OpenCV – Videos, color spaces and histograms

Introduction

The goal of this lecture is to understand how you can open and read a video file, convert images in different color spaces and manipulate 1D histograms with OpenCV.

Exercise 1: Open and read a video file

In this first exercise you will have to open and read sequentially all the frames from a video file (without displaying them in a first time).

1. Display, each 100 frames, in the console of your program the reading speed of your video in Frame Per Second (FPS).
2. Do the same process while you are displaying the frames with imshow().
3. Compare the speed.

Documents

- https://docs.opencv.org/4.5.4/d7/d9e/tutorial_video_write.html (video functions)
- https://docs.opencv.org/4.5.4/db/da5/tutorial_how_to_scan_images.html (time functions)

Exercises 2: Color conversions

Open an RGB image and transform it in 9 gray images. One corresponding to the R channel (RGB color space), one from B (RGB color space), one from G (RGB color space), one from H (HSV color space), one from S (HSV color space), one from V (HSV color space), one from L* (L*a*b* color space), one from a* (L*a*b* color space) and one from b* (L*a*b* color space).

Save all these images with a file name including the corresponding color space and channel.

Document

- https://docs.opencv.org/4.5.4/de/d25/imgproc_color_conversions.html (color conversions)

Exercises 3: Histograms

Open an RGB image and compute for each channels the corresponding 1D histogram.

Draw these 3 histograms in the original image with a transparency effect and display it.

Document

- https://docs.opencv.org/4.5.4/d8/dbc/tutorial_histogram_calculation.html (histogram functions)

Exercises 4: Class design

Design and implement a class which will allow you to display a frame (at a time t) from a video file and 2 other images:

1. One with 3x3 images draw on it, corresponding to the following gray images: the R channel gray image (from RGB), B (from RGB), G (from RGB), H (from HSV), S (from HSV), V (from HSV),

L* (from L*a*b*), a* (from L*a*b*) and b* (from L*a*b*). Each of these gray images at 1/3 resolution of the original image.

2. One with 3x3 histograms draw on it, corresponding to the following gray images: the R channel gray image (from RGB), B (from RGB), G (from RGB), H (from HSV), S (from HSV), V (from HSV), L* (from L*a*b*), a* (from L*a*b*) and b* (from L*a*b*).