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Analysis of Various Region Incrementing Visual Cryptography Techniques

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Abstract

In today's world, secret data is more pretended to hack easily by unauthorized user. These hacked data may be misused in various ways. So, the field of Cryptography plays an important role to secure data. There are various security media's used to transmit secret information from one location to another, and one of them is image media.

Visual Cryptography is a new technique for securing the visual information like picture, text etc. The basic idea of Visual Cryptography is that images are divided into several parts called shares. These shares are distributed among concerned participants and to decrypt them arrange or stacked to get the image back. At first there are various measures on which performance of visual cryptography schemes depends, such as pixel expansion, visual quality, image quality, contrast, security, quality of shares, size, computational complexity. Visual Cryptography techniques was developed for binary images only but later on it was advanced for colour images also. In this paper, we have done the literature survey on existing work which used different techniques for visual cryptography.

Keywords: *visual cryptography, pixel expansion, visual quality, security, quality of shares.*

I . INTRODUCTION

In today's emerging world of privatization, liberalization, globalization almost every field has become computerized and technologically more advanced for showing of secret images, one of the best techniques with less computation effort is Visual Cryptography.

Visual cryptography is an encryption technique which is used to hide information which is present in an image. In this scheme two transparent images called shares are developed. One of the shares is made of random pixels in which black and white pixels are of equal number. Second share is made according to first share. When these two shares are superimposed, information is revealed. If the image is divided into shares, one of which is completely random and second one is made according to first share, then second one will also look like collection of random pixels. Only when both of these shares will be superimposed, information will be revealed otherwise any single share will be seen as a group of random pixels. If visual secret sharing is used in cryptography, the sender creates two shares one of which is completely random and second one is made according to first share. Sender sends the first share in advance to receiver and the second share which is made according to first share and has the secret information, is sent. Now the first share works as a secret key for receiver. He aligns both the shares and reveals information. Visual cryptography does not require any mathematical computation. It only needs to align both shares and information is revealed. It is impossible to retrieve information from any of the single share because any single share is just a group of random pixels. Visual cryptography is a secure cryptography because the sender generates the shares randomly and each share consist equal number of black and white pixels. These black and white pixels are scattered randomly in a particular share and information is retrieved when these randomly generated shares are superimposed. Figure 1 depicts example for 2-out-of-2 VCS with two sub pixel layouts.

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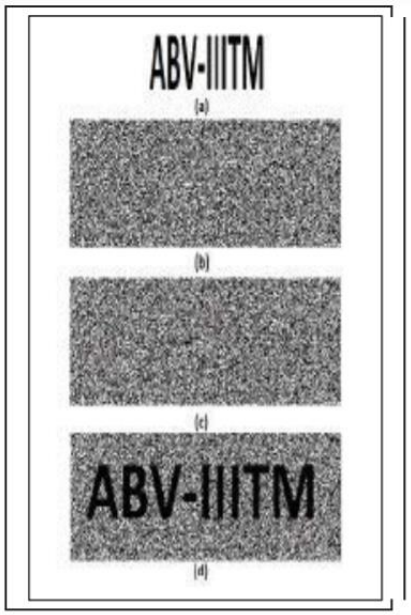

Fig. 1. A 2-out-of-2 VCS with 2-subpixel layout: (a) Secret Image S (b) First Share S1 (c) Second Share S2 and (d) Reconstructed Image by superimposing S1 and S2.

1.1 Visual cryptography for gray level images

Previous efforts in visual cryptography were restricted to binary images which is insufficient in real time applications. Chang- ChouLin, Wen-HsiangTsai proposed visual cryptography for gray level images by dithering techniques. Instead of using gray sub pixels directly to constructed shares, a dithering technique is used to convert gray level images into approximate binary images. Then existing visual cryptography schemes for binary images are applied to accomplish the work of creating shares. The effect of this scheme is still satisfactory in the aspects of increase in relative size and decoded image quality, even when the number of gray levels in the original image still reaches 256.

