APPLICATION OF IMAGE HALFTONE TECHNIQUE IN VISUAL SECRET SHARING OF TEXT IMAGE

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Abstract: Cryptography has a long and fascinating history and it is one of the most important fields within the security profession. Visual cryptography uses the characteristics of human vision to decrypt encrypted images and in it the secret image is split into two or more separate random images called shares. To decrypt the encrypted information, the shares are stacked one on top of the other, and the hidden secret image appears. Due to its simplicity, anyone can physically manipulate the elements of the system, and visually see the decryption process in action without any knowledge of cryptography and without performing any cryptographic computations. In this experiment two techniques have been merged. One is halftone and another one is (k, n) VCS. The basic objective is to obtain a better reconstructed image and reduce the encryption and decryption time. In this paper an algorithm is proposed to create share of a text image and reconstruct the image.

Keywords: Visual Cryptography, Image Sharing, Image halftone, pixel

Introduction: In visual secret sharing, the message bit consists of a collection of black and white pixels i.e. it is assumed to be a binary image and each pixel is handled separately. Each original pixel appears in n modified versions (called shares) of the image, one for each transparency. Each share consists of m black and white sub-pixels. Each share of the sub-pixels is printed on the transparency in close proximity (to best aid the human perception, they are typically arranged together to form a square with m selected as a number). The resulting structure can be described by a [n x m] (n = number of shares, m = pixel expansion) Boolean matrix $S = (S_{ij})_{nXm}$ where $S_{ij} = 1$ if and only if the j^{th} sub-pixel in the i^{th} share (transparency) is black and $S_{ij} = 0$ if and only if the j^{th} sub-pixel in the i^{th} share (transparency) is white. When transparencies $i_1, i_2, \ldots, i_r$ are stacked together in a way which properly aligns the sub-pixels, we see a combined share whose black sub-pixels are represented by the Boolean "OR" of rows $i_1, i_2, \ldots, i_r$ in S. The grey level of this combined share is proportional to the Hamming weight H (V) of the "OR" ed m-vector V. This grey level is interpreted by the visual system of the users as white if $H(V) < d-\alpha.m$ and as black if $H(V) > d$ for some fixed threshold $1 \le d \le m$ and relative difference $\alpha > 0$. Now, (k,n) Extended Visual Cryptography scheme allows the construction of visual secret sharing scheme within which the shares are meaningful as opposed to having random noise on the shares. After the sets of shares are superimposed, this meaningful information disappears and the secret is recovered.

Proposed Algorithm: In this paper we have proposed an algorithm combining a most common image processing techniques halftone and k, n VCS. We have used (4, 8) VCS scheme for this experiment. There are different types of image halftone techniques are there. In this experiment we have chosen Floyd-Steinberg Halftoning Algorithm. The steps of the proposed algorithm are as follows:

Step1: K, threshold value for the no. of share required to reconstruct the image.

Step2: N, Input the maximum no. of share.

Step3: Input the index of share to

reconstruct original image.
Step4: Input Image
Step5: Read the Image data
Step6: Making halftone of the original image
Step7: Creating the maximum N no of share of the halftone image.
Step8: Calculating the required image for reconstruction of original image.
Step9: Recovering the original image.

System Block Diagram: According to the algorithm at first we prepared the halftone image from the original image and then create 8 share of it. The we applied the (k,n) VCS scheme to reconstruct the image. It has been observed that this is working fine for the text images. The working model of the system is displayed below.

Figure-2: Original Image

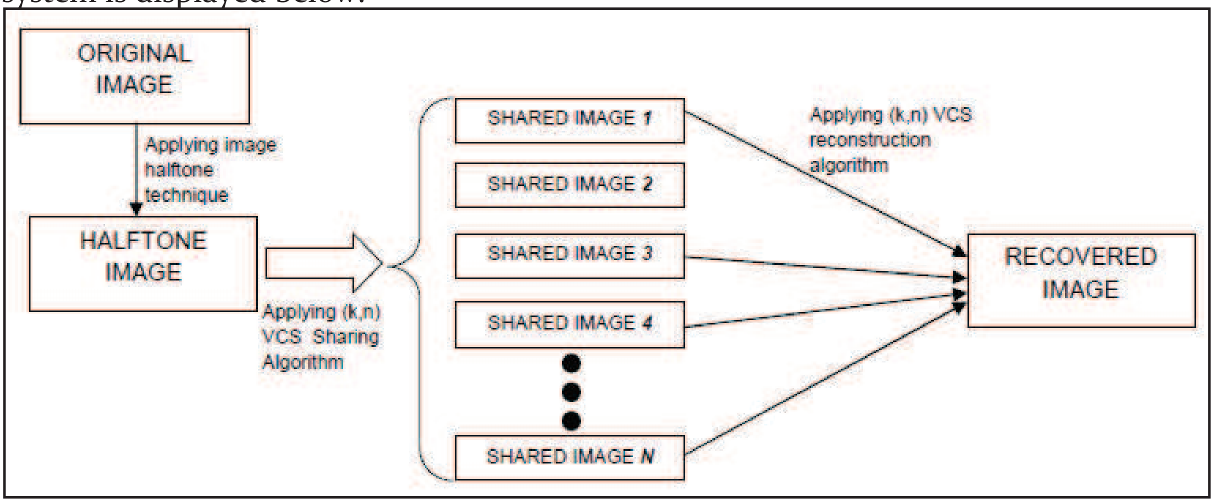

Figure-1: Proposed system block diagram

Experimental Results:
Specification of the sample image
Image Type: bitmap image (.bmp)
Image Size: 256X256 pixel, 65KB

