UNIVERSIDADE DE AVEIRO

DEPARTAMENTO DE ELECTRÓNICA, TELECOMUNICAÇÕES E INFORMÁTICA

Information and Coding (2022/23)

Lab work nº 2 — Due: 27 Nov 2022

Intro

- In this work, besides dealing with audio files, you will also need to manipulate image files.

- This will be done using the OpenCV library (`https://opencv.org/`). Therefore, start by installing this library and take a look at `https://docs.opencv.org/4.x/de/d7a/tutorial_table_of_content_core.html`. Note: before trying to download and build the OpenCV library from scratch, find out if there are prebuilt packages for your system. As usual, you will need both the runtime and development libraries.

Part I

1. Using the OpenCV library, implement a program to copy an image, pixel by pixel, from one file to another file. Both file names should be passed as command line arguments to the program. You may find some examples of images in moodle.

2. Implement a program that:

    (a) Creates the negative version of an image

    (b) Creates a mirrored version of an image: (a) horizontally; (b) vertically

    (c) Rotates an image by a multiple of 90º

    (d) Increases (more light) / decreases (less light) the intensity values of an image

Part II

3. Implement a C++ class for Golomb coding. This class should have (at least) functions for encoding an integer (generating the corresponding string of bits) and for decoding an appropriate string of bits into an integer. The class should also be able to handle negative numbers.

Part III

4. Implement a lossless audio codec, based on Golomb coding of the prediction residuals. Consider both temporal and, in the case of stereo audio, inter-channel prediction. Remember that the efficiency of Golomb coding depends on a parameter, m, which can be fixed and indicated directly to the encoder or, preferably, be adaptive and optimally determined by it.

5. Include an option for lossy audio coding, based on residual quantization.

Part IV

6. Implement a lossless image codec, based on Golomb coding of the prediction residuals.

Part V

7. Elaborate a report, where you describe all the relevant steps and decisions taken in all the items of the work. When appropriate, include also measures of processing time, compression ratios and corresponding errors introduced by the compression/decompression process. For this, use several audio and image examples. This report should not be a description of the code implemented. Instead, it should illustrate what can be obtained using the software developed and how it can be obtained. Also, it is important to compare your results with those obtained with existing audio and image codecs.