

SOURCE : JAPAN

TITLE : SEGMENTATION TRICK TO IMPROVE STRUCTURED PACKING EFFICIENCY
OF CODED VIDEO SIGNALS

PURPOSE : Information

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One good candidate for a cell loss recovery scheme is a structured packing method where structures of coded video signals are taken into account, and quick recovery of video data synchronization is achieved by aligning the video data boundary with a cell boundary at a certain period. In this method, transmission efficiency and deteriorated area size in decoded pictures caused by cell loss are in a trade-off relation. In this contribution, a new cell segmentation method for coded video signals is presented which can reduce picture damage caused by cell loss while maintaining high transmission efficiency. The detailed segmentation algorithm is described in the attached ANNEX. It should be noted that although the segmentation algorithm itself is not a matter of standardization, the cell packing structure such as presented in Fig.1 must be standardized which requires cell boundary information.

Detailed Algorithm of Coded Video Data Segmentation

1 Structured Packing Scheme

An example of the structured packing method which was adopted for simulations in this ANNEX is shown in Fig.1. In ATM video transmission, it is desired that the influence of cell loss be localized within a small picture area and no artifacts appear in the decoded picture. From this viewpoint, the conventional synchronization system using unique words is not preferable because loss of a unique word damages all picture data covered by that unique word. Since unique word bits are relatively long, transmission efficiency will fall when the covered data length is shortened.

The method makes use of cell synchronization as a coded video signal synchronization. Cell synchronization has merits in reliability and overhead information if we compare it with the conventional unique word method. Further, since the cell bit length is usually much shorter than one coded picture frame, fast recovery of end-to-end signal synchronization is achieved, and the effect of a cell loss is localized in the decoded picture.

In Fig.1, P (integer) cells are treated as a transmission unit, and coded data of independently coded picture blocks are packed into one transmission unit until the next data exceeds the unit. The first data in a unit is specified by an absolute address (AA) in a picture frame, while other data can be specified by a more effective relative address (RA). At the head of each cell except the first one, a special code (CI) is attached which indicates the continuation of a cell. At the end of the data in the last cell, another special code (EOI) is added which indicates the end of effective data followed by fill bits. Here, picture data including side information such as motion vectors and quantizer indices are coded independently.

Using the above packing scheme, the effect of cell loss is limited to one transmission unit by discarding received cells until an absolute address is detected at the head of a cell. In addition, since it can prevent a decoder from receiving an erroneous bit-stream, artifacts will not appear in the decoded picture. This method can therefore easily be combined with any picture concealment scheme to increase decoded picture quality[1]. The delay caused by P -cell-packing is equivalent to that of one-cell-packing. Further, the number of coded data in one transmission unit can be limited by using an End-Of-Data code, which is effective to reduce packing delay when the coding bit rate is low.

2 Improvement of Transmission Efficiency

In this scheme, the transmission efficiency and the number of picture blocks damaged by a cell loss are in a trade-off relation. When the relation between the video data block boundary position and cell boundary position is considered in the actual packing process, however, both boundaries may be close to one another with a certain probability. In this case, if the video data boundary is located before the cell boundary, the short average length of the transmission unit and small amount of inserted fill bits are both achieved by truncating the transmission unit at the present cell. This can be realized as follows:

- (1) Video data units are packed into a cell until the transmission unit length exceeds p .
- (2) If the position of the currently packing cell is n or more in a transmission unit and the number of resilient bits in the cell is r or less, then the transmission unit is truncated at the current cell.

Here, n and r are prepared for preventing the transmission efficiency from falling due to overhead bits such as fill bits, and p is for preventing the picture area damaged by cell loss from becoming large.

3 Simulations

The characteristics of the method have been analyzed by simulations using actual TV program pictures in a CIF format coded by the source coding part of the CCITT H.261 algorithm with a constant step size of 6. p is set at 7 in order to obtain a transmission efficiency of around 0.95.

Fig.2 and Fig.3 show the relation of the average length of a transmission unit and transmission efficiency to r respectively. The average length of a transmission unit decreases as r increases and n decreases, while the transmission efficiency first increases and then decreases as r increases.

