Watermarking Robust Against Dropping Frame

DR. Tawfiq A. Abbas   Isra'a Hadi Ali   Majid Jabbar Jawad

Abstract

Recently, digital contents are copied easily. So digital watermark technique which aims to copyright protection of digital contents becomes important. There are several watermarking methods have been proposed in this area, but this watermarking methods must be robust against geometric attacks, such as rotation, cropping, frame dropping. So, robustness against geometric attacks remains one of the most difficult areas of watermark research, not only for video, but also for still images. In this paper, we proposed a method for embedding digital watermark in video, by dividing the watermark into Blocks according to the number of scenes within video, then we embedded any block of watermark in the frames of scenes. After embedding operations, we examined the robustness of the proposed method against frame dropping, by dropping several frames from watermarked video arbitrarily. After extraction operation, and by using PSNR we found that there is no difference between the embedded and extracted watermark.

1. INTRODUCTION

Advancements in digital multimedia technologies have given rise to a growing popularity in video-based applications such as Internet video, wireless video, videophones, video conferencing, among many others. In parallel to the growing diversity in video applications, technology also facilitated unauthorized copying and distribution of digital video, thus creating a copyright dilemma for the multimedia industry. A promising technology that received a considerable attention for embedding copyright information in a broad range of multimedia applications, including video, is digital watermarking[G. Langelaar, I.Setyawan, and R.Lagendijk.2000]. Video watermarking research received less attention than image watermarking due to its inherit difficulty, however, many algorithms have already been proposed [G. Doerr and J. Dugelay.2003]. Existing algorithms can be classified into compressed video watermarking and uncompressed video watermarking algorithms[D. Kundur, K, Su, and D. Hatzinakos.2004].

2. GEOMETRIC ATTACKS

There are several geometric attacks on embedded digital watermarking, we will illustrate some of these attacks

2.1 THE SCALING OPERATOR

Performs a geometric transformation, which can be used to shrink or zoom the size of an image (or part of an image). Scaling is used to change the visual appearance of an image, to alter the quality of information stored in a scene representation, or as a low-level preprocessor in the multistage image processing chain, which operates on feature of a particular scale. Scaling can be divided into two categories: one is symmetric scaling, which means that the scaling factor in the x direction is same as in the y direction; the other is nonsymmetric scaling, sometimes called shearing, which means that the scaling factors are different in two directions. Symmetric scaling can be considered as a special case of asymmetric scaling [Juergen Seitz. 2005, Yulin Wang and Alan Pearmain.2006].

2.2 THE ROTATION OPERATOR

Performs a geometric transform, which maps the position (x1, y1) of a picture element in an input image onto a position (x2, y2) in an output image by rotating it through a user-specified angle about an original. Rotation is the most commonly used method to improve the visual appearance of an image, though it can be useful as a preprocessor in applications where directional operations are involved [Juergen Seitz. 2005, Yulin Wang and Alan Pearmain.2006].

2.3 THE CROPPING OPERATOR

Although cropping only removes part of the rows in each frame of the video, assuming hereinafter the cropping is only done horizontally, reassembling of blocks to generate cropped videos will completely change the total number of blocks and the block structure, even if the number of rows removed is the multiple of 8. Due to this reason, the embedding watermark on individual 8 x8 block(s) is not reliable unless you know in advance which block(s) will be preserved by cropping. Unfortunately, this is often impractical [Juergen Seitz. 2005, Yulin Wang and Alan Pearmain.2006].

.

2.4 THE DROPPING OPERATOR

The effect of scaling and cropping is equally on each frame, whereas frame dropping is unequally on less significant frames for the scenes of the video[Yulin Wang and Alan Pearmain.2006].

3. PROPOSED METHOD

The proposed method is illustrated in **Fig.(1)**, where the original video is segmented into scenes, then the digital watermarking is divided into number of blocks according to the number of scenes. The goal of dividing the watermarking is for embedding each block of watermark in it's local scene (for more details **Fig.(2)** and **Fig.(3)** ,illustrate the embedding and extracting operations).

