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Survey On Audio Water Marking Techniques

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ABSTRACT: Watermarking is a technique, which is used in protecting digital information like image, video and audio as it provides copyrights and ownership Audio watermarking is more difficult than image watermarking than image watermarking due to the dynamic supremacy of hearing capacity over the visual field. Digital watermarking is a technique by which copyright information is embedded into the host signal in a way that the embedded information is imperceptible, and robust .Audio water marking is possible for multimedia content production system. In this paper we are going to study about different types of watermarking methods based on different domain.

I.INTRODUCTION:

Before the invention of steganography and cryptography, it had been difficult to transfer secure data and, thus, to realize secure communication surroundings. a number of the techniques used in time period are writing with Associate in Nursing invisible ink, drawing a regular painting with some tiny modifications, combining two images to form a new image. A digital watermark could be a visible or absolutely invisible, identification code that\'s permanently embedded in the data and remains present inside the information once any decryption method. The digital watermark is then introduced to solve this drawback. Covering several subjects like signal processing, communications and encoding, the research in digital watermark is to produce copyright protection to digital product, and to stop and track illegal copying and transmission of them. Watermarking for audio signal has greater importance because the music industry is one of the leading businesses in the world. Now the digital watermarking technologies are divided into 2 sorts. By the embedding position special domain and transform domain watermark. spatial domain techniques developed earlier and is less complicated to implement, but is limited in strength, whereas transform domain techniques, which infix watermark within the host's rework domain, is more subtle and sturdy.

II.REQUIREMENTS OF THE EFFICIENT WATERMARK TECHNIQUE:

According to IFPI(International Federation of the Phonographic Industry), audio watermarking algorithms ought to meet sure necessities. The foremost vital necessities are

A. Capacity:
Watermarking capacity normally depend on the amount of data that can be embedded into a host signal. Generally sound signal, capacity requirement always depend on, two other important needs, are imperceptibility and hardiness. Higher capacity is usually obtained at the expense of either hardiness or imperceptibility.

B. Imperceptibility:
Most importantly, the watermark signal should be imperceptible to the end user who is listening to or viewing the host signal. This means that the perceived \quality" of the host signal should not be distorted by the presence of the watermark. A typical user should not be able to differentiate between watermarked and UN watermarked signals. In the importance of incorporating perceptual modelling techniques into watermarking systems is further discussed. There is a reason why it's necessary to make sure that the watermark signal is in cognizable. 1st of all, the presence or absence of a watermark should not subtract from the first purpose of the host signal, that of transfer high-quality audio or visual data. Additionally, perceptible distortion might indicate the presence of a watermark, and maybe its precise location within a host signal. This data information is also used by a malicious party to distort, replace, or take away the watermark information.

C. Asymmetry:
If for the complete set of cover objects the watermark remains same; then, extracting for one file can cause harm watermark of all the files. Thus, imbalance is also an understandable concern. It's suggested to possess distinctive watermarks to completely different files to help build the technique more helpful.

D. Robustness:
Another vital demand is that watermark signals should be moderately resilient to common signal processing operations. Once a variety of host signal is encoded with watermark information, distortions could be applied to the signal before, during, and when distribution across the web. These distortions could be designed to boost the quality of the host signal or compress it before transmission, and they could or could not significantly disrupt the host signal.

E. Speed:
Speed of embedding is one amongst the factors for efficient watermarking technique. The speed of embedding of watermark is very important in real time applications wherever the embedding is completed on continuous signals like, speech of a politician or language between pilot and communication system workers. a number of the attainable applications wherever speed may be a constraint are audio streaming and airline traffic observation. Each embedding and extraction method ought to be created as quick as attainable with greater efficiency.

III.Audio Water Marking Technique:

Based on domain transformation water marking is divided in to two types they are,

- **Spatial domain**
- **Frequency domain**

A. SPATIAL DOMAIN:

Time domain method (spatial domain) watermarked data is embedded without any transformation and it can be easily destroyed. The water marked system should maintain the audibility of the original host signal. The robustness of the time domain algorithm is poor. Hence most of the research work is focused on transform based watermarking techniques. Because the audio signal sampling frequency is low, and the human auditory system (HAS) is more sensitive than the human visual system (HVS), so the amount of information to be embedded in the audio signal is much less than in the visual media.

The discrete cosines transform:

The DCT, introduced in [8], produces real-valued coefficients that do not suffer from the symmetry constraints of the DFT. It is commonly used for audios, images, and videos compression as the heart of transform-based coders. The DCT is also computed from the DFT, thus quick algorithms like the FFT is also wont to work out it.

