IJCSI International Journal of Computer Science Issues, Vol. 11, Issue 4, No 2, July 2014
ISSN (Print): 1694-0814 | ISSN (Online): 1694-0784
www.IJCSI.org

VideoWatermarking using Discrete Slantlete Transform

Ahmed Toman Thahab
Electrical and Electronics Department/Engineering College
Karbala University/Karbala/Iraq

Arwa Hameed Mohammed Taqi
Electrical and Electronics Department/Engineering College
Karbala University/Karbala/Iraq

Abstract

The protection of ownership and the prevention of unauthorized tampering of multimedia data (audio ,video,, image, and document) have become important concerns. A digital watermark is a code that embedded inside an image/video .It acts as a digital signature ,giving the image/video a sense of ownership. In this paper, a watermarking scheme based on slantlet transform, an orthogonal discrete wavelet transform is presented. The watermark is hidden into mid band frequencies of slantlet coefficients of one frame in a video, which will produce a small amount of distortion in that watermarked video. *The* PSNR and MSE will specify the performance of the video watermarking system.

Keywords: ***Slantet Transform; Watermarking; Video processing; Hiding Process.***

1.INTRODUCTION

Digital watermarking is a technique to insert a digital signature (mark) into an image/video so that the signature can be extracted for the purpose of ownership verification. This type of technology is becoming increasingly important due to the popularity of the usage of digital images/video on the World Wide Web and in electronic commerce[1]. In general, the inputs are message to be hidden and some media in which to hide it, such as an audio stream , an image , or a video stream .The output of the embedder is media is perceptually very similar to the input media ,but contains the input message as a hidden watermark[2]. The watermark can be embedded directly in the spatial domain or in some transform space using common transform , such as DCT, wavelet transform or slantlet transform. In transform based schemes the image/ video is transformed prior to watermark embedded and the watermark is hidden in the coefficients representing the image/video .The watermarked image/video is obtained using an inverse transformation[3].

2. Slantlet Transform

The slantlet transform is based on an improved version of the usual discrete wavelet transform (DWT) where the support of the discrete-time basis functions is reduced[4]. The slantlet transform is an orthogonal discrete wavelet transform with two zero moments and with improved time localization, the basis of the slantlet is based on a filter bank structure where different filters are used for each scale.

Let us consider a usual two-scale iterated DWT filter bank shown in Fig. 1.a and its equivalent form Fig. 1.b. The slantlet filter bank is based on the structure of the equivalent form shown in Fig. 1.b, but it is occupied by different filters that are not products. With this extra degree of freedom obtained by giving up the product form, filters of shorter length are designed satisfying orthogonality and zero moment conditions[5]. Some characteristic features of the slantlet filter bank are orthogonal, having two zero moments and has octave-band characteristic as in Fig. 1.c. Each filter bank has a scale dilation factor of two and provides a multi-resolution decomposition. The slantlet filters are piecewise linear. Even though there is no tree structure for slantlet it can be efficiently implemented like an iterated DWT filter bank. Therefore, computational complexities of the Slantlet are of the same order as that of the DWT, but slantlet transform gives better performance in de-noising and compression of the signals[6].

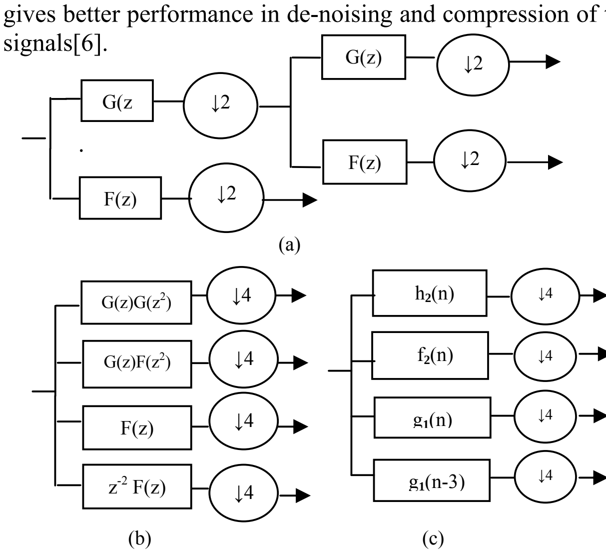


Fig. 1 (a) Two-scale iterated filter bank DWT.
(b) Equivalent form using the DWT.
(c) Two-scale filter bank using SLT.

