COMPUTER VISION
ASSIGNMENT 4

TASK (a)

We are given

$\gamma = 0.5$

$\Theta = 0$

In this case,

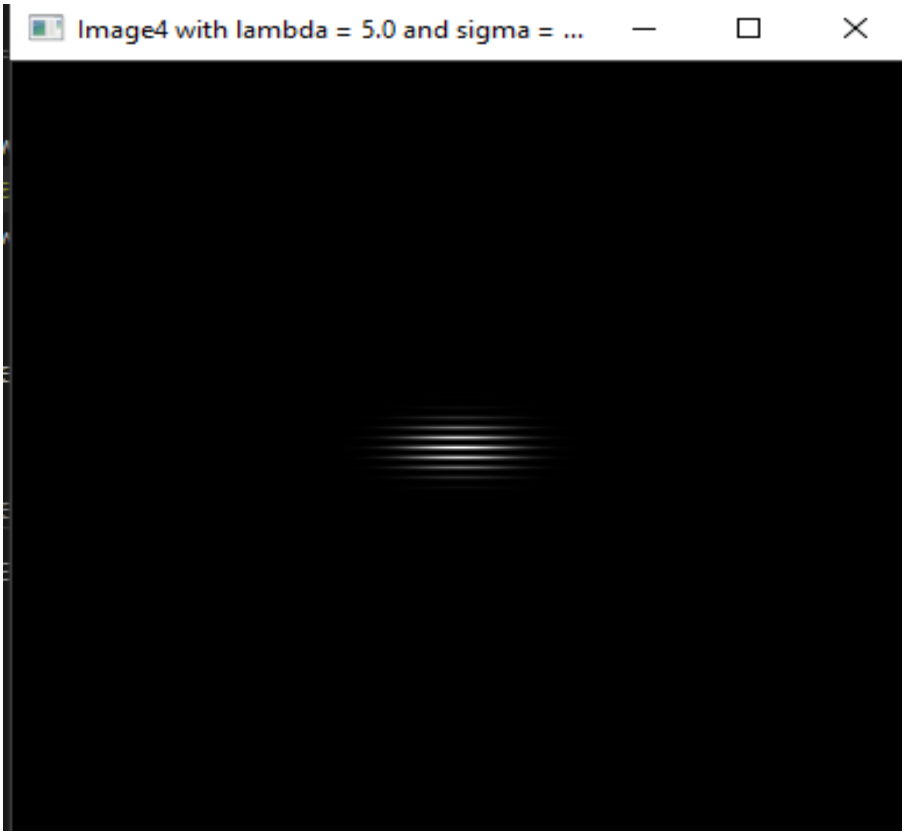
$x_o = x\cos\Theta + y\sin\Theta = x$

$y_0 = -x\sin\Theta + y\cos\Theta = y$

We get the following characteristics of gabor filter when

