СЕКЦИЯ «ИНТЕЛЛЕКТУАЛЬНЫЕ ТЕХНОЛОГИИ И СИСТЕМЫ»

COMPARATIVE STUDY OF STC AND LSB IMAGE CODING METHODS BASED ON STEGANOGRAPHIC MODIFICATION STATISTICS

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In this paper, steganography algorithms based on STC and LSB methods are subjected to comparative analysis from different perspectives, and visualization and quantitative statistics of their results are performed.

Keywords: algorithm; low bit-plane image; STC and LSB steganographic methods; statistics

СРАВНИТЕЛЬНОЕ ИССЛЕДОВАНИЕ МЕТОДОВ STC И LSB КОДИРОВАНИЯ ИЗОБРАЖЕНИЙ НА ОСНОВЕ СТАТИСТИКИ СТЕГАНОГРАФИЧЕСКИХ МОДИФИКАЦИИ

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В работе алгоритмы стеганографии на основе STC и LSB методов подвергаются сравнительному анализу с разных точек зрения, а также выполняются визуализация и количественная статистика результатов их использования.

Ключевые слова: алгоритм; младшая битовая плоскость изображения; STC и LSB стеганографические методы; статистика

INTRODUCTION

Information hiding is one of the important means of information security. In the process of network communication and data storage, it can not only ensure the security of the confidential information itself, but also hide the fact of transmission and storage of secret information.

Traditional, widespread, steganographic algorithms based on LSB method have a significant disadvantage - low steganographic stability.

Steganographic algorithm based on the STC method is an image encoding algorithm that minimizes the distortion of the container image when embedding secret information into it by minimizing the number of modifiable bits of the container. The mathematical basis of STC includes the following aspects:

binary linear convolution code, Syndrome-Trellis code, Trellis diagram and Viterbi algorithm [1, 2].

EXPERIMENTAL STUDIES

In this paper, experimental studies of steganographic parameters of STC and LSB methods for hiding secret information (message) are carried out.

For this purpose, five containers of two types are selected each: synthetic images and natural photos. The sizes of the containers are 2500/1500/1000/500/500/250 KB respectively. The lowest (zero) bit plane of the container was used to embed the message. The corresponding maximum possible message size is the container size divided by eight. The parameter diff % was evaluated, showing the percentage of the number of modified bits of the container to the total number of bits of the embedded message.

The container bit modification statistics when using STC and LSB methods are shown in Fig. 1. It can be seen that when the low-order bit plane of the container is filled with the message at 100%, the variation of the diff parameter did not exceed a few percent for a10-fold change in the container size. However, the diff value is on average 5% smaller when using the STC method.
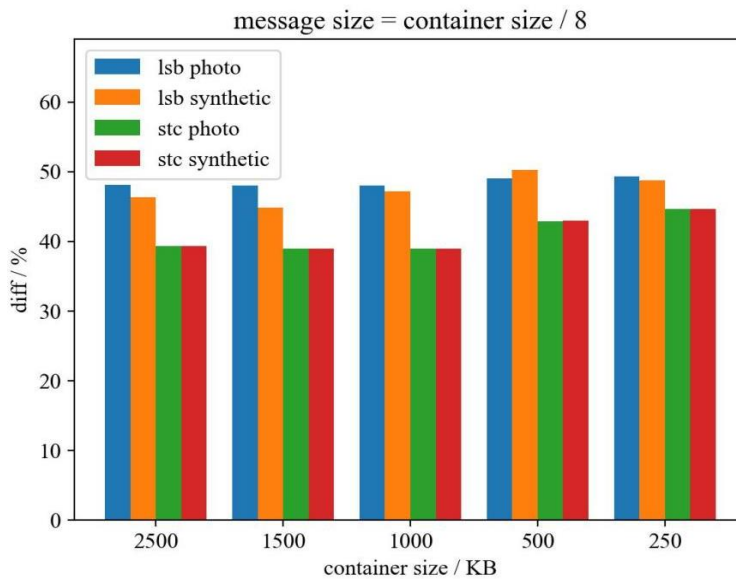

Fig. 1. Statistics of image modification with STC or LSB

Fig. 2 visualizes the results of using two types of containers as well as LSB and STC embedding methods. The message is embedded in the minor bit planes of the containers when they are 100% filled. The results of steganographic modifications of two synthesized (artificial) containers are shown on the left, and two natural (photo) containers are shown on the right. Both types of

containers have the same size - 2500 KB and 1500 KB, the message size is 300 KB and 180 KB respectively, which corresponds to the size of the minor bit planes of the containers.

It can be seen that steganofiles obtained by both methods are visually indistinguishable from unfilled containers.

At the same time, differences in the image structure of the minor bit planes of both unfilled containers and LSB STC steganofiles are observed, which can be used in steganoanalysis.

