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Document AVC-412

SOURCE : Japan
TITLE : Comparison between short-slice method and structured packing
PURPOSE : Proposal

## 1. Introduction

In this document, short-slice (slice size reduction) method and structured packing are compared in coding efficiency as a mean of spatial localization of errors (core experiment F.8). In addition, desirable re-synchronization period is evaluated in order to keep the picture degradation due to cell loss within visually acceptable bounds.

## 2. Computer simulation

Computer simulations were performed based on a TM3 based coding algorithm. The simulation conditions were as follows.

- Picture format : 4:2:0
- GOP structure : M=1, N=150 (IPPPP....)
- Picture structure : Frame picture
- Prediction method : Adaptive frame/field
- Bit rate : Short-slice method 4 Mb/s
  Structured packing 3.904 Mb/s
- Re-synchronization period : 44MB, 22MB, 11MB, and 4MB

Table 1 and 2 show the simulation results of each method. Cases when each method is combined with concealment and leaky prediction were also simulated. According to the results, structured packing gives better SNR than that of short-slice method in 4MB case and the results were reversed in the other case. However, the differences were not significant. In subjective evaluation of the picture quality, difference between the two methods wasn't remarkable. A detailed numerical comparison shows the same tendency (see Annex).

As for the evaluation of re-synchronization period, even the 4MB case seemed to be insufficient in the case when a high level of compensation performance is required. It will depend on applications, picture size, and so on.

Some of the reproduced pictures will be demonstrated by VCR at the meeting.

## 3. Conclusion

Short-slice method and structured packing were compared as a mean of spatial localization of errors. The results didn't indicate remarkable advantages of structured packing, therefore short-slice method that doesn't affect syntax is recommended. As for the proper re-synchronization period (slice size), further study may be required taking the required performance level of compensation into account.

Table 1: Average SNR(dB) for Flower Garden

| Re-synchronization period (MB) | Without cell loss | | With $10^{-3}$ of cell loss | | | |
|---|---|---|---|---|---|---|
| | SS | SP | SS | SP | SS+CN+LP | SP+CN+LP |
| 44 | 28.38 | — | 22.33 | — | 26.79 | — |
| 22 | 28.33 | 28.23 | 23.41 | 23.25 | 26.93 | 26.83 |
| 11 | 28.22 | 28.18 | 23.73 | 23.63 | 27.03 | 26.98 |
| 4 | 27.80 | 28.01 | 24.84 | 24.93 | 26.74 | 26.93 |

Table 2: Average SNR(dB) for Mobile & Calendar

| Re-synchronization period (MB) | Without cell loss | | With $10^{-3}$ of cell loss | | | |
|---|---|---|---|---|---|---|
| | SS | SP | SS | SP | SS+CN+LP | SP+CN+LP |
| 44 | 26.56 | — | 24.02 | — | 25.34 | — |
| 22 | 26.51 | 26.43 | 24.59 | 24.62 | 25.45 | 25.35 |
| 11 | 26.42 | 26.38 | 25.00 | 24.97 | 25.42 | 25.39 |
| 4 | 26.07 | 26.24 | 25.01 | 25.24 | 25.13 | 25.28 |

SS: Short-slice method
SP: Structured Packing
CN: Concealment
LP: Leaky Prediction

ANNEX to document AVC-412

# Estimation of transmission overhead

Overhead bits and transmission efficiency for short-slice method and structured packing are estimated as follows.

