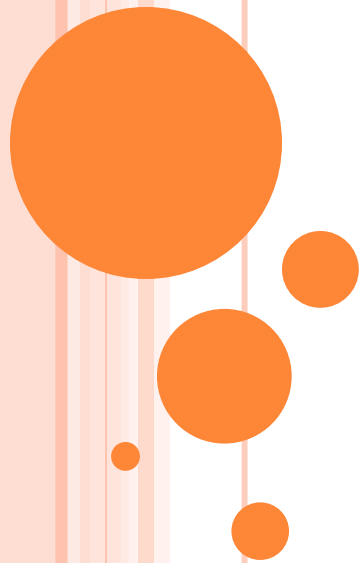


IMAGE PROCESSING

Examples

Ch2 – part 4



EX1/ Apply the median filter on the following sub image using window size (3x3) and write the filtered sub image:

2	0	3	9
1	4	5	1
7	5	8	7
1	1	0	0

2	0	3	9
1	4	5	1
7	5	8	7
1	1	0	0

2	0	3	9
1	4	5	1
7	5	8	7
1	1	0	0

2	0	3	9
1	4	5	1
7	5	8	7
1	1	0	0

Sol./ After apply convolution (Ascending Sort and chose center pixel) to each window (3x3):

0	1	2	3	<u>4</u>	5	5	7	8	→	4
0	1	3	4	<u>5</u>	5	7	8	9	→	5
0	1	1	1	<u>4</u>	5	5	7	8	→	4
0	0	1	1	<u>4</u>	5	5	7	8	→	4

New sub image after apply median filter

0	0	0	0
0	4	5	0
0	4	4	0
0	0	0	0



EX2/ Expand the following sub image using first-order hold:

30	50	70
20	70	60
30	50	70

Where the convolution mask is:

1/4	1/2	1/4
1/2	1	1/2
1/4	1/2	1/4

Sol./ first step : image extended with zeros :

0	0	0	0	0	0	0
0	30	0	50	0	70	0
0	0	0	0	0	0	0
0	20	0	70	0	60	0
0	0	0	0	0	0	0
0	30	0	50	0	70	0
0	0	0	0	0	0	0

0	0	0	0	0	0	0
0	30	40	50	60	70	0
0	25	43	60	63	65	0
0	50	45	70	65	60	0
0	25	43	60	63	65	0
0	30	40	50	60	70	0
0	0	0	0	0	0	0

$1(30) = 30$	$1/2(30) + 1/2(50) = 40$	$1(50) = 50$	$1/2(50) + 1/2(70) = 60$	$1(70) = 70$
$1/2(30) + 1/2(20) = 25$	$1/4(30) + 1/4(50) + 1/4(20) + 1/4(70) = 43(42.5)$	$1/2(50) + 1/2(70) = 60$	$1/4(50) + 1/4(70) + 1/4(70) + 1/4(60) = 63(62.5)$	$1/2(70) + 1/2(60) = 65$
$1(50) = 50$	$1/2(20) + 1/2(70) = 45$	$1(70) = 70$	$1/2(70) + 1/2(60) = 65$	$1(60) = 60$
$1/2(20) + 1/2(30) = 25$	$1/4(20) + 1/4(70) + 1/4(30) + 1/4(50) = 43(42.5)$	$1/2(70) + 1/2(50) = 60$	$1/4(70) + 1/4(60) + 1/4(50) + 1/4(70) = 63(62.5)$	$1/2(60) + 1/2(70) = 65$
$1(30) = 30$	$1/2(30) + 1/2(50) = 40$	$1(50) = 50$	$1/2(50) + 1/2(70) = 60$	$1(70) = 70$

EX3/Enlarge the following sub image to twice its original size using the general method techniques (K-Times method). What is the new dimension of the enlarged sub image?

20	35	20
30	33	13

Sol./ expended with row where k=2

$$35-20 = 15, 15 / 2 = 7.5 (8), 20+(1*8)=28$$

$$35-20 = 15, 15 / 2 = 7.5 (8), 20+(1*8)=28$$

$$33-30=3, 3/2=1.5(2), 30+(1*2)=32$$

$$33-13=20, 20/2=10, 13+(1*10)=23$$

Expended with column

$$30-20=10, 10/2=5, 20+(1*5)=25$$

$$32-28=4, 4/2=2, 28+(1*2)=30$$

$$35-33=2, 2/2=1, 33+(1*1)=34$$

$$28-23=5, 5/2=2.5(3), 23+(1*3)=26$$

$$20-13=7, 7/2=3.5(4), 13+(1*4)=17$$

20	28	35	28	20
25	30	34	26	17
30	32	33	23	13



New dimension of the enlarged sub image = (3x5)

Q/ Apply histogram equalization technique for the following (3-bit) sub image?

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

Gray-level value	0	1	2	3	4	5	6	7
No. of pixel	12	8	9	2	11	3	5	3
Run Sum	12	20	29	31	42	45	50	53
Normalized	12/53	20/53	29/53	31/53	42/53	45/53	50/53	53/53
Multiply by 7	2	3	4	4	6	6	7	7
New Value	2	3	4	4	6	6	7	7