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Non Blind Watermarking Scheme for Image and Video using DWT-SVD

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ABSTRACT
Recent developments in digital image and Internet technology help the common users to easily produce illegal copies of the images. In order to solve the copyright protection problems of the image, several watermarking schemes have been widely used. Very few watermarking schemes have been proposed for defining the copyrights of color image. To resolve the copyright protection problem of color image, we propose an effective, robust and imperceptible color image watermarking scheme. This scheme embeds the watermark into cover image in (Red, Green, Blue) RGB space. The combinations of Discrete Wavelet Transform (DWT) and Singular Value Decomposition (SVD) are used to embed the watermark.
In the combination of Discrete Wavelet Transform (DWT) and Singular Value Decomposition (SVD), the singular values of different sub band coefficients are modified using different scaling factors to embed the singular values of the watermark. The copy of the watermark is embedded into four sub band coefficients which is very difficult to remove or destroy. The combination of DWT and SVD increases the security, robustness and imperceptibility of the scheme. In this project, we employ watermarking for video also.

Keywords: DWT, SVD, DWT-SVD

I.INTRODUCTION

The security and authenticity issues of digital image are becoming popular than ever, due to the rapid growth of multimedia and Internet technology. On Internet, digital images are easily and widely shared among the different users at different geographical places. Every day large amount of digital images are transmitted over the Internet in various applications. As digital technology allows unauthorized reproduction of digital images, the protection of the copyrights of digital image is a very important issue. Image watermarking schemes are used to protect the digital images. Image watermarking is the process of embedding an imperceptible data (watermark) into cover image. The image watermarking schemes have been widely used to solve the copyright protection problems of digital image related to illegal usage or distribution. Several image watermarking schemes are proposed, considering different viewpoints. The image Watermarking schemes are classified into different types based on domain of processing, visibility of watermark and rigidity of scheme. Based on the domain of processing, the watermarking schemes are classified into two categories: spatial-domain and frequency-domain schemes. Spatial domain schemes embed the watermark by directly modifying the pixel values of the cover image and these schemes are less complex in computation. On the other hand, transform domain schemes embed the watermark by modulating the frequency coefficients in a transformed domain such as, Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT) and Discrete Wavelet Transformation (DWT). Transformed domain schemes are more robust when compared to spatial domain schemes. The robustness of the wavelet domain scheme is increased. In this scheme the wavelet transform is applied on chaotic logistic map. This scheme is robust to geometric attacks but sensitive to filtration and sharpening. The Singular Value Decomposition (SVD) is numerical technique for diagonalzing the image matrices in which transform domain consist of basis state that is optimal. To achieve high robustness against attacks like Gaussian noise, compression and cropping the combinations of DWT-SVD are used. The combination of DWT- SVD was proposed to insert the watermark into the high frequency sub band of cover image. This scheme is rigid to different types of image processing operations. The SVD is applied on sub bands LH and HL sub bands and the watermark is embedded into these SVD transformed sub bands. The rigidity of this scheme is analyzed considering different types of image processing operations. In few schemes, both watermark and cover images are preprocessed in transformed domain to achieve high rigidity. In the literature, many schemes uses the SVD-DWT based embedding for gray scale image watermarking. The proposed scheme embeds the monochrome watermark into color cover image. The color image is represented by Red (R), Green (G) and Blue (B) channels. Out of these three channels, change in the intensity of R channel is the most sensitive to human eyes whereas for B channel it is least sensitive. Hence, in the proposed scheme the blue channel is considered for embedding. The wavelet transform of image gives four frequency sub-band coefficients. In image processing each subband is resistant to different types of attacks or transformations. For example, the low frequency subband coefficients are less robust to geometrical distortions and histogram equalization. In the proposed scheme the copy of the watermark is embedded into all subband coefficients which is hard to destroy the watermark even after the different types of attacks on the watermarked images to improve the robustness of the scheme the watermark is embedded into singular values of different sub-band coefficients obtained from B channel of the color image.

