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Easy Search Method of Suspected Illegally Video Signal Using Correlation Coefficient for each Silent and Motion regions

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Abstract. Motion picture distribution has been great increase of content, the copyright infringement measures are becoming increasingly important. In this paper we propose a simple moving image retrieval method. The method divides the motion region and a static region by using a mhi image. Due to check the similarity of target video and original video, it uses the correlation coefficient of mhi image for motion region, and uses the correlation coefficient of the static image for the silent area. Computer simulation is carried out to show the effectiveness of the proposed method.

Keywords: digital watermark, video search, mhi, static and dynamic region division.

1 Introduction

Recently portable information terminal has a built-in high-performance camera, so not only still images but moving image signals came to distribution through the Internet, by many uploading and downloading. With above change in the situation, even for motion image signal, anti-piracy is becoming increasingly important. As a countermeasure of this copyright infringement there are authentication and digital watermark. At the certificate authority, it is proved that the content belongs to the copyright holder, but it does not find the unauthorized copy on the Internet. Therefore, the copyright owner needs to find his own illegal copy on the Internet by himself. Digital watermarking is a technology for the digital content embedding information so that it can not be perceived for humans. And the techniques for motion video signal has been studied.[1-4] In a typical digital watermark, since the complex embedding technique is used for resistance to the attack, a number of computational amount is required for embedding and extraction of watermarking data. Therefore, it is very difficult to find the illegal copy from a large amount of content on the Internet. On the other hand, from the past, also, including the future, the number of the proposed digital watermarking technology is so much. So there is very big stress that individual digital

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watermark technology, to explore the illegal copy from a large amount of content on the Internet.

The authors, in place of the digital watermarking technology providers have proposed a simple image search method of detecting pirated candidates not related to individual digital watermark technology. In the moving image contents, it is important to the properties of both characteristics of the motion and the static regions. In this paper, by using the mhi (motion history information) image, is divided the dynamic region and a static region, we propose a method of utilizing the individual characteristics.

2 Search Method for Still Picture[5]

To address the piracy image which attacks on the peripheral region of the original image, it is required how to ignore the area attacked. In general, the ornament process is often done at not only near the edges of the upper and lower left and right, but particularly corners parts.


(a) Sample of ornament[12] (b) Proposed mask image

Fig.1 Proposal of use of mask image for ornament attacks.

So we proposed a search method that uses the oval mask image. The mask image is used for both the original image and the search target image, and determines the pixels to be used for voting in the calculation of the histogram of pixel values which is included in the oval mask. By using the mask image can be made to eliminate the influence of change in pixel values on the peripheral region.

The experiments were conducted in the case of ornament, rotation and scaling attack at the same time.

Table 1 shows the experimental results. In Table 1, (a) is the original image. (c), (d) and (e) are attacked images enlarged to twice its sides of the original image (a), and rotated 30 degrees clockwise. The image (d) has been decorated, and (e) framed

Table 1. Experimental results rotation and scaling attak

Image name	(a)Original image	(b)Mask image	(c)Unornamented image	(d)Decorated image	(e)Framed image
Images[6]					
Scaling factor	1	(1.999)	2(1.999)	2(1.999)	2(2.0675)
Rotation angle	0	(30)	30(30)	30(30)	30(30)
Image size	192x128	(466x418):for Decorated (482x433):for Framed	466x416 (466x418)	466x416 (466x418)	478x430 (482x433)
Correlation coefficient			0.9984	0.9916	0.9916

in particular. (b) is the produced mask image. Scaling factor and rotation rate in Table 1 are the values used to create the image attack. Each image sizes are as shown in Table 1. In row of the correlation coefficient shown in Table 1, the values show the calculation results of the correlation coefficient by normalized histograms obtained for each attack images to the original image.

The method, which delete the attack area by this mask image, has suggested the possibility of a study about stationary area after removing the dynamic region.