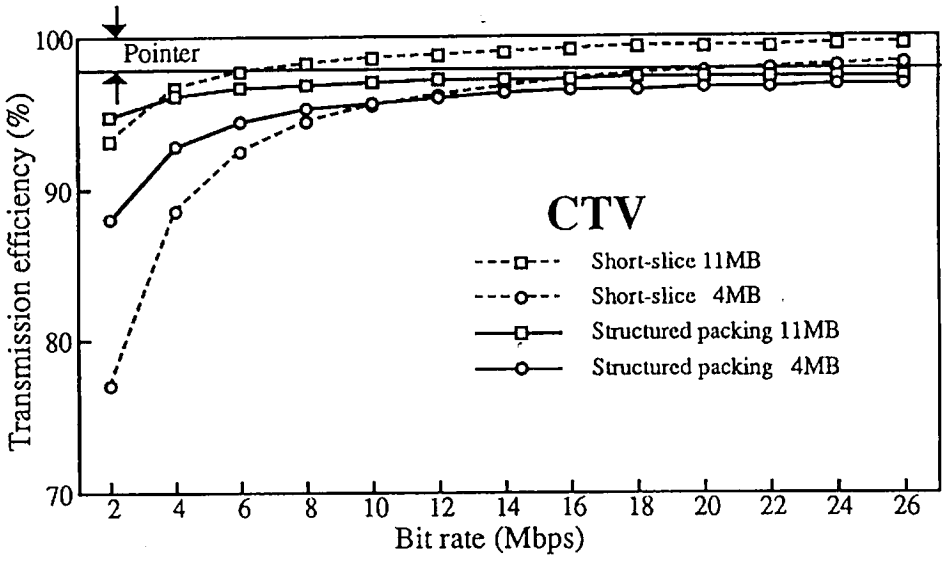
## 1.Overhead bits per re_synchronization period

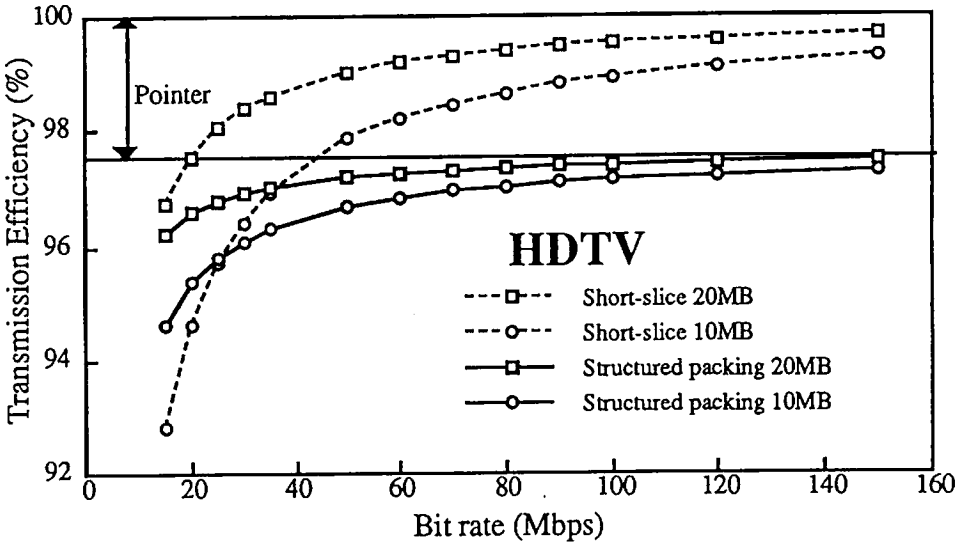
$$Ess = 1 - \{ Oss * Mx * My * f * ( 1 / Nss - 1 / Mx ) \} / b$$
$$Esp = 1 - \{ Osp * Mx * My * f * (1 / Nsp - 1 / Mx) + b *( Cp / Cs ) \} / b$$