The filters *gi(n)*, *fi(n)* and *hi(n)* are implemented in piecewise linear forms and they can be represented as:

$$g_i(n) = \begin{cases} a_0 + a_1 n & \text{for } n = 0,\ldots,2^i - 1 \\ b_0 + b_1(n - 2^i) & \text{for } n = 2^i,\ldots,2^{i+1} - 1 \end{cases} \quad (1)$$

IJCSI
www.IJCSI.org

$$f_i(n) = \begin{cases} c_0 + c_1 n & \text{for } n = 0,\ldots,2^i - 1 \\ d_0 + d_1(n-2^i) & \text{for } n = 2^i,\ldots,2^{i+1} - 1 \end{cases} \quad (2)$$

$$h_i(n) = \begin{cases} a_0 + a_1 n & \text{for } n = 0,\ldots,2^i - 1 \\ b_0 + b_1(n-2^i) & \text{for } n = 2^i,\ldots,2^{i+1} - 1 \end{cases} \quad (3)$$

These filters must satisfy the following constraints, which, in turn, satisfy orthogonality and two vanishing moments:

(1)Each of $g_i(n)$,$f_i(n)$ and $h_i(n)$ is of unit norm i.e.= 1

$$\sum_{n=0}^{2^{i+1}-1} g_i^2 = 1 \quad (4)$$

2) $g_i(n)$ is orthogonal to its shifted time reverse i.e.

$$\sum_{n=0}^{2^{i+1}-1} g_i\,(n) g_i = 0 \quad (7)$$

3) Each of $g_i(n)$ and $f_i(n)$ annihilates linear discrete time polynomials i.e.

$$\sum_{n=0}^{2^{i+1}-1} g_i = 0 \quad (8)$$

$$\sum_{n=0}^{2^{i+1}-1} f_i = 0 \quad (10)$$

4) f_i (n) and h_i (n) are orthogonal to their shifted versions i.e.

$$\sum_{n=0}^{2^{i}-1} h_i\,(n) h_i = 0 \quad (11)$$

$$\sum_{n=0}^{2^{i}-1} f_i\,(n) f_i = 0 \quad (12)$$

$$\sum_{n=0}^{2^{i+1}-1} h_i\,(n) f_i = 0 \quad (13)$$

$$\sum_{n=0}^{2^{i}-1} h_i\,(n) f_i = 0 \quad (14)$$

Hence, ST will produce a filter bank, where each filter has its length in power of 2. In case of a finite length signal (with length in power of 2), this results in a periodic output for the analysis filterbank and an orthogonal transformation can be constructed[6,7].

3. Proposed Digital color Video Watermarking

The proposed method is a unique method to watermark video data using text mark. A text will be written and watermarked on each frame of the video. Fig. 2 frame (200) of video(4) r the proposed watermarking system.

The video is separated into scene frames; each frame consists of three color components, red, green and blue. Every component is input to the slantlet block for transforming.

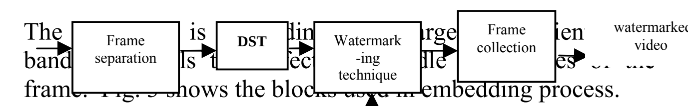
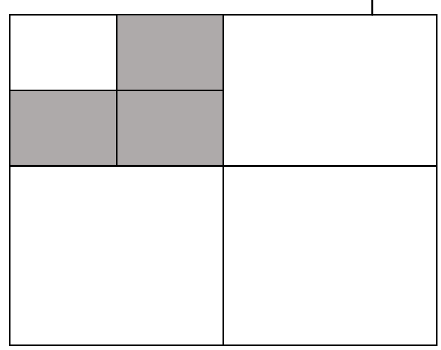


Fig. 2 Block diagram of the proposed digital color video Watermarking system.

The is din rge ien band ls t ec dle es frame. Fig. 3 shows the blocks used in embedding process.



Slantlet Transform of any video frame.

Fig. 3 Blocks used in embedding proc

For embedding a bit stream in any data (image or video), first it must be transform into a sequence *w(1* ng the 0 by –1, where L is the length of nd $w(k) \in \{-1,1\}$, (k =1,…,L).This sequence is used as the watermark. Let $g(m,n)$ represents the DST coefficients which are not located at the low frequency band of the frame. The embedding process is performed as the following formula:

$g'(m,n) = g(m,n) + € g(m,n)w(k)$,

where € is the strength of the watermark controlling the level of the watermark $w(1)...w(L)$.

