AUDIO AND VIDEO WATERMARKING USING EMD ALGORITHM

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Abstract **-This study concerns a noble audio and video watermarking technique using Empirical Mode Decomposition (EMD). The audio or video signal is divided into number of frames and these frames are suitably decomposed using EMD into intrinsic periodic components called as intrinsic mode function (IMF). The watermark and therefore the synchronization codes are embedded into IMF, an occasional frequency mode stable beneath different attacks and protective audio and video sensory activity quality of the host signal. All this mean that, the methodology can be applied to any audio and video signals. Experimentation has ensured the mark physical property, the ability of detection of the mark and therefore the hardiness against completely different varieties of attacks.**

Keywords- Empirical mode decomposition, intrinsic mode function, audio watermarking, video watermarking, quantization index modulation, synchronization.

I .INTRODUCTION

Digital watermarking is coming up as a solution for copyright protection of digital media by embedding a watermark in the original multimedia signal [1]. Main requirements of digital audio watermarking are physical property, hardiness, robustnessand information capability. Watermark should be inaudible in audio watermarking and invisible in video watermarking to take care of the quality and the structure of a host signal. Finally, the watermark should be simple to extract as a proof of possession [2].

In a strong watermarking structure totally different attacks are planned however with a restricted transmission bit rate. To boost the bit rate wavelet decomposition was used initially but limit of wavelet approach is that the essential functions are fastened, and hence it does not work efficiently on every real time signal. To overcome this limitation, more effective decomposition methodology called Empirical Mode De-composition (EMD) has been introduced for analyzing non-stationary signals. Significant advantage of EMD is its independent of prior selection of filters or basis functions which classical kernel based methods are usually not. EMD is fully data-driven method that recursively breaks down any signal into a reduced number of zero-mean with symmetric envelopes AM-FM components called Intrinsic Mode Functions (IMFs). The decomposition starts from finer scales to coarser ones. Any signal is expanded by EMD. The IMFs are nearly orthogonal to each other and every IMF has nearly zero mean i.e. the number of extrema is decreased when going from one mode to succeeding. Therefore the whole decomposition is bound to be completed with a finite number of modes. The IMFs are fully described by their local extrema and thus can be recovered using these extrema. Higher order IMFs have low frequencies and lower order IMFs have high frequencies. Hence lower order IMFs are signal dominated and their alteration can lead to degradation of signal. As result, these modes can be considered to be good locations for watermark placement. EMD is combined with Pulse Code Modulation (PCM) and the watermark is inserted in the final residual of the Sub-bands in the transform domain. The method supposes that mean value of

PCM audio signal may no longer be zero but the method is not robust to attacks such as band-pass filtering and cropping, and no comparison to watermarking schemes reported by authors. Hence the EMD is associated with Hilbert transform and the watermark is embedded into the IMF containing highest energy. However, why the IMF carrying the highest amount of energy is the best candidate mode to hide the watermark has not been addressed. Further, in practice an IMF with highest energy can be a high frequency mode and thus it is not robust to attacks. Watermarks inserted into lower order IMFs (high frequency) are most at risk of attacks. It has been argued that for watermarking hardiness, the watermark bits are typically embedded within the perceptually components, mostly, the low frequency elements of the host signal. We embed the watermark in the extrema of the last IMF to have better resistance against attacks and physical property. In our methodology we elect a watermarking technique within the class of quantization Index Modulation (QIM) because of its good hardiness and blind nature. Parameters of QIM are chosen to ensure that the embedded watermark within the last IMF is inaudible and invisible. The watermark is associated with a synchronization code to facilitate its location. An advantage to use the time domain approach, based on EMD, is the low cost in searching synchronization codes.

Sync-code	Watermark bits	Sync-code

Audio signal is initially segmented into frames and decomposed adaptively into IMFs. Bits are inserted into the extrema of the last IMF specified the watermarked signal in audibleness is bonded. Experimental results demonstrate that the hidden information is strong against attacks such as additive noise, MP3 compression, re-quantization, cropping and filtering.

Our method has high data payload and performance against MP3 compression compared to audio watermarking approaches reported recently in the literature.

III.EMD ALGORITHM

In the original video audio or video signal has hidden watermark hidden together with synchronized code(SC) in time domain. First the input signal is segmented into frames and on EMD technique is used on individual frame to extract IMFs(Intrinsic Mode Function) as shown in Fig 1.In the extrema of set of last consecutive IMFs the binary sequence consisted of SCs and watermarked bits is embedded. The number of extremas and number of IMFs depend on amount of data in each frame and also the number of bits differ from one last IMFs to the next.If number of bits SCs are N1 and N2 and watermark respectively.Then the number binary sequence to be embedded is 2N1+N2.On the last IMFs of consecutive frames this bits are spread.To recover the watermarked audio signal by superposition of the IMFs of each frame followed by the concatenation of the frames the inverse transformation (EMD^{-1}) is applied to the modified extrema.. In watermark extraction, the watermarked audio signal or video is split into frames and EMD applied to each frame.The watermark is extracted by searching SCs from several last IMFs .EMD technique is robust thus it is gurantee that the number of IMFs before and after embedding will be same.In the proposed watermarking method the host signal is not required for watermark extraction process.

A. Synchronization Code

To find the embedding position of the hidden watermark bits in the host signal a SC is used. This code is unaffected by cropping and shifting attacks .

