International Journal of Emerging Technology and Innovative Engineering
Volume 1, Issue 8, August 2015 (ISSN: 2394 – 6598)

SECURE IMAGE TRANSMISSION USING SECRET FRAGEMENT IMAGE MOSAICING AND PIXEL COLOR TRANSFORMATION

P.Sailaja[1]
M.Tech (decs),
Jntu College of engineering
Pulivendula, Andhra Pradesh
pedada.sailaja2@gmail.com

***Smt.Shaik Taj Mahaboob[2]**
Assistant professor, ECE department
Jntu College of engineering
Pulivendula, Andhra Pradesh
shaiktajmahaboob@gmail.com

P.Sreekanth[3]
M.Tech (decs),
Jntu College of engineering
Pulivendula, Andhra Pradesh
sreekanth.svcet@gmail.com

ABSTRACT:

Hiding the data in digital images has been area of interest in the digital image processing domain. Although so much work has been carried out in the literature to resolve the issues like increasing the data capacity, creating the secret image similar to target image but most of the works fails to meet the practical requirements. To fulfill the practical requirements of image hiding /embedding the proposed algorithm presents an approach where mosaic image generation is done by dividing the secret image into fragments and transforming their respective color characteristics into corresponding blocks of the target image. Usage of the Pixel color transformations helps in yielding the lossless recovered image based on the untransformed color space values. Generation of the key plays an important role to recover the data from the secret image in lossless manner. Finally the same approach can be performed on videos as well, which helps to eliminate the flickering artifact and achieve the lossless data recovery in motion related videos. The experimental result shows good robust behavior against all incidental and accidental attacks when compared to the conventional algorithms. Performance evaluation has increased in a significant way.

Keywords: Image Encryption, image/video mosicing, secure image transmission, PixelColor transformation.

1. INTRODUCTION:

Currently, images from various sources are frequently utilized and transmitted through internet for various applications, such as online personal photograph albums, confidential enterprise archives, document storage systems, medical imaging systems, and military image databases. These images usually contain private or confidential information so that they should be protected from leakages during transmissions. Recently, many methods have been proposed for securing image transmission, by using some algorithms like LSB substitution, histogram shifting, difference expansion, prediction-error expansion, recursive histogram modification, and discrete cosine/wavelet transformations.

Main issues of the methods for hiding data in images are the difficulty to embed a large amount of message data into a single image. Specifically, if one wants to hide a secret image into a cover image with the same size, the secret image must be highly compressed in advance. But, for many applications, such as keeping or transmitting medical pictures, military images, Legal documents, etc., that are valuable with no allowance of serious distortions; such data compression operations are usually impractical. Moreover, most image compression methods, such as JPEG compression, are not suitable for line drawings and textual graphics, in which sharp contrasts between adjacent pixels are often destructed to become noticeable artifacts. In this paper, a new technique for secure image transmission is proposed, which transforms a secret image into a meaningful mosaic image with the same size and looking like a preselected target image. The transformation process is controlled by a secret key, and only with the key a person can recover the secret image nearly lossless from the mosaic image. The proposed method is inspired by Lai and Tsai, in which a new type of computer art image, called secret-fragment-visible mosaic image, was proposed, and the generated mosaic image can be sufficiently similar to the selected target image. Using their method, the user is allowed to select freely their favorite image for use as the target image

Fig.1. Results obtained by the proposed method. (a) Secret image. (b) Target image. (c) Secret-fragment-visible mosaic image.

In proposed method when a target image is selected arbitrarily, the given secret image is first divided into rectangular fragments, incase videos it can be divided into frames called tile images, which then are fit into similar blocks in the target image, called target blocks, according to a similarity criterion based on color variations. Next, the color characteristic of each tile image is transformed to be that of the corresponding target block in the target image, resulting in a mosaic image which looks like a selected target image/video. Relevant schemes are also proposed to conduct nearly lossless recovery of the original secret image from the resulting mosaic image/video. Also, the proposed method can transform a secret image into a disguising mosaic image/video without compression, while a data hiding methods must hide a highly compressed version of the secret image into a cover image when the secret image and the cover image have the same data volume.

2. PROPOSED METHOD

The proposed method contains two phases namely

I) Mosaic image/video creation II) Secret image recovery. These two phases can be done by using the following algorithms namely

1) Pixel color transformation
2) Rotating the blocks with small RMSE value.
3) Embedding information for secret image recovery.

