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BLIND ROBUST DIGITAL VIDEO WATERMARKING SCHEME USING HYBRID BASED APPROACH

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Abstract: With the rapid development of Computer Network and Multimedia Technology, dissemination of information in the forms of audio, video and still image has become widespread. The piracy and copyright is a major issue when information is transmitted over Networks. So to prevent the problem of piracy Video Watermarking techniques introduced. There are various watermarking schemes available but quality of watermarking scheme is depending on the robustness factor. In this paper, we introduce the Robust Digital Video Watermarking techniques Based on hybrid approach which give better result against various attacks that performed on watermarked video thereby improve NC and PSNR values.

Keywords: GA, DWT, PCA, SVD, PSNR, NC



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INTRODUCTION

This World Wide Web, Peer-to-Peer Networks and digital versatile disk (DVD) make it easy to exchange information in digital form. The accuracy and speed of digital processing play an important role in the digital invasion. Now users can subscribe in a program such as pay-per-view, video-on demand. Digital media can be stored, processed and distributed easily but the disadvantage of digital media is that it can't protect copyrights. It means that attackers can make perfect copies of digital media and modify it in order to forge copyright information. Video watermarking means embedding a special pattern that identifies the author or creator of the video. The watermark should exist in each frame so that it must be possible to detect a watermark in a single frame extracted from the video.

The basic components involved in robust watermarking are *watermark embedding*, *attack*, and *watermark detection*. In watermark embedding, a watermark signal (Text, image or audio etc) is constructed and then embedded into an original signal (Video in context with this paper) to produce the watermarked signal. Once embedding is done, the watermarked video can be subjected to various attacks. During watermark detection, the watermark detector is given a test signal that may be watermarked, attacked or not. The watermark detector reports whether the watermark is present or not on examining the signal at its input. The Fig.1 shows watermark embedding in which video is taken as an input and watermark W is embedded in that video using the watermarking algorithm.

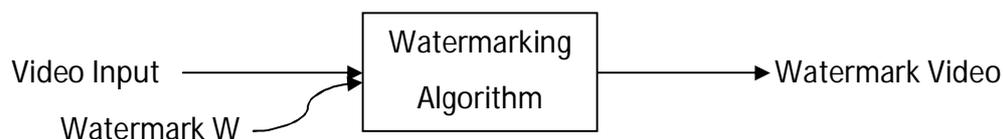


Fig.1 Watermark Embedding

A. Video Watermarking Application

Digital video watermarking has huge application

- Copyright Protection
- Source tracking

- Broadcast Monitoring
- Fingerprinting
- Video Authentication.
- Tamper proofing
- Content authentication
- Media digital rights management (DRM) in content supply chain
- Security

B. Video Watermarking Attack

The attacks on video watermarking are frame dropping, frame averaging, statistical analysis, lossy compression, cropping, Median Filter, Adding Noise such Gaussian noise.

C. Properties of Digital Video Watermark

For digital watermarking of video, the different characteristics of the watermarking are given below.

- Invisibility: The digital watermark that we embed should be invisible to the human eyes. So that attacker does not aware the presence of watermark.
- Robustness: robustness refers to the Attack that should be performing on watermarked video and analyze how it shows the resistant to various type of attack. A video watermark is highly robust then it can say that it having more resistant power. High robustness preserves the quality of video.
- Perceptible: A digital watermark is called perceptible if the presence of that mark is noticeable. Achieving the Imperceptibility is great task for researcher.
- Capacity: capacity refers to the length of the embedded message into digital video.
- Fidelity: It is the similarity at the point at which the watermarked content is provided to the customer that count weather video given to the customer is degraded or not. A watermark is said to be high fidelity if degradation it causes is very difficult for a viewer to see.

- Computational Cost: it refers to the cost or time required for embedding and extracting the watermark from the digital video. For better working digital video watermarking scheme computational cost should be minimized.
- Interoperability: it refers, the watermark should remain in video even the compression and decompression operations are performed on that video.
- Blind/informed detection: in the Informed watermarking schemes the detector requires access to the original video. In Blind watermarking Detectors do not require any original information.
- False positive rate: A false positive refers detection of watermark information from a digital media such as video, image that does not actually contain that watermark.