1.1 Steganography

Art of writing hidden messages and recipient knows the existence of the message.
"*Message Existence Secret*"

1.2 Cryptography

Cryptography hides the contents of the message from an attacker, but not the existence of the message.
Message itself is not disguised, but the content is obscured. Anybody can see that both parties are communicating in secret.
" *Message Contents secret*"

1.3 Watermarking

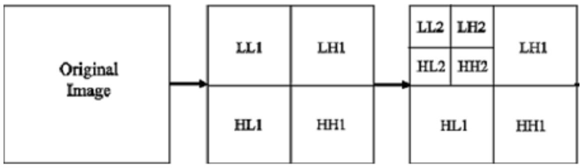
The process of embedding information into another object.
"*Recognizable image or pattern*"
Steganography/watermarking even hide the very existence of the message in the communicating data.

II. SINGULAR VALUE DECOMPOSITION

Singular value decomposition (SVD) is an effective tool for minimizing data storage and data transfer in the digital community. In linear algebra, the singular value decomposition (SVD) is a factorization of a real or complex matrix, with many useful applications in signal processing and statistics.
SVD technique in image processing applications to be noticed is
a) The SVs (Singular Values) of an image has very good stability, which means that when a small value is added to an image, this does not affect the quality with great variation.
b) SVD is able to efficiently represent the intrinsic algebraic properties of an image, where singular values correspond to the brightness of the image and singular vectors reflect geometry characteristics of the image.
c) An image matrix has many small singular values compared with the first singular value. Even ignoring these small singular values in the reconstruction of the image does not affect the quality of the reconstructed image.

III .DISCRETE WAVELET TRANSFORM

The discrete wavelet transform divides the image into four parts as in the following procedure:
(P1) The scaling function $\phi(x)\ \phi(y)$ produces the top left part.
(P2) The vertical wavelet function $\psi(x)\ \phi(y)$ produces the top right part.
(P3) The horizontal wavelet function $\phi(x)\ \psi(y)$ produces the bottom left part.
(P4) The diagonal wavelet function $\psi(x)\ \psi(y)$ produces the bottom right part.
The top left part is called an approximation because it is smooth and has large values. The other three parts are called details because they emphasize horizontal, vertical, and diagonal edges, respectively. These three parts have small absolute values except for edges.
DWT decomposes image into four non overlapping multi resolution sub bands:



LL1 (Approximate sub band), HL1 (Horizontal sub band), LH1 (Vertical sub band) and HH1 (Diagonal Sub band). Here, LL1 is low frequency component whereas HL1, LH1 and HH1are high frequency (detail) components. Embedding watermark in low frequency coefficients can increase robustness significantly but maximum energy of most of the natural images is concentrated in approximate (LL1) sub band. Hence modification in this low frequency sub band will cause severe and unacceptable image degradation. Hence watermark is not embedded in LL1 sub band. The good areas for watermark embedding are high frequency sub bands (HL1, LH1 and HH1), because human naked eyes are not sensitive to these sub bands.
They yield effective watermarking without being perceived by human eyes. But HH1 sub band includes edges and textures of the image. Hence HH1 is also excluded. The rest options are HL1 and LH1. But Human Visual System is less sensitive in horizontal than vertical. Hence Watermarking is done in HL1 region.
In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency and location information (location in time).

IV .VIDEO WATERMARKING

Digital watermarking can be categorized into image watermarking, video watermarking and audio watermarking depending upon the range of application. Video watermarking is very different from image watermarking, even though some techniques can be viewed as an extension to it. Video watermarking refers to embedding watermarks in a video sequence in order to protect the video from illegal copying and identify manipulations. A variety of robust and fragile video watermarking methods have been proposed to solve the illegal copying and proof of ownership problems as well as to identify manipulations . The methods can be divided into techniques that work on compressed or uncompressed data. Various types of watermarking schemes have been proposed for different applications. The watermarking techniques have been applied either in the spatial domain or in the frequency domain using various transforms.

V. EXPERIMENTAL RESULTS

The series of experiments are conducted to analyze the effect of embedding and extraction on the image and video.