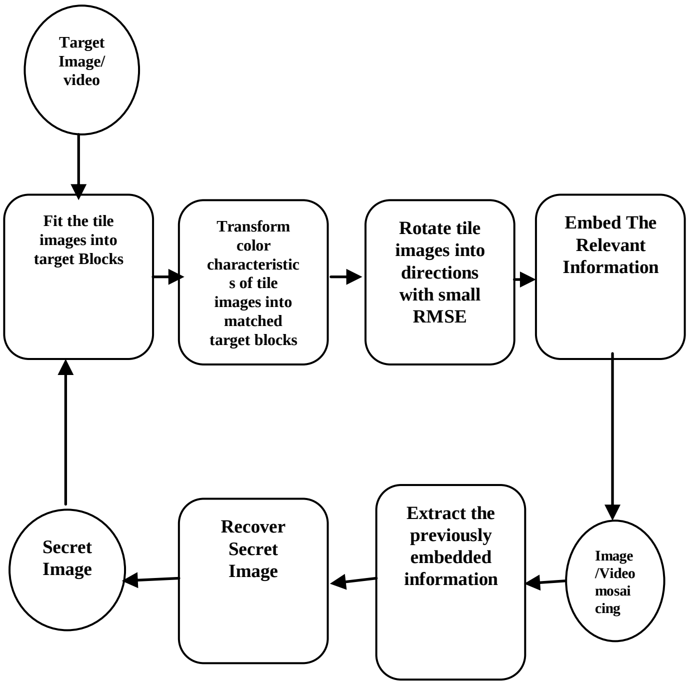


Fig. 2. Algorithmic flow for proposed method.

2.1. Pixel Based Color transformation between blocks

In the initial part of the planned technique, every tile image T within the given secret image is match into a target block B in a preselected target image. In proposed method we use the RGB color space rather than the l α β one is employed to reduce the amount of the desired data for recovery of the original secret image and also used for perfect color matching between T and B. More specifically, let and B be described as two pixel sets {p1,p2 ,p3,…….. p_n } and {p_1', p_2' ……p_n' }. Let the color of every p_i be denoted by ((r_i, g_i, b_i). which of every p'$_i$ by (r_i', g_i', b_i'). At first, we tend to work out the means and standard deviations of T and B, severally; in every of the 3 color channels R, G, and B by the subsequent formulae.

$$\mu_c = \frac{1}{n}\sum_{i=1}^{n} ci$$

$$\mu_c = \frac{1}{n}\sum_{i=1}^{n} c_i' i \text{ .... (1)}$$

$$\sigma_c = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c_i - \mu_c)^2}$$

$$\sigma_c' = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c_i' - \mu_c')^2} \text{ .... (2)}$$

in which c_i and c_i',denote the C-channel values of pixels p_i and p_i', severally, with and C=R,G,or B. Next, we have a tendency to compute new color values (r_i', g_i', b_i'). for each p_i in T by

$$c_i^n = q_c(c_i - \mu_c) + \mu_c' \text{ ....(3)}$$

in $q_c = \sigma_c/\sigma_c'$ is the standard deviation quotient and c=(r, g, b). It can be verified easily that the new color mean and variance of the resulting tile image T$_i$' are equal to those of B, respectively. To compute the original color values ((r_i, g_i, b_i) of p_i from the new ones (r_i', g_i', b_i'), we use the following formula which is the inverse of (3)

$$c_i = \frac{1}{q_c}(c_i^n - \mu_c') + \mu_{c,} \text{ ... ... (4)}$$

Furthermore, we've to embed into the created mosaic image sufficient data concerning the new tile image T$_i$' for use within the later stage of convalescent the initial secret image. For this, theoretically we will use (4) to compute the initial pixel price of p_i However, the concerned mean and normal deviation values within the formula area unit all real numbers, and it is impractical to embed real numbers, every with several digits, in the generated mosaic image. Therefore, we limit the numbers of bits wont to represent relevant parameter values in (3) and (4). Specifically, every color channel we tend to enable each of the means of T and B to have 8 bits with its worth within the vary of 0 to 255, and also the standard deviation quotient qc in (3) to have seven bits with its worth within the vary of 0.1 to 12.8. That is, each mean is modified to be the closest value within the range of0 to 255, and each qc is modified to be the closest value in the range of 0.1 to 12.8. We don't enable q_c to be zero 0otherwise the first picture element worth cannot be recovered back by (4) for the reason that 1/qc in (4) isn't outlined once qc=0

2.2. Rotating Blocks with smaller RMSE

In transforming the color characteristic of a tile image T to be that of a corresponding target block Based represented higher than, how to choose an appropriate B for every T is a problem. For this, we use the standard deviation of the colors within the block as a live to pick out the foremost similar for each T. Specially, we type all the tile pictures to make a sequence, S tile, and every one the target blocks to make another, S target, consistent with the typical l values of the quality deviations of the 3 color channels. Then, we work the primary in S tile into the primary in S target, fit the second in S tile into the second in S target, and so on.

