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A Review of Hiding of Data in Mosaic Images by Reversible Color Transformations

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Abstract: Images are transmitted through the internet for various purposes, such as confidential enterprise archives, document storage systems, medical imaging systems, and military applications. These images may contain secret or confidential information since it should be protected from leakage during transmissions. An approach for secure image transmission is needed, which is to transform a secret image into a meaningful Secret Fragment Mosaic Image with size almost same and looking similar to the preselected target image. The mosaic image is the outcome of arranging of the block fragments of a secret image in a way so as to disguise the other image called the target image. The mosaic image looks similar to a randomly selected target image. It is used for hiding of the secret image by color transforming their characteristics similar to the blocks of the target image. The appropriate information is embedded into the mosaic image for the recovery of the transmitted secret image.

Keywords: Color transformation, data hiding, mosaic image, covert communication.

I. INTRODUCTION

In recent years data hiding has been proposed for the purpose of information assurance, authentication, fingerprint, security, data mining, and copyright protection, etc. In data hiding, pieces of information which are represented by some data are hidden in a cover media like image. In many cases, the cover media experienced some eternal distortion due to data hiding and cannot be inverted back to the original data. In the last some year image mosaic has become a popular topic in field of digital image processing and image based technique. Mosaic is a different type of art created by generating small pieces of any materials, such as stone, glass, tile, etc. It is invented in ancient time, but still used in many applications today. Creation of mosaic images by computer is a new research direction in recent years. Currently, images from various sources are frequently utilized and transmitted through the internet for various applications, such as online personal photograph albums, confidential enterprise archives, document storage systems, medical imaging systems, and military image databases. These mosaic images usually contain private or confidential information so that they should be protected from leakages during transmissions.

Image transmission is a technique where not only meaningful mosaic images are created but also can transform secret image. With the use of proper overflows and underflows as well as pixel color transformations in the converted values of pixels' colors, secret fragment visible mosaic images with almost similar to selected target image. The original secret image is recovered nearly lossless from the created mosaic image [1]. LSB substitution with pixel adjustment process for hiding of data is proposed. The image quality of stego image can be improved with less complexity [2]. Lossless data embedding embeds invisible data into a digital image in reversible way. In this method one can improve the embedded data to restore the original image [3].

A traditional approach for quality assessment based on degradation of structural information. In this paper objective method for accessing perceptual image quality attempted to quantify the visibility of errors between a distorted image and a reference image [4]. This paper has proposed reversible data hiding algorithm, which can recover the original image without any distortion from the marked image once the secret data have been extracted. It is showed that peak signal-to-noise ratio of the marked image generated using this method is above 48 dB [5]. A spatial domain reversible watermarking providing high data embedding bit-rate at a very low mathematical complexity has been discussed in the paper [6],[9]. A blind watermarking method based on the DWT has proposed in the paper. The values of PSNRs of the watermarked images are always greater than 40 dB as shown in results [7]. DE algorithm may cause distortions in the output image; moreover the algorithm cannot perform smoothly near the layer embedding capacity limit. In this paper a new embedding algorithm has proposed to overcome these problems. The mechanism effectively avoids embedding distortions resulting from the use of large differences in the previous difference image [8].

In the proposed scheme the difference between centre index and its neighbouring indexes in each sub-block of indexed table by using a palette colour replacement is used[10],[11]. A new type of digital art called secret-fragment-visible mosaic image has been proposed in this paper. A new color scale and new gray scale have been proposed to define a new feature which then are used to define appropriate similarity measures for images and

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blocks for generating secret-fragment-visible mosaic images more effectively [12].A image steganography method has been proposed in this paper [13], which creates secret mosaic image from an arbitrarily selected target image.

II. PROPOSED SYSTEM

In this paper, a new technique for safe imagetransmission 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 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 [12], in which a new type of computer art image, called secret-fragment-visible mosaic image, was proposed. The mosaic image is result of rearrangement of the fragments of a secret image in disguise of another image called the target image preselected from a database.

