INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC2/WG11

CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

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Title: Elements of TM0 and its simplification.

1 Six Simulations

I tested the effect of the Frame/field DCT (F/f dct) and Frame/field Prediction (F/f pred) (both elements of adaptive frame/field TM0 described in MPEG92/080), for the four sequences, BC, FG, MC, and PP (each 150 frames, 5 sec), with M = 3, Bit rate = 4 Mb/s. Rate control is as described in MPEG92/077. The features of the six simulations are listed below:

(1) TM0 with F/f dct and F/f pred. There are two additive bits.

(2) TM0 without f dct, only F/f pred is used. The additive is one bit.

(3) TM0 without f pred, only F/f dct is used. The additive is one bit.

(4) Frame based TM0, without f pred and f dct. There is no additive bit.

(5) Connected F/f DCT.
TM0 without F/f dct independent of F/f pred. F/f dct uses F/f pred mode for its mode in the non-intra coding. In the intra coding, F/f dct is equal to TM0. The additive bit is one.

(6) TM0 with refined F/f dct decision method as below:
Field DCT rather than frame DCT is used when $Var1 \geq (Var2 + 4096)$.

$$Var1 = \sum_{i=0}^{15}(\sum_{j=0}^{15} C_j^1 X_{i,j})^2, \qquad C_j^1 = \{1, -1, 1, -1, ...\}$$

Original:

$$Var2 = \sum_{i=0}^{15}(\sum_{j=0}^{15} C_j^2 X_{i,j})^2, \qquad C_j^2 = \{1, 1, -1, -1, ...\}$$

Refined:

$$Var2 = \sum_{i=0}^{15}\{(\sum_{j=0}^{15} C_j^2 X_{i,j})^2 + (\sum_{j=0}^{15} C_j^3 X_{i,j})^2\}, \quad C_j^2 = \{1, 1, -1, -1, ...\}, C_j^3 = \{1, -1, -1, 1, ...\}$$

2 Results

The luminance SNR results of the six simulations are shown in Table 1. Relative SNR's for the elements F/f dct and F/f pred are shown in Table 2.

Table 1: The result of the six simulations (SNR for luminance [dB])

	Pred.	DCT	Additive bits	BC	FG	MC	PP
(1) TM0	F/f	F/f	2	27.87	29.44	28.14	30.92
(2) TM0 - f dct	F/f	F	1	27.65	29.42	28.25	30.30
(3) TM0 - f pred	F	F/f	1	27.45	28.78	27.93	30.84
(4) Frame based	F	F	0	27.15	28.75	28.04	30.08
(5) New	F/f	F/f	1	27.81	29.38	28.14	30.85
(6) Refined TM0	F/f	F/f	2	27.91	29.46	28.24	30.94

Table 2: Relative SNR's of the elements [dB]

Elements	Difference	BC	FG	MC	PP	Average
Frame/filed DCT	(3)-(4)	+0.30	+0.03	-0.11	+0.76	+0.25
Frame/field MC	(2)-(4)	+0.50	+0.67	+0.21	+0.22	+0.40
TM0 - Frame based	(1)-(4)	+0.72	+0.69	+0.10	+0.84	+0.59
New - Frame based	(5)-(4)	+0.66	+0.63	+0.10	+0.77	+0.54
New - TM0	(5)-(1)	-0.06	-0.06	0.00	-0.07	-0.05
Refined TM0 - TM0	(6)-(1)	+0.04	+0.02	+0.10	+0.02	+0.05
New - Refined TM0	(5)-(6)	-0.10	-0.08	-0.10	-0.09	-0.09

- From (3)-(4), frame/field DCT has a negative effect for MC (-0.11 dB), small effect for FG (+0.03 dB), large effect for BC (+0.30 dB) and PP (+0.76 dB). The average effect for all sequences is +0.25 dB.

- From (2)-(4), frame/field Prediction has a small effect for MC (+0.21 dB) and PP (+0.22 dB), large effect for BC (+0.50 dB) and FG (+0.67 dB). The average effect is +0.40 dB.

- TM0 is effective for all sequences. The average effect is +0.59 dB.

- The new connected frame/field DCT method has a +0.54 dB average effect. The image quality of the new method does not differ from TM0. This method does not provide better quality than TM0, but it does simplify the syntax of the bit stream and thereby the decoder/encoder.

- The Frame/field dct decision method can be refined about +0.05 dB. The connected F/f dct is about 0.1 dB lower than the refined F/f dct.

3   Conclusion

Frame/field DCT and frame/field prediction were tested and both are confirmed to be effective. Although frame/field DCT can be refined slightly, the connected frame/field DCT has simple syntax and decoder/encoder.