The Steganography in Spectral Area of the Image

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ABSTRACT

In this topic is presented the hiding algorithm of the image in the spectral field with the help of Fast Fourier Transform (FFT).

Keywords

Image processing, informatics, Fast Fourier Transform (FFT), steganography, cryptography.

1. PREFACE

Now days the safe and secure delivery of information is very important issue. Many methods have been worked out and practiced for realization of this issue. One method of solving the problem is steganography (the aim of which is handing the information so, that "the trespasser" cannot even identify the presence of the information) [1,2]. Rome Caesars used this method by writing information in the shaved heads of their slaves. As science and technique are developing, the steganographical algorithms also need to be developed and fashioned.

2. WHAT IS SUGGESTED

The actuality of the method of solving the problem is, that it suggested new method and guarantee the hiding of the information in the spectral field of the image without changing its' outward by using FFT [3-5]. So, we will have increased degree of secretness and stability of information hiding which is needed in modern world.

Above-mentioned method can be used in many modern systems: for example, passing information in a governmental management or in a national security fields in a safe mode.

3. THE ALGORITHM

We have image in a .tiff format [7], in which we need to hide information. The hiding process is going by following way:

At first, we read the information from the .tiff file and present it as three-dimensional array. We get that three-dimensional array by producing R, G and B (Red, Green, and Blue) components as two-dimensional arrays and for each of them doing Fast Fourier Transform. In this case it is more rationale to use complex <double> type of three-dimensional array, as at first, variables of complex type are needed for FFT, and double, cause if we use, for example, int (integer) type, we will have a big flow of information, because of rounding of numbers (for example, for phase values are from $-\pi$ to $+\pi$. If we pass 0.74 to the int type without rounding, we will have zero and we will have one with rounding, which will make too big mistakes in further calculations).

So, having three-dimensional complex <double> type arrays we do FFT on them, after which each element of R, G and B components of image, which should be hidden, is copied on the real part of the container's (the file in which information should be hidden) corresponding elements.

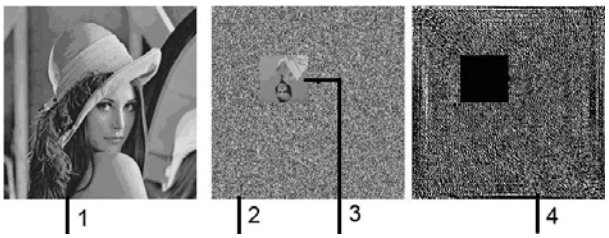
After this, we make the inverse algorithm of the FFT and get the source image, in which already exists the hidden information and its' presence cannot be seen by naked eye. For decoding the information, we must do FFT for each component of the image (in which hidden information already existed), after which we will get the hidden information.

During hiding the information we must take a notice in which part of the phase sphere it is being saved, as its influence can be rather big and can damage the primary image.

4. THE SYSTEM'S GRAPHIC INTERFACE

Now we will produce the process of hiding information in a graphic interface (in order of information hiding).

In pic.1 is produced: primary image – pic.1.1, in which information should be hidden, the amplitude – pic.1.2, after Fast Fourier Transform and the phase – pic.1.4, as well as information (pic.1.3) that is already copied in the spectral field.



Pic.1

After inverse Fourier Transform, we get Pic.2.

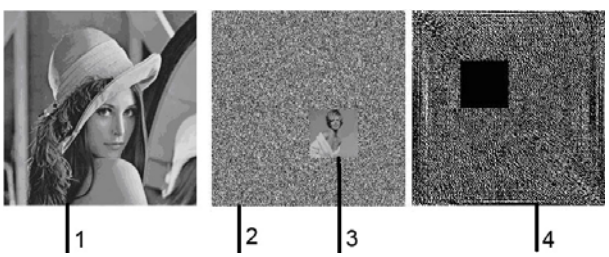
Pic.2

As we see (with naked eye) there is no difference between the primary image and image that already contains information – pic.2.2 (pic.2.3 is the imaginary part after complex transformations).

After these actions, we save the final image.

Now let us produce the inverse action: decoding.

After reading the image which already contains information, we do FFT and get images' amplitude (pic.3.2), phase (pic.3.4) and the hidden information (pic.3.3).



Pic.3

So, we have full information (without any corruption), which were hidden.

5. CONCLUSION

In this work is worked out and realized the steganographical algorithm, which gives an opportunity of hiding information in the spectral field of the image.

In the process of making project has been realized the algorithm of Fast Fourier Transform, worked out and realized simple cryptographic algorithm and steganographic algorithm for the images' spectral field.

Developed algorithms and systems have their own place in the software system, which gives opportunity to check the developed method for hiding information of any type and size and make more powerful steganographical systems.

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