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# Video Watermarking by using the Wavelet Transform with Perform SVD Technique

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## ABSTRACT

Digital technology allows unauthorized reproduction of digital videos, the protection of the copyrights of digital video is a very important issue. Video watermarking schemes are used to protect the digital videos. It is the process of embedding an imperceptible data (watermark) into cover video. The video watermarking schemes have been widely used to solve the copyright protection problems of digital video related to illegal usage or distribution. To resolve the copyright protection problem, it proposes an effective, robust and imperceptible video watermarking scheme. The combination of Discrete Wavelet Transformation (DWT) and Singular Value Decomposition (SVD) of Blue channel is used to embed the watermark. The copy of the watermark is embedded into high frequency sub band coefficients which are very difficult to remove or destroy. The combination of DWT and SVD increases the security, robustness and imperceptibility of the scheme. The extracted watermark image will be matched with input logo image for authentication to access (play) the video

**Keywords:** Digital Video, Video Watermarking, DWT-SVD Process, Embedding Process, Robustness and Imperceptibility

## 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 whose traditional counterpart is not necessarily imperceptible.

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## 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.

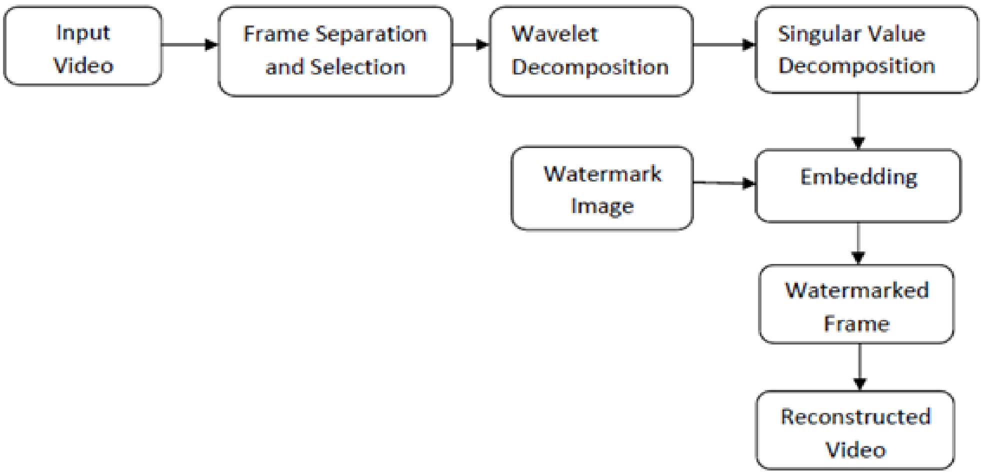


**Figure1.** *Block Diagram for Proposed System*

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.

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

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.

## VIDEO

Digital video refers to the capturing, manipulation, and storage of moving images that can be displaced on computer screens. This requires that the moving images be digitally handled by the computer. The word digital refers to a system based on discontinuous events, as opposed to analog, a continuous event. Computers are digital systems; they do not process images the way the human eye does.  Stands for Audio Video Interlaced. It is one of the oldest formats. It was

Created by Microsoft to go with Windows 3.1 and it's "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 operations systems and other interface boards (Fisher & Schroeder).

**Figure2.** *Input Videos*

Frame processing is the first step in the background subtraction algorithm, the purpose of this step is to prepare the modified video frames by removing noise and unwanted object's in the frame in order to increase the amount of information gained from the frame and the sensitivity of the algorithm. Pre-processing is a process of collecting simple image processing tasks that change the raw input video info a format. This can be processed by subsequent steps.

