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Source: UK
Title: Snr Scalable experiment with compatible syntax
Purpose: Information

1. Introduction

MPEG-2 can support snr scalability using the compatibility extensions. This document demonstrates that the compatibility extensions provided by the MPEG-2 syntax can support snr scalable coding with interlaced TV pictures in the two layers.

This experiment uses the compatible syntax proposed at the London MPEG meeting (MPEG92/651) as documented in G.5 of TM3.

2. SNR Scalability

Snr scalable coding is achieved by the use of layered coding. Firstly the full resolution picture is coded using core TM3 with no compatibility extensions at a particular bit rate. The locally decoded pictures from this coding can be used as a prediction in a second layer which also codes the full resolution picture with the remaining bit rate available.

The compatible syntax of TM3 can support two general snr scalable approaches. The first is to use only I-pictures in the second layer and second to use I,P, and B pictures in the second layer. There is a third specific method for snr scalability using a two-layer quantization structure. This is not dealt with in this document.

I-Picture only second layer

Figure 1 shows an snr scalable encoder with TV resolution in both layers using only intra coding for the second layer.

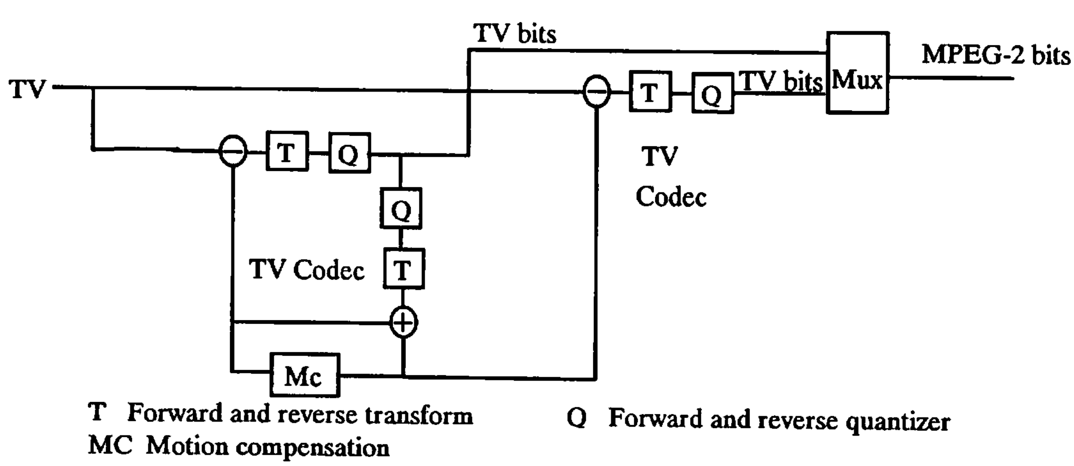
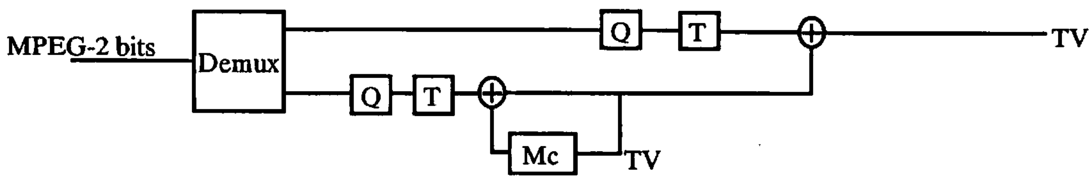


Figure 1. MPEG-2 snr scalable encoder using only I-pictures in the second layer.

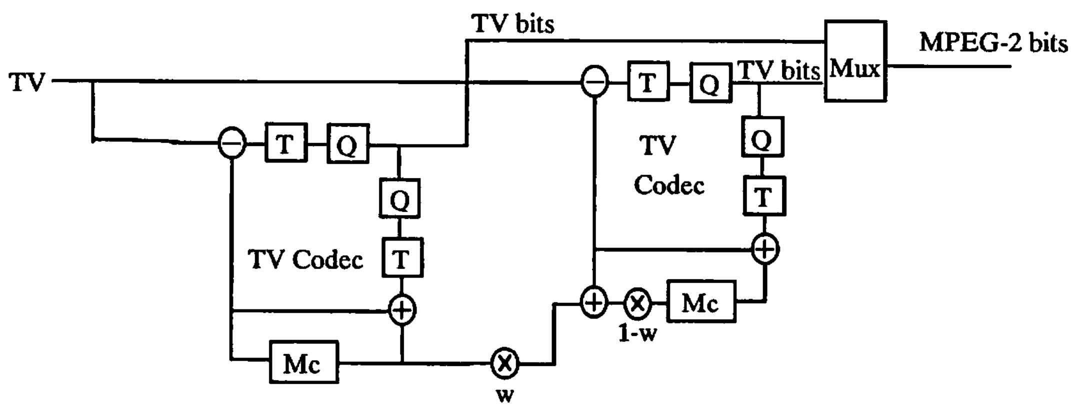
The corresponding decoder is shown in figure 2. It should be noted that many of the functions for the two decoders are the same. Hence additional hardware is not needed for these functions provided a 100% increase in throughput can be achieved. There is no extra memory required for the second layer.



