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Secure Video watermarking Algorithm Using K-harris feature point detection with dual watermarks

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Abstract- Now days, cyberspace and compression technology allow the well-known use of multimedia applications. Digital watermarking technique is a process of embedding an unperceptive signature or a copyright message such as an image or signature into a video. The advantages of watermarking are due to its imperceptibility and robustness. This paper proposes a best technique for content-based watermarking based on feature points of a video. At each feature point, the watermark is embedded after scale normalization according to the local characteristic scale. Characteristic scale is the highest scale of the scale-space representation of an image at the feature point. Dual Watermarks increases the robustness of the Watermarked Video. The experimental results show that the presented scheme guarantees high peak signal to noise ratio (PSNR), low mean square error value(MSE), low Bit Error Rate (BER).

Keywords- K-Harris, Feature point, video watermarking, BER , PSNR, MSE, Robustness.

INTRODUCTION

Video watermarking is a technology that has been provided a platform to deal with the crisis of illegal manipulation and sharing of digital video. It is the procedure of embedding copyright information in video bit streams. The watermark is encoded by both the error correcting codes and the spread spectrum technique to improve the detection accuracy and ensure a large measure of security against unintentional or intentional attacks. As per the human perceptions, there are two types of digital watermarks whether the watermark is visible or invisible to the casual viewer. In order to be effective, the watermark should have the following properties, according to [1], be:

Unobtrusive

The watermark should not be perceptually visible.

Robust

The watermark should not be possible to eliminate even if the algorithmic or technique principle of the watermarking method is public.

Unambiguous

The extracted watermark should identify the copyright owner of the data or content, or in case of fingerprinting applications, the authorized recipient of the data or content. The reason is absolute simple: if the watermark was embedded in perceptually

insignificant areas, it would be possible to eliminate it without quality degradation of the cover data or content.

This paper presents a robust and imperceptible video watermarking algorithm using K–harris point detection. In this algorithm, watermark bit data is embedded in the transformed video in a blocks-wise fashion. The performance of the proposed algorithm is evaluated with respect to robustness and data payload. This algorithm shows similar imperceptibility but high level of robustness. However their performance varies with respect to robustness. The block-wise algorithm gave higher data payload rate. This paper presents a content-based digital video watermarking scheme, which is robust against a variety of image-processing attacks and geometric manipulations. The image content is represented by significant feature points obtained by image texture based adaptive Harris corner detector.

PERFORMANCE METRICES

In order to find the imperceptibilty and robustness of the watermarked video, quality parameters such as PSNR,MSE,BER are evaluated.

The notions used are shown below:

X(i , j) :Original video

Y(I , j) : Watermarked video

Nof : Size of video

Mean Square Error (MSE)

Mean Square Error is calculated between original and watermarked video is calculated as follows:

$$MSE=\frac{1}{Nof}\sum_{i,j}[X(i,j)-Y(I,j)]^2$$

Peak Signal to Noise Ratio (PSNR)

PSNR is calculated between the original and watermarked video. Better the PSNR value, more similar is watermarked video to the original video. The video quality parameter is defined in decibels as:

$$PSNR=10\log_{10}\frac{255*255}{MSE}$$

Bit Error Rate (BER)

This performance metric is appropriate for random binary sequence watermark. This parameter is defined as ratio between numbers of incorrectly decodes bits (DB) and length of the binary sequence (NB). BER indicates probability of incorrectly decoded bits. It is defined as follows

$$BER=\frac{DB}{NB}$$

PROPOSED ALGORITHM

In the proposed algorithm (implemented using matlab), A blind, robust and imperceptible video watermarking algorithms based on K-harris feature point detection. This algorithm embeds the watermark in the transform-domain YCbCr space thus spreading the watermark in each frame of the video. The algorithm suggests hiding watermark information in a 3*3 matrices.

This algorithm includes two backbones to structure a fully system which are watermark embedding and watermark extraction procedures. Finally, a well-known concept is that k-harris point detection can efficiently embed watermark and human vision cannot distinguish the image has be changed. Due to point detection has self-similarity property which can cooperate watermarking. Graphical user interfaces (GUI) will tells about complete water mark procedure which will work as an efficient way to implement proposed algorithm.

