Alpha Channel base Data Hiding using Compressive Sensing

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ABSTRACT

In recent day image ownership authentication has drawn a sharp attention due to easy availability of the internet and inexpensive digital recording and storage peripherals has created an environment where duplication, unauthorized use, and distribution of the digital content has become easier that leads cybercrime. Due to the wide distribution and usage of digital media, an important issue is protection of the digital content.There is a number of algorithms and techniques developed for the digital watermarking. Today already proposed different color image watermarking frameworks for embedding a color watermark within a color input image. An input image is divided into some blocks. In proposed technique use embed watermark at two LSBs in alpha channel of all such blocks. Although alpha channel is used for controlling the transparency of the image, but two LSB's in the alpha channel are unused bits. In this technique we have used these two bits for embedding information. They don't have any contribution in luminance and chrominance factor. For that reason watermark is fully invisible to the Human Visual System (HVS) and no bits are changed in the RGB channel of the input image and for that reason no color information of the input image have been lost. So the color density of the original and watermarked image is same. Use the compressive sensing (CS) method that provides reconstruction of the signal/image. CS can provide good quality of image reconstruction with smaller number of samples and at the same time to detect and extract the watermark. At the extraction end quality of input image and watermark is same as it is.

Keywords - *Digital Image Watermarking, Alpha Channel, Compressive Sensing (CS), Embedding, Extraction*

1. INTRODUCTION

Intensive growth of digital communication and technologies causes using digital media in everyday life. However, illegal usage and reproduction of digital content have also intensively growth in recent years. Therefore, there is an intensive development of the methods for digital content protection. One method used for protection of digital media is digital watermarking. Various signals can be protected using watermarking techniques: audio and video signals, images, etc [5]. The watermarking procedure consists of watermark embedding and watermark detection and watermark extraction. A signal, called watermark, is embedded into the host data. In order to prove the ownership, it should be detectable within the host data and extract within the host data [7].

Many digital image watermarking schemes have been proposed. Most, if not all, of them use either intensity channel (Y component) or one of the three color channels (e.g., blue channel) as a place for embedding a watermark. Embedding a watermark in the color image's intensity channel is perhaps a mostly adopted choice because intensity change is less perceptible than color change. On the other hand, it does not make use of the other two channels which form complete information about a digital image. By using the alpha channel as a place for watermark embedding as described in our paper, a wider embedding space within a whole color space may be used for the purpose. In particular, this is the case of an image with vibrant color, having comparatively constant brightness (e.g., a graphic-style image) [4].

In our proposed technique, we use alpha channel during the embedding process. Watermarking information is added as digital data to the original host image without changing the intensity and color density of the pixel, and it cannot be perceived HVS. It is highly sensitive to any type of data alteration and tampering can easily be detected [3].

Watermark could be affected by various attacks (such as filtering, compression, geometrical image transformation, etc.) that may significantly degrade the watermarking detection and extraction performances. In this paper, we analyze the watermark detection and extraction under the influence of a new kind of concept which is based on popular, recently developed, Compressive Sensing (CS) concept [7].

Compressive Sensing (CS) is a new approach to the signal sampling. Using different types of optimization algorithms, CS allows signal reconstruction when only small number of samples is available. This reconstruction is possible under certain conditions. Namely, signal should be sparse in certain domain, and samples should be acquired randomly. Two dimensional signals are generally not sparse, in a strict sense .Therefore, in the reconstruction of 2D signals; the gradient is used in the optimization programs. Various algorithms for the reconstruction of the 1D and 2D signals exist: L1-and L2-norm minimization, Total Variation *(TV)* minimization [5].

Alpha channel and Compressive sensing is great importance in digital watermarking process such as embedding, detecting and extracting to guarantee the improving speed and accuracy of image reconstruction and also improving the image quality. In this paper we improve the parameter such as PSNR, SNR and MSE. Also reconstruct the lossless data.
Our framework will also ensure:

- The persistency of quality of watermarked image.
- Watermark invisibility to human visual system.
- The persistency quality of reconstructed image.
- Improve Parameter.
- Improve speed accuracy.
- Reconstruct Lossless Data.

