Secret Image Protection using Image Fusion

Chaitanya Rejintal
M.Tech in DEC, Department of ECE,
MVJ College of Engineering,
Bangalore, India.

Mr. Manoranjan Kumar
Associate Professor, ML Department,
MVJ College of Engineering,
Bangalore, India.

***Abstract*— Images are considered for handling in different fields. The paper has an algorithm to guard the key image whose privacy must be kept up and verify the dealer who needs to disseminate that key image to a numerous clients. For authentication purpose the key image and palm-print of dealer are fused. In this paper Dual Tree Discrete Wavelet Transform is applied on both key image and palm print, coefficients obtained from both images are being fused using Image Fusion technique. DTDWT is used to overcome the drawbacks of DWT. Image fusion is a strategy or a procedure of consolidating pertinent data from set of pictures into a solitary picture, the resultant picture got will be more finished and useful than the information pictures. The threshold secret sharing is used to distribute the fused image to many shares. This gives both privacy as well as verification about the dealer whoever sends the image. During decryption key image is known and the palm print of the dealer has to be reconstructed from the shares collected from authorized users, finally verification is done.**

Keywords—DTDWT, Image fusion, Threshold secret sharing, Reconstruction.

I. INTRODUCTION

In many areas like pharmacy, military and so on, bunches of images should be prepared to get the correct data regarding the patient issue on account of therapeutic area, to acquire the data of the terrorists in a military area, to get the data of the areas which give great yield. Everybody in the above area use the various pictures gathered from many sources which are processed using different image processing tools according to the requirement. The two types of images are: ordinary ones and important ones. The ordinary images are accessible to all whereas important images cannot be accessed by all. Some of the times the images can be utilized as a part of the cryptanalysis field to encoded the data or it is used like a key for encrypting and decrypting of the information. Images in both condition has to be shielded from the unapproved clients particularly in an open system such as web. Thus the privacy assumes an imperative part while taking care of delicate or mystery data in a system. Encryption gives secrecy to the private data yet it generally needs a key for encryption as well as for decryption of information.

The key is either symmetric key or public key. Both encryption and decryption require same key while using symmetric key whereas while using public key encryption has one key which cannot be used for decryption. If single owner has the key then it leads to many issues such as the owner may lose the key, he might not be present at the time of emergency. To avoid all these issues the key is shared among the required number of authorized users, this is done using threshold secret sharing technique which is introduced by Shamir [7].

Authorized people are recognized to whom the secret key has to be assigned. Suppose there are N users B= {b1, b2 … bn} and let K be the key which has to be divided among N users {k1, k2… kn}. These keys {k1, k2… kn} are assigned to the {b1, b2 … bn} users respectively. In threshold secret sharing method (m, n), where threshold value is represented by m and the n represents about shares. Whenever a request comes from any user for the key its necessary that at least m number of shares is required to carry out decryption process. It cannot carry out the decryption process even if it collects m-1 number of shares. This provides privacy to the key image. Verification is provided only when it collects the correct share from the authorized user.

Image compression using Wavelet has given an incredible accomplishment in previous years. Using 2D DWT we cannot get the directional elements about the pictures effectively. Many endeavors have been added to multi-directional illustratation. Kingsbury has proposed DTDWT which gives a promising apparatus to same type [5].

The Discrete Wavelet Transform has two drawbacks they are shift invariant and poor directional selectivity [6]. These two drawbacks are overcome using Dual-Tree Discrete Wavelet Transform. DTDWT has been viably used as a part of numerous applications for example, picture denoising, surface examination, and movement estimation. To utilize an excess change for pressure appears to be opposing to the objective of pressure which is to decrease whatever repetition however much as could reasonably be expected. Be that as it may, if coefficients of an excess change are sufficiently inadequate, pressure can even profit by the presented repetition since most coefficients are almost zero.

