolation.

$$\begin{bmatrix} 69 & 50 & 80 \\ 45 & 60 & 66 \\ 30 & 55 & 80 \end{bmatrix}$$

$$\begin{bmatrix} 69 & 50 & 80 \\ 45 & 60 & 66 \\ 30 & 55 & 80 \end{bmatrix} = \begin{bmatrix} 69 & 69 & 50 & 50 & 80 & 80 \\ 45 & 45 & 60 & 60 & 66 & 66 \\ 30 & 30 & 55 & 55 & 80 & 80 \end{bmatrix} = \begin{bmatrix} 69 & 69 & 50 & 50 & 80 & 80 \\ 69 & 69 & 50 & 50 & 80 & 80 \\ 45 & 45 & 60 & 60 & 66 & 66 \\ 45 & 45 & 60 & 60 & 66 & 66 \\ 30 & 30 & 55 & 55 & 80 & 80 \\ 30 & 30 & 55 & 55 & 80 & 80 \end{bmatrix}$$

Original image

image with rows expanded

image with rows and columns expanded

The pixel values of the following 5x5 image are represented by 8-bit integers.

$$f = \begin{bmatrix} 123 & 162 & 200 & 147 & 93 \\ 137 & 157 & 165 & 232 & 189 \\ 151 & 155 & 152 & 141 & 130 \\ 205 & 101 & 100 & 193 & 115 \\ 250 & 50 & 75 & 88 & 100 \end{bmatrix}$$

Determine f with a gray-level resolution of 2^k for (i) k = 5 and (ii) k = 3

Dividing the image by 2 will reduce its gray level resolution by 1 bit.

Hence to reduce the gray level resolution from 8-bit to 5-bit,

8 bits – 5 bits = 3 bits will be reduced

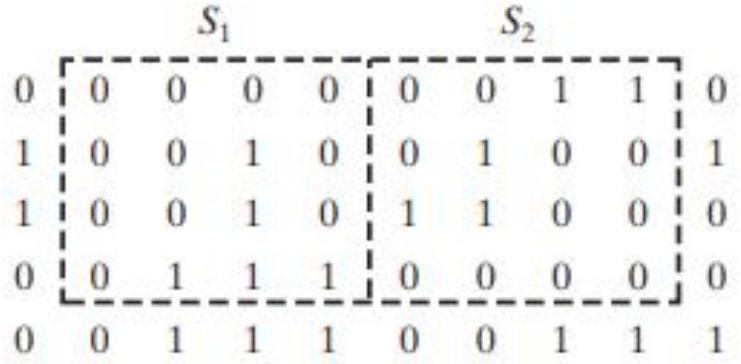
Thus, we divide the 8-bit image by 8 (2^3) to get the following 5-bit image:

$$f = \begin{bmatrix} 15 & 20 & 25 & 18 & 11 \\ 17 & 19 & 20 & 29 & 23 \\ 18 & 19 & 19 & 17 & 16 \\ 25 & 12 & 12 & 24 & 14 \\ 31 & 6 & 9 & 10 & 12 \end{bmatrix}$$

Similarly, to obtain 3-bit image, we divide the 8-bit image by 2^5 (32) to get:

$$f = \begin{bmatrix} 3 & 5 & 6 & 4 & 2 \\ 4 & 4 & 5 & 7 & 5 \\ 4 & 4 & 4 & 4 & 4 \\ 6 & 3 & 3 & 6 & 3 \\ 7 & 1 & 2 & 2 & 3 \end{bmatrix}$$

Consider the two image subsets, S_1 and S_2, shown in the following figure. For V = {1}, determine whether these two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) m-adjacent.



Consider the image segment shown.
(a) Let V = {0, 1} and compute the lengths of the shortest 4-, 8-, and m-path between p and q. If a particular path does not exist between these two points, explain why.
(b) Repeat for V = {1, 2}.

3	1	2	1 (*q*)
2	2	0	2
1	2	1	1
(*p*) 1	0	1	2