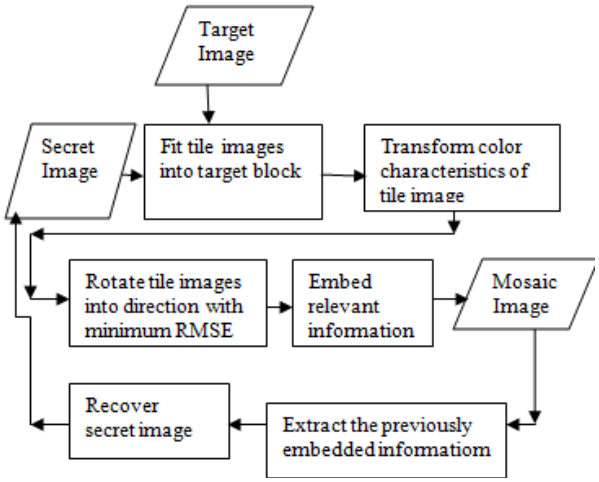
The weakness of [12] is that requirement of large image database so that the generated mosaic image can be sufficiently similar to the selected target image. Using this method the user can not select his/her favourite image as a target image. Therefore to overcome this drawback; a new method has been designed that can transform a secret image into secret fragment visible mosaic image of the same size.

Fig.1. Result by the proposed method (a) Secret image (b) Target image (c) Secret-fragment-visible mosaic image created from (a) and (b) by the proposed method

As shown in fig. 1 fig (a) indicates secret image, fig (b) indicates target image and fig (c) indicates secret-fragment-visible mosaic image. Once the target image has selected by the user, the given secret image is first divided into rectangular fragments called tile images, which then are fir into similar blocks in the target image, called target blocks, according to similarity criterion based on color variations. The color characteristics of each tile image is transformed onto a corresponding target block in the target image, which results in a mosaic image looking like a target image. The proposed method can transform a secret image into mosaic image without any compression, at the same time data hiding method must hide highly compressed version of the secret image into cover image when the secret image and the cover image have the same data volume.

III. IDEAS OF THE PROPOSED METHOD

The embedding of secret image into the target image in tile form and maintaining the visibility of the original target image. The proposed method includes two main phases as shown in fig. 2: 1) mosaic image creation 2) secret image recovery.



1) Mosaic image creation :

- Fitting the tile images of the secret image into the target blocks of a preselected target image.
- Transforming the color characteristics of each tile image in the secret image to become that of the corresponding target block in the target image.
- Rotating each tile image into a direction with the minimum RMSE value with respect to corresponding target block.
- Embedding relevant information into the created mosaic image for future recovery of the secret image.

2) Secret image recovery :

- Extracting the embedded information for secret image recovery from the mosaic image.
- Reverse transforming the color characteristic of each tile image in the secret image to become that of the corresponding target block in the target image.
- Reverse rotating each tile image into a direction with respect to its corresponding target block.
- Recovering the secret image using the extracted information.

Performance parameters:

1) MSSIM: To measure the mosaic effect, metric of mean structural similarity (MSSIM) has been adopted to compare the similarity of the mosaic image. If the MSSIM value of the created mosaic image with respect to the target image varies by some number, then it shows that the similarity of the details of the created mosaic image to those of the target image is not good enough.

2) RMSE: The Root Mean Square Error (RMSE) (also called the Root Mean Square Deviation, RMSD) is frequently used measure of the difference between values predicted by a model and the values actually observed from the environment that is being modelled. These individual differences are also called residuals, and the

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RMSE serves to aggregate them into a single measure of predictive power.

3) PSNR: The Peak Signal to Noise Ratio (PSNR) has been used as a benchmark to evaluate new objective perceptual video quality metrics. The calculation of PSNR is highly dependent upon proper estimation of spatial alignment, temporal alignment, gain and level offset between the processed video sequence and the original video sequence, the method of measurement for PSNR should ideally include a method for performing these calibration procedures.

IV. CONCLUSION

A novel method for secret transmission of images is presented. The secret color image is camouflaged into a target image of the same size to produce a mosaic image. The mosaic image resembles the target image and is visually indistinguishable from it. The mosaic image creation involves block by block processing of the images. Gaussian noise is added to the secret image to ensure positive variance of intensities within image blocks. Image blocks are matched according to the standard deviation of the intensities. Then a color transformation equation is utilized to transform the secret image blocks into the mosaic image blocks. The performance of the method was experimentally analyzed using RMSE and PSNR. It was found that the method yields high quality mosaic images and the extraction of the secret image accurate.

V. FUTURE SCOPE

Future studies may be directed to applying the proposed method to images of color models other RGB. In the proposed method only one secret image can be transmitted into a mosaic image. Multiple secret images can be transmitted into mosaic image using the concept of transmission of single secret image. User can save his/ her time by transmission of multiple secret images.

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