# Image Processing
## Exercise 1: Image Representations and Point Operations

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### This exercise covers:

- Loading grayscale and RGB image representations.
- Displaying figures and images.
- Transforming RGB color images back and forth from the YIQ color space.
- Performing intensity transformations: histogram equalization.
- Performing optimal quantization.
- Gamma correction.

### Requirements:

- Python version: 3.7
- opencv−python~ = 4.2.0.32
- numpy~ = 1.18.2
- matplotlib~ = 3.2.1

### Files attached:

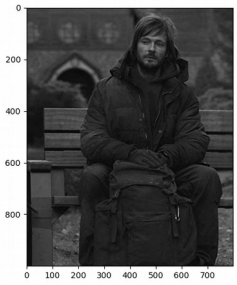
- ex1_utils.py: the functions that we had to implement on the exercise.
- gamma.py: perform gamma correction on an image with a given $\gamma$.
- ex1_main.py: demonstrates how to use the functions of ex1_utils.py and gamma.py.
- testImage1.jpg: dark image (see result section).
- testImage2.jpg: bright image (see result section).

### Description of functions:

- imReadAndConvert: reads a given image path, converts it into a given representation and normalize the image to range $[0, 1]$.
- imDisplay: utilizes imReadAndConvert to display a given image file in a given representation.
- TransformRGB2YIQ, transformYIQ2RGB: two functions that transform an RGB image into the YIQ color space and vice versa.
- HsitogramEqualize: perform histogram equalization of a given grayscale or RGB image.
- QuantizeImage: perform optimal quantization of a given grayscale or RGB image.
- GammaDisplay: performs gamma correction on an image with a given $\gamma$.