Discrete Slantlet Transform coefficients at the lowest frequency bands which are located in the upper left corner block are not used or modified. The watermarked frame is obtained by applying the Inverse Discrete Slantlet Transform (IDST). In the watermark extraction process both the received video (received frame) and the original one are decomposed into the slantlet transform. It is assumed that the original video is known for extraction. The extraction process is described by the following formula:

wr(k)=(gr'(m,n)-g(m,n))/(€g(m,n)),
where *gr'(m,n)* are the DST coefficients of the received frame. As known, in any communication channel there is some noise added to the data (image or video) by attacks or transmission, the extracted sequence *wr(1)...wr(L)* has a positive and negative values. Hence, it is better to take the extracted watermark as:
we(k)=sgn(wr(k)).
After extraction of the watermark, the bit stream is reconstructed according to the replacement rule at the beginning.

4. Results and Discussion

Various color video clips are input to the system shown in Fig. 4 with input size of 256*256. The results involve the PSNR and MSE of the watermarked video and the original video. Results shows a significant PSNR and MSE for the videos tested in the system.

Table 1 shows the PSNR &MSE for various videos.

No.	Input video	No.of frames	PSNR	MSE
1	Rhinos	114	63.12	0.0356
2	Videparture	337	63.46	0.029
3	Mother&daughter	300	62.48	0.036
4	Tennis	150	61.67	0.045
5	Paris	200	60.11	0.063
6	Clair	494	60.17	0.062
7	Bus	150	59.87	0.067

Table 1 illustrates the high PSNR gained from using the proposed technique for various video resolutions and details. The mean error for each video is at its minimum using slantlet transform. Regarding subjective quality, the figures shows the high quality of the reconstructed frames for the videos tested.

frame(1) of video(3)

frame (150) of video(3)

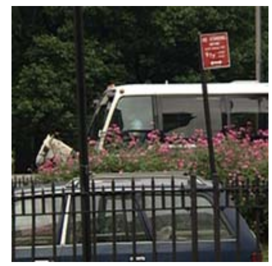
Fig. 4 The watermarked frames of video(3).

frame (1) of video(4)

frame(200)of video(4)

Fig. 5 The watermarked frames of video(4).

frame (1) of video(7)



frame (150) of video(7)

Fig. 6 The watermarked frames of video(7).

5. Conclusion

This paper presents a new technique to watermark video movies. The paper proposes using slantlet transform to watermark each frame of the video movie. Each frame is slantlet transformed and a text is embedded in the upper left corner in the slantlet domain. The PSNR is ranged between (63-59)dB for all the experiments conducted. As for the MSE, it ranged between (0.035-0.067).

REFERENCE

[1] J. Fridrich, "Method for Tamper Detection in Digital Images",
fridrich@binghamton.edu, 2000.

[2] P. Lamy, J. Martinho, T. Rosa, and M. Paula, "Content-based Watermarking for Image Authentication", A.pfitzmann (ED):
IH 99. LNCS 1768, pp.187-198, 2000.

[3] J. Fridrich, "Application of Data Hiding in Digital Images",
http://ssie.binghamton.edu/ jirif, 1998.

[4] Chatterjee, A., Maitra, M. & Goswami, S.K. "Classification of overcurrent and inrush current for power system reliability using Slantlet transform and artificial neural network", Expert Systems with Applications, Vol. 36, Elsevier, pp.2391-2399, 2009.

[5] Selesnick, I.W. "The Slantlet Transform", IEEE Transaction on Signal Processing, Vol. 47, No. 5, MAY, 1999.

[6] Samah, G. 2010. Speech Signal Recognition using Slantlet Transform and Artificial Neural Network, M .Sc Thesis, College of Engineering, Baghdad University, pp. 28-35.

[7] Chatterjee, A., Madhubanti, M and , S. 2009" System reliability using Slantlet transform and artificial neural

network", Elsevier, Expert System with application, Vol 36, pp.2391-2399.

Ahmed Toman: Assist lecture in electrical and electronics department in engineering college of Karbala university, Karbala, Iraq since 2012. He had M Sc. Degree in communication and electronic engineering (2011), B Sc. in electrical engineering (2006) from Baghdad university, Baghdad ,Iraq. He had a paper named "Video steganography using YCbCr color space and dynamic least significant bit , Babil Journal, "Proposed system for digital video compression", Babil Journal(2011), "Fast algorithm for color digital video compression", second regional conference for engineering science, Al Nahrain University (2010).

Arwa Hameed: Assist lecture in electrical and electronics department in engineering college of Karbala university, Karbala, Iraq since 2011.
She had M Sc. Degree in electrical engineering(2010), B Sc. in electronics and communication engineering (2007) from Baghdad university, Baghdad ,Iraq.
She had a paper named "Parallel computing of Viterbi decoding algorithm" published in International Journal of Computer Application (IJCA) at 2012. Field of interest in communication field in general like decoding processes, modulation technical and in the image processing field.
She had Educational qualification course and teaching methods from Karbala university at 2012