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Title: Experiments on the effect of losses of picture-type or f-code in picture headers
Purpose: Information and proposal
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1. Background

This contribution retraces the redundant concept given in MPEG 93/064 and presents some results of supporting evidences which have shown the effect of losses of picture type or f-code in picture headers. This proposal is motivated by the fact that all bits are not equal importance within the video bit-stream. In MPEG video there are two data elements within the picture header which are absolutely crucial to decoding. They are Picture-type and f-code. Without them, no decoding can be accomplished. They are also neccesary for the VCR applications of doing fast forward. The basic idea proposed here is to allow redundant transmission of very sensitive data within the MPEG-2 video headers for the purpose of improving the noise channel performance.

This short simulation study was conducted to evaluate the penalty to re-evaluate and re-affirm the need for redundant Picture Headers.

2. Simulation results

To simulate the loss of the picture header in the bit-stream, we conducted the following experiments. Two sequences: Table Tennis and Flower Garden, were encoded with the bit rate of 4 Mbps and N=12, M=3. We considered only the effect of losing a packet with a picture header in which case we use the nearest anchor frame (I or P-frame) to replace the frame losing picture header. Subsequent decoding continues. For example, if a picture header of the P-frame, say frame 15, was lost, we use frame 12 to replace frame 15. It can be visually seen that if the anchor frame lost, the serous degradations were caused in the moving areas and the errors were propagated through the rest of GOP. We varied the location of the loss within the GOP, and the degradation is uniformlly bad based on frame location.

In the experiments, the following locations of frame loss are simulated:

Case 1: I frame, frame 12 is lost and then replaced by frame 9.
Case 2: P frame, frame 15 is lost and then replaced by frame 12.
Case 3: P frame, frame 18 is lost and then replaced by frame 15.
Case 4: P frame, frame 21 is lost and then replaced by frame 18.

The numerical results have been shown in the following figures:

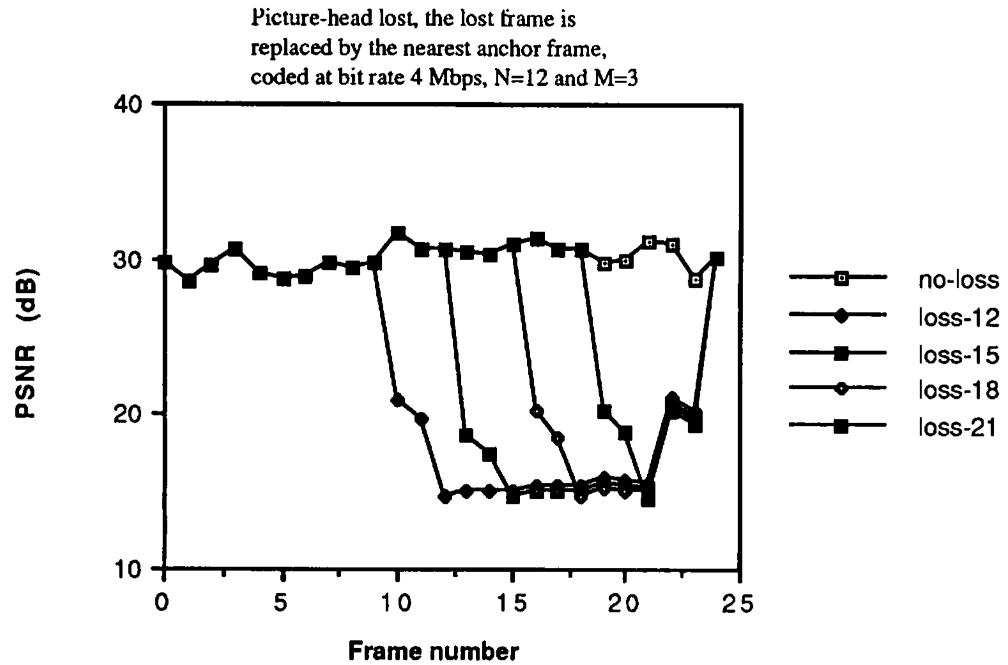

Fig.1 Picture-header loss for Flower Garden sequence

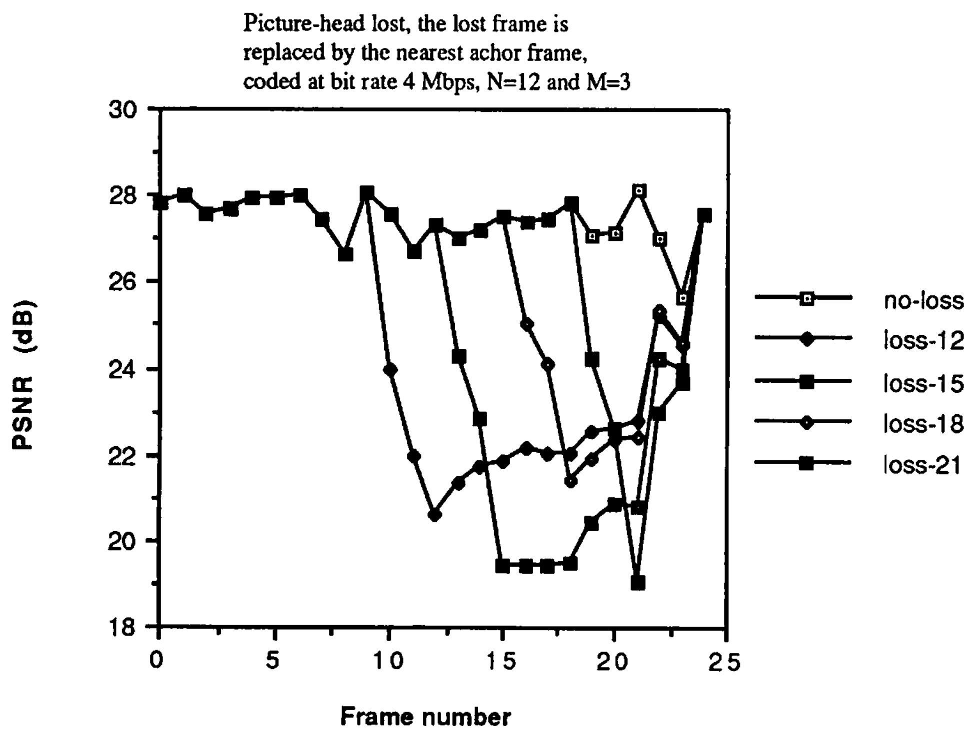

Fig.2 Picture-header loss in Table Tennis sequence

From the above numerical results it can be seen that a -16dB loss in Flower Garden sequence and -7dB loss for Table Tennis, based on a loss in an I or P frame picture-header. The degree of loss is of course very picture dependent. The key result is the picture is completely unwatchable for between 3 and 12 frames (100 mSec to 100 mSec). Since there are

30x60x60x24 = ~2,600,000 picture headers a day, a packet loss rate of 1 in 1,000,000 will have 2-3 such events per day. If there are 1000 bits/packet, and using the first two terms of a Taylor series, the correct bit error rate to achieve this result is 1 in 10^9. Such performance may not be guaranteed in all media at any realistic level of FEC. Consequently, we proposed the ability to support redundant transmission of picture headers in a manner which has an easy implementation for using this information. After further consideration, we still think such capability is extremely useful.

The results of losing frame 3 and frame 6 for two sequences have been saved on D1 tape for viewing.

3. Conclusions

The loss of picture type (and f-codes) etc. is much more serious. Redundant Picture Header can be truncated after this data and before quant matrix to limit redundant bandwidth, and to ensure the data fits within a single transport packet.