STUDY OF COLOR VISUAL CRYPTOGRAPHY

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Abstract:
This paper shows the study on the concept of color visual cryptography. This paper includes study of color visual cryptography which involves visual information pixel (VIP) synchronization and error diffusion technique applicable for color visual cryptography. VIP carries visual information of original image and VIP synchronization helps to keep the same position of pixels throughout the color channels. Error diffusion generates shares which are clear and visible to human eyes and it improves the visibility of shares. With the help of these two concepts it results in visual quality improvement of images. It also includes a brief description of color model used for the process color visual cryptography.

Keywords: error diffusion, visual cryptography, visual information pixel, visual information pixel synchronization

Introduction

Visual cryptography, is an emerging cryptography technology, uses the characteristics of human vision to decrypt encrypted images. It needs neither cryptography knowledge nor complex computation. For security concerns, it also ensures that hackers cannot perceive any clues about a secret image from individual cover images. There have been many published studies of visual cryptography. Most of them, however, have concentrated on discussing black-and-white images, and just few of them have proposed methods for processing gray-level and color images. Based on previous study in binary image and grey level images this analyzed concept gives a better visual cryptography method for color images and it provides pleasant feel of shares and high visual quality to human eye using Visual Information Pixel and Error Diffusion Technique.

Visual Cryptography for Color Images

In visual cryptography the secret information that is an image is split into shares such that the decryption can be performed by the human visual system by simply superimposing the shares. No computations are involved in the reconstruction of images. This section provides an overview on a color visual cryptography which is simple and good. This method involves C, M, Y subtractive color model in which the color is represented by applying the combinations of colored lights reflected from the surface of an object because most of the objects do not radiate by them [1].

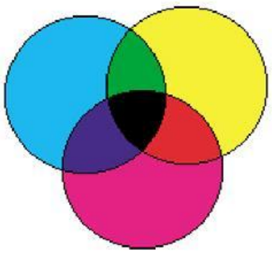

Fig 1. Subtractive color model [1]

This proposed method includes the concept of visual pixel information synchronization and error diffusion.

Error Diffusion: This is simple but efficient method for image halftone generation. The quantization error is filtered and fed to future inputs. The error filter is designed in a way that the low frequency differences between the input and output images are minimized and it produces pleasing halftone images to human vision.

VIP synchronization: Synchronization of the visual information pixel across the color channels improves visual contrast of shares. In color VC schemes the colors of encrypted pixels and the contrast can be degraded due to random matrix permutation. Random matrix permutations are key security features in VC schemes [3]. In gray scale VC schemes it does not affect the visual schemes however in color schemes, independent execution of random matrix permutation for each color channel can cause color distortion by placing VIPs at random positions in sub pixels which finally degrades the visual quality. VIP synchronization prevents the color and contrast of original images from degradation even with matrix permutations. In this concept it derives basis matrices from the given set of matrices which is used in standard VCS.

VIP pixels include the color information of original image which helps in making encrypted shares meaningful. In this process a set of basis matrices $S_c^{c1,c2,,cn}$ (c,c1,c2,,,cn € {0,1}) is generated where c is a pixel bit of message and c1,,,,cn indicates the corresponding pixel bits from the shares. In each row of $S_c^{c1, c2, cn}$ there are q number of VIPs which are denoted as c_i and the values are defined by halftone process. The actual bit values of c_i are defined by referring the pixel values of original shares which are not known at the matrix derivation stage and then errors are diffused away. In this analyzed method each pixel carries visual information as well as message information [3], while other method used needs extra pixels in addition to the pixel expansion to produce meaningful shares. Since each VIP is placed at the same position in sub pixels across three color channels, VIP represents accurate colors of original image. In this method ω (S_c[i]) is a hamming weight of 'OR' -ed row vector up to i^{th} rows in $S_c^{c1, c2, cn}$. This row vector should not contain any c_i as elements. Since the values of ci are undefined, it can be represented as 0 or 1 in the halftone stage which ensures the placement of c_i at the same position in each row of S_c [3].

Thus each encrypted sub pixel has the same VIP positions across three channels which mean that these sub pixels carry accurate visual information of the original image and this result in high visual quality in encrypted shares.

EXAMPLE FOR ANALYZED METHOD

Fig. 2 Secret Image [2]

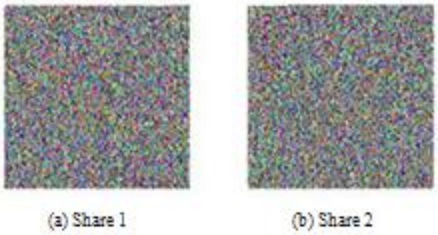

Fig. 4 Shares of original image [2]

Fig. 5 Reconstruction of shares [2]

Conclusion

Review of this proposed method provides a study on a better visual cryptography for color images and it provides pleasant feel with high visual quality.

References

1. Young Chang Hou,2003,vol 36,pp 1619-1629
2. Duo Jin, Wei-Qi Yan, Mohan S. Kankanhalli ,"Progressive Color Visual Cryptography " , JEI,2004
3. InKoo Kang, Gonzalo R Arce, Heung Kyu Lee, "Color Extended Visual Cryptography using Error Diffusion" , 2009