1.2 Visual cryptography for general access structures

In (k,n) Basic model any „k" shares will decode the secret image which reduces security level. To overcome this issue the basic model is extended to general access structures by G. Ateniese, C. Blundo, A. De Santis, and D. R. Stinson, where an access structure is a specification of all qualified and forbidden subsets of „n" shares. Any subset of „k" or more qualified shares can decrypt the secret image but no information can be obtained by stacking lesser number of qualified shares or by stacking disqualified shares. Construction of scheme is still satisfactory in the aspects of increase in relative size and decoded image quality, even when the number of gray levels in the original image still reaches 256.

1.3 Halftone Visual Cryptography

The meaningful shares generated in extended visual cryptography proposed by Mizuho NAKAJIMA and Yasushi YAMAGUCHI was of poor quality which again increases the suspicion of data encryption. Zhi Zhou, Gonzalo R. Arce, and Giovanni Di Crescenzo proposed halftone visual cryptography which increases the quality of the meaningful shares. In halftone visual cryptography a secret binary pixel „P" is encoded into an array of Q1 x Q2 („m" in basic model) sub pixels, referred to as halftone cell, in each of the „n" shares. By using halftone cells with an appropriate size, visually pleasing halftone shares can be obtained. Also maintains contrast and security.

1.4Recursive Threshold Visual Cryptography

The (k,n) visual cryptography explained in section I needs „k" shares to reconstruct the secret image. Each share consists at most [1/k] bits of secrets. This approach suffers from inefficiency in terms of

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number of bits of secret conveyed per bit of shares. Recursive threshold visual cryptography proposed by Abhishek Parakh and SubhasKak eliminates this problem by hiding of smaller secrets in shares of larger secrets with secret sizes doubling at every step. When Recursive threshold visual cryptography is used in network application, network load is reduced.

1.5Visual Cryptography for color images

The researches in visual cryptography leads to the degradation in the quality of the decoded binary images, which makes it unsuitable for protection of color image .F.Liu,C.K. Wu X.J. Lin proposed a new approach on visual cryptography for colored images.

1.6Visual Cryptography Regional incrementing

VC schemes mentioned above usually process the content of an image as a single\ secret i.e all of the pixels in the secret image are shared using a single encoding rule. This type of sharing policy reveals either the entire image or nothing, and hence limits the secrets in an image to have the same secrecy property. Ran-Zan Wang proposed Region Incrementing Visual cryptography for sharing visual secrets in multiple secrecy level in a single image.

1.7Extended Visual Cryptography for natural images

All of the VC methods suffer from a severe limitation, which hinders the objectives of VC. The limitation lies in the fact that all shares are inherently random patterns carrying no visual information, raising the suspicion of data encryption. Mizuho NAKAJIMA and Yasushi YAMAGUCHI proposed Extended visual cryptography for natural images constructs meaningful binary images as shares. This will reduce the cryptanalysts to suspect secrets from an individual shares. While the previous researches basically handle only binary images, establishes the extended visual cryptography scheme suitable for natural images.

1.8Progressive Visual Cryptography

The application of digital halftoning techniques results in some downgrading of the original image quality due to its inherently lossy nature and it is not possible to recover the original image from its halftone version. Duo Jin Wei-Qi Yan ,Mohan S, Kankanhalli proposed a new encoding method that enables us to transform gray-scale and color images into monochrome ones without loss of any information. Incorporating this new encoding scheme into visual cryptography technique allows perfect recovery of the secret grayscale or color image.

VSS technique have been developed only for black and white images, there are different approaches for gray scale image, and color image have been proposed but these earlier works resulted in a lower quality of the decrypted image into n-shares that are either encoded, printed on transparency and stored in a digital form[4]. These shares may appear as meaningful images or as a noisy like pixel but it will increase interception risk and arouse suspicion during transmission of these secret shares. It cannot leak any confidential or critical information of the shared secret by any combination of the n-shares images except for all of images.