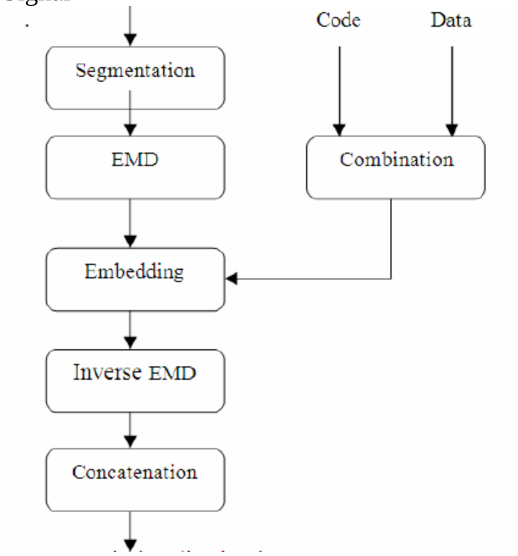
$$E_m = F^{-1}\{\log(F(x))\}$$

F represents the Fourier Transform and the inverse Fourier Transform can be examined at two
locations, corresponding to the delays of the "one" and "zero" kernel, respectively.

B. Watermark Embedding

SCs are combined with watermark bits before embeddeding to form a binary sequence denoted by mi E {0, 1},it bit of watermark basics of watermark embedding are follows Split original audio signal into frames and decompose each frame into IMFs. Embedded p times the binary sequence {mi} into extreme of the last IMF by QIM. The Watermark Embedding is shown in figure below.

Audio and video
Signal



Watermarked Audio and video

Fig.1. Watermark Embedding

Reconstruct the frame using modified and concatenate the watermarked frames to retrieve the watermarked signal.

C. Watermark Extraction

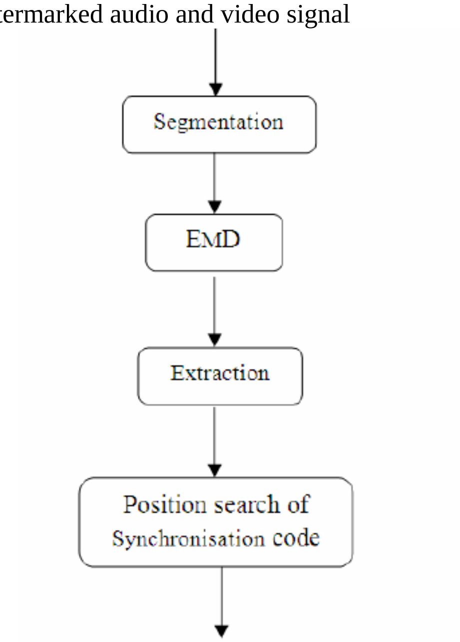
For watermark extraction, host signal is splitted into frames and.EMDis performed on each one as, inembedding.We extract binary data, using rule given by (3). We then search for SCs in the extracted data. This procedure is repeated by shifting the selected segment (window) one sample at time until a SC is found (6). The Watermark Extraction is shown in Fig 2.Basic steps concerned within the watermarking extraction, shown in Fig. B, are given as follows:

Step 1: Split the watermarked signal into frames.
Step 2: Decompose each frame into IMFs.
Step 3: Extract the extrema of {ei*} and IMFc .Step 4: Extract mi* from ei* using the following rule:

mi*= { 1 if ei*-[ei*/S].s>sgn(s/2)
0 if ei*-[ei*/S].s<sgn(s/2)

Step 5: Set the start index of the extracted data, y , I=1 to and select L=N1 samples (sliding window size).
Step 6: Evaluate the similarity between the extracted segment V=y(I:L) and U bit by bit. If the similarity value is >=T, then V is taken as the SC and go to Step 8. Otherwise proceed to the next step.
Step 7: Increase I by 1 and slide the window to the next L=N1 samples and repeat Step 6.
Step 8: Evaluate the similarity between the second extracted segment, V=y(I+N1+N2;I+2N1+N2) and U bit by bit.
Step 9: I=I+N1+N2, of the new I value is equal to sequence length of bits, go to Step 10 else repeat Step 7.
Step 10: Extract the P watermarks and make comparison bit by bit between these marks, for correction, and finally extract the desired watermark.

Watermarked audio and video signal



Watermarked bit

Fig.2 watermarked Extraction

With the position of SC determined, we can then extract the hidden information bit, which follows the SC. Let $y=\{m^*_i\}$denote the binary data to be extracted and U denote the original SC. To locate the embedded watermark we search the SCs in the sequence $y=\{m^*_i\}$bit by bit. The extraction is performed without using the original audio signal.

IV .REFERENCES

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V.SUMMARY

The work described in the study is about the security for the audio and video communication using EMD technique of watermarking .There are many techniques used for watermarking forprotection ofaudio and video data. But the EMD technique overcomes following drawbacks:

1. A robust watermarking technique was proposed but it has limited transmission bitrate.

2. To enhance the bitrate a technique named wavelet domain was introduced but this technique approach is that the base functions are not varying and hence they do not match the real signals.

The Study is an approach to enhance understanding about the technique of watermarking called EMD for protection of audio and video data. A main advantage of this EMD technique is it is independent on filters and base functions .The principle of EMD is it recursively breaks down any signal into IMFs.

The first application on EMD was based on audio watermarking which has several advantages of self decomposition and achieved good performance against various attacks. The technique of watermarking includes simpler calculation methods. Our further research is to reduce elapsed time.