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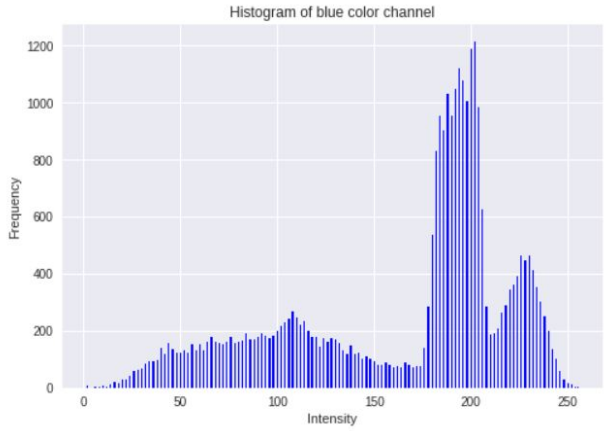
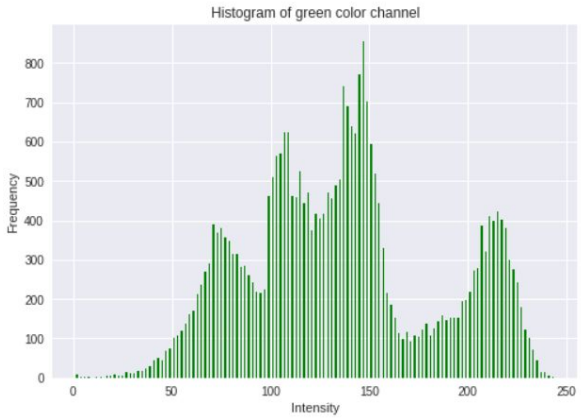
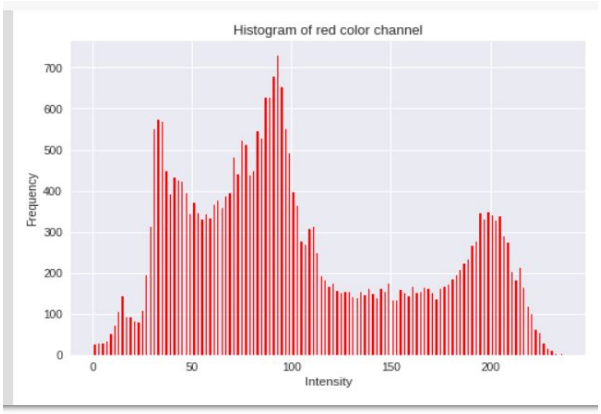
1.)







OBSERVATIONS:

The above images depict histograms of each colour channel i.e. Blue, Green and Red respectively.

- The histogram of a digital image is a distribution of its discrete intensity levels(L) in the range [0,L-1] . It gives the number of pixels at each intensity level. Here, in our example the range varies from 0 to 255.
- When all these histograms are combined together, we get the overall histogram of an image.
- The shape of each color channel histogram reflect the visible properties of the image
- In the Blue channel histogram, we observe that this color is in more of a lighter tone in the image as the histogram is more shifted to the right side .
- Whereas in Red color channel, it is observed that the darker image has more red intensities as the histogram is comparatively shifted to the left side. Maybe the rocks and land area represent in dark red areas in the image

- In the Green channel histogram, the distribution of the pixel intensities is still more skewed to the right side i.e the lighter part.

