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Document AVC-279

SOURCE : Japan
TITLE : Cell-loss compensation scheme
PURPOSE : Information

1. Introduction

Cell-loss resilience is one of the most important requirements for the next coding algorithm, that will take the communication services over ATM networks into account (ATM profile ?). A cell-loss compensation scheme, which consists of structured packing, leaky prediction and concealment at the decoder, was introduced at this past meetings in Stockholm and Haifa (AVC-235, MPEG92/184). In this document, the proposed scheme was installed into a TM1 based coding algorithm and evaluated through computer simulation.

2. Cell-loss compensation scheme

The proposed cell-loss compensation scheme is composed of three elements as follows:

(1) Structured packing

To minimize the effect of cell loss, a structured packing method that uses a Macro block Start Pointer(MSP) and an Absolute Block Address (ABA) is introduced (see Figure 1). Furthermore, for the first MB in a cell, absolute coding is used for the motion vector and for dc-components of the INTRA coded blocks. These items need to be standardized, if adopted. In addition, "cell-phase" information which indicates the timing between the user data and the AAL structures must be defined as a primitive at the AAL type 2/user interface.

(2) Leaky prediction

A leakage factor is inserted in the coding loop for recovery after a cell loss. This item also need to be standardized, if adopted.

(3) Concealment at the decoder

The lost MB is replaced by a MB in the previous picture using the average of the motion vectors of the two adjacent MBs. The MB above and

below are used, since horizontally adjacent MB's may also be lost (see Figure 2). This item may not require standardization, but would improve the recovery performance of leaky prediction.

3. Computer simulation

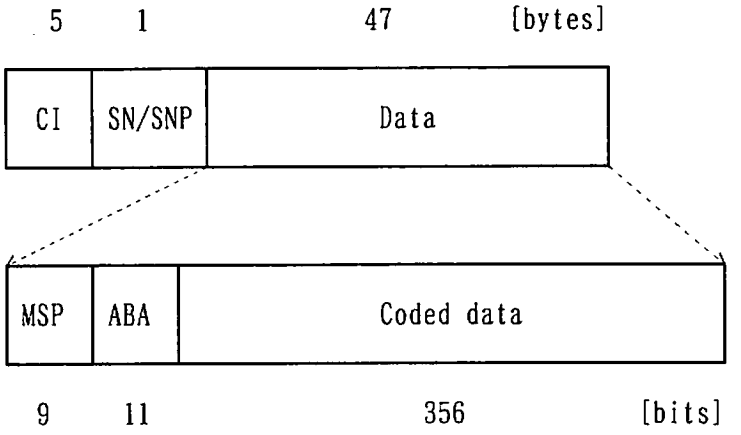
Computer simulation was performed using the scheme described above, installed in TM1 with low delay mode (M=1). The simulation conditions were as follows.

- Picture format : 4:2:0
- GOP structure : M=1, N=150 (IPPPP....)
- Picture structure : Frame structure
- Prediction method : Adaptive frame/field
- Leakage factor : 0.95
- Mean cell-loss ratio : 10^{-3}
- Mean burst of cell loss : 2
- Overhead for cell assembly : 20 bits (MSP and ABA)

The cell-loss generation process was based on the method described in the documents AVC-205 and MPEG92/027. For comparison, another low delay coding mode, described in Appendix H of the TM1 document, was also simulated. Tables 1 and 2 show the simulation results of each method. According to these results, structured packing improves the SNR of the reproduced picture by up to 2.2 dB at 4 Mb/s and up to 4 dB at 9 Mb/s in the case with cell loss. As for leaky prediction and concealment, the improvement is evident in Flower Garden (up to 2.8 dB at 4 Mb/s and up to 5.5 dB at 9 Mb/s), but not in Mobile & Calendar. Subjective evaluation of the reproduced picture gives the same result, and degradation due to cell loss is hardly noticeable using the proposed compensation scheme, even in the severe cell-loss condition that was simulated. Some of the reproduced pictures will be demonstrated by VCR at the meeting.

4. Conclusion

The proposed cell-loss concealment method was installed into TM1 and evaluated through computer simulation based on a detailed cell-loss experiment specification. The results indicate that the scheme is effective not only for RM8, but also for the TM1 based coding algorithm, especially for sequences in which the effect of cell loss is obvious.



CI : Cell Identification byte (AVC-205, MPEG92/027)
SN : Sequence Number (AVC-205, MPEG92/027)
SNP : Sequence Number Protection (AVC-205, MPEG92/027)
MSP : Macro block Start Pointer
ABA : Absolute Block Address

Figure 1 : Adopted structured packing method

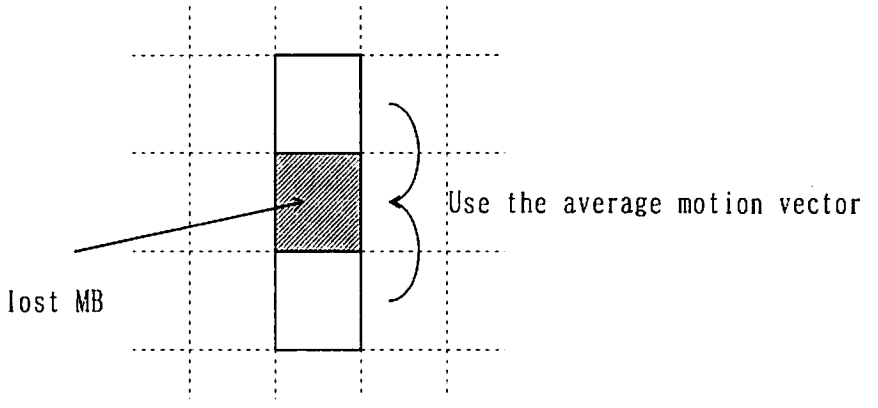


Figure 2 : Reference motion vector for lost MB

Table 1: Computer simulation results for Flower Garden

			Average SNR [dB]		
			I P mode	Low delay mode	I P mode + compensation
4 Mb/s	No cell loss	Without SP	28.73	28.20	28.18
		With SP	28.37	27.85	27.80
	With cell loss	Without SP	24.94	26.09	27.73
		With SP	27.10	27.41	27.66
9 Mb/s	No cell loss	Without SP	33.54	33.05	33.14
		With SP	33.10	32.64	32.73
	With cell loss	Without SP	24.52	27.60	30.01
		With SP	28.50	30.63	32.21

SP : Structured Packing

Table 2: Computer simulation results for Mobile & Calendar

			Average SNR [dB]		
			I P mode	Low delay mode	I P mode + compensation
4 Mb/s	No cell loss	Without SP	26.38	25.89	25.68
		With SP	26.10	25.62	25.39
	With cell loss	Without SP	25.31	25.30	25.59
		With SP	25.75	25.42	25.30
9 Mb/s	No cell loss	Without SP	30.62	30.19	30.15
		With SP	30.29	29.83	29.85
	With cell loss	Without SP	27.55	28.49	29.23
		With SP	29.39	29.46	29.59