II. RELATED WORK

Image combination methods can enhance the quality and also increase the use of this information. Deepak Kumar Sahu, M.P.Parsai [2] gave about an image fusion percentage of strategies for picture combination such as primitive combination, fusion based on DWT, and based on Principal segment examination (PCA) combination and so on. Correlation of the considerable number of methods finishes up the good approach for future exploration.

Image fusion is a strategy or a procedure of consolidating pertinent data from set of pictures into a solitary picture, the resultant picture got will be more finished and useful than the information pictures. Here work begins with image fusion investigation. R.J.Sapkal, S.M.Kulkarni introduces, the combination of pictures from various sources utilizing change in multi-resolution wavelet processing of Fused Image.

Mohammad Pooyan et.al [4] presents a methodology to find ECG signals wavelet pressure using set dividing in

progressive trees coding calculation using SPIHT. In image compression SPIHT algorithm has made conspicuous progress. For 1-D signs we utilize a changed adaptation of SPIHT. SPIHT coding is connected with wavelet change calculation on various MIT-BIH records. Outcomes of ECG pressure demonstrate good productivity about this technique.

Nick KINGSBURY and Julian MAGAREY [5] described Filter bank implementation of DWT in their paper. They have shown the wavelets which permit perfect reconstruction are similar in shape and scale. They have also discovered the drawbacks of using DWT, and then they proposed the CWT to overcome these drawbacks.

Rudra Pratap Singh Chauhan, Dr. Rajiva Dwivedi, Dr. Rajesh Bhagat [6] in their paper have shown the drawbacks of DWT they are shift invariance and directional selectivity and they proposed a new transform called DTDWT to overcome these two drawbacks.

Adi Shamir [7] in his paper has explained clearly about threshold secret sharing. He has shown it with the equations how it works. This paper also explains how decryption is carried when minimum number of shares is collected.

III. PROPOSED SYSTEM

Image fusion is a strategy or a procedure of consolidating pertinent data from set of pictures into a solitary picture, the resultant picture got will be more finished and useful than the information pictures. Below Fig. 1 and Fig. 2 shows block diagram of proposed algorithm which is used to maintain the privacy the secret image.

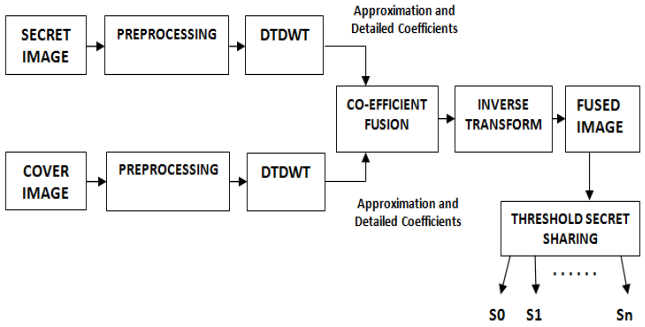

Fig. 1. Image Fusion Process

A. ENCRYTION PROCESS:

1) Input image: The inputs taken are secret image and the other is cover image. Secret image is the one which needs to be protected and the cover image is known both during encryption as well as decryption process.

2) Preprocessing: Preprocessing steps include resizing of both secret and cover image, both images are resized to same size. If the images are in RGB then they are converted to gray image.

3) DTDWT: To the preprocessed secret and cover image Dual- Tree Discrete Wavelet Transform is applied.

