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Lossless Reversible Visible Watermark

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ABSTRACT : *Digital watermarking is on high demand for the contained protection which is the efficient way to protect the digital properties recently. This paper review several techniques about digital watermarking(visible as well as invisible) and a new approach of lossless reversible watermarking techniques with robust security is explained. It consists of mathematical model. It is a process of embedding information in digital signal in a such way that anyone unable easily to remove it. However, most of the scheme do not support for removing visible watermark. Experimental expected result shows a good result than other methods mathematically.*

Keywords - Watermarking, Lossless visible Watermark, Mathematical model, Extraction of watermark, visible.

I INTRODUCTION

Watermarking alters the original data *I* with the watermark data *W* such that the original image and the watermark can be recovered later. Some factors related to watermarking are robustness, security, transparency, complexity and capacity and some of these parameters are mutually exclusive tradeoffs. Robustness is related to the reliability of watermark detection after it has been processed through various signal-processing operations. Security deals with the difficulty of removing the watermark. A scheme is considered secure if the knowledge of the embedding algorithm does not help in detecting the hidden data bits. Capacity relates to the amount of information that can be embedded in a given cover object. It is important for the watermarked image to be resistant to common image operations to ensure that the hidden information is still retrievable after such alterations. Methods of the second type, on the other hand, yield visible watermarks which are generally clearly visible after common image operations are applied.

In addition, visible watermarks convey ownership information directly on the media and can deter attempts of copyright violations. Embedding of watermarks, either visible or invisible, degrade the quality of the host media in general. A group of techniques, named reversible watermarking, allow legitimate users to remove the embedded watermark and restore the original content as needed. However, not all reversible watermarking techniques guarantee lossless image recovery, which means that the recovered image is identical to the original, pixel by pixel. Lossless recovery is important in many applications where serious concerns about image quality arise. Some examples include forensics, medical image analysis, historical art imaging, or military applications. Compared with their invisible counterparts, there are relatively few mentions of lossless visible watermarking in the literature.

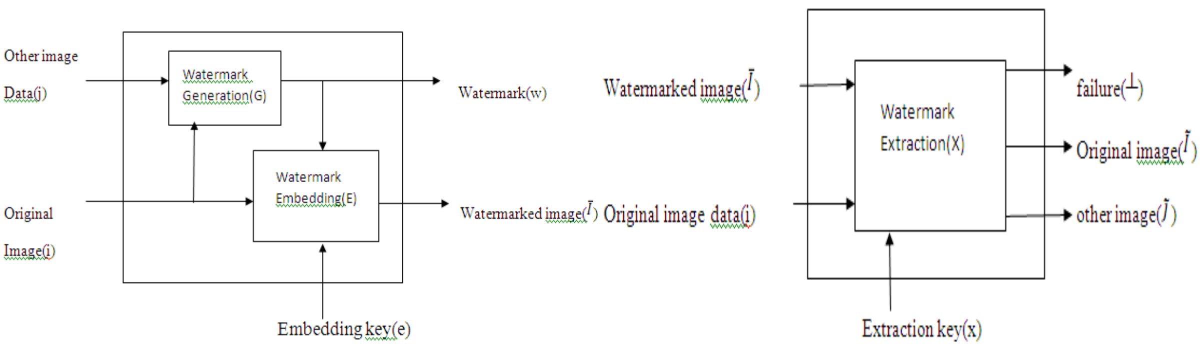
II LITERATURE REVIEW

Several lossless invisible watermarking techniques have been proposed in the past. In circular interpretation of bijective transformations . The histograms of groups of pixels are mapped to a circle. The transform is chosen so as to provoke the rotation of the histograms around the circle. The relative orientation of the histograms of two groups of pixels conveys one bit of information. The retrieval of the embedded information and, consequently, the reversibility process are not altered by wrapped around pixels. Additionally, the visual quality of the watermarked images does not suffer from the classic "salt-and-pepper" artifact. Finally, the extraction of the complete embedded message is still possible after alteration of the watermarked image. This robustness permits conveying embedded information from lossless to lossy environments.[6].For difference-expansion (DE)-based reversible data hiding, the embedded bit-stream mainly consists of two parts: one part that conveys the secret message and the other part that contains embedding information, including the 2-D binary (overflow) location map and the header file. The first part is the payload while the second part is the auxiliary information package for blind detection. To increase embedding capacity, we have to make the size of the second part as small as possible. However, the compressibility of the overflow location map is still undesirable in some image types they focus on improving the overflow location map. They design a new embedding scheme that helps them to construct an efficient payload-dependent overflow location map. Such an overflow location map has good compressibility. Their accurate capacity control capability also reduces unnecessary alteration to the image. Under the same image quality, the algorithm often has larger embedding capacity. It performs well in different types of images, including those where other algorithms often have difficulty in acquiring good embedding capacity and high image quality[7].