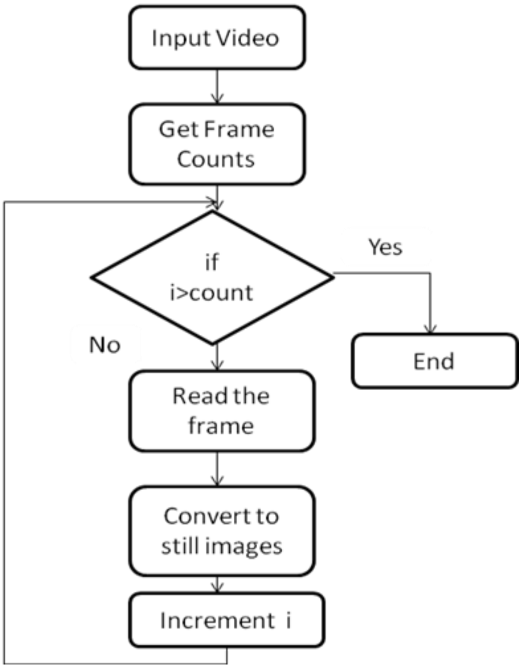


**Figure3**. *Frame Separation Process*

An Input Video **(.avi files)** is converted into still images for processing it and to detect the moving objects. These sequences of images gathered from video files by finding the information about it through **'aviinfo'** command. These frames are converted into images with help of the command **'frame2im'** Create the name to each images and this process will be continued for all the video frames.

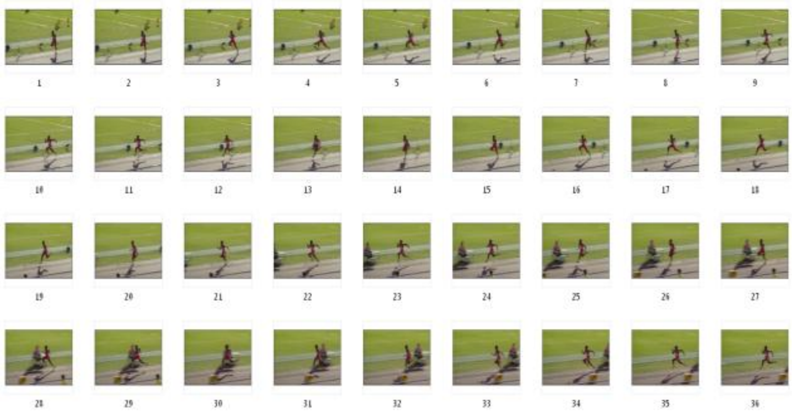

**Figure4.** *Frame Separations for Input Video*

## SINGLE FRAME

According to ADPS a picture is a foresaid as array of numbers that represents lightweight intensities at pixels, which ends in information. Image consists of eight bits per picture element i.e.256 colors. Frame could be a image that has been created or derived and keep in electronic sort of Image Format. A picture is delineate in terms of vector graphics or formation graphics. a picture keep in formation type is typically known as a picture.

**Figure5.** *(a) RGB Plane Image (b) Single (Blue) Plane Image*

The colors square measure generated from 3 primary colours as red, inexperienced and blue (RGB) [28][11-13]. varied approaches has been designed for image steganography a number of common approaches square measure LSB(Least important Bit) substitution that is that the straightforward and commonest approach of concealment information within pictures. Masking is another technique of embedding messages in important areas. The DWT supported image transformation involves the mathematical relation for concealment information within the pictures.

## DISCRETE WAVELET TRANSFORM

These functions contain the direct and inverse lifting riffle remodel (LWT) M-files for each 1-D and 2-D signals. LWT reduces to the poly part version of the DWT algorithmic rule with zero-padding extension mode and while not extra-coefficients. Coming up with new riffles that square measure similar temperament for the distinct wavelet remodel (DWT) is additional delicate and, till recently, was completely a subject for riffle specialists. The 1-D DWT is extended to 2-D remodel exploitation divisible riffle filters. With divisible filters, applying a 1-D remodel to any or all the rows of the input and so continuation on all of the columns will cypher the 2-D remodel. Once one-level 2-D DWT is applied to a picture, four remodel constant sets square measure created.

