
Histogram Equalization (lec 8)

Is a popular technique for improving the appearance of a poor image. It's a function is similar to that of a histogram stretch but often provides more visually pleasing results a cross a wide rang of images. Histogram equalization is a technique where the histogram of the resultant image is as flat as possible (with histogram stretching the overall shape of the histogram remains the same).

The histogram equalization process for digital images consists of four steps:

1. Find the running sum of the histogram values
2. Normalize the values from step1 by dividing by total number of pixels.
3. Multiply the values from step2 by the maximum gray level value and round.
4. Map the gray-level values to the results from step 3, using a one-to one correspondence. The following example will help to clarify this process.

Example:-

We have an image with 3 bit /pixel, so the possible range of values is 0 to 7.

We have an image with the following histogram:

Gray-level value	0	1	2	3	4	5	6	7
No of Pixel Histogram value	10	8	9	2	14	1	5	2

Step 1: Great a running sum of histogram values. This means that the first values is 10, the second is $10+8=18$, next is $10+8+9=27$, and soon. Here we get 10,18,29,43,44,49,51.

Step 2: Normalize by dividing by total number of pixels. The total number of pixels is $10+8+9+2+14+1+5+2=51$.

Step 3 : Multiply these values by the maximum gray – level values in this case 7 , and then round the result to the closet integer. After this is done we obtain 1,2,4,4,6,6,7,7.

Step 4 : Map the original values to the results from step3 by a one –to one correspondence.

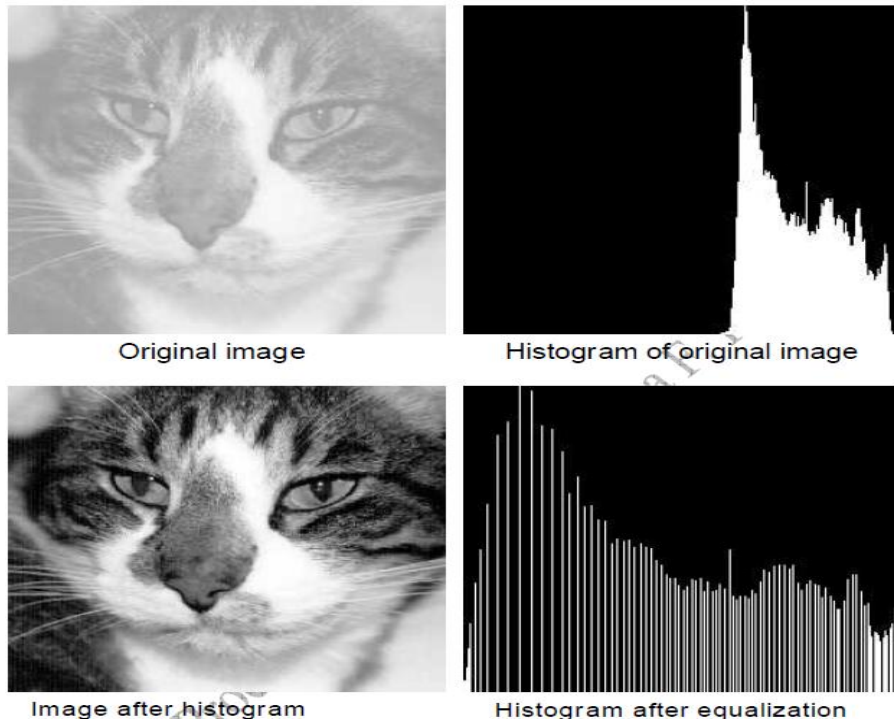
The first three steps:

Gray-level	0	1	2	3	4	5	6
No. of Pixel	10	8	9	2	14	1	5
Run Sum	10	18	27	29	43	44	49
Normalized	10/51	18/51	27/51	29/51	43/51	44/51	49/51
Multiply by 7	1	2	4	4	6	6	7

The fourth step:

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

All pixel in the original image with gray level 0 are set to 1, values of 1 are set to 2, 2 set to 4, 3 set to 4, and so on (see figure (8-1)) histogram equalization, you can see the original histogram and the resulting histogram equalized histogram. Although the result is not flat, it is closer to being flat than the original.



Figurer (8-1): Histogram Equalization.