Additionally, after a target block B is chosen to fit a tile image T and after the color characteristic of T is transformed, we conduct a further improvement on the color similarity between the resulting tile image T_i' and the target blockBby rotating $T_i$into one of the four directions, 0°, 90°, 180°, and 270° , which yields a rotated version of T_i' with the minimum root mean square error (RMSE) value with respect to B among the four directions for final use to fit T into B.

2.3. Embedding Information for Secret Image Recovery

In order to recover the secret image from the mosaic image, we have to embed relevant recovery information into the mosaic image.. For this, we adopt a way planned by Coltuc and Chassery and apply it to the smallest amount vital bits of the pixels within the created mosaic image to conduct information embedding. The proposed method yields high data embedding capacities close to the highest bit rates and has the lowest complexity reported so far The information required to recover a tile image T which is mapped to a target block B includes: 1) the index of B;2)the optimal rotation angle of T; 3) the truncated means of T and Band the standard deviation quotients, of all color channels; and 4) the overflow/underflow residuals. These data items for recovering a tile image Tare integrated as a five-component bit stream of the form M=t1t2...tmr1r2m1m2...m48q1q2...q21d1d2...d

In more detail, the numbers of required bits for the five data items in Mare discussed below: 1) the index of B need m bits to represent, with m computed by m = [log [(Ws×Hs)]/N_T].

Table 1: comparison of existing methods and proposed method

Algorithms	Cover Image	Computational complexity	Payload
LSB	Fixed 512x 512 8bit gray scale image	Low	512x512x k K is no. of LSBs in the cover Image Pixels.1 bpp
Histogram Shifting	Fixed 512x 768 gray scale images	Low	512x768x k
Difference Expansion	Same as LSB	Low	Same as LSB but >1 bpp.
Secret fragment visible mosaic	Selected image from database	High	Compression of Image using LSB method.
Secret fragment image/video mosaicing and pixel color transformation	Any Image	Low	Without compression of Secret Image.

3. THE FLOW OF PROPOSED METHOD

In this proposed method it contains mainly in the two phases they are one is mosaic image/video creation and second one is secret image recovery process.

3.1. Fitting the tile images into the target blocks.

Step 1: here first we need to compare the sizes of the target and secret image sizes if they are not equal then we need to resize and equalize them and divide the secret image into tile images or in videos divided into frames $\{T_1, T_2, T_3 \dots\dots\dots T_n\}$ and also the target image as$\{B_1, B_2 B_3 \dots\dots\dots. B_N\}$ and with each T_i , B_j belongs to size of N_t.

Step 2: then calculate the both mean and standard deviation from the above equations are (3),(4) for each tile image or video T_i and target image B_j respectively for i,j=1 …n.

Step 3: now we have the set of tile images as $S_{title} = \{T_1, T_2, T_3 \dots\dots\dots T_n\}$ and target blocks are S_{target} =$\{B_1, B_2 B_3 \dots\dots\dots. B_N\}$ then by sorting of this two according to the mean and standard deviation values we need to map the two tile image set to the target blocks in 1-to-1 manner then resulting mapping sequence L of the form T_1 B_{j1} ……..T_N B_{jn}

Step 4: so create the mosaic image F by fitting the tile images into the corresponding blocks according to L.

3.1.1.Rotating Images

For each colored transformed tile image T_1 calculate the RMSE values in F with respected to corresponding target block B_{ji} after rotating T_i into directios of $\theta = 0°, 90°, 180°, 270°, 360°$ respectively.

3.2. secret image retrieval

Step 1: extract the bit stream I from the F by reversion scheme and decode them to get the below items1) the number of iterations N_i for embedding $M_i^{'}$ the total number of used pixel pairs N_{pair} in the last iteration.

Step 2: repeat the above step to extract the $M_i^{'}$.

Step 3: and decrypt the bit stream $M_i^{'}$ into M_i by the using of key K.

Step 4: DecomposeM_t into n bit streamsM_1 through $M_n$for the n to-be-constructed tile images T_1 through T_n in S, respectively.

