A Review of Histogram Graph in Digital Image Processing

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Abstract— **A histogram is a graph. A graph that shows frequency of anything. Usually histogram have bars that represent frequency of occurring of data in the whole data set. In an image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. A histogram is a graphical representation of data captured in an image in the form of light. To understand histograms, we first need to understand pixels. 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 available gray levels, and the y-axis indicates the number of pixels that have a particular gray-level value. Multiple gray levels can be combined into groups in order to reduce the number of individual values on the x-axis.**

Keywords—— **Histogram, Pixel, Graph, Intensity.**

I. INTRODUCTION

The histogram shows the graphical presentation on the histogram in the document file that appears on the screen. This means that the amount of pixels of each tone. By capturing a histogram for a particular photo[1], the observer will have the ability to judge the initial tonal transmission. And image histograms are available on a modern computer camera. The takers of the image can use them as a guide to show the transmission of recorded tones and whether the details of the picture are lost for faded functions or for missing shadows.[2] This is less valuable if we design a rough image because the dynamic range of the displayed image simply estimates that in the raw file. The horizontal pivot of the diagram is about the tonal frequencies, while the vertical hub speaks about the exact no. of pixels. The left half of smooth and dark areas speaks of the dark and low areas, central portion shows the medium light areas and right hand side shows lighter and untouched white areas. The vertical ranges show it and region, which are located in the most recent zones. On these lines, the extremely vague image histogram will play a decisive role on the left and center of the graph. On the other hand, the splendid shade areas and the splendid images of shadows in the histogram show much information on the right and center of the chart. Image editors usually have the histogram of the edited image. The histogram reflects the pixel number of the image (vertical axis) with a given brightness (horizontal axis). The digital editing algorithms allow the user visually to adjust the brightness of each pixel and dynamically display the results as a correction.[3] This way, the brightness and contrast of the image can be improved. In computer vision, image histograms can be useful tools for thresholds[4]. Since the information in the graph is the representation of the pixel distribution as a function of the sound change, the image histograms can be analyzed for peaks and / or valleys[5,6]. This threshold can be used to detect edges, image segmentation and cohabitation matrices.

II. EASE OF USES

A normal 8 bit high contrast picture has 255 shades of dark[7]. Truly, that is more than 50.

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Envision the shading white. Presently envision it gradually swinging to dark in 255 stages, and in each progression it continues getting somewhat darker; which means, it needs to get darker 255 times with the goal that the white shading, turns dark
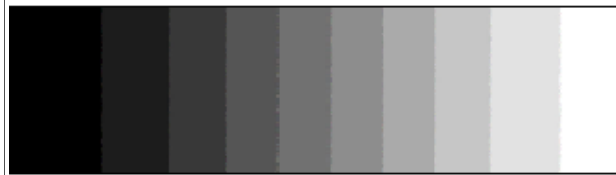

Figure 1 .   Black and White Image

The resolution of this image is 1600X900. That means there are 1,440,000 pixels in this image. Also, the colour of each pixel in this image is one of 255 shades of grey.

III. Pixels

Each picture that shows on a screen is made out of extremely little squares which are not unmistakable to the stripped eye[8]. These squares of various shades and hues blend when they are put together on a vast exhaust plane to frame a picture. It resembles mosaic craftsmanship where tiles of various hues are put beside each other to make a photo. A histogram addresses blacks, shadows, mid tones, highlights and whites as the diagram moves from left to right.
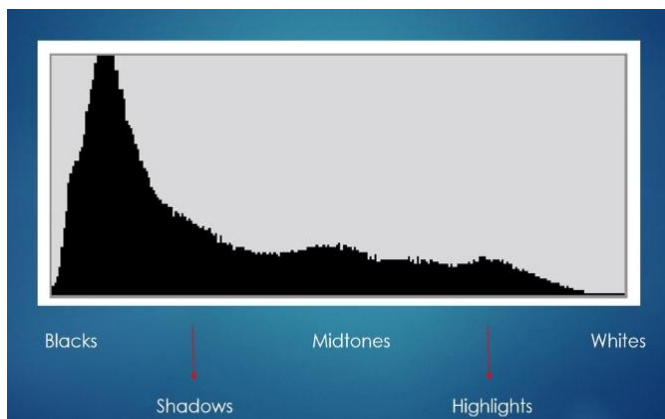

Figure 2. histogram image read like this

The pinnacles that find in this diagram speak to the quantity of dabs of that specific shade, which is one of those 255 shades of dark. This effortlessly speaks to the measure of blacks, shadows, mid tones, features and whites in picture.

