International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 8, Issue 4 (August 2013), PP.65-68

Visual Cryptography in Gray Scale Images

Archana B. Dhole[1], Prof. Nitin J. Janwe[2]
[1,2]IIIrd Sem. M.Tech (C.S.E.) Department of Computer Science &Engg.

Abstract:- Visual Cryptography is a new Cryptography technique which is used to secure the images. In Visual Cryptography the Image is divided into parts called shares and then they are distributed to the participants. The Decryption side just stacking the share images gets the image. The initial model developed only for the bi-level or binary images or monochrome images. Later it was advanced to suit for the Colour Images means Gray Images and RGB/CMY Images. For the RGB/CMY Images different methods are developed based on the colour decomposition techniques. Pixel expansion and the quality of the reconstructed secret image has been a major issue of visual secret sharing (VSS) schemes. A number of probabilistic VSS schemes with minimum pixel expansion have been proposed for black and white (binary) secret images. This paper presents a (2, 2)-VSS scheme for gray scale of the shadow images (transparent shares) is based on the bit plane coding.

I. INTRODUCTION

Visual cryptography is a cryptographic technique which allows visual information(e.g. printed text, handwritten notes and pictures) to be encrypted in such a way that the decryption can be performed by the human visual system, without the aid of computers. Naor and Shamir [1], in 1994 proposed a new security technique named visual cryptography scheme. In this technique, a secret image of type binary is encoded in a cryptographical manner into random binary patterns which contains n shares in a k-out-of-n scheme.

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 techniques is used to convert gray level images.

A typical grayscale image

In photography and computing a grayscale or grayscale digital image is an image in which the value of each pixel is a single sample that is it carries only intensity information. Images of this sort also known as black and white are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest.

The grayscale images are distinct from one-bit-bi-tonel black and white images, which in the context of computer imaging are images with only the two colors, black and white images, which in the context of computer imaging are images with only the two colors, black and white. Grayscale images have many shades of gray in between. Grayscale images are also called monochromatic, denoting the presence of only one (mono)color (chrome).

Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of electromagnetic spectrum and in such cases they are monochromatic proper when only a given frequency is captured. But also they can be synthesized from a full color image.

In gray scale each pixel has 8 bits. Hence there are 0 to 255 intensity level are there. No matter what pixel depth is used, the binary representations assume that 0 is black and the maximum value (255 at 8 bpp, 65,535 at 16 bpp, etc.) is white, if not otherwise noted.

This paper is well thorough-out as follows, Section II deals with the review of literature. Section III described method of gray scale visual cryptography. And offers proposed scheme.Finally the conclusion of this paper in Section IV.

II. LITERATURE SURVEY

A few researches have discussed the visual cryptography for grayscale and color images. Naor and Shamir mentioned the extention of their scheme to grayscale images[Naor95]. That is, torepresent the graylevels of the hidden image bycontrolling the way how the opaque subpixels ofthe sheets are stacked together. The grayscaleversion of the visual cryptography is fundamentallyproposed in the paper.

There are some researches that deal with color images[Naor96, Koga98, E.R.V97, Rijme96].Naor and Shamir discussed the visual cryptographyscheme which reconstructs a message withtwo colors, by arranging the colored or transparen tsubpixels[Naor96]. Koga et al. deviseda lattice-based (*k*, *n*) scheme[Koga98]. The approach by Verheul and van Tilborg[E.R.V97] isbasically similar to Koga's. Both approaches assign

A color to a subpixel at a certain position,which means that displaying m colors uses $m-1$subpixels. The resulting pixels contain one colored subpixel and the rest of the subpixels are black. Therefore the more colors are used, theworse the contrast of the images becomes significantly.Their approaches cannot be applied tothe extended visual cryptography, either. Rijmen and Preneel talked about enabling multicolors with relatively less subpixels. However each sheets must containcolor random images, which means applying this approach to the extended visual cryptography isimpossible.

In the paper Extended Visual Cryptography for Natural Images[2] proposed by Nakagima focuses on the (2, 2) scheme and discussesthe method to deal with the natural images with intermediate graylevels. It also shows howto enhance the contrast.

In 2002 Young-Chang Hou proposes a Visual cryptography [3]for color images. There have been many published studies [1–10] 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. Rijmen and Preneel [8] have proposed a visual cryptography approach for color images. In their approach, each pixel of the color secret image is expanded into a 2×2 block to form two sharing images. Each 2×2 block on the sharing image is Elled with red, green, blue and white (transparent), respectively, and hence no clue about the secret image can be identified from any one of these two shares alone. Rijman and Preneel claimed that there would be 24 possible combinations according to the permutation of the fou2.3. Gray-level visual cryptography.Since most printers have to transform gray-level images into halftone ones before printing, and the transformed halftone images are black-and-white only, such an image format is very suitable for the traditional method to generate the shares of visual cryptography. So in this paper, use transformed halftone images to generate the visualcryptography for gray-level images. The algorithm is asfollows:

1. Transform the gray-level image into a black-and-whitehalftone image.
2. For each black or white pixel in the halftone image, decompose it into a 2×2 block of the two transparencies

In the paper of Visual Secret Sharing Scheme using Grayscale Images By Sandeep Katta [7] in 2012 proposes a probabilistic 2-out-of-3 visual secret sharing scheme for grayscale images and gives a high quality images that of perfect (original) quality to be reconstructed. Here currently investigating to modify the grayscale secret sharing scheme in to most efficient way. In this scheme the quality of the image is maintained perfectly without any loss of generality but the size of the shadow is increased drastically, which represents the pixel expansion problem.