| | | CTV | HDTV |
|---|---|---|---|
| f : | frame rate (Hz) | 29.97 | 30 |
| Mx : | horizontal size (macroblocks) | 44 | 120 |
| My : | vertical size (macroblocks) | 30 | 64 |
| b : | bit rate (bit/s) | | |
| Oss : | number of overhead bits for short slice (bits) | 51 bits (note 1) | |
| | slice_start_code | 32 bits | |
| | quantizer_scale | 5 bits | |
| | extra_bit_slice | 1 bits | |
| | macroblock_address | 9.5bits (ave.) | |
| | zero_bits (stuffing) | 3.5bits (ave.) | |
| Osp : | number of overhead bits for structured packing (bits) | 21.5 bits (note 1) | |
| | macroblock_address | 14bits | |
| | macroblock_type (for macroblock_quant) | 2.5bits (ave.) | |
| | quantizer_scale | 5bits | |
| Cs : | cell size (bit) | 47*8 bits | |
| Cp : | number of bits used for MB boundary pointer(bits) | 9 bits | |

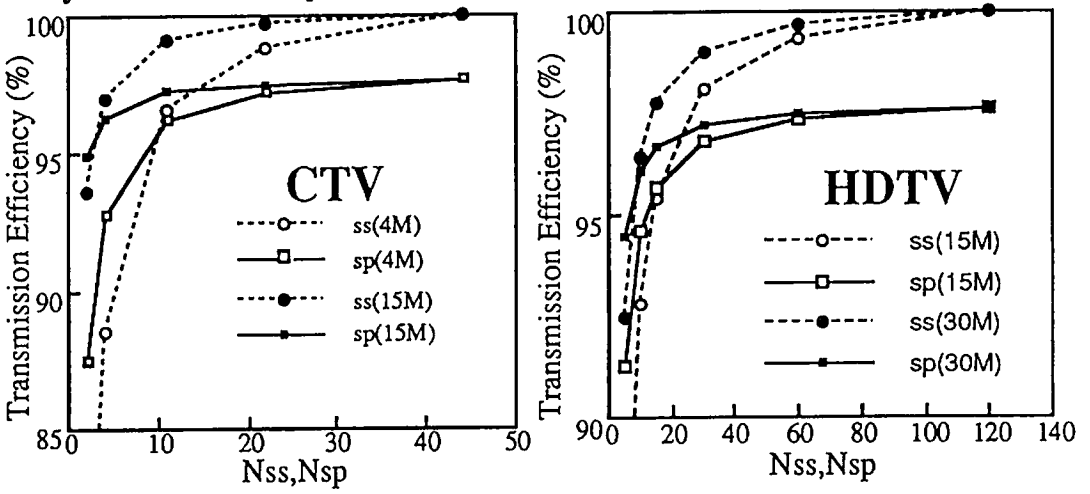
note 1: Coding efficiency loss in the DPCM of motion vector is not considered.

## 2.Bit rate vs.Transmission efficiency






## 3.Re-synchronization period vs.Transmission efficiency




## 4.Consideration

Table A-1 Comparison of Transmission Efficiency for each requirements

| Requirements | | | Transmission Efficiency (%) | |
|---|---|---|---|---|
| Picture format | bit rate | localization area (Nss,Nsp) | short slice (ss) | structured packing (sp) |
| CTV | 4Mbps | small (4) | 88.5 | 92.8 (+4.2) |
| | | medium (11) | 96.6 | 96.2 (- 0.4) |
| | 9Mbps | small (4) | 94.9 | 95.5 (+0.6) |
| | | medium (11) | 98.5 | 97.0 (- 1.5) |
| HDTV | 15Mbps | small (10) | 92.8 | 94.6 (+1.8) |
| | | medium (20) | 96.7 | 96.2 (- 0.5) |
| | 30Mbps | small (10) | 96.4 | 96.1 (+0.3) |
| | | medium (20) | 98.4 | 96.9 (- 1.5) |

- The overhead increases rapidly in Short slice when Nss becomes smaller.
- The overhead is larger in Structured packing when Nsp is large because of the pointer overhead.
- In higher bit rate (9Mbps:CTV) or in higher format such as HDTV, the difference of the efficiency are negligible. Even in the case of lower bit rate and lower picture format (CTV) the advantage of Structured packing is less than 5%.