Dual level Image watermarking using SVD and Edge detection technique

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***Abstract*— With the advent of the internet, the online purchasing and distribution of the digital images can now be performed relatively easily. However there exists one major problem associated with the distribution of any digital images are the most important issue of the copyright protection and the proof of rightful ownership. To deal with these problems the concept of image watermarking came into existence. A digital watermark is a sequence of information containing the owner's copyright for the multimedia data. Watermark is inserted invisibly in another image (host image) so that it can be embedded at later times for the evidence of rightful ownership. In this paper dual level image watermarking technique is used .Canny edge detection technique has been used .Here we used L.S.B – S.V.D technique for multi-level watermarking. quality of image has been checked in the form of psnr and cc values have also been computed.**

Index Terms*— Edge detection technology,*Image watermark, SVD.

I. INTRODUCTION

Digital watermarking technology has been playing an important role in protecting copyrights in digital information such as images, audio, and video which can be accurately copied and arbitrarily distributed much more easily. In addition, the availability of powerful image processing tools has also provided opportunities to manipulate and tamper with

Digital images for the misuse of intellectual property. Therefore, how to protect the content of digital images for image authentication is an urgent issue.

Over the last few years, the technology of digital watermarking has gained prominence and emerged as a leading candidate that solve the fundamental problems of legal ownership and content authentications for digital multimedia data (e.g. audio, image, video). A digital watermark is a sequence of information containing the owner's copyright for the multimedia data. Watermark is inserted invisibly in another image (host image) so that it can be embedded at later times for the evidence of rightful ownership. Digital image watermarking techniques can be categorized into one of the two domains i.e. spatial and transform according to the embedding domain of the host image. The simplest technique in the spatial domain methods is to insert the watermark image pixels in the least significant bits (LSB) of the host image pixels. Watermarking is more secure and robust in transform domain to the attacks. The information is needed by the detector in the classification of watermarking schemes.

Based on the information required ,there are 3 types of watermarking techniques (i) Non-blind schemes require both the original image and the secret key(s) for watermark embedding, (ii) Semi-blind schemes require the secret key(s) and the watermark bit sequence,(iii) Blind schemes require only the secret key(s).

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II. LITERATURE REVIEW

Liu et al. in [1] have proposed an SVD based watermarking scheme in which the watermark is added to the SVs of the whole image or a part of it. A single watermark is used in this scheme which may be lost due to attacks. To avoid this disadvantage, we propose an approach in which, the original image is segmented into blocks and the watermark is added to the SVs of each block in a modified manner. F. A. P. Petitcolas, R. J. Anderson and M. G. Kuhn in [2] have proposed Information-hiding techniques that have recently become important in a number of application areas. Digital audio, video, and pictures are increasingly furnished with distinguishing but imperceptible marks, which may contain a hidden copyright notice or serial number or even help to prevent unauthorized copying directly. Military communications systems make increasing use of traffic security techniques which, rather than merely concealing the content of a message using encryption, seek to conceal its sender, its receiver, or its very existence. A variable block size based adaptive watermarking, in spatial domain was proposed by Kimpan *et al*. [3], where the original image was divided into different blocks of varied size and the watermark was embedded into the blocks by analyzing and adjusting the brightness of a block. In a later period of 2006, Verma *et al*. [4] proposed a probability block based watermarking method for color image with fixed block size. In this method, the image was initially divided into blocks of size 8*8 and manipulated the pixel intensity to embed a watermark bit.In 2011, Jassim Mohmmed Ahmed and Zulkarnain Md Ali [5] made an improvement to the LSB technique by randomly embedding the bits of the message in the image to produce more secured system. The proposed system goal gave more the complexity to cryptosystems and the execution time did not differ great than the original methods. The proposed scheme hides the messages inside image in a way that does not

allow any attacker to even detect that there is secret message. As a result, the proposed system was more efficient compared to that introduced earlier.J.J.K.O'Runaidh et al. [7] prepare a discrete Fourier transform phase based method of conveying watermark information. They used the fact that phase is more important than magnitude of the DFT values. The watermark survived 15:1 JPEG image compression.The authors Cheng *et al*. [8] in 2004 proposed an algorithm which was based on embedding the watermark image in three times at three different frequency bands, namely, low, medium and high. The results proved that the watermark cannot be totally destroyed by either low pass, medium or high pass filter. In Chun-Shien *et al*. [9], two complementary watermarks were embedded into the host image in order to make it difficult for attackers to destroy both of them. The main benefit obtained from these techniques is that they can take advantage of properties of alternate domains to address the limitations of pixel-based methods or to support additional features. Generally, the main drawback of transform domain methods is their higher computational requirement.

III. EDGE DETECTION

Edge detection is the method of localizing pixel values or intensity changes. The edge detection has been used by several areas such as segmentation, target tracking and object recognition etc. Therefore, the edge detection is main parts of image processing. There mostly exist several edge detection approaches {Sobel, Prewitt, Roberts and Canny}.These methods have been offered for identifying changes in images. Early methods determined the best gradient operator to detect sharp intensity variations. Normally apply derivative operation on image for identifying edge. Derivative based approaches can be characterized into two sets, specifically first and second order derivative approaches. First order derivative based methods depend on calculating the gradient some directions and merging the result of each gradient. To calculate the value of the gradient magnitude and orientation is estimated using two differentiation masks. Following figure shows the output of applying edge detection technique.

