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WPROWADZENIE UKRYTEJ INFORMACJI PRZY UŻYCIU DYSKRETNEJ TRANSFORMATY FOURIERA

EMBEDDING OF THE HIDDEN INFORMATION WITH THE USE OF DISCRETE FOURIER TRANSFORM

Streszczenie

W artykule przedstawiono wyniki badań algorytmu ukrywania informacji w nieruchomych obrazach za pomocą dyskretnej transformaty Fouriera. Przedstawiono schemat blokowy algorytmu ukrywania i znaleziono problemy powstałe w procesie ukrywania

Słowa kluczowe: steganografia, pojemnik, ukrywanie, dyskretna transformata Fouriera

Abstract

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The paper presents the results of studying the algorithm of embedding information in stationary images using the discrete Fourier transform. It also presents the block diagram of the hiding algorithm and analizes the problems that appear in the process of embedding.

Keywords: steganography, container, hiding, discrete Fourier transform

In the contemporary world it is very popular in science to use cryptography, digit signal prosessing and communication theory. This is digital steganography. It allows to hide one data in others with the use of the digit signal prosessing methods. For example, it is possibile to hide image in image, text in text, text in image etc.

Different methods are used during the image processing. For the high frequency signals it is the Fourier transform and for the data with very small details it is wavelet transform.

Methods of hiding information in frequency domain use image decomposition to the frequency bands in which the steganographic message is embedded. For such realization we use discrete cosine transform, discrete Fourier transform, discrete wavelet transform and other methods.

This work has analyzed algorithms of hiding information in frequency domain of the static images.

For the research we use two images different sizes. Suppose image in which we hide information (container) has size n_1 x m_1 pixels, and the hiding image – size n_2 x m_2 pixels.

Steganographic algorithm consist of such steps:

- reading from files the images of container and hidden message-image;
- decomposition of the images to colors in the RGB palette;
- transition to frequency domain;
- transition into frequency domain for the container with using the discrete Fourier transform;
- creation of amplitude-frequency and phase-frequency spectrum for the container;
- embedding pixels of hidden image into the amplitude coefficients of container amplitude-frequency spectrum;
- transition into spatial domain with the use of the inverse discrete Fourier transform;
- creation the file of image with a hidden message.

This algorithm realized in MatLab. Block diagram of embedding algorithm is shown in fig. 1. The process of embedding occurs as follows.

The image from the file *image1.jpg* (empty container) reads into variable *A* and steganographic message (file *image2.jpg*) – into variable *B*. After this has entered shifts along axes X and Y (d_1, d_2) to determine the place of empty container in

which the hidden image will be embedded. In the next step those images decompose on red, blue and green palette (x, y, z – for container A; x_1, y_1, z_1 – for steganographic message B).

For the transition into frequency domain straight two-dimensional quick Fourier transform was used to all colors palettes of empty container and for the obtained complex numbers allocate amplitudes a_1, a_2, a_3 (modules of complex numbers) and phases f_1, f_2, f_3.

The next step is the process of embedding the hidden image into the container. For this use the high frequency domain of container amplitude-frequency is characteristic. During the embedding process there is the changing of amplitudes on high frequencies on the pixels value of red, green and blue palettes.

In the last step for obtained modified amplitudes and phases of phase-frequency characteristic of empty container we have constructed complex numbers. Inverse two-dimensional Fourier transform apply to those numbers. For the resulting complex numbers the image with using the MatLab function rgb() has been constructed.

Afterwards the obtained hidden image from the full container is transpired, the obtained image is slightly distorted. The reason for the existence of noise in obtained image is rounding errors of real and imaginary parts of complex numbers after the inverse Fourier transform.

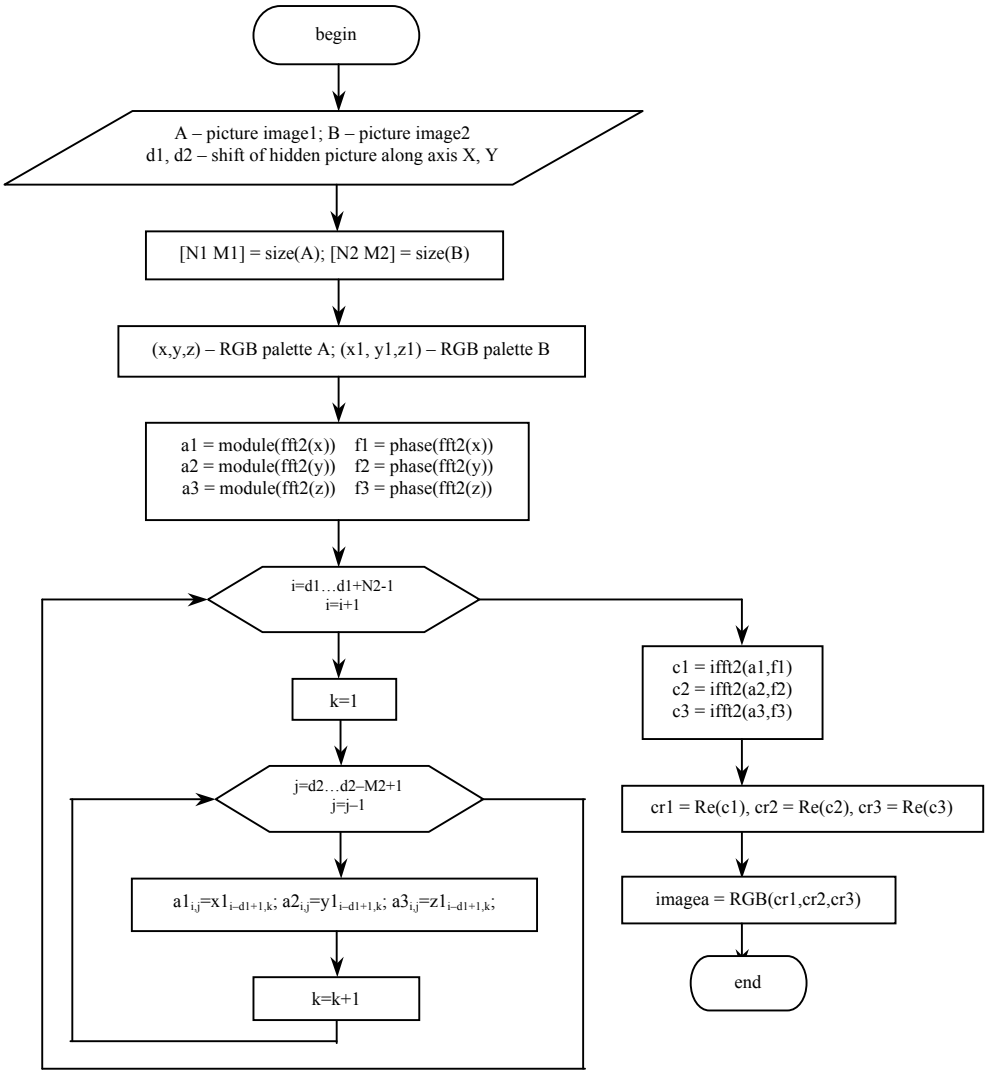

Fig. 1. Block diagram of embedding algorithm

During the research we also embedded hidden image into different frequency bands of image-container amplitude spectrum. But an improvement of the quality of the obtained image did not happen.

In the next research we plan to use other color palettes, for example LAB, for decrease the noise of obtained image.

References

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