Secret sharing techniques belong to the larger area of information hiding that includes watermarking [1]-[8]. In secret sharing, random looking shares when brought together recreate the secret. In recursive secret sharing, the shares themselves have components defined at a lower recursive level [3]-[6]. The injection of the random bits in the shares may be done conveniently using d-sequences [9]-[11] or other random sequences.

A grayscale image is an image in which the value of each single pixel is a sample, that is, it carries only intensity information. The darkest possible shade is black, which is the total absence of transmitted or reflected light and the lightest possible shade is white.

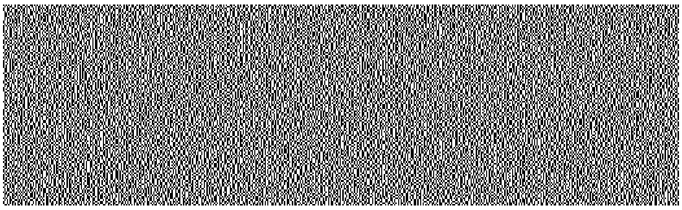
According to their physical characteristics, different media use different ways to represent the color level of images. The computer screen uses the electric current to control lightness of the pixels. The diversity of the lightness generates different color levels. The general printer, such as 2dot matrix printers, laser printers, and jet printers can only control a single pixel to be printed (black pixel) or not to be printed (white pixel), instead of displaying the gray level. As such, the way to represent the gray level of images is to use the density of printed dots. The method that uses the density of the net dots to simulate the gray level is called "halftone" and transforms an image with gray level into a binary image before processing. Every pixel of the transformed halftone image has only two possible color levels (black or white). Because human eyes cannot identify too tiny printed dots and, when viewing a dot, tend to cover its nearby dots, we can simulate different gray levels through the density of printed dots, even though the transformed image actually has only two colors – black and white.

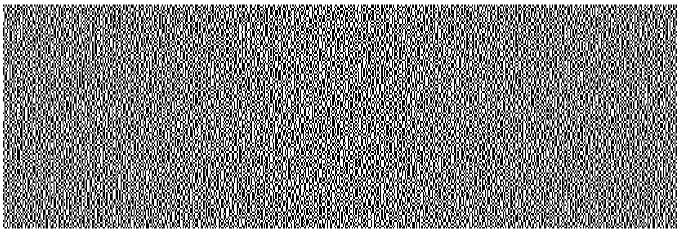
In the paper Boolean XOR Based (K,N) Threshold Visual Cryptography for Grayscale Images by Ram Krishna proposed a VisualCryptography Scheme based on image division of grey level images for the generation of Secret Shares. In this paper werepresent the (k, n) Threshold Visual Cryptography Scheme in which the size of generated Shares as well as RecoveredImage have same as the Secret Image rather than other VCS where k is the threshold value. Also we proposed the newtechnique to generate the Shadow Assignment Matrix with the help of Genetic Algorithm (GA).

In New Algorithm For Halftone Image Visual Cryptography[9] byTalalMousaAlkharobi,King Fahd University of Pet. & Min. proposeses schemes are for gray scale image and by stacking the shares; the resultant image achieved in same size with original secret image. We used randomization and pixel reversal approach in all methods.

Based on our observation that proposed algorithm could not give perfect meaningless shares in case of the dark or high contrast secret image, we have added preprocessing elements to change the dark or high level of gray image into lighter one (called preprocessed image or halftone image). This is to be done before giving input secret image to proposed algorithm. We define two way of preprocessing of the input image as follows: We change the pixel values to white (255) on the bases of the position of the pixel. We use odd and even combination of the pixel values in the matrix as follows:

Method 1: If i=j=odd and i=j=even
pixel (i, j) = 255
Method 2: if i=odd & j=even OR i=even & j=odd
pixel (i, j) = 255.





III PROPOSED SCHEME

The gray scale image is first decomposed into 8 bit binary codes by using bit planes that are equivalent to 8 binary images. A bit plane of a digital discrete signal is a set of bits corresponding to a given bit position in each of the binary numbers representing the signal. For example for 16 bit data representation there are 16 bit planes: the first bit plane contains the set of the most significant bit and the 16^{th} contains. It gives better approximation.

Bit Plane	**Value**	**Contribution**	Running Total
1^{st}	**1**	**1*2 ^7=128**	128
2^{nd}	**0**	**0*2 ^ 6=0**	128
3^{rd}	**1**	**1*2 ^ 5 =32**	160
4^{th}	**1**	**1*2 ^4=16**	176
5^{th}	**0**	**0*2 ^ 3=0**	17
6^{th}	**1**	**1*2 ^ 2=4**	180
7^{th}	**0**	**0*2 ^ 1=0**	180
8^{th}	**1**	**1*2 ^ 0=1**	181

Applied the VCS to each bit plane in order to get n random looking binary images. By stacking the corresponding binary images in bit level, the gray-scale noisy shares can be generated.