3 Motion Search Method Using HMI

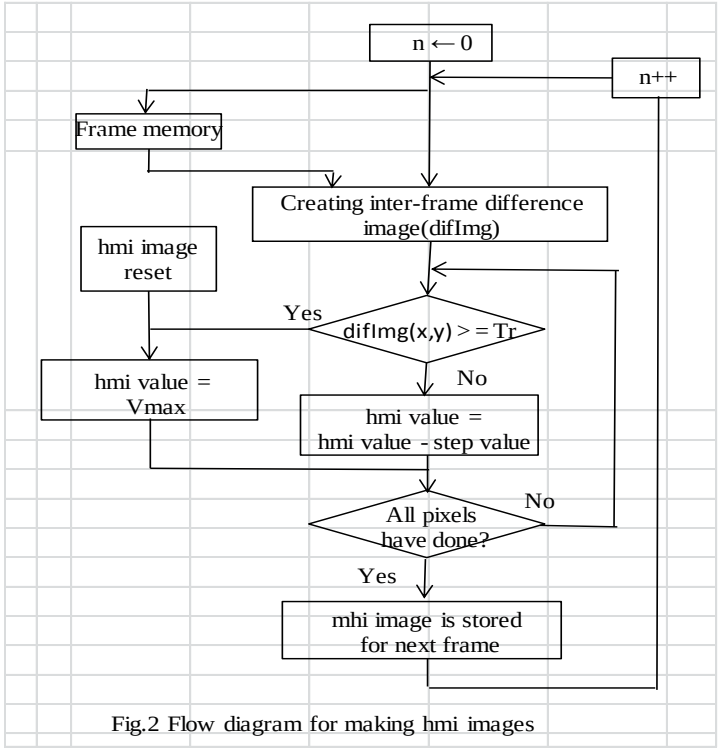

Fig.2 Flow diagram for making hmi images

Fig 2 shows the flow diagram for making mhi images. First hmi image is reset by 0 by off-line processing. Inputting each frame from the input video sequence, inter-frame difference image (hereafter says as difimg) is created between two successive frames. If difimg(x,y) is equal to or larger than the threshold Th, hmi value is set to Vmax (here 255) as the pixel is at the moving region. In case of less than the threshold value Th, the hmi value is subtracted by step value from the hmi value. If the value is negative it is limited to 0 value.

When the processing of all pixels of the frame is completed, to capture the next input image, it performs the same processing, creating hmi image sequence. In the fig.3, (a) is an image of No.116 frame from original video 30 frames

sequence(Salesman)[8], and (b) shows an example of hmi image created by the video sequence. In the image(b), white (255) is the pixel determined as motion area just occurred. Areas of gray level close to black show that it is silent area or was moving area before. Black(0) shows that it was a still region from the beginning or became silent area at the moment though there has been a past movement.

The maximum motion history is (Vmax / step value) from Vmax to zero. If Vmax is set to 255, and step value set to 2, then the maximum motion history become 127 frames.

