IJITKM 0973-4414 Volume-9, Number-2 Jan-Jun 2016 pp. 30-34 **Impact Factor 2.8** available online at www.csjournalss.com

Modulation Technique for Robust Watermarking using Data Hiding and Psycho Acoustic Frequency Masking

Sonu[1], Prof. (Dr.) Rajeev Yadav[2]
[1]Research Scholar in RPS College of Engineering & Technology, Balana, Mohindergarh
[2] Professor in RPS College of Engineering & Technology, Balana, Mohindergarh
barsiwal.sonu@gmail.com, yadavrajeev6@gmail.com

Abstract: Now, over the distributed networks, Digital Data can be shared by multiple users and it also managed by making replicas of data without any damage for a long time. As various replicas of data can be construct by the users at their places, the problem of copyright protection and illegal distribution. This paper defines the technique to protect the copyright information from unauthorized copying. Digital watermarking is a technique which protects the ownership of the contents. By digital audio watermarking we can cover the copyright information into an audio file. In this paper we use the Direct Sequence Spread Spectrum (DSSS) technique is used to embed watermarks which is a patchwork algorithm based robust audio watermarking technique. To compensate the unnecessary disturbance in audio files, audio watermarking techniques are improved with Frequency Masking (FM) technique.

Keywords: Watermark (WM), Frequency Masking (FM), Direct Sequence Spread Sequence (DSSS), Psycho Acoustic Frequency Masking (PAFM), Quantization Index Modulation (QIM), Human Auditory System (HAS), Human Visual System (HVS)

Introduction

Information hiding is unlike cryptography. Cryptography is a technique to encrypt the information so that the key holder can only access that information and once it decrypted the security is lost. But in information hiding the messages is embedded with the digital media which can be used normally and also can be distributed.

Information hiding can be categorized into two types of techniques: Watermarking and Steganography. Steganography‘s main purpose is to hide the fact of communication. Watermarking (WM) is a particular embodiment of multimedia security.

Watermark called to the specific information that can be appended in a digital content to make available as a proof-of. Watermarking algorithms were mainly developed for digital images and video data. Wm gives a method for copyright protection and ownership verification. In audio watermarking technique, the copyright information hide in an audio file which creates the information being audible to the listener, and by less disturbing the audio quality of original file.

Among many techniques of audio watermarking, the spread spectrum (SS) audio watermarking is the finest by being robust to any kind of intentional or non-intentional attacks. It also provide the technique of correlation based watermark detection, that provide blind watermarking technique in which original file is not needed at the detector for watermark detection and extraction.

The embedded messages should be imperceptible; and also the fidelity of digital media must be maintained. The WM word comes from using invisible ink to write secret messages. Additional requirement of WM schemes is robustness.

According to the type of document to be watermarked types of watermarking are as follow:

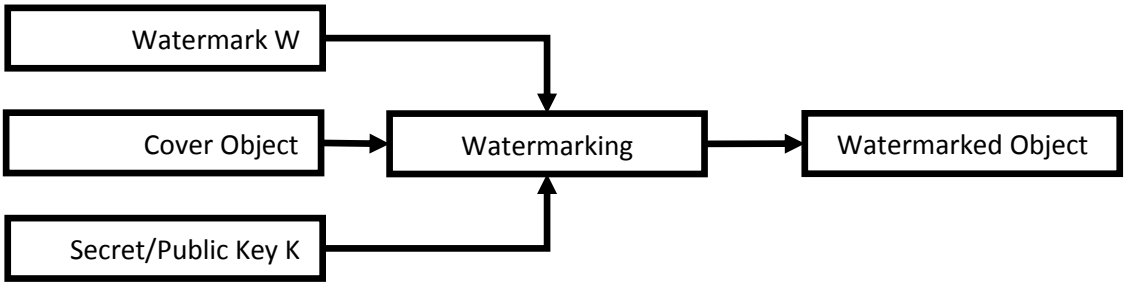
1. Image Watermarking
2. Video Watermarking
3. Audio Watermarking
4. Text Watermarking

And according to the Human perception, the digital watermarking can be of three types as follow:

1. Visible Watermark
2. Invisible Watermark
3. Invisible-Fragile Watermark
4. Dual Watermark

Digital WM can be used for a range of application as:

1. Fingerprinting
2. Copyright Protection
3. Broadcast Monitoring
4. Covert Communication



Proposed Work:

Direct-Sequence Spread Spectrum (DSSS) technique is applied to embed Watermarks and techniques are developed to improve the effectiveness of their detection and embedding in audio. WM robustness is allowed using repetition coding for prevention against de-synchronization attacks and psycho-acoustic frequency masking (PAFM). Using Patchwork Algorithm, a digital watermark is modulated through PN sequences and embedded in frequency component of the audio file. Sound Fidelity is evaluated as a function of embedding capacity and robustness. Repetition embedding in the Quantization Index Modulation (QIM) samples of audio is done to prevent de-synchronization attacks. PSNR is worked as quality metric for the evaluation of the results.

Scope:

Over Human Visual System (HVS) audio watermarking has much more complex techniques to embed watermark in view of eminence of Human Auditory System (HAS). With the growth of Internet, unauthorized copying and illegal distribution of digital media increases. Traditional, data protection methods like scrambling or encryption cannot be used since the content must be played back in original form so it can always be rerecorded and then freely distributed. For solution of this problem is marking the media signal with a secret, robust and imperceptible WM. The media player at the client side can detect this mark and consequently enforce a corresponding e-commerce policy.

Algorithm:

1. Digitize the given audio file into PCM samples with specified sampling rate.
2. After getting the PCM samples, covert the samples into frequency domain using Discrete Fourier Transform.
3. The Fourier coefficients are complex numbers of the form a + ib, where a,b ϵ R and i= √-1.
4. Convert the given coefficients into Polar Form a + ib = $r.e^{i\theta}$, where
5. $r = \sqrt{a^2 + b^2}$ and $\theta = \tan^{-1}\frac{a}{b}$.
6. Magnitude of Fourier coefficients corresponding to the key values is considered and the difference is computed. If the difference is greater than a certain threshold, then the embedded bit is approximated as 1, if it is less than same threshold, it is zero. if it lies between the threshold, then it indicates that data is corrupted or erased.

Conclusion:

Patchwork Based watermark embedding is improved using spread spectrum techniques in frequency domain. M sequence produced by linear feedback shift register is used to modulate the watermark bits which are then embedded into the Fourier coefficients using patchwork algorithm. Also, PAFM is investigated as a function of embedding capacity, robustness and imperceptibility. It is concluded that PAFM as a function of watermark step size and threshold, depends upon the message length and therefore, the total number of samples under consideration. It also depends upon the type of music file under consideration. The scaling factor, selected frequency band and the frame size are the three adjustable parameters of this method; these regulate the capacity, the perceptual distortion and the robustness trade-off of the scheme accurately. Furthermore, the suggested scheme is blind, since it does not need the original signal for removing the hidden bits. The experimental results show that this scheme has a high capacity (0.7 to 2.8 kbps) without significant perceptual distortion.

Future Scope:

Watermarking of audio can be done in temporal and frequency domain. The temporal domain is very sensible to all the forms of echo, noise addition, down sampling, encoding. That is why the Watermark audio algorithms are mostly applied in the frequency domain. The embedded content should be statically undetectable, inaudible, robust again manipulation and secure. Thus it has to be efficient for monitoring a file, fingerprinting, and to indicate if content has been manipulated.

References:

1. Gordy, J.D.; Bruton, L.T., "Performance evaluation of digital audio watermarking algorithms," *Circuits and Systems, 2000. Proceedings of the 43rd IEEE Midwest Symposium on* , vol.1, no., pp.456,459 vol.1, 2000
   doi: 10.1109/MWSCAS.2000.951682
2. Min Wu; Craver, S.A.; Felten, E.W.; Liu, B., "Analysis of attacks on SDMI audio watermarks," *Acoustics, Speech, and Signal Processing, 2001. Proceedings. (ICASSP '01). 2001 IEEE International Conference on* , vol.3, no., pp.1369,1372 vol.3, 2001
   doi: 10.1109/ICASSP.2001.941183
3. Xuemin Zhao; Yuhong Guo; Jian Liu; Yonghong Yan, "A Spread Spectrum Audio Watermarking System with High Perceptual Quality," Communications and Mobile Computing (CMC), 2011 Third International Conference on , vol., no., pp.266,269, 18-20 April 2011.
   doi: 10.1109/CMC.2011.30
4. Bhattacharjee, S.; Lertwachara, K.; Gopal, R.D.; Marsden, J.R., "No more shadow boxing with online music piracy: strategic business models to enhance revenues," System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on , vol., no., pp.11 pp.,, 6-9 Jan. 2003 doi: 10.1109/HICSS.2003.1174455
5. Cvejic, N.; Seppanen, T., "Robust audio watermarking in wavelet domain using frequency hopping and patchwork method," Image and Signal Processing and Analysis, 2003. ISPA 2003. Proceedings of the 3rd International Symposium on , vol.1, no., pp.251,255 Vol.1, 18-20 Sept. 2003 doi: 10.1109/ISPA.2003.1296903
6. Ruhland, Marco; Goetze, Stefan; Brandt, Matthias; Doclo, Simon; Bitzer, Joerg, "A New Approach for Reduction of Supergaussian Noise Using Autoregressive Interpolation and Time-Frequency Masking," Acoustic Signal Enhancement; Proceedings of IWAENC 2012; International Workshop on , vol., no., pp.1,4, 4-6 Sept. 2012
7. Xuemin Zhao; Yuhong Guo; Jian Liu; Yonghong Yan, "Quantization Index Modulation audio watermarking system using a psychoacoustic model," Information, Communications and Signal Processing (ICICS) 2011 8th International Conference on , vol., no., pp.1,4, 13-16 Dec. 2011
   doi: 10.1109/ICICS.2011.6173132
8. Ko, Byeong-Seob; Nishimura, R.; Suzuki, Y., "Time-spread echo method for digital audio watermarking using PN sequences," Acoustics, Speech, and Signal Processing (ICASSP), 2002

IEEE International Conference on , vol.2, no., pp.II-2001,II-2004, 13-17 May 2002
doi: 10.1109/ICASSP.2002.5745024

9. Xiaoyuan Yang; Xiang Wu; Minqing Zhang, "Audio Digital Signature Algorithm with Tamper Detection," Information Assurance and Security, 2009. IAS '09. Fifth International Conference on , vol.1, no., pp.15,18, 18-20 Aug. 2009
doi: 10.1109/IAS.2009.258
10. Lee, D., "Hash Function Vulnerability Index and Hash Chain Attacks," Secure Network Protocols, 2007. NPSec 2007. 3rd IEEE Workshop on , vol., no., pp.1,6, 16-16 Oct. 2007
doi: 10.1109/NPSEC.2007.4371616
11. Zhaofeng, Ma; Yang Yixian; Niu Xinxin, "Secure and Flexible Digital Rights Management in a Pervasive Usage Mode," Computational Intelligence and Security, 2007 International Conference on , vol., no., pp.863,867, 15-19 Dec. 2007
doi: 10.1109/CIS.2007.210
12. Voloshynovskiy, S.; Pereira, S.; Pun, T.; Eggers, J.J.; Su, J.K., "Attacks on digital watermarks: classification, estimation based attacks, and benchmarks," Communications Magazine, IEEE , vol.39, no.8, pp.118,126, Aug. 2001
doi: 10.1109/35.940053
13. Hui Tian; Ke Zhou; Yongfeng Huang; Dan Feng; Jin Liu, "A Covert Communication Model Based on Least Significant Bits Steganography in Voice over IP," Young Computer Scientists, 2008. ICYCS 2008. The 9th International Conference for , vol., no., pp.647,652, 18-21 Nov. 2008
doi: 10.1109/ICYCS.2008.394
14. Fallahpour, M.; Megias, D., "High Capacity Logarithmic Audio Watermarking Based on the Human Auditory System," Multimedia (ISM), 2012 IEEE International Symposium on , vol., no., pp.28,31, 10-12 Dec. 2012
doi: 10.1109/ISM.2012.13