# An Effective Approach for Digital Watermarking Using SVD In Wavelet Domain

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***Abstract-*** The Project presents an effective, robust and imperceptible video invisible watermarking scheme. This scheme embeds the watermark into any of frame from video. Here the blue channel of frame will be selected for watermarking based on Discrete Wavelet transformation and Singular Value Decomposition. The singular values of different sub band coefficients of Blue channel are modified using one least factor to embed the singular values of the watermark. SVD based from distortion factors like rotation and shifting. The watermark will be extracted from video for recognition with user's watermark using co-occurrence features and Euclidean distance to access the copy righted video.

***Keywords-*** *Authentication, copyright protection, robustness, Discrete Wavelet Transform (DWT), Singular Value Decomposition (SVD)*

## I. INTRODUCTION

The identification of objects in an image and this process would probably start with image processing techniques such as noise removal, followed by (low-level) feature extraction to locate lines, regions and possibly areas with certain textures. The clever bit is to interpret collections of these shapes as single objects, e.g. cars on a road, boxes on a conveyor belt or cancerous cells on a microscope slide. One reason this is an AI problem is that an object can appear very different when viewed from different angles or under different lighting. Another problem is deciding what features belong to what object and which are background or shadows etc. The human visual system performs these tasks mostly unconsciously but a computer requires skilful programming and lots of processing power to approach human performance. Manipulation of data in the form of an image through several possible techniques. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be processed optically or digitally with a computer. Digital information revolution and the thriving progress in network communication are the major driving forces of this change. The perfect reproduction, the ease of editing, and the Internet distribution of digital multimedia data have brought about concerns of copyright infringement, illegal distribution, and unauthorized tampering. Techniques of associating some imperceptible data with multimedia sources via embedding started to come out to alleviate these concerns. Interestingly, while most such techniques embed data imperceptibly to retain the perceptual quality and value of the host multimedia source, many of them were referred as digital watermarking[1],[2] whose traditional counterpart is not necessarily imperceptible.

### A. Digital Watermarking

We would normally like to increase the energy of the watermark (or payload of the watermark) in order to increase its robustness. However, increasing the payload of the watermark degrades the visual quality of the image such that human eye will notice the degradation. A dual reasoning leads us to think that it might be better to increase the payload of the watermark by embedding the watermark bits into places where human eye will not detect the changes to the image. Several watermarking schemes were proposed by researchers that aim to exploit the characteristics of the human visual system. For example, [8] suggests to make the gain factor luminance dependent. This is because of the fact that Human Visual System (HVS) is less sensitive to changes in regions of high luminance. We can exploit this property by increasing the payload (energy) of the watermark in those specific areas. We can create a mask image that consists of those areas that are less sensitive to distortions and modulate the watermark bits using this mask image.


Fig 1. Watermark image

**WI(i,j) = I(i,j) + Mask(i,j).k.W(i,j) Eq(1)**

W is the watermark pattern (image), k is the gain factor, and Mask is the mask image as mentioned above. In my implementation, I generate the Mask image using an edge detection algorithm. I convert the edge image into a binary image. I amplify the effect of watermark bits by k on pixels where edge image is '1' and keep the effect of the watermark bits minimal on pixels where edge image is '0'. This increases the energy of the watermark along the edges in the image. I use the canny edge detector to extract the edge information out of the image.

### B. Video

Stands for Audio Video Interlaced. It is one of the oldest formats. It was created by Microsoft to go with Windows 3.1 and its "Video for Windows" application. Even though it is widely used due to the number of editing systems and software that use AVI by default, this format has many restrictions, specially the compatibility with operation systems.


Fig.2: Extracted watermark image

It was achieved slight influence on bit rate and PSNR with real-time performance forVOD services. It has proposed blind MPEG-2 video watermarking achieved high video quality and robustness to camcorder recording and other attacks. Embedding capacity of the proposed method has been computed which is better than the most cases compared to the existing methods. The MSE and PSNR value is also better than existing methods after embedding of secret image in various coefficients of the cover image.