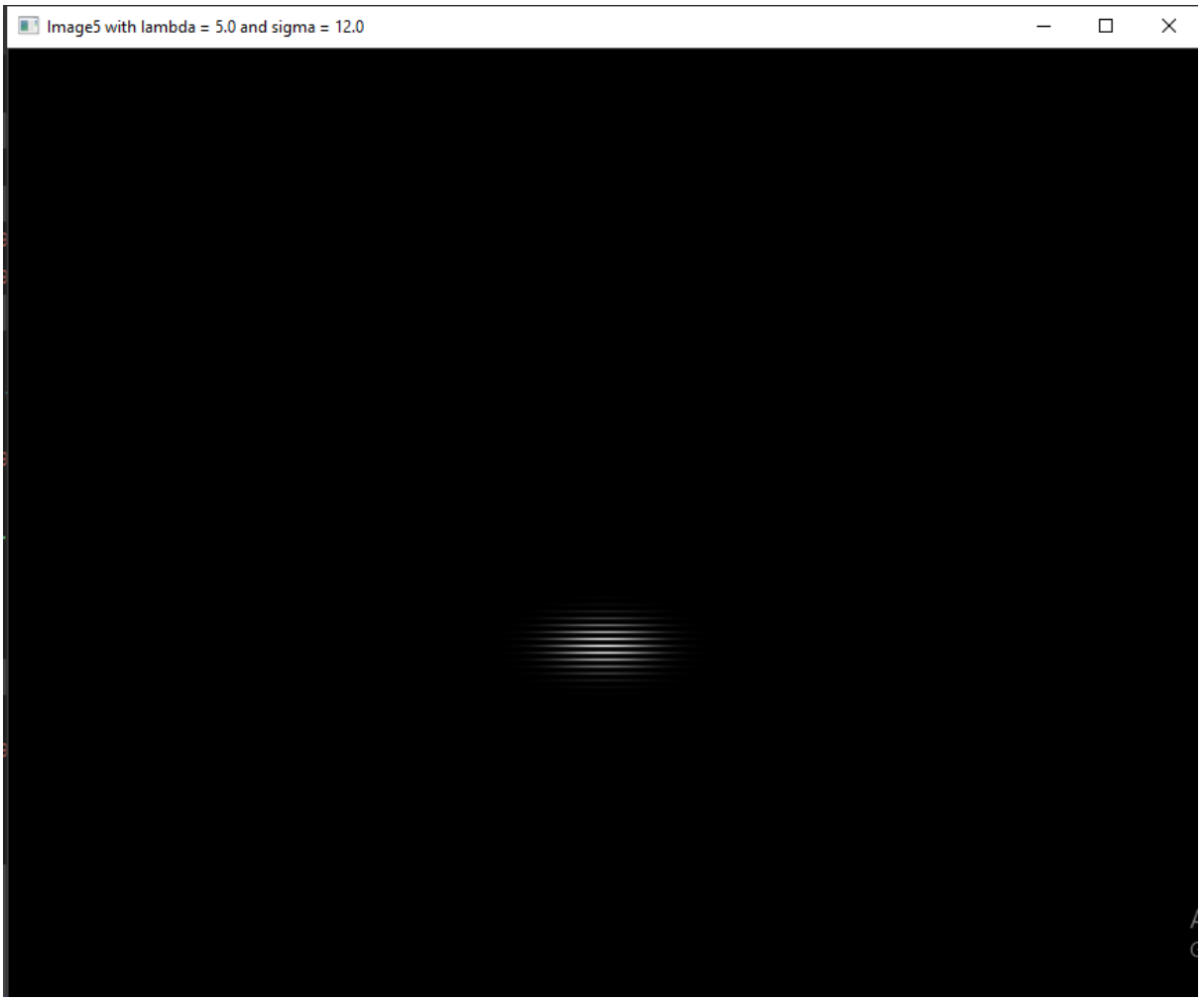
$\lambda = 5$

$\sigma = 8$



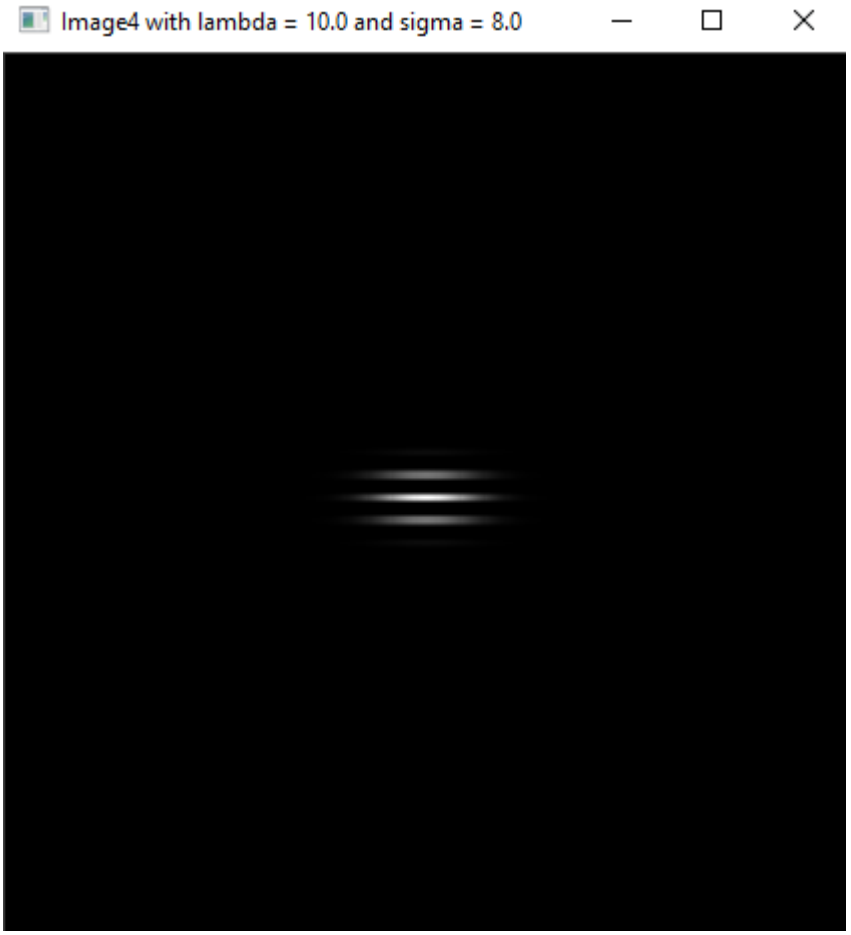
Clearly, these are the characteristics of a Lowpass Filter (of course except stripes because of which we lose some useful low frequencies).

