Zurich University
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June 22, 2022
Digital Image Processing
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Lab 2 – Basic Grayscale Transformations

1 Introduction

This lab focuses on simple image enhancement by basic gray level transformations. In particular we will be dealing with brightness adjustment and contrast enhancement.

2 Learning Objectives

- You know how to obtain a gray level histogram of an image.

- You understand basic gray level transformations such as γ-correction or histogram equalization.

- You know how to apply these transformations.

3 Tasks

3.1 Grayscale Histograms

The idea of this exercise is that you develop **your own code** to compute and display a gray level histogram of an arbitrary image.

1. In a first step think about an efficient way to determine the gray level histogram of an image.

2. Write your own code to compute the histogram for the three given images `bloodCells.tif`, `xRayChest.tif` and `ctSkull.tif`.

3. For each case display the resulting histogram.

3.2 γ-Correction

In this exercise you are supposed to write your own γ-correction code to adjust the brightness of the images `xRayChest.tif` and `ctSkull.tif`. Recall that the mapping for γ-correction is defined as

$$s = r^{\gamma}, \text{ with } r \in [0, 1], \ s \in [0, 1].$$

1. Write your own code that applies γ-correction to the given images. There are various ways how to do that. Depending on your solution it might be necessary to make sure you chose the right data types.

2. Try various values for γ and check which yields the best result.

3. **For those who dare:** Compare various implementations of γ-correction algorithms and check if the use of lookup-tables accelerates your code.

3.3 Contrast Stretching and Histogram Equalization

Implement an automatic histogram equalization algorithm and see which impact it has on the given grayscale images.