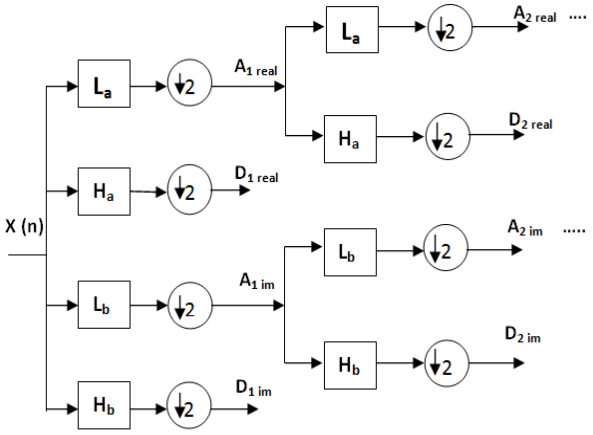

Fig. 2. DTDWT flow diagram

The two parallel trees filter in the same way as in DWT and then down-sample it as shown in Fig. 2. Due to these two trees the aliasing which resulted in shift dependency will be removed. Real part coefficients are produced by one tree and imaginary coefficients by other tree. Any one among real part and imaginary part gives the restoration that is correct and is utilized for stand-alone transform. We just utilize real part to decrease the excess variable from 4:1 to 2:1.

Six sub-band images and one low pass images are produced at every level. The wavelet coefficients magnitude of sub-band images is proportional to ±15, ±45, ±75 directional edges of original image. From this the directional selectivity drawback is overcome.

Applying DTDWT is extremely clear. The set of two channel banks disintegrate the input image separately and the image is filtered on horizontal columns first and then later on vertical very similar to what 2D DWT does. By doing so we get two coefficients they are Approximation and Detailed coefficients of secret image and cover image separately.

*4) Coefficient Fusion:*The coefficients obtained after DTDWT is applied on both secret image and cover images are fused. Sub band of high-pass obtained in one channel bank is consolidated with other channel sub-band using basic linear operations: difference method or average method.

Since the low recurrence band will be the unique picture at coarser determination level, it might be viewed as Similarly as a smoothen and sub sampled form of the unique picture. To the high back bands, since the reason for picture combination obliges that those combined picture must not dispose of whatever suitable data held in the wellspring pictures Also adequately preserve those points about information pictures for example, such that edges What's more textures. It is for the most part accepted that the points for a picture are principally incorporated in the high back of the picture.

*5) Inverse Transform:*After the coefficients are fused, to that fused image inverse transform is applied.

*6) Threshold secret sharing:*The fused image obtained is divided and distributed to authorized users to obtain confidentiality and authentication. These are distributed to N number of users.

B. DECRYPTION PROCESS:

Fig. 3 shows the image reconstruction process. It involves reverse operation. The cover image is known during decryption process. Fused image is obtained from the authorized users who have the shares. At least M<N number of shares are required to obtain the fused image. If shares collected are less than M, then decryption cannot be done.

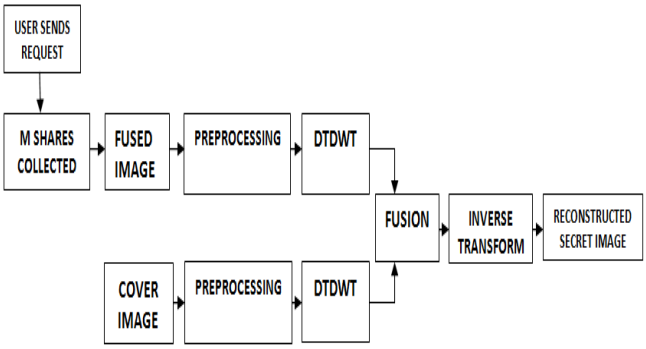

Fig. 3. Image Reconstruction Process

From the M shares collected fused image is constructed. Again similar to encryption process preprocessing is carried out for both fused image and host image. To the preprocessed image DTDWT is applied and the coefficients obtained are fused. After fusion inverse transform is applied and finally we get the secret image. In this way decryption process is carried out.

IV. RESULT AND DISCUSSION

The image fusion joins the images that are given as input to it and acquires the final image that is more informative. Fig. 4 and Fig. 5 shows the input secret image and cover image.