λ = 5
σ = 12



Keeping the value of λ constant, when we increase the value of σ, we can observe that the number stripes in the gabor filter has increased. So we can make a conclusion that when σ is increased at constant λ, the cut-off frequency of the filter won't get affected but there is a possibility to lose some useful low frequencies.

Now we will keep the value of σ = 8 and λ = 10.

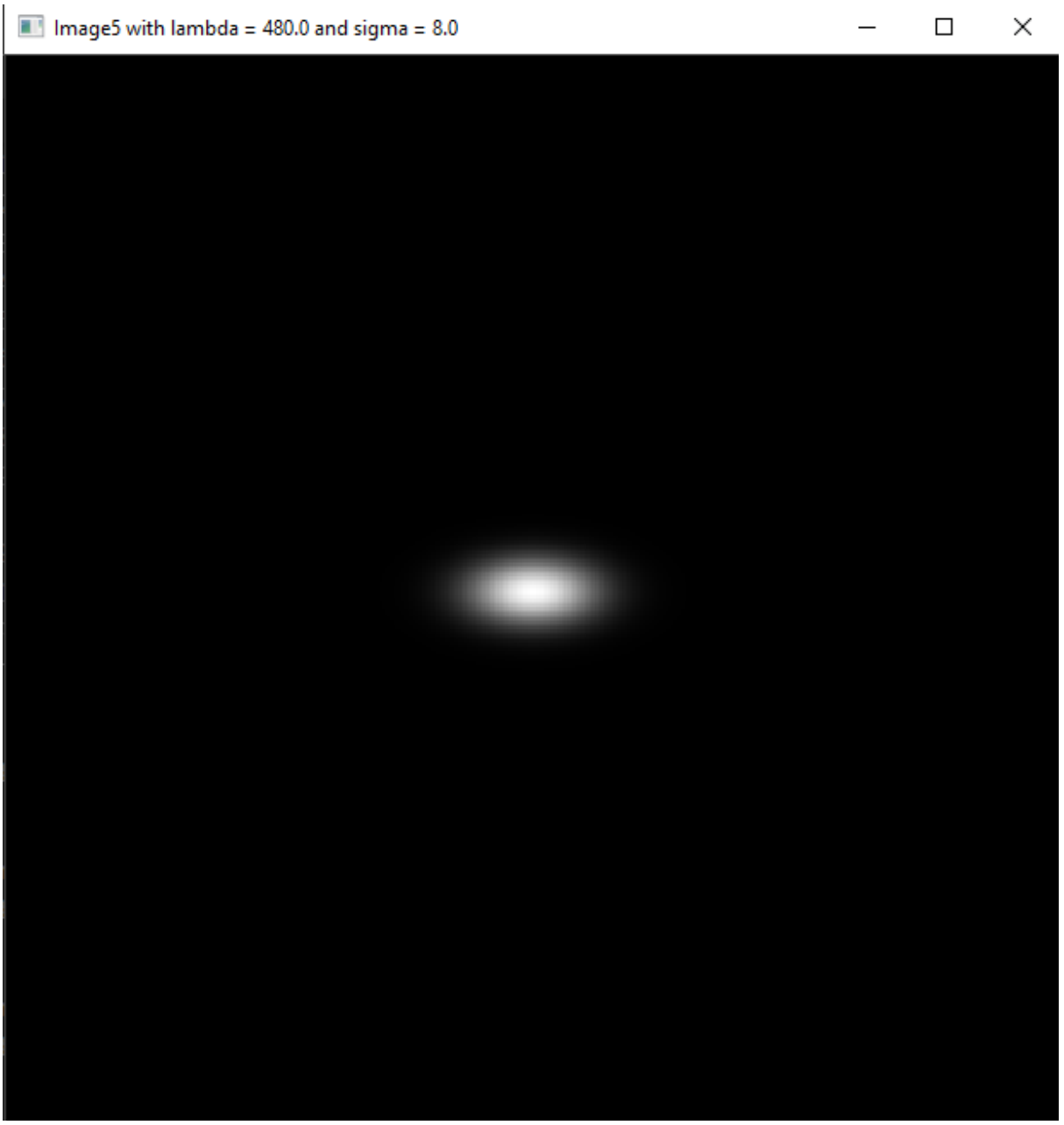


We can observe that as the λ has increased keeping the σ constant (compared first image), the spread of the gabor filter has increased. Consequently it eats up some stripes. So, some of the useful frequency content that we were losing in case 1 and 2 , will be retained.