## Results:

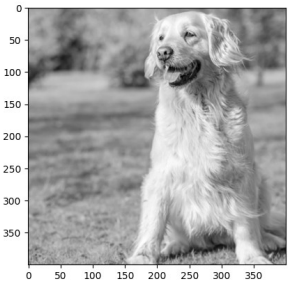
Test image 1



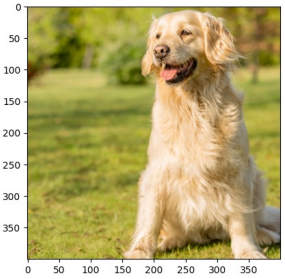
Gray-scale

RGB

Test image 2



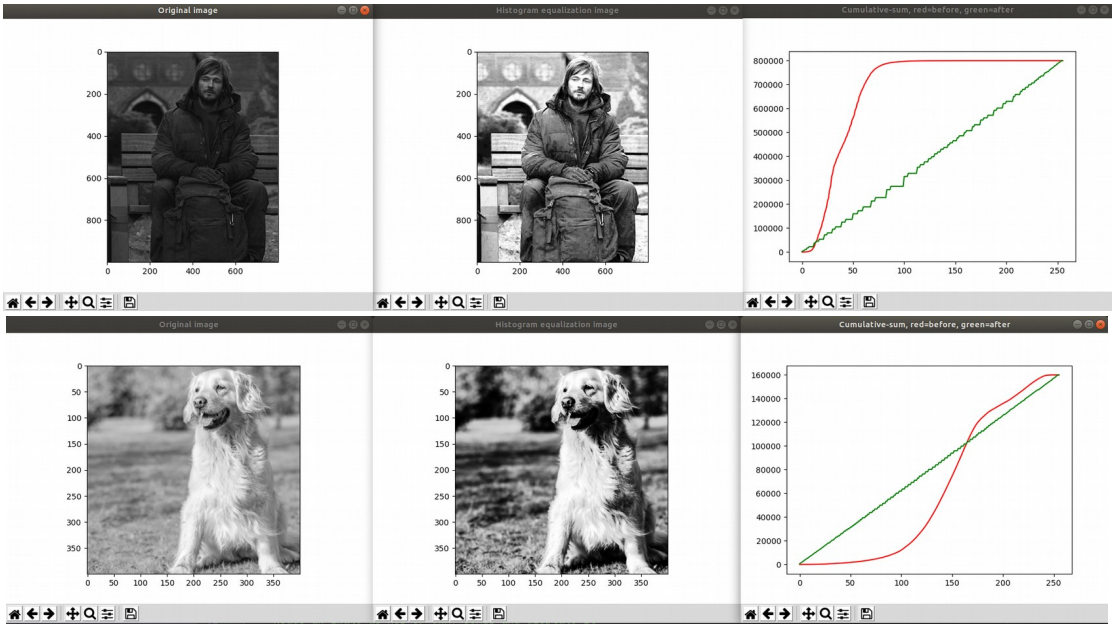
Gray-scale



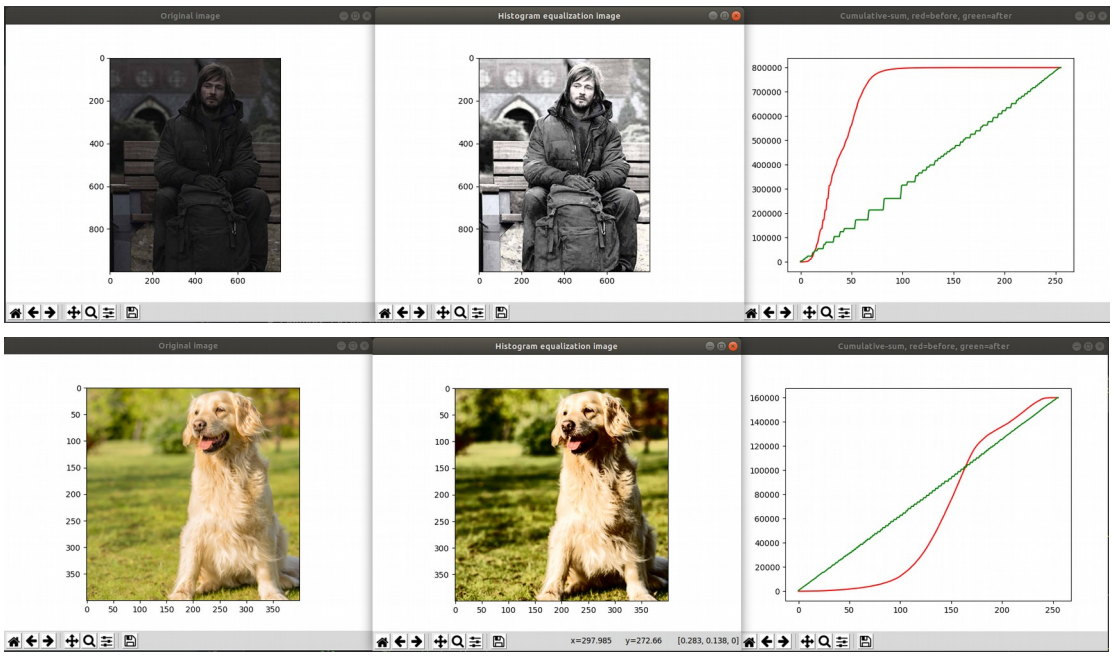
RGB

histogram equalization

Gray-scale

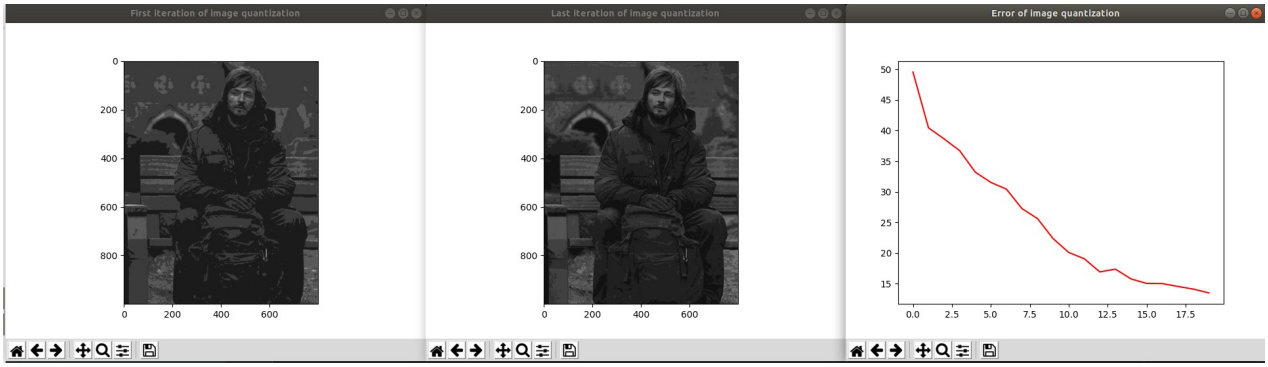


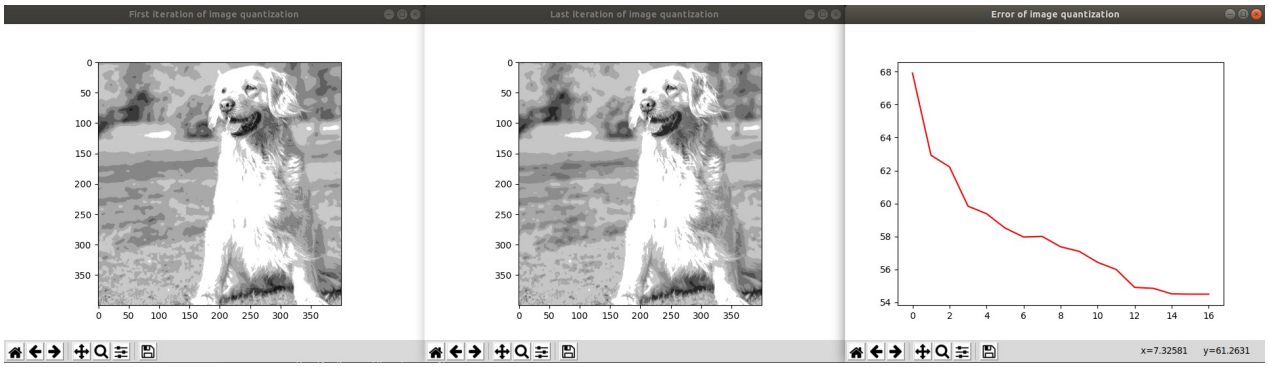

RGB



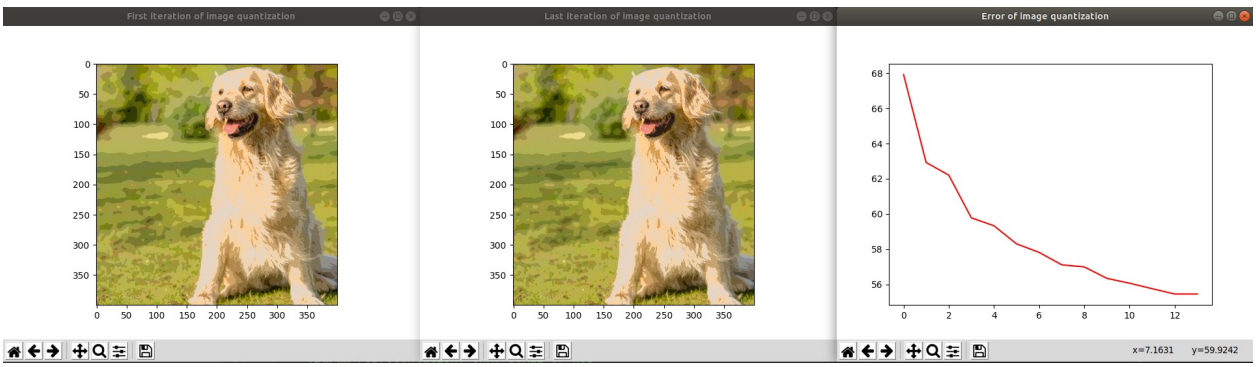
# image quantization (8 colors)

Gray-scale




RGB

gamma correction


**question from section 4.5:** The quantization procedure needs an initial segment division of [0..255] to segments, z. If a division will have a grey level segment with no pixels, procedure will crash (Why? ).

**answer : if** a division will have a grey level segment with no pixels, procedure will crash because we will divide by 0 when we calculate weighted mean.