

A Review on Different Visual Cryptography Techniques

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Abstract— Now a day, every sensitive data must be secured. Visual cryptography is a technique to hide the image based secret. In visual cryptography the secret image is encrypted in to shares and at decryption side all shares are superimposed with each other so that secret is revealed. The key feature of visual cryptography is that; no difficult computation is needed at decryption side to decrypt the secret. In this paper various visual cryptographic techniques are discussed and performance analysis is done based on number of secret image, pixel expansion, image format, type of share generated.

Key words: Secret Image Sharing, Pixel Expansion, Visual Cryptographic Scheme, Visual Cryptography

I. INTRODUCTION

In today's technological Era, every sensitive data must be secured and protected. Visual cryptography is a cryptographic technique to hide image based secret. Visual cryptography is a special kind of cryptographic technique, which can decode concealed images devoid of any cryptographic computation [1]. In visual cryptography the secret image is encrypted in to shares. Share is a scrambled form of data. To decrypt the secret, all or qualified set of shares are stacked together and logical XOR operation is performed between them. Visual cryptographic technique uses human visual system to decode the secret. Decryption process does not require any complex computation.

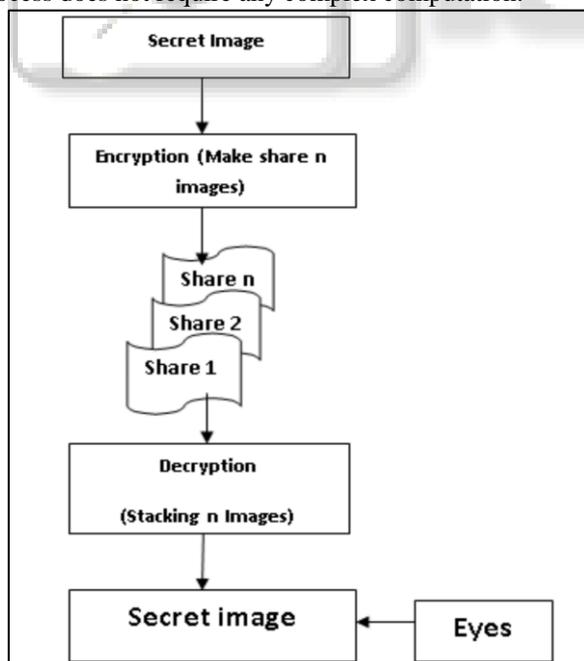


Fig. 1: General flow of visual cryptography[26].

The (2, 2) visual cryptographic scheme is a basic scheme. In this scheme secret image is divided in to exactly two shares, if both two shares are superimposed then secret will be revealed. The (k, n) and (n, n) visual cryptographic scheme is extended version of (2, 2) visual cryptographic

scheme. In (k, n) visual cryptographic scheme secret image is divided into n shares; if k or more then k shares are superimposed then secret will be decoded. In (n, n) visual cryptographic scheme all n shares are require to decrypt secret.

The basic flow of visual cryptography is shown in figure 1. In this flow secret image is fed as an input. Then secret image is encrypted in to shares. Share is nothing but scrambled form of original secret image. When all or qualified set of shares are super imposed with each other then original secret image will be revealed.

In this paper various visual cryptographic techniques and research work done in this field is discussed. This paper also does performance analysis of different visual cryptographic techniques on the basis of image format, pixel expansion, number of secret image, type of share generated.

II. COMPREHENSIVE REVIEW ON DIFFERENT VISUAL CRYPTOGRAPHYS TECHNIQUES

Visual cryptography is an image encryption technique, which hide the image based secret. The big advantage of visual cryptography is that it does not require any complex computation for decryption of secret but it is performed by human visual system. In the following section the review of the different types of visual cryptography schemes are given.

A. A Review on Halftone Visual Cryptography

The review based on halftone visual cryptography is given as follows. In [5] authors have developed a general halftone visual cryptography framework, where secret image is encoded into halftone shares. This technique uses blue noise halftoning principle. The visual quality of obtained halftone shares is better than other methods. In [8] authors have proposed halftone visual cryptography construction method based on error diffusion. Pixels which carry the secret information are preset before a halftone shares are generated from grayscale image. The homogeneous and isotropic distribution of the preset pixels imposes the least noise in the error diffusion, thus leading to shares with high image quality. In [10] authors have proposed a method for processing halftone image that improve the quality of generated shares and recovered secret image, and also maintain the perfect security. In [11] authors have proposed a size invariant VSS scheme which is suitable for different distribution of image's gray values. The secret image is changed to another image then histogram of original image is generated, according to the type of the histogram shares are generated.

B. A Review on Color Visual Cryptography

The review based on color visual cryptography is given as follows. In [3] authors have proposed an effective and generalized scheme for color image hiding. In this scheme, a

secret color image hides itself in two arbitrary color images, which can be constructed and then are kept by two participants, separately. The processed image is known as camouflage image. In [4] authors have proposed a method of visual cryptography for color image. This method exploits the techniques of halftone technology and color decomposition to construct three methods that can deal with both gray-level and color visual cryptography. In [18] authors have proposed a new color transfer scheme with (k,n) visual cryptography model. In encoder a color image is encrypted in to n noise like binary share images, when any k or more than k shares are collected, a high quality colorful version of secret image can be reconstructed. The proposed method is a cheating immune. The reconstructed color image quality is determined by digital halftoning approach, inverse halftoning technique and printing and scanning distortion. This scheme is cheating immune and can be used as an image and video colorization. In [23] authors have proposed a secret sharing scheme for color image using Asmuth bloom technique which is further extended for accurate reconstruction of given original image. The proposed method uses quantization process to avoid loss of secret data.

C. A Review on general access structure visual cryptography

The review based on general access structure is given as follow. In [13] authors have proposed a new visual cryptography method for general access structure using optimization technique. The advantage of this method is that it improves the visual quality of worse image; no need of codebook or basis matrices as well as it reduces the pixel expansion problem. The recovered image has better display quality than original image. In [14] authors have extended the capabilities of XORed based visual cryptography for general access structure. The advantages of this method are that no codebook is needed; decryption is done by XOR operation, no pixel expansion and perfect reconstruction of secret. In [24] authors have introduced minimization of pixel expansion using integer linear program visual cryptography for general access structure.

D. A Review on Random grid based visual cryptography

The review based on random grid based visual cryptography is given as follow. In [15] authors have shown the strict relation between deterministic and random grid based visual cryptography. The authors shown new results of (2, n), (3, n), (k, n), (n, n) threshold scheme for both deterministic and random grid based visual cryptography. In [16] authors have discussed a new random grid based non expanded visual cryptography for generation of both meaningful and noise like share. They have proposed probability allocation method for production of best contrast in share image as well as stack image. The advantage of this method is that it improved the visual quality of both share and stack images. In [17] authors have proposed a new scheme for random grid based visual cryptography. The size of revealed image is same as original secret image. The researchers have used randomization and pixel reversal approach for all methods. The proposed scheme is highly secured because of randomness. The future work is to improve contrast and reduce pixel expansion.

E. A Review on extended visual cryptography

The review based on extended visual cryptography is given as follows. In [9] authors have proposed an extended visual cryptography for color image, which uses VIP synchronization and error diffusion for visual quality improvement. In [19] authors have proposed a new algorithm for extended embedded visual cryptography for color image using artificial bee colony algorithm. First halftoning process is applied over color image then embedding process is applied. The visual quality is increased then other methods.

F. A Review on Hierarchical visual cryptography

Hierarchical visual cryptography encrypts the secret image in to levels. In [12] authors have introduced a new concept for secret image sharing. Hierarchical visual cryptography hides the secret information into number of levels. The expansion ration is 1:4. In [19] authors have proposed design of hierarchical visual cryptography. The secret image is divided into two shares; these two shares are independently generated their own two share. In this method Generated shares are expansion less. In [20] authors have proposed a novel idea of signature based authentication using hierarchical visual cryptography. HVC encrypts the secret in three different levels. Shares generated out of HVC are used for authentication mechanism. All shares are high contrast in nature. Signature based authentication is found to be powerful than biometric authentication as biometric patterns changes over time. Shares generated with this scheme are random in nature giving no information by visual inspection. This is expansion less scheme retaining the size of secret. Graying effect is reduced to zero due to high contrast nature of shares. In [25] authors have proposed a new protocol for hierarchical visual secret sharing using steganography, which maintain hierarchy and detect fake share. The PSNR value of this method is higher than other method.

III. PREPARE YOUR PAPER BEFORE STYLING

Performance of different visual cryptographic techniques is analyzed on the basis of image format, number of secret image, pixel expansion and type of share generated. Table 1 shows the performance analysis of different visual cryptographic techniques.

Paper ref. no.	Image Format	No. of secret image	Pixel Expansion	Type of share generated
[7]	Binary	n	1:4	Random
[8]	Grayscale	4	1:9	Random
[9]	Color	4	1:6	Meaningful
[10]	Grayscale	n	1:1	Meaningful
[11]	Grayscale	1	1:1	Noise like
[12]	Binary	1	1:2	Meaningless
[13]	Binary	1	1:5	Random
[14]	Binary	1	1:1	Random
[15]	Grayscale	1	1:1	Random
[16]	Grayscale	1	1:1	Meaningful
[17]	Grayscale	1	Minimized	Random
[19]	Color	1	1:4	Meaningful
[20]	Binary	1	1:4	Meaningless
[21]	Grayscale	1	1:1	Meaningless

[23]	Color	1		Meaningless
[24]	Grayscale	1	Minimized	Random
[25]	Binary	1	Minimized	Meaningless

Table 1: Performance analysis of different visual cryptographic techniques

IV. CONCLUSION

Visual cryptography is a special kind of image encryption technique in which image is encrypted in to shares and at decryption side all shares are superimposed with each other so that secret is revealed by human visual system. In this paper different visual cryptographic techniques and their performance analysis is done based on image format, number of secret image, pixel expansion, type of share generated.

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