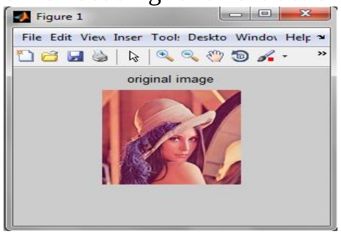


Fig : 5.1 Original image

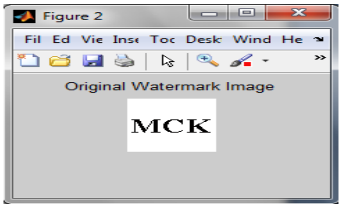


Fig:5.2 Original watermark image

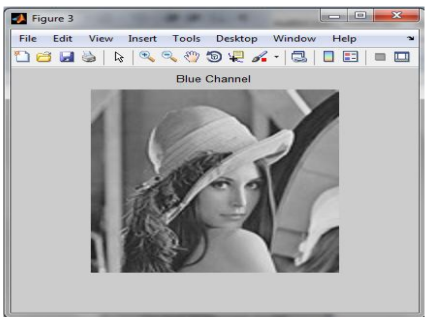


Fig:5.3 Blue channel image

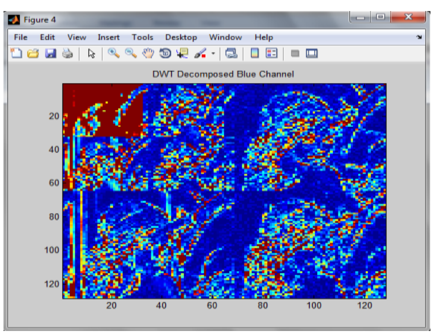


Fig:5.4 DWT Decomposed Blue Channel Image

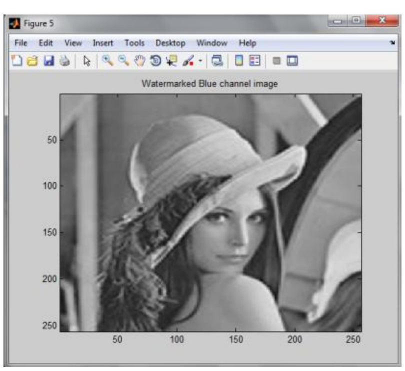


Fig:5.5 Watermarked Blue channel image

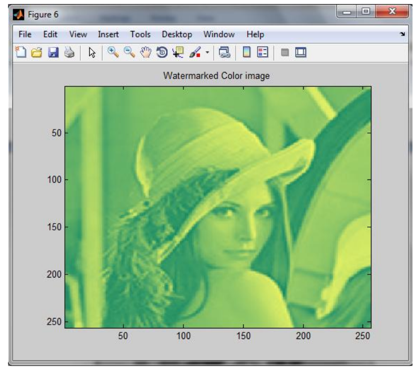


Fig:5.6 Watermarked Color image

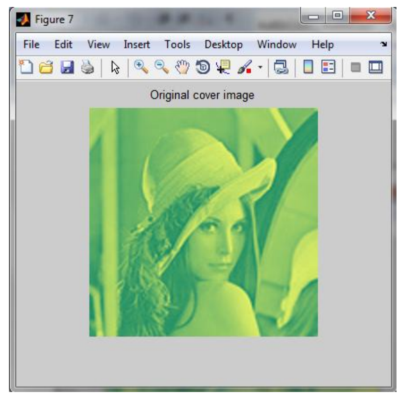


Fig:5.7 Original Cover Image

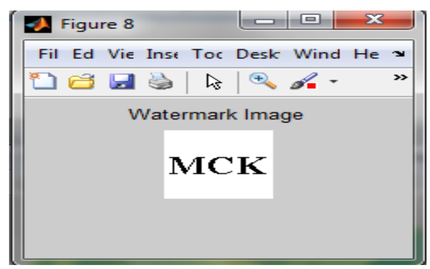


Fig: 5.8 Watermark image

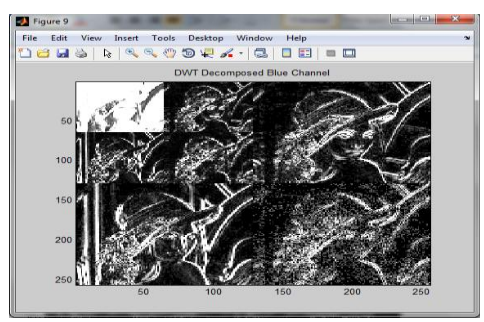


Fig:5.9 DWT Decomposed Blue channel

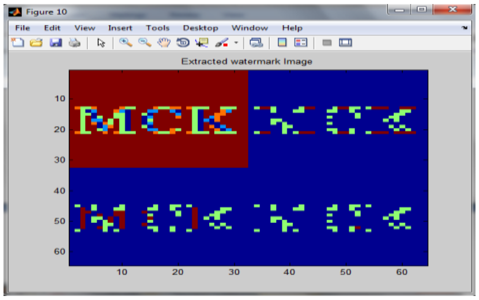


Fig:5.10 Extracted watermark image

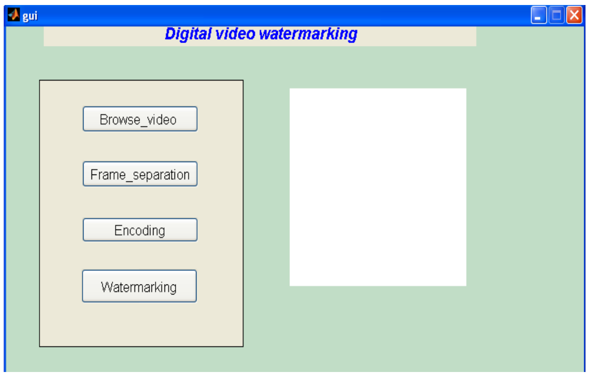


Fig 5.11 : GUI of Digital video watermarking

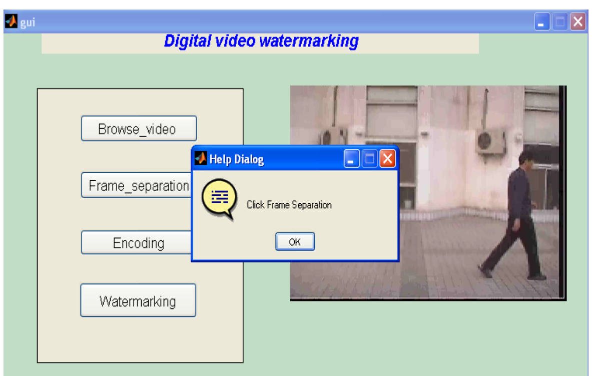


