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SPATIAL DOMAIN IMPROVED CAPACITY FEWT BASED WATERMARKING TECHNIQUE

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Abstract**: Watermarking is gaining prime importance with increased use of electronic data. The use of watermarking in applications like telemedicine, e-commerce requires various high levels of security. In the proposed technique three levels of security are provided. The first level is finger print verification, second level is encryption of the secret images using symmetric key cryptography and the third level is template matching scheme where the secret information gets destroyed if attacked or changed by an intruder. In addition to the high level of security the proposed technique maintains the tradeoff between capacity , invisibility and robustness.**

Keywords: Watermarking, Fragile, invisibility, security, robustness, capacity.

I. INTRODUCTION

[1]The process of secret information hiding and sharing is being used from ancient times. The types are cryptography, steganography and watermarking. In cryptography the secret information is made hidden in cover image creating an encrypted image. Watermarking is a type of steganography where the secret information and cover image are related to each other in some way or the other and also it makes no change to the cover image.

[2]The watermarking techniques are classified into several types based on parameters. Based on the domain it is classified in to spatial and frequency domain watermarking system. Taking in to account the type of documentation it is classified in to text, image audio or video watermarking technique. It is classified in to two types based on perception of human sensory system: visible and invisible watermarking system. Invisible watermarking system is further of two types robust and fragile watermarking technique. Robust watermarking is a technique in which modification to the watermarked content will not affect the watermark. As opposed to this, fragile watermarking is a technique in which watermark gets destroyed when watermarked content is modified or tampered with. In this paper a completely fragile watermarking system is approached. [3]The various application of fragile watermarking are

- Ownership Assertion – to establish ownership of the content.
- Security in Telemedicine: to provide treatment from remote and this requires transfer of medical images confidentially and securely.
- Secured E-voting System: to prevent fraud and to protect voter's privacy.
- Fingerprinting – to avoid unauthorized duplication and distribution of publicly available multimedia content

The rest of the paper is organized as follows .Related work is briefly explained in Section II. The proposed watermark embedding technique with improved capacity and invisibility is explained in Section III. Section IV describes the highly secured template matching watermark detection scheme. Experimental results and discussion are presented in Section V. Section VI provides the conclusion of the work and presents the future work.

II. RELATED WORK

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[4] and [5]Probably one of the simplest techniques used in the spatial domain is the LSB modification. This method encodes a signal in the least significant bits. The invisibility of the watermark is achieved on the assumption that the LSB data are visually insignificant. There are two ways of doing an LSB modification: Watermarking methods based on modifying the least significant bit(s) of a cover signal can be applied to every media type robust to bit modifications. Usually the LSB of a media (e.g. sample or pixel) can be changed without degrading the perceived quality. Additional gate functions can be applied to ensure a high transparency by allowing the usage of least significant bits only in those parts of the cover signal where the overall energy is high. This operation can be repeated for each sample or pixel, enabling a very high capacity. The watermark, however, was not robust to additive noise

[7]The color image is transformed in to luminance and chrominance form. The luminance part is taken for processing. The entire image is divided into 8X8 blocks. The log average of the whole image and the individual blocks are determined. The watermark is embedded in those blocks which have log average value greater than or equal to the log average value of the entire image. The image is then converted to the RGB format.

[8]Cynthia Palma Hernandez proposed a fragile watermarking technique for image authentication in mobiles. In this scheme, the watermark is generated by pseudo-random chaotic process that involves the values of the original image pixels, i.e., its image content dependent .The detection of the watermark is performed only with the information of the parameters used. If the image is not attacked the watermark embedded can easily be extracted.

Unlike, the above approaches where the maximum capacity is embedded an RGB image in another RGB image. This paper approaches a complete fragile watermarking technique which can embed two RGB images in one RGB image and a highly secure template matching watermark detection scheme

[6]In this method four diversified pixel intensity matrices of the original and watermark image are created. Of the eight matrices created four diversified pixel matrices of the watermark are scales by one factor and the diversified pixel matrices of original image are scaled by another factor. These matrices are added to form the watermarked image. The value of the two factors is adjusted to change the visibility level.

III. PROPOSED SYSTEM

The proposed FEWT (Fingerprint Encryption Watermarking Based on Template matching detection) technique produces a fragile watermarking system thereby helping in maintaining the trade-off between the various properties of watermarking.