### C. Methodology Analysis

The raw frame I is divided into 8 pixels by 8 pixel blocks. The result is an 8 by 8 matrix of coefficients. The transform converts spatial variable into frequency variations, but it does not change the information in the block; the original block can be recreated exactly by applying the inverse cosine transform. The advantage of doing this is that the image can now be simplified by quantizing the coefficients. Many of the coefficients, usually the higher frequency components, will then be zero. The penalty of this step is the loss of some subtle distinctions in brightness and colour.

### D. Singular Value Decomposition (SVD)

The singular value decomposition (SVD) is a factorization of a real or complex matrix, with many useful applications in signal processing and statistics. Formally, the singular value decomposition of an $m \times n$real or complex matrix $M$ is a factorization of the form follow in this equation.

**M = UΣV' .......*Eq* (2)**

Where $U$ is an $m \times m$ real or complex unitary matrix, Σ is an $m \times n$ rectangular diagonal matrix with nonnegative real numbers on the diagonal, and $V^*$ is an $n \times n$ real or complex unitary matrix. A non-negative real number σ is a singular value for $M$ if and only if there exist unit-length vectors $u$ in $Km$ and $v$ in $KN$such that show as equation

**Mv=σu........Eq (3)**

The vectors $u$ and $v$ are called left-singular and rightsingularvectors for σ, respectively.


Fig3. Watermark image DWT

### E. Discrete Wavelet Transform

An image that undergoes Haar wavelet transform will be divided into four bands at each of the transform level. The first band represents the input image filtered with a low pass filter and compressed to half. This band is also called 'approximation'. The other three bands are called 'details' where the high pass filter is applied. These bands contain directional characteristics. The size of each of the bands is also compressed to half.

Fig.5 (a) Cover image (b)watermark image (c)DWT image (d) watermarked image

Specifically, the second band contains vertical characteristics, the third band shows characteristics in the horizontal direction and the last band represents diagonal characteristics of the input image. Conceptually, Haar wavelet is very simple because it is constructed from a square wave. Moreover, the Haar wavelet computation is fast since it only contains two coefficients and it does not need a temporary array for multi-level transformation. Thus, each pixel in an image that will go through the wavelet transform computation will be used only once and no pixel overlapping during the computation.

## II. PROPOSED MODEL

### *A. Embedding Process*

In the embedded process video file we have taken the Blue Plane of Any one frame and apply SVD [3]. Insert a logo and take DWT on both Blue Plane frame with logo and QR code image was composite with DWT co-efficient. Next apply IDWT to obtain the watermarked image. Finally watermarked Blue Plane frame add in a video file.

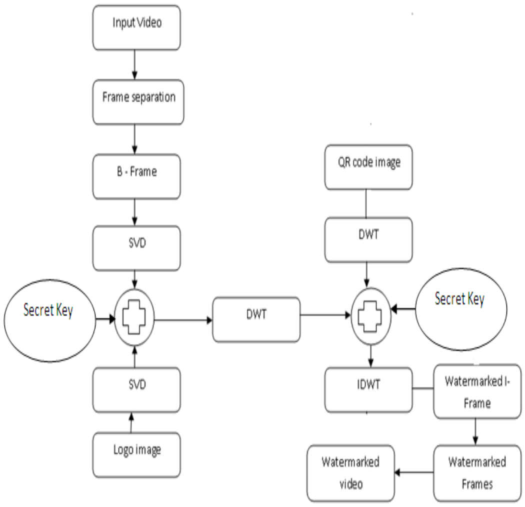



Fig5: Shows the Proposed Embedded Process with Secret Key

### *B. Algorithm for Embedding Process*

Step 1: Read the video file and extract RGB from Blue Plane in Any one frame,
Step 2: Read the Blue Plane for image as a cover image.
Step 3: Generate a QR image
Step 4: Apply SVD to I frame and get three singular Coefficients as **u, Σ, v'**
Step 5: Add logo with components of an SVD image to get an SVD cover image
Step 6: Apply DWT on both SVD cover image and QR image to get combined image
Step 7: Take the inverse DWT on the combined image to get Watermarked Blue Plane
Step 8: Finally watermarked I frame image to get the watermarked video files.

### *C. Extracting Process*

In extracting process, SVD is applied to watermarked image and recover the logo. Apply DWT on original video file and watermarked I-frame extract wavelet co-efficient fusion process on the wavelet co-efficient, take the IDWT to obtain the QR image.