In this paper, Section 2 related work for Digital Watermarking, Alpha Channel and Compressive Sensing. Proposed work and experimental results is presented in Section 3 and 4 respectively

2. RELATED WORK

Alpha Channel:

The alpha channel is a color component that represents the degree of transparency (or opacity) of a color (i.e., the red, green and blue channels).It determine how a pixel is rendered when blended with another. When a color (source) is blended with another color (background), when an image is overlaid onto another image, the alpha value of the source color is used to determine the resulting color. If blending is transparent, the source color is invisible, allowing the background color to show through. Alpha is known as Transparent channel for which all pixels values of image will be 255 and for background it is 0 value pixel .when we use alpha on image .Image should only be render other part will be clipped off.so alpha is basically subject with either 0 or 1.

The image is appended with an alpha channel plane to form a png image. The appended alpha channel helps in creating a transparency region onto which the recovery data to be used at the recovery stage is embedded into. At the recovery stage, the appended alpha channel is removed once the watermark has been extracted. The removal of the alpha channel brings back the original image without any loss [1].

Digital Watermarking:

Digital watermarking is a technique for multimedia data protection, copyright protection, tracking of digital copies, etc. Watermark is the secret signal embedded in the multimedia content in a way that does not modify the original content. Depending on the type of host signal, different watermarking techniques were introduced audio watermarking video and image watermarking approaches. Watermark could be embedded either directly into the signal domain, or into some of the transform domains [7].

There is a growing need for multimedia data protection against illegal copying, distribution and misuse of digital content. Watermarking provides copyright protection, monitoring copies of the content, tamper resistance, authentication and annotation. Watermark is secret digital signal which can be *1D* random sequence, or can be logo image inserted into the multimedia signal. Embedding can be done in time domain or into some of

transform domains and work both, for 1D and 2D signals [5]. Generally the watermark should be imperceptible, secure and robust to all kinds of intentional attacks, such as compressions, noises and geometrical attacks [5].However, there is usually a trade-off between watermark imperceptibility and robustness[7].

Watermark Classification

Watermark can be classified:

- By the human perceptibility to watermark:
  Visible or Invisible. Visible watermark often represents owner logo image.
- By robustness level: Fragile watermarking is watermark implementation in the high frequency part of the spectrum, which can be easily removed by high frequency filter .Semi-fragile watermarking provides resistance to some signal processing techniques. Robust watermarking is watermark that can't be removed without significant degradation of the signal.
- By transform domain watermark implementation is performed. Watermark can be inserted into the multimedia signals in time domain or into some of transform domains such As discrete wavelet transform (*DWT),* discrete cosine transform(*DCT*) or discrete Fourier transform (*DFT)*[5].

Compressive Sensing:

Compressive Sensing introduces an alternative way of signal sampling that differs from standard sampling approach, based on the Shannon Nyquist theorem. According to the CS theory, the signal samples could be acquired randomly, at the rate which is far below Nyquist. CS is based on the powerful mathematical algorithms used for the reconstruction of missing content. To provide high accuracy signal reconstruction with CS reconstruction technique, certain conditions need to be fulfilled. Namely, the signal has to be sparse in a certain transform domain, which means that the information about the signal is concentrated within a small number of coefficients. The second requirement refers to sampling procedure. The signal acquisition/measurement procedure should be incoherent, in order to provide signal reconstruction with small number of available samples. Reconstructed signal can be obtained by using certain optimization algorithm, which can be based on different norms minimization (l0, l1, l2etc). The optimal solution in large number of applications is provided using l0 -norm minimization. In image processing applications, the commonly used optimization technique is called Total Variation (TV) minimization [7].

3. PROPOSED SYSTEM

The overall goal is to improve the quality of image and reconstruction of image using Alpha channel base data hiding using compressive sensing.

- The primary goal is to develop such a hierarchy that improves the quality of watermarked image using alpha channel embedding.
- The secondary goal is to work with effective region of watermarked image and get the proper reconstruction image using compressive sensing.

For the proposed methodology two steps are performed. first one is the watermark embedding and second one is the watermark extraction.

1. Watermark Embedding

Steps of Proposed Watermark Embedding Method:

Step 1: Read colour host image.

Step 2: Apply Framing

In this step, after read colour host image, the colour host image or original image is divided into equal size block where each block size is same with color watermark and reference image. Each divided area will be used to embed the watermark.

