MPEG 92/185

--begin--

Document AVC-251
Stockholm, March 1992

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

Source: Germany, Daimler-Benz
Purpose: for discussion

Title: Improved prediction for low delay video coding mode

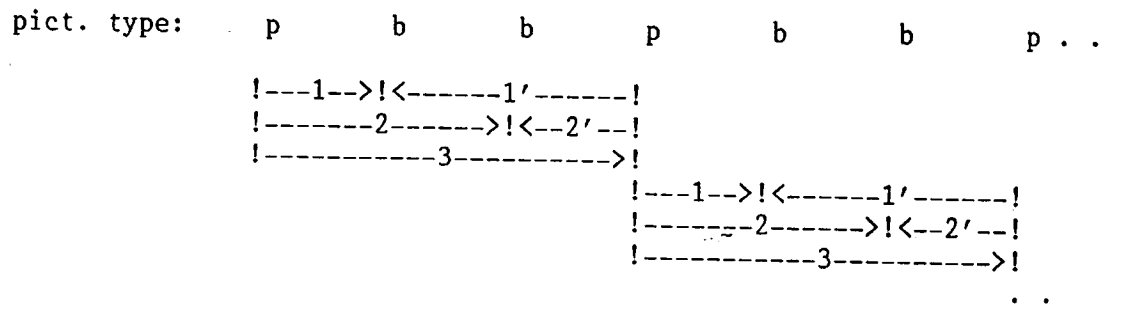
Summary:
Bidirectional video communication services need low coding and decoding delay. An interpolative forward prediction method is investigated which raises the prediction gain and picture quality significantly compared to to simple prediction from the preceeding frame only. The performance is somewhat less than MPEG 1 coding with 2 bidirectional interpolated pictures between predicted ones, but better than MPEG 1 coding with forward prediction only.

Video coding according to H.261 has a low delay, which is favourable for bidirectional video communication services. The more sophisticated prediction and bidirectional interpolation of MPEG 1 lead to better performance at bitrates higher than e.g. 1 Mbit/s, at the expense of a high codec delay. This paper describes a different prediction method, resulting in a low delay and better performance than MPEG 1 using only forward prediction. The the quality of MPEG 1 in the I b b p b b p b .. mode is not yet reached.

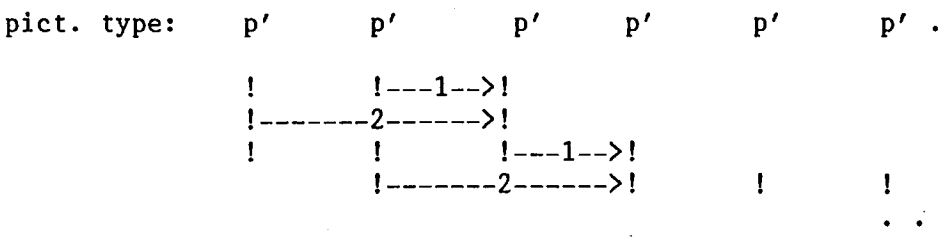
The investigations have been done based on MPEG 1 Simulation Model 3 at a bitrate of 1856 Mbit/s. The technique promises to be suitable in MPEG 2 coding for better performance in the low delay mode. The technique investigated is similar to MPEG 1 Simulation model 3 in an I p p p . . mode, but uses the following interpolative prediction technique:

Two preceeding frames are used to predict the actual frame. For each macroblock a decision is done wether
1. the (displaced) macroblock of the preceeding frame,
2. the (displaced) macroblock of the pre-preceeding frame,
3. a weighted interpolation from both (displaced) macroblocks
4. no prediction (intra coding)

is used. Signalling of the decision and transmission of the displacement vectors is done analog to MPEG 1. The prediction scheme for MPEG 1 in I p b b p b b p . . can be drawn as follows:



The prediction scheme for MPEG 1 in the proposed low delay I p'p'p'.. mode (interpolative prediction mode) looks like:



S/N Results:
For the sequences Mobile and Calendar and Flower Garden the following mean values (over 75 CIF frames) for the signal to noise ratio have been attained at a bitrate of 1.856 Mbit/s:

MPEG1 in	Ibbpbbp..	Ipppp.. (forw.pred.)	I p'p'p'.. (int.pred.)	mode
Flower G.	31.42	29.73	30.52	dB
Mob+Cal	30.78	29.43	29.89	dB

The values show that MPEG 1 with forward prediction only performs 1.7 resp. 1.35 db worse than MPEG 1 with bidirectional interpolated pictures. The loss of the investigated forward interpolative prediction with low delay is only 0.9 dB.

Conclusion:
The investigated interpolative prediction technique promises good performance in a low delay mode for MPEG 2 coding. Further work and simulations are necessary in order to optimise e.g. the quantizer control and to check the results at different transmission rates.

--end--