Proposed Work

The proposed methodology is aimed to develop a decision support system which identify that Digital watermarking is important one in the field of Piracy protection and from the work of many researchers various methods for video watermarking was proposed. But all this method cannot shows the high robustness against several possible attacks. And also there is a need to improve the Peak signal to noise ratio (PSNR) and Normalized Correlation value. The proposed schemes use to combine several existing algorithms and build a Hybrid approach for Digital video watermarking. The Proposed scheme shows high robustness against several attacks such as JPEG coding, Gaussian noise addition, Histogram equalization, frame cropping, and frame averaging and contrast adjustment. Also In the proposed scheme, there is chance to improve in PSNR and NC values. For the watermark detection no original video is required. Using this perceptually invisible robust watermarking achieved.

PSNR: The Peak-Signal-To-Noise Ratio is used to deviation of the watermarked and attacked frames from the original video frames and is defined as:

$$PSNR = 10\log_{10}\left(\frac{255}{MSE}\right) \quad (1)$$

Where, MSE represent Mean Square Error.

The proposed decision support system contain following steps as

- Discrete Wavelet Transform
- Principal Component Analysis
- Singular Values Decomposition

- Genetic Algorithm

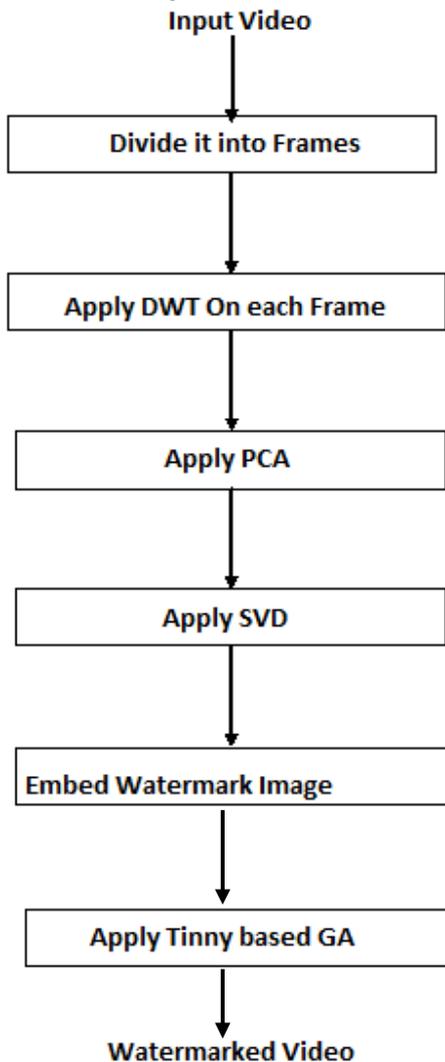


Fig. 2 Proposed Decision Support System

A. Discrete Wavelet Transform

Discrete wavelet transform (DWT) is a tool for continuously decomposing an image. DWT is the multi-resolution description of an image. The DWT splits the signal into high and low frequency parts. The high frequency part contains information about the edge components, while the low frequency part is split again into high and low frequency parts. As the human eyes are less sensitive to the changes in the edges the high frequency components are used for watermarking. There is various level of decomposition, after the first level of decomposition,

there are sub-bands: LL1, LH1, HL1, and HH1. For each successive level of decomposition, the LL sub band of the previous level is used as the input. To perform second level decomposition, the DWT is applied to LL1 band which decomposes the LL1 band into the four sub bands LL2, LH2, HL2, and HH2. To perform third level decomposition, the DWT is applied to LL2 band which decompose this band into the four sub-bands if we increase the level of decomposition for embedding the watermark then proposed video watermarking scheme made much robust.

In the proposed method, first the host video is divided into video shots. Then from each video shot one video frame called identical frame is selected for watermark embedding. Each identical frame is decomposed using DWT, and then select the higher sub band coefficients to embed the watermark and the watermark are adaptively embedded to these coefficients and thus guarantee the perceptual invisibility of the watermark. For watermark detection, the correlation between the watermark signal and the watermarked video is compared with a threshold value obtained from embedded watermark signal. [14].

B. Principal Component Analysis

Principal Component Analysis (PCA) is a process or method which uses an orthogonal transformation procedure to change a set of observations of possible correlated variables into a set of values of uncorrelated variables which we called as principal components. PCA highlights the similarities and dissimilarities of the data. Since patterns in data are difficult to find in data of high dimension, graphical representation is not available, PCA is a powerful tool for examining data. It plots the data into a new coordinate system where the data with maximum covariance are plotted together and is known as the first principal component.