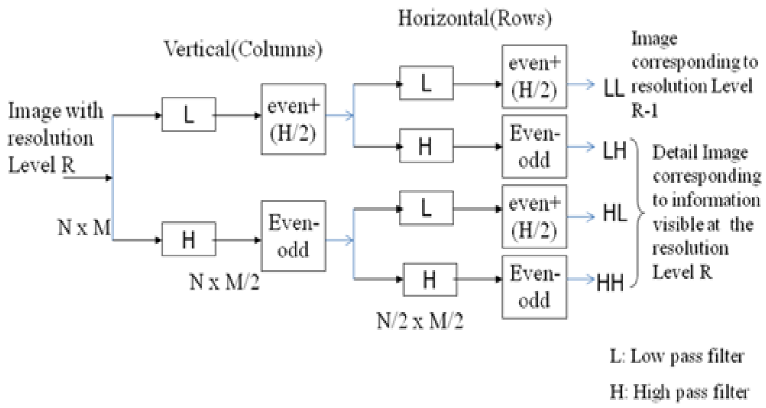


**Figure6**. *Wavelet Decomposition Process*

An image that undergoes Haar riffle remodel are divided into four bands at every of the remodel level. The primary band represents the input image filtered with an occasional pass filter and compressed to 0.5. This band is additionally known as 'approximation'. the opposite 3 bands square measure known as 'details' wherever the high pass filter is applied. These bands contain directional characteristics. The dimensions of every of the bands is additionally compressed to 0.5.

Specifically, the second band contains vertical characteristics, the third band shows characteristics within the horizontal direction and also the last band represents diagonal characteristics of the input image.Conceptually, Haar riffle is extremely straightforward as a result of it's created from a sq. wave. Moreover, the Haar riffle computation is quick since it solely contains 2 coefficients and it doesn't would like a short lived array for multi-level transformation. Thus, every picture element in a picture that may undergo the riffle remodel computation are used just one occasion and no picture element overlapping throughout the computation.

## HAAR WAVELET PROCESS

The first DWT was fictitious by Hungarian man of science Alfred Haar. For Associate in Nursing input drawn by an inventory of numbers, the Haar riffle remodel could also be thought-about to combine up input values, storing the distinction and spending the add. This method is perennial recursively, pairing up the sums to supply succeeding scale, that results in variations and a final add. The Haar riffle is additionally the only potential riffle. The technical advantage of the Haar riffle is of signals with fast transitions, like watching of tool failure in machines.

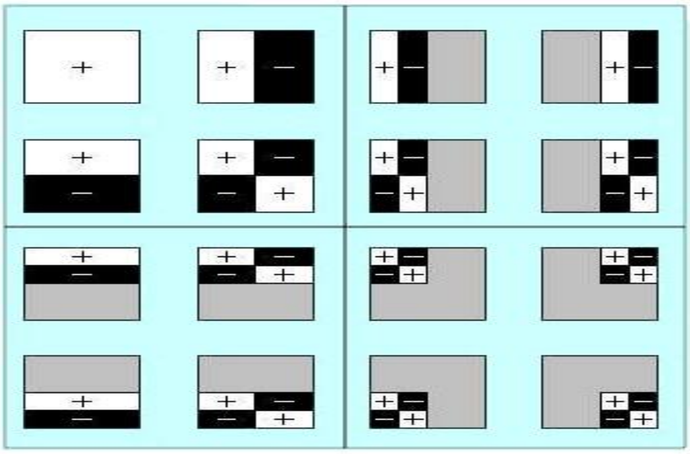

**Figure7.** *Sub band Representation in Haar wavelet Transform*

The Haar wavelet's mother wavelet function $\psi(t)$ can be described as

$$\psi(t) = \begin{cases} 1 & 0 \le t < \frac{1}{2}, \\ -1 & \frac{1}{2} \le t < 1, \\ 0 & \text{otherwise.} \end{cases}$$

Its scaling function $\phi(t)$ can be described as

$$\phi(t) = \begin{cases} 1 & 0 \le t < 1, \\ 0 & \text{otherwise.} \end{cases}$$