Now, let us increase the value of λ by a large amount and see what happens.

λ = 480

σ = 8



We can observe that there are no stripes in the gabor filter anymore. All the lowpass frequency components of the input image will be retained and high pass frequency components will be rejected.

Moreover, we can see that the gabor filter characteristics now tend towards the Lowpass gaussian filter characteristics. Hence we can say, the lowpass nature of the gabor filter is enhanced.

TASK(b)

Taking σ = 3pw, λ = 5pw, γ = 0.5 when we applied gabor filter on given images for different values of Θ then we got the following results.

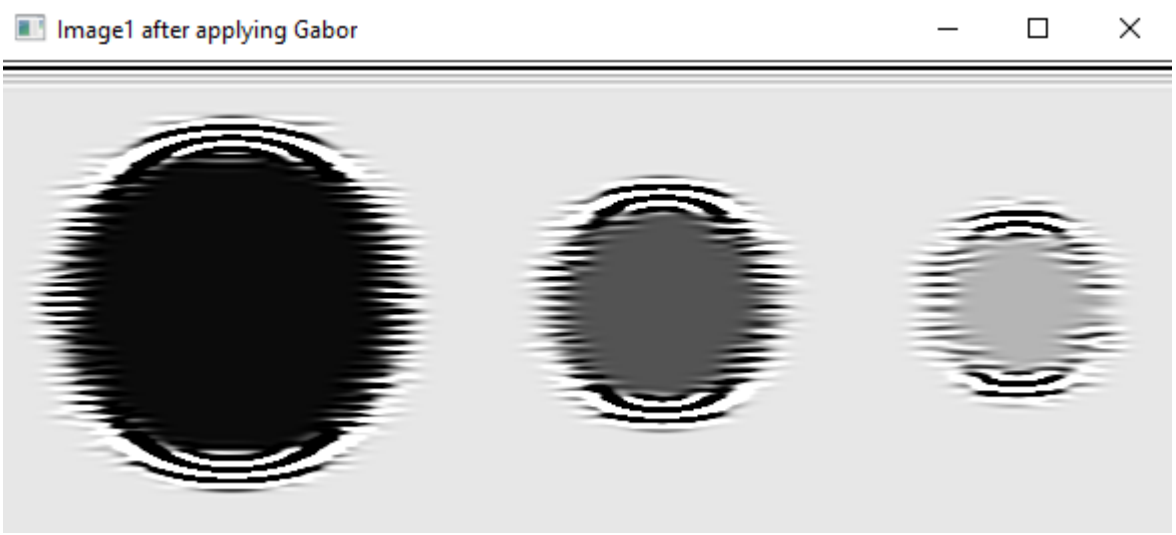


Fig. At Θ = 0

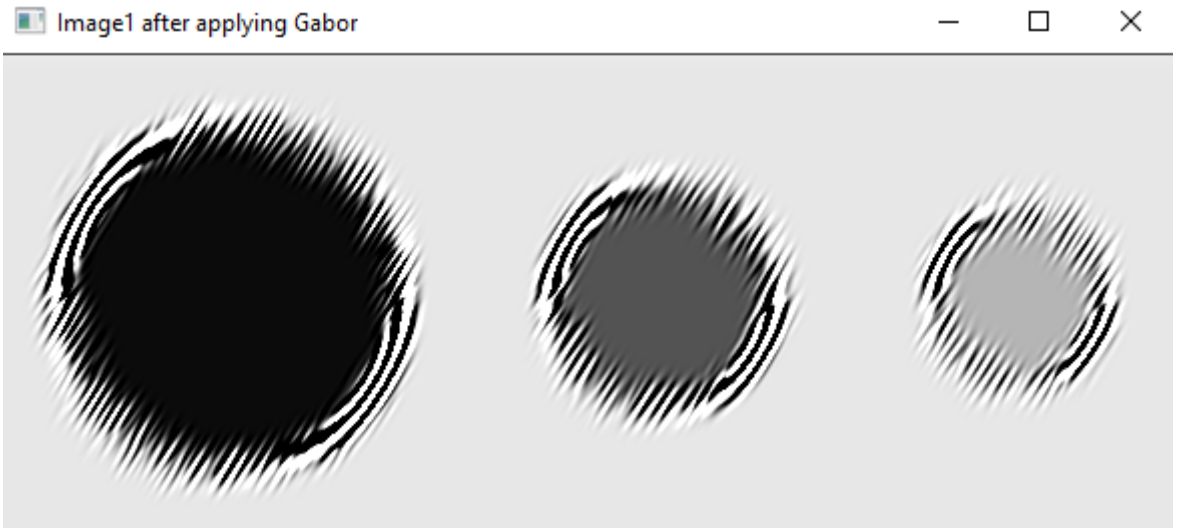


Fig. At Θ = 45

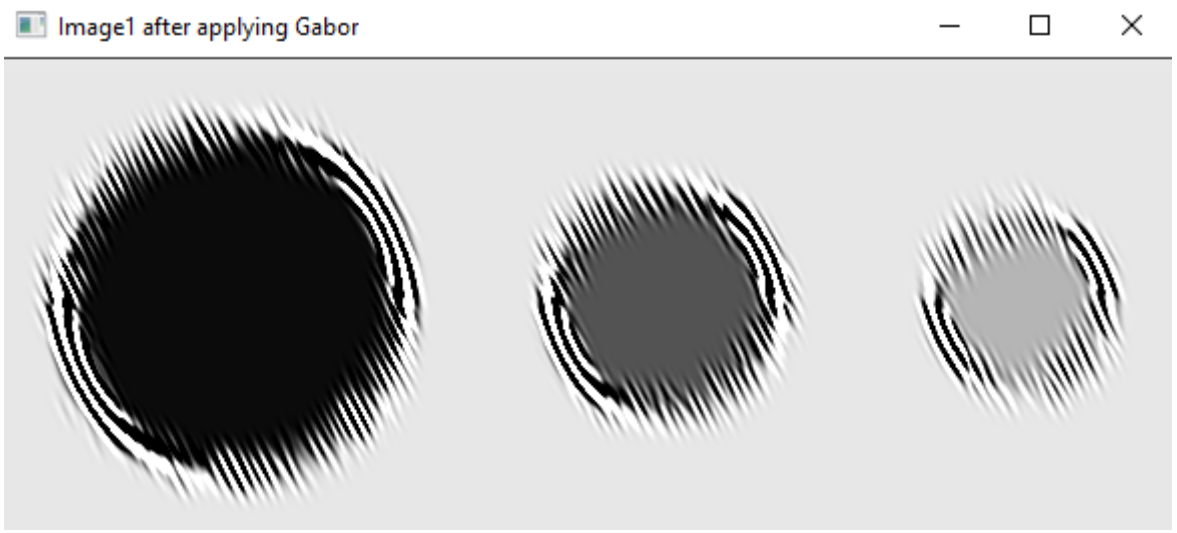


Fig. At Θ = 90

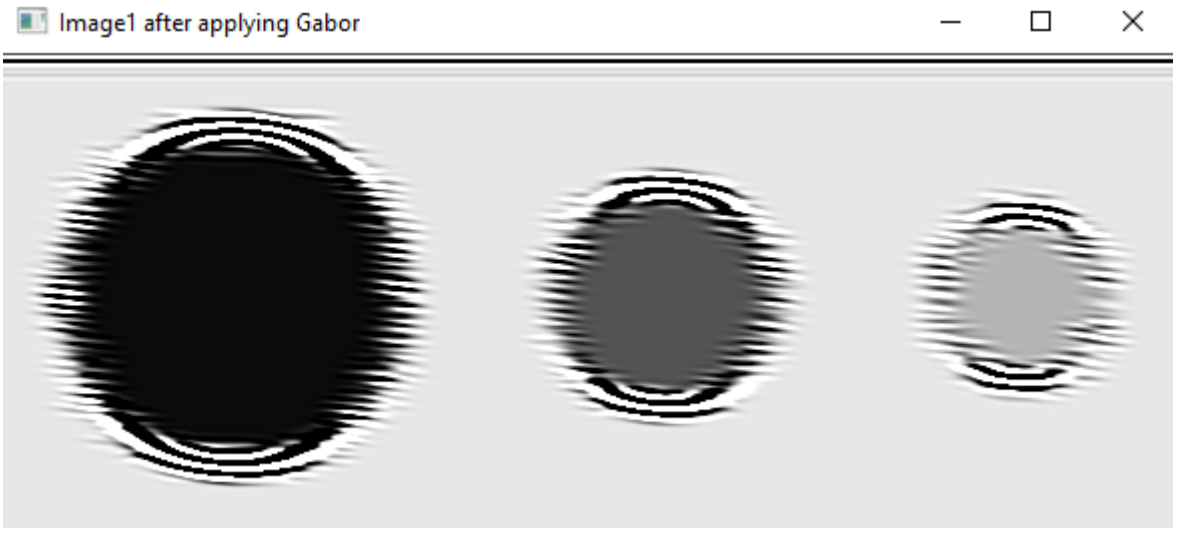


Fig. At Θ = 135

When gabor filter is oriented at some particular angle Θ, then all the features oriented in that direction will be extracted.