GUI FLOW CHART

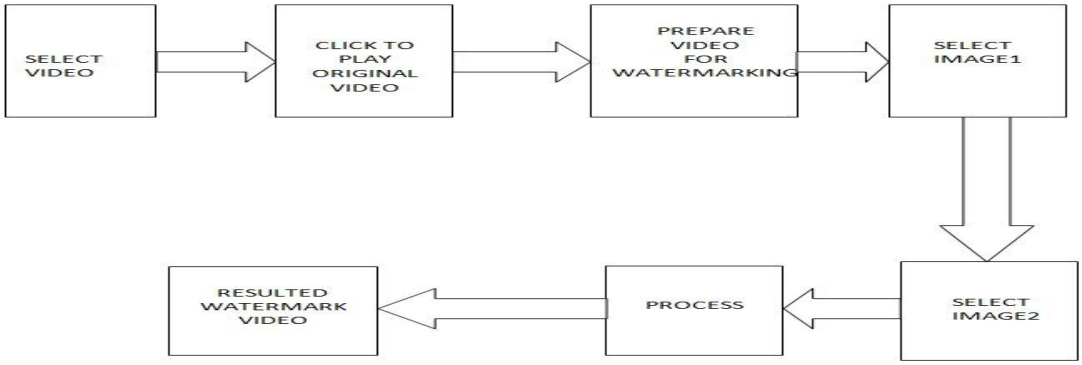

Fig 1: Graphical User Interface (GUI) for flow chart

Watermark Embedding Procedure

The embedding procedure of the algorithm, it is described in details in the following steps:

Step 1: Divide the video clip into video frames.

Step 2: Process the frames of each video scene using block division described in steps 3 ~ 9 below.

Step 3: Convert every video frame F from RGB to YCBCR color matrix format.

Step 4: Do the block division process for the S matrix in each frame F. This operation generates 3*3 matrices.

Step 5: Rescale the watermark image so that the size, of the watermark will counterpart the size of the matrix which will be used for embedding S.

Step 6: Embedding can be done in one of 3*3 matrices frames.

Step 7: Convert the video frames F' from YCBCR to RGB color matrix.

Step 8: Reorganize frames into the final watermarked Video frames.

Step 9: Reconstructed watermarked frames to get the final watermarked Video.

Block division is a numerical technique for dividing the watermarked image into 3*3 matrices in which the transformed domain consists of basis states that is optimal in some sense. The block division of an S= N x N matrix, a frame image is treated as a matrix decomposed into the three matrices.

Figure 2: Graphical User Interface (GUI) for watermark-embedding Procedure

Watermark Extraction Procedure

Input: Watermarked video frame

Output: Recovered watermark.

Step 1: Video frame pre-processing

Step 2: Watermark extraction unit

The first step is to extract the piece number of the watermark from the frames. Due to noise, these numbers may have been distorted. Therefore, the piece number is set to be the number whose frequency is more than the threshold.

There are some pieces of information stored during the embedding process such as durations of the group of frames. Based on the information, the following procedure is applied to extract the watermark:

1. Split video sequence to group of frames.
2. Apply the following algorithm in frames.
    a. Convert NxM RGB frames to YUV.
    b. Compute the frequency domain of the luminance layer (Y) for each frame.
    c. Extract the binary visual watermark from the middle frequency bands.
3. Collect all the watermarked portions, and output is the watermark image.

Significance of dual watermarks

Using single watermark image are very slightly visible in nature, to overcome that we use dual watermarks. As we know, the intensity of a pixel is expressed within a given range between a minimum and maximum. This range is represented in an abstract way as a range from 0(total absence, means black) and 1 (total Presence, means White) with any fractional values in between. In this presented Research, when the combination of white and black watermarks used as Image1 and Image2, It results in Invisible Watermarked Video which improves the Imperceptibility of the video.

EXPERIMENTAL ENVIRONMENT AND RESULTS

This represents the simulation part using K-Harris feature point detection with dual watermarks. The performance parameters are evaluated using video and watermark of properties:

Table 1: Video Properties

S. No.	Property Name	Property Value
1	Video Name	hello_xvid.avi
2	Video Duration	49 seconds
3	Frame Rate	25frames/sec
4	Total Number of Frames	1224
5	Video Format	RGB

Table 2: Watermark Properties

Test Watermark	Type	No. Of Pixels of Watermark image(HxW)	Size of Watermark
Watermark_1	.JPG	99*96	4KB

Table 3: video watermarking quality parameters with watermark1

Performance Parameters with Watermark_1 and video frame Size (272x480)	Values after embedding of watermark
MSE mean square error	0.0147
PSNR peak signal to Noise ratio	69.6811dB
BER Bit Error Rate	0.0127

CONCLUSION AND FUTURE DIRECTIONS

A novel video watermarking algorithm is implemented and experiments are conducted for watermark embedding using MATLAB 7.8.0 version. In this paper, interest points in K-harrsis feature point detection are employed in the video watermarking. Applying K-harris method to video watermarking is beneficial to locate the embedding frame index and coordinates, which improves the robustness resisting against both spatial and temporal attacks efficiently. The quantization scheme realizes the blind extraction meeting the requirement for video watermarking. The experimental result shows that the proposed scheme preserves not only the high perceptual quality, but also is robust against various kinds of attacks. The key idea of the proposed algorithm is the combination of the k – harris feature point detection algorithm and watermarking algorithm, the performance of K-harris detection scheme influences the performance of the whole scheme greatly. Dual watermarks improve the imperceptibility up to great extent which also increases the robustness.

Future work is to focus on the attacks like color gray scale conversion, cropping that has not been considered yet.

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