Histogram Equalization of Grayscale and Color Image

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Summary—This report presents the Histogram Equalization of Grayscale and Color Image. Tools used in this project are OpenCV 3.2 Library which is a library used for Computer Vision, and Visual Studio 2015 (64 bit).

I. INTRODUCTION

Histogram is the intensity distribution of an image. Histograms plots how many times (frequency) each intensity value in image occurs. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance. A Histogram has two axis the x axis and the y axis. The x axis contains event whose frequency you have to count. The y axis contains frequency. An image histogram is a graphical representation of the number of pixels in an image as a function of their intensity. Histogram equalization is used to enhance contrast. It is not necessary that contrast will always be increase in this. There may be some cases were histogram equalization can be worse. In that cases the contrast is decreased.

Consider the following image. Say, depth of the image is 2 bits. Therefore the value range for each and every pixel is from 0 to 3.

2	3	2	1	2
1	2	0	2	3
0	1	1	3	1
2	3	0	1	2
0	1	2	2	0

Fig.1. Sample Image (Depth = 2 bits)

Histogram of the image shows how the pixel values are distributed. As in the above image there are 5 pixels with value 0, 7 pixels with value 1, 9 pixels with value 2 and 4 pixels with value 3. These information is tabulated as follows.

Pixel Value	Number of Pixels
0	5
1	7
2	9
3	4

Fig.2. Intensity Distribution of sample image

Histogram of an image usually presented as a graph. The following graph represents the histogram of the above image.

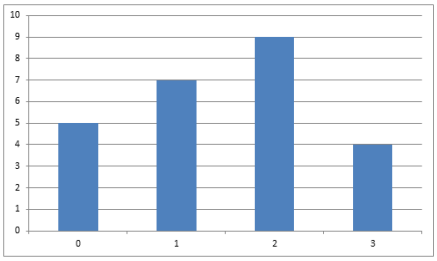

Fig.3. Image Histogram

There are various techniques to achieve histogram equalization. In OpenCV, there is a built OpenCV function to equalize histogram.

II. OPENCV CODE

i) For Grayscale Image

```
Mat img = imread("..//data//green.JPG",
CV_LOAD_IMAGE_GRAYSCALE); //open and read the
image in Grayscale Format

Mat img_hist_equalized;
equalizeHist(img, img_hist_equalized);
//equalize the histogram
```

ii) For Colored Image

```
Mat img = imread("../data/green.jpg",
CV_LOAD_IMAGE_COLOR); //open and read the
Colored image.

vector<Mat> channels;
Mat img_hist_equalized;

cvtColor(img, img_hist_equalized, CV_BGR2YCrCb);
//change the color image from BGR to YCrCb
format

split(img_hist_equalized, channels); //split the
image into channels

equalizeHist(channels[0], channels[0]);
//equalize histogram on the 1st channel (Y)
```

```
merge(channels, img_hist_equalized); //merge 3
channels including the modified 1st channel into
one image

cvtColor(img_hist_equalized, img_hist_equalized,
CV_YCrCb2BGR); //change the color image from
YCrCb to BGR format (to display image properly)
```

III. RESULTS

Fig. 4. Original Image

Fig. 5. Histogram Equalized Image

Fig. 6. Original Image

Fig. 7. Histogram Equalized Image

CONCLUSION: - OpenCV provides many built-in functions for Histograms and Histogram Equalizations, in which some of the basic functions along with the source code and implementation on images were discussed in this report.