Figure-3: Share1

Figure-4: Share2

Figure-5: Share3

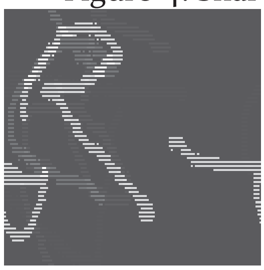

Figure-6: Share4

Figure-7: Share5

Figure-8: Share6

Figure-9: Share7

Figure-10: Share8

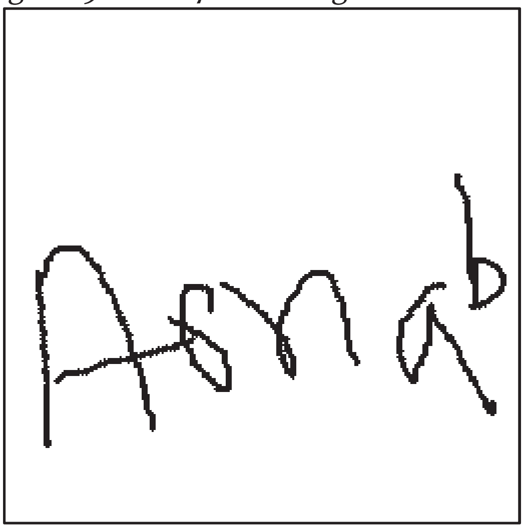

Figure-11: Reconstructed Image

Specification of the reconstructed image

Image Type: bitmap image (.bmp)

Image Size: 256X256 pixel, 65KB

Histogram Analysis:

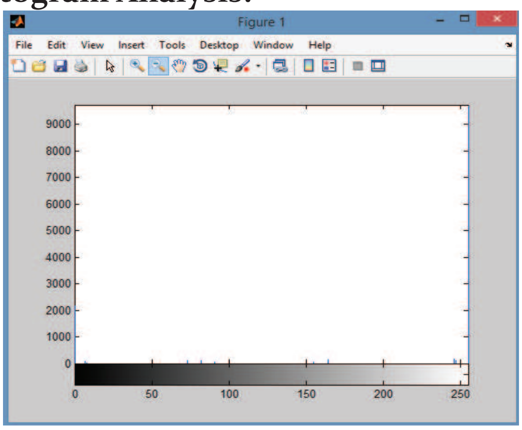

Figure-12: Histogram of Original Image

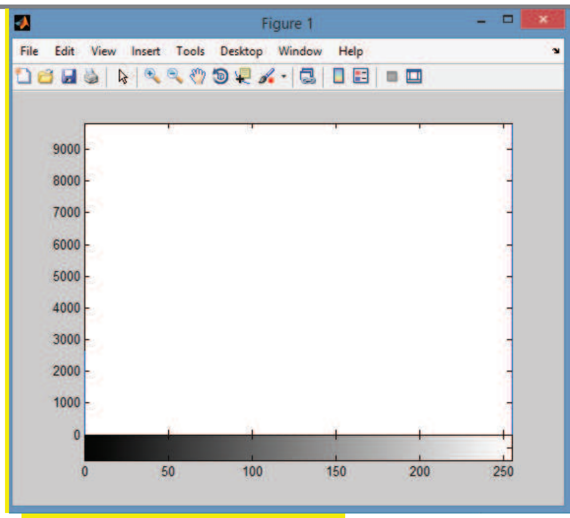

Figure-13: Histogram of Reconstructed Image

We can find from the above histogram analysis that the histogram characteristics is almost same for the original image and the reconstructed image.

Advantages of the proposed system: We have collected data from different perspective and observed the following advantages of the system:

a. Simple to implement, there is no need of adding noise externally, which eventually reduced the computational cost.
b. No use of cover image so no additional computation is required to reconstruct the image.
c. Works very effective for text images
d. As each share is a halftone share, fewer details will be transmitted per share.

Conclusion: The paper described Extended (k,n) VCS for black and white images. In this scheme the original image is converted to halftone image and then it is divided into equal dimension of shares. This scheme can reconstruct the secret image precisely and has low computational complexity. The probability of reconstruction of the image from individual shares is very less so this method ensures satisfactory results in the field of security. The drawback of this scheme is that it works with only gray scale images. So this scheme can be extended to work with other image formats. Also emerging technique like, colour visual secret sharing scheme can be used along with this algorithm. The concept of general access structure can also be used with this scheme. Also we can use key based approach for secret share.

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