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SOURCE : Telia Research AB, SWEDEN
TITLE : Cell loss experiments on one layer coding
PURPOSE : Information

General

The possibility of uncorrectable transmission errors[1] imply that decoders must implement special strategies to cope with such errors. We distinguish between two strategies :

a) No detection of errors
b) Detection of errors
   The decoder is informed about exact position of the error.

In case b) it may happen that the decoder fails (although unlikely), so all necessary items in case a) must always be implemented also in case b).

The first observation is that the VLC tables in TM3 are not always complete. There are some unused codewords. It is likely that the decoder runs into such an undefined codeword, sooner or later after an undetected transmission error (especially after cell loss). Before that, the decoder has probably decoded some rubbish. It is important that the decoder has a well defined strategy for each undefined codeword. Such action can be for example :

1) Go to next start code
2) Step back n bits and then goto next start code

Action 2 is developped from the fact that many undefined coded words (but not all) consist of only zeroes, and if that happens one can conclude that a start code has occured before expected.

For the undecoded picture area (between discovered error and start code) one of the following stategies can be used :

A) Use the actual content in the Frame Store as decoded picture.
B) Make an intelligent prediction from the content in the Frame store.

[1] It is worth noting that all kind of transmission errors, such as bit errors, bit slip, cell loss etc imply the same strategies. In this study cell loss has been used as transmission error.

Simulation results

One layer coding with the sequence "Mobile and calender" has been simulated, with and without detection of errors (a) and b)) with decoder actions 2) A) and 2) B).
Comparisons were also made between M=3 without leaky prediction and M=1 with leaky prediction.

A comparison between a) and b) (with and without cell loss detection by cell number) shows that b) performs better, as rubbish never needed to be decoded in the simulations. The amount of decoded rubbish in a) depends highly on the exact position of the lost cell(s).

The statistical model was NOT used, but cell losses were introduced by hand in well known positions. 12 cells (every 3rd slice) were removed from one picture in the sequence. This corresponds to burst CLR in the range 0.01 for I-pic, 0.025 for P-pic and 0.05 for B-pic.
Cell losses in I and P pictures give simular artifacts and are normally annoying (also in I-pic there is normally somthing in the frame store). Cell losses in B picutres are much less annoying.

Two stategies have been tested to reconstruct undecoded areas :

A) The actual content in frame store is displayed again (previous decoded picure)
B) The last correctly decoded motion vector is used for a motion compensated prediction. This method can be applied on P and B pictures. Major improvements are to be expected for P pictures only.

Results show that A) is often very annoying, while B) performs well for most of the cell losses tested on "Mobile and Calender" (panning sequence).

Leaky prediction and M=1 gives considerably better cell loss performance than M=3 without leak (cell losses in P-pictures in both cases). This fact must be weighted against worse coding performance with M=1

Conclusions

It is preferable to detect cell losses (errors) and to inform the decoder about its exact position in the bitstream to avoid rubish to be decoded. However, the decoder can not fully rely on this strategy.

On I and P pictures the undecoded picture area has to be reconstructed carefully. On panning sequences the last correctly decoded motion vector can be used for the motion compensated prediction. Further study is needed with different kinds of sequences to work out a strategy for an intelligent prediction of frame store for the undecoded areas.

M=1 and leaky predictions outperforms M=3 (no leak) for very high CLR values.