Mohanty et al. [2] proposed a visible watermarking technique in the discrete cosine transform (DCT) domain. Their scheme modifies each DCT coefficient by C_ = αC + βW, where C and W are the DCT coefficients of original image and watermark, respectively. The parameters α and β are determined by exploiting the texture sensitivity of human visual model (HVS). Huang [5] proposed a visible watermarking scheme with discrete wavelet transform (DWT). The intensity of the watermark in different regions of the image are varied depending on the underlying content of the image and humans' sensitivity to the spatial frequency. However, these two schemes are not reversible. Hu et al. [4 proposed a removable visible watermarking. The scheme uses a key to determine the unchanged coefficients, and the pixel-wise varying parameters of the embedder are calculated from those unchanged coefficients. Thus, the user with the correct key in the receiver end can recalculate the parameters to remove the visible watermark from the watermarked image. However, the scheme cannot perfectly recover the original image due to rounding error caused by wavelet transform. In this paper Novel reversible visible watermarking scheme which meets the three major requirements of visibility, transparency and robustness for visible Watermarking . It additionally provides the capability that only the user with correct key can lossless restores the original image from the visible watermarked image. The variance of the key compromises between the transparency of visible Watermarked image and robustness . Users with the wrong key cannot successfully remove the visible watermark.[3]

A next approach is to manipulate a group of pixels as a unit to embed a bit of information .Although one may use lossless invisible techniques to embed removable visible watermarks, the low embedding capacities of these techniques hinder the possibility of implanting large-sized visible watermarks into host media. As to lossless visible watermarking, the most common approach is to embed a monochrome watermark using deterministic and reversible mappings of pixel values or DCT coefficients in the watermark region. Another approach is to rotate consecutive watermark pixels to embed a visible watermark. One advantage of these approaches is that watermarks of arbitrary sizes can be embedded into any host image. However, only binary visible watermarks can be embedded using these approaches, which is too restrictive since most company logos are colorful. In this paper, a new method for lossless visible watermarking is proposed by using appropriate compound mappings that allow mapped values to be controllable. The mappings are proved to be reversible for lossless recovery of the original image. The approach is generic, leading to the possibility of embedding different types of visible watermarks into cover images. Two applications of the proposed method are demonstrated, where opaque monochrome watermarks and no uniformly translucent full-color ones are respectively embedded into color images. More specific compound mappings are also created and proved to be able to yield visually more distinctive visible watermarks in the watermarked image.

III SYSTEM ARCHITECTURE



IV MATHEMATICAL MODEL

Irrespective of the strict system and security requirements, we start with a basic watermarking model having three basic functions: Watermark Generation(G), Watermark Embedding(E), and Extraction(X). To denote different data within this context, plain letters indicate the original version, and respective single bar letter and tilde letter indicates their watermarked and estimated version accordingly, where applicable. These basic functions do the following in digital image watermarking: Watermarking Generation(G) takes a original image data(i) and Other image data(j) (e.g., logo) as input and yield a watermark(w), Watermark Embedding (E) takes a original image-data(i), embedding key(e) and yields a watermarked image ($\bar{I}$) as output. Watermark Extraction (X) takes a watermarked image-data ($\bar{I}$) and Extraction key and yields the original image-data ($\tilde{I}$) and other image data($\tilde{J}$) as outputs . Thus, a basic watermarking scheme for digital images, in general, can be defined as a 5-tuple ($\mathbb{I}$,G,W,E,X) such that:

(1) $\mathbb{I}$, the image-data space, is a set of Z^+ and its each element is a function of co-ordinates such that f(x,y) for 2D-space, where x Є Z^+, y Є Z^+, z ЄZ^+. Here, Z^+ is the set of positive integer, Z^+ = {|a| >= 0 : a Є Z}. An element of image data space is called an image of a*b size for 2D-space, where, a Є Z^+ b ЄZ^+, and x = { 1,2,3,…. a}, y = {1,2,3……b}, I ,J, $\bar{I}$ and $\tilde{I}$ are subset of $\mathbb{I}$, where

a)I is the set of original unwatermarked image-data, i.e I $\subseteq$ $\mathbb{I}$

b)J is the set of other image-data used for watermark generation, i.e., (J $\subseteq$ $\mathbb{I}$: J ∩ I = Ø)

c) $\bar{I}$ is the set of watermarked image-data, i.e $\bar{I} \subseteq$ $\mathbb{I}$

d) $\tilde{I}$ is the set of estimated original image-data, i.e., $\tilde{I} \subseteq$ $\mathbb{I}$

e) $\tilde{J}$ is the set of estimated other image-data, i.e ($\tilde{J} \subseteq$ $\mathbb{I}$)

(2)G is a function G: I * J -> W that is used for watermark generation.

