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Semester: 7th
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Image processing (CS703D)
Assignment 1
24/09/18

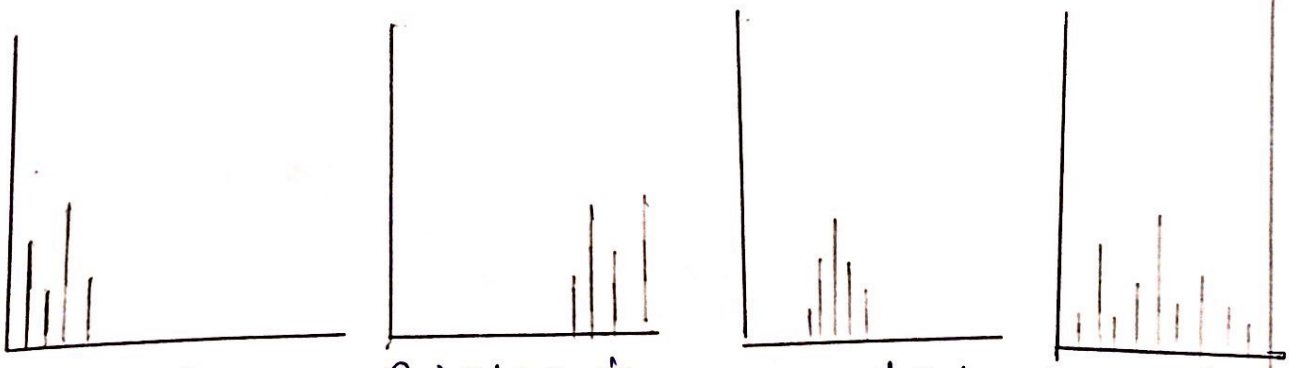
1.a) An image histogram is a graph of pixel intensity (on the x-axis) versus number of pixels (on the y-axis). The x-axis has all the available gray levels, and the y-axis indicates the number of pixels that have a particular gray-level value in the image.

A darker image will have the most of the frequency values in the first half of the histogram.

A brighter image will have the most of the frequency values in the second half (brighter range) of the histogram.

In a low contrast image the range of histogram values will be small.

In a high contrast image there will be a huge spread in histogram values.

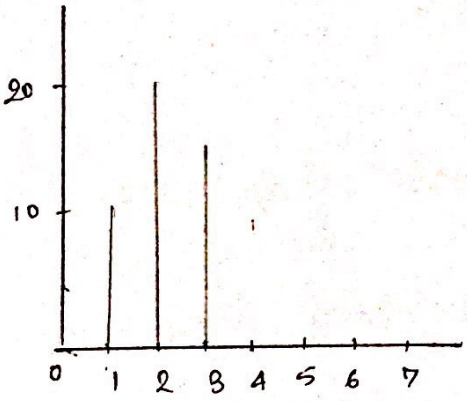


Dark image | Bright image | Low contrast image | High-contrast image

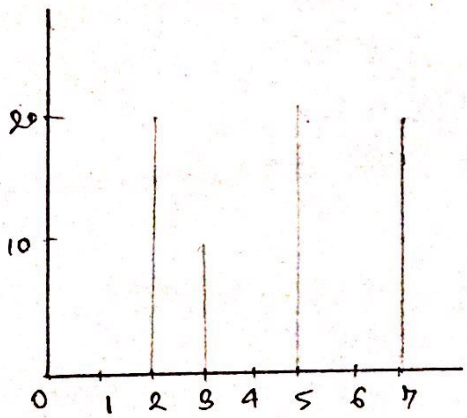
1.b)

Gray level	Number of pixels	Cumulative frequency	Cumulative frequency $\times \frac{L-1}{MN}$	S_k
0	20	20	2	2
1	10	30	3	3
2	22	52	5.2	5
3	18	70	7	7
4	0	70	7	7
5	0	70	7	7
6	0	70	7	7
7	0	70	7	7

where, L-1 (Max. intensity level) = 7
MN (Total no. of pixels) = 70



Input histogram



Output histogram

2.a) A mean filter is used to smoothen an image and reduce gaussian noise by reducing the variation in pixel value from one pixel to the next. The larger the size of the kernel or window, the more pronounced the effect of smoothing is, so it is possible to use a larger windowed filter instead of smaller ones.

2. b) The values of the shaded pixel after applying median filter is as follows:

pixel with intensity 130 → median(10, 20, 30, 35, 130, 80, 20, 20, 30)
→ median(10, 20, 20, 20, 30, 30, 80, 35, 130)
→ 30 (new value)

pixel with intensity 30 → median(20, 30, 25, 80, 30, 170, 20, 30, 30)
→ median(20, 20, 25, 30, 30, 30, 30, 80, 170)
→ 30 (new value)

pixel with intensity 170 → median(30, 25, 80, 30, 170, 25, 80, 30, 25)
→ median(25, 25, 25, 30, 30, 80, 30, 30, 170)
→ 30 (new value)

pixel with intensity 25 → median(25, 80, 20, 30, 25, 20, 30, 25, 25)
→ median(20, 20, 25, 25, 25, 25, 30, 30, 30)
→ 25 (new value)

3. a) The value of the shaded pixels after applying sobel operator are as follows:

pixel with intensity 130 → |-10-40-80+20+40+80|
+ |-10-70-20+30+60+30|
→ |10| + |20| = 30 (new value

pixel with intensity 30 → |-20-60-25+20+60+80|
+ |-20-60-20+25+340+30|
→ |51| + |295| = 300 = 255 (after clipping)

pixel with intensity 170 → |-30-50-30+30+60+25|
+ |-30-510-30+30+50+25|
= |5| + |-465| = 470 = 255 (clipped)

pixel with intensity 25 → |-25-60-20+30+50+25| +
|-25-510-30+20+40+25|
→ |0| + |-480| = 255 (after clipping)

3. b) The values of the shaded pixels after applying unsharp masking are as follows:

Pixel with intensity 130 → $2 * f(x,y) - \bar{f}(x,y) = 2 \times 130 - 36$

→ 224 (new value)

Pixel with intensity 80 → $2 * f(x,y) - \bar{f}(x,y) = 2 \times 80 - 64$

$= -4 = 0$

Pixel with intensity 170 → $2 * f(x,y) - \bar{f}(x,y) = 2 * 170 - 41$

→ 299 = 255

Pixel with intensity 25 → $2 * f(x,y) - \bar{f}(x,y)$

$= 2 * 25 - 57 = 0$