IV. HISTOGRAM BACKGROUND INFORMATION

Computerized pictures are made out of two-dimensional whole number clusters that speak to singular segments of the picture, which are called picture components, or pixels. The quantity of bits used to speak to these pixels decides the quantity of dim levels used to depict every pixel. The pixel esteems in dark and - white pictures can be either 0 (dark) or 1 (white), speaking to the darker and brighter regions of the picture, individually, as appeared in Figure 1(a).
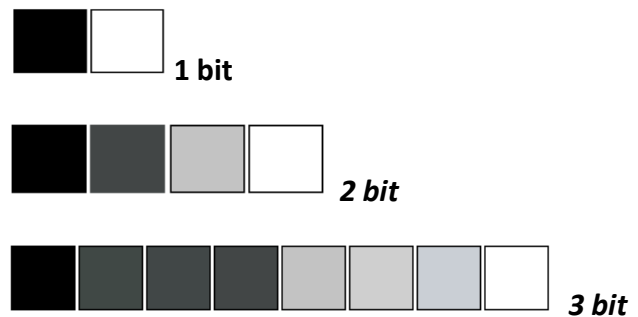

Figure 3. **Available pixel intensities for 1-bit, 2-bit and 3-bit, image data**

On the off chance that n bits are utilized to speak to a pixel, at that point there will be 2n pixel esteems running from 0 to (2n - 1). Here 0 and (2n - 1) relate to highly contrasting, separately, and all other middle esteems speak to shades of dark. Such pictures are said to be monochromatic (Figures 1(b) through 1(d)).A mix of various monochrome pictures brings about a shading picture. For instance, a RGB picture is a joined arrangement of three individual 2-D pixel clusters that are translated as red, green, and blue shading segments.

V. APPLICATION OF HISTOGRAM

THRESHOLDING

A grayscale picture can be changed into a high contrast picture by choosing a limit and changing all esteems over the skirt to the most extreme power and all esteems beneath the edge to the base force. A histogram is a fitting methods for distinguishing a reasonable edge.

IMAGE ENHANCEMENT

Picture change a process of changing the pixel power of the info picture to the yield picture it is raises to the way toward changing over a picture in order to make it all the more outwardly appealing or to empower more investigation A picture histogram can help us to quick arrange handling tasks that are legitimate for a specific picture[8]. For instance, if the pixel esteems are engaged in the far-left offer of the histograms[9].
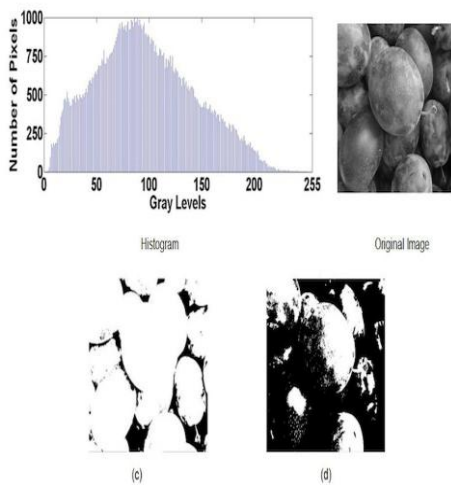

Figure 4 . histogram orignal image

Histograms are often used as part of computer image preparation. The main use, as mentioned above, is image research, the second use of the histogram is the brightness purpose. Histograms are widely used for brightening images.

VI BRIGHTNESS

Brightness is a relative term. It relies on our visual perception. This brightness is a relative concept, so the brightness through the light source can be considered as the degree of vitality compared to the parallel source[10,11]. Now sometimes we can undoubtedly say that the picture is much bright, but sometimes, it is difficult to detect.

Make the picture brighter as:

Brightness can be effectively expanded or diminished by straightforward numerical terms like addition or subtraction, in the picture matrix[12].
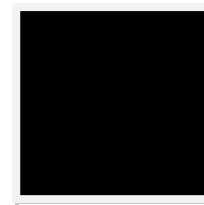
Assume this black picture of 5*5 size

Figure 5 . black image

We definitely know, that every image has a combination of rows and columns (matrix)[13] in behind them which stores the value of pixels. This matrix of picture is as follows:

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

Figure 6 . combination of row & columns

As we can see that the given matrix is completely filled with 0's, so the picture seems to be very much darker[14,15].

Redusing the brightness level by using sliding in histogram
Presently if you somehow reduce the brightness of the new image so much that the previous image looks brighter, you have to decrease some values from the whole matrix of the new image[16,17]. The value that we will minus is eighty (80). As we add 50 to the first image and get a clearer picture, now that we need to make it darker, we need to minus more than 50.

Increase the contrast of picture as:

The equation used for extending the image histogram to differentiate

$$g(x,y) = \frac{f(x,y) - f\min}{f\max - f\min} * 2^{bpp}$$

The equation needs the base and most extreme pixel power increase with levels of gray.

$$g(x,y) = \frac{f(x,y) - 0}{225 - 0} * 255$$

Where:
f(x,y) denotes the every pixel intensity value.
For every f(x,y) in a picture , we will compute the given equation.

Conclusion

In this paper the different applications of histogram in image enhancement are discussed, there are a number of histogram processing techniques, to choose the appropriate technique for a particular application such as enhancement, compression etc. from a number of available techniques; we can simply select a particular technique by just having a look on the histogram of image. So, we can say that having a huge number of other applications, histograms also reduce the complexity of choosing a processing technique in order to process an image. Histogram equalization is powerful method for image enhancement and it will increase the contrast of image. The enhanced image will give the full dynamic range of histogram. However, histogram equalization process tries to merge the adjacent gray levels together in order to force the uniformity of number of pixels in each appeared gray levels consequently, the intensity saturation will be presented in darkness regions and whiteness region.

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