(3)E is a function E:I * W -> $\bar{I}$ that is used for watermark embedding.

(4)X is a function X: $\bar{I}$ * i -> $\tilde{I}$ * $\tilde{J}$ ∪ {⊥) that is used for watermark Extraction, indicates a failure. A watermark(W) is valid if and only if it is obtained from valid inputs,(I,J) and valid watermark generation function such that, G : I * J -> W. Similarly, a watermarked image ($\bar{I}$) is valid if and only if is obtained from valid inputs,(I,W) and valid watermark embedding function (E) such that E : I * W -> $\bar{I}$. (More formally, we can define a digital image watermarking system to be complete, if the following is true: ∀ (I ,j) Є I * J ∃($\tilde{i}$, $\tilde{J}$) Є $\tilde{I}$* $\tilde{J}$ | $\tilde{i}$ ≈ i , $\tilde{J}$ ≈j : X(E(i,(G(i, j))) = ($\tilde{i}$, $\tilde{J}$).Here, $\tilde{i}$ ≈ i implies that $\tilde{i}$ is perceptually similar to i. The same applies to $\tilde{J}$≈ j.

V IMPLEMENTATION

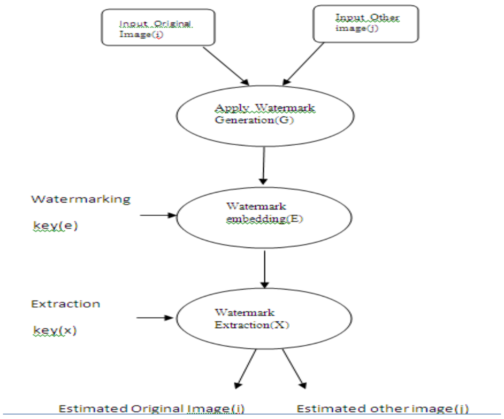
A. Project Methods

Watermarking Generation(G) takes a original image data(i) and Other image data(j) (e.g., logo) as input and yield a watermark(w), Watermark Embedding (E) takes a original image-data(i), embedding key(e) and yields a watermarked image ($\bar{I}$) as output. Watermark Extraction (X) takes a watermarked image-data ($\bar{I}$) and Extraction key and yields the original image-data ($\tilde{I}$) and other image data ($\tilde{J}$) as outputs. In watermark generation original image data is set P= {p_1,p_2,….p_n) and Watermark image data set is mapped as Q =(q_1,q_2,…..q_n)

$$q = f(p) = F_b^{-1}(F_a(p))$$

(1)The compound mapping described by (1) is indeed reversible, can be derived exactly from using the following formula:

$$p = f^{-1}(q) = F_a^{-1}(F_b(q)) \quad (2)$$



B. Test cases(Evaluation Parameters)

1) **Visibility** A watermarking system is called visible (or perceptible), if the embedding function(E) embeds a given watermark (w Є W) in an image (i ЄI) such that the watermark (w Є W) at least noticeably appears on the watermarked image,($\tilde{i}$ Є $\tilde{I}$). That is: $\forall$(i, w) Є I * W:| E_e (I,w) – i|= $\tilde{w}$|$\tilde{w}$ ≈w.

2) ***Blindness*** A watermarking system is called blind (or oblivious) if the extraction (X) function takes the original image (I) and watermark (W) whichever applies as input. Contrariwise, the watermarking system is called non-blind (or non-oblivious or informed) if functions X, take I and W, where appropriate as input. Otherwise, the watermarking system is called semi-blind. Thus, for non-blind watermarking system, Xx: $\tilde{I}$ * I * $\tilde{W}$ - > $\tilde{I}$ U {$\perp$} and for blind watermarking system: X_x: $\tilde{I}$ * $\tilde{W}$ - > $\tilde{I}$ U {$\perp$) Similarly, for semi-blind watermarking, X_x: $\tilde{I}$ * $\tilde{W}$ -> $\tilde{I}$ * $\tilde{W}$ U{$\perp$} is true.

VI EXPERIMENTAL RESULT

Implementation proposed that an provably allow mapped values to always be close to the desired watermark if color estimates are accurate. Also described are pseudo randomization techniques ,which can prevent illicit recoveries of original images without correct input keys.

Original

Recovered

Method	Image1		Image2	
Test Name	Original	Recoverd	Original	Recoverd
Mean	187.0328	187.0328	129.8193	129.8146
Standard Deviation	54.7162	54.7162	59.5137	59.4923
Median	196	196	120	120

VII CONCLUSION

In this paper a new method for reversible visible Water marking with lossless image recovery capability has been proposed. The method uses one-to-one compound mappings that can map image pixel values to those of the desired visible watermarks .mathematically prove the reversibility of the compound mappings for lossless reversible visible watermarking .The compound mappings allow different types of visible watermarks to be embedded.

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