ISSN: **3139-5503** | Volume-1 Issue-3 | July-August 2026 | **ADSJ-1303**
DOI: https://doi.org/10.5281/zenodo.22637750

AUDIO DATA HIDING USING DOUBLE-DENSITY DUAL-TREE DISCRETE WAVELET TRANSFORM

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ABSTRACT: The essay's organization illustrates that we initiate the construction of a binary tree structure discrete wavelet transform (DWT) with double thickness. Wavelets with optimal variable commitments and analytical properties are generated by enhancing the obtained channels through nonlinear refinement. We provide two configurations that surpass those identified by a prior technique. The veiled watermark demonstrates filtering, altering, validating, re-quantizing, augmenting signal noise, and compressing Mp3 files. Our technique surpasses previously documented watermarking strategies in job execution, as evidenced by the correlation analysis.

keywords:*MP3 Audiowatermarking,DD-DWT.*

1.INTRODUCTION

Safeguarding information from unauthorized access, disclosure, modification, or destruction, including hacking, is vital. Confidentiality and verification are essential when transmitting sensitive information to its designated recipient. The security of digital records must be ensured. A crucial method for safeguarding digital assets from copyright infringement is the implementation of a digital watermark. This step is crucial to prevent unauthorized duplicating of the audio file. This examination will mostly focus on audio files, despite extensive research on digital watermarking in other media formats, such as photographs and movies. Digital audio files are particularly susceptible to copyright infringement due to their ease of replication and downloadability. Watermarks, which are signals, are utilized in digital audio. A detection method is employed to discover and extract signals, which are subsequently decoded. These deceptive strategies exploit the reality of human auditory limitations. Among all the senses, the human ear possesses the highest acuity. This renders the development of efficient and effective audio watermarking systems exceedingly challenging. Nonetheless, the issue of copyright infringement now has a solution. A variety of watermarks have been employed. The authors proposed utilizing embedded data, which may include text, images, or information, to process and analyze audio recordings and potentially uncover concealed content. Conversely, several authors employ watermarks produced by pseudorandom number generators, and others utilize a hybrid of methods, including chaotic watermarks, to safeguard audio recordings. The implementation of copyright has thus far depended on a diverse array of methodologies. Nonetheless, there has been limited advancement in the creation of real-time applications. Therefore, it is essential to devise a strategy or method to avert the misuse of this endeavor. This necessitates a thorough assessment of the finished product to determine its suitability for the purpose of swiftly fulfilling this

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requirement. This paper seeks to improve the watermarking approach by proposing an audio-embedded method that effectively addresses the obstacles impeding its progress.

The incorporation of a concealed data signal into the original audio signal is referred to as "digital audio watermarking," which has been extensively examined in scholarly discourse as a method to safeguard digital assets from copyright violations. Digital audio watermarking signals must essentially be undetectable, robust, and possess sufficient data capacity. The characteristics of the watermark may vary based on the application; however, it must remain imperceptible in the original audio data to avoid signal distortions that could compromise the integrity of the host data and preserve audio quality. Fortunately, eliminating the watermark to establish ownership is effortless. Devising novel watermarking techniques to address these issues is a formidable challenge. Various advanced watermarking techniques have been proposed. A watermarking method with a restricted transmission bit rate is recommended, while not being entirely impervious to all forms of attacks. Employing watermarked techniques in the wavelet domain is proposed to enhance the bit rate. The method's ability to accurately represent all real signals is constrained by the predetermined basis functions. Diverse varieties of Dual Tree Wavelets (DWTs) can be developed employing the dual tree concept. The predominant focus of the current literature on digital content copyright protection has been digital audio watermarking. This method effectively resolves the issue by incorporating a watermark into the original audio stream.

2.EXISTING METHOD

Various watermarking techniques, differing in complexity, have been established. Despite restricted data transmission capacity, a robust watermarking technique is developed to effectively mitigate various types of attacks. To enhance bit rate, watermarked designs in the wavelet domain have been proposed. The wavelet approach becomes ineffective for all real signals above a specific threshold due to a degradation of its fundamental capabilities.

AUDIO WATER MARKING TECHNIQUES

This section examines five of the premier sound watermarking solutions presently accessible. All procedures resemble those employed to amalgamate the dispersed data and watermark pattern into a singular sign.