The Discrete Fourier Transform:

The DFT generally produces complex-valued frequency domain coefficients. For a real-valued input x (n), its DFT possesses certain symmetry constraints [10]that must be maintained in order to obtain a real-valued inverse transform. Fast algorithms exist for computing the DFT, such as the Fast Fourier Transform (FFT). The forward and inverse Discrete Fourier Transform of a signal N samples in length may be written by the following transform pair:

$$X(k) = \frac{1}{N}\sum_{n=0}^{N-1} x(n)e^{-j2\pi\frac{nk}{N}}$$

$$x(n) = \sum_{k=0}^{N-1} X(k)e^{j2\pi\frac{nk}{N}}$$

B. FREQUENCY DOMAIN:

Transform domain (frequency domain) technique the audio water marking take the advantage of frequency masking property of Human auditory system (HAS). Transforming the audio signal in to frequency domain enables water marking system to hide the watermark data into significant component of an audio signal. It gives high robustness against signal processing operations. This technique includes the methods of discrete cosine transform(DCT), discrete Fourier transform(DFT), discrete wavelet transform(DWT). Each transform has mention above has own characteristics and represent in different ways .Audio signal is transform from time domain to frequency domain to develop high robustness in water marked audio signal.

PHASE CODING:

The phase coding algorithm embeds data into an audio signal by taking advantage of the human auditory system (HAS) response to phase information. In an important work on the topic, Oppenheim and Lim discussed the importance of phase information in audio and image signals [2]. They note that for most audio signals, particularly speech, the short-term phase of the signal, arising from the Short-Time Fourier Transform (STFT) over a small time interval, is less important than the long-term phase over the course of the entire signal. The authors suggest that long-term phase information, containing sharp edges , contributes more to the intelligibility of an audio signal than the magnitude response. Another way of approaching the HAS sensitivity to phase is to consider the superposition of two sinusoidal signals that are out of phase by a constant factor:

$$x(t) = \cos(2\pi f t) + \cos(2\pi f t + \phi_0)$$

The human auditory system is not able to discern the phase difference between the two signals. However, if the phase difference is allowed to vary with time, according to

$$x(t) = \cos(2\pi f t) + \cos[2\pi f t + \phi_0 + \phi(t)]$$

LSB CODING:

This technique is one amongst the common techniques used in signal process applications. it's supported the substitution of the LSB of the carrier signal with the bit pattern from the watermark noise. The strength depends on the amount of bits that square measure being replaced in the host signal. this kind of technique is often employed in image watermarking as a result of, every pel is painted as AN number therefore it can be simple to replace the bits. The audio signal has real values as samples, if regenerate to AN number can degrade the standard of the signal to a good extent. The operation of the 2-bit LSB secret writing is shown in Figure1

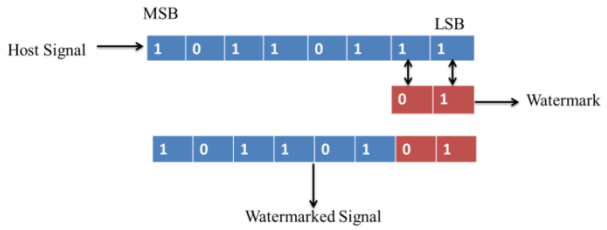

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Figure1.

SUB BAND CODING:

Akira Nishimura et al. [9] have presented a sub band coding amplitude modulation based audio watermarking approach. This approach shows strong robustness against perceptual audio coding & reverberation but this technique is very sensitive to pitch modification. Watermark embedding & extraction process enhances the security of the watermark data using a secret key.Most of existing audio watermarking techniques have low embedding capacity.

SPREAD SPECTRUM SCHEME:

In spread spectrum scheme presented by D. Kirvoski&Malvar [5][7], each watermark bit is spread over a number of MCLT frequency coefficients. This approach

shows strong robustness against additive noise this method requires original audio signal to extract the watermark. Difference between (spatial) abstraction domain and frequency domain is shown below.

	Spatial Domain	Frequency Domain
Computation Cost	Low	High
Robustness	Fragile	More Robust
Perceptual Quality	High Control	Low Control
Capacity	High (depend on the size of the image)	Low
Example of Applications	Mainly Authentication	Copy Rights

IV. Families Of Watermark Attacks:

Main water mark attack families we are concerned with:

- lossy compression,
- filter-linear, non-linear and adaptive filtering,
- de noising
- multiple watermarks, noise addition
- collage, superimposition
- stochastic attacks

V. APPLICATIONS OF WATERMARKING:

1) Ownership protection
2) Authentication
3) Finger printing
4) Broadcast monitoring
5) Copy control and access control
6) Information carrier
7) Medical applications
8) Airline traffic monitoring

VI. CONCLUSION:

The audio watermarking is new technique and has wide scope for research. The audio watermarking technique will be enforced on live signals instead of a set signal as thought-about in it. Some of the real time audio signals include speech, live music recording sound signal and conversation of pilot with ground controllers. Further research can be carried on embedding watermark in video sequences i.e. movies or surveillance. Applying watermarking technique on the surveillance system will decrease the security issues by keeping track of the voice communication. The research can be extended by developing watermarking technique using neural networks.

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