The estimate of container distortion in this experiment by PSNR parameter for both steganographic methods was about 52 dB.
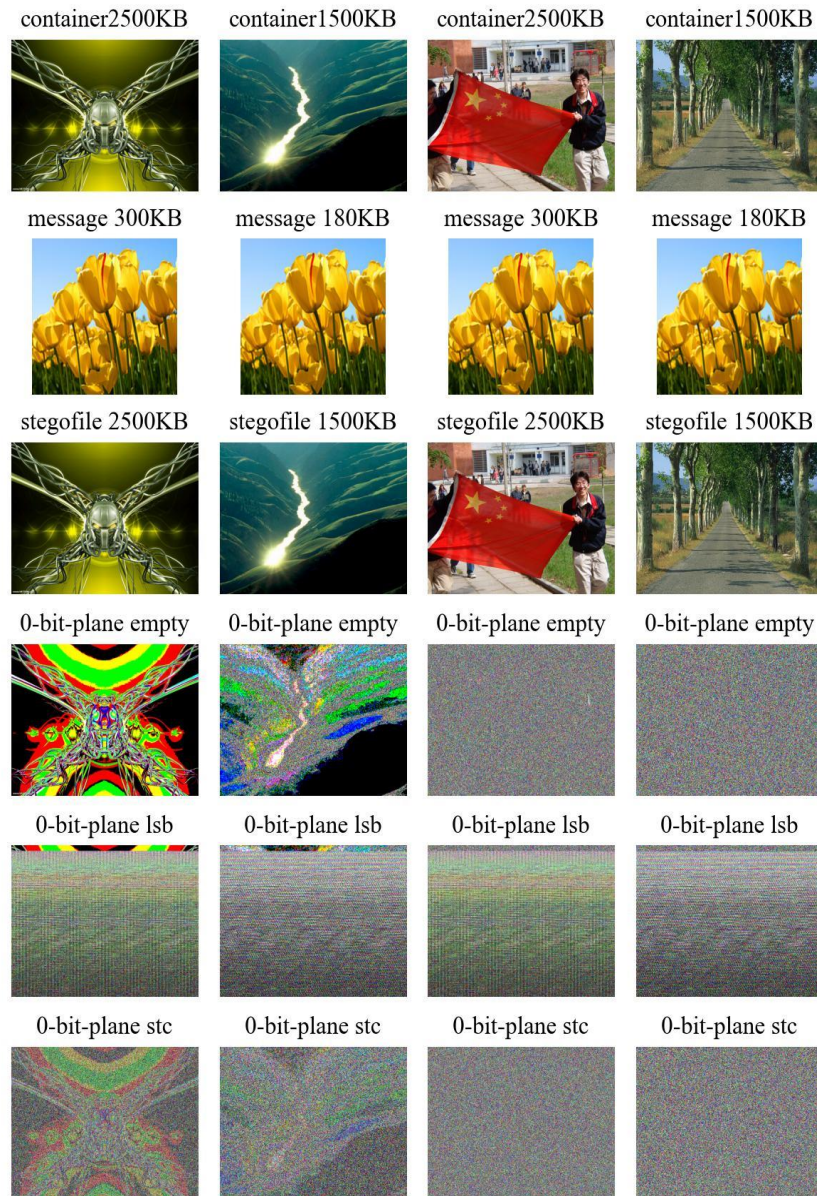

Fig. 2. Comparison of images and their 0-bit plane using STC or LSB

Fig. 3 shows the dependence of diff value on the degree of filling the container with message when using LSB and STC steganographic methods.
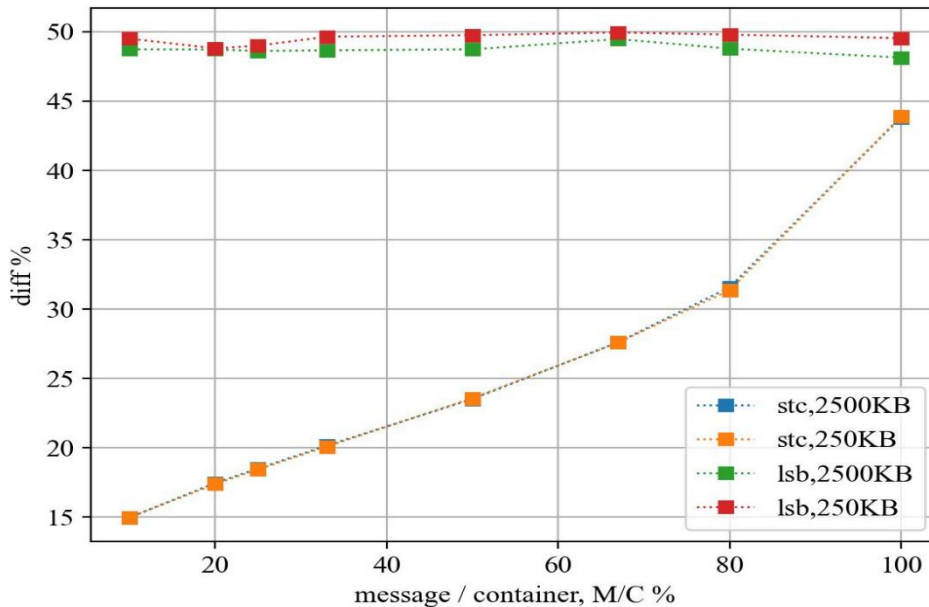

Fig. 3. Statistics of image modification using STC with different message sizes

The figure shows that the STC method is characterized by a decrease in the number of modifiable bits of the container as the size of the embedded message decreases. It is noticeable that when the container occupancy with the message decreases from 100% to 50%, the diff value decreases from 43% to 23%. The value of diff in case of LSB method remains practically unchanged at the level of 50%, which is statistically justified.

CONCLUSION

The STC steganographic method has significant advantages over the LSB method in terms of container distortion when the container is 80 percent or less filled with the message, regardless of the absolute size of the container.

REFERENCES

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