Spread spectrum water marking

Transmit audio data. The hidden scheme correlation method retrieves secret data by embedding a pseudorandom sequence into a watermarked audio stream and exploiting their interconnection. Spread spectrum watermarking is a technique for hypothetically retrieving information from broadcasts by employing a narrow-band signal to fill a wide-band audio channel. The model appears to function effectively, considering the characteristics of both the audio signal A and the watermark W. Spread spectrum approaches enhance the likelihood of safeguarding the confidentiality of concealed data by employing a secret logic key to regulate the pseudorandom sequence generator. Spread spectrum approaches facilitate the alignment of frequency bands prior to message encoding. Spread spectrum

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techniques can be employed to develop watermarking systems for secure communication. There are two primary categories of spread spectrum techniques: direct sequencing and frequency hopping. Both methodologies aim to disseminate watermark data throughout an extensive frequency range that encompasses nearly the entirety of the audible spectrum.

Amplitude modification

This approach may also be referred to as LSB substitution. This is frequently employed in steganography and watermarking due to its ability to exploit quantization errors occurring during audio digitization. The essential components of the audio data are extracted and encoded. To accomplish this, one may either embed the watermark message within the pseudorandom (PN) sequence that wholly substitutes the lower request bits of the digital audio signal or integrate the PN arrangement into the lower request bit stream utilizing a capacity that generates a sequence centered on both the nth bit of the watermark message and the nth sample of the audio file. The primary issue with this strategy is its susceptibility to manipulation. If the data is not encrypted with sufficiently complicated methods, it may become rendered ineffective owing to channel noise, reevaluation, or other complications. These tactics merely reduce the information rate by one, according to an individual's typical pursuit of perfection. Employing a pseudorandom number generator to randomly disseminate the message over the spread can enhance the watermark's resilience against limited separation.

Replica Method

Data can be obfuscated by employing the original audio signal. For instance, consider echo concealing as an example of this replication type. Replica modulation use either the original signal or a suitably modulated signal as a watermark, while it further utilizes a segment of the original audio stream to generate a frequency-domain watermark. It additionally computes the correlation. Detectors also possess the capability to produce duplicates of the watermarked audio.

Dither water marking

To improve the testing procedure for that input, particularly when it is essential and not in digital format (4), a dither is incorporated into the audio signal as a noise component. This solution eliminates bending permanently, although it incurs a larger disturbance threshold. Dithering is achieved by introducing a noise signal characterized by a specific probability distribution, such as a triangular or Gaussian distribution, to the audio data stream. The watermark is utilized solely to regulate the dither signal for its integration. A similar dither quantizer is employed to quantify the host signal, referred to as the distinct audio file. The process is referred to as quantization index modulation (QIM). This methodology is exemplified through a case paper. This situation involves two distinct quantizers, each possessing its own record, analyzed through the use of Xs and Os. Each quantizer assigns a distinct value. The quantization cells regulate the level of distortion in the audio files, as illustrated in the image. However, the dmin value may serve as a rudimentary indicator of intensity.

3.PROPOSED METHOD

Signal processing applications, such as noise reduction and over-complete transforms, provide a superior balance

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between complexity and efficiency compared to relying solely on sampled transforms. The double density (DD) discrete wavelet transformation (DWT), a crucial component of this wavelet transformation family, is illustrated in Figure 1 as a segment of a filter bank. The attenuation factor for the input audio stream is doubled across all three channels. The signal from the initial channel is evaluated using an analogous filter bank. The critically sampled DWT is half the cost of the DD-DWT. When an input audio signal meets specific criteria and undergoes two wavelet transforms, a dual tree (DT) is generated. A method to approximate the Hilbert transform involves the utilization of wavelets. The DT-DWT exhibits direction selectivity and near-shift invariance for large amplitudes.

Assuming we select two sets of filters as depicted in Figure 1, the first set will comprise filters H0(z), H1(z), and H2(z), whereas the second set will consist of filters K0(z), K1(z), and K2(z). Define ψh,i(t) and ψg,i(t) for i = 1 and i = 2.

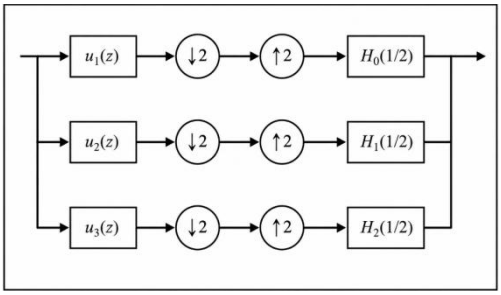

Fig.1 Filter bank used for the Implementation Of the DD-DWT.

This series of wavelets is generated by utilizing the filters H0(z), Hi(z), K0(z), and Ki(z). The two discrete and dyadic wavelet transformations (ψg,i(t) and ψh,i(t)) are termed a dual-tree if they exhibit the Hilbert transform property. At negative frequencies, the spectrum of the complex wavelet, i(t), •R, approaches zero due to its analytical complexity, represented as ψi(t) = ψh,i(t) + jψg,i(t).

