

*Нагиева Абабил Фахраддин гызы, старший преподаватель,
Кафедра компьютерной инженерии и телекоммуникаций, Азербайджанский
Технологический Университет, Гянджа, Азербайджан*

**МЕТОДЫ СКРЫТИЯ ДАННЫХ НА ОСНОВЕ ИНТЕРПОЛЯЦИИ
ИЗОБРАЖЕНИЙ**
DATA HIDING TECHNIQUES BASED ON IMAGE INTERPOLATION

Аннотация: Последние десятилетия нашего центра характеризуются увеличением количества цифровых камер и устройств мобильной связи и, соответственно, потока информации, распространяемой через Интернет в форме мультимедиа. Потенциальные пользователи глобальных компьютерных сетей получили возможность ассимбилизироваться со всеми видами источников информации, получать и модифицировать эти данные. В связи с этим появилась новая проблема – надежная защита хранимой и передаваемой информации. В данной работе соблюдается стеганографическая техника информационной безопасности, методом сокрытия данных методом интерполяции. Приведена методология повышения качества изображения, которое будет использоваться в качестве контейнера для секретного сообщения с помощью интерполяционной техники.

Ключевые слова: Стеганография изображений, обработка изображений, сокрытие данных, интерполяция изображений.

Annotation: Last decades of our centruy is characterised by encreasing an amount of digital cameras and devises of mobile communication and accordingly flow of information and circulated over Internet on the shape of multimedia. Potential users of global computer nets have got an opportunity to assesibility to all kinds of information sources, to get and modify those data. In conjunction with that appeared

a new problem-securely protection of stored and transmitted information. In this work steganographic information security technic methodology of data hiding by using interpolation method is observed. Metodology of improving quality an image to be used as container for secret message by utilisation of interpolation technic is given.

Keywords: Image steganography, image processing, data hiding, image interpolation.

Introduction

Internet and wireless communication have been created new opportunities for massive exchange of multimedia information. Developed and implemented last time all over the world software and devices has enhanced user opportunity to accessibility, development and modification of multimedia sources on global level. That in turn increased morbid fascination to detection and utilization of secret data. Thus clear increased role of scientific development concerning robustness of information systems i.e. information security. For this purpose cryptography, steganography and watermarking techniques are used.

Cryptography is encrypted secret message that transmitted (sends) that over open communication cannel to receiver of message. In this case eavesdropper could detect the presence of message, but can't to read encrypted information. Steganography is hided secret message into any multimedia domain. Attacker doesn't know about existence of secret message.

Variety of multimedia carriers have created multiple of different data hiding technics for insure information security. Information security means deprive attacker an opportunity to detect existence of hided information. Data hiding and transmission is going on in stenographic systems (Figure 1). At the time of stegosytsems design most important question is properly developed criteria of security.

Steganography

Steganography is a new direction of science and used for data hiding, more preferable than cryptography and watermarking, because securely is conceal

communication and nobody in this case can't imagine concerning hidden data except sender and receiver. In simple words steganography is invisible communication.

Secret information is hid into any multimedia carriers, so called container. There are many unused spaces in container which are a convenient for insertion secret message. After insertion message to these spaces, container is sent to receiver and this data will be invisible for the third party. Enough note worth scientific papers from different countries dedicated to digital steganography and it's constituent part image steganography are published and most popular among them are [1; 2; 3]. The word steganography has Greece origin stegano (covert) and graph (writing). Ancient Greeks used primitive elements of steganography, but nowadays is utilized computer steganography which have many branches.

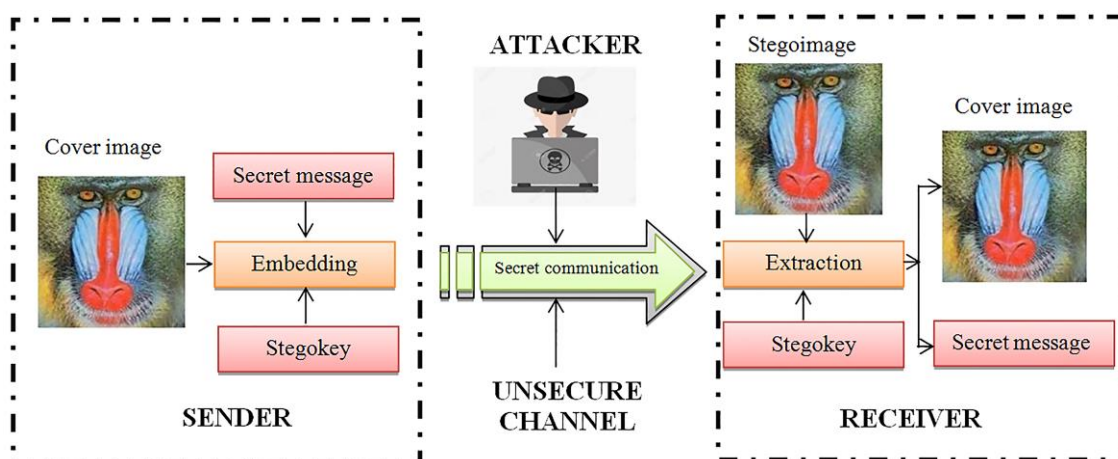


Figure 1. Scheme of stegosystem

Image steganography

Last decades have been characterized by wide implementation of digital cameras and high speed internet transmissions and connected with that worldwide circulated a huge flows of data on the shape of image. That's reason why image steganography has so rapid development and implementation accordingly. This is an art of data hiding within digital images to ensure secret communication [1; 2; 3]. Thanks to its advantages image steganography has become more popular than other methods [4].

