MysteryTwister C3

THE CRYPTO CHALLENGE CONTEST

HOLOGRAPHIC ENCRYPTION – PART 1

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Introduction

Holography has the ability of recording the full information of an electromagnetic wave. Its most popular feature is the possibility of rendering 3D images by projecting fields through the propagation of waves along with their phase information.

As it also has properties of information encoding and data compression, it has been proposed to employ holography to encrypt images, especially as it can record the encrypted information directly on the storage medium.

Challenge

You received an encrypted image, given by three phase-shifted holograms "challenge_holo0.tif", "challenge_holo1.tif" and "challenge_holo2.tif". The three encrypted holograms have been created using double phase Fourier encryption. You also received the two encryption masks, but these have been corrupted during transfer ("mask1_corrupt.tif" and " mask2_corrupt.tif"). You know the pattern is right, but the 10 values used in the masks encoding have been permuted. You know that the encoded information is limited to a pure amplitude binary image (only the two values 0 and 255). Can you still decrypt the image?

The solution consists of the codeword given in the image. Please enter the solution in capital letters, e.g. CODEWORD.

References

In the document **"mtc3_holocrypto_description.pdf"** the cipher is explained in detail. You can find it within the additional zip file.

An implementation of the encryption procedure is provided in "holoCryptoFourier.c", which can be employed to test the putative phase masks. During encryption, the program takes two 8-bit images [0, 255] as input (i.e. "input0.tif" and "input1.tif"), which represent the input field, with respectively the amplitude and phase of the field $o = Oe^{i\varphi}$, and the 2 phase masks encoded as 8-bit images ("mask1.tif" and "mask2.tif"). The output is given by 3 phase-shifted holograms encoded as 16-bit images [0, 65535] (i.e. "holo0.tif", "holo1.tif" and "holo2.tif"). During decryption, the inputs and outputs are reversed. You can find the implementation also within the additional zip file.

Additional Files

The additional zip archive contains the following files:

- mtc3_holocrypto_description.pdf
    - ➡ detailed explanation of holographic encryption
- challenge_holo0.tif, challenge_holo1.tif, challenge_holo2.tif
    - ➡ the phase-shifted holograms of the encrypted image
- mask1_corrupt.tif, mask2_corrupt.tif
    - ➡ the corrupted encryption masks
- holoCryptoFourier.zip
    - ➡ C source code and test files for holoCryptoFourier
- All tif files are also available as csv files.