After this we labeled each pixel with its dominant orientation. We considered the dominant orientation at a pixel as the orientation corresponding to the maximum absolute value among the 4 Gabor output values at that pixel.

Next, we found the decimal local binary patterns at each pixel and assigned them at corresponding pixel location. Resulting image is as shown below,

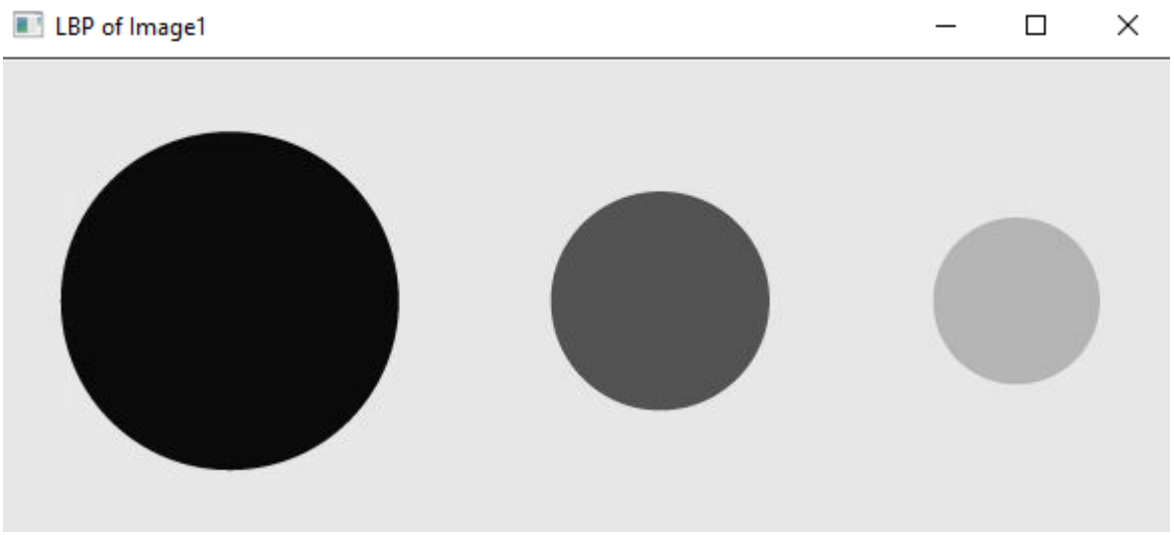


Fig. Local Binary Patterns

Histograms of the above LBP image at different dominant orientation are as shown below,