The purpose of embedding the watermark in the video frame while the PCA based watermarking scheme allowed to select the appropriate area of PCA coefficients for embedding and we could analyzed that it is always possible to watermark a color video file without affecting its perceptual quality [16].

C. Singular Value Decomposition

Singular Value Decomposition (SVD) is mathematical technique for diagonal matrices in that the transformed domain consists of basis states that are optimal. The singular value decomposition of a complex matrix X is given by (2)

$$X = U \Sigma V^t \quad (2)$$

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^t is an $n \times n$ real or complex unitary

matrix. The diagonal entries of Σ are called the singular values of A and are assumed to be arranged in decreasing order the columns of the U matrix are called the left singular vectors while the columns of the V^t matrix are called the right singular vectors of A . Singular value of the matrix shows the luminance of a video frame layer while the corresponding pair of singular vectors specifies the geometry of the video frame layer. In the SVD-based watermarking, an video frame is treated as a matrix, which further broke by SVD base method into the three matrices such as U , Σ and V^t . the small changes in the elements of matrix Σ does not affect visual perception of the quality of the cover video frame, SVD-based watermarking algorithms add the watermark information to the singular values of the diagonal matrix Σ in such a way to meet the imperceptibility and robustness requirements of effective digital image watermarking algorithms.[15]

D. Genetic Algorithm

In the area of Soft Computing, Genetic algorithms play an important role in an optimization technique. In this we use this technique to optimize the performance of our proposed scheme. GA is inspired by Darwin's theory that is Survival of the Fittest. For solving the problem as a GA problem, the fitness function, and GA operators should defined. In GA-based optimizations, there is a population from this we have to select things of our use then perform the crossover on it and then calculate the fitness by using fitness function. Fitness of the thing is defined as success of the thing in their entire life cycle. The main aim is too defined as an objective function that indicates the fitness of any possible solution. In the life cycle of GA-based optimization processes, there is three GA operators known as reproduction, crossover, and mutation, are applied to the chromosomes repeatedly which is a finite-length string. And by this way find the fittest chromosomes. Fig. 3 shows the. GA based optimization process.

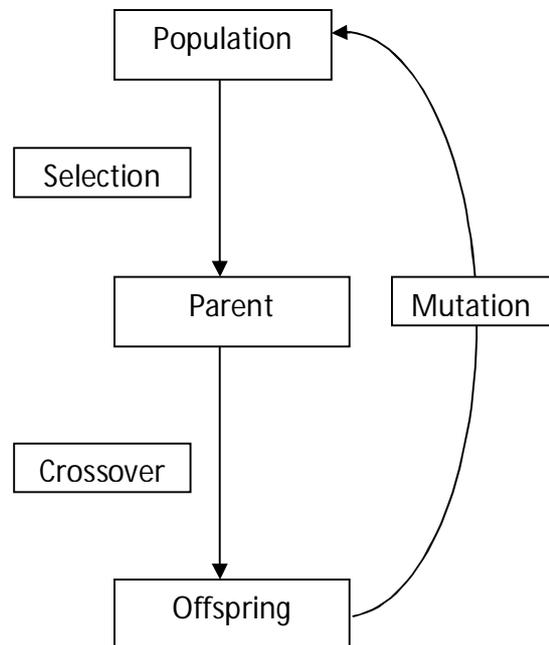


Fig. 3 GA based Optimization Process

Reproduction is a method in that chromosomes are copied according to their fitness values. The Chromosomes which is having higher fitness values have strong probability to contribute much offspring in the next generation. The objective function decides the probability of the chromosomes' survival or removal during the competition. Crossover is the method in that pair of chromosomes replaces portions of their genes to form fresh chromosomes.

CONCLUSIONS

In this paper, we proposed a decision support system which identifies Digital watermarking is important one in the field of Piracy. Various methods for video watermarking were used different algorithms. All these method has its own impact factor. In this we use the concept of Genetic Algorithm and combine it with all existing algorithms for getting a new hybrid approach of Video Watermarking which may having high PSNR, NC value and shows robustness against various types of attacks. In the future, we will going to deals with result calculation and improve the result parameter.

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