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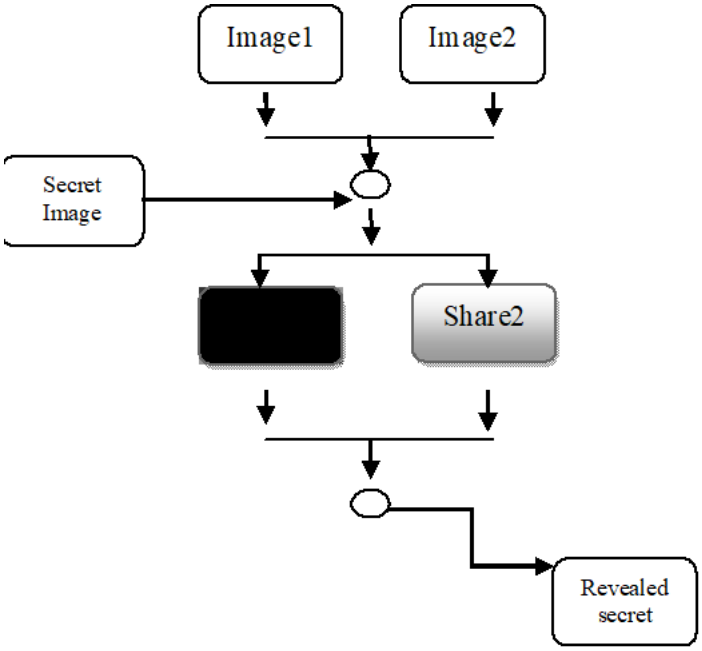

Fig2: Visual Secret Sharing Scheme

Below mentioned are some of the applications of VSS by embedding of an extra confidential image with pair key structure.

- Halftone conversion: In these method the two input images, secret image and the extra confidential image has to be converted into halftone image in order to diffuse the secret image and the extra confidential image in the two input images. Hence halftone conversion can be done by using the Floyd Steinberg dithering process.
- Diffusion: Diffusing the secret image and the extra confidential image into two input image to create share image A and B. Therefore this can be done by swapping each of pixels in the image.
- Pair key structure: The two input image and one secret image has been converted to halftone image. When converting these extra confidential image to halftone and diffuse it with input image, a pair key should be given in order to sender and receiver to get paired mutually.
- Stacking: The two share image that are transmitted via Internet holds secret image, hence to reveal secret image both the share image has to be stacked.
- Shifting: Shifting is the process of placing first share constantly and shifting the second share image to certain unit N/2 to reveal extra confidential image.

Diverse media

Diverse media is used in digital image, printed image and hand-printed pictures.

II. A BROAD REVIEW ON SHARING SECRET IMAGE TECHNIQUES.

A. Review based on enhanced VC scheme for secret image retrieval using average filter.

These approach increase the quality of color decode image. In these approach sender takes one secret image which is encoded into n shares, by applying Jarvis halftoning and encoding table and for the decoding process, the share images are used along with decoding table to obtain original secret image. In these approach basically average filter method has been apply to decrease the noise produce during encoding operation so that the quality of the decoded secret image has been increased [8].

So 15-20% of noise gets reduced by using average filter scheme. But in these approach pixel expansion problem is been arised, to overcome the problem further, inverse halftoning can be applied at the time of decoding of the image.

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B. Review based on a new color VC scheme with perfect contrast.

For security purpose, researcher has made some technique for color image visual cryptography. In these techniques a new color VC scheme is based upon the modified VC. These approach can share a color secret image over n-1 arbitrary natural images and one noise like share images. Natural image can be grayscale or live photos, landscape photos. In these scheme it does not alter the content of natural images, instead it extract feature images from each natural image during encryption process [7].

These propose technique can effectively reduce the transmission risk problem, and also avoid the pixel expansion problem, and makes it possible to obtain original secret image without any distortion. Hence the proposed scheme can share black and white gray-level or color images in a secure way. But the drawback of the scheme is that it cannot work on the threshold type and multiple images vc.

C. Review based on Information hiding in gray scale images using pseudo-randomized VC algorithm for visual information security.

Security has gained more important information technology has become more popularly. In these schemes a novel method of VC has been used for halftoning images which represent the resultant image in the same size as that of original secret image. Halftone image are nothing but continued stored images, photograph that has been converted into black-white images. So hiding of visual information scheme is based on pseudo randomization and pixel reversal [9].Pseudo random is nothing but a deterministic random bit generator generating a sequence of no whose property approximately the properties o sequence of random numbers.

The proposed scheme reveals pixel expansion and the quality of image. But the drawback of the scheme is that dividing pixel into two or more sub pixel, help secret picture required with additional impairments and poor resolutions.

