BLIND VIDEO WATERMARKING SCHEME FOR MPEG-4
VIDEOS WITH PARITY SEQUENCES IN TRANSFORM
DOMAIN

1S. JanardhanaRao, 2Dr. O. NagaRaju
1Research Scholar, ANU, Guntur, AP, India,
2Head, Computer Science Department Government College, Macherla, Guntur, AP, India

ABSTRACT

High quality video broad casting is of high demand both with DVB-2 (Digital Video Broad
casting) and Internet services. But these broadcasted data is distributed without protection. Invisible
mode of video watermarking is one of the solutions, here in this paper a novel approach of data
embedding scheme is proposed for MPEG-4 videos with different parity check codes and processed
in transform domain. A subjective and objective analysis is performed to examine the proposed
approach. Experimental results on various videos have shown that LDPC (Low density parity check)
code with Gold spreading sequence in transform domain outperforms when compared against the
other methods.

Keywords: Video Watermarking, Parity Check Codes, Spreading Sequences, DCT.

I. INTRODUCTION

With the advent of digital video broadcasting over the internet and DTH (Direct to Home)
/DVB (digital video Broadcasting) many issues of copy right protection is of great importance [3]
[4]. Since the duplication of digital video signals does not result in the inherent decrease in quality of
the suffered analog video signals. Invisible watermarking is one of the solutions for the protection of
the digital data. A water mark is a digital code that is embedded in the video sequence which can be
used to transmit that video to the copyright owner in others terms this can be used to send the copy
of digital data only to the legal user. This allows illegally reproduced copies to be traced back to the
receiver from which they are originated. A simple diagram used to depict the scenario.
The digital video watermarking is regarded as a complete cryptogram communication system in which the watermark is regarded as the transmitted message and the video frame as the channel or carrier for the watermark and the pixels that are encountering attacks as the noise in the channel [1]. Based on this concept we can use parity check codes for error correction codes. In this paper we use LDPC codes for error correction.

Error correction codes are commonly used to protect memories from so-called soft errors, which change the logical value of memory cells without damaging the circuit. As technology scales, memory devices become larger and more powerful error correction codes are needed. To this end, the use of more advanced codes has been recently proposed. These codes can correct a larger number of errors, but generally require complex decoders. To avoid a high decoding complexity, the use of one step majority logic decoding codes was first proposed in for memory applications.

LDPC code was first presented by Gallager [2], these codes have many advantages like stronger ability to correct errors and have the lower error floor, it’s a parallel algorithm which is very much suitable for hardware implementation, lower delay in decoding process, lastly it uses the length of the watermark and the value of the transformed coefficients for adaptive embedding.

In [5], XU Ba et al proposed a blind video watermarking algorithm based on LDPC, improving the robustness of video watermarking algorithm in the original domain. In [6], Hsu et al proposed a video watermarking scheme based on DCT, using the DCT coefficients to embed watermark. In [7], Hartung et al proposed a scheme that the watermark is added in the MPEG-4 facial motion parameters. The disadvantage of the method is that extracting the watermarking requires the original host signal and the rate of extracting is unbalance. In [8], Chen Chao et al proposed a video watermarking algorithm in compressed domain, using the intermediate frequency coefficient of the luminance to embed watermark. Also, in [9], Li Jing et al proposed a robust blind video watermarking algorithm, using the low-frequency coefficient of the luminance component to embed watermark.

In this paper an invisible mode of video watermarking is proposed with LDPC codes, for more security different spreading sequences are convolved during the embedding process. The paper is organized as follows

**II. PROPOSED APPROACH**

![Figure 1: Block diagram of Copyright protection](image)

![Figure 2: Block diagram of embedding and extraction process](image)
Original Video: In this paper for the experimental analysis different videos available at [10]. The sample video frames are displayed below

![Sample Video Frames](image1)

![Sample Video Frames](image2)

![Sample Video Frames](image3)

![Sample Video Frames](image4)

**Figure 3:** video frames of the video samples considered for experiments

**Embedding algorithm**

- Consider a frame which is in true color RGB which is converted into Ycbcr.
- Consider the Y component of the color transformed frame
- Apply DCT (Discrete Cosine Transform) [11][12] and consider the middle frequency components for embedding line [32:32: MxN] where M & N are the x & y dimension of the frame.
- Consider a logo to be embedded of size 32x32 and make the values to be as {-1, +1}.
Generate a random sequence of size [1 MxN] and consider the frequency position as stated in before point