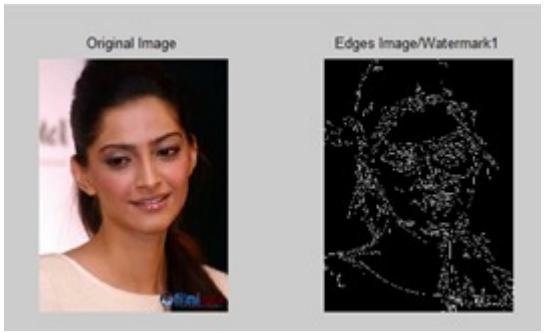

Figure 1: Extracting edges

IV. L.S.B WATERMAKING

L.S.B technique is used for a grey scale image.It is a simple technique. We use a grey scale 8- bit image .We read in the file and data is added to least significant bits of each pixel. Each pixel is formed of 1 byte consisting 8 bits. The LSB's of each of these bytes is encoded. Since only last two significant bits are encoded , it will not be detectable to human eye.
In the following figure edges of the original image are embedded in the original image using L.S.B technique producing watermarked image 1.

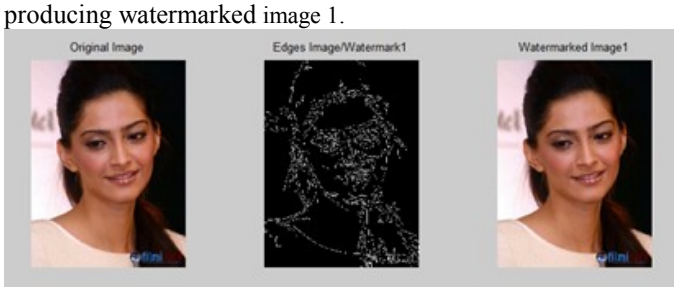

Figure 2: L.S.B watermarking

V. SINGULAR VALUE DECOMPOSTION (SVD)

The Singular Value Decomposition is one of the most useful tools of linear algebra with several applications to multimedia which includes Image compression, watermarking and other Signal Processing. Given a real matrix, A (m, n); $1 \le m \le M$, $1 \le n \le N$, it can be decomposed into a product of three matrices given by equation1.

$$A = USV^{\top} \quad (1)$$

Where U and V are orthogonal matrices,
The main property of SVD based watermarking is that the largest of the modified singular values change very little for most types of attacks like transpose, flip, rotation, scaling and translation.
The diagonal entries of S are called the singular value of A, the columns of U are called the left singular vectors of A, and the columns of V are called the right singular vectors of A. This decomposition is known as the Singular Value Decomposition (SVD) of A.
Following figure shows embedding another image in the watermark image 1 using SVD technique to produce watermarked image 2.

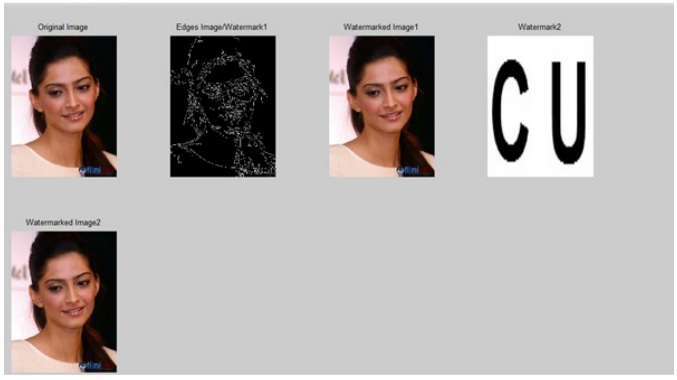

Figure 3: S.V.D watermarking

VI. PROPOSED WATERMARKING ALGORITHM

Proposed watermarking algorithm is an improvement over the existing combined approach of LSB –DCT watermarking.
1) Take an image.
2) Apply edge Detection technique on Original Image Using Canny Edge Detection Operator.

3) Take the edges of original image from step no. 2 as watermark1 image.
4) Replace LSB of Original Image by MSB of watermark1 image (edge of original image).
5) Display original image and watermarked1 image.
6) Consider Watermarked1 image as original image for SVD Watermarking
7) Load any other new image as a watermark.
8) Apply SVD Watermarking, to find watermarked2 image.
9) Applying inverse SVD we find watermark2 and original image (watermarked1 image).
10) Apply Inverse of LSB to find watermark1 (edge of original image) and original image.

Figure 4: Extracted watermarks

Table 1. **PSNR and CC values of the proposed algorithm**

PSNR & CC on applying SVD technique		
PSNR	**68.5833**	**49.6655**
CC	**1**	**0.99923**

VII. CONCLUSION

In this paper, SVD and edge detection is used for watermarking for the purpose of high authentication of original image and security of image. Mat lab version 7.10.0 tool has been used .Implementation is done using 384*512 image. In this paper, we check quality of image in the form of psnr and cc values have also been computed. . These values have been improved significantly as shown in the table 1. Now a day's image watermarking is the largest area of research. In this paper we concentrate only on dual-level image based data security using SVD and edge detection technique on watermarking. In future, we aim to develop an application that removes the effect of noise on cover object and recover watermark image.

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