Comparative Study Of Error Diffusion Algorithms With Raster Scan

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Abstract - Visual cryptography is a secret sharing scheme which uses images distributed as shares such that, when the shares are superimposed, a hidden secret image is revealed. Color visual cryptography encrypts a color secret image into n halftoned image shares. The secret image can be recovered simply by stacking these shares together without any complex computations involved. The shares are very safe because separately they reveal nothing about the secret image. Halftoning is the key feature of visual cryptography which provides security at the early stage of cryptography. A particular halftoning method that has been used extensively in visual cryptography scheme is so called error diffusion method. This method provides a simple and efficient algorithm for halftoning. Error diffusion algorithm has attracted much attention in the graphics community. We will make a review of error diffusion halftoning techniques that are used in visual cryptography scheme. A halftoning toolbox is used that will help us in generating halftoned shares and values for parameters like PSNR, WSNR, LDM, UQI .The one with more accuracy and good output will be considered as the best error diffusion algorithm. To enhance the quality of decoded image, XOR operation will be used.

Keywords - Halftone, Floyd, Stuckie, Jarvis, Error Diffusion, Raster Scan, PSNR, WSNR, LDM, UQI

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1. INTRODUCTION:

Visual cryptography is a cryptographic technique which allows visual information (pictures, text, etc.) to be encrypted in such a way that decryption becomes the job of the person to decrypt via sight reading. There are several generalizations of the basic scheme including k-out-of-n visual cryptography. Visual cryptography first proposed in 1994 by Moni Naor and Adi Shamir [1] is a secret sharing scheme, based on black- and-white or binary images. Secret images are divided into share images which, on their own, reveal no information of the original secret. Shares may be distributed to various parties so that only by collaborating with an appropriate number of other parties, can the resulting combined shares reveal the secret image. Recovery of the secret can be done by superimposing the share images and, hence, the decoding process requires no special hardware or software and can be simply done by the human eye.

For example, biometric information in the form of facial, fingerprint and signature images can be kept secret by partitioning into shares, which can be distributed for safety to a number of parties. The secret image then recovered when all parties release their share images which are then recombined. Visual cryptography is a technique used for protecting image- based secrets. Moni Naor and Adi Shamir [1] proposed the basic model of visual cryptography. For exemplifying. Visual cryptography, we consider the two out-of-two visual scheme. Here each pixel p of the Secret Image is encoded into a pair of sub pixels in each of the two shares. If pixel p is white, one of the two rows under the white pixel in Fig1 is selected. If pixel p is black, one of the two rows under the black pixel is selected. The selection is performed by each row has 1/2 probability to be chosen. So, in the selected row the first two pairs of sub pixels are assigned to share 1 and share 2, respectively. An individual share gives no clue as to the value of p. Now consider the superposition of the two shares as shown in the last column of Fig.1. If a pixel is white, the superposition of the two shares always shows one black and one white sub pixel. If p is black, it yields two black sub pixels. VCs are usually in the position of power by being the only source of capital and by having the ability to influence the network. But the lack of good managers who can deal with uncertainty, high growth, and high risk can provide leverage to the truly competent entrepreneur. Visual cryptography is of particular interest for security applications based on biometrics [2].

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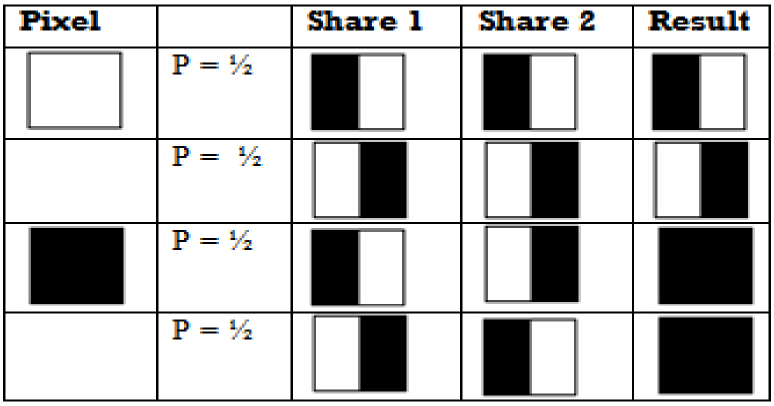

FIG.1- VC PRINCIPLE

2. HALFTONING:

Halftone visual cryptography (HVC) is a visual sharing scheme where a secret image is encoded into halftone shares taking meaningful visual information. A method is proposed that can encode a secret halftone image into color halftone shares. The secret image is concurrently embedded into color halftone shares while these shares are halftoned by three error diffusion algorithms. Halftoning is one of the oldest applications of image processing, since it is essential for the printing process. Halftone is the reprographic technique that simulates continuous tone imagery through the use of dots, varying either in size or in spacing, thus generating a gradient like effect. Halftone can also be used to refer specifically to the image that is produced by this process. With the evolution of computers and their gradual introduction to typesetting, printing, and publishing, the field of halftoning that was previously limited to the so-called halftoning screen evolved into its successor digital halftoning [4].