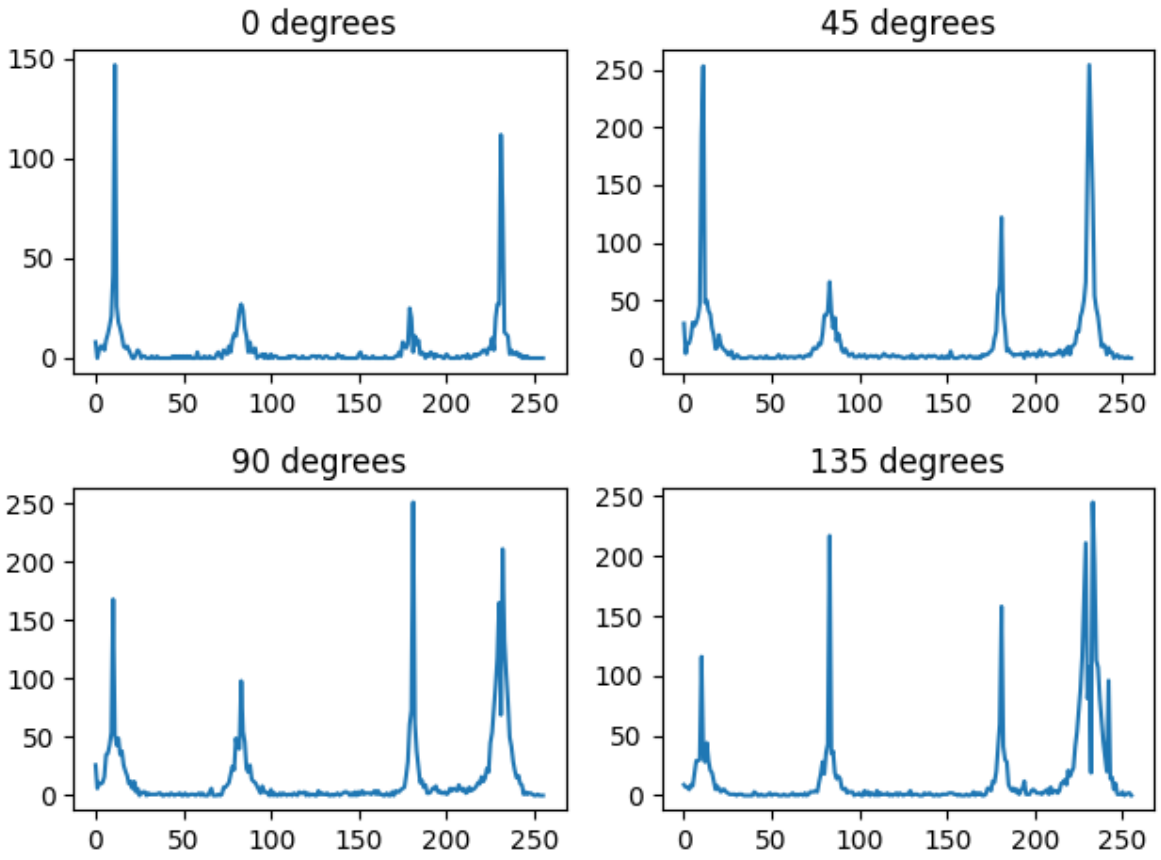


Fig. Histograms at 0,45,90 and 135 degrees

Comparison for different orientation of same image

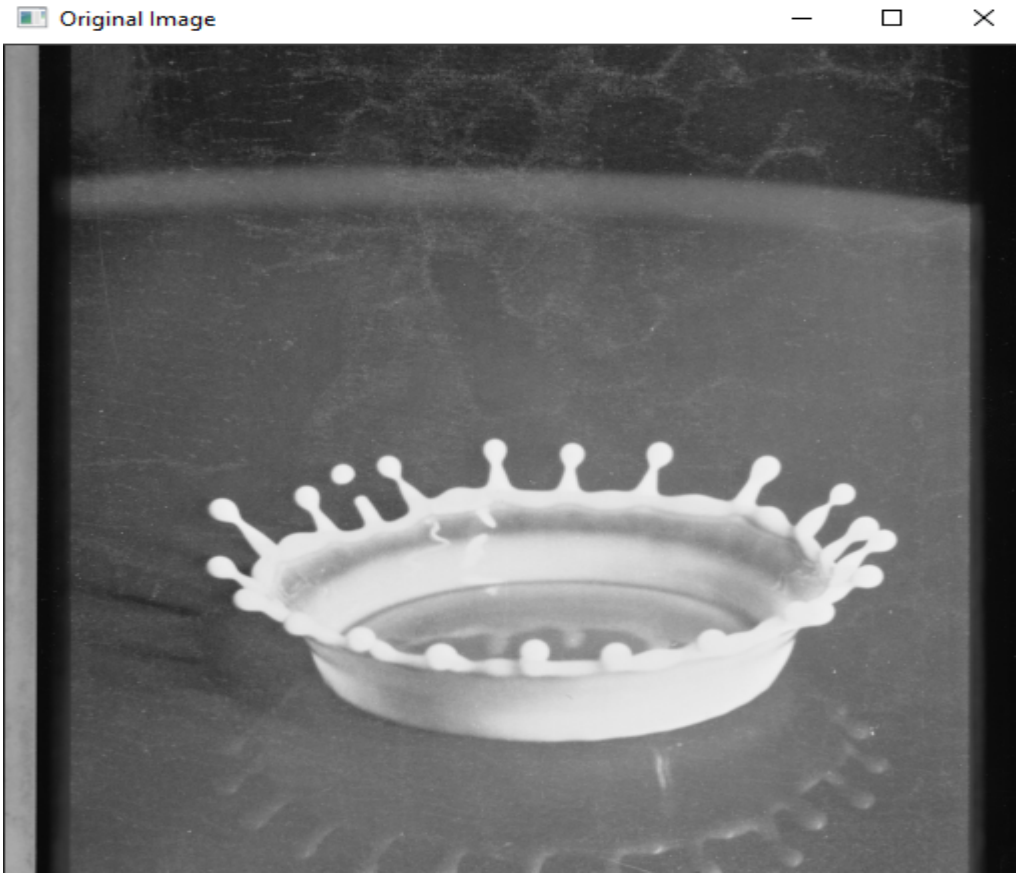
When the dominant orientation is 0 degree, all the features of the image along the horizontal axis can be extracted. Most pixels that fall in this orientation are either of least intensity or high intensity. So we can observe, the histogram shows peaks only at those intensities and not at the mid intensities.