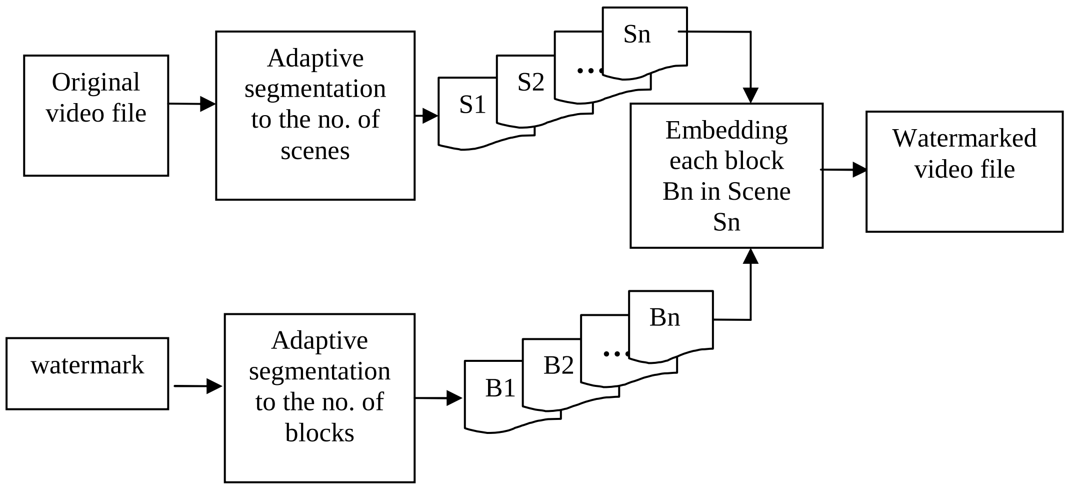


Fig.(1), block diagram of proposed method

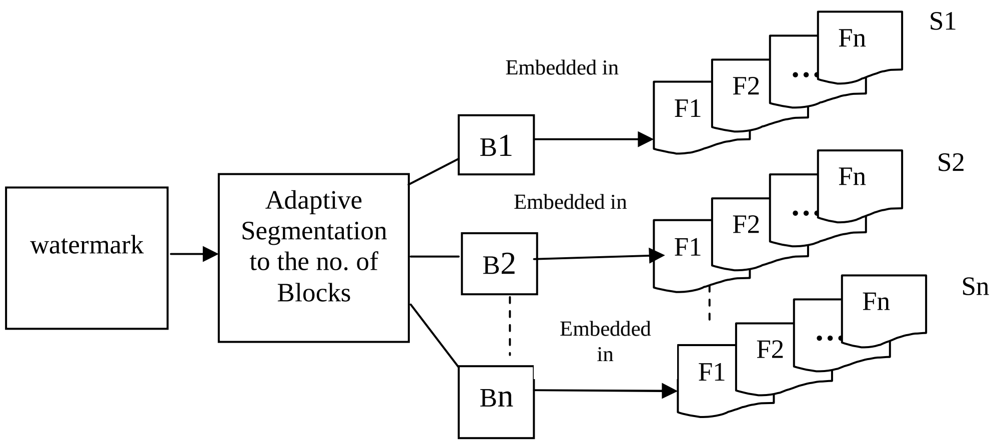


Fig.(2), essential operation of embedding each block of watermark in scenes of video

The algorithms of embedding and extracting is illustrated in Fig.(3) as below

```
                    (Embedding algorithm)
Divide the video into n scenes
Divide the watermark into n blocks according to the no. of  scenes
For i=1 to no. of  scenes
Begin
      For x=1 to number of  frames within scene (i)
      Begin
            Embed block no.(i) of watermark in frame(x) of
scene(i)
      End  for
End  for
                    (Extracting algorithm)
Divide the watermarked video into n scenes
For i=1 to no. of  scenes
Begin
      Extract block no.( i) of watermark from any frame of scene(i)
End  for
Collect all extracted blocks to reconstruct the watermark
```

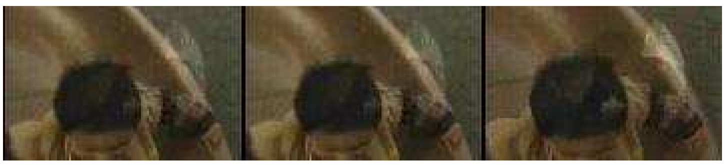
Fig.(3), embedding and extracting algorithms

3.2 ILLUSTRATIVE EXAMPLE

for illustrating the proposed method, let us take ***baby*** video. This video can be divided into five scenes, as shown in **Fig.(4).** So the watermark which will be embedded in it must be divide into five blocks according to the number of scene within video, as shown in **Fig.(5)**