4 Proposed motion Video Search Method

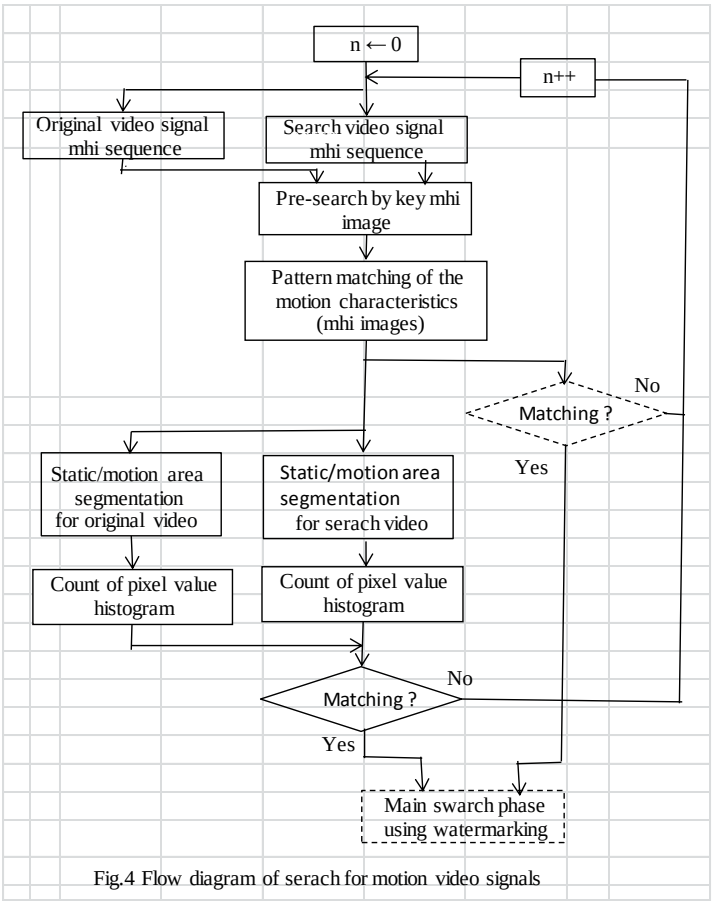

Fig.4 Flow diagram of serach for motion video signals

A flow diagram of the proposed motion video search method is shown in Figure 4. In the figure, first, it is created an original video signal hmi sequence by preparatory step, through off-line. As a first flow, it is created search video signal mhi sequence to

search for the motion video. In this case, each parameter has the same value as in the original video. Then, a key frame mhi image is selected from the original moving which shows proper characteristics.

Pre-search is carried out using the key mhi image in the target moving picture sequence.

If a matching frame can not be found, it is determined not to be a copy image. If a match is found, re-check from the beginning of the sequence is carried out to confirm to be a copy image.

Next, using the mhi image of key frame, the dynamic/silent area division is performed. From here, a check of the stationary area is started. Figure 5 shows

a. Original image b. MHI image

Fig.3. MHI image No,116 frame of salesman video sequence.[8]

Fig.5. Silent area image **Fig.6.** mhi + Silent area

a still areas of interest. Using Fig.4 (b), the motion characteristic is searched between the original video sequence and target video sequence, and using Fig(5) the silent area characteristic is searched between the original and the target sequences.

For these search, computer simulation is carried out that correlation coefficient between original sequence and target sequence is calculated.

Table.2 Correlate coefficient between characteristics of each arear of test sequences. a:mhi+silent area, b:mhi image, c:silent area, Image size :144 × 176, Test frame : No.116 of 30frames.

Test video		Salesman	Silent	Grandma	Miss-america	Akiyo
Salesman	a	1	0.2813	0.4655	0.4539	0.3365
	b	1	0.476	0.4483	0.4247	0.401
	c	1	−0.2832	0.6462	0.7676	0.7436
Silent	a	0.2813	1	0.273	0.1494	0.2198
	b	0.476	1	0.415	0.2635	0.3453
	c	−0.2832	1	0.3195	−0.2252	−0.0888
Grandma	a	0.4655	0.273	1	0.3347	0.2232
	b	0.4483	0.415	1	0.386	0.4989
	c	0.6462	0.3195	1	0.3213	0.3795
Miss-america	a	0.4539	0.1494	0.3347	1	0.4399
	b	0.4247	0.2635	0.386	1	0.3602
	c	0.7676	−0.2252	0.3213	1	0.6235
Akiyo	a	0.3365	0.2198	0.2232	0.4399	1
	b	0.401	0.3453	0.4989	0.3602	1
	c	0.7436	−0.0888	0.3795	0.6235	1

Table 2 shows the experimental results. Row (a) in the table shows the correlation coefficient for the image of Fig.6 which includes both motion area and still area at the same time. Row (b) shows the correlation coefficient of mhi image shown in Fig.3(b), and row(c) shows the correlation coefficient of silent area image shown in Fig.5. The result of correlation coefficient is 1 for only between same image sequences.

5 Conclusions

We proposed a simple search method for video content that is suspected of illegal copy to original video content. First, using the hmi image representing the motion characteristics of the image, divides the moving region and still region. We examine the similarity of the search object content and original content to each individual area. We use a correlation coefficient of the mhi characteristics for dynamic area, and a correlation coefficient of still area. The experimental results showed the effectiveness of proposed method.

In the near future, including the optimization of the parameters, it is planned to study in more detail.

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