2.) Histogram of the Grayscale image generated from the Original image

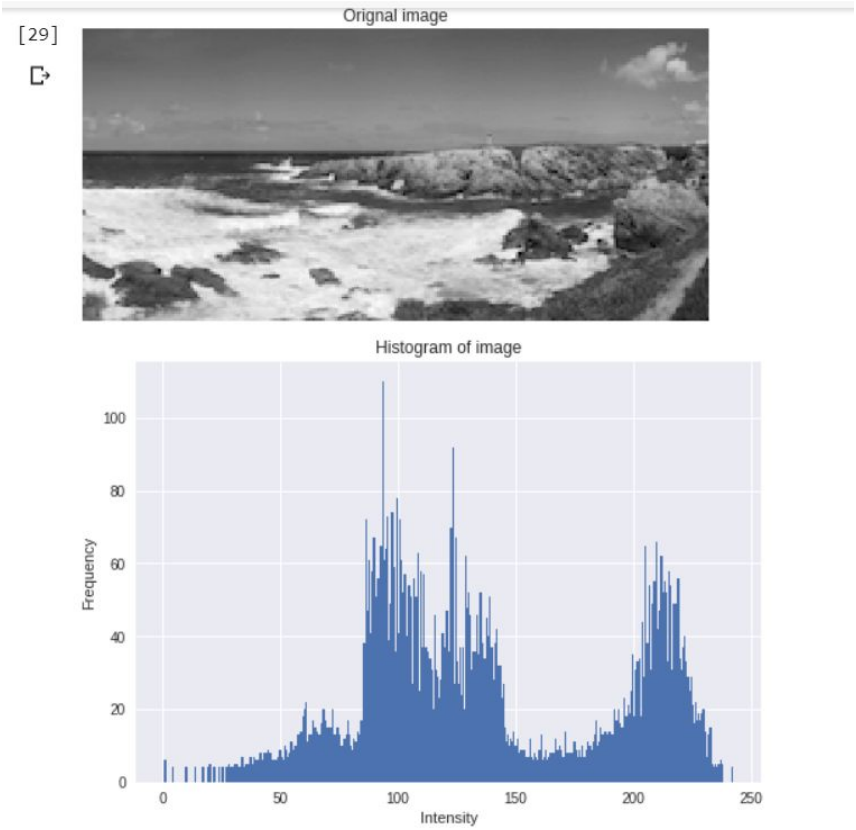


FIG 2: Grayscale image and it's histogram

OBSERVATIONS:

- From the above histogram we can infer that the corresponding image is much lighter overall, but also have some dark regions as well.
- The pixel intensities are more skewed in the range of [90-110] and [215] depeicting the image consists of more lighter parts than the darker ones.
- As we know that the histogram concentrated on the left side depicts a darker image whereas the histogram concentrated on the right side depicts a lighter image.
- Histogram gives an idea about the intensity variation across the image.

3.)