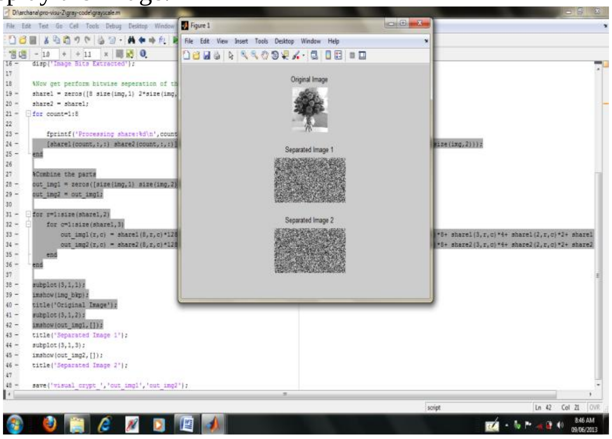
- $S(i,j) = Sb1\,(i,j).2^{N-1} + Sb2(i,j)\,.2^{N-2} + \cdots \ldots\ldots.. + Sb^{(N-1)}\,i,j\,.2 + Sb8(\,i,j)$ -----(1)
- We consider a $w \times h$ grayscale secret image (denoted as S) with *8* bits per pixel. A single pixel value *S (i, j)* with *8* bits image can be represented in a binary form using Eq.(l). Grayscale image is decomposed into its *8* 1-bit plane and every bit plane is a binary image containing a level of information. $S\ i,j = Sb1\ i,j.2N-1+Sb2\ i,j\ .2N-2+\cdots\ \ldots.+Sb(N-1)\ i,j\ .2\ +Sb8\ i,j$ *(1)* Here, *S bi (i, j)* represents the pixel value in location *(i, j)* in *i-th*bit plane of each channel, and *Sbl(i, j)* is the most significant bit plane. Therefore, a channel can be divided into *N* binary images using Eq.(l). Then,

every pixel of all the binary images generated from the bit plane is expanded into a 2× 2 block to which a black or white color is assigned according to the model presented in Fig. 1. Every block of the sharing images therefore includes two white pixels and two black pixels so that the entropy reaches its maximum to conceal the content of the secret image. The *(k-n)* threshold VCS can be expressed in the form of equation (2).

- $S1, S2, S3, ...Sn \in S0, Pij=0$ $FVCS\ Pij$ = (2) $S1, S2, S3 .... Sn \in S0, Pij=1$ Where, S0 = {all the matrices obtained by permuting the columns of basis matrix B0, which meets the requirement in Definition I}

Algorithm (M, n)

1. Take a gray scale image M.
2. Separate the bit planes of that gray scale image (shade image) into n bit plane where n is the number of bits to represent a pixel.
3. Apply the gray code method to bit plane.
   - For gray scale image the first part is just initialization phase.
   - Apply bit plane coding to form eight binary images.
   - Then application of visual cryptography to all image bits.
   - Then combining all the bits to form the actual image and
   - Finally display the image.



IV. CONCLUSIONS

This paper presents an improved bit plane coding algorithm for gray scale image for applying visual cryptography scheme.A bit plane of an image is a binary image that carries visual information of original images so as to retain the original pixel values the same before and after encryption. In visual cryptography if a person gets sufficient k number of shares; the image can be easily decrypted. This paper develops an encryption method to construct grayscale VC scheme with using bit plane encoding .

REFERENCES

[1]. M. Noar and A. Shamir, "Visual cryptography," *Advances in Cryptology - EUROCRYPT'94*, pp. 1-12, 1995.

[2]. Mizuho Nakajima and Yasushi Yamaguchi, "Extended Visual Cryptography for Natural Images"

[3]. Young-Chang Hou, "Visual cryptography for color images," *Pattern Recognition*, Vol. 36, No. 7, pp. 1619-1629, 2003.

[4]. Z. Zhou, G.R. Arce and G. Crescenzo, "Halftone visual cryptography," *IEEE Transactions on Image Processing*, Vol. 15, No. 8, pp. 2441-2453, 2006.

[5]. Inkookang, G.R. Arce, and H.K. Lee, "Color Extended Visual *Cryptography using Error Diffusion*," 2009.

[6]. Chandramati S., Ramesh Kumar R. , Suresh R. and Harish S., " An overview of visual cryptography" issue 2010.

[7]. SandeepKatta,"Visual Secret Sharing Scheme using Grayscale Images", 2012.

[8]. Ram Krishna Jha1 &AbhijitMustafi 2, "Boolean XOR Based (K,N) Threshold Visual Cryptography for Grayscale Images," 2012.

[9]. TalalMousaAlkharobi, "New Algorithm For Halftone Image Visual Cryptography," 2012.

[10]. T.Rajitha, Prof P.Pradeep Kumar, V.Laxmi in August 2012,"Construction of Extended Visual Cryptography Schemefor Secret Sharing."