The dual-tree DD-DWT architecture was improved using an allpass-based methodology. Approximately fifty percent of the input signal's duration is caused by the system as a delay. We employ an alternative methodology in this instance. The original DD-DWT is presented here with the renowned FIR filters H0(z), H1(z), and H2(z). The FIR filters K0(z), K1(z), and K2(z) — an exceptionally efficient dual filter bank – are derived using semi-definite programming (SDP) methodologies. The filters employed to approximate z^The infinity norms of z^(1/2)H2(z) and (1/2)H1(z) correspond to the Hilbert transformations of z^ and (-1/2)H0(z), respectively. Nonetheless, these filters do not entirely satisfy the P2 perfect reconstruction (PR) criteria essential for the DD filter banks.

$$\text{i=0, K i(z) Ki(z−1) = 2 P2}$$
$$\text{i=0, K i(z) Ki(−z−1) = 0}$$

The execution of the scenario necessitates the adjustment of the K0(z), K1(z), and K2(z) filters due to their effectiveness not being readily apparent. The DD-dual-tree DWT, or double-density complex DWT, effectively integrates the characteristics and advantages of the dual-tree discrete wavelet transform (DWT) with the double-density DWT. We ensure that (1) one set of wavelets is configured to approximate the Hilbert transforms of the other two sets, and (2) one set of wavelets is displaced relative to the other set such that the integer translations of one set are positioned midway between the integer translations of the other set, facilitating the collaboration of the DD and dual-tree DWTs. The DD complex wavelet transform facilitates the creation of intricate and customizable wavelet

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transforms.

To optimize the efficacy of the DD dual-tree DWT, it is essential to construct a filter bank model that integrates both the DD and dual-tree DWT characteristics. Following our previous examination of the filter bank mode of the double-density discrete wavelet transform (DWT), we shall now explore the characteristics of the dual-tree discrete wavelet transform (DWT). This mode includes a lowpass scaling filter alongside two highpass wavelet filters. Two discrete wavelet transforms (DWTs) sampled at the critical rate produce the dual-tree DWT. To do this, we construct a filter bank that executes many iterations simultaneously.

4.EXPERIMENTAL RESULTS

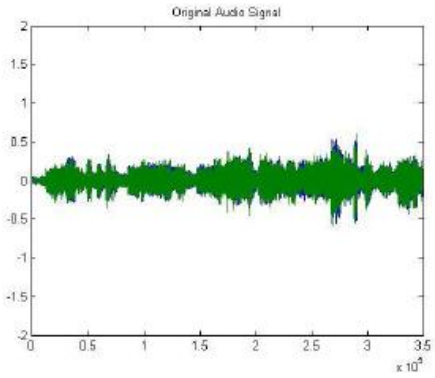

Fig.2 Original Audio Signal



Fig.3 Water mark Logo

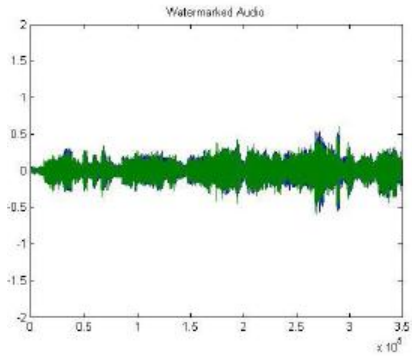

Fig.4 Audio Water marking

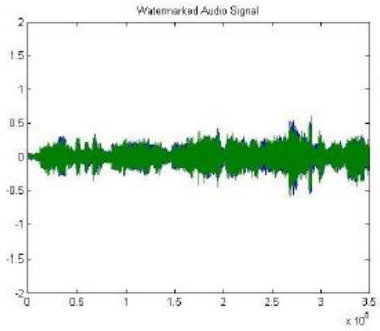

Fig.5 Audio Water marking signal



Fig. 6 Extracted Logo

5.CONCLUSION

Evidence indicates that digital audio watermarking techniques effectively safeguard the copyright of digital information. The volume of research on audio watermarking is significantly less than that on video or image watermarking. Audio watermarking has, nonetheless, undergone significantly more investigation and analysis in the past decade. Advancements in audio watermarking techniques have resulted from many contributions. This paper not only summarized numerous significant methods for digital audio watermarking but also examined the previously listed articles.

This inquiry yields two contributions. The provided examples demonstrated the approach's feasibility, and we incorporated the methodology required to calculate the second filter bank of a DD-DWT.

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