Fig 5.12 : Frame separation of video

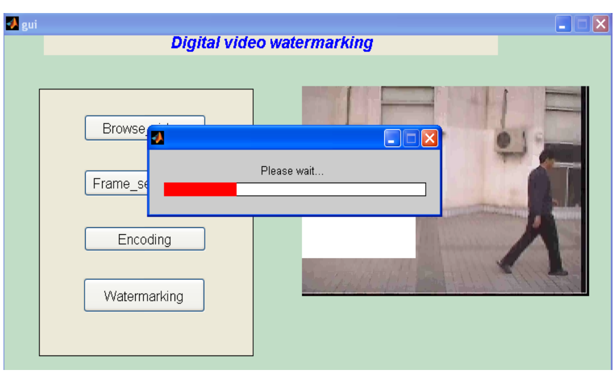


Fig 5.13 Frame separation process

Fig 5.14 Encoded image

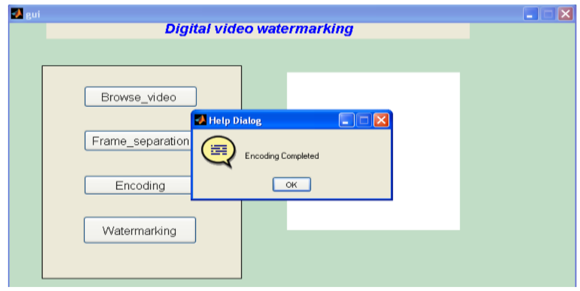


Fig 5.15:Encoding completed dialog

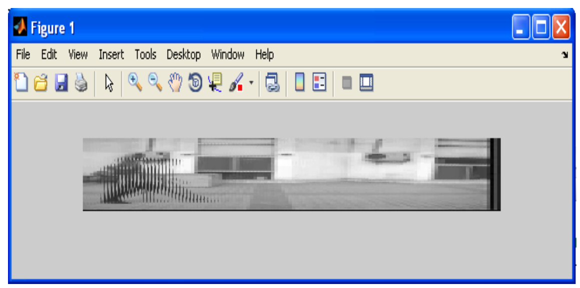


Fig 5.16: Original Encoded Image

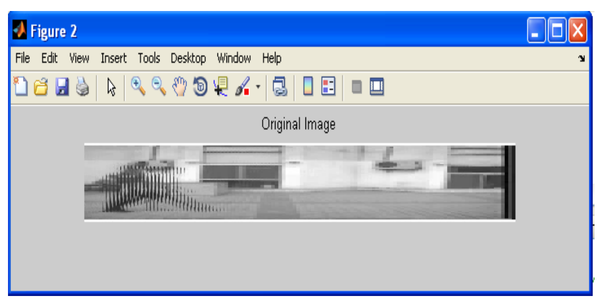


Fig 5.17:Original image

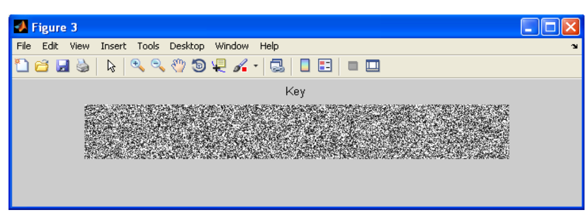


Fig 5.18 Key image

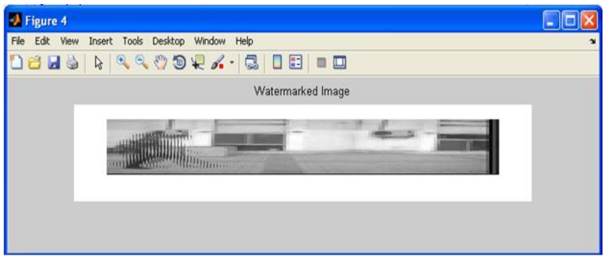


Fig 5.19:Watermarked image

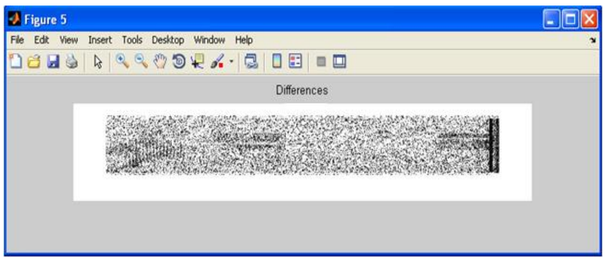


Fig 5.20:Differences between original and watermarked image

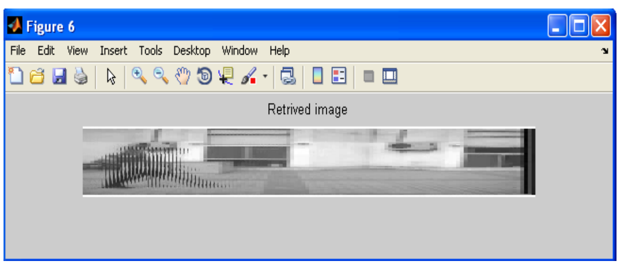


Fig 5.5.11:Retrived Image

PSNR for 50 frames: 24.1216

PSNR for 25 frames: 21.1113

PSNR for 12 frames: 18.1010

PSNR for 6 frames: 14.5792

PSNR for 3 frames: 12.9822

VI. CONCLUSION

We have proposed a DWT- SVD based non-blind watermarking scheme. The SVD is an efficient tool for watermarking in the DWT domain. To embed the watermark into cover image the scaling factor is chosen from a wide range of values for all subbands. The same watermark is embedded into four subbands which is very difficult to remove or destroy. The rigidity of the proposed scheme is analyzed by considering various types of image processing attacks. The scheme was found robust to various types of image processing attacks

Digital video Watermarking is a new and merging area of research. It mainly deals with adding hidden messages or copyright notices in digital video. This paper reviews various techniques for video watermarking and attacks on watermarks. As a result, video watermarking is a potential approach for protection of ownership rights on digital video.

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