

Audio Watermarking Using Lsb With Adjustment Method

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ABSTRACT

In this paper we are discussing watermarking on audio signals. In this method the recorded audio data is first sampled using a sampling frequency of 22050 Hz. Then the watermark message is watermarked into the sampled data of the audio signal. In this method the adjustment is done to increase the accuracy of the watermarked signal. Finally we extract the message from the audio data.

Keywords— Watermarking, LSB, Adjustment method

I. INTRODUCTION

In this paper we are discussing watermarking on audio signals. In this method the recorded audio data is first sampled using a sampling frequency of 22050 Hz. The sampled audio data is then transformed into Discrete Cosine Transform domain. Then the watermark message is watermarked into the DCT coefficients of the audio signal. In this method the adjustment is done to increase the accuracy of the watermarked signal. Finally we extract the message from the audio data after performing Inverse Discrete Cosine Transform to the watermarked audio signal.

II. WATERMARKING

In this method the watermarking is done using LSB (least significant bit). First we capture the audio data. Then the audio data is sampled using a sampling frequency of 22050 Hz. The message which is to be watermarked into the audio signal is entered into the text box. Each letter in the message is converted into its ascii value. The ascii values are represented by 7 bit binary representation. These binary bits are stored into a column vector. Each bit is bitwise xored with the 2nd bit of sampled audio data. The resultant bits after bitwise xoring are the watermark bits. These watermark bits are watermarked into the 2nd bit of each sampled audio data.

III. ADJUSTMENT METHOD

Here let 'a' be the value of original data (sampled audio data), 'b' be the value of

watermarked data. Then we choose a value 'c' as the watermarked data such that it is very close the value

of 'a' and the watermark bit should remain as that of the watermarked data 'b'. If $a > b$, then $b \leq c < a$ or if $a < b$, then $a < c \leq b$.

For example, consider an 8 bit representation. Let the 3rd bit is to be watermarked by a watermark bit '1'. Let 'a'='00001011' (11d) be the sampled data of audio signal. After watermarking 'a' will become 'b'='00001111' (15d). This watermarked data is adjusted to a new value 'c'='00001100' (12d). Here 'c' is very close to 'a' and the watermark bit remains same as that of 'b' ie; '1'. Hence now we select the watermarked data as 'c'.

a=00001011=11d

b=00001111=15d

c=00001100=12d

IV. EXTRACTION OF MESSAGE

We are using the property of bitwise xoring for extraction of message from the watermarked signal. If $C = A \text{ xor } B$, then $A = C \text{ xor } B$. Hence the 2nd bits of watermarked audio data are bitwise xored with 2nd bits of sampled audio data before watermarking. The resultant bits are the message bits and are converted into the message data.

V. EXPERIMENTAL RESULTS

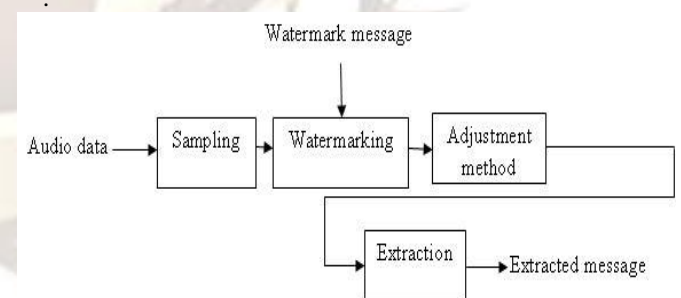


Fig 1: Block diagram of watermarking using LSB with adjustment method

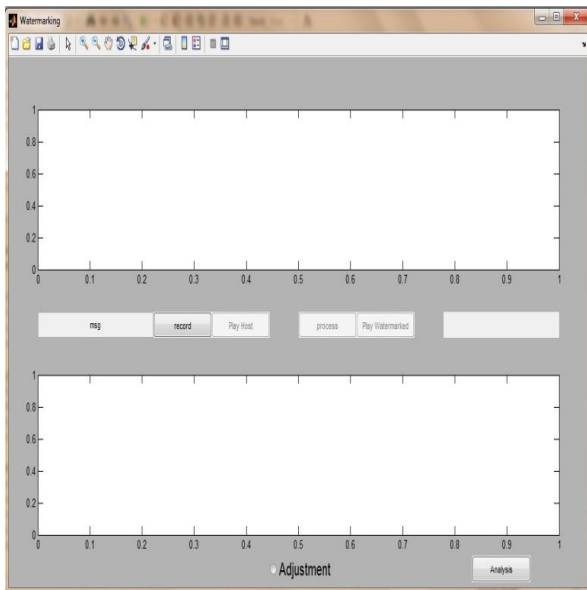


Fig 2: Output window

The output window consists of push buttons 'record', 'Play Host', 'process' and 'Play Watermarked' and the edit text box for typing the message. The edit text box contains 'msg' as default watermark message. When we select the push button 'record', the recording takes place for 5 seconds of time. The extracted message will be displayed in the text box provided for it.