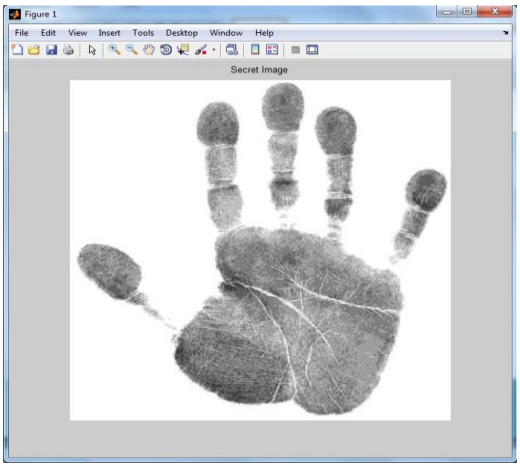

Fig. 4. Secret image

Fig. 5. Cover image

These two are the inputs taken for the encryption process. To these two images DTDWT is applied and the coefficients obtained from both the images after transform is applied are fused together to obtain fused image. Fig. 6 shows the fused image obtained. This fused image is divided and distributed to authorized users.

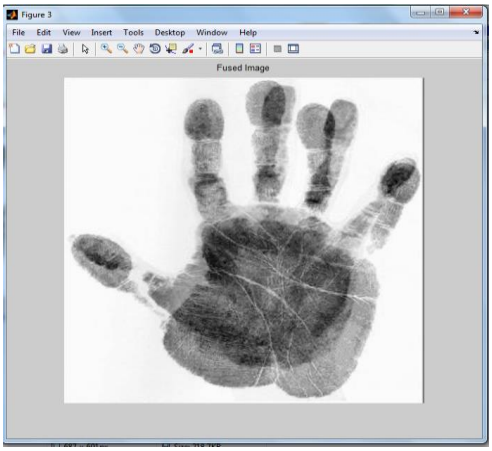

Fig. 6. Fused Image

To this fused image threshold secret sharing is applied, here visual cryptography method is used. While applying this method we can either choose horizontal or vertical. Fig. 7 and Fig. 8 show the vertical shares obtained by applying Visual Cryptography to the fused image.

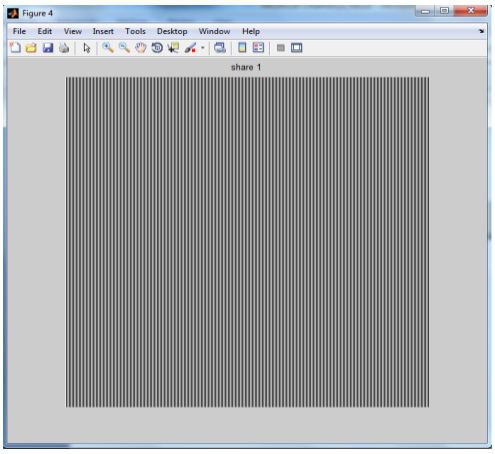

Fig. 7. Vertical Share 1

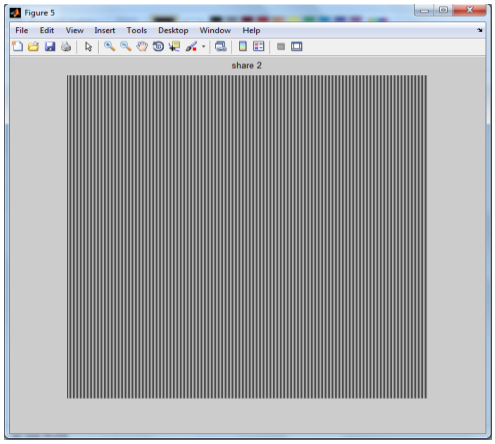

Fig. 8. Vertical Share 2

Similarly when horizontal is chosen for applying Visual Cryptography, we get two shares that are divided horizontally. Fig. 9 and Fig. 10 show the shares obtained when divided horizontally.

