

Digital Water Marking and its Application in Various Media Types

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Abstract: In the wake of increasing copyright misuses, several new technologies are developed to preserve the authentication of information. Digital water marking is one of them. It is a technique that allows us to add hidden copyright notices, verification messages or any other useful information to the original signal. The hidden message can be a group of bits that describe something about the signal or about the genuine author of the signal. The description can be about the name, place or something related to this. Much of the research work has been done in the field of digital watermarking in the recent period of time. In this paper, a brief description about various digital water marking techniques for different media types is given. Watermark insertion and watermark decoding is described as well. The watermarking techniques described for various media types include audio water marking, video water marking, image water marking and text water marking. Some of the properties and applications are also discussed.

Keywords: Audio Watermarking, Video Watermarking, Image Watermarking, Text Watermarking.

BIOMETRICS

To begin with, the meaning of “watermark” (on a paper) is a mark that is not perceptible to the naked eye in ordinary circumstances but is visible when focused through a special light. A digital water marked signal is also difficult to differentiate from the original signal normal circumstances. In fact, there should be no detectable difference between the original signal and watermarked signal. The desire to communicate secretly is a human trait that dates back to the earliest times. This led to the invention of steganography at first and encryption later on. Before the origin of watermarking technique, there were two technique called “steganography” and “encryption”. Steganography takes its origin from the old Greek language that means ‘cover writing’. It is nothing but, a way of transmitting hidden messages between two persons. Encryption is used to provide communication privacy and deny access to unauthorized persons from damaging the content. The usage of the watermark does not limit the usage of the original file in any way.

WATERMARKING FOR VARIOUS MEDIA TYPES TECHNIQUES

Digital Audio Watermarking

Here in, the watermark i.e. the digital audio watermark consists of the information pertaining not only to the creator of the audio information that could be any one of several forms of song, music etc., but also to the authenticated user of the audio information. This allows that particular information to be used by only the authorized user and no one else. The watermark can also be used for secondary applications other than authentication. E.g. providing information about the song, album, style of tunes, etc. This watermark is useful in voice conferencing halls to indicate the person who is speaking at the moment. This application can be extended to videoconferences as well. The method of inserting watermark consists of concealing the watermark in the low frequency components of the message signal (audio signal), so that the insertion of watermark is not noticeable by the human ear. At first, the audio signal to be processed is partitioned into some frames, allotting a finite time interval to each frame. Following this, analysis is done to calculate the spectral components, which is accomplished using FFT, more often than not. This process also allows us to find out the power contained in each frame, which is useful in the later

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parts of the method. From the above calculations, the low frequency components are removed from the signal. Now, the watermark is placed in the low frequency region, where the low frequency components are removed earlier on. This finishes the process of inserting the watermark in the audio file. Now that the process of insertion is accomplished, the user has to extract the watermark and get it verified with his license to access the information in the audio file. The process of extraction of watermark is similar to the process of inserting the watermark as well.

Digital Video Watermarking

A watermark inserted in a video signal can be used for DVD copy protection. First of all, the watermark Analysis for spectral comp. partitioning into frames Elimination of low frequency comp. componenco Insertion of watermark partitioning into frames Analysis using FFT Carrier Processing should satisfy the requirements of strength and imperceptibility. Besides this, it can be bestowed on to convey the information to restrict copying in many ways such as copy never i.e. the DVD is copy protected, copy no more i.e. it is possible to copy a finite number of times, copy liberally i.e. it can be copied any number of times, copy only once. The design depends upon the content in the DVD. A general process of digital video watermarking consists of inserting a group of bits along with the video frame to be transmitted. The process of insertion of watermark is through a 'hidden key' that is known to the transmitting person and the receiving person as well. Actual video signal watermarked signal to be transmitted Watermark hidden key.

