Warsaw, 08.01.2017

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"Computer-generated holograms compression algorithm" documentation

1. Introduction

This project is a part of Bachelor's thesis: "*Design of the algorithm of a lossless compression of computer-generated holograms*". This document describes basic usage of 4 python files created for the purposes of this project.:

a) Bytes algorithm -files: *encode_bytes.py*, *decode_bytes.py*

Designed for bitmaps with size that is a multiple of 8.

b) 4-bits algorithm – files: *encode_4bits.py, decode_4bits.py*

2. Technical requirements

Below you can find suggested requirements for using the scripts. Even though it is probably possible to use different versions of libraries, programs were not tested for other configurations.

- Python 3.5, e.g. distribution Anaconda (https://www.continuum.io/downloads)
- Libraries: numpy, os, math, io, sys, time
- OpenCV 3.1 for Python 3.5 (example instructions for Windows: https://www.scivision.co/install-opencv-python-windows/)

3. Files usage

Execution of the file:

python <name_of_the_file>

Example:

python decode_bytes.py

After execution of the file a proper message is printed into console and the user is asked for the location of binary/bmp files (highlighted in listing below). Sample listing of the program *encode_bytes.py*:

```
F:\CGH_compression
λ python encode_bytes.py
Bytes algorithm - compression
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Path to source bitmaps: F:\CGH_compression\samples
Path to output binary files: F:\CGH_compression\output
Found files: ['Lena-4000mm']
Image F:\CGH_compression\samples\Lena-4000mm.bmp loaded.
Extracting bitplanes to F:\CGH_compression\output\Lena-4000mm.
Image 0.bmp
Image 1.bmp
Image 2.bmp
Image 3.bmp
Image 4.bmp
Image 5.bmp
Image 6.bmp
Image 7.bmp
Extracting bitplanes took 7.011911630630493 seconds

Encoding in progress...
F:\CGH_compression\output\Lena-4000mm\0_.bmp
F:\CGH_compression\output\Lena-4000mm\1_.bmp
F:\CGH_compression\output\Lena-4000mm\2_.bmp
F:\CGH_compression\output\Lena-4000mm\3_.bmp
F:\CGH_compression\output\Lena-4000mm\4_.bmp
F:\CGH_compression\output\Lena-4000mm\5_.bmp
F:\CGH_compression\output\Lena-4000mm\6_.bmp
F:\CGH_compression\output\Lena-4000mm\7_.bmp
Data encoded.
Encoding binary files took 4.499652624130249 seconds
```

Listing of decoding scripts are similar. Listing of *decode_bytes.py* file is shown below. Again highlighted directories are provided by the user.

```
F:\CGH_compression
λ python decode_bytes.py
Bytes algorithm - decompression
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Path to input binary files: F:\CGH_compression\output
Full path to output bmp files: F:\CGH_compression\final
Found folders: ['Lena-4000mm',]
How many bitplanes do you want to decode? 3
Decoding in progress...
Lena-4000mm
Found files: ['0', '1', '2', '3', '4', '5', '6', '7']
5
6
7

Data decoded.
Decoding took 3.7092325687408447 seconds

Writing final image...
F:\CGH_compression\finalLena-4000mm_final.bmp
Done.
```

It is possible to encode/decode multiple images in one script execution. In *samples* folder attached to documentation you can find some sample holograms. Executing one of the encoding scripts with providing source directory as absolute path to *samples* will result in encoding all of the images at once. It is crucial to remember to always provide full path to the directory with the file location, not the single file name nor full path with file name.

For any other information please contact me: kochanska.paula@gmail.com. I will be happy to answer all of the questions.