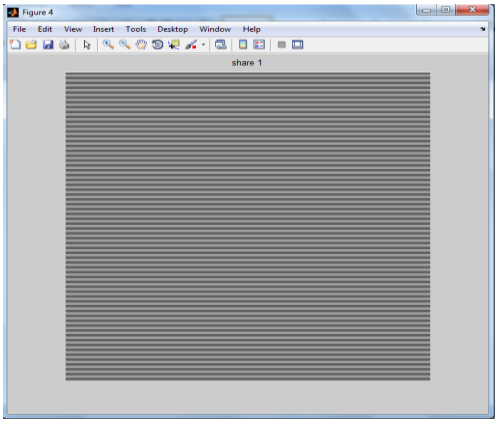

Fig. 9. Horizontal share 1

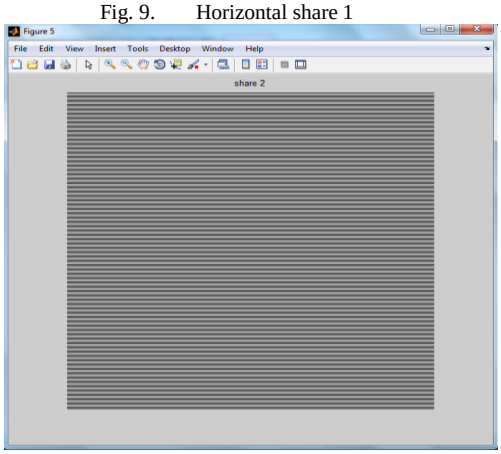

Fig. 10. Horizontal share 2

During the decryption process the cover image is known and the fused image is obtained from the shares collected from authorized users. Even if one share is missing, then decryption cannot be carried out. To these images DTDWT is applied and the coefficients are fused similar to the encryption process.

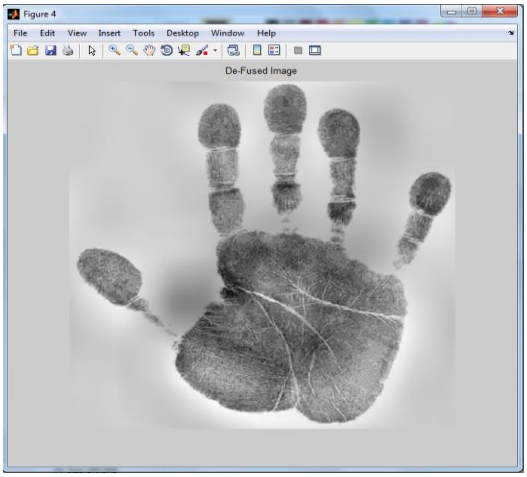

Fig. 11. Defused Image

To this fused image obtained Inverse Transform is applied so that we get back the secret image. Fig. 11 shows the expected output at the end of the decryption process which is secret image.

Suppose if we do not give the two shares during the decryption instead only one share is provided then decryption cannot take place. When only one share is provided the pop we get saying one more share is required. The pop is shown below.

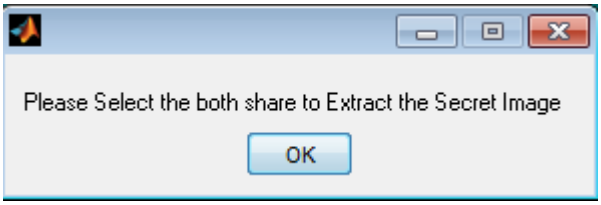

Fig. 12. Error message

The Fig. 12 shows the error message obtained when only one share is given while decryption. The result obtained using DTDWT is compared with the results obtained using DWT. Here we have analyzed the true rate and the false rate of the images obtained after fusion. The analysis result is shown in Fig. 13.