Thus, the average length of a transmission unit can be shortened both by r and n . Fig.4 shows the relation between the average length of a transmission unit and transmission efficiency. The figure indicates that the transmission unit can be effectively shortened by setting n at a smaller value and setting r as large as the required transmission efficiency is maintained. Further, the transmission efficiency achieved by the proposed method falls less than in the conventional segmentation method ($r=0$) indicated by the broken line in the figure.

Fig.5 shows the improvement of the transmission efficiency compared with the

conventional method. The figure shows that the transmission efficiency is improved especially when the average length of a transmission unit is short.

4 Conclusion

In the structured packing method, a new cell segmentation scheme for coded video signals is presented which can reduce picture damage caused by cell loss while maintaining high transmission efficiency.

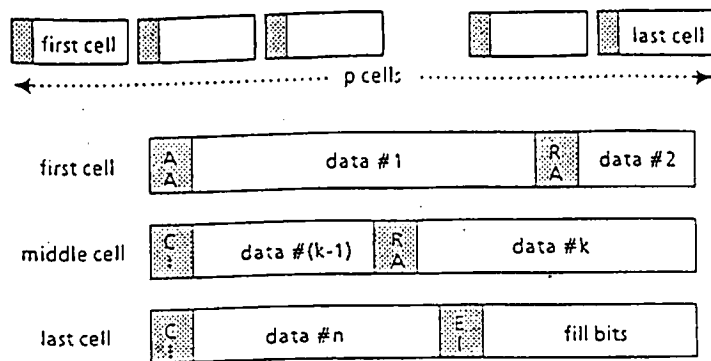


Fig.1 Packing structure

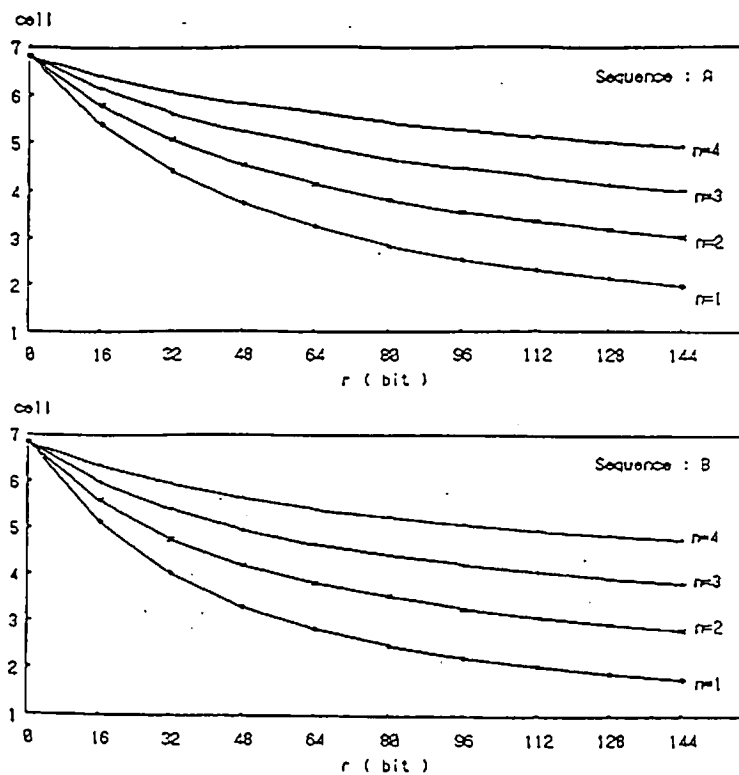


Fig.2 Average transmission unit length

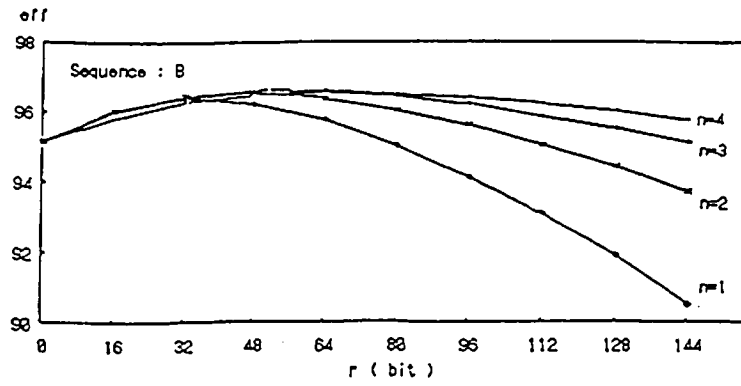
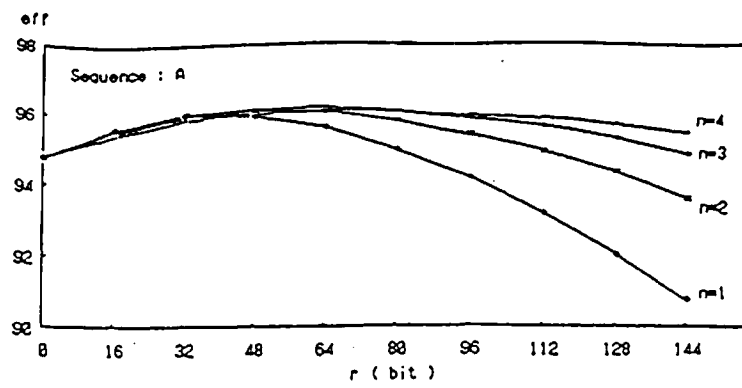


Fig.3 Transmission efficiency

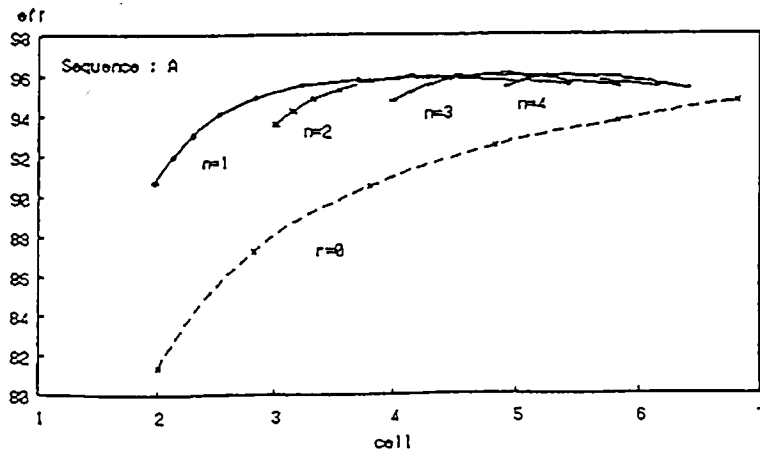


Fig.4 Transmission unit length vs transmission efficiency

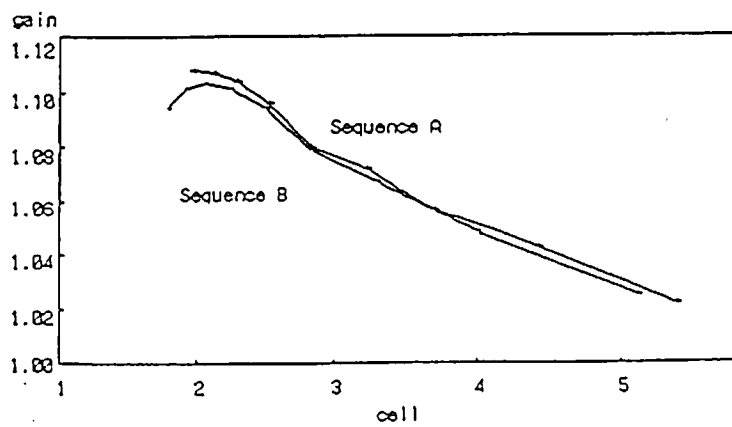


Fig.5 Improvement on transmission efficiency