공간 및 프레임간 정보를 이용한 비디오 워터마크와 시스템 구현에 관한 연구

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System Realization and Video Watermark with Spatial and interframe Information

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요 약

본 논문은 비디오 워터마킹 알고리즘을 적용한 비디오 시스템 구현에 관한 것이다. 시스템은 압축 알고리즘과 워터마킹 알고리즘을 실시간으로 처리하기 위해 DSP 프로세서를 기본으로 하여 구성하였다. 비디오 워터마킹 알고리즘은 공간영역과 프레임간의 정보를 이용하여 워터마크를 삽입하는 방법을 사용하였다. 실험결과, DSP에서 D1 영상 한 프레임 당 처리 시간이 약 32.1ms 소요되었다.

ABSTRACT

System realization and video watermarking using spatial and interframe information is presented in this paper. The system is constructed with DSP processor to process compression and watermark algorithm with real time. Video watermark algorithm is used the watermark insertion using the spatial and interframe. As a results, the processing time of D1 image per frame is 32.1msec in DSP.

Keywords

Video Watermark, DSP, Video System, Spatial, Interframe

Ⅰ. Introduction

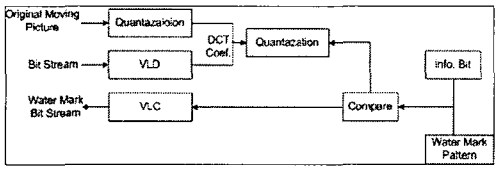
Recently, A large amount illegal reproduction is increasing because various multimedia service and developing internet. The copyright problem came out because of the illegal reproduction. So, necessity of the security system technology is incrementing for protection of the stabilization, confidence, copyright of multimedia contents and progressing encoding research of digital data in association with necessity of the security system technology. The research about protection of digital data was processing using watermark technology among the method of encoding of digital data. Digital watermark technology has protected digital data effectively by the method of hidden special code value in multimedia data. Now, All digital data of image and audio is applying watermark technology.[1-6] This paper implements real time video system that inserting and compressing video watermark using spatial and interframe

Ⅱ. System realization

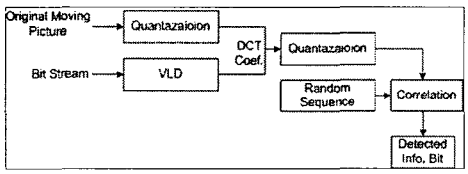
2-1. Watermarking

Watermarking is inserting watermark to digital

data and executing after compression in video system. The method of watermark is insetting space and frequency domain for compressing data. In case of inserting space domain, the advantage is available insert simply and various watermark information to original image. As compression image insert to watermark, the weak point is steam size bigger than original image, In case of decoding image, occur the loss of original image and watermark. And the watermark be remove and change by easy filtering and a transformation of signal. To make up for this weak point, insert to frequency domain.



(a) Watermarking insertion



(b) Watermarking extraction

Fig 1. Watermarking insertion and extraction

Fig.1 is the block diagram about insert and draw out watermark for DCT processing. The process of inserting watermark is processing DCT the original image and calculate the DC coefficient first thing, in case of bit stream, calculate the DC coefficient by VLD(Variable Length Decode). And quantize the calculated DC coefficient. Compare the quantized DC coefficient with watermark bit and change to same value and insert to watermark simply. Like this, the abstracting process is similar the inserting process. DC coefficient obtained from VLD in the bit stream, and in case of the original image, DC coefficient procure from quantizing the DCT to bit stream, and quantize them into same size and calculate the correlation. This method often use extremely because can insert to watermark. In case of MPEG compression algorithm, the insertion method of watermark is inserting watermark later converting DCT by macro block units. At this time, MPEG frame is I, B, P frames and construct to the stream data. From here it uses only the I frame where the data loss is little and it inserts only the intra block to B, P frames where the data loss is little.

