CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

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Source: G. Bjøntegaard, NTA
Title : Core Experiment for testing B-frames/no B-frames.
Purpose: Proposal

Introduction.

The document describes a core experiment supported by several European companies. The definition of a good coding mode without B-frames is of great importance for keeping the coding delay down.

The definition and results from this core experiment is therefore expected to be of interest for the experts group.

TESTING B-FRAMES /NO B-FRAMES

supported by: NTA, DTB, NTL, RAI, CCETT, SIEMENS, FI, RETEVISION

2. 4. 1. Background.

After reviwing the subjective test results of the proposals for the Kurihara meeting, and as a result of the review of the methods used inthe same proposals, it was strongly urged from the implementation group to have a closer examination of the coding using B frames compared to not using B-frames.

The inclusion of B-frames results in a considerable increase of implementation complexity. Furthermore, if B-frames - and the resulting reordering if frames - is used the coding / decoding delay is considerably increased.

Experimental conditions:

Bitrate:

The target bitrate for the experiment is 4 Mb/s.

Test sequences:

Test sequences shoud contain both zoom and pan situations (as in MOBCAL and FLOWERGARDEN) and large motion situations (as in FOOTBALL and partly in TABLETENNIS).

Rate control:

The perfonmance of the rate controller is important for the picture quality. The different experiments would also require different rate control mechanisms for optimum performance. For this experiment the rate control is therefore switched off.

Instead the following assignment of quantizer stepsize (QS) is adopted:

1. Pictures of the same type(I,P,B,P') have the same QS throughout the sequence
2. Pictures of different types may or may not have the same QS.
3. The actual size of the different quantizer stepsizes to give the average target bitrate have to be determined by "hand tuning".

2. 4. 2. Experiments:

The main topic of the experiment is B-frames or no B-frames. For that reason the first experiment (0) is a comparison between coding with TM0 plus B-frames on the one side and coding with only forward prediction and one decoder frame memory on the other side. This first experiment deviates from the usual definition of "Core experiment" in the sense

that two non-TM0 methods are compared.
The remaining experiments are all intended to test improvements of different prediction methods relative to TM0.

0) Coding with B-frames as defined in MPEG-1 with M = 2 is compared with forward only prediction with one decoder memory. It is assumed that a number of "tricks" may be included in the latter method to compensate for not having B-frames.

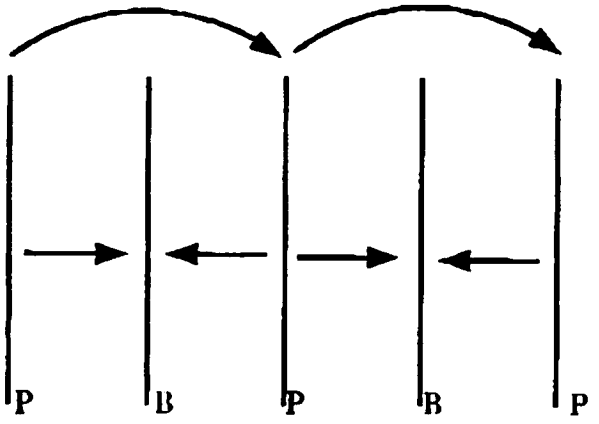
1) B-frames as in MPEG-1 with M=2
The B-frames can be predicted from the previous P(or I), the following P (or I) or a combination of both.

2) Lower Quality Predicted Frames (P')in prediction loop.
Alternate frames are coded to a lower quality by using a different QS(P'). Prediction is from the previous frame (I,P,P').

3) Lower Quality Predicted Frames(P') out of prediction loop
Alternate frames are coded to a lower quality by using a different QS(P'). Prediction is from the previous high quality frame (I or P).

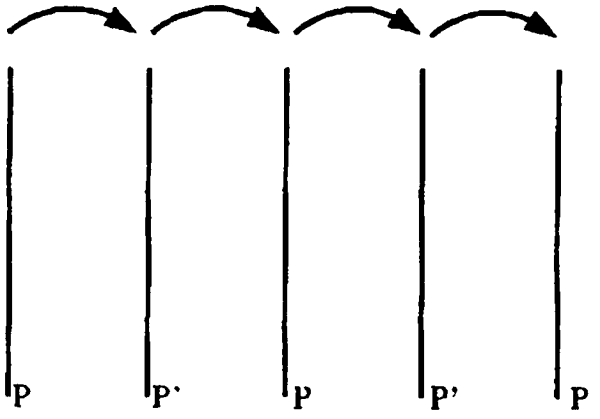
4) Prediction Based on two previous frames
Every frame (except for the first P frame in a GOP) can be predicted from the previous P frame, the next-to-previous P (or I) frame, or a combination of both. The first P-frame in a GOP is predicted from the preceding I frame only.

1)



B-frames as in MPEG-1

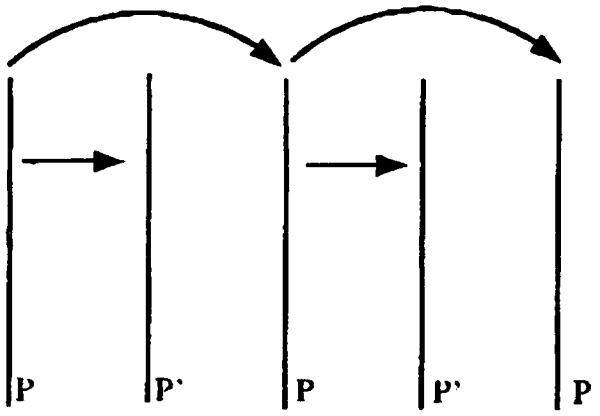
2)



Low resolution predicted frames (P')

in prediction loop

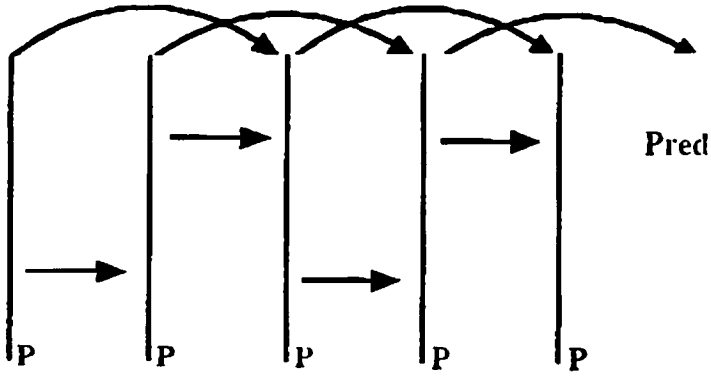
3)



Low resolution predicted frames (P')

out of prediction loop

4)



Prediction based on two previous frames