Step 3: Then apply Reference image.

In this step, after framing, the colour reference image or colour watermark image will be applied to the embedding process.

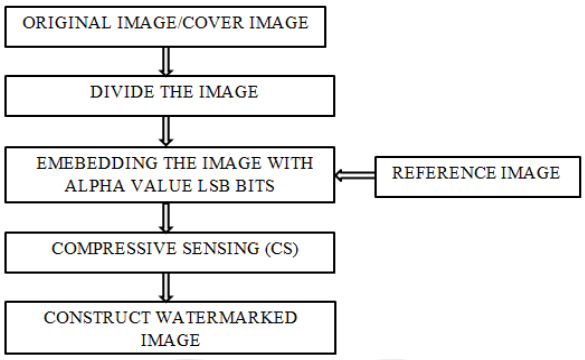


Fig 1- Proposed System for Watermark Embedding

Step4: Embedding Reference Image with Alpha Value using LSB bits.

In this step, after apply reference image, embed colour reference image into equal size blocks with alpha value using LSB bits. Alpha Channel is used for controlling the transparency of the image and do not have any contribution in luminance and chrominance factor. For that reason watermark is fully invisible to the Human Visual System and no bits are changed in the red, green, and blue channel of the host image and for that reason no color information of the host image have been lost. So the color density of the original and watermarked image is same.

Step5: Apply Compressive Sensing (CS).

In this step, after embedding process, apply compressive sensing. Compressive sensing is used for faster transformation and also will be compressing the data and proper reconstruction image.

Step6: Get watermarked image.

2. Watermark Extraction

Flow Diagram of Watermark Extraction:

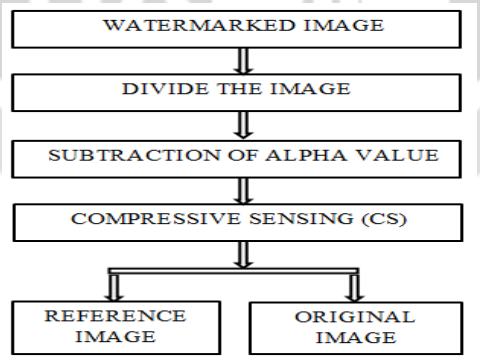


Fig 2- Proposed System for Watermark Extraction

Steps of Proposed Watermark Extracting Method:

Step 1: Read Watermarked image.

Step 2: Apply Framing.

- In this step, after read watermarked image, the watermarked image divided into equal size block. Each divided area will be used to subtract the alpha value.

Step 3: Subtract the Alpha Value.

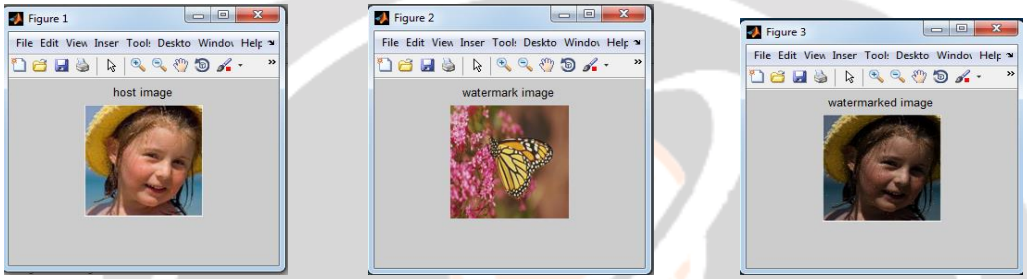
Step 4: Apply Compressive Sensing (CS).

- In this step, after subtract the alpha value, apply compressive sensing. Compressive sensing is used for faster transformation and also will be compressing the data and proper reconstruction image.

Step 5: Get Reference image and Original image.