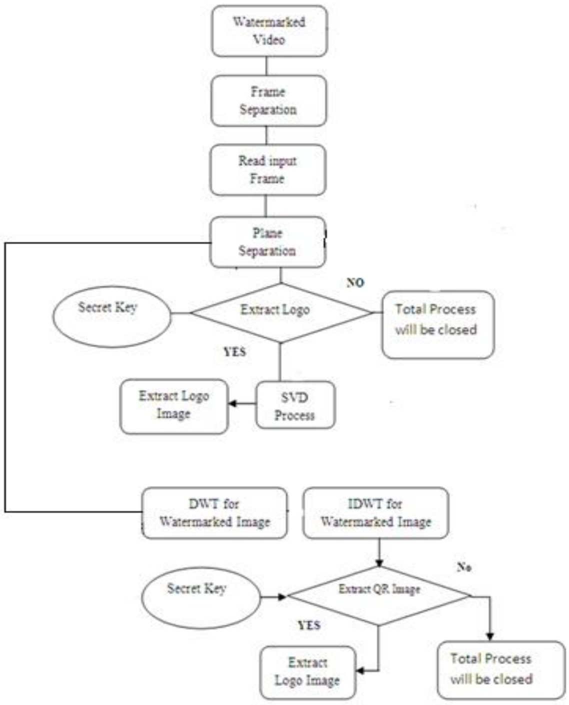



Fig6:Block diagram of the extracting process with secret key

### *D. Algorithm for Decoding Process*

Step 1: Read the watermarked video files and extractWatermarked Blue Plane
Step 2: Read the original video file and extract originalVideo Blue Plane.
Step 3: Apply DWT on both videos Blue Planes.
Step 4**:** Subtract watermarked video Blue Plane coefficientwith original video I frame coefficient and take Inverse DWT to get a QR image.
Step 5: By using QR code reader extract company nameFrom QR code image.
Step 6: Apply SVD on watermarked I frame to recoverthe logo by using the singular value component.

## III. RESULT ANALYSIS

### *A. Mean Square Error (MSE)*

It is defined as the square of error between Cover image and the Watermarked image. The distortion in the image can be measured using MSE.

$$MSE=\frac{\sum\sum [A(i,j) - B(i,j)]^2 \ldots}{M \times N} \quad (4)$$

Here, A (i.j) = Cover Image (Frame).

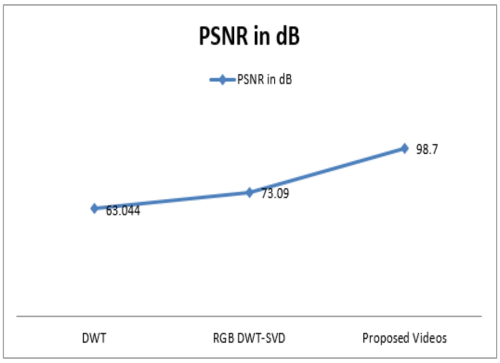
B (i.j) = Watermarked Image (Frame).

M X N=row and column of image intensity of pixel vales (255 255) image size.

*B. Peak Signal to Noise Ratio*

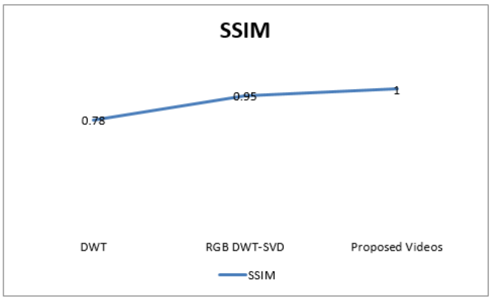
It is the ratio of the maximum signal to noise in the Watermarked Image.

**PSNR=20log10{(255X255)/(MSE)}Eq(5)**




Comparison of PSNR values

Fig7. Comparison of PSNR Values




. Comparison of SSIM values

Fig8. Comparison of SSIM Values

## IV. CONCLUSION

This method has achieved the improved imperceptibility and security watermarking. In this QR imaging process and get excellent performances. In the first method watermark was embedded in the diagonal element. On the other hand embedding text messages in the QR image. So, the dual process given two authentication details. The logo is located very safely in the QR code image. This method is convenient, feasible and practically used for providing copyright protection. Experimental results show that our method can achieve acceptable certain robustness to video processing.

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