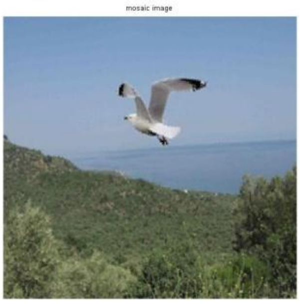
Step 5: Decode M_i for each tile image T_1 to obtain the following data items: 1) the index ji of the block B_{ij} in F corresponding to T_i2) the optimal rotation angle θ° of T_i; 3) the means of $T_i$and B_{ij} and the related standard deviation quotients of all color channels

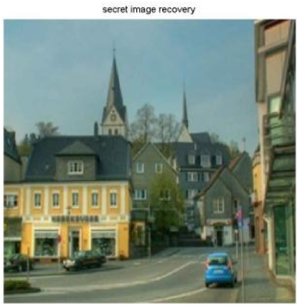
Step 6: Recover one by one in a raster-scan order the tile images T_i, i= 1 through n, of the desired secret image S by the following steps: 1) rotate in the reverse direction the block indexed by j i, namely B_{ij}, in F through the optimal angle θ° and fit the resulting block content into T_i to form an initial tile image T_i 2) use the extracted means and related standard deviation quotients to recover the original pixel values in T_i according to (4); 3) use the extracted means, standard deviation quotients, and(5) to compute the two parameters c_S and c_L;4) scan T_i to find out pixels with values 255 or 0 which indicate that overflows or underflows, respectively, have occurred there; 5) add respectively the values c_S or c_L to the corresponding residual values of the found pixels; and 6) take the results as the final pixel values, resulting in a final tile image T_i.

Step 7: combine the all final tile images to get desired secret image T.

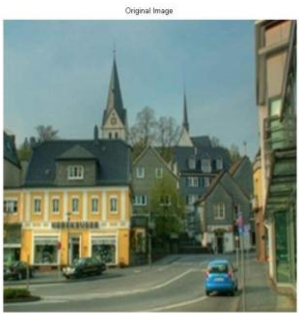
4. RESULTS

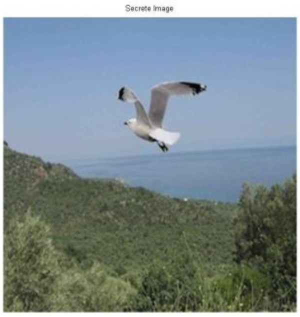
(a) (b)





(c) (d)

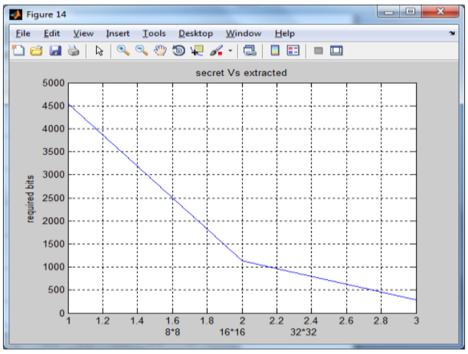




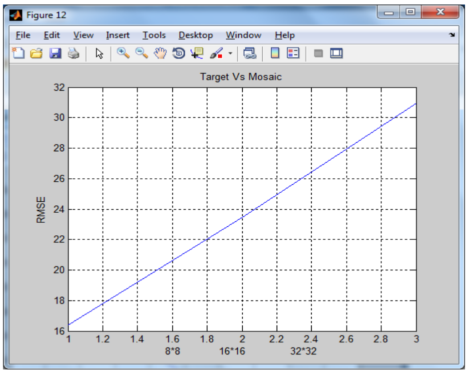
(e) (f)

(g) (h)

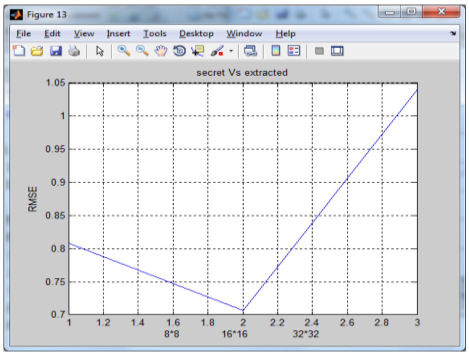
Fig .3. Results yielded by the proposed method.
(a) & (e) Original Images. (b) & (f) Secret Images.
(c) & (g)Image Mosaicing.(d)&(h) Recovered Secret Image



Graph(1)