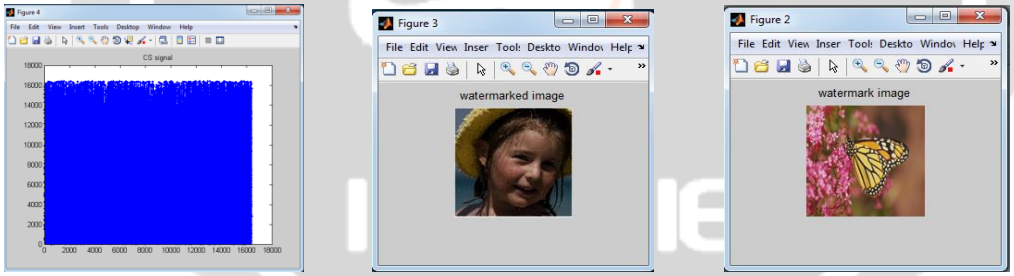
4. EXPERIMENTAL RESULTS

The proposed scheme has been experimented on several no. of different color images. The host image child.png and watermark image monarch.png is considered. Some of the result is given below. From the below image it is clear that the watermark is entirely invisible to the human visual system (HVS).



(a) (b) (c)

Fig 3- (a) Host Image (b) Watermark image (c) Watermarked image



(d) (e) (f)

Fig 4-(d) CS Signal (e) Watermarked Image after CS (f) Extracted Watermark

Experimental Parameters:

Different size of color images are tested under this proposed system and table given below shows experimental results among PSNR, MSE and SNR parameters.

Table 1 PSNR, MSE, SNR Value Analysis using LSB Scheme and CS

IMAGE	PSNR(Proposed Method)	MSE(Proposed Mehod)	SNR (Proposed method
Child.png	63.25	2.00	0.46
Fruits.png	63.83	2.70	0.10

Beach.png	62.90	2.94	0.14

5. CONCLUSIONS

In proposed work try to get the maximum accuracy of reconstructed image using alpha channel embedding and compressive sensing also prove result with different parameter like PSNR, SNR, and MSE. In future we will security based work.

6. REFERENCES

[1] Kishore Sebastian,Jenny Maria Johny,"ROI-Based Watermarking Technique for Medical Images via the Use of Alpha Channel", ISSN: 2250-2459, International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 7, July 2014.

[2] Fan Tiesheng , Lu Guiqiang,Dou Chunyi, Wang Danhua,"A Digital Image Watermarking Method Based on the Theory of Compressed Sensing", International Journal of Automation and Control Engineering Volume 2 ,Issue 2, May 2013.

[3] Pradosh Bandyopadhyay, Soumik Das, AlaiChaudhuri, Monalisa Banerjee, "A New Invisible Color Image Watermarking Framework through Alpha Channel", ISBN: 978-81-909042-2-3, IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 2012.

[4] Natapon Pantuwong, Nopporn Chotikakamthorn, "Alpha Channel Digital Image Watermarking Method", ISBN: 978-1-4244-2179-4/08, ICSP2008.

[5] Jelena Musi, Ivan Knežev and Edis Franca, "Wavelet Based Watermarking Approach in the Compressive Sensing Scenario", 4rdMediterranean Conference on Embedded Computing MECO – 2015 Budva,Montenegro.

[6] Qia Wang, Wenjun Zeng, *Fellow, IEEE*, and Jun Tian, *Member, IEEE* ,"A Compressive Sensing based Secure Watermark Detection and Privacy Preserving Storage Framework", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 23, NO. 3, MARCH 2014.

[7] Irena Orovic, Member, IEEE, Andjela Draganic, and Srdjan Stankovic, "Compressive Sensing as a Watermarking Attack",ISBN:978- 1 -4799- 1 420-3/1 3/©2013 IEEE , 21st Telecommunications forum TELFOR 2013.

[8] Sheng Shi, Ruiqin Xiong, Siwei Ma, Xiaopeng Fan and Wen Gao, "Image Compressive Sensing Using Overlapped Block Projection and Reconstruction",ISBN:978-1-4799-8391-9/15/©2015 IEEE.

[9] Lin Zhang, Xialing Zeng, "Image Adaptive Reconstruction Based on Compressive Sensing and the Genetic Algorithm via ROMP", ISBN:978-1-4673-6850-6/15,2015 2nd International Conference on Information Science and Control Engineering.

[10] Di Xiao and Shoukuo Chen, "Separable data hiding in encrypted image based on compressive sensing", Electronics Letters 10th April 2014 Vol. 50 No. 8 pp. 598–600.

[11] Xinpeng Zhang, "Separable Reversible Data Hiding in Encrypted Image", IEEE Transaction On Information Forensics And Security, Vol. 7, NO. 2, April 2012.