Digital image in image steganography is called container and plays role of carrier of hidden information. Container must be properly chosen, because reliability stegosystem depend on characteristics of image [5]. There're different technics for preliminary processing and improving containers quality. One of them is image interpolation technic.

Interpolation technic

Interpolation method are used in image steganography for improving image resolution which to be utilized as cover for secret message transmission. This method is one of the widely used and important techniques on the field of signal theory. In the same time there are image interpolation methods what alike computer graphics and image processing have a big history. The main reason of interpolation technical implementation in steganography is increasing important indicators of image which to be used as container for secret communication.

The main target of all investigations regarding image interpolation implementation is simplification of computing and achieving high quality of image.

Related work

Let as consider existed interpolation methods. Most popular among them is neighbor an bilinear interpolation methods. Bilinear interpolation method has been utilized four nearest pixel of image to determine coordinates of the four increasing image resolution and quality of image respectively. But disadvantage of this method is that required 3-4 time more computing time. Ki-Nyun Jung and Kee-Young Yoo have proposed a new data hiding technic using image interpolation [6].

In accordance with proposed neighbor pixels value is used for calculation of mean number and after that inserted these calculated values into not embedded pixels. Generally it is possible to get pixels with more high resolution by implementation of such calculating technics. That is advantage of proposed NMI method.

Muhammad S., Naveed E., Irfan M., Sung W. B., "Digital image super-resolution using adaptive interpolation based on Gaussian function". Here has proposed a new approach for increasing of super resolution of digital image. In this approach for evaluation of value of neighbor pixels Gauss edge interpolation is used.

According to this method interpolation inserted to edge and smooth areas and texture of an image with low resolution. As resulting in a high quality of image is provided by a short time complexity. Input digital image after implementation of offered method is becoming with a high resolution. This method of super resolution of image is utilized in very different areas- such as TV, medical images satellite images and others. This method was qualitative and quantitative tested and have got good results. In the same time, proposed technic was compared with 4 others technic: IIN and other three well known classic interpolation methods the nearest neighbor bilinear, bicubic.

Olivier R., Hanqiang C., “Advances on image interpolation based on ant colony algorithm”. AACA (ant colony algorithm) based Image interpolation method is proposed for high resolution scaling getting. Difference between existed OBACA algorithms based on bilinear interpolation method is that in a new proposed technic AACA global evaluation scheme is utilized. In contrast that in OBACA local evaluation scheme is used. Proposed approach is compared with previous well known methods: executed in MATLAB two algorithm and a new edge interpolation algorithm. At the time estimation of quality of two images PSNR and MSE calculation technics are used. From the results of testing seen that output image has a high PSNR and accordingly quality. Finally it may concluded that AACA algorithm is able to decrease interpolation errors and produced image has more high quality than original image. All of said conclusions are illustrated on the example of well known Lena’s photo.

Jana B., Giri D., Mondal S. K., “Weighted Matrix based Reversible Data Hiding Scheme using Image Interpolation”. Here is introduced a new reversible data hiding technic with a high payload based on weight matrix method. In accordance with technic dimension of original message is increased by using interpolation.

Proposed scheme is provided embedding payload on average 2,97 bit/pixel (bpp), good visual quality of image with PSNR higher than 37,97 dp. Proposed method was compared with other widely used methods and was also confirmed high embedding capacity and visual quality.

In the same time proposed scheme has tested at condition of different attacks and defined level of security. A distinctive feature of this method is that security level of Data hiding is achieved by using secret Key K and modification of Weight Matrix. From the other hand Weight Matrix based data hiding method isn't reversible, but proposed method is reversible.

Sabeen Govind P.V., Sajila M. K, Bindiya M. Varghese, "A Two Stage Data Hiding Scheme with High Capacity Based on Interpolation and Difference Expansion" are offered two stage data hiding scheme with a high embedding capacity. On a first stage of image interpolation an original image is changed to cover image. On this stage difference between values of original and interpolated pixels are calculated. On the base of these differences is carried out data hiding proses. On the second stage difference expansion method is used for enlarging of payload capacity.

At the time of testing it becomes known that proposed method of data hiding provides more higher embedding capacity and visual quality of image is satisfactory.

Ahmad A. M., Ali Al-Haj, Mahmoud F., "An improved capacity data hiding technique based on image interpolation", are presented a new interpolation based technic which differs from others by simple calculation. According to the idea of authors proposed method provide high embedding capacity and limited image distortion. All operations are divided to two phases.

First step scaling down/up and on the second step data hiding operation is performed. On the first step of proposed a new interpolation algorithm distortions of image are reduced. Distinguished feature of this method is to trade of between data hiding capacity and the implemented algorithm on adaptive manner regulates quality of image.

An efficiency of proposed algorithm is tested by implementation of PSNR, WPSNR and SSIM (structural similarity index).

The results of testing are:

- Hiding capacity equally 1.7 bpp;
- PSNR-54 dp; WPSNR 78 dp; SSIM-0,9998

Summary

In presented paper we're reviewed some efficient interpolation methods used in data hiding. In these works considered developed by authors new methods for improving quality of images, that uses as cover in secret communication. Among of array existed interpolation methods was chose technics with better conditions of data concealing. We would like implement results of this observe in our future investigation

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