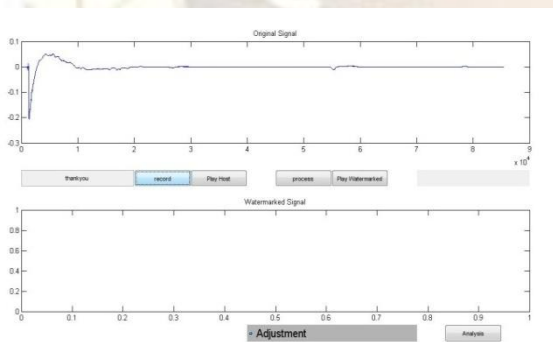


Fig 3: Output window after recording finished

The original audio signal will be displayed after the recording finished. We can check the recorded audio data by selecting the 'Play Host' push button.

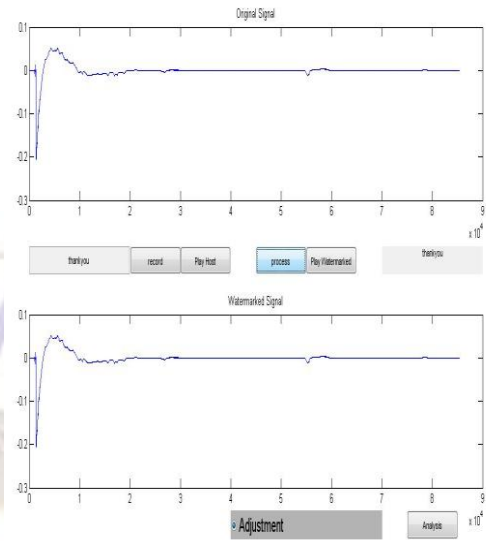


Fig 4: The watermarked signal and extracted message on the output window while using the adjustment method

VI. ANALYSIS

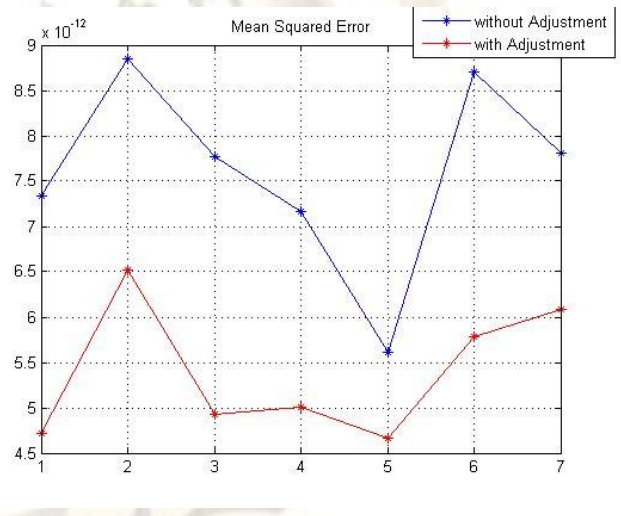


Fig 5: Analysis

The mean squared error between the original signal and the watermarked signal is calculated for both the watermarking methods with and without using the adjustment method. The mean squared error can be calculated as follows.

$$\text{Mean squared error} = \frac{1}{N} \sum_{n=0}^{N-1} [Y(n) - X(n)]^2$$

Where N- total number of data taken

Y(n)- watermarked data

X(n)- sampled audio data.

The mean squared errors for both the cases are calculated for 7 audio test files. It can be seen that the mean squared error is higher for the

watermarking method without using the adjustment method.

VII. CONCLUSION

In this paper we discussed about LSB watermarking method. The watermarking is done with and without using the adjustment method. In both the cases the watermarking is performed on the sampled audio data. The adjustment method is used to increase the accuracy of the watermarking. An analysis is carried out for seven audio files using the three watermarking methods. The analysis is carried out by calculating the mean squared error between the watermarked signal and the original signal. From the result we can conclude that the mean squared error is less for watermarking using the adjustment method. The accuracy is therefore more for the watermarking using adjustment method.

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