T Reverse transform Q Reverse quantizer MC Motion compensation

Figure 2. MPEG-2 snr scalable decoder using only I-pictures in the second layer.

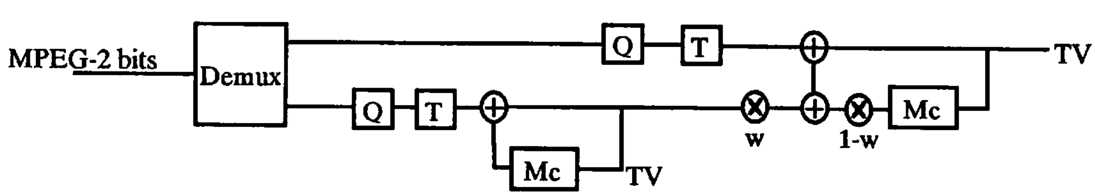
I,P,B-Picture second layer
Figure 3 shows an snr scalable encoder with TV resolution in both layers. In this case the second layer has a full coding loop capable of I,P and B-picture coding along with compatible predictions.



T Forward and reverse transform
MC Motion compensation
Q Forward and reverse quantizer
w weighting factor

Figure 3. MPEG-2 snr scalable encoder, full implementation.

The corresponding decoder is shown in figure 4. It should be noted that many of the functions for the two decoders are the same. Hence additional hardware is not needed for these functions provided a 100% increase in throughput can be achieved. There is the penalty of 100% extra memory required for the second layer.



T Forward and reverse transform
MC Motion compensation
Q Forward and reverse quantizer
w weighting factor

Figure 4. MPEG-2 snr scalable decoder, full implementation.

3. Encoder Parameters

The encoder is Test Model 3, with M=3 and N=12, using frame/field adaptive prediction and compatible prediction from the locally decoded TV resolution pictures.

For the frame/field prediction, the motion estimation is done on the source pictures to full pel accuracy (these were then refined in the coding loop by +/- 0.5 pels). The compatible prediction uses the spatio-temporal weighting technique. Table 1 gives the weightings and the fixed length codes used to represent them.

Code	Field 1		Field 2	
	ISIF	TV	ISIF	TV
0 0	1.0	0.0	0.0	1.0
0 1	0.0	1.0	1.0	0.0
1 0	0.5	0.5	0.5	0.5
1 1	1.0	0.0	1.0	0.0

Table 1. Spatio-temporal weightings.

The decision to use compatible coding is made on a macroblock basis. The weightings of table 1 apply to predicted macroblocks. In the intra picture only two modes are allowed: pure compatible or pure intra.

4. Simulation

The source interlaced TV sequences were coded at 2.5Mbits/s using the core of TM3. These TV pictures were then coded again at 1.5Mbit/s (totalling 4Mbits/s) using TM3 with frame/field adaptive prediction and compatible prediction.

These two-layered coded TV pictures were also compared with single-layered coded TV pictures. The TV pictures were coding according to the simulcast concept: single-layered coding at 2.5Mbit/s. They were also coded incompatibly, that is, with all the bits allocated in one TV layer.

The following source sequence was used: Mobile and Calendar.

5. Results

The full statistics are shown in table 2. It can be seen that the two-layered scheme achieves better performance than the simulcast scheme by 1dB when using I,P,B pictures and 0.66dB when using I pictures only. The addition of P and B pictures gives only a 0.34dB gain.

6. Conclusion

It has been shown that the TM3 provides the possibility of snr scalable coding using the compatible syntax extensions of TM3 in two ways. There is an increase in complexity when using the second scheme. Other schemes are possible.

		All	I	P	B
base 2.5Mbits/s	snr y	26.8	26.65	26.73	26.85
	quant	18.00	14.06	14.04	20.03
snr scale I only	snr y	27.46	27.46		
2.5+1.5Mbits	quant	12.36	12.36		
snr scale I P B	snr y	27.79	28.25	27.86	27.71
2.5+1.5Mbits/s	quant	14.04	8.38	11.38	15.81
non-comp 4Mbits	snr y	29.06	29.46	29.25	28.93
	quant	10.81	8.47	8.46	12.01

Table 2: Results of snr scalable coding on Mobile and Calendar