Scene 1

Scene 2



Scene 3

Scene 4

Scene 5

Fig.(4), scenes of *Baby* video

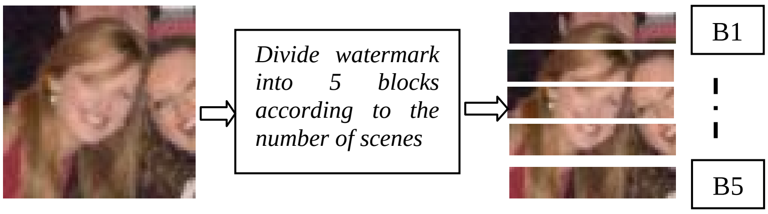


Fig.(5), blocks of watermark

After dividing watermark into 5 blocks, we shall embed these blocks in the scenes, according to the embedding algorithm block 1 will be embed in all frames of scene 1, block 2 will be embed in all frames of scene 2, … etc. **Fig.(6),** illustrates scenes of the watermarked video.

Scene 1

Scene 2

Scene 3

Scene 4

Scene 5

Fig.(6), scenes of *watermarked* video

4. RESULTS & DISCUSSION

1- In this proposed method, we don't focus on the embedding method itself but we focus on how can we embed watermark in video to be robust against frame dropping, so we can apply any embedding method.

2- After we embedded watermark, we dropped some frames from video arbitrarily, then we can extracted the watermark perfectly.

3- The watermark extraction is blind, i.e., no original unwatermarked video is needed for watermark extraction.

5- REFERENCES

-D. Kundur, K, Su, and D. Hatzinakos, "**Digital Video Watermarking: Techniques, Technology, and Trends,**" in *Intelligent Watermarking Techniques* , chapter 10, P. Pan, H. Huang, and L. Jain, eds., World Scientific Computing, pp. 265-314, 2004.

-G. Doerr and J. Dugelay**, "A Guided Tour to Video Watermarking," *Signal Processing: Image Communication* ,** vol. 18, pp. 263-282, 2003.

- G. Langelaar, I. Setyawan, and R. Lagendijk, "**Watermarking Digital Image and Video Data: A State-of- Art Overview**," *IEEE Signal Processing Magazine*, vol. pp. 20-46, Sep. 2000.

-Juergen Seitz"**digital watermarking for digital media** ", University of Cooperative Education Heidenheim, Germany, 2005.

-Yulin Wang and Alan Pearmain "**Blind MPEG-2 video watermarking Robust Against Geometric Attacks: A set of Approaches in DCT Domain**", IEEE Transactions on image processing, vol 15.No 6, 2006.

علامة مائية رقمية في ملف فيديو محصنة ضد سحب الإطارات

د.توفيق عبدالخالق عباس أسراء هادي علي ماجد جبار جواد

الخلاصة

أصبح استنساخ المنتجات الرقمية من الأمور السهلة، وعليه أصبحت أبحاث تقنيات العلامة المائية الرقمية التي تعمل في مجال حماية الملكية الفكرية من الأمور المهمة، وهنالك عدة طرق تم تقديمها في هذا المجال، ولكن تلك التقنيات يجب أن تكون قوية ضد الهجمات الهندسية (geometric attacks) على سبيل المثال التدوير(rotation)، قطع جزء من الغطاء الحاوي على العلامة المائية (cropping)، قطع إطار(frame) من ملف الفيديو الحاوي على العلامة المائية (frame dropping). لذلك تبقى أبحاث تقوية العلامة المائية (robustness) ضد الهجمات الهندسية من أصعب أبحاث العلامة المائية ليس فقط في الملفات الفيديوية ولكن حتى في جميع أنواع الصور الثابتة.

في هذا البحث تم تقديم طريقة لإخفاء علامة مائية رقمية في ملف فيديو وذلك من خلال تقسيم العلامة المائية إلى كتل (Blocks) اعتمادا" على تقسيم ملف الفيديو إلى عدد من المشاهد (Scenes)، ثم إخفاء أي كتلة من العلامة في إطار مشاهد الملف، وبعد إجراء عملية الإخفاء تم اختبار قوة الطريقة المقترحة من خلال إلغاء عدة إطارات (Frame Dropping) من الملف الحاوي على العلامة المائية وبصورة عشوائية، وبعد استرجاع تلك العلامة لم تتأثر بعملية إلغاء الإطارات والمقياس لذلك هو إيجاد PSNR للعلامتين.