Encode the message data with LDPC

The embedding process is

\[ V_i' = V_i + a_i b_k p_k \]  

Where ‘i’ is the \( i^{th} \) Dct coefficient and ‘k’ is the middle frequency component, \( V_i \) is the original DCT coefficient and \( V_i' \) is the modified coefficient, \( p_k \in \{-1,1\} \) is the spreading sequence. The value of \( a_i \) is set as

If \( |V_i| < 2 \) then \( a_i = 2 \)
If \( 2 < |V_i| < 10 \) then \( a_i = 2.5 \)
If \( 10 < |V_i| < 20 \) then \( a_i = 3 \)
If \( |V_i| > 20 \) then \( a_i = 5 \)

Extraction Process

The watermarked video frame is converted into Ycbcr from which the ‘Y’ component is selected for the process

Apply the DCT transform and convolve the middle frequency coefficients with spreading sequence.

\[ E_k = \sum_{i=kcr}^{(k+1)xcr-1} V_i' p_i \]

\( cr = 32 \)

Consider the sign of the resultant coefficient value and perform LDPC decoding to extract the logo

III. EXPERIMENTAL RESULTS

Experiments were conducted using the video sequences from [10] on Matlab 2012 Version, windows 7 OS
Figure 4: (a) Original Video frame (b) Watermarked frame (c) Original Logo (d) extracted with PN spreading sequence and LDPC coding (e) extracted Without LDPC coding

Table 1: Analytical results with and without Pre coding

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NO PRE-CODING</th>
<th>LDPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BER</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>NC</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>PSNR</td>
<td>49.28</td>
<td>49.31</td>
</tr>
</tbody>
</table>

Table 2: Analytical results for extraction with different spreading sequences

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LDPC with PN seq</th>
<th>LDPC with gold codes</th>
<th>LDPC with Hadamard</th>
</tr>
</thead>
<tbody>
<tr>
<td>BER</td>
<td>0.01</td>
<td>0.011</td>
<td>0.011</td>
</tr>
<tr>
<td>PSNR</td>
<td>48.29</td>
<td>48.32</td>
<td>48.27</td>
</tr>
<tr>
<td>MSE</td>
<td>0.964</td>
<td>0.956</td>
<td>0.967</td>
</tr>
</tbody>
</table>

Figure 5: Performance analysis for mobile video sequence with proposed approach

Figure 6: Zoomed Graph of the figure 4
Figure 7: Mean square Error Analysis of the proposed approach for the Mobile.avi video sequence

Figure 8: Zoomed graph of figure 6

Figure 9: PSNR analysis for different video sequences

IV. CONCLUSION

A invisible mode of video watermarking with pre coding and spreading sequences is proposed in this paper, the present approach is compared against three spreading sequences and found that when encoded with LDPC gold sequences of spreading leads to the low bit error and also high visual quality of the video sequence. This work can implemented for all the DVB and internet services where the quality of video is of greater demand. This work can be further extended by implementing this methodology with advanced transforms like contourlet and curve lets.
REFERENCES

BRIEF PROFILE OF AUTHORS

Dr. O NagaRaju received Ph.D. in the department of Computer Science Engineering, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India. He has a satisfactory consistent academic track of record. He is currently working as a Head, Computer Science Department Government College, Macherla, Guntur (Dt). He has occupied various academic responsibilities like practical examiner, project adjudicator in Andhra Pradesh. His current research is focused on Software Engineering, Image Processing & Database Management System. He has published several papers in National & International Journals.

Syamalapalli Janardhan Rao graduated his AMIE from Kolkata, India, Masters Degree in ECE from Jawaharlal Nehru Technological University (JNTU), Anantapur, A.P, India, in 2010. He got another Master Degree in CSE from IETE Delhi, India in 2009. He is currently being Fellow of IETE, New Delhi, and working as an Associate Professor in the Department of electronics and communication Annasaheb Dange college of engineering& Technology, ashta, India. He has served for 20 years in Indian Air force on different RADAR Systems. His main research fields include and Digital Water Marking, Network security.