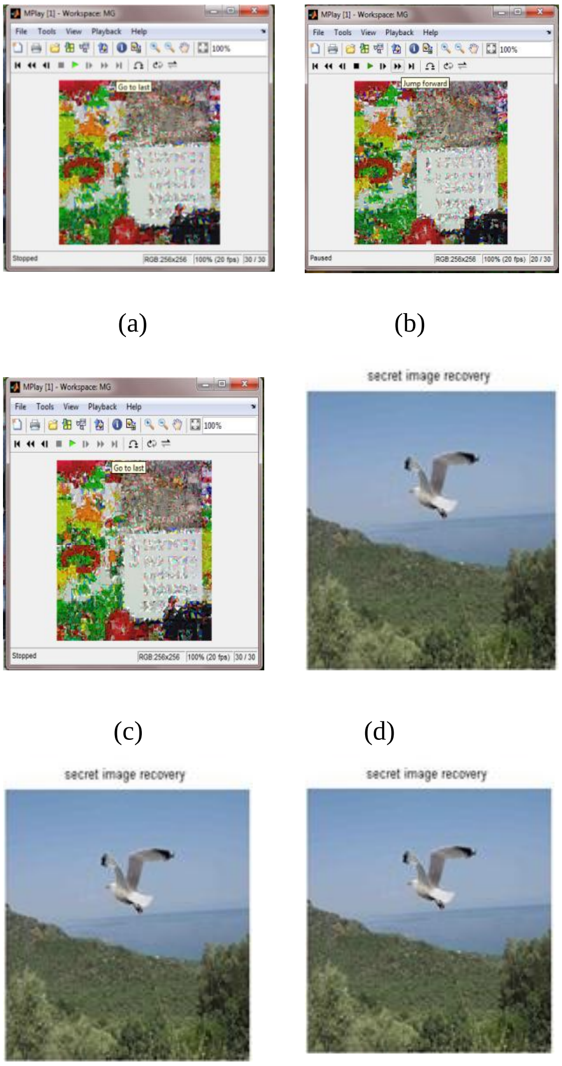
Graph(2)



Graph(3)

Fig .4. Graphs obtained by proposed method. Graph1: Secret vs Extracted (Required bits) Graph 2: Target vs Mosaic (RMSE). Graph 3: Secret vs Extracted (RMSE).

The same approach can be performed on videos as well. In Mosaicing videos the video can be fragmented into frames after applying the above mentioned algorithms to those fragments. Then the experimental results are shown in below.



(a) (b) (c) (d) (e) (f)

Fig.5. Results obtained by proposed method in video mosaicing. (a)(b)&(c)video mosaicing at 10^{th} 20^{th} &30^{th} frame. (d)(e)&(f) Recovery of secret image from video.

5. CONCLUSIONS:

The proposed method presents an approach where mosaic image generation is done by dividing the secret image into fragments and transforming their respective color characteristics into corresponding blocks of the target image, and the RGB color space based Pixel color transformations helps to yield the lossless recovered image based on the untransformed color space values. And by using the proposed method we choose any image as a target image without need of database. Generation of the key plays an important role to recover the data from the secret image in lossless manner. Finally the same approach can be performed on videos as well, without loss of information in motion videos. Future studies may be directed to applying the proposed method to increase the image/video mosaicing resolution.

REFERENCES

[1] J. Fridrich, “Symmetric ciphers based on two-dimensional chaotic maps,” *Int. J. Bifurcat. Chaos*, vol. 8, no. 6, pp. 1259–1284, 1998.

[2] G. Chen,Y. Mao, and C. K. Chui, “A symmetric image encryption scheme based on 3D chaotic cat maps,” *Chaos Solit. Fract.*, vol. 21, no. 3, pp. 749–761, 2004.

[3] L. H. Zhang, X. F. Liao, and X. B. Wang, “An image encryption approach based on chaotic maps,” *Chaos Solit. Fract.*, vol. 24, no. 3, pp. 759–765, 2005.

[4] H. S. Kwok and W. K. S. Tang, “A fast image encryption system based on chaotic maps with finite precision representation,” *Chaos Solit. Fract.*, vol. 32, no. 4, pp. 1518–1529, 2007.

[5] S. Behnia, A. Akhshani, H. Mahmodi, and A. Akhavan, “A novel algorithm for image encryption based on mixture of chaotic maps,” *Chaos Solit. Fract.*, vol. 35, no. 2, pp. 408–419, 2008.

[6] D. Xiao, X. Liao, and P. Wei, “Analysis and improvement of a chaosbased image encryption algorithm,” *Chaos Solit. Fract.*, vol. 40, no. 5, pp. 2191–2199, 2009.

[7] V. Patidar, N. K. Pareek, G. Purohit, and K. K. Sud, “A robust and secure chaotic standard map based pseudorandom permutation substitution scheme for image encryption,” *Opt. Commun.*, vol. 284, no. 19, pp. 4331–4339, 2011.

[8] I. J. Lai and W. H. Tsai, “Secret-fragment-visible mosaic image—A new computer art and its application to information hiding,” *IEEE Trans. Inf. Forens. Secur.*, vol. 6, no. 3, pp. 936–945, Sep. 2011.