The first level of security is incorporated using fingerprint verification. Only an authenticated person gets involved in the process but once authenticated the system is no longer protected. The finger print image is first enhanced using Wavelet Transform, and then segmented to obtain the region of interest. Further a 2D correlation matching of the input image and the stored image in database is done at various angles. If matched the person is authenticated else the person is prevented from entering in to the process of extraction of the secret information. The second level of security is provided by employing a symmetric key encryption technique to the secret image template before watermarking.

The capacity which depicts the amount of information hidden in the cover image is first taken in to account. Previous works embed a RGB image in another RGB image which is the highest level of capacity .This is because the amount of information in a RGB image is three times higher than the amount of information in a gray scale image. In the proposed system two RGB images are embedded in a RGB image or six gray scale images are embedded in a RGB image. This is achieved by taking in to account the red, green and blue planes of an image. The former case is considered first. The two color watermark images are interleaved pixel wise using two base templates to form the final template which is the watermark image. The later case where six gray scale image are considered and taken in to consideration. Two base color templates are created. The three planes of the template red, green and blue are used to impose three gray scale images. Thus six gray scale images are imposed in two base templates. The two base templates are further interleaved to form the final watermark image .Thus by this way the capacity which is one of the key properties is improved.

Next we take in to account the invisibility and robustness of the watermarking technique. The LSB of a pixel in a image contains less information about the image and changes to it does not alter the invisibility level of the image to the

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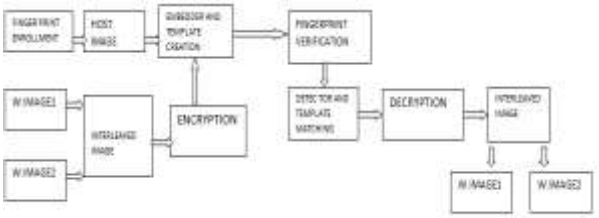
naked eye. Likewise the MSB of a pixel in a image contains the dominant information and changes to it alters the visibility level of the image. Thus we make use of this property to enhance the invisibility level of an image. The MSB of the pixels of the watermark image is embedded in to the LSB of the pixels of the host image. This therefore preserves the information in the watermark image together preventing it visibility in the host image.

Further to improve the security and robustness of the image that is transferred a fragile watermarking system can be employed in the proposed watermarking technique. The fragile watermarking system destroys the watermark if is attacked by an intruder. This is achieved by using a template matching scheme. In this approach the watermark is embedded in the host image in the above proposed method and a template of it is created and stored as a 2D key value in the database. In the extraction side the watermarked image is used to create a template and the 2D key value. A correlation matching of both the key values is performed, if it matches the watermark images are extracted and if does not match the, entire host image gets destroyed.



[1] Figure1. Block diagram of proposed watermarking system

A.ALGORITHM

1) Fingerprint of the previously authenticated user is stored to the database
2) The host image and two watermark images are all resized to same size.
   Host Image= Himg
   Watermark Images=Wimg1&Wimg2
3) The two colour watermark images are imposed to two base templates Template=T1 & T2
   T1 (R:G:B) = WImg1(R:G:B)
   T1 (R:G:B) = WImg1(R:G:B)
4) The two templates are interleaved to form the watermark image. Arrange the pixels of templates alternatively in odd and even columns to form the interleaved watermark image.
5) The watermark image is the encrypted using a secret key.
6) The watermark image is then embedded to the host image by LSB substitution of pixels of watermark image to MSB substitutions of pixels of host image

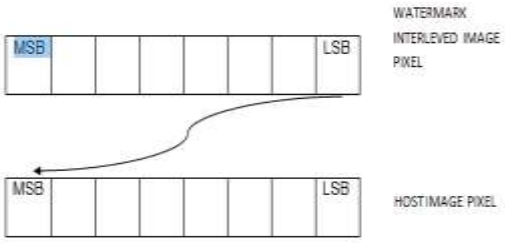


Figure2. LSB substitution of one pixel.

7) A template is created for the watermarked image and 2D key value is obtained from the template.

IV. TEMPLATE MATCHING DETECTION SCHEME

The watermarked image is the input to the watermark detector. To create a fragile watermarking system a template of the watermarked image is created in a similar manner that is done above. A 2D key image value is obtained from the template. A correlation checking of the 2D key value is done.

If it produces a correct result the watermarks are extracted. If it does not produce a correct result it implies that the watermarked image is been subjected to changes and it therefore destroys the watermark.

