

SAMPLING AND QUANTIZATION

The 'chart_test.png' image represents a test pattern. This contains high frequencies and low frequencies.

You will have to generate (using OpenCV) two images 'chart_test50.png' and 'chart_test25.png' representing respectively a downsampled version by a factor of 2 and a factor of 4.

- 1 - View the images and compare them.
- 2 - Describe the effects of downsampling on the image.

The image 'la_Rochelle.png' represents a classic photo of La Rochelle :

- Using OpenCV, get the resolution of the photo and modify it to 300dpi and to 25dpi. What do you observe ?

IMAGE HISTOGRAM

A **histogram** is a graph or a plot that represents the distribution of the pixel intensities in an image. In this post, we're going to focus on the RGB color space, hence the intensity of a pixel is in the range $[0,255][0,255]$. When plotting the histogram we have the pixel intensity in the X-axis and the frequency in the Y-axis. As with any other histogram, we can decide how many bins to use.

A histogram can be calculated both for the grayscale image and for the colored image. In the first case we have a single channel, hence a single histogram. In the second case we have three channels, hence three histograms.

Calculating the histogram of an image is very useful as it gives an intuition regarding some properties of the image such as the **tonal range**, the **contrast**, and the **brightness**.

OpenCV provides many functions to compute, display, filter histograms

Histogram computation

https://docs.opencv.org/master/d8/dbc/tutorial_histogram_calculation.html

Helped by the previous tutorial and OpenCV documentation:

- 1 - Open the image 'lena.png'.
- 2 - View the image and the histogram.
- 3 - What does the histogram represent?
- 4 - Now view the histogram on 16 levels
- 5 - What do you observe?.

Histogram comparison

- 1 - Display the histogram of the images 'susie.png', 'house.png' and 'aquitaine.png'.
- 2 - What can we say about the histogram of each of these images?
- 3 - What are the minimum and maximum intensities? (compute them using OpenCV)
- 4 - Open the 'aquitaine.png' image. Display the image and its histogram.
- 5 - Now modify the image by adding 100 to the intensity of each pixel.
- 6 - Display the image and its histogram again.
- 7 - Can you explain the difference between histograms?

Histogram equalization

The histogram equalization process is an image processing method to adjust the contrast of an image by modifying the image's histogram. The intuition behind this process is that histograms with large peaks correspond to images with low contrast where the background and the foreground are both dark or both light. Hence histogram equalization stretches the peak across the whole range of values leading to an improvement in the global contrast of an image.

It is usually applied to grayscale images and it tends to produce unrealistic effects, but it is highly used where high contrast is needed such as in medical or satellite images.

Documentation and tutorial :

https://docs.opencv.org/master/d4/d1b/tutorial_histogram_equalization.html

- 1 - Open the 'tire.png' image.
- 2 - View the image and its histogram
- 3 - Apply the histogram equalization.
- 4 - View the image obtained and its histogram
- 5 - Comment on the results obtained both on the image and on the histogram?
- 6 - If we apply equalization to 'moon.png' image. What is going on ?

https://docs.opencv.org/3.4/d4/dbd/tutorial_filter_2d.html