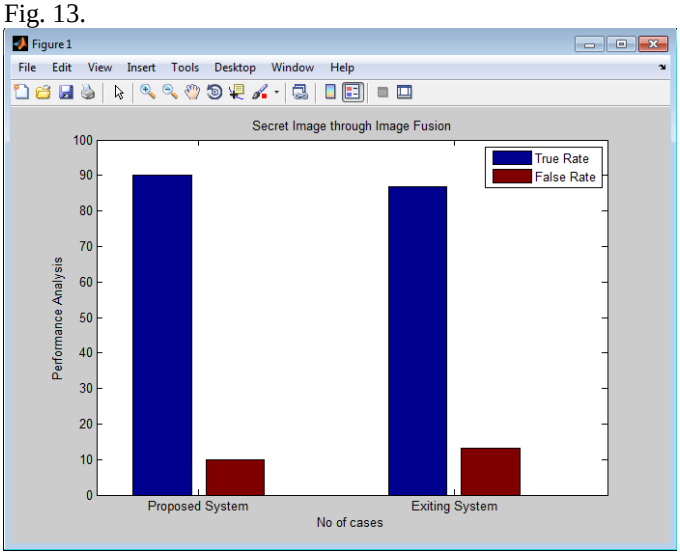

Fig. 13. Analysis results

The above Fig. 13 tells the True rate of both transforms that is DWT and DTDWT. The existing system is using DWT and the proposed system is by using DTDWT. Here True rate indicates how much the image obtained is similar to original image and the False rate tells how much the obtained image is different from original image.

The Peak Signal-to-Noise-Ratio (PSNR) and Normalized Cross Correlation (NCC) is calculated for the results obtained using DWT and DTDWT. It shown in the table below.

$PSNR = 10 * \log_{10}(Max^2/MSE)$ (1)

Max - maximum possible pixel value of the image

MSE – Mean Squared Error

Equation(1) shows how PSNR is calculated.

TABLE. I. COMPARISON RESULTS

Transform	Image	
	PSNR	NCC
DWT	21.69	0.87
DT-DWT	33.54	0.97

V. CONCLUSION

An algorithm using DTDWT is put forward in this paper. Image fusion combines two images which gives a better visual image suitable for processing. The drawbacks of using Discrete Wavelet Transform they are directional selectivity and shift invariance are overcome using DTDWT. Threshold secret sharing is used to provide both confidentiality and authentication to the secret image.

VI. ACKNOWLEDGMENT

The author would like to take an opportunity to thank N. G. Kingsbury, from the Cambridge University who has given the code for DTCWT without which the work wouldn't have been so easy.

REFERENCES

[1] P. Devaki, Dr G Raghavendra Rao, " A Novel Algorithm to Protect the Secret Image through Image Fusion and Verifying the Dealer and the Secret Image", Fifth IEEE International Conference on Signal and Image Processing, 2014.

[2] Deepak Kumar Sahu, M.P.Parsai, "Different Image Fusion Techniques –A Critical Review", International Journal of Modern Engineering Research (IJMER), Vol. 2, Issue. 5, Sep.-Oct. 2012 pp.4298-4301.

[3] R.J.Sapkal, S.M.Kulkarni, "Image Fusion based on Wavelet Transform for Medical Application" , International Journal of Engineering Research and Applications , Vol. 2, Issue 5, September-October 2012, pp.624-627.

[4] Mohammad Pooyan, Ali TAheri, Morteza Moazami-Goudarzi, Iman Saboori, "Wavelet Compression of ECG Signals Using SPIHT Algorithm", International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering Vol:1, No:2, 2007.

[5] N. G. Kingsbury, "The dual-tree complex wavelet transform: a new technique for shift invariance and directional filters", IEEE Digital Signal Processing Workshop, 1998.

[6] Rudra Pratap Singh Chauhan, Dr. Rajiva Dwivedi, Dr. Rajesh Bhagat, "Comparative Analysis of Discrete Wavelet Transform and Complex Wavelet Transform For Image Fusion and De-Noising", International Journal of Engineering Science Invention, Vol. 2, Issue 3, March 2013, pp.18-17.

[7] A. Shamir, "How to share a secret", Comn.ACM., 22(1979), 612-613.