A.ALGORITHM

1) Fingerprint matching is done. If successful the following steps are followed
2) The input to the watermark extractor is the watermarked image. A template is created in a similar manner and a 2D key value is obtained.
3) A 2D correlation checking is done. If the watermarked image is not subjected to any changes, then checking yields to a positive results proving to be a fragile watermarking system.
4) Then the interleaved watermark image is first obtained by bitwise pixel comparison.
5) The interleaved image id decrypted using the same key.
6) The watermark images are then obtained from the interleaved image by arranging odd and even pixels.
7) The images are further modified by padding of missing pixels relating it to the neighbor pixels.

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V. RESULTS AND DISCUSSION

[9]In a fragile watermarking system the performance of the algorithm is tested in terms of three key perspectives

CAPACITY AND ROBUSTNESS: The amount of information hidden in the host image is taken in to account. The larger the capacity the more robust the algorithm is.

INVISIBILTY: This describes the inability of human naked eye to view the watermarks embedded in the host image.

SECURITY: The security is the way the watermarked image behaves to attacks (i.e) the watermarks should get destroyed when disturbed by an intruder or actions on it in fragile watermarking system.

Two cases are considered .In the former RGB host and RGB watermark images of same sizes are taken and experimentally analyzed. The host image is GCT building and is of size 512*512 shown in figure3.The watermark images are GCT logo and a text image and both are of size 512*512 and are shown in figure 4.

Figure3. Host Image

Figure4. Watermark images (RGB)

The watermarking is performed using the above mentioned technique and the watermarked RGB image is shown in figure 5.

Figure5. Watermarked Image.

The watermarked image obtained is used to create a template and is shown in figure 6

Figure6. Template

In the detector if the watermarked image is not attacked or made changes the template will match and the watermark will be extracted. The extracted watermarks are shown in figure 7.

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Figure6.Extracted Watermark images

In the later case RGB host image and 6 gray scale watermark images all of size 512*512 are taken and is shown in figure 8 and 9..

Figure7.Host image

Figure5. Watermarked Image.

The watermarked image obtained is used to create a template and is shown in figure 6

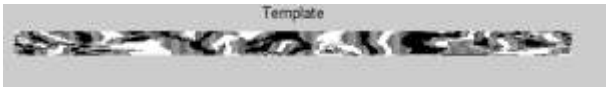

Figure6. Template

In the detector if the watermarked image is not attacked or made changes the template will match and the watermark will be extracted. The extracted watermarks are shown in figure 7.

Figure6.Extracted Watermark images

In the later case RGB host image and 6 gray scale watermark images all of size 512*512 are taken and is shown in figure 8 and 9..

Figure7.Host image

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Figure8. Watermark images (Gray scale)

The watermarking is done by interleaving two base templates. Red, green, blue planes are individually used to embed three gray scale images. Thus six gray scale images can be stored in two base templates. This is because a color image stores three times more information than a gray scale image. The invisible watermarked image is shown in figure 10.

Figure9. Watermarked image.

A template is created and sent to the detector where a template matching scheme is employed. If the result is success the watermarks are extracted. The extracted watermarks are shown in figure 11.

Figure10.Extracted watermark images

The results of security features like fingerprint verification and encryption are in progress and will be included in the next paper.

TABLE I PERFORMANCE ANALYSIS

TECHNIQUES	PSNR (dB)	INVISIBILITY LEVEL	CAPACITY IN TERMS OF WATERMARK
[7] Jamal.A	62.49	Low	1 gray scale image

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[10]Patil (2011)	30.53	High	1 gray scale image
[8]Palma Hermandez (2011)	48.13	High	1 gray scale image
[11]U.M.Gokhale (2012)	50.44	Medium	1 gray scale image
[12]Dr.M.Mohammed (2012)	59.11	High	1 gray scale image
[13]S.K.Ghosal (2013)	39.64	High	1 RGB image
[14]Taha. Jassim (2013)	47.59	High	1 RGB image
Proposed Case1	53.23	High	2 RGB images
Proposed Case2	53.94	High	6 gray scale images

It is well seen from the table 1 that the proposed technique maintains the tradeoff between the key perspectives of watermarking. It increases the capacity, robustness and security of the system there by maintaining the invisibility level of the watermarked image.

VI. CONCLUSION AND FUTURE WORK

Thus the fragile watermarking scheme proposed in this paper has the ability to detect images that are attacked or made changes in the communication. This feature is enabled by embedding watermark which is of very high capacity in the proposed scheme and any changes to the watermarked image destroys the watermark indicating that is been intruded. The future work aims in using frequency domain techniques to further improve the robustness and to work on semi fragile watermarking with same level of security and capacity.

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