ERROR DIFFUSION HALFTONING:

Error diffusion is a simple but efficient way to halftone a grayscale image. The quantization error at each pixel is filtered and fed into a set of future inputs. The quantization error depends upon not only the current input and output but also the entire past history. Error diffusion is a type of halftoning in which the quantization residual is distributed to neighboring pixels that have not yet been processed. Its main use is to convert a multi-level image into a binary image, though it has other applications. The error filter is designed in such a way that the low frequency difference between the input and output image is minimized. The error that is diffused away by the error filter is high frequency or "blue noise." These features of error diffusion produce halftone images that are pleasant to human eyes with high visual quality [3].

Raster Scan: In this paper implement the halftone share of select image with raster scan type. In raster scan beam will move across the screen, one row at a time. The direction of movement is top to bottom. When beam move from top to bottom beam will be on or off so pattern of spots is created.

3. HALFTONED BASED ERROR DIFFUSION ALGORITHMS WITH RASTER SCAN:

There are 3 error diffusion algorithms to perform half toning on color images:

A. Floyd-Steinberg halftoning algorithm.

B. Stuckie halftoning Algorithm.

C. Jarvis halftoning Algorithm.

A.FLOYD-STEINBERY HALFTONING ALGORITHM:

It raised the idea to keep track of the error. Algorithm implements the error-diffusion halftoning of an n by m grayscale image. The boundary conditions are ignored. It is convenient to compute the output pixels in scan line order from upper left to lower right. At every step, the algorithm compares the grayscale value of the current pixel J (i, j) which is represented by an integer between 0 and 255, to some threshold value. If the grayscale value is greater than the threshold, the output pixel I (i, j) is considered black (value 0), else it is considered white (value 1). The difference between the pixel's original value and the threshold is considered as an error. Because we don't want to alter the already computed pixels, we spread this error intensity only to the pixels on the right, the right diagonal, the left diagonal and the bottom [6].

	X	7/16
3/16	5/16	1/16

B.STUCKIE HALFTONING ALGORITHM:

Stuckie diffused the error in the 12 neighboring cells. The only difference between Jarvis algorithm and Stuckie algorithm is the fraction which is added to the neighboring pixels.

		X	7/42	5/42
2/42	4/42	8/42	4/42	2/42
1/42	2/42	4/42	2/42	1/42

C.JARVIS HALFTONING ALGORITHM:

Another error diffusion algorithm has been proposed by Jarvis. It diffuses the error in the 12 neighboring cells instead of 4 cells as in the Floyd-Steinberg algorithm. As a result, this algorithm is even slower, requiring at least $24 \cdot n \cdot m$ floating point and memory access operations. Further, when printing color images, the running time increases by a factor of four. All these three algorithms will give some differences in the output image and also there will be corresponding different values of parameters used for comparison [7].

		X	7/48	5/48
3/48	5/48	7/48	5/48	3/48
1/48	3/48	5/48	3/48	1/48

4. RESULTS AND ANALYSIS:

The experimental results of the entire error-diffusion halftoning algorithms used in color visual cryptography. We will compare these algorithms on the basis of following parameters and the algorithm which leads to better quality of image will be considered as the best error diffusion algorithm. All 3 algorithms are compared with Raster scan. At the end we got the result that which algorithm is best with Raster scan. And which scan type is good with these 3 algorithms:

PSNR (peak signal to noise ratio): Higher is better
WSNR (weighted signal to noise ratio): Higher is better
LDM (Linear Distortion measure): lower is better
UQI (Universal quality index): higher is better

The table showing the different parameter values in case of input image named as “School.jpg” one is self clicked named as “School.jpg”. image are used as input data set. The error diffusion algorithms are generated halftone of selected images with raster scan.

IN CASE OF “School.jpg” WITH RASTER SCAN:

a) Original image

b) Floyd half toned share

c) Jarvis half toned share

d) Stuckie half toned share

Parameters value with Raster Scan:
For image named as School.jpg with Raster scan type, the parameters are given below:

Images	Scan type	Algorithms	PSNR RATIO	WSNR RATIO	LDM RATIO	UQI RATIO
School	Raster	Floyd-Steinberg	5.20004	10.6025	0.232498	0.119385
School	Raster	Jarvis	5.01133	9.2424	0.28537	0.111756
School	Raster	Stuckie	5.08471	9.6814	0.266525	0.112498

5. CONCLUSION:
Error diffusion is a simple but efficient way to halftone a grayscale image. Its main use is to convert a multi-level image into a binary image, though it has other applications. In this study Different algorithms for error diffusion are compared. The comparison is done on the basis of WSNR, LDM, UQI and the PSNR values. The experimental result shows that image quality of Floyd-Steinberg is better than the stuckie and Jarvis algorithms.

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