Equalized Image

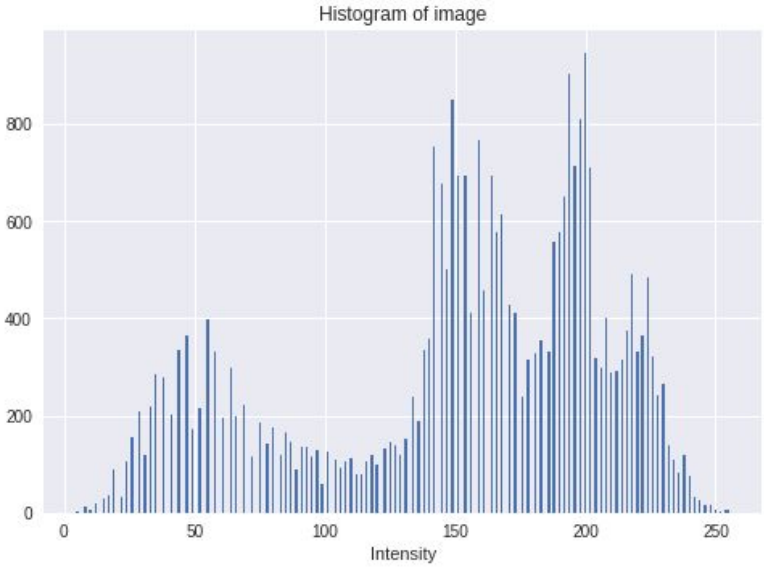


FIG 3: Histogram of equalized image

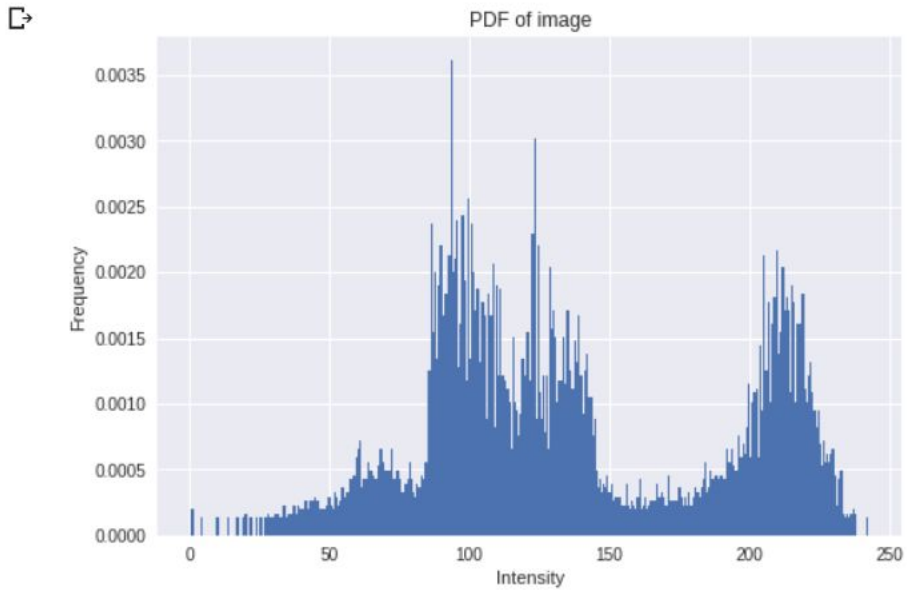
OBSERVATIONS:

- Histogram equalization is a method to process images in order to adjust the contrast of an image by modifying the intensity distribution of the histogram.
- We can observe that all the peaks in the above histogram for the original image exists only for intensity values between 100 to 150 which is expected as the image only contains shades of gray.

- In the Figure (3) after performing Histogram Equalization the contrast of the original image is enhanced. Also, the histogram of the contrast enhanced image contains peaks with similar heights, spread uniformly over the full intensity range.
- After equalization, the generated histogram is spread out over the entire scale of gray-levels. The discrete data of the gray-levels does not allow to obtain a strictly flat histogram.
- Any strongly represented gray-level is stretched while any weakly represented gray level is merged with other close levels.
- Thus we can conclude that if the histogram of the original image is concentrated on one side, equalization will stretch it to cover the whole range and will enhance contrast. But if the histogram is already distributed over almost the entire range of intensities the the equalization procedure will not of use because it is not going to change a lot the intensity distribution. Hence it won't serve the purpose.

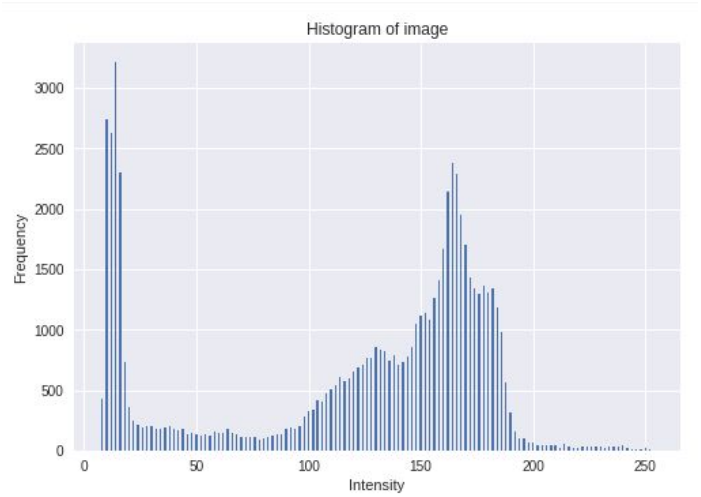
COMPUTING PDF AND CDF OF IMAGE b1.png

PDF :

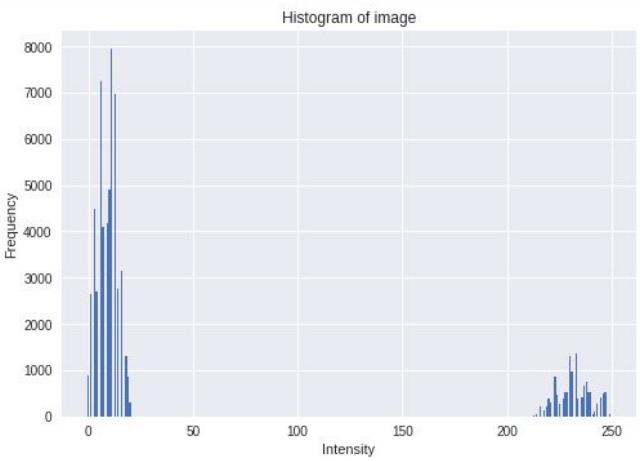


CDF:

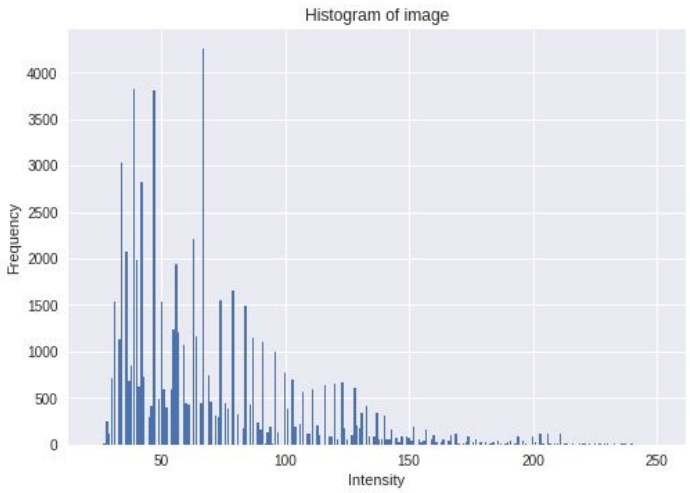
HISTOGRAMS OF THE ORIGINAL IMAGES BEFORE CONVERTING INTO BINARY



Histogram of original image b2_a.png



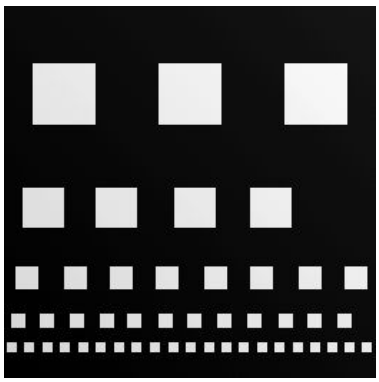
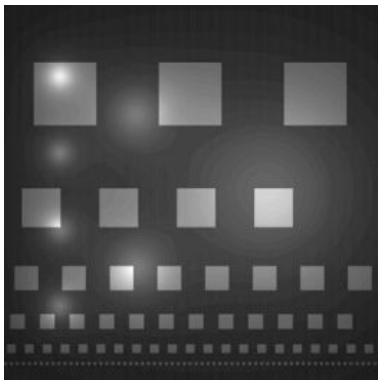
Histogram of original image b2_b.png



Histogram of original image b2_c.png

4.) **OBSERVATIONS:**

The original images:

The manually chosen threshold was the mean of the max and the min value.
it was 123. These images consist of only ‘1’s and ‘0’s also called as the black and white image.

OTSU Algorithm for Binary Image :


```
89
(([], <a list of 0 Text xticklabel objects>),
 ([], <a list of 0 Text yticklabel objects>))
```

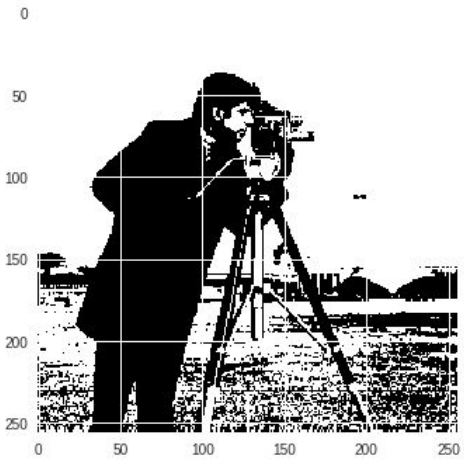
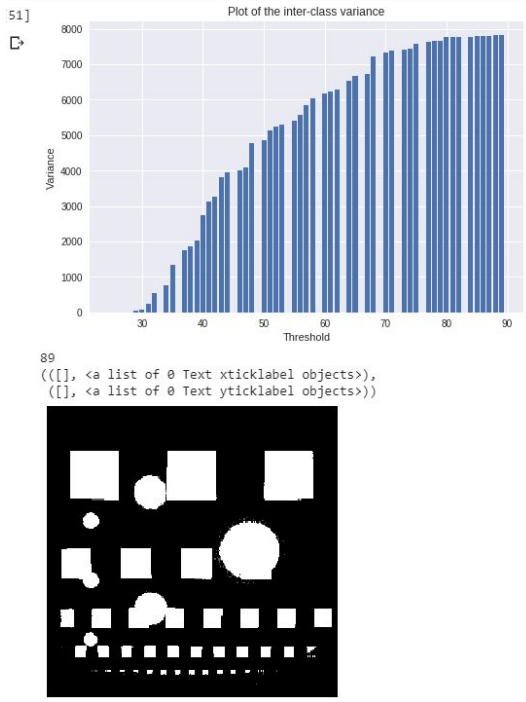



Fig 4.1: Image_otsu1 **Fig 4.2:Image_manual**

OBSERVATIONS:

In **Fig 4.1** we observe that the threshold value selected is about 89 which is lesser than what I selected manually.

