

Project 0

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MC920 - Introduction of Digital Image Processing
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1 Introduction

The goal of the first project was for the students to familiarize with the environment of development by applying some basic techniques to process digital images in Python. The images used for testing are available [here](#).

1.1 Execute the program

First of all, it was necessary to define an argument required to receive the path to the image file. The image should be in the working directory, otherwise a full path of it should be given.

See an example of usage to execute the program if the image is in the working directory:

```
$ python3.5 trabalho_0.py butterfly.png
```

2 Image Processing

Bellow, there's a brief description of what the code to process the image does.

2.1 Read image

To load the image from a file into a matrix the OpenCV library's function *imread()* was used.

2.2 Plot histogram

To create and plot the histogram, the function *hist()* from Matplotlib was used. The histogram plots the number of pixels in the image (vertical axis) with a particular intensity value (horizontal axis).

2.3 Image's statistics

From the image as a matrix it's possible to extract some statistics. The width and the height of the image, for instance, are inferred by the information of the matrix shape. The levels of maximum, minimum and average intensity are also extracted from the matrix with functions already implemented (*min()*, *max()* and *mean()*).

2.4 Negative transformation

To obtain the negative transformation of an image it was necessary to reverse the intensity levels. Considering that fact, and since the levels of intensity are in the range of 0 to 255, each pixel was substituted by the subtraction $(255 - pixel)$.

2.5 Linear transformation

To convert the intensity level range of $[0,255]$ to $[120,180]$ it was necessary to establish a linear relation between the ranges using the minimal and maximal levels of intensity:

$$\frac{f - 0}{255 - 0} = \frac{g - 120}{180 - 120}$$
$$g = \frac{60f}{255} + 120$$

3 Results

The results presented here are an example of the outputs of the program when it was runned with the image *butterfly.png* as argument.

3.1 Histogram

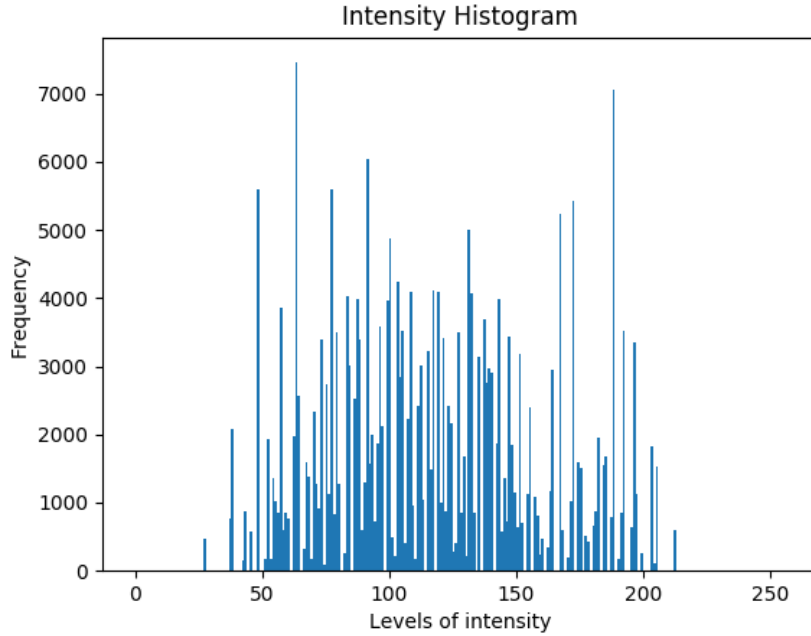


Figure 1: Intensity Histogram

3.2 Statistics

Width: 512

Height: 512

Minimum level of intensity: 27

Maximum level of intensity: 212

Average level of intensity: 116.77

3.3 Transformations

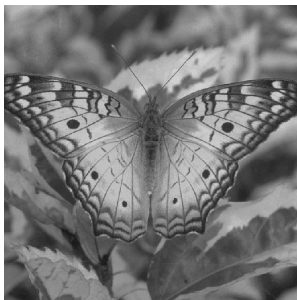


Figure 2: Original Image



Figure 3: Negative Transformation



Figure 4: Linear Transformation