D. Review based upon Linear equation based VSS

Linear equation is an algebraic equation in which each term is constant or product of constant it can have one or more variables. In this scheme Linear equation of Hill Cipher divide the image into sub images and then the method of random grid is used for sub images construction of an encrypted images. In this scheme Linear Equation are used along with Hill Cipher. Hill Cipher is a substitution technique based on multiplication to encrypt the given plain text [6].

These scheme overcome the security issues and it is more secure and effective. But the drawback of the scheme is it is only used or single secret sharing.

E. Review based on digital image sharing by diverse image media.

In Visual Cryptography secret data is hidden in the shares, these shares are either printed on transparencies or are encoded and stored in a digital form. The shares can be noise-like pixels or as meaningful images, but it will increase interception risk during transmission of shares. Hence VSS schemes suffer from transmission risk problem, so to avoid this problem NVSS.

In these approach it uses (n, n)-NVSS scheme that can share digital secret image over (n-1) arbitrary selected natural image (natural share) and one noise –like share. Natural images such as hand-printed picture or photos, I digital form or in printed form. The natural share which are generated using these schemes remains unaltered which are diverse and innocuous, hence reducing the transmission risk issues. This approach also uses different ways to hide the noise–like share (QR-CODE) to greatly reduce the transmission risk problem or the share [5].So these scheme compared with the existing VSS, these scheme provides highest level of user friendliness for shares and for participant .By transmitting secret image via heterogeneous carrier media thus reducing transmission risk.

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2.1 ANALYSIS OF VARIOUS VISUAL CRYPTOGRAPHY SCHEME:

Table: Table for Visual Cryptography problems and solving techniques

AUTHOR NAME	TITLE AND YEAR	METHOD TO SOLVE	PROBLEM
Xuehu Yan et al	Halftone Visual CryptographyWith Minimum Auxiliary Black Pixel & Uniform ImageQuality 2015	HVCS(Halftone Visual Cryptography Scheme)	Error diffusion Large auxiliaryblack pixel distribution
P.G.Haritha et al	A New Visual Cryptography Technique For Color Images 2015	VSS Error Diffusion Chen technique	Visual quality Pixel expansion Contrast loss
Ms.Deepti Chaudhary et al	A Secure Authentication UsingVisual Cryptography & Steganography 2015	Steganography(LSB) VC (k,n)	Authenticity
J. Ida Christy et al	Feed Forward Networks InColor Extended Visual Cryptography To Generate Meaningful Shares 2015	EVCS ColorHalftoning	Random pixel management Pixel expansion
AlfiyaSaiyyad et al	Secure Authentication By Image Processing And VisualCryptography For Banking Applications. 2015	Image processing Correlation method	Authenticity
RiteshD.Yelane et al	Security Approach By UsingVisual Cryptographic Technique 2015	EVCS Halftone	Informationsecurity Contrast
ShrutiSekra et al	Steganography Using Genetic Encryption Along With Visual Cryptography 2015	Steganography (using LSB-Genetic algorithm) VCS	Authenticity
SujitAhirrao et al	Visual Cryptography SchemeFor Color Image Using K-N Secret Sharing Algorithm2015	K n secret sharing algorithm Secure Visual Crytography Water Marking(LSB)	Malicious attacks
Sankar Das et al	Visual Cryptography using Three Independent Shares inColor Images 2015	(3,3)VCS Random insertion of bits Floyds error diffusion Halftone	Reconstruction of secret message

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Fersna et al	Progressive VCS Without Pixel Expansion For Color Images 2015	Progressive Visual Cryptography Halftone Digital watermarking algorithms	Pixel expansion Security Contrast
AparnaBhosale et al	Reducing Transmission RiskUsing Diverse Image Media 2015	(n,n) NVSS(natural image based VSS scheme)	Transmission risk problem

III. PERFORMANCES ANALYSIS OF VARIOUS SECRET SHARING SCHEME.

Performance of VSS is evaluated on the basis of some parameter which is recommended by researchers they are pixel expansion, contrasts, transmission factor or security, quality of image.

IV. CONCLUSION

In today's world security of the image is very important. In this paper surveyed different problems and techniques. This survey is very useful to understand problems and corresponding problem solving techniques and also identifies available techniques to solve a problem. In the 20 years of VC history the extended and embedded VC techniques are hard to hack the hidden information. We conclude that all techniques are good for data hiding and have their own advantages and disadvantages and give a security so that no one can access the image in open network.

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