- The inter-class variance of the image was : 3289.11
- The main difference observed between the manual threshold image and the one generated using otsu is in darkness in the ground area.
- Otsu's algorithm separated the image clearly into black and white as compared to the Fig 4.2



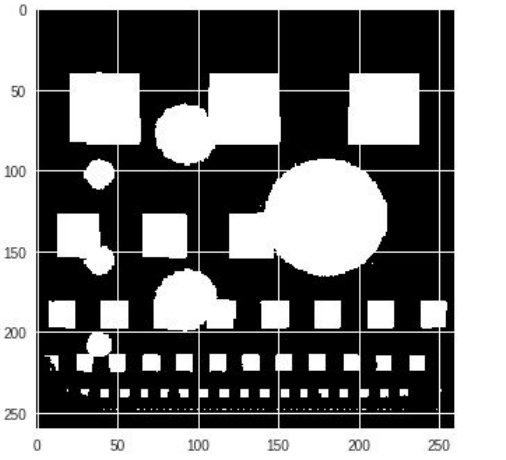


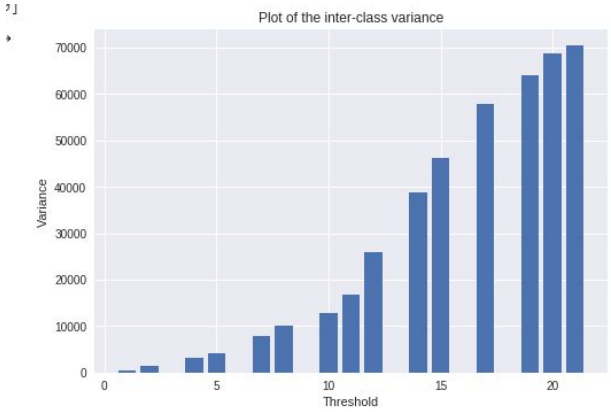
Fig 5.1: Image_otsu2 **Fig 5.2: Image_manual2**

OBSERVATIONS:

In **Fig 5.1** we observe that the threshold value selected is about 89 which is lesser than what I selected manually.

- The inter-class variance of the image was : 7821.79
- The main difference observed between the manual threshold image and the one generated using otsu are the retention of a few white areas in the manual ones since the threshold chosen was a middle region

- In otsu, since the threshold was 89, slight whiter areas were converted to black.




```
21
(([], <a list of 0 Text xticklabel objects>),
 ([], <a list of 0 Text yticklabel objects>))
```