**Figure8**. *Sub band image for Haar Wavelet Transform*

## SVD PROCESS

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'**

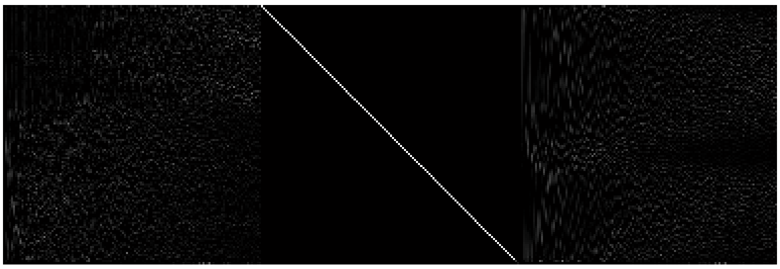

**Figure9.** *SVD Process*

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**

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

## EMBEDDING PROCESS

The secret image will be decomposed into singular and two orthogonal matrixes. These values are concealing into singular values of high frequency sub bands by modifying it through key value. The key should be selected as least value to reduce the embedding error. The singular value of sub band will be modified by,

**Ms = Cs + (Ws * K)**

Where, Cs – Singular value of cover image sub bands

Ws – Singular value of Watermark Image

Ms – Modified Singular matrix

K – Least Key Value.

## WATERMARK EXTRACTION PROCESS

The recognition will be included for accessing the video by person who is having same logo which is already embedded. Before recognition, the watermark image will be extracted from corresponding frame of particular video.

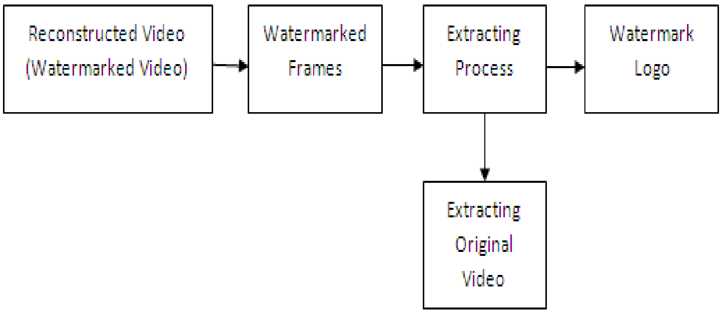


**Figure10.** *Block Diagram for Extraction Process*

The extracted logo will be matched with query image to check authentication by extracting the statistical features. The features are extracted and its matched with query features by Euclidean distance. If the query image will be matched then corresponding video is accessible otherwise is not opened.

## RESULT ANALYSIS

### Image Quality

Although there are several metrics that tend to be indicative of image quality, each of them has situations in which it fails to coincide with an observer's opinion. However, since running human trials is generally prohibitively expensive, a number of metrics are often computed to help judge image quality; the metrics that see the widest usage are generally quite simple to compute. And once a metric has been used in a seminal article that presents test results, , other researchers will continue using that metric so that their data can be compared to the previous work. This last reason was the determining factor in the use of peak signal-to-noise ratio (PSNR).

### Mean Square Error

Two other quantities that appear frequently when comparing original and reconstructed or approximated data are (root) mean square error. These measures will not be seriously skewed by a single anomaly, since they are measuring average behaviour. RMSE produces the same units as the original image data, so its results are easy to interpret. Again it should be remembered that these metrics attempt to measure an inverse to image quality.

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

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.

### Peak Signal Noise Ratio

Peak signal-to-noise ratio has two definitions, the original more precise definition, and the second easier to compute and more commonly used. It is this second definition that we use throughout this report. This is the first metric mentioned so far where the results generally run proportional to image quality rather than the inverse.

$$\mathbf{PSNR = 10\ log_{10}} \left( \frac{255^2}{MSE} \right)$$

Generally when PSNR is 20 dB or greater, then the original and the reconstructed images are virtually in-distinguishable by human eyes.

## CONCLUSION

The Project presented an effective, robust and imperceptible video watermarking scheme for logo matching based on chaotic crypto system with SVD based data concealment. Here, discrete wavelet transform was used to reserve space for concealing data effectively and chaos encryption was used as to protect image contents. Watermark recognition is used to recognize the input water mark for verification to access the video. This system was generated the Watermark image with less error under maximum data hiding capacity. Finally, the performance of system was evaluated with quality metrics such as error and PSNR factor. It is widely used for copy right protection of image or videos during internet sharing. It was better compatible approach and flexibility with better efficiency rather than prior methods.

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