2-2. System architecture

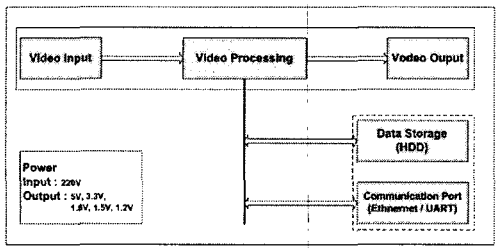


Fig 2. Video System Block

In general, the construction of video system makes up the module that receive the signal and process the algorithm and the module that store the compressed data and transmitted data like Fig. 2. is general video system block. The construction of signal processing module inputs the created analog signal from camera and microphone to the video and audio decoder like Fig. 2. Video and audio decoder sampling the input data and to make digital data. DSP processor process the inserted digital data as the preprocessing of video and audio. After, the video and audio data compress that is applied compression algorithm and video watermarking algorithm. The large operating routines convert to assembly code that is adapted processor and the code realized the soft pipeline code in MPEG4 algorithm and video watermarking algorithm

III. Experiment and Results

Fig. 3 is shown the board's picture that implemented video system in this paper. This system is implemented the MPEG4 compression

algorithm and video watermarking algorithm. The camera input image used the D1(720 x 480) frame.

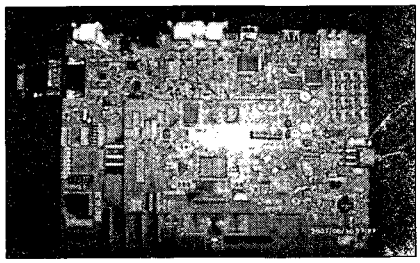
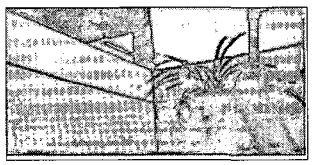


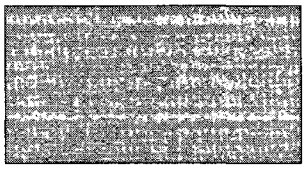
Fig 3. Video system

The experimental image is used the stop image and the moving image that have 60% movements. Experimental results, The table 1 is shown the processing time when compress one frame by MPEG4 and input watermark and decoding image and abstracting video watermark. The processing time that inserting and abstracting video watermark is 2.0ms like table 1. Therefore, the user have to reduce the processing time of MPEG4 algorithm and watermarking algorithm for process the encoding and decoding at once.

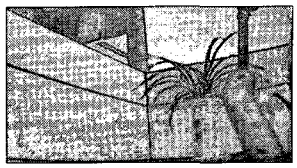


(a) Original image

(b) Insertion image



(c) Watermarking image



(d) Reconstructed image

(e) Extracted image

Fig 4. Firm object moving image

Table 1. Experimental results

Coder / Image	Firm Object	Moving Object(60%)
Encoder		
Preprocessing time	1.5ms	1.5ms
MPEG4 compressing time	12.3ms	19.3ms
Video watermarking inserting time	0.6ms	0.9ms
Postprocessing time	0.4ms	0.4ms
Frame/second	**14.8ms**	**22.1ms**
Decoder		
Preprocessing time	0.4ms	0.4ms
MPEG4 reconstructing time	5.0ms	8.1ms
Video watermarking extracting time	0.8ms	1.1ms
Postprocessing time	0.4ms	0.4ms
Frame/second	**6.6ms**	**10.0ms**

IV. Conclusion

This paper presents the real time system applied video watermarking algorithm to the video system with spatial and interframe. Experimental results, the processing time that inserting and extracting video watermark takes round 2.0ms on the 60% moving image. This result leads to realize real-time video system because of 32.1ms totally processing time for one frame. However, in case of moving image time 60% over, the system needs optimizing algorithm and improvement more to be increased MPEG4 processing time for fast real time video system realization.

References

[1] Hartung F. and B. Girod, "Watermarking of Uncompressed and Compressed Video", Signal Processing, vol. 66, no. 3 (Special issue on Watermarking), pp. 283-301, May, 1998.

[2] Lintian Qiao and Klara Nahrstedt, "Watermarking Methods For MPEG Encoded Video: Towards Resolving Rightful Ownership", IEEE IC on Multimedia Computing and Systems, Austin. Tx., pp.276-285, June 1998.

[3] Wu T.L. and S.F. Wu, "Selective Encryption and Watermarking of MPEG Video", in proceeding of International conference on Image Science, Systems, and Technology, June, 1997.

[4] M.D. Swanson, M. Kobayashi and A. H. Tewfik, "Multimedia Data-Embedding and Watermarking Technologies," Proc. of the IEEE, Vol. 86, No.6, pp.1064-1087, 1998

[5] Ja-Hwan Kim, Kwang-Ryol Ryu, "Real-time DVR System Using Video Watermarking", KIIT. 2005

[6] Ja-Hwan Kim, Kwang-Ryol Ryu, "A Study on the DVR System Realization with Watermarking and MPEG-4 for Realtime Processing Speed Improvement", KIMICS, 2005