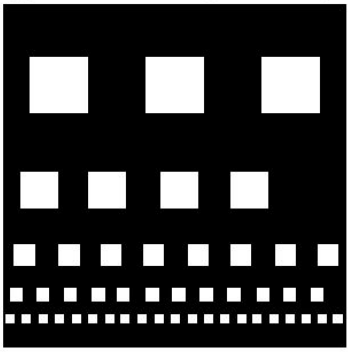


Fig 6.1: Image_otsu3

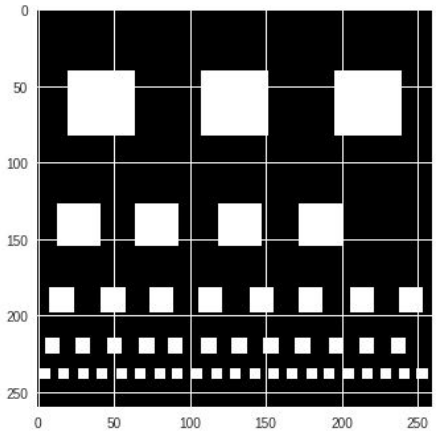


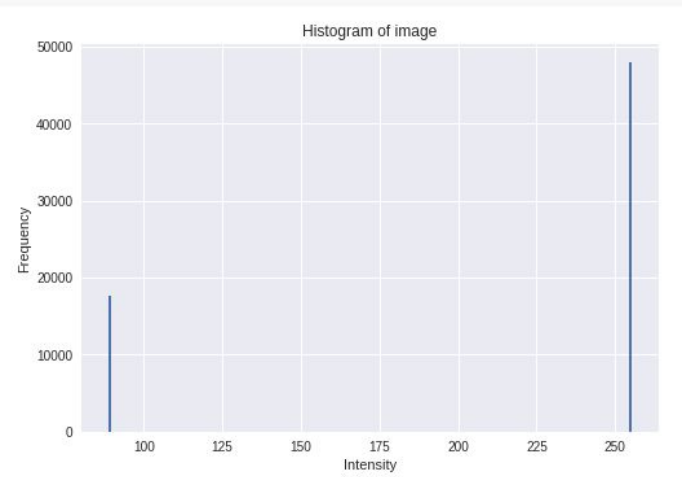
Fig 6.2: Image_manual2

OBSERVATIONS:

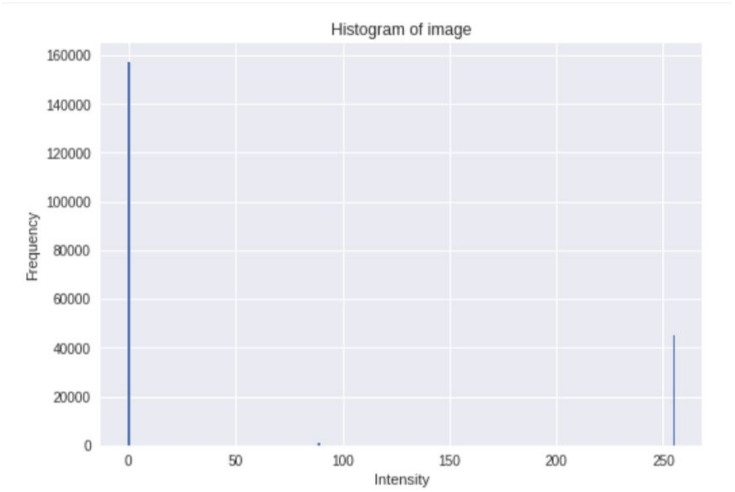
In **Fig 5.1** we observe that the threshold value selected is about 21 which is lesser than what I selected manually.

- The inter-class variance of the image was : 7821.79
- No major difference was observed between both the images as both the threshold could successfully separate the white and black areas.
- Since the image had only black and white areas, i.e 2 intensities, All the three images look similar with no change
- The image looks decent in both the figures i.e Fig 6.1 and Fig 6.2

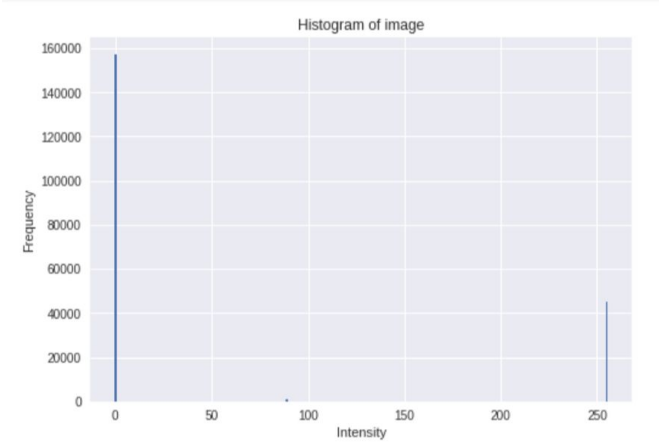
HISTOGRAMS OF THE BINARY IMAGES AFTER CONVERTING USING OTSU



Histogram of binary image b2_a.png and it is so as only 2 intensities are present i.e.0 and 255.



Histogram of binary image b2_b.png and it is so as only 2 intensities are present i.e.0 and 255. Here the image is more darker and hence the histogram is left side skewed.



Histogram of binary image b2_c.png and it is so as only 2 intensities are present i.e.0 and 255. Here the image is more darker and hence the histogram is left side skewed. It also has a slight intensity in the middle.