When the dominant orientation is 45 degrees, all the features along 45 degree orientation can be extracted. Compared to the previous case, mid intensites are enhanced.

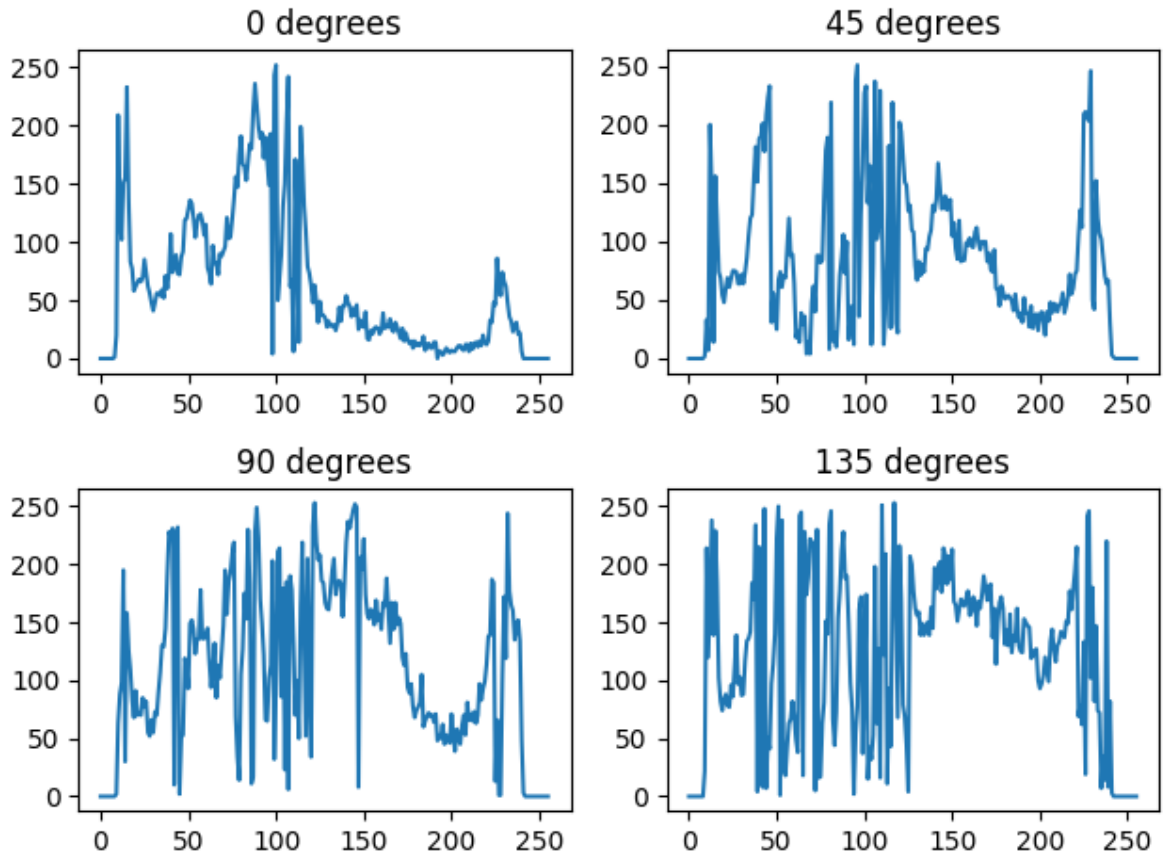
At 90 degree dominant orientation, peaks can be observed near four intensities.

When orientation is 135 degrees, more intensity near white region gets hiked. That is, more white pixels are observed at this orientation.

If we consider the histogram for another image,



Then observations can be made by looking at the histogram in the similar way as before.



At 0 degree, low intensities are dominant.
At 45 degrees, higher intensities are also enhanced and the histogram seems comparatively uniform. At 135 degrees, the histogram becomes even more uniform.

Comparison of Histograms across images

In the Blobs image, we can see that the histogram is not well distributed as the intensity variation is not much in the image. So the histogram is concentrated only in some regions.

When we consider the Drop image, we can see that the intensities in the image are well distributed in the image. Consequently, the histogram is uniformly distributed.