Image Watermarking

For watermarking a still image, the watermark is directly inserted on to the picture information itself such as colour, brightness, and luminescence etc. the watermark may be inserted directly on to the pixels, which are either in the spatial domain or in the transform domain. Earliest form of spatial domain techniques consists of inserting a finite number of sequences of bits into the least significant data of the host signal. This type of insertion provides for efficient visible insertion technique. Another advantage of using this technique is that the implementation requires very low cost.

Text Watermarking

Text watermarking is the process of inserting watermark into the text for preserving the creator's identity. This is especially applicable to such valuable texts such as poetry. An earlier form of watermarking the texts was accomplished by inserting spaces in specific parts of the text. The disadvantage associated with this form of watermarking was that it was quite easy to remove the watermark. Later on, watermarks were placed in the text that depends on linguistic properties like synonyms, sequence of words etc. minor modifications are made to characters, and such characters are used for watermarking. Text watermarking schemes are applicable to any type of texts from usual word documents to PDF files. At detection stage, the watermark is removed by processing which involves the correction for noise, and distortion introduced, if any (during the insertion process) as well.

WATERMARK INSERTION

Mid frequency components are chosen for embedding the watermark in a simple way, owing to the shortcomings with the low frequency components and high frequency components. The difficulty with the low frequency components is that they are highly susceptible to distortion. The high frequency components do not bear much of the information reliably, since their removal from the actual signal does not affect the signal's quality too much. The watermarking process is a process known to all, thus the safety of the signal completely depends up on the hidden key. This key 'C' determines the sequence of bits, which are to be embedded into the host signal. The key acts in such a way that, it would be difficult (almost impossible) to recover the original signal without knowing the confidential key 'C'. There are simple additive watermarking methods, which can be represented using simple mathematical equation:

$$F' = H + P$$

Where F' is the watermarked signal, 'H' is the host signal. The new signal 'P' is nothing but the signal originating from the hidden key 'C' and the original watermark 'F'.

WATERMARK DECODING

'Detection' and 'identification' are not the same. The method of deciding about whether a signal received contains a watermark or not is 'detection'. But, identification is the actual process of decoding the unique watermark from a finite number of possible choices. Two kinds of errors could occur at the detection. The first one is detection of a watermark in the received signal when it really does not exist.

The second one is quite opposite to this. Herein, the watermark, which inherently exists in the received data, is not detected.

APPLICATIONS

Some of the additional applications of digital watermarking are broadcast monitoring, usage of contractual watermarks for special purposes, secret communication and copy control. Broadcast monitoring: Watermarks are used in broadcast monitoring by inserting watermarks in the message that is to be transmitted. Many watermarks do not actually prevent the copying of content into which they are embedded, but serve as identification marks of the genuine owner of it. But using certain mechanisms that detect the watermarks and inhibit the copying of the information, it is possible to preserve the integrity of the information.

PROPERTIES

Some of the properties of the watermarking techniques are strength, fidelity, cost involved, and the tamper resistance. Strength: Strength is an important parameter because it decides the capacity of the watermarked signal to withstand the wide range of attacks. Especially, the image and video signals need to tolerate the attacks including the geometric ones. Besides, it should be able to endure ordinary attacks like A to D conversion and lossy conformations. More often than not, a watermarked signal is expected to endure common processing transformations only during the time interval between the insertion and decoding of the signal. The toughness of the signal is not limited to any one constraint, but it can be extended to many others. It means, a signal, which is capable of withstanding an attack, may not be able to tolerate another. Consequently, the signal is made to withstand attacks, which may differ from one application to another.

CONCLUSION

Digital watermarking is an outstanding technology that can serve a wide range of applications in various media types. But, the employment of schemes depends upon the requirements that may vary widely. A sound knowledge of communication techniques and signal processing methods is essential for efficient development of watermarking techniques. Besides this, the attacks that the signal is expected to endure the assessment of the amount of distortion that the signal suffered which in turn determine the efficacy of the system and the effective cost involved need to be taken